

Sydney Metro City and Southwest – North Corridor Works

Construction Noise and Vibration Management Plan (CNVMP)

Document

Title	Construction Noise and Vibration Management Plan (CNVMP)
Client	Sydney Metro City and Southwest
Document Reference No.	MNNSCW - Portion 7b - CNVMP_V0.5.docx
Laing O'Rourke Contract No.	K38

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Revisions

Date	Version	Description	Prepared by	Approved by
22/06/2018	V0.1	1 st Draft to LOR	ERM	LOR
06/07/2018	V0.2	2 nd Draft to LOR	ERM	LOR
14/08/2018	V.03	Address Sydney Metro, AA + ER Comments	ERM	LOR
27/09/2018	V.04	Address additional Sydney Metro, AA + ER Comments	ERM	LOR
09/11/2018	V.05	Address DPE comments	ERM	LOR

Terms and definitions

The following general terms, abbreviations and definitions are used in this plan.

Terms	Explanation
A1055	Standards Australia AS1055–1997™ – Description and Measurement of Environmental Noise
AMM	Additional Mitigation Measures
AMMM	Additional Mitigation Measures Matrix
AS2436	Standards Australia AS 2436–2010™ – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.
AS61672 or AS1259	Standards Australia AS IEC 61672.1–2004™ – Electro Acoustics - Sound Level Meters Specifications Monitoring or Standards Australia AS1259.2-1990™ – Acoustics – Sound Level Meters – Integrating/Averaging as appropriate to the device.
BS 6472	British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) dated 1992;
BS 7385	British Standard BS7385: Part 2-1993 - Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration, dated 1993.
CNVS (I&S)	Transport for NSW Infrastructure and Services Division (TfNSW I&S) - Construction Noise and Vibration Strategy (I&S CNVS), May 2018;
CNVS (SM)	TfNSW - Sydney Metro Construction Noise and Vibration Strategy (SM CNVS), August 2016 and CNVS Addendum June 2017. (Report No 610.14213-R3).
CNVIS	Construction Noise and Vibration Impact Statement
CNVMP	Construction Noise and Vibration Management Plan
CoA	Conditions of Approval
DIN4150:3	German Institute for Standardisation – DIN 4150 (1999-02) Part 3 – Structural Vibration - Effects of Vibration on Structures.
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
ER	Environmental Representative
ERM	Environmental Resources Management Australia Pty Ltd
HNML	Highly Noise Affected Management Level
ICNG	NSW Department of Environment and Climate Change – NSW Interim Construction Noise Guideline, July 2009.
IEC60942	Standards Australia AS/IEC 60942:2004/IEC 60942:2003 – Australian Standard™ – Electroacoustic – Sound Calibrators.
INP	NSW Environment Protection Authority – NSW Environmental Noise Management – Industrial Noise Policy, January 2000 and relevant application notes.
Laing O’Rourke	Laing O’Rourke Australia Construction Pty Limited
LGA	Local Government Area
LOR	Laing O’Rourke Australia Construction Pty Limited
Minister, the	NSW Minister for Planning

Terms	Explanation
NCA	Noise Catchment Area
NML	Noise Management Level
NSW Vibration Guideline, the	NSW Department of Environment and Conservation – NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline), February 2006.
OEH	Office of Environment and Heritage
OOHW	Out of Hours Works
POEO Act	Protection of the Environment Operations Act 1997
RNP	NSW Department of Environment, Climate Change and Water – NSW Road Noise Policy, March 2011.
SSI	State Significant Infrastructure
TfNSW	Transport for New South Wales
the project	North Corridor Works Project

The following technical terms, abbreviations and definitions are used in this plan. A glossary of relevant acoustical concepts and terminology is provided in **Appendix A**.

Terms	Explanation
Decibel, dB	The unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure
dBA	The unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear
LAeq	Equivalent Continuous Sound Level
LAeq, 15minute	Equivalent Continuous Sound Level, over a period of 15 minutes
LA90	Background Noise Level
RBL	Rating Background Level
LW or SWL	Sound Power Level
LP or SPL	Sound Pressure Level
PPV	Peak Particle Velocity (in mm/s)
VDV	Vibration Dose Value (in $m/s^{1.75}$)
mm/s	Millimetres per second
m/s	Metres per second

0. Consolidated Compliance Matrix

Table 1 - Compliance Matrix – CoA

Item	Requirement	Document Reference
A1	The CSSI must be constructed generally in accordance with the description of the CSSI in the EIS as amended by the: (a) description in the PIR; (b) Sydney Metro City and Southwest Chatswood to Sydenham Victoria Cross Station and Artarmon Substation Modification Report (Transport for NSW) as amended by the Victoria Cross and Artarmon Substation Modification Submission Report (Transport for NSW); and (c) the terms of this approval	This CNVMP
A2	The CSSI must be carried out in accordance with all procedures, commitments, preventative actions, performance criteria and mitigation measures set out in the EIS as amended by the documents listed in A1, unless otherwise specified in, or required under, the approval.	This CNVMP
A3	In the event of an inconsistency between the EIS as amended by the description in Chapters 2, 3 and 9 of the PIR, or any other document required under this approval, and a term of this approval, the term of this approval prevails to the extent of the inconsistency. For the purpose of this condition, there will be an inconsistency between a term of this approval and any document if it is not possible to comply with both the term and the document.	Section 2.2
A9	Where the terms of this approval require consultation with identified parties, details of the consultation undertaken, matters raised by the parties, and how the matters were considered must accompany the strategies, plans, programs, reviews, audits, protocols and the like submitted to the Secretary.	Section 1.4
A22	A suitably qualified and experienced Environmental Representative (ER) who is independent of the design and construction personnel must be nominated by the Proponent, approved by the Secretary and engaged for the duration of construction of the CSSI. Additional ERs may be engaged for the purpose of this condition in which case the obligations to be carried out by an ER under the terms of this approval may be satisfied by any ER that is approved by the Secretary. The details of nominated ER(s) must be submitted to the Secretary for approval no later than one month before the commencement of works, or within another timeframe agreed with the Secretary.	Section 12.1
A23	Works must not commence until an ER nominated under Condition A22 of this approval in respect of such works has been approved by the Secretary.	Section 12.1
A24	From commencement of construction until completion of construction, the approved ER must: a) receive and respond to communications from the Secretary in relation to the environmental performance of the CSSI; b) consider and inform the Secretary on matters specified in the terms of this approval; c) consider and recommend any improvements that may be made to work practices to avoid or minimise adverse impact to the environment and to the community; d) review all documents required to be prepared under the terms of this approval, ensure they address any requirements in or under this approval and if so, endorse them before submission to the Secretary (if required to be submitted to the Secretary) or before implementation (if not required to be submitted to the Secretary). For documents requiring specialist review and/or endorsement the ER is not required to endorse the specialist content; e) regularly monitor the implementation of all documents required by the terms of this approval for implementation in accordance with what is stated in the document and the terms of this approval; f) review the Proponent's notification of incidents in accordance with Condition A41 of this approval; g) as may be requested by the Secretary, help plan, attend or undertake Department audits of the CSSI, briefings, and site visits;	Section 12.1

Item	Requirement	Document Reference
	<ul style="list-style-type: none"> h) if conflict arises between the Proponent and the community in relation to the environmental performance of the CSSI, follow the procedure in the Community Communication Strategy approved under Condition B3 of this approval to attempt to resolve the conflict, and if it cannot be resolved, notify the Secretary; i) review any draft consistency assessment that may be carried out by the Proponent, and provide advice on any additional mitigation measures required to minimise the impact of the work; j) consider any minor amendments to be made to the CEMP, CEMP sub-plans and monitoring programs that comprise updating or are of an administrative nature, and are consistent with the terms of this approval and the CEMP, CEMP sub-plans and monitoring programs approved by the Secretary and, if satisfied such amendment is necessary, approve the amendment. This does not include any modifications to the terms of this approval; k) assess the impacts of minor ancillary facilities as required by Condition A18 of this approval; and l) prepare and submit to the Secretary and other relevant regulatory agencies, for information, a monthly Environmental Representative Report detailing the ER's actions and decisions on matters for which the ER was responsible in the preceding month (or other timeframe agreed with the Secretary). The Environmental Representative Report must be submitted within seven (7) days following the end of each month for the duration of works and construction of the CSSI, or as otherwise agreed with the Secretary. 	
A25	<p>A suitably qualified and experienced Acoustics Advisor (AA), who is independent of the design and construction personnel, must be nominated by the Proponent and engaged for the duration of construction and for no less than six (6) months following operation of the CSSI.</p> <p>The details of the nominated AA must be submitted to the Secretary for approval no later than one (1) month before commencement of works, or within another timeframe as agreed with the Secretary. The Proponent may nominate additional suitably qualified and experienced persons to assist the lead Acoustics Advisor for the Secretary's approval.</p> <p>The Proponent must cooperate with the AA by:</p> <ul style="list-style-type: none"> a) providing access to noise and vibration monitoring activities as they take place; b) providing for review of noise and vibration plans, assessments, monitoring reports, data and analyses undertaken; and c) considering any recommendations to improve practices and demonstrating, to the satisfaction of the AA, why any recommendation is not adopted. 	Section 12.1
A26	Any activities generating noise and vibration in excess of the Noise Management Level derived from the Interim Construction Noise Guideline must not commence until an AA, nominated under Condition A25 of this approval, has been approved by the Secretary.	Section 12.1
A27	<p>The approved AA must:</p> <ul style="list-style-type: none"> a) receive and respond to communication from the Secretary in relation to the performance of the CSSI in relation to noise and vibration; b) consider and inform the Secretary on matters specified in the terms of this approval relating to noise and vibration; c) consider and recommend, to the Proponent, improvements that may be made to work practices to avoid or minimise adverse noise and vibration impacts; d) review all noise and vibration documents required to be prepared under the terms of this approval and, should they be consistent with the terms of this approval, endorse them before submission to the Secretary (if required to be submitted to the Secretary) or before implementation (if not required to be submitted to the Secretary); e) regularly monitor the implementation of all noise and vibration documents required to be prepared under the terms of this approval to ensure implementation is in accordance with what is stated in the document and the terms of this approval; f) notify the Secretary of noise and vibration incidents in accordance with Condition A41 of this approval; g) in conjunction with the ER, the AA must: <ul style="list-style-type: none"> i. consider requests for out of hours construction activities and determine whether to endorse the proposed activities in accordance with Condition E47; 	Section 12.1

Item	Requirement	Document Reference
	<ul style="list-style-type: none"> ii. as may be requested by the Secretary or Complaints Commissioner, help plan, attend or undertake audits of noise and vibration management of the CSSI including briefings, and site visits; iii. if conflict arises between the Proponent and the community in relation to the noise and vibration performance during construction of the CSSI, follow the procedure in the Community Communication Strategy approved under Condition B3 of this approval to attempt to resolve the conflict, and if it cannot be resolved, notify the Secretary; iv. consider relevant minor amendments made to the CEMP, relevant sub-plans and noise and vibration monitoring programs that require updating or are of an administrative nature, and are consistent with the terms of this approval and the management plans and monitoring programs approved by the Secretary and, if satisfied such amendment is necessary, endorse the amendment. This does not include any modifications to the terms of this approval; v. assess the noise impacts of minor ancillary facilities as required by Condition A18 of this approval; and vi. prepare and submit to the Secretary and other relevant regulatory agencies, for information, a monthly Noise and Vibration Report detailing the AAs actions and decisions on matters for which the AA was responsible in the preceding month (or other timeframe agreed with the Secretary). The Noise and Vibration Report must be submitted within seven (7) days following the end of each month for the duration of construction of the CSSI, or as otherwise agreed with the Secretary. 	
C2	<p>The CEMP must provide:</p> <ul style="list-style-type: none"> a) a description of activities to be undertaken during construction (including the scheduling of construction) b) details of environmental policies, guidelines and principles to be followed in the construction of the CSSI c) a schedule for compliance auditing d) a program for ongoing analysis of the key environmental risks arising from the activities described in subsection (a) of this condition, including an initial risk assessment undertaken before the commencement of construction of the CSSI e) details of how the activities described in subsection (a) of this condition will be carried out to: <ul style="list-style-type: none"> i. meet the performance outcomes stated in the EIS as amended by the documents listed in A1(a) to A1(c) inclusive; and ii. manage the risks identified in the risk analysis undertaken in subsection (d) of this condition. f) an inspection program detailing the activities to be inspected and frequency of inspections g) a protocol for managing and reporting any: <ul style="list-style-type: none"> i. incidents; and ii. non-compliances with this approval and with statutory requirements h) procedures for rectifying any non-compliance with this approval identified during compliance auditing, incident management or at any time during construction i) a list of all the CEMP sub-plans required in respect of construction, as set out in Condition C3. Where staged construction of the CSSI is proposed, the CEMP must also identify which CEMP sub-plan applies to each of the proposed stages of construction j) a description of the roles and environmental responsibilities for relevant employees and their relationship with the ER k) for training and induction for employees, including contractors and sub-contractors, in relation to environmental and compliance obligations under the terms of this approval l) for periodic review and update of the CEMP and all associated plans and programs 	Section 8, Section 9, Section 12, Table 8.1

Item	Requirement	Document Reference										
C3	<p>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.</p> <ul style="list-style-type: none"> a) Noise and Vibration – consult with relevant council(s) b) Biodiversity - OEH and Relevant Council(s) c) Air Quality - N/A d) Soil and Water - DPI Water, Relevant Council(s), OEH, SES, NSW Fire and Rescue e) Groundwater - DPI Water f) Heritage - Heritage Council (or its delegate) and Relevant Council(s) 	Section 1.4, Table 5 - Compliance Matrix – Sydney Metro CEMF.										
C4	<p>The CEMP sub-plans must state how:</p> <ul style="list-style-type: none"> a) the environmental performance outcomes identified in the EIS as amended by the documents listed in A1(a) to A1(c) inclusive will be achieved; b) the mitigation measures identified in the EIS as amended by the documents listed in A1(a) to A1(c) inclusive will be implemented; c) the relevant terms of this approval will be complied with; and d) issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed. 	<ul style="list-style-type: none"> a) Section 8 b) Refer Table 2 below c) This table d) Refer Table 5 below 										
C5	<p>The CEMP sub-plans must be developed in consultation with relevant government agencies. Where an agency(ies) request(s) is not included, the Proponent must provide the Secretary justification as to why. Details of all information requested by an agency to be included in a CEMP sub-plan as a result of consultation and copies of all correspondence from those agencies, must be provided with the relevant CEMP sub-plan.</p>	Section 1.4										
C8	<p>Construction must not commence until the CEMP and all CEMP sub-plans have been approved by the Secretary. The CEMP and CEMP sub-plans, as approved by the Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where the CSSI is being staged, construction of that stage is not to commence until the relevant CEMP and sub-plans have been approved by the Secretary.</p>	Section 2.3										
C9	<p>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.</p> <table border="1"> <thead> <tr> <th>Required Construction Monitoring Programs</th> <th>Relevant government agencies to be consulted for each Construction Monitoring Program</th> </tr> </thead> <tbody> <tr> <td>A Noise and Vibration</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>B Blasting</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>C Water Quality</td> <td>EPA and Relevant Council(s)</td> </tr> <tr> <td>D 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	Section 10, Construction Noise and Vibration (CNV) Monitoring Program
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B Blasting	EPA and Relevant Council(s)											
C Water Quality	EPA and Relevant Council(s)											
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Item	Requirement	Document Reference
C10	<p>Each Construction Monitoring Program must provide:</p> <ul style="list-style-type: none"> a. details of baseline data available; b. details of baseline data to be obtained and when; c. details of all monitoring of the project to be undertaken; d. the parameters of the project to be monitored; e. the frequency of monitoring to be undertaken; f. the location of monitoring; g. the reporting of monitoring results; h. procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and i. any consultation to be undertaken in relation to the monitoring programs. 	<p>CNV Monitoring Program</p> <ul style="list-style-type: none"> a. Section 3.1 b. Section 3.1 c. Section 10.1 d. Section 10.1 e. Section 10.1 f. Section 10.2 g. Section 10.2 h. Section 10 i. Section 1.4
C11	<p>The Noise and Vibration Construction Monitoring Program and Blast Construction Monitoring Program 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 in real time. The Department and EPA must be provided with access to the real time monitoring data in real time.</p>	<p>Section 4.1 of the CNV Monitoring Program</p>
C12	<p>The Construction Monitoring Programs must be developed in consultation with relevant government agencies as identified in Condition C9 of this approval and must include, to the written satisfaction of the Secretary, information requested by an agency to be included in a Construction Monitoring Programs during such consultation. Details of all information requested by an agency including copies of all correspondence from those agencies, must be provided with the relevant Construction Monitoring Program.</p>	<p>Section 1.2 of the CNV Monitoring Program</p>
C13	<p>The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Secretary for approval at least one (1) month before commencement of construction or within another timeframe agreed with the Secretary.</p>	<p>Section 1.2 of the CNV Monitoring Program</p>
C14	<p>Construction must not commence until the Secretary has approved all of the required Construction Monitoring Programs, and all relevant baseline data for the specific construction activity has been collected.</p>	<p>Section 1.2 of the CNV Monitoring Program</p>
C15	<p>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.</p>	<p>Section 1.1 of the CNV Monitoring Program</p>
C16	<p>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.</p>	<p>Section 4.8 of the CNV Monitoring Program</p>
C17	<p>Where a relevant CEMP sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP sub-plan.</p>	<p>CNV Monitoring Program</p>

Item	Requirement	Document Reference
E28	<p>Vibration</p> <p>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 ground-borne vibration</p>	Section 4.4, Section 5.3
E29	<p>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. The management of construction works in the vicinity of properties at risk of exceeding the screening criteria for cosmetic damage must be considered in the Noise and Vibration management sub plan required by Condition C3.</p>	Section 8.2
E31	<p>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.</p>	Section 8.1.3
E32	<p>Construction Noise and Vibration Strategy</p> <p>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 receptors including:</p> <ul style="list-style-type: none"> a) at property or architectural treatment; b) relocation; and c) other forms of mitigation where impacts are predicted to be long term and significant. <p>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.</p> <p><i>Note: The Construction Noise and Vibration Strategy was prepared by TfNSW and approved by DP&E. In accordance with condition allocation in the contract, LORAC is required to comply with the Sydney Metro City & Southwest Construction Noise and Vibration Strategy for all works south of Chatswood Station, including any subsequent versions of this document which may be produced. This CNVMP has been prepared to assist LORAC achieve this.</i></p>	This CNVMP Section 8 Section 8.2
E33	<p>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.</p>	Section 7, Section 8
E34	<p>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.</p>	Section 6.1

Item	Requirement	Document Reference
E36	<p>Standard Construction Hours</p> <p>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. 	Section 6.1
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 receptors.	Section 7.2.1, Table 8.1
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.	Section 7.2.1, Table 8.1
E41	<p>Mitigation – Non Residential Zones</p> <p>The Proponent must ensure that residential receptors, located in non-residential zones, likely to experience an internal noise level exceeding Leq, 15 minute 60 dB(A) between 8pm and 9pm or Leq, 15 minute 45 dB(A) between 9pm and 7am (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 (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>	Section 8.2, Table 8.1, Section 7.2.2
E42	<p>Mitigation – Residential receptors in residential zones</p> <p>The Proponent must ensure that residential receptors in residential zones likely to experience an internal noise level of Leq, 15 minute 45 dB(A) or greater between 8pm and 7am (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 (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>	Section 8.2, Table 8.1, Section 7.2.2
E43	<p>Workplace health and safety for nearby workers</p> <p>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 85dBA for any employee working at a location near the CSSI.</p>	Table 8.1
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 receptors of the likely impact and duration of those works.	Section 6.1.2, Table 8.1

Item	Requirement	Document Reference
E46	<p>Notwithstanding Conditions E44 and E48, rock breaking and other particularly annoying activities for station shaft or cut and cover stations is not permitted outside of standard construction hours, except at Central; or</p> <ul style="list-style-type: none"> a) 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 b) where different construction hours are permitted or required under an EPL in force in respect of the construction; or c) construction that causes LAeq(15 min) noise levels: <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, measures 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). 	Section 6.1, Section 8, Table 8.1
E48	<p>24 Hour Construction</p> <p>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. 	Section 6.1.1, Appendix B, Table 8.1

Table 2 - Compliance Matrix – PIR Revised Environmental Mitigation Measures (REMM)

Item	Requirement	Document Reference
NV1	<p>The Construction Noise and Vibration Strategy would be implemented with the aim of achieving the noise management levels where feasible and reasonable. This would include the following example standard mitigation measures where feasible and reasonable:</p> <ul style="list-style-type: none"> • Provision of noise barriers around each construction site • Provision of acoustic sheds at Chatswood dive site, Crows Nest, Victoria Cross, Barangaroo Martin Place, Pitt Street, Waterloo and Marrickville dive site • The coincidence of noisy plant working simultaneously close together would be avoided • Offset distances between noisy plant and sensitive receptors would be increased • Residential grade mufflers would be fitted to all mobile plant • Dampened rock hammers would be used • Non-tonal reversing alarms would be fitted to all permanent mobile plant • High noise generating activities would be scheduled for less sensitive period considering the nearby receptors • The layout of construction sites would consider opportunities to shield receptors from noise. <p>This would also include carrying out the requirements in relation to construction noise and vibration monitoring.</p>	Section 8, Table 8.1
NV2	<p>Unless compliance with the relevant traffic noise criteria can be achieved, night time heavy vehicle movements at the Chatswood dive site, Crows Nest Station, Victoria Cross Station and Waterloo Station sites would be restricted to:</p> <ul style="list-style-type: none"> • The Pacific Highway and Mowbray Road at the Chatswood dive site • The Pacific Highway, Hume Street and Oxley Street at the Crows Nest Station construction site • McLaren Street, Miller Street and Berry Street at the Victoria Cross Station construction site • Botany Road and Raglan Street at the Waterloo Station construction site. 	Section 8, Table 8.1
NV3	<p>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.</p> <p>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.</p>	Section 8.1.1, Section 8.1.3
NV4	<p>Feasible and reasonable measures would be implemented to minimise ground borne noise where exceedances are predicted.</p>	Section 8.1.1, Section 8.1.2, Section 8.2

Item	Requirement	Document Reference
NV6	<p>Transport for NSW would engage an Independent Acoustic Advisor to act independently of the design and construction teams and provide oversight of construction methods, construction noise and vibration planning, management and mitigation, and construction noise and vibration monitoring and reporting. The key responsibilities of the Independent Acoustic Advisor would include :</p> <ul style="list-style-type: none"> Assurance of contractor noise and vibration planning, modelling, management and monitoring practices Verification of compliance with relevant guidelines and approval requirements Audit noise and vibration management practices. 	Section 12.1
NV7	<p>Alternative demolition techniques that minimise noise and vibration levels would be investigated and implemented where feasible and reasonable. This would include consideration of:</p> <ul style="list-style-type: none"> The use of hydraulic concrete shears in lieu of hammers/rock breakers Sequencing works to shield noise sensitive receptors by retaining building wall elements Locating demolition load out areas away from the nearby noise sensitive receptors 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 saw-cutting 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 / hours to minimise impacts during peak pedestrian times and / or adjoining neighbour outdoor activity periods. 	Section 8

Table 3 - Compliance Matrix – PIR Revised Environmental Performance Outcomes

Item	Requirement	Document Reference
PIR, Table 11-2	<ul style="list-style-type: none"> Noise and vibration – amenity (requirement): Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimize adverse impacts on acoustic amenity. Environmental performance outcome: Noise levels would be minimised with the aim of achieving the noise management levels where feasible and reasonable. 	Section 8
PIR, Table 11-2	<ul style="list-style-type: none"> Noise and vibration – structural (requirement): Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimize adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Environmental performance outcome: The project would avoid any damage to buildings from vibration. 	Section 8

Table 4 - Compliance Matrix – MR - minor E

Item	Requirement	Document Reference
2.1	The Contractor must comply with the requirements of the SM ES-ST-204 Sydney Metro Construction Environmental Management Framework (CEMF), as detailed in Annexure A and any other reference Documents identified in Annexure B of the Management Requirement Minor – Environment (MR - minor E).	Section 10
2.2	a) The Contractor must provide a monthly report, using the SM ES-FT-421 Sydney Metro City & Southwest Environmental Reporting Template	Section 10
2.2	b) Within 5 Business Days each Calendar Quarter Date, a register of ongoing Environmental Compliance Requirements (ECRs) must be submitted to the Environmental Representative for review in accordance with the Contract, which identifies progress and evidence of compliance against each ECR.	Section 10
2.2	c) The register of ECRs must classify each ECR as: <ul style="list-style-type: none"> i. Ongoing or Complete, to indicate their progress; and ii. Compliant or Non-Compliant, to indicate compliance. 	Section 10

Table 5 - Compliance Matrix – Sydney Metro CEMF (as required by Annexure A of MR- minor E)

Item	Requirement	Document Reference
2.1	<p>Key Legislative Requirements</p> <p>Table 1.1 of the CEMF identifies key NSW environmental legislative requirements and their application to SM C&SW construction works, current as at the date of this document. TfNSW and its Contractors should regularly review their legislative requirements.</p>	Section 2
2.2	<p>Environmental Approvals</p> <p>Sydney Metro City and Southwest is also classified as Critical State Significant Infrastructure and requires approval from a consent authority under the requirements of the Environmental Protection and Assessment Act 1997 (Section 115W). Two separate approvals will be sought:</p> <ul style="list-style-type: none"> i. Sydney Metro City and Southwest - Chatswood to Sydenham ii. Sydney Metro City and Southwest - Sydenham to Bankstown <p>The requirements of the approval are required to be complied with by TfNSW. Responsibility for implementing mitigation measures and conditions of approval will be allocated between TfNSW and Principal Contractors as appropriate. Typically TfNSW will produce a Staging Report which sets out the applicability and allocation of approval requirements within the project's program of works.</p>	Section 1.2.2.3
2.3	<p>Environment Protection Licence Requirements</p> <p>Sydney Metro projects often meet the definition of a number of scheduled activities under Schedule 1 of the Protection of the Environmental Operation Act 1997 (POEO Act) and as such our contractors may be required to obtain an Environment Protection Licence (EPL) or work under the existing EPL held by Sydney Trains.</p> <p>Where required, Sydney Metro Principal Contractors will:</p> <ul style="list-style-type: none"> a) Apply for and be granted an EPL from the EPA. b) Hold an EPL which covers their scope of works as necessary under the POEO Act. c) Undertake their scope of works in accordance with the conditions of the applicable EPLs as issued by the EPA. d) Work under the existing Sydney Trains EPL. 	Section 2
2.4	<p>Standards and Guidelines</p> <p>Numerous environmental publications, standards, codes of practice and guidelines are relevant to TfNSW construction and are referenced throughout this Construction Environmental Management Framework. A summary of these applicable standards and guidelines is provided in Table 1.3 of the CEMF.</p>	Section 2.2
3.3	<p>Construction Environmental Management Plan</p> <p>The Contractor must comply with the requirements to prepare a CEMP and in addition to the requirements of Section 3.3 of the CEMF, the Principal Contractor's procedures included in the CEMP must be consistent with the following Reference Documents:</p> <ul style="list-style-type: none"> i. City and Southwest Construction Noise and Vibration Strategy (SM ES-ST-210); ii. Environmental Incident Classification and Reporting Procedure (SM ES-PW-303); iii. Water Discharge and Reuse Procedure (SM ES-PW-309); iv. Planning Approval Consistency Procedure (SM ES-PW-314); and v. Environment & Sustainability Policy (SM SE MM 102). 	Section 2.2

Item	Requirement	Document Reference
3.4	<p>Construction Environmental Management Sub-Plans</p> <p>The Contractor must comply with the requirements of section 3.4 of the CEMF and in relation to Section 3.4 a. only the following issue-specific environmental Sub plans to the CEMP, are required:</p> <ul style="list-style-type: none"> i. Construction Traffic Management Plan (and its sub-plans per section 8.2); ii. Construction Noise and Vibration Management Plan; and iii. Sustainability Management Plan in line with requirements of MR-minor Sustainability (MR-minor Sy). 	This CNVMP
3.6	<p>Additional Environmental Assessments</p> <p>Where the requirement for an additional environmental assessment is identified, this will be undertaken prior to undertaking any physical works. The environmental assessment will include:</p> <ul style="list-style-type: none"> i. A description of the existing surrounding environment; ii. Details of the ancillary works and construction activities required to be carried out including the hours of works; iii. An assessment of the environmental impacts of the works, including, but not necessarily limited to, traffic, noise and vibration, air quality, soil and water, ecology and heritage; iv. Details of mitigation measures and monitoring specific to the works that would be implemented to minimise environmental impacts; and v. Identification of the timing for completion of the construction works, and how the sites would be reinstated (including any necessary rehabilitation). 	NCW CNVIS
3.8	<p>Register of Hold Points</p> <ul style="list-style-type: none"> a) Principal Contractors will identify hold points, beyond which approval is required to proceed with a certain activity. Example activities include vegetation removal and water discharge. Hold points will be documented in relevant CEMFs. b) Table 1.4 of the CEMF provides the structure for the register of hold points as well as a preliminary list of hold points which will be implemented. 	Section 2.1
3.9	<p>Training, Awareness and Competence</p> <p>Principal Contractors will be responsible for determining the training needs of their personnel. As a minimum this will include site induction, regular toolbox talks and topic specific environmental training as outlined in the CEMF.</p>	Section 9
3.10	<p>Emergency and Incident Response</p> <p>Principal Contractors will develop and implement a Pollution Incident Response Management Plan, in accordance with the requirements of the POEO Act. Contractors' emergency and incident response procedures will also be consistent with any relevant SMDO procedures and are outlined further in the CEMF.</p>	Section 11
3.12	<p>Roles and Responsibilities</p> <ul style="list-style-type: none"> a) In relation to Roles and Responsibilities the CEMP will: <ul style="list-style-type: none"> i. Describe the relationship between the Principal Contractor, TfNSW, key regulatory stakeholders, the independent environmental representative and the independent certifier; ii. For each role that has environmental accountabilities or responsibilities, including key personnel, provide a tabulated description of the authority and roles of key personnel, lines of responsibility and communication, minimum skill level requirements and their interface with the overall project organisation structure; iii. Provide details of each specialist environment, sustainability or planning consultant who is employed by the Principal Contractor including the scope of their work; and iv. Provide an overview of the role and responsibilities of the Independent Environmental Representative, the Independent Certifier and other regulatory stakeholders. b) All sub-contractors engaged by the Principal Contractor will be required to operate within the EMS documentation of that Principal Contractor. 	Section 12.1

Item	Requirement	Document Reference
3.13	<p>Environmental Monitoring, Inspections and Auditing</p> <ul style="list-style-type: none"> a) Issue specific environmental monitoring will be undertaken as required or as additionally required by any approval, permit or licence conditions. b) The results of any monitoring undertaken as a requirement of the EPL will be published on the Principal Contractor's, or a project specific, website within 14 days of obtaining the results. c) Environmental inspections will include: <ul style="list-style-type: none"> i. Surveillance of environmental mitigation measures by the Site Foreman; and ii. Periodic inspections by the Principal Contractor's Environmental Manager (or delegate) to verify the adequacy of all environmental mitigation measures. This will be documented in a formal inspection record. d) Regular site inspections by the ERs and TfNSW representatives at a frequency to be agreed with the Principal Contractor. e) Principal Contractors must undertake internal environmental audits. The scope will include: <ul style="list-style-type: none"> i. Compliance with any approval, permit or licence conditions; ii. Compliance with the E&SMS, CEMP, SMP, sub-plans and procedures; iii. Community consultation and complaint response; iv. Environmental training records; and v. Environmental monitoring and inspection results. f) TfNSW (or an independent environmental auditor) will also undertake periodic audits of the Principal Contractor's E&SMS and compliance with the environmental aspects of contract documentation, including this Construction Environmental Management Framework. 	Section 10
3.14	<p>Environmental Non-compliances</p> <ul style="list-style-type: none"> a) Principal Contractors will document and detail any non-compliances arising out of the above monitoring, inspections and audits. TfNSW will be made aware of all non-compliances in a timely manner. b) Principal Contractors will develop and implement corrective actions to rectify the non-compliances and preventative actions in order to prevent a re-occurrence of the non-compliance. Contractors will also maintain a register of non-compliances, corrective actions and preventative actions. c) TfNSW or the Environmental Representative may raise non-compliances against environmental requirements. 	Section 11
3.15	<p>Environmental Records and Compliance Reporting</p> <ul style="list-style-type: none"> a) Principal Contractors will maintain appropriate records of the following: <ul style="list-style-type: none"> i. Site inspections, audits, monitoring, reviews or remedial actions; ii. Documentation as required by performance conditions, approvals, licences and legislation; iii. Modifications to site environmental documentation (e.g. CEMP, sub-plans and procedures); and iv. Other records as required by this Construction Environmental Management Framework. b) Records will be retained onsite for the duration of works. c) Additionally records will be retained by the Principal Contractor for a period of no less than 7 years. Records will be made available in a timely manner to TfNSW (or their representative) upon request. d) Compliance reports detailing the outcome of any environmental surveillance activity including internal and external audits (refer to Section 3.13) will be produced by the Principal Contractors Environmental Manager or delegate. These reports will be submitted to TfNSW at an agreed frequency. 	Section 10

Item	Requirement	Document Reference
4.5	<p>Business and Property Impacts</p> <p>a) Principal Contractors will proactively work with potentially affected stakeholders to identify the likely impacts and put in place measures to minimise impacts.</p> <p>b) Construction works will be undertaken to meet the following objectives:</p> <ol style="list-style-type: none"> i. Minimise the potential impact of the project to businesses affected by construction works; ii. Ensure businesses are kept informed of the project and consulted in advance of major works or factors that are likely to have a direct impact; iii. Consult with all business directly affected by changes to access arrangements regarding specific requirements at least two weeks prior to those changes coming into effect; and iv. Ensure that business stakeholder enquiries and complaints regarding the project are managed and resolved effectively. <p>c) Principal Contractors will document in the Community Communication Strategy (Section 4.2) key issues relating to business impacts by locality with a particular focus on proactive consultation with affected businesses. Including:</p> <ol style="list-style-type: none"> i. Identification of specific businesses which are sensitive to construction activity disturbances; ii. Summary of the commercial character of the locality, its general trading profile (daily and annually) and information gained from the business profiling such as: <ul style="list-style-type: none"> • Operating hours; • Main delivery times; • Reliance on foot traffic; • Any signage or advertising that may be impacted; • Customer origin; and • Other information specific to the business that will need to be considered in construction planning. iii. Define the roles and responsibilities in relation to the control and monitoring of business disturbances; iv. Identification of locality specific standard business mitigation measures which would be implemented; v. Maps and diagrams to illustrate the information for easy identification of measures which would be implemented; vi. Description of the monitoring, auditing and reporting procedures; vii. Procedure for reviewing performance and implementing corrective actions; viii. Description of the complaints handling process; and ix. Procedure for community consultation and liaison. 	Section 7
5.1	<p>Working Hours</p> <p>a) Standard working hours are between 7am – 6pm on weekdays and 8am – 1pm on Saturdays.</p> <p>b) Works which can be undertaken outside of standard construction hours without any further approval include:</p> <ol style="list-style-type: none"> i. Those which have been described in respective environmental assessments as being required to take place 24/7. For example, tunnelling and underground excavations and supporting activities will be required 24/7; ii. Works which are determined to comply with the relevant Noise Management Level at sensitive receivers; iii. The delivery of materials outside of approved hours as required by the Police or other authorities (including RMS) for safety reasons; iv. Where it is required to avoid the loss of lives, property and / or to prevent environmental harm in an emergency; and v. Where written agreement is reached with all affected receivers. <p>c) Principal Contractors may apply for EPA approval to undertake works outside of normal working hours under their respective Environment Protection Licences.</p>	Section 6

Item	Requirement	Document Reference
5.2	a) Principal Contractors will consider the following in the layout of construction sites: <ol style="list-style-type: none"> i. The location of noise intensive works and 24 hour activities in relation to noise sensitive receivers; ii. The location of site access and egress points in relation to noise and light sensitive receivers, especially for sites proposed to be utilised 24 hours per day; iii. The use of site buildings to shield noisy activities from receivers; iv. The use of noise barriers and / or acoustic sheds where feasible and reasonable for sites proposed to be regularly used outside of daytime hours; and v. Aim to minimise the requirement for reversing, especially of heavy vehicles. 	Section 8
8.3	Construction Traffic Mitigation <ol style="list-style-type: none"> a) Examples of traffic mitigation measures include: <ol style="list-style-type: none"> i. Minimising heavy vehicle movements during peak traffic times; ii. Avoidance of local roads for heavy vehicle routes, where feasible; iii. Providing for safe pedestrian and cyclist movements around the worksites; and iv. Where feasible and reasonable, contractors will provide its workforce with satellite car parking and buses to transport them to the worksites. 	Section 8
9.1(a)	Construction Noise and Vibration Management Objectives The following noise and vibration management objectives will apply to construction: <ol style="list-style-type: none"> i. Minimise unreasonable noise and vibration impacts on residents and businesses; ii. Avoid structural damage to buildings or heritage items as a result of construction vibration; iii. Undertake active community consultation; and iv. Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners. 	Section 1.3
9.2(a)	Principal Contractors will develop and implement a Construction Noise and Vibration Management Plan for their scope of works consistent with the Interim Construction Noise Guidelines (Department of Environment and Climate Change, 2009). The Construction Noise and Vibration Management Plan will include as a minimum: <ol style="list-style-type: none"> i. Identification of work areas, site compounds and access points; ii. Identification of sensitive receptors and relevant construction noise and vibration goals; iii. 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); iv. 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 or vibration impacts on surrounding sensitive receptors, in particular residential areas; v. Identification of feasible and reasonable procedures and mitigation measures to ensure relevant vibrations and blasting criteria are achieved, including a suitable blast program; vi. Community consultation requirements and Community notification provisions specifically in relation to blasting; vii. The requirements of any applicable EPL conditions; viii. Additional requirements in relation to activities undertaken 24 hours of the day, 7 days per week; ix. Pre-construction compliance requirements and hold points; x. The responsibilities of key project personnel with respect to the implementation of the plan; xi. Noise monitoring requirements; xii. Compliance record generation and management; and xiii. An Out of Hours Works Protocol applicable to all construction methods and sites. 	<ol style="list-style-type: none"> i. Section 1.2 ii. Section 3 iii. Section 8 iv. Section 7 v. Section 8 vi. Section 8.2 vii. Section 2/5 viii. Section 6.1.1, Section 8.2 ix. Section 2.3 x. Section 12.1 xi. Section 10 xii. Section 10, Section 11 xiii. Section 6.1.1, Appendix B

Item	Requirement	Document Reference
9.2(b)	Detailed Construction Noise and Vibration Impact Statements will be prepared for noise intensive construction sites and or activities, to ensure the adequacy of the noise and vibration mitigation measures. Specifically, Construction Noise and Vibration Impact Statements will be prepared for EPL variation applications and works proposed to be undertaken outside of standard construction hours.	NCW CNVIS
9.2(c)	Noise and vibration monitoring would be undertaken for construction as specified in the CNVS and the EPL.	Section 10
9.2(d)	The following compliance records would be kept by Principal Contractors: <ul style="list-style-type: none"> i. Records of noise and vibration monitoring results against appropriate NMLs and vibration criteria; and ii. Records of community enquiries and complaints, and the Contractor's response. 	Section 10 Section 11
9.3(a)	All feasible and reasonable mitigation measures would be implemented in accordance with the CNVS. Examples of noise and vibration mitigation measures include: <ul style="list-style-type: none"> i. Construction hours will be in accordance with the working hours specified in Section 5.1; ii. Hoarding and enclosures will be implemented where required to minimise airborne noise impacts; and iii. The layout of construction sites will aim to minimise airborne noise impacts to surrounding receptors. 	Section 8

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0.1 Structure of this CNVMP

This CNVMP has been prepared to address all requirements tabulated in the consolidated compliance matrix. They are addressed throughout this plan which is structured in the following format:

- **Section 1 – Introduction:** provides an overview of the purpose and application of this CNVMP, a background to the NCW project and the broader Sydney Metro City and Southwest Project, identifies the location of work areas, identifies the likely works duration and summarises potential noise and vibration issues.
- **Section 2 – Legal and Other Requirements:** provides an overview of the legal context of the Plan and summarises the applicable policy, standards and guideline.
- **Section 3 – Existing Environment and Noise/Vibration Guidelines:** summarises the existing noise environment, presents the measured baseline (background noise) data from the EIS, identifies potentially sensitive receptors, and describes how the baseline data is applied in the content of the applicable noise and vibration guidelines.
- **Section 4 – Noise and Vibration Guidelines:** describes the noise and vibration guidelines that will apply during construction works and activity.
- **Section 5 – Noise Management Levels:** describes the management levels (for noise and vibration) that will apply during construction works and activity.
- **Section 6 – Work Hours:** describes the NCW hours of work that will apply during construction works and activity.
- **Section 7 – Aspects, Impacts & Risks:** presents the NCW activities and work phases, lists the likely noise and vibration generating sources and reproduces the predicted noise and vibration impacts from the CNVIS.
- **Section 8 – Mitigation and Management Measures:** describes the overall approach to managing and mitigating noise and vibration impacts as a result of the NCW based on the predicted impacts as summarised this CNVMP. It details the relevant noise and vibration mitigation measures to be implemented during the works.
- **Section 9 – Training:** summarises the training that will be provided during NCW project as applicable to the management of noise and vibration.
- **Section 10 – Noise and Vibration Monitoring:** refers to the stand alone noise and vibration monitoring program that details the requirements of any noise and vibration monitoring that is required and the technical methods that will be adopted.
- **Section 11 – Enquiries, Complaints and Incident Management:** summarises the enquiries, complaints and incident management that will be undertaken as per the NCW CEMP and Communications Strategy, including that related to noise and vibration.
- **Section 12 – CNVMP Administration:** provides information regarding relevant roles and responsibilities associated with this plan and the CNVMP review process.
- **Section 13 – References:** lists the documents, policy, standards and guidelines applicable to this plan, those that were considered during the preparation of the CNVMP.
- **Appendix A – Acoustics: Glossary of Terms and Definition:** provides an overview of relevant acoustical terminology and concepts.
- **Appendix B – Out of Hours Works (OOHW) Protocol:** presents the OOHW Protocol that will apply during the NCW construction works. A template Out Of Hours Work Application Form (OOHWAF) is also provided.
- **Appendix C – Summary of Predicted Noise Levels:** presents the summary of predicted noise levels from the CNVIS. This includes the most affected receptors in each scenario.
- **Appendix D – Assessment Scenarios:** presents the summary of Assessment Scenarios from the CNVIS.
- **Appendix E – Potentially Sensitive Receptors:** presents the potentially sensitive receptors identified in the CNVIS.
- **Appendix F – Construction Program:** presents the Construction Program outlined in the CEMP.
- **Appendix G – Sydney Metro Stakeholder Comment Register:** presents the summary of government stakeholder engagement.

1. Introduction

1.1 Purpose and Application

The Northern Corridor Works (NCW) Construction Noise and Vibration Management Plan (CNVMP or this plan) describes how Laing O'Rourke Australia Construction Pty Ltd (LOR) and its sub-contractors will ensure all risks associated with noise and vibration issues are considered and managed effectively during the NCW project, as part of the Sydney Metro City and Southwest project.

This plan has been developed to address the following:

- Critical State Significant Infrastructure Conditions of Approval (SSI 15_7400).
- Sydney Metro Construction Environmental Management Framework (August 2016).
- Sydney Metro Construction Noise and Vibration Strategy (Report No 610.14213-R3; V0.4 August 2017).
- NCW Portion 7b Construction Noise and Vibration Impacts Statement (CNVIS) (NCW – P7B CNVIS, June 2018).
- All applicable guidelines and standards specific to noise and vibration management during construction.

A summary table demonstrating CNVMP compliance against the requirements of the relevant project Approval for the works is documented in **Section 0** of this CNVMP. The CNVMP is supported by, and forms a sub-plan to, the NCW Construction Environmental Management Plan (CEMP).

1.2 Background and Scope

Nuisance, or an unacceptable level of noise and vibration amenity, may arise from construction activities associated with new or existing developments. These potential issues are recognised in the various approval documents requiring the preparation of this CNVMP and the mitigation and management of potential impacts during the NCW.

This plan addresses these potential issues and applies directly to the construction phase of the NCW project of the Sydney Metro City and Southwest project (hereafter referred to as the project). This plan applies to all activities, tasks, products and services on the site over which it has control or influence.

The overall LOR CEMP has been developed for the construction phase of the project, in compliance with the Client's requirements and LOR environmental management system. As a sub-plan this CNVMP has been developed to specifically address potential noise and vibration impacts. Blasting (a feature of the broader Sydney Metro City and Southwest project) is not required for the project and is therefore not addressed in this CNVMP.

The NCW project site is located in the rail corridor of the T1 North Shore Line between Chatswood Station and Artarmon Station. The location of the site is illustrated below in **Figure 1.1**. The site compound is located in the rail corridor south of the project site and south of Artarmon Station. Access and egress from the site compound is located on Cleland Rd, Artarmon. The location of the site compound is presented in **Figure 3.7**.

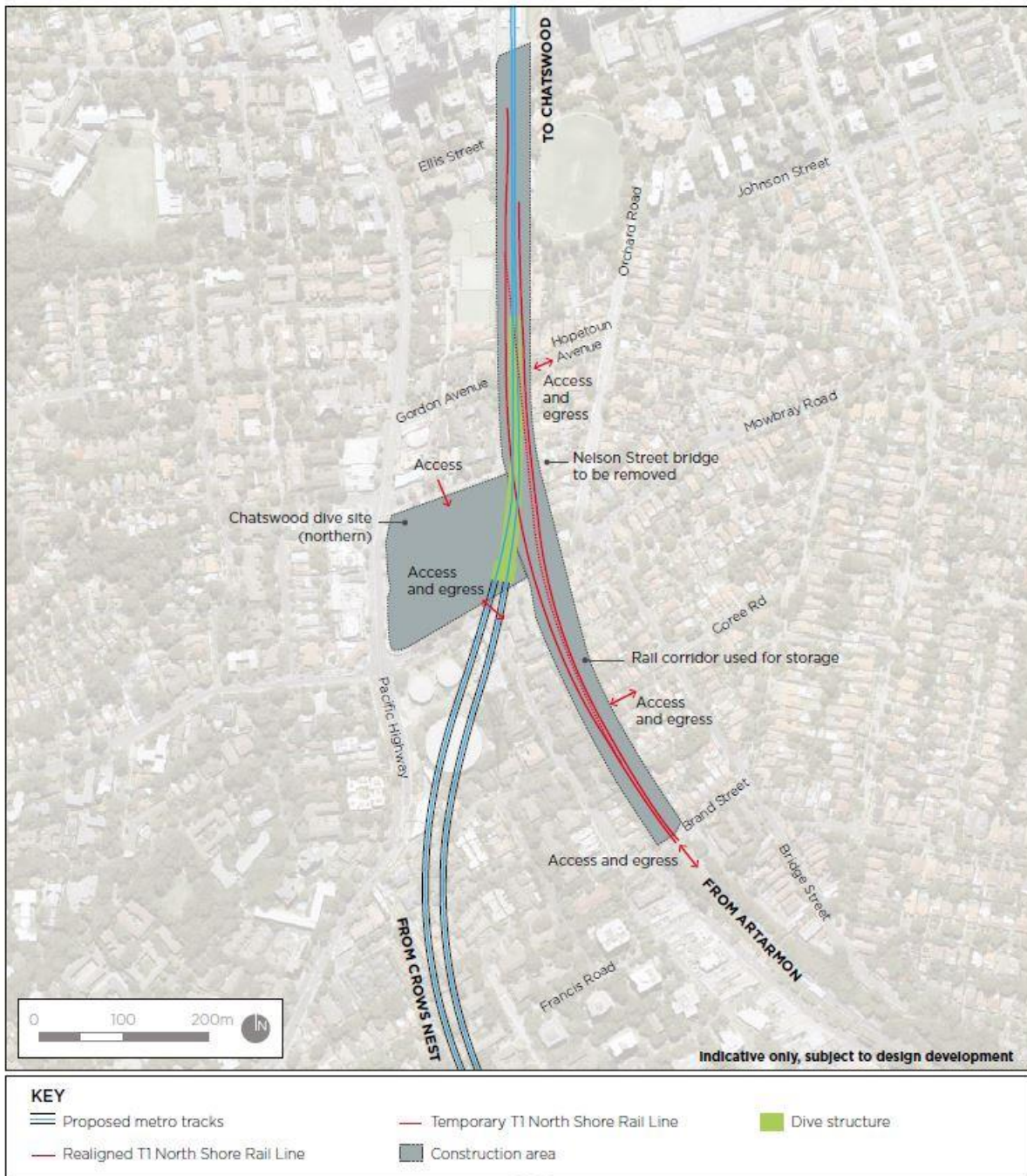


Figure 1.1: Northern Corridor Works Project Site (TfNSW Sydney Metro C2S EIS 2016)

1.2.1 North Corridor Works Project Overview

Sydney Metro City and Southwest is a new 30 Kilometre (KM) metro line extending metro rail from the end of Sydney Metro Northwest at Chatswood under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the capacity to run a metro train every two minutes each way through the centre of Sydney. The NCW project forms part of the Sydney Metro City and southwest project and includes the following scope of works.

The intent of the NCW is the realignment of the T1 North Shore Line between Chatswood Station and Brand St, Artarmon, approximately 1 kilometre in length, to accommodate the new metro tracks to be constructed between the country and city rail lines, and the future construction of the Chatswood tunnelling dive site.

1.2.2 Project scope of works

The NCW project works include earthworks and construction of all permanent new infrastructure and modifications to existing infrastructure, including the following key phases of work:

Portion 7A:

- Geotechnical investigations
- Installation of footings
- Detention basin construction

Portion 7B:

- Drainage Works
- Hopetoun Ave Access Ramp removal
- Placement of noise walls and construction of retaining walls
- Track slews
- Nelson Street Bridge removal;
- Mowbray Road/Hampden Road intersection upgrade; and
- Mowbray Road Bridge widening.

There are also a number of temporary works being conducted as part of the NCW project, which are discussed in detail throughout the CEMP.

Additional construction scenarios to those listed above were developed to assess noise and vibration as part of the Portion 7A CNVIS and Portion 7B CNVIS. These assessment scenarios were established in consultation with LOR. They are consistent with the construction methodology of NCW as described above but provide further detail for specific activities and tasks required during the works. The noise and vibration assessment scenarios for Portion 7B are outlined in **Section 7.1** and further detailed **Appendix D**.

1.2.2.1 *Potential Noise Issues*

The key acoustical issues potentially associated with NCW are noise and vibration emissions attributable to general construction plant, equipment and machinery in use (or activities undertaken) within the site area, during and outside the approved (**CoA – E36**) standard construction hours. In addition, potentially high noise impact issues associated with sheet piling; during the approved specified construction hours are considered in this CNVMP.

During works outside the approved standard construction hours noise issues potentially associated with NCW includes general emissions (LAeq, 15minute) but extends to include potential sleep disturbance emissions (LA1, 1minute) attributable to construction plant, equipment and machinery in use (or activities undertaken) within the site area. Potential NCW activities required outside the approved standard construction hours are considered in this CNVMP. These are the focus of the OOHV Protocol (refer *Appendix B*) developed for the assessment, management and approval of these non-standard works and activities, if required.

The broader environmental assessment for the Sydney Metro City and Southwest project has identified generic impacts for typical works near the Chatswood dive site. Subsequently, a site specific NCW Construction Noise and Vibration Impact Statement (CNVIS) has been prepared for the project. The CNVIS has identified task specific impacts associated with general construction noise (LAeq, 15minute)

and potential sleep disturbance (LA₁, 1minute) noise emissions. Further detail regarding the specific works, tasks and impacts assessed is provided in **Section 7.1** of this CNVMP. Consistent with the CoA and this CNVMP the CNVIS has identified that general construction (and sleep disturbance) noise emissions during and outside the approved standard hours should be the focus of NCW environmental noise management. Based on the NCW project construction methodology and design, these potential impacts are the key emissions with the potential to generate a nuisance, or an unacceptable level of noise amenity, or give rise to complaints.

Other potential noise issues associated with NCW works include road traffic emissions (LA_{eq}, 15hour and LA_{eq}, 15hour) attributable to NCW vehicles on the existing public road network, and ground-borne noise. A quantitative assessment of construction road traffic noise and ground-borne construction noise identified that impacts are minimal if any at all, regardless these are considered in the CNVMP.

1.2.2.2 *Potential Vibration Issues*

The key vibration issues potentially associated with NCW are human comfort or structural and cosmetic damage vibration (VDV in m/s^{1.75} or PPV in mm/s) attributable to general construction plant, equipment and machinery in use (or activities undertaken) within the site area.

Consistent with noise, a site specific CNVIS has been conducted for the NCW project. It identified that general construction vibration (VDV in m/s^{1.75} or PPV in mm/s) during and outside the approved standard construction hours should be the focus of this CNVMP. Only one activity/equipment item within a particular work phase has the potential to generate any significant vibration, this scenario is identified in **Section 7** of this CNVMP.

Other potential vibration issues associated with NCW include road traffic vibration attributable to NCW vehicles on the existing public road network. A quantitative assessment of construction road traffic vibration identified that impacts are minimal if any at all, regardless these are considered in the CNVMP.

1.2.2.3 *Environmental Planning Approval*

The project is subject to assessment by the Department of Planning and Environment and approval by the Minister for Planning under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) as State Significant Infrastructure (SSI).

The project has been declared as Critical State Significant Infrastructure by virtue of clause 5 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (NSW) and under Section 115V of the EP&A Act. The project, its impacts, consultation and mitigation were documented in the following suite of documents:

- Critical State Significant Infrastructure Application SSI 15_7400;
- *Sydney Metro City & Southwest – Chatswood to Sydenham – Environmental Impact Statement – Construction Noise and Vibration Strategy* (TfNSW, 2016).
- *Sydney Metro City & Southwest – Chatswood to Sydenham – Submissions and Preferred Infrastructure Report* (TfNSW, October 2016).

The Minister for Planning granted Approval for NCW in the Minister's Recommended Conditions of Approval (CoA, 9 January 2017 (SSI 15_7400)).

1.2.3 Project-Specific Environmental Management System

The NCW CEMP is the primary Environmental Management System (EMS) document for the delivery of the proposed works. This CNVMP (Sub Plan) is one of a suite of aspect-specific support plans to the CEMP that have been prepared to support the CEMP.

1.3 Objectives and Targets

The objectives and targets related to construction noise and vibration are as identified in **Table 1.1**. Details on how the project objectives and performance targets will be achieved is provided in **Section 8** of this CNVMP.

Table 1.1 Objectives and Targets

Objectives	Performance Targets
<ul style="list-style-type: none"> • Minimise unreasonable noise and vibration impacts on residents and businesses. • Avoid structural damage to buildings or heritage items as a result of construction vibration. • Undertake active community consultation. • Maintain positive, cooperative relationships with schools, childcare centres, local residents and building owners. 	<ul style="list-style-type: none"> • Noise levels will be minimised with the aim of achieving the noise management levels where feasible and reasonable. • The project will avoid any damage to buildings from vibration.

For the purpose of this CNVMP a feasible mitigation measure is considered to be a measure that can be engineered and is practical to build and/or implement, given project constraints such as safety, maintenance and reliability requirements. It may also include options such as amending construction practices (for example, changing noisy works to a less-sensitive period or location) to achieve noise reduction, as is detailed in the CNVMP.

For the purpose of this CNVMP selecting reasonable measures from those that are feasible involves judging whether the overall noise and/or vibration benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the mitigation measure. Where mitigation measures are considered both feasible and reasonable they will be implemented. Where mitigation measures are not considered both feasible and reasonable they will not be implemented. Furthermore, some mitigation and/or management measures may not be feasible and reasonable at all times and at all work locations within the rail corridor, for example, where the use of alternate equipment or the ability to erect noise barriers is not possible. In these circumstances alternatives may be considered or a combination of the measures outlined in **Section 8** of this CNVMP implemented to achieve similar outcomes.

1.4 Consultation

The **CoA - C3(a), C5 and C9(a)** for the NCW requires that the CNVMP (and monitoring program) be prepared in consultation with the EPA and/or relevant Councils. The NCW project falls into the Willoughby City Council area. A consultation copy of the CNVMP was provided to Willoughby City Council and the EPA for review and comment on 1 August 2018. Willoughby City Council and the EPA reviewed and acknowledged the CNVMP with no comments or edits required, evidence of consultation is provided in **Appendix G** of this CNVMP.

In accordance with **CoA – E33**, community consultation has commenced with the intention of identifying specific mitigation measures. Community engagement has been undertaken with select businesses in the area and residential receivers in and around Frank Channon Walk (FCW). This consultation is outlined in **Table 1.2** below. It should be noted that consultation around FCW has been undertaken first as this is where works are commencing. Further detail of this consultation is outlined in Section 6.1 of the CNVIS.

Table 1.2 Community Consultation Undertaken to Date

Date	Receptor	Summary
6/09/2016	Various	Chatswood Information Session - Northern surface track works - Chatswood Bowling Club 655 Pacific Highway, Chatswood. 40 community members attended. Community was given the opportunity to provide feedback and comment on the Northern Corridor Works, this was acknowledged and further consultation provided for specific projects. For example the closure of Frank Channon Walk.
02/09/17	Various	Information stand held at the Emerge Festival, Chatswood. Those who attended were provided with information regarding the Northern Corridor Works and the wider City and South West Metro Project.
9/11/2017	7 Drake Street	Business survey phone call - Artarmon Family Day Care - 7 Drake Street, Artarmon
9/11/2017	12 Drake Street	Business survey phone call - SIPE Day care - 12 Drake Street, Artarmon
9/11/2017	134-136 Hampden Road	Business survey phone call - Bella Babes child care centre - 134-136 Hampden Road, Artarmon
22/12/17	Various	Notification delivered as a hard copy to 700 properties in Artarmon and Chatswood. The Notification provided a Northern Corridor Works update.
23/01/18	Various residents along the rail corridor in Brand, Hawkins, Drake and Raleigh Street and Hampden Road, Artarmon.	Notification/Fact Sheet provided information regarding upcoming Northern Corridor Works.
24/01/18	Various residents along Ellis Street, Pacific Highway, and Gordon Avenue, Chatswood.	Notification regarding Frank Channon Walk survey work as part of the Northern Corridor Works.
02/02/18	Over 700 copies distributed 100m along Rail corridor from access gate in Valetta Lane/Brand Street, Artarmon to Albert Avenue, Chatswood along Pacific Highway and Orchard Road as well as Cleland Road access Gate.	Notification/Fact sheet regarding the Northern Corridor Works was provided to businesses and residents from Artarmon to Chatswood.
17/02/18	157 notifications distributed via email to local email distribution list.	Email distributed which informed residents of upcoming work relating to the Northern Corridor Works.
23/02/18	Bicycle North Group	Briefing session provided to the Bicycle North Group. This session was to inform and consult with members about the closure of Frank Channon Walk and upcoming works associated with the Northern Corridor Works.

Date	Receptor	Summary
26/02/18	Various (along the rail corridor between Waitara and Waverton)	12,000 copies of the Northern Corridor Works Quarterly Newsletter were distributed between Waitara and Waverton.
02/05/18	Artarmon Progress Association	Briefing session to inform and consult with residents about the Northern Corridor Works. The session was attended by representatives from NRT (Northwest and 33kV), TSE (Chatswood dive site), Laing O'Rourke (Northern Corridor Works) and Sydney Coordination Office covering Station Link i.e. temporary bus plan during the closure of the Epping to Chatswood section from 30 September 2018.
13/06/18	No. 2 and No. 10 Orchard Road.	Phone call to inform residents of work relating to the installation of a noise wall as part of the Northern Corridor Works.
15/06/18	Chatswood email distribution list.	Email distributed which informed residents of upcoming work relating to the Northern Corridor Works.
28/06/18	Various residents along the rail corridor on Hampden Road between the corner of Brand Street and 99 Hampden Road, Artarmon. Details recorded in Consultation Manager.	Door-knocked residents to inform of upcoming security fence and noise wall work in the area as part of the Northern Corridor Works.
28/06/18	Various residents along the rail corridor in Brand, Hawkins, Drake and Raleigh Street, Artarmon.	Door-knocked residents to inform of upcoming security fence and noise wall work in the area as part of the Northern Corridor Works.
27/07/18	Various residents along the rail corridor in Hawkins and Drake Street, Artarmon.	Notification/Fact sheet regarding the Northern Corridor Works (specifically the new drainage and stormwater detention basin) was provided to residents in Artarmon. Following this consultation equipment selection for the activity was modified from sheet piling to augured piling.

Source: LOR, Sydney Metro

Further consultation with sensitive receptors will be undertaken as the project progresses where sensitive periods can be refined based on the type of activities, expected impacts and the particular circumstances of the receptor at that time. All consultation will be undertaken prior to the start of the relevant portion of works predicted to affect those receptors. Mitigation measures can then be tailored based on the consultation feedback. Further detail of mitigation is outlined in **Section 8** of this CNVMP.

2. Legal and Other Requirements

2.1 Legislation

In NSW, noise pollution is typically regulated through the Protection of the *Environment Operations Act 1997* (POEO Act) as the key piece of environment protection legislation. Noise pollution is defined under the POEO Act as:

'the emission of offensive noise, which means noise that by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances, is harmful (or is likely to be harmful) to or interferes unreasonably (or is likely to interfere unreasonably) with the comfort or repose of a person outside the premises from which the noise is emitted'.

The NCW project is considered as 'Railway Systems Activities' as listed in Schedule 1 to the Protection of the Environment Operations Act 1997 (POEO Act). The NCW project will be delivered under the Sydney Trains Environment Protection Licence (EPL) 12208. Compliance with all relevant licence conditions will be tracked, monitored and ensured.

Various construction noise and vibration assessment guidelines (and policy) are endorsed by NSW regulators and provide a framework and methodology for deriving acceptable levels and standard methods for assessing, managing and measuring construction noise and vibration impacts with due regard to the POEO Act. For the CNVMP the applicable policy and guidelines are presented in **Section 2.2** below.

2.2 Policy and Guidelines

The CNVMP has been prepared with due regard to and in accordance with the:

- NSW Department of Environment and Climate Change – *NSW Interim Construction Noise Guideline* (ICNG), July 2009.
- NSW Government – Transport for NSW (TfNSW) - *Sydney Metro Construction Noise and Vibration Strategy* (SM CNVS), August 2016 and CNVS Addendum June 2017.

The ICNG is the key guideline relating to construction noise and vibration in NSW with the SM CNVS developed to address other noise and vibration issues associated with the broader project.

In the event of any conflict between the CoA, EPL 12208, the ICNG and the SM CNVS, the conditions specified in the CoA will prevail as per **CoA - A3**.

The CNVMP has also considered and applied the following additional policy, guidelines and standards as relevant:

- British Standard BS7385: Part 2-1993 (BS 7385) - *Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration*, dated 1993.
- British Standard (BS 6472–1992) – *Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*, dated 1992.
- German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150:3) – *Structural Vibration - Effects of Vibration on Structures*.
- NSW Environment Protection Authority – *NSW Environmental Noise Management – Industrial Noise Policy* (INP), January 2000 and relevant application notes.
- NSW Department of Environment and Conservation – *NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline (the NSW Vibration Guideline)*, February 2006.
- NSW Department of Environment, Climate Change and Water – *NSW Road Noise Policy* (RNP), March 2011.
- NSW Government – Transport for NSW Infrastructure and Services Division (TfNSW I&S) - *Construction Noise and Vibration Strategy* (I&S CNVS), May 2018;
- Standards Australia AS 2436–2010™ (AS2436) – *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.
- Standards Australia AS1055–1997™ (AS1055) – *Description and Measurement of Environmental Noise*.
- Standards Australia AS IEC 61672.1–2004™ (AS61672) – *Electro Acoustics - Sound Level Meters Specifications Monitoring* or Standards Australia AS1259.2-1990™ (AS1259) – *Acoustics – Sound Level Meters – Integrating/Averaging* as appropriate to the device.
- Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – *Australian Standard™ – Electroacoustic – Sound Calibrators*.

2.3 Pre-Construction and Hold Points

The activities outlined in the table below are not to proceed without objective review and approval by the nominated authority. These activities below are considered hold points. These hold points should be incorporated into the working plans for the project (SWMS, work instructions, construction methodologies etc.). Construction will not commence until all pre-construction requirements have been complied with and (in accordance with **CoA – C8**) the CEMP and relevant Sub-plans are approved by the Secretary.

Table 2.1 Hold Points

Item	Process Held	Acceptance Criteria	Approval Authority
Minor works approval	Pre-construction minor works	All Pre-construction works will be undertaken under pre-construction minor works approval.	TfNSW ER/Acoustic Advisor (Endorsement) TfNSW (Approval)
Construction Environmental Management Plan and Sub Plans	Site activities	Site specific Environmental Management Plan has been developed, reviewed and approved.	Department of Planning and Environment
Out of Hours Work (OOHW)	Works to be performed outside of approved standard construction hours	OOHW Protocol Application Form and Community Notification Noise Assessment must be conducted and endorsed by the AA	ER/Acoustic Advisor (Endorsement) TfNSW (Approval)
High Risk OOHW	Works to be performed outside of approved standard construction hours	High risk out of hours work construction must be submitted to the DPE for approval unless otherwise approved through an EPL	Department of Planning and Environment

Source: CEMP

3. Existing Environment

The NCW project and associated construction works are located in the rail corridor between Chatswood train station and Brand Street in Artarmon, near the Artarmon train station. It is situated within the Willoughby Local Government Area (LGA) and borders the Lane Cove LGA and North Sydney LGA. The primary NCW site compound has been established within the rail corridor off Cleland road, Artarmon for the duration of the project. A number of other site compounds will be used throughout the project, these are identified in **Figure 3.1** to **Figure 3.8**.

The existing noise environment in the broader vicinity of the NCW site is best described as 'suburban', being an area with an acoustical environment that:

- has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry.
- decreasing noise levels in the evening period.
- evening ambient noise levels defined by the natural environment and infrequent human activity.

The existing noise environment in some areas surrounding the NCW site is best described as 'urban', being an area with an acoustical environment that:

- is dominated by 'urban hum' or industrial source noise.
- has through traffic with characteristically heavy and continuous traffic flows during peak periods.
- is near commercial districts or industrial districts.
- has any combination of the above, where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

Existing conditions have been quantified from data in the EIS. Environmental noise monitoring was conducted by SLR at five locations during August to September 2015 to inform the EIS (TfNSW, SLR 2016).

3.1 Background Noise Levels

Quantifying the existing noise environment (via measurement) at the closest and/or potentially most affected receptors situated within the potential area of influence of a site is a key feature of assessing and managing potential noise impacts.

For the purpose of the CNVMP and CNVIS, surrounding precincts were divided into nine Noise Catchment Areas (NCAs). These NCAs (adopted for the CNVIS) are shown in **Figure 3.1** and described in **Table 3.1** below.

Rating Background Levels (RBL) representative of each of the nine NCAs identified for this CNVMP were adapted based on the RBLs presented in the EIS. The assumptions utilised in adapting the EIS RBL data are outlined in the CNVIS. The RBLs adopted for the CNVMP are presented in **Table 3.2** below for the day, evening and night-time periods. The EIS background noise logging locations are also presented in **Figure 3.1**.

There is no formal requirement to measure existing vibration levels. In general ambient vibration levels are typically imperceptible, in the absence of any significant vibration generating source.

Table 3.1 Sensitive Receptors / Noise catchment Areas

Noise Catchment Area (NCA)	Description	Distance (~m) Rail/Road or Train Station
NCA01	Residential and industrial/commercial receptors within 150m of the rail corridor.	<150m
NCA01a	The portion of NCA01 that falls within 150m of the M2 motorway.	<150m
NCA02	Residential and commercial receptors beyond 150m and within 550m west of the rail corridor.	>150m west
NCA02a	The portion of NCA02 that falls within 150m of the M2 motorway.	>150m west
NCA03	Residential and commercial within a radius of 500m from the Chatswood train station encompassing the Chatswood CBD area.	<500m

Noise Catchment Area (NCA)	Description	Distance (~m) Rail/Road or Train Station
NCA04	Residential and commercial receptors beyond 150m and within 550m east of the rail corridor.	>150m east
NCA04a	The portion of NCA04 that falls within 150m of the M2 motorway.	>150m east
NCA05	Receptors that fall within 50m of Mowbray Road	<50m
NCA06	Residential and commercial within a radius of 500m from the St Leonards train station encompassing the St Leonards CBD area, in close proximity to the Pacific Highway.	<500m

Source: CNVIS

Table 3.2 Rating Background (Noise) Levels

Noise Catchment Area (NCA)	Overall Rating Background Levels (RBL) in dBA		
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night-time (10pm to 7am)
NCA01	42	41	35
NCA01a	49	46	41
NCA02	42	41	35
NCA02a	49	46	41
NCA03	46	44	37
NCA04	41	40	34
NCA04a	49	46	41
NCA05	63	60	45
NCA06	45	45	38

Source: CNVIS

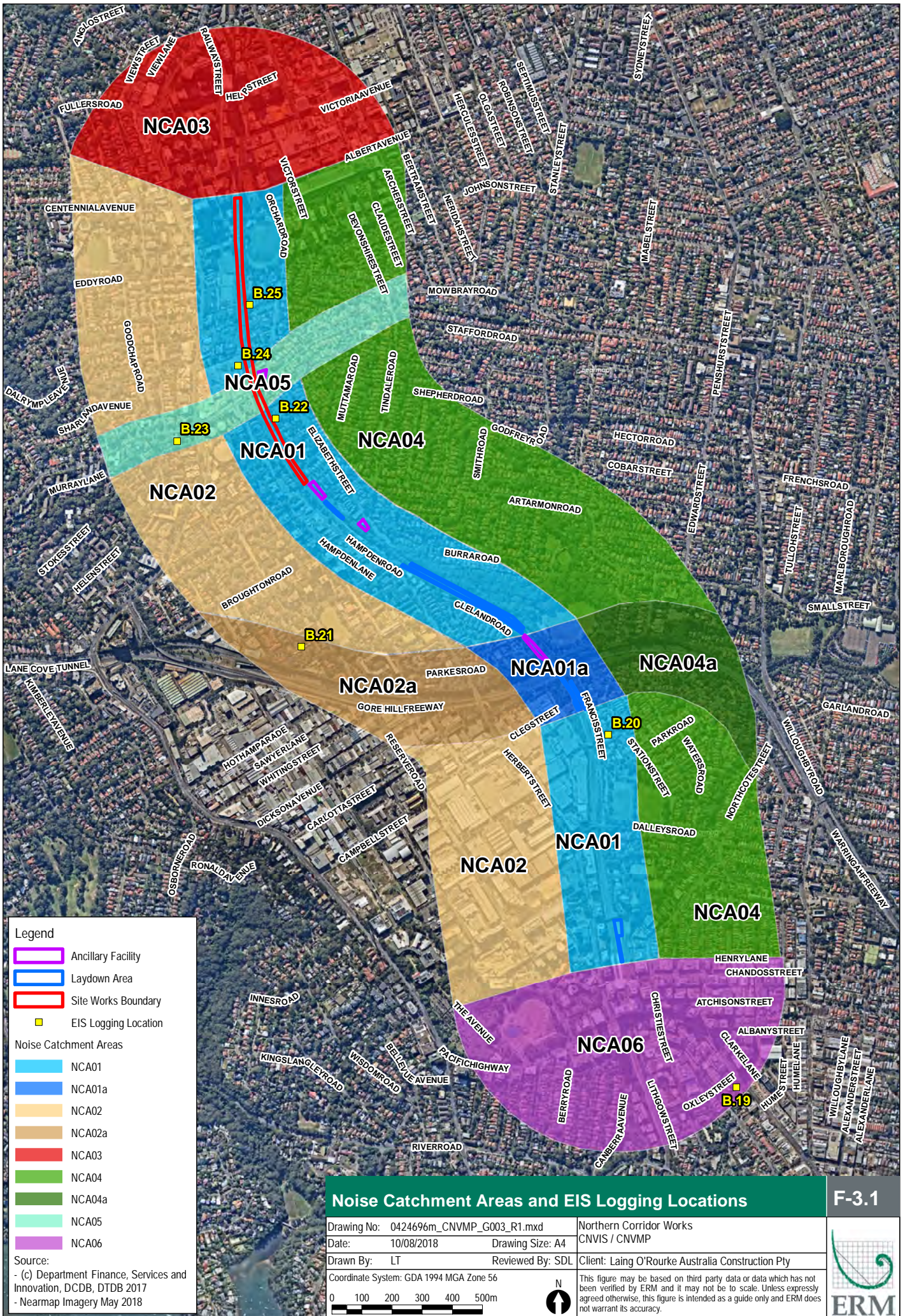
3.2 Potentially Sensitive Receptors

Five hundred and thirty (530) sensitive receptors were identified in the CNVIS as the closest and/or potentially most affected locations situated within the potential area of influence of the NCW. The full list sensitive receptors are provided **Appendix E** and the stand-alone noise and vibration monitoring program **LOR-NCW-Monitoring Program**.

These locations were established based on review of aerial photography, land use zoning and cadastre data and the results of preliminary noise modelling, where receptor positions were optimised to ensure representative worst-case levels were being predicted.

The selected locations do not represent all receptors located in the vicinity of the NCW but have been selected for the purposes of this noise and vibration impact assessment; they are considered to be representative of locations that will potentially experience the highest impacts associated with the NCW, and will be the most affected during construction activities.

The NCA and an overview of all sensitive receptor locations are identified in the **Figure 3.1 to Figure 3.8**.



Legend

- Ancillary Facility
- Laydown Area
- Site Works Boundary
- EIS Logging Location

Noise Catchment Areas

- NCA01
- NCA01a
- NCA02
- NCA02a
- NCA03
- NCA04
- NCA04a
- NCA05
- NCA06

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Noise Catchment Areas and EIS Logging Locations

F-3.1

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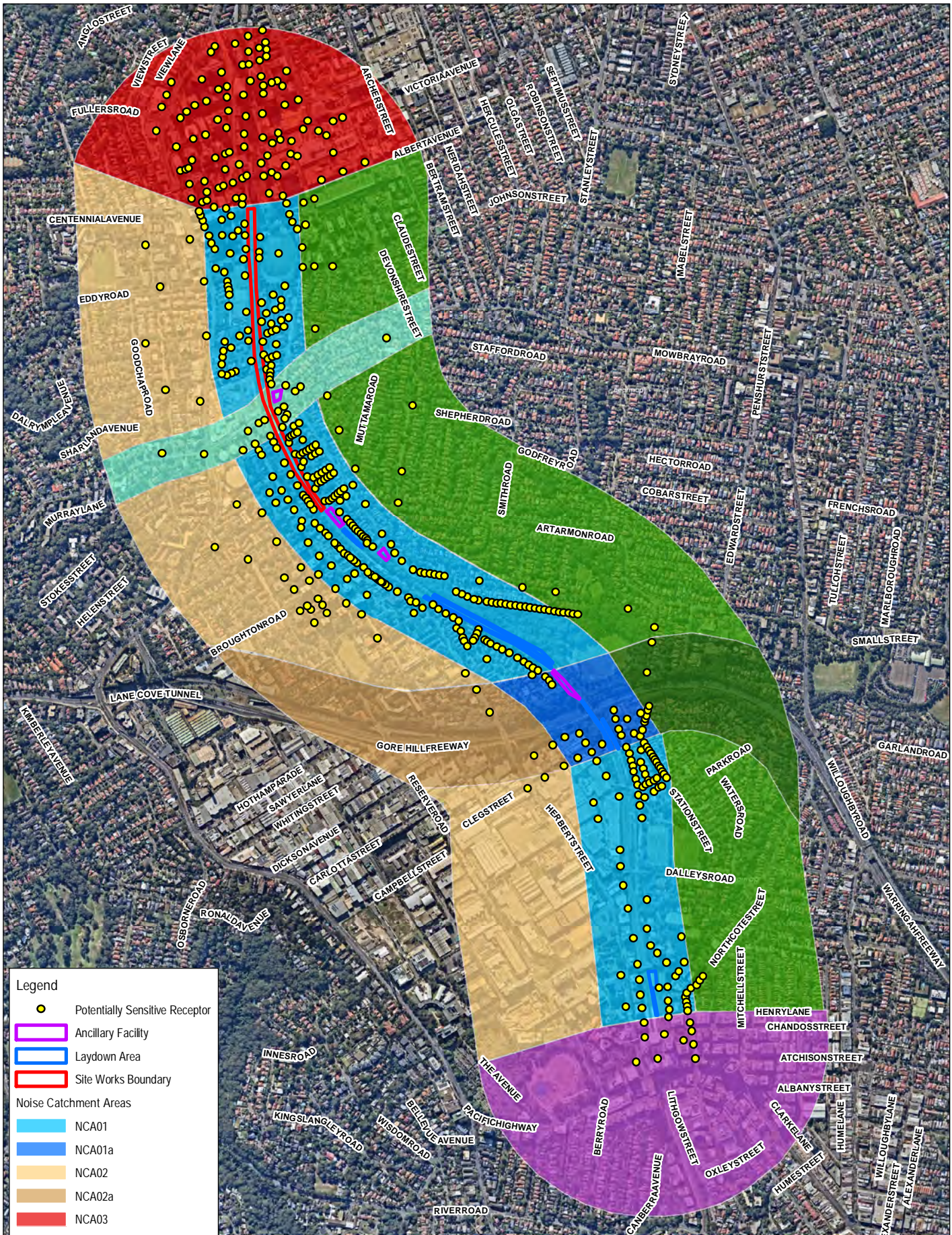
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 CNVIS / CNVMP
 Client: Laing O'Rourke Australia Construction Pty

Coordinate System: GDA 1994 MGA Zone 56
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.





Legend

- Potentially Sensitive Receptor
- Ancillary Facility
- Laydown Area
- Site Works Boundary

Noise Catchment Areas

- NCA01
- NCA01a
- NCA02
- NCA02a
- NCA03
- NCA04
- NCA04a
- NCA05
- NCA06

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Potentially Sensitive Noise Receptors - Overview Map

F-3.2

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Drawn By: LT	Reviewed By: SDL

Client: Laing O'Rourke Australia Construction Pty

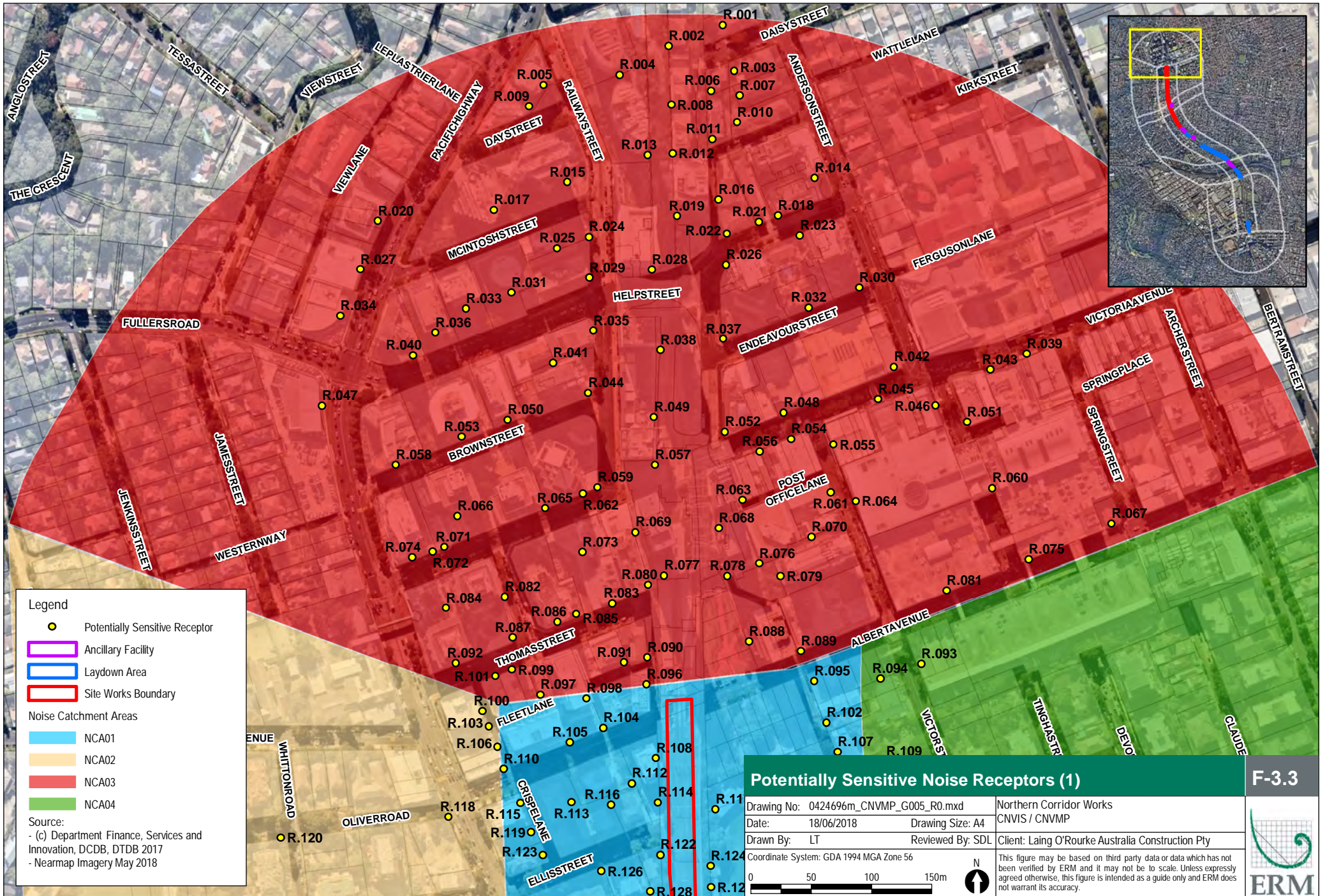
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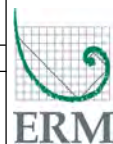


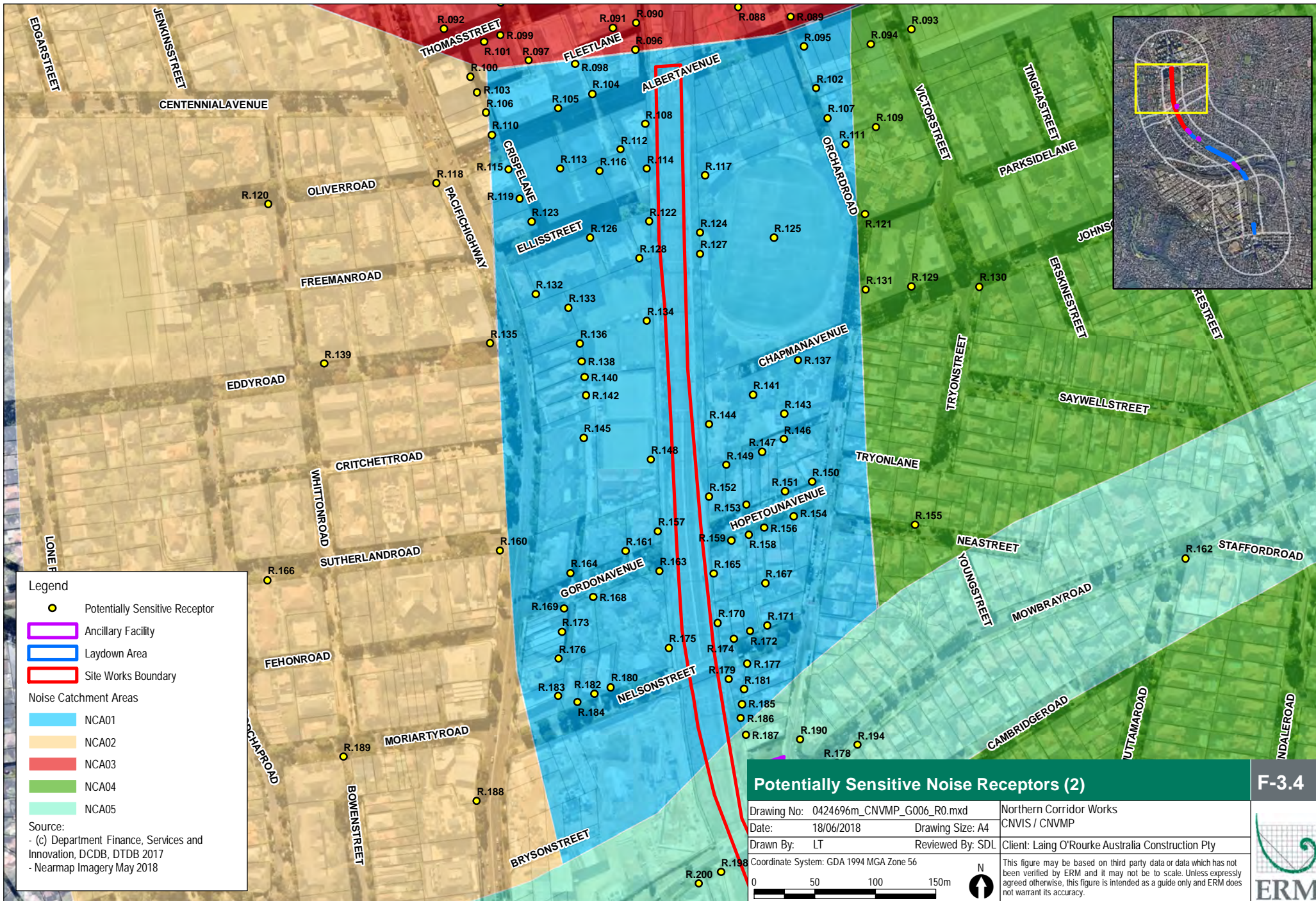
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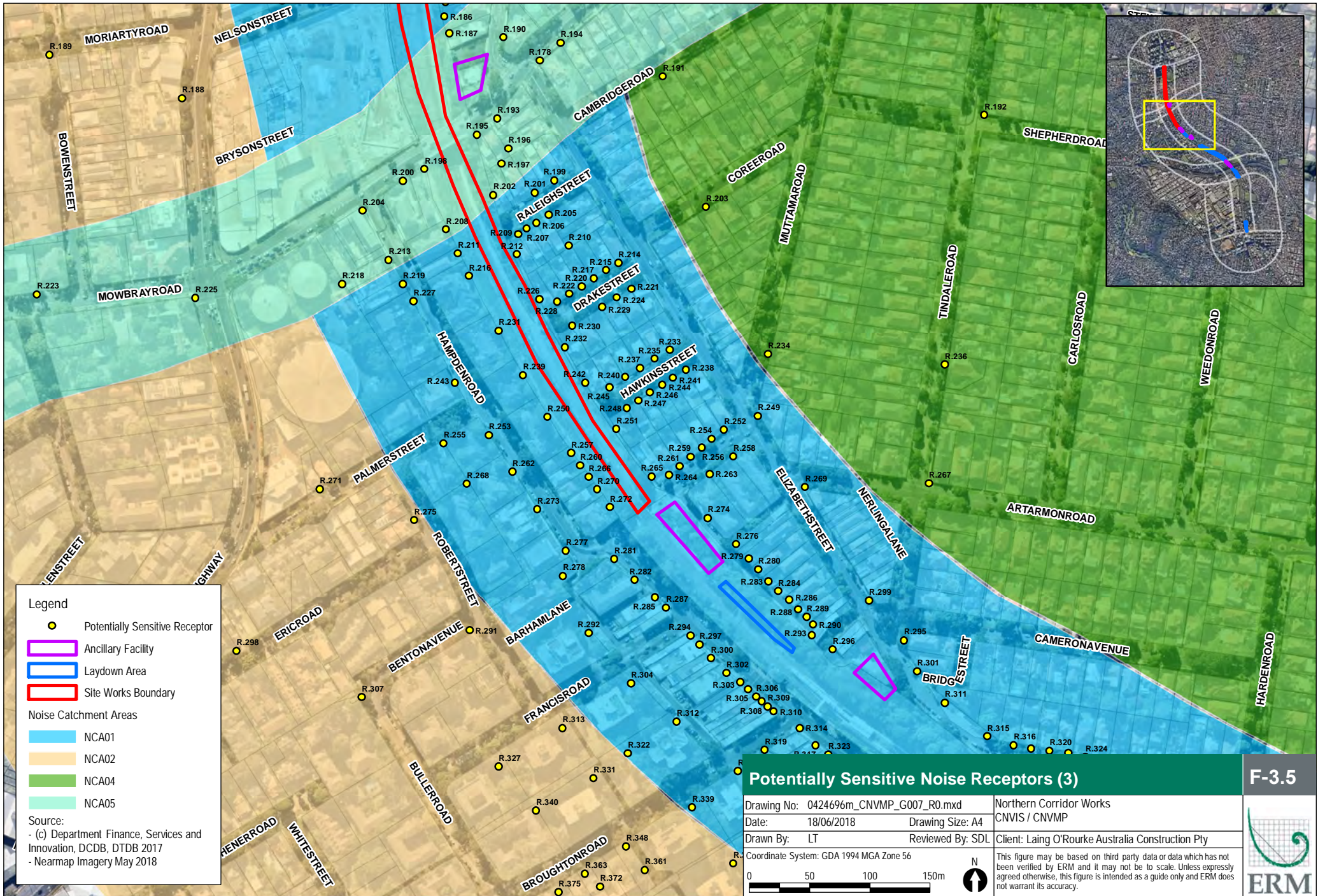
- Potentially Sensitive Receptor
 - Ancillary Facility
 - Laydown Area
 - Site Works Boundary
- Noise Catchment Areas
- NCA01
 - NCA02
 - NCA03
 - NCA04

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

F-3.3







Legend

- Potentially Sensitive Receptor
- Ancillary Facility
- Laydown Area
- Site Works Boundary

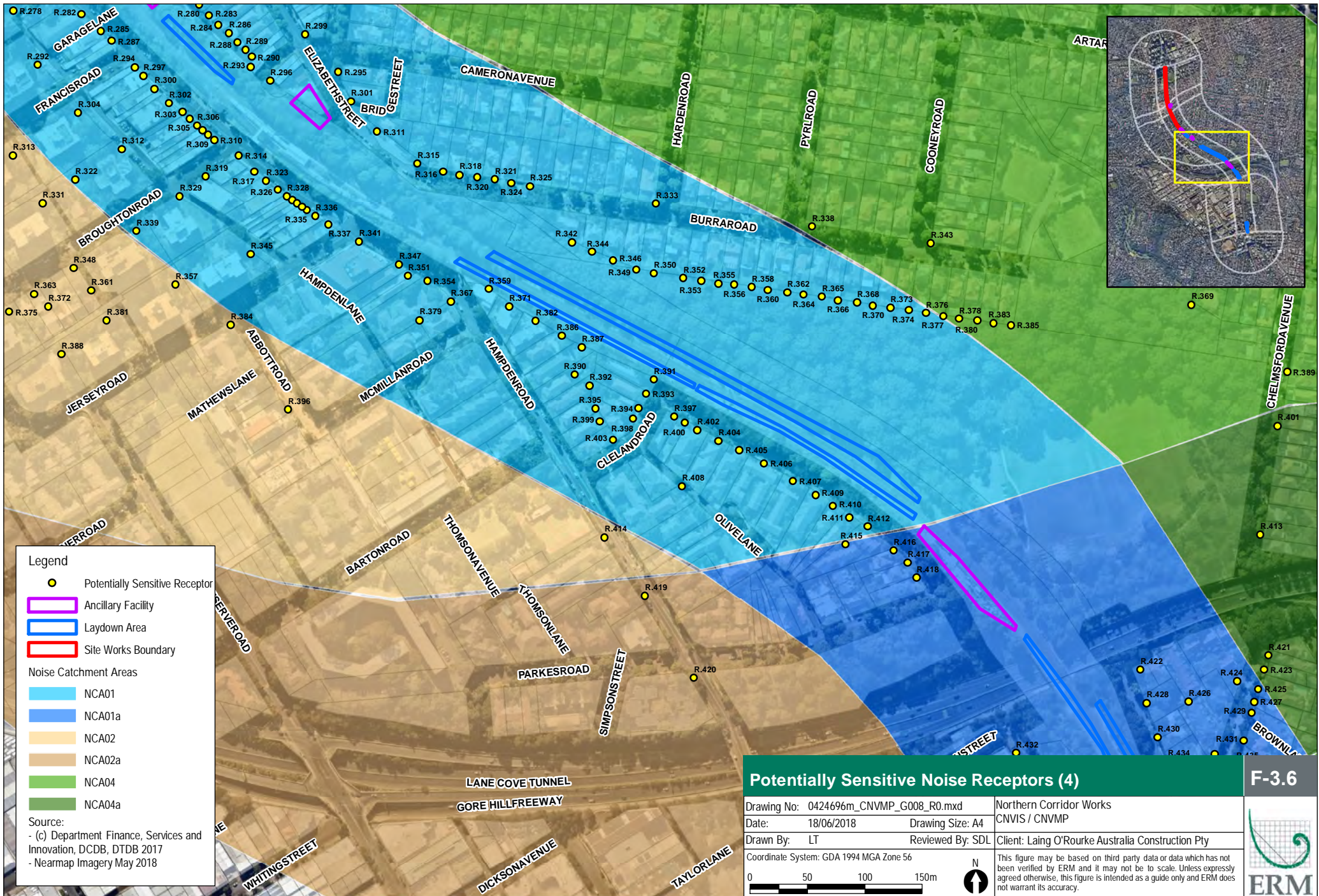
Noise Catchment Areas

- NCA01
- NCA02
- NCA04
- NCA05

Source:

- (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
- Nearmap Imagery May 2018

Potentially Sensitive Noise Receptors (3)		F-3.5
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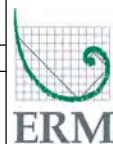
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- Potentially Sensitive Receptor
 - Ancillary Facility
 - Laydown Area
 - Site Works Boundary

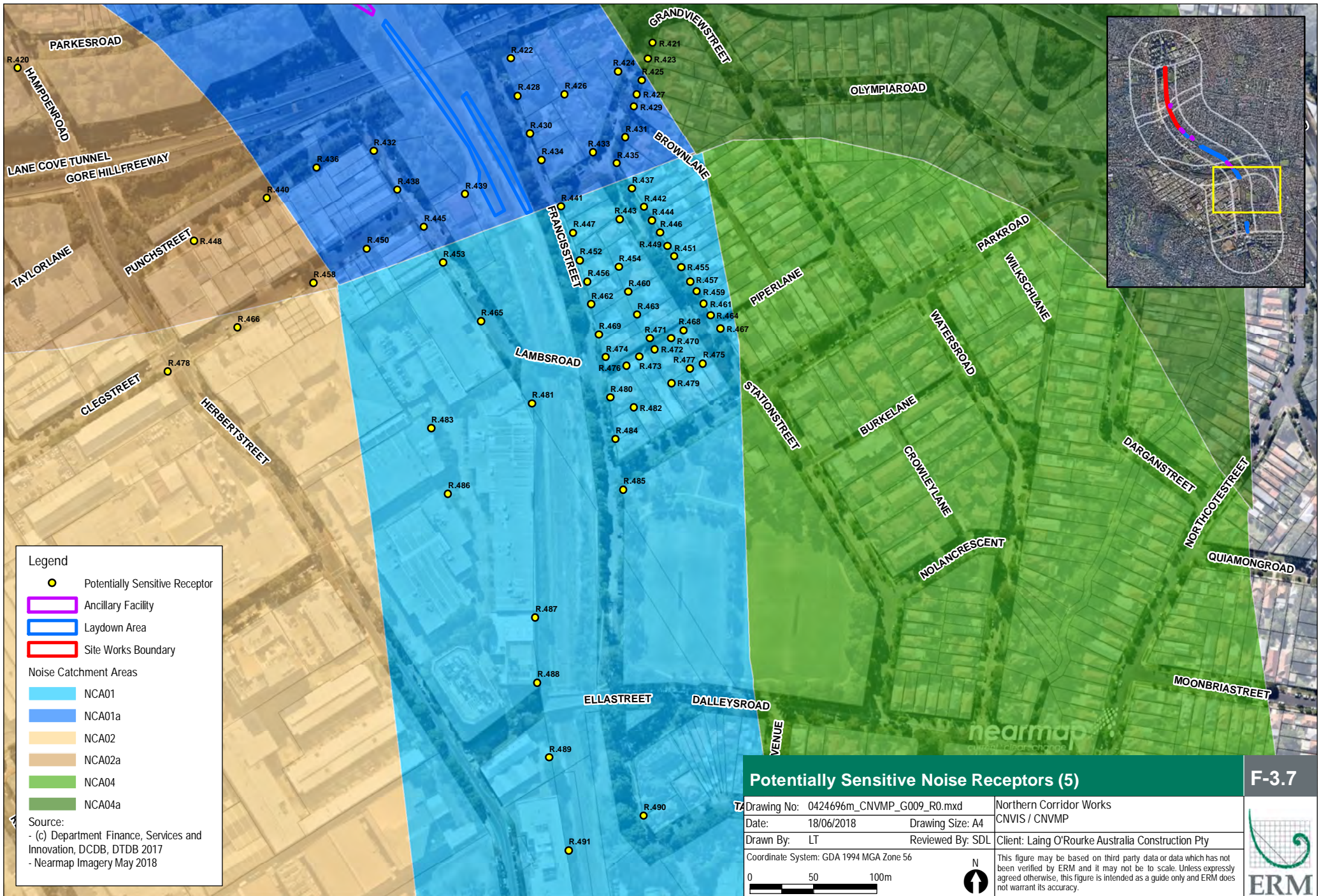
- Noise Catchment Areas**
- NCA01
 - NCA01a
 - NCA02
 - NCA02a
 - NCA04
 - NCA04a

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Potentially Sensitive Noise Receptors (4) F-3.6

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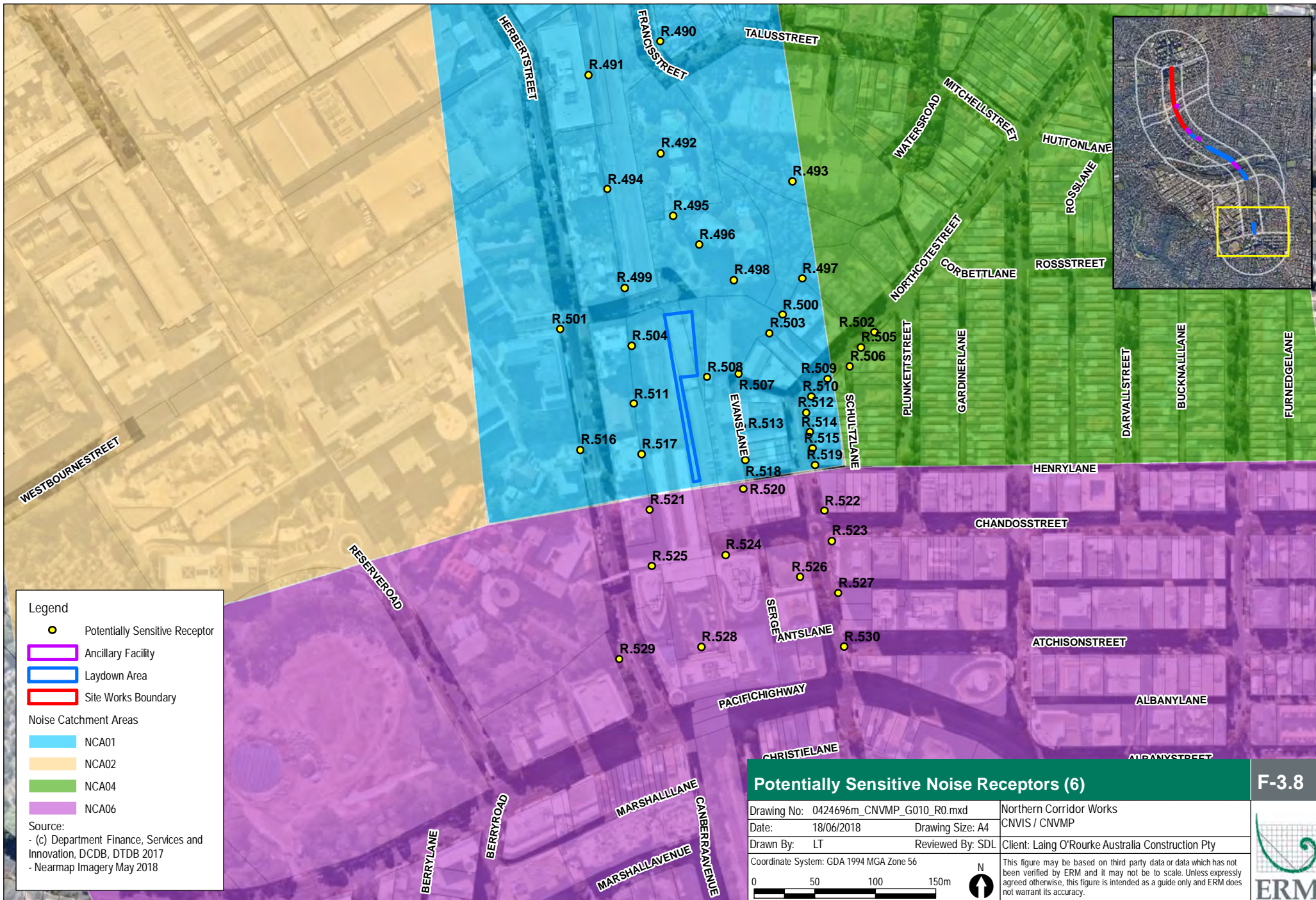


- Legend**
- Potentially Sensitive Receptor
 - Ancillary Facility
 - Laydown Area
 - Site Works Boundary
- Noise Catchment Areas**
- NCA01
 - NCA01a
 - NCA02
 - NCA02a
 - NCA04
 - NCA04a

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Potentially Sensitive Noise Receptors (5) F-3.7

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Coordinate System: GDA 1994 MGA Zone 56	
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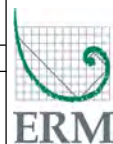
- Legend**
- Potentially Sensitive Receptor
 - ▭ Ancillary Facility
 - ▭ Laydown Area
 - ▭ Site Works Boundary

- Noise Catchment Areas**
- NCA01
 - NCA02
 - NCA04
 - NCA06

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Potentially Sensitive Noise Receptors (6) F-3.8

Drawing No: 0424696m_CNVMP_G010_R0.mxd	Northern Corridor Works
Date: 18/06/2018	CNVIS / CNVMP
Drawn By: LT	Client: Laing O'Rourke Australia Construction Pty
Reviewed By: SDL	
Coordinate System: GDA 1994 MGA Zone 56	
0 50 100 150m	
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>	



4. Noise and Vibration Guidelines

The ICNG and SM CNVS are relevant to the NCW project and provide guidance to establishing noise (and vibration) management levels (criteria) for the purpose of assessing and managing noise impacts.

For residential receptors, the noise management levels are established based on existing background noise levels i.e. thresholds above which the background noise level may be exceeded. For other sensitive receptors the management levels are fixed values.

For residential and other sensitive receptors (human); and potentially sensitive structures (buildings) vibration management levels are fixed values established for either human comfort or structural/cosmetic damage. The levels vary depending on the potential sensitivity of the receptor and do not reply on existing conditions.

A summary of each in the context of the ICNG and SM CNVS is provided below.

4.1 Residential Receptors (Noise)

The method for establishing ICNG Noise Management Levels for residential receptors is summarised in **Table 4.1** below. Separate criterion is provided for works during and outside the ICNG standard construction hours. The ICNG recommends more stringent noise criterion for works outside these standard hours. These hours of work are consistent with the approved hours described in **CoA – E36**.

Table 4.1 Construction Noise Management Levels – Residences

Time of Day	Noise Management Level (L _{Aeq, 15minute})	How to Apply
Recommended Standard Hours: Monday to Friday, 7am to 6pm Saturday, 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10 dBA	<ul style="list-style-type: none"> The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured L_{Aeq, 15minute} is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	<ul style="list-style-type: none"> 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 proponent would consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent would communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside the Recommended Standard Hours	Noise affected RBL + 5 dBA	<ul style="list-style-type: none"> A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the Guideline.

Source: INCG, SM CNVS

4.2 Sleep Disturbance (Noise)

For residential receptors it is also important to consider potential sleep disturbance impacts associated with OOHW conducted during the night time (10pm to 7am) period. The INP and RNP provide indicative sleep disturbance thresholds and was utilised as the basis for establishing 'sleep disturbance screening levels' in the SM CNVS and CNVIS.

The SM CNVS also provides guidance on sleep awakening levels. This includes the following:

- External sleep disturbance screening criterion of RBL + 15 dB.
- External sleep disturbance criterion (sleep awakening level) of 65 dB LA_{max} (assuming open windows).
- One or two events per night, with maximum external noise levels of 80 dB LA_{max} (assuming open windows), are not likely to affect health and wellbeing significantly.

The RBL + 15 dB method is widely accepted as the appropriate method for assessing and managing sleep disturbance impacts (using the LA_{1, 1minute} or LA_{max} parameters) and is adopted here to establish criteria for use in the CNVMP.

4.3 Non-Residential Receptors (Noise)

As noted above the ICNG defines fixed management levels for other sensitive receptors and non-residential sensitive land uses. These values are reproduced in **Table 4.2** below.

Table 4.2 Noise Levels for non-residential sensitive land use

Land Use	Noise Management Level: LA _{eq, 15minute} (applies when properties are being used)
Classrooms at schools and other educational Institutions	Internal Noise Level 45dB ¹
Hospital wards and operating theatres	Internal Noise Level 45dB ¹
Places of worship	Internal Noise Level 45dB ¹
Active recreation	External noise level 65dB
Passive recreation	External noise level 60dB
Community centre	Depends on intended use – see AS2107
Industrial premises	External Noise Level 75 dB
Offices, retail outlets	External Noise Level 70 dB.

Source: ICNG, SM CNVS

1. External goal of 55dBA applies. The ICNG recommends that construction noise levels do not exceed 45 dB (LA_{eq, 15minute}) internally within school classrooms when in use. For the purpose of the CNVIS (and as adopted here to verify criteria for use in the CNVMP) the internal noise level has been translated to an external level of 55dB (LA_{eq, 15minute}) based on the accepted level of attenuation (10dB) that is readily achieved through windows, partially opened for ventilation.

4.4 Vibration (All receptors)

Vibration refers to the oscillating movement of any object. In relation to construction projects, ground-borne vibration is the most likely outcome of intensive piling, demolition, vibratory rolling or hammering works. For the NCW project this is limited to sheet piling activities which have two potential effects on sensitive receptors: ground-borne vibration that may cause annoyance and ground-borne vibration that may have an adverse effect (cosmetic or structural damage) on a structure e.g. a building.

Each of these two potential effects is assessed in accordance with the relevant standard. For human comfort the NSW Vibration Guideline and British Standard BS 6472-1992 applies in accordance with the SMCNVS. For cosmetic or structural damage the British Standard BS 7385:1993 applies in accordance with the SM CNVS and **CoA – E28**. To meet the requirements of the SM CNVS, BS7385 is also considered in this CNVMP to provide guidance for potential cosmetic damage issues. Each of these relevant guidelines and standards are technical in nature but ultimately present fixed (frequency dependant) criterion values that may apply to either human or building receptors.

Heritage buildings and structures are also considered in the CNVMP, assessed as per the screening criteria in BS7385, as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound. If a heritage building or structure is found to be structurally unsound conservative cosmetic damage criteria from German standard DIN 4150 will apply. Each standard is considered and adopted in the CNVMP to establish the applicable management levels for vibration that will apply to the NCW project.

5. Noise Management Levels

Based on the ICNG and SM CNVS methodology summarised in **Section 4** the following construction Noise Management Levels (NMLs) will apply to the NCW project as presented in **Table 6.1** and **Table 6.2**.

5.1 General Construction Noise

The following general construction NML will apply externally and will be assessed at the most-affected point on or within the receptor property boundary or, if that is more than 30 metres (m) from the receptor, at the most-affected point within 30 m of the receptor.

For other sensitive receptors (classrooms at schools and other educational institutions; hospital wards and operating theatres; and places of worship) the external criteria value translated from the ICNG internal goal may be adopted as relevant and if other receptors are identified. The NML of other sensitive receptors are further outlined in the CNVIS and identified in **Table 6.2**.

Section 4.1 of the ICNG notes that the NML apply at a height of 1.5 m and also notes that noise levels may be higher at upper floors of a noise affected residence. The NML presented in this CNVMP will apply only at an assessment height of 1.5 m above ground level. Where multi-storey buildings/receptors are identified their features will be noted (i.e. double storey brick house etc.) however no additional assessment will be undertaken at any height above 1.5 m.

'Sleep disturbance screening thresholds' have been developed as per the guidance summarised in **Section 3** and will be assessed externally, at a boundary location consistent with other NML and at a height of 1.5 m above ground level. These screening levels (refer **Table 6.3**) will only apply during the night time period. These screening levels will generally apply at residential (dwelling) receptors with other sensitive receptors considered where applicable e.g. at other receptors where habitable sleeping spaces are identified.

Table 6.1 Construction Noise Management Levels (Residential Receptors)

Noise Catchment Area (NCA)	Acceptable LAeq, 15 minute Noise Level			
	Standard Construction Hours ¹ (RBL + 10 dBA)	Outside Standard Construction Hours (RBL + 5 dBA)		
		Daytime ²	Evening ³	Night ⁴
NCA01	52	47	46	40
NCA01a	59	54	51	46
NCA02	52	47	46	40
NCA02a	59	54	51	46
NCA03	56	51	49	42
NCA04	51	46	45	39
NCA04a	59	54	51	46
NCA05	73	68	65	50
NCA06	55	50	50	43

Source: CNVIS

1. Standard (daytime): 7:00am to 6:00pm Mondays to Fridays, inclusive and 8:00am to 1:00pm Saturdays;
2. Outside standard (daytime): 1:00pm to 6:00pm Saturdays, and 8:00am to 6:00pm on Sundays or public holidays;
3. Outside standard (evening): 6:00pm to 10pm Monday to Sunday, inclusive; and
4. Outside standard (night time): 10:00pm to 7:00am Monday to Friday and 10:00pm to 8:00am on Saturdays, Sundays and public holidays.

Table 6.2 Construction Noise Management Levels (Other Sensitive Receptors)

Acceptable L_{Aeq} , 15 minute Noise Level				
Noise Catchment Area (NCA)	Outside Standard Construction Hours			
	Standard Construction Hours ¹	Daytime ²	Evening ³	Night ⁴
Commercial	70	70	70	70
Industrial	75	75	75	75
Recreational (Active)	65	65	65	65
Place of Worship*	55	55	55	55
Educational*	55	55	55	55
Hospital wards and operating theatres*	55	55	55	55

Source: CNVIS

1. Standard (daytime): 7:00am to 6:00pm Mondays to Fridays, inclusive and 8:00am to 1:00pm Saturdays;
2. Outside standard (daytime): 1:00pm to 6:00pm Saturdays, and 8:00am to 6:00pm on Sundays or public holidays;
3. Outside standard (evening): 6:00pm to 10pm Monday to Sunday, inclusive; and
4. Outside standard (night time): 10:00pm to 7:00am Monday to Friday and 10:00pm to 8:00am on Saturdays, Sundays and public holidays.

* External criteria value translated from the internal ICNG management level, assuming windows operable.

Highly Noise Affected Management Level

In accordance with the ICNG, the Highly Noise Affected Management Level (HNML) of 75 dBA will apply to residential (dwelling) receptors. LOR will consult with all receptors identified to exceed the NMLs in the CNVIS in accordance with **CoA – E33** with the objective of determining appropriate additional mitigation measures in line with the SM CNVS, refer **Section 8.2**.

Table 6.3 Sleep Disturbance Screening Levels

Noise Catchment Area (NCA)	Sleep Disturbance Screening Level (L_{Amax})
NCA01	50
NCA01a	56
NCA02	50
NCA02a	56
NCA03	52
NCA04	49
NCA04a	56
NCA05	60
NCA06	53

Source: CNVIS

1. These sleep disturbance screening levels only apply during the night time defined by the INP as the period from 10:00pm to 07:00am (Monday to Saturday) and 10:00pm to 08:00am (Sundays and Public Holidays).

5.2 Construction Road Traffic Noise

The ICNG does not include any criteria to assess off-site traffic noise associated with construction and demolition. Criteria for off-site road traffic noise applicable to 'existing residences affected by additional traffic on existing roads generated by land use developments' are specified in the RNP.

An objective of the RNP is to protect sensitive receptors against excessive decreases in amenity as the result of a project by applying relevant permissible noise increase criteria. In assessing feasible and reasonable mitigation measures, an increase of up to 2 dBA represents a minor impact that is considered barely perceptible to the average person.

On this basis, as outlined in the SM CNVS, construction traffic NMLs set at 2 dBA above the existing road traffic noise levels during the daytime and night-time periods are considered appropriate to identify the onset of potential noise impacts. Where the road traffic noise levels are predicted to increase by more than 2 dBA as a result of construction traffic, consideration would be given to applying feasible and reasonable noise mitigation measures to reduce the potential noise impacts and preserve acoustic amenity.

Whilst these criteria do not specifically apply to construction/demolition traffic movements, they have been conservatively adopted here in the CNVIS and are summarised in **Table 6.4 below**.

Table 6.4 Road Traffic Noise Management Levels

Category	Road	Management Level, dBA	
		Daytime ¹	Night time ²
Sub-arterial roads	e.g. Pacific Highway / Mowbray Road	LAeq,1 hour ≤ 60 (external)	LAeq,1 hour ≤ 55 (external)
Local Roads	e.g. Brand St / Drake St / Hopetoun Ave	LAeq,1 hour ≤ 55 (external)	LAeq,1 hour ≤ 50 (external)

Source: SM CNVS, RNP

1. Daytime means between 7:00am and 10:00pm, Monday to Sunday inclusive; and
2. Night time means between 10:00pm to 7:00am, Monday to Sunday inclusive.

The **Table 6.4** criteria do not apply to vehicle movements within the NCW Site. For the purpose of this CNVMP any noise generated by on-site vehicle movements is considered as construction noise and managed holistically with on-site mobile plant in accordance with the ICNG. Additionally, it is typically recognised that for existing residences and other sensitive land uses affected by additional traffic on existing roads, any increase in the total traffic noise level will preferably be limited to 2dB above the existing road traffic noise levels as an increase of 2dB is typically considered not noticeable.

The road traffic noise management levels differ from general construction NML and apply 1 m from the property façade. Road traffic impacts are not anticipated such that direct assessment of NCW road traffic noise will not be undertaken unless it becomes necessary (i.e. impacts are identified or complaints are received) during the works. Where impacts are identified or complaints are received the extent of assessment will be determined on a case by case basis.

5.3 Vibration Management Levels

Impacts from vibration will be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (structural/cosmetic damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

Refer **Section 7.2.2** which describes how the human comfort structural/cosmetic damage criteria will be evaluated, selected and applied as appropriate to the receptor and potential impacts.

5.3.1 Human Comfort (or Annoyance)

The NSW Vibration Guideline provides guidance for assessing human exposure to vibration. The publication is based on British Standard BS 6472:1992.

BS 6472-1992 provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV). The vibration dose value is dependent upon the level and duration of the short term vibration event, as well as the number of events occurring during the daytime or night-time period. The vibration dose values recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in **Table 6.5**.

Based on the NSW Vibration Guideline, Intermittent vibration can be defined as interrupted periods of continuous vibration (e.g. vibratory rolling, heavy truck pass-by's or rock breaking) or continuous periods of impulsive vibration (e.g. impact pile driving). Higher vibration levels are allowed for intermittent vibration compared with continuous vibration on the basis that the higher levels occur over a shorter time period. Hence, for intermittent vibration, human comfort vibration levels are assessed on the basis of the Vibration Dose Value, based on the level and the duration of the vibration events. Given the scenarios and activities outlined in the CNVIS, the vibration generating activities identified for the NCW P7B project will be classified as intermittent vibration.

Table 6.5 Vibration Dose Value Ranges which Might Result in Various Probabilities of Adverse Comment within Residential Buildings

Place and Time	Low Probability of Adverse Comment ($m/s^{1.75}$)	Adverse Comment Possible ($m/s^{1.75}$)	Adverse Comment Probable ($m/s^{1.75}$)
Residential buildings 16 hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hr night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Source: SM CNVS

Note: For offices and workshops, multiplying factors of 2 and 4 respectively will be applied to the above vibration dose value ranges for a 16 hr day.

It is noted however that the direct measurement (or equivalent estimation via calculation) of VDV is often impractical and does not allow for the assessment of impacts whilst works are occurring. VDV provides an indication of impacts after the works have occurred based on the duration, intensity and characteristic frequency of the measured vibration events throughout a work day. To provide greater flexibility and to enable the assessment of potential impact via the PPV parameter (which can be measured and evaluated during works) the following thresholds identified in **Table 6.6** will be applied to assess the probability for adverse comment from residential receptors. These values have been established as per Table C1.1 of the NSW Vibration Guideline and will be applied in combination with the VDV presented in **Table 6.5**.

Table 6.6 Perceptible Vibration Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Peak Particle Velocity (mm/s)	
		Preferred	Maximum
Continuous Vibration			
Residences	Daytime	0.28	0.56
	Night-time	0.20	0.40
Offices	Day- or Night-time	0.56	1.1
Workshops	Day- or Night-time	1.1	2.2
Impulsive Vibration			
Residences	Daytime	8.6	17.0
	Night-time	2.8	5.6
Offices	Day- or Night-time	18.0	36.0
Workshops	Day- or Night-time	18.0	36.0

1. Values given for the most critical frequency range >8Hz assuming sinusoidal motion.

Source: Table C1.1 – The NSW Vibration Guideline

5.3.2 Building Damage (Structural/Cosmetic Damage)

There are currently no Australian Standards or guidelines to provide guidance on assessing the potential for building damage from vibration and it is common practice to derive goal levels from international standards.

To achieve the requirements of the SM CNVS, British Standard BS 7385:1993 is presented (refer **Table 6.7**) in the CNVMP and will be considered during works where applicable. BS 7385 provides safe limit guideline values, below which vibration is considered insufficient to cause structural or cosmetic damage to buildings.

The recommended limits (guide value, refer SM CNVS) from BS7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented in **Table 6.7** with each “Line” shown in **Figure 6.1**. In accordance with **CoA – E28** vibration from construction activities for this project must not exceed the vibration limits set out in the BS7385.

For most construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receptor type is given below:

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

At locations where the predicted and/or measured vibration levels are greater than shown above (peak component particle velocity), a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure will be required to determine the applicable safe vibration level.

Table 6.7 Building Damage Vibration Management Levels (BS 7385)

Line	Type of Building	Peak Particle Velocity (PPV in mm/s) in the Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz & Above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20mm/s at 15 Hz increasing to 50mm/s at 40 Hz and above

Source: BS 7385, SM CNVS

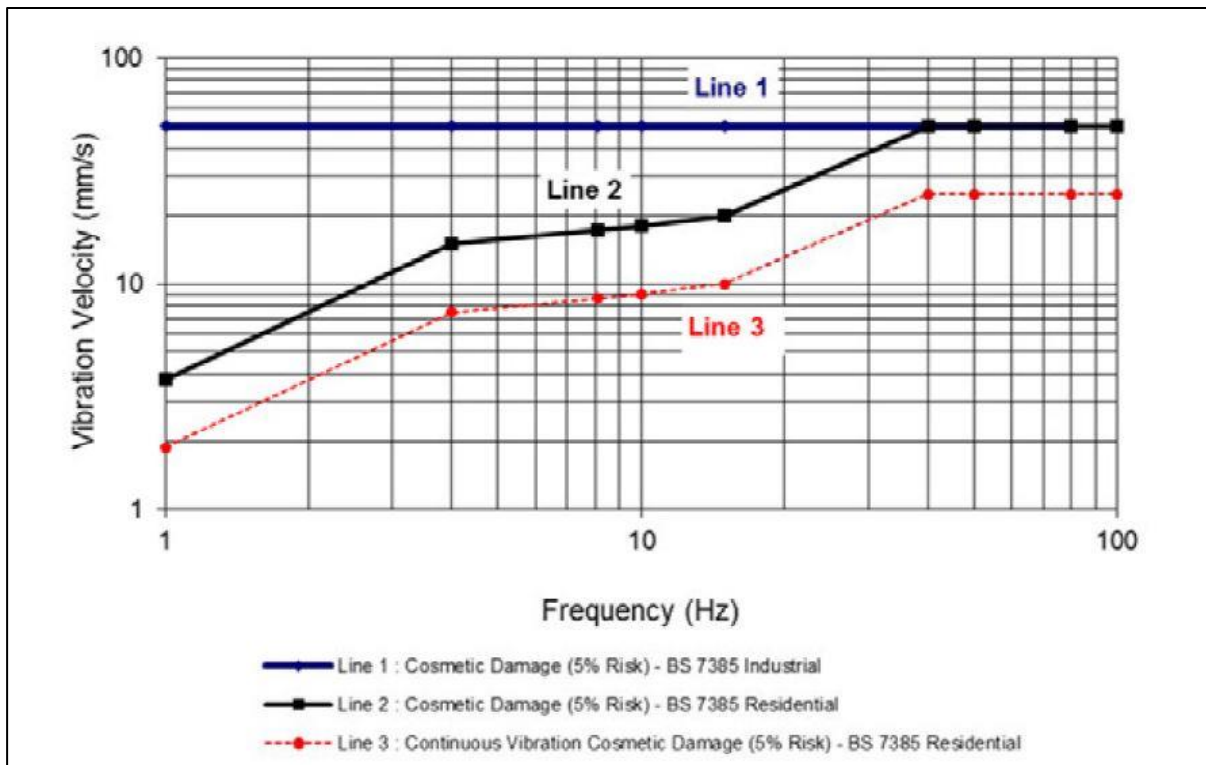


Figure 6.1: Building Damage Vibration Management Levels (BS 7385)

Guidance Note

With regard to these levels BS 7385 states, “Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.”

Also that: “A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.”

Heritage buildings and structures will also be assessed as per the screening criteria in **Table 6.7** as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound.

If a heritage building or structure is found to be structurally unsound (following inspection) a more conservative cosmetic damage criteria of **2.5 mm/s** peak component particle velocity (from DIN 4150) will be considered. The applicable German Standard DIN 4150:3 management levels are tabulated in **Table 6.8** with each “Line” shown in **Figure 6.2**.

Table 6.8 Building Damage Vibration Management Levels (DIN4150:3)

Line	Type of Structure	Guideline Values for Velocity (PPV in mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz ¹
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under either of the other classifications and of great intrinsic value	3	3 to 8	8 to 10

Source: SM CNVS, CNVIS

1. At frequencies above 100 Hz, the values given in this column may be used as minimum values; and
2. The 50 Hz values may be applied to assess vibration at the horizontal plane of the highest building floor at all frequencies.
3. As per the SM CNVS, Heritage criteria are provided. It is noted that line one and line two do not apply to this project. These criteria are only to be applied if a heritage building or structure is found to be structurally unsound.

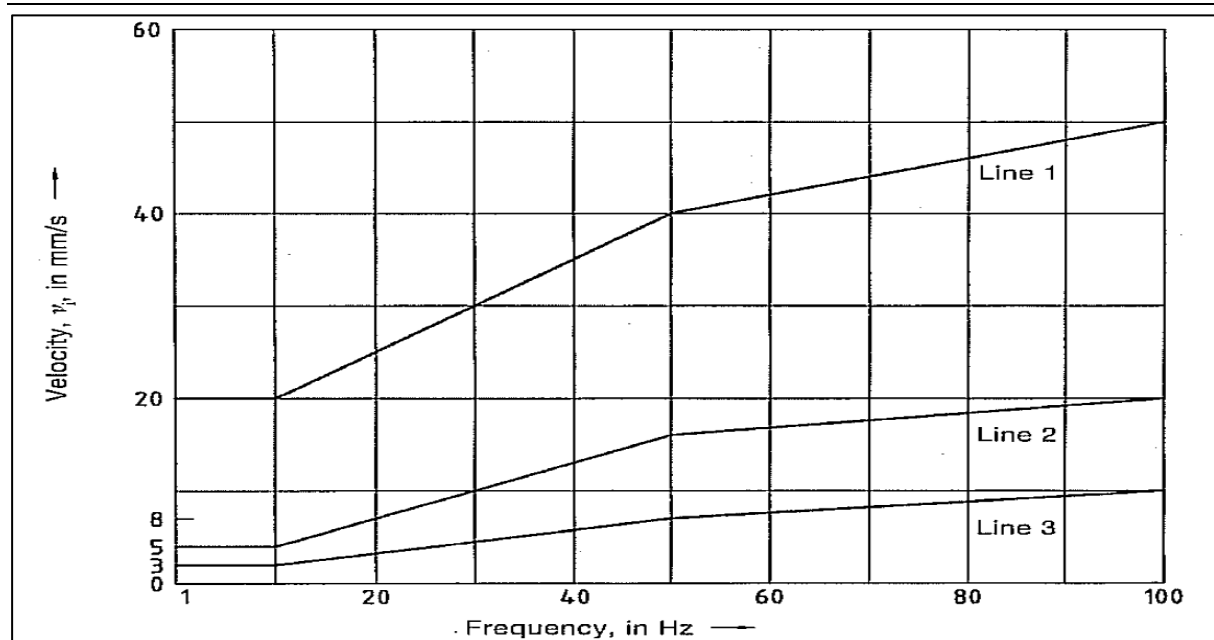


Figure 6.2: Building Damage Vibration Management Levels (DIN4150:3)

Guidance Note

With regard to these levels DIN 4150:3 states, “experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding [these] values does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary.”

6. Work Hours

6.1 Hours of Work

In accordance with the **EPL 12208**, the approved NCW standard construction hours are as follows (**CoA – E36**). All general construction works and activity will be scheduled to occur between these hours, unless OOHW becomes necessary (see below):

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

For construction activities, **EPL 12208** regulates the hours that 'high noise impact generating works' may occur. Any high noise impact generating works must only be undertaken:

- between the hours of 8:00am and 10:00pm Monday to Friday; and
- between the hours of 8:00am and 6:00pm Saturdays and Sundays.

In accordance with **EPL 12208**, **CoA – E40** and the SM **CNVS**, where the high noise impact generating construction works are planned to impact the same noise sensitive receptors in blocks of three hours, one hour respite is required between each block of work.

For the purposes of **EPL 12208** 'high noise impact generating works' include:

- a) rail regulating and tamping, jack hammering, grinding, line drilling, pile driving, rock hammering, rock breaking, saw cutting, **sheet piling**, vibratory rolling; or
- b) any other activities where those activities in either (a) or (b) above generate offensive noise (as defined in the Dictionary to the POEO Act 1997) at noise sensitive receivers, because of their impulsive, intermittent, low frequency or tonal characteristics.

In accordance with **CoA – E34** noise and vibration 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.

Commercial, educational, religious and a number of other sensitive receptor types have been identified in the CNVIS (refer Appendix E). LOR must undertake consultation with sensitive receptors, in order to identify sensitive time periods as required by **CoA – E34**.

6.1.1 Works Outside of the Approved Standard Hours

In reference to **CoA – E48**, there are no activities for the NCW project scheduled to be undertaken 24 hours a day 7 days a week. However, there are instances throughout the project where OOHW will be required.

In accordance with the **EPL - 12208**, where maintenance or construction activities are undertaken outside of the approved maintenance and construction hours, noise impacts must be managed in accordance with those provisions of the ICNG. **EPL – 12208** also states for Out of Hours Works (OOHW) that notification of potentially affected sensitive receptors must be made not less than 5 days and not more than 14 days before those activities are to be undertaken (refer conditions O5.1 to O5.6 in the EPL).

In accordance with the OOHW Protocol in **Appendix B**, the contractor is expected to:

- Prepare an application to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for review in accordance with the SM CNVS and EPL requirements;
- Submit the revised application to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for endorsement and / or approval;
- Ensure any required community notifications have been issued (by either TfNSW or the contractor directly) at least seven days prior to the works commencing.

OOHW (i.e. works outside the approved NCW standard hours) at this stage are proposed for a number of work phases. Impacts for these phases are assessed in the CNVIS. Other activities may become necessary as the construction methodology develops, during both design and actual implementation of the works at the site.

Where OOHW is required or becomes necessary the OOHW Protocol will be implemented, as presented in **Appendix B**. In addition to the OOHW protocol presented in **Appendix B**, the Additional Mitigation Management requirements will be considered as outlined in **Section 8.2** of this CNVMP, in accordance with the SM NVS.

Where OOHW is required or becomes necessary, a task specific Out Of Hours Work Application Form (OOHWAF) will be submitted to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for review. Following their reviews, TfNSW, the AA and the ER may provide comments on the application, which need to be adequately addressed by the contractor in a resubmitted application to the satisfaction of the comment provider(s). Once all comments have been adequately addressed, the application requires endorsement by the TfNSW Principal Manager (Stakeholder & Community Liaison), and will be forwarded to the AA to identify a risk level for the proposed OOH work as either 'Low risk' or 'High risk'.

Following the identification of risk level by the AA, the AA endorses the OOH work application and provides any conditions or comments. If the AA identifies that the OOH work application is high risk and includes works after 9pm, the application will be forwarded to the ER for endorsement only. Following the ER's endorsement, the application will then be formally submitted by TfNSW via email to the Secretary for approval as per **CoA - E47**. For all other applications, the ER will indicate their approval (or otherwise) on the application, including any conditions or comments, and will forward directly to TfNSW, the contractor and the AA.

6.1.2 Emergency Construction

Notwithstanding **CoA – E36** and **EPL – 12208**, construction associated with the CSSI may be undertaken outside the hours specified under those conditions 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.

On becoming aware of the need for emergency construction, LOR must notify the AA, the ER and the EPA of the need for those activities or work. LOR must also use best endeavours to notify all affected sensitive receptors of the likely impact and duration of those works in accordance with **CoA – E45**.

7. Aspects, Impacts & Risks

This section outlines relevant aspects of the construction methodology and the predicted construction noise and vibration impacts. The predicted noise and vibration impacts are detailed in the CNVIS and summarised here as relative to the surrounding community or nearby by structures. The CNVIS was prepared for the NCW project prior to the commencement of construction, to ensure the adequacy of the noise and vibration mitigation measures.

7.1 Construction Methodology

A number of key construction scenarios (SCN / Work Phases) were identified in the CNVIS for NCW Portion 7B as follows:

- SCN01 - Clearing and Grubbing for site establishment
- SCN02 - Overhead Wiring Footings, Structures and Wiring
- SCN03 - Drainage System Installation
- SCN04 - Track Slew or Switch
- SCN05 - Removal of existing Tracks
- SCN06 - HV Electrical Works
- SCN07 - Construction of Combined Services Route (CSR)
- SCN08 - Under Line Crossing (ULX) Works
- SCN09 - Relocation and Termination of Utilities in Nelson St Bridge
- SCN10 - Nelson St Bridge Demolition
- SCN11 - Mowbray Rd Bridge Demolition of break Wall- OOHW
- SCN12 - Mowbray Rd Bridge Construction of base slab and deflection wall
- SCN13 - Mowbray Rd Bridge Install of Precast piles - Standard Hours
- SCN14 - Mowbray Rd Bridge Install of Crash Barrier and Footpath - OOHW
- SCN15 - Mowbray Rd Bridge Footpath alterations / Road Works - Standard Hours
- SCN16 - Rail Corridor Fence / Noise Walls Installation
- SCN17 - Orchard Rd Ancillary Facility
- SCN18 - Brand St Ancillary Facility
- SCN19 - Brand St Laydown Area
- SCN20 - Hampden Road Laydown Area
- SCN21 - Elizabeth St Ancillary Facility
- SCN22 - Elizabeth St Laydown Area
- SCN23 - Cleland Rd Ancillary Facility
- SCN24 - Cleland Rd Laydown Area
- SCN25 - Cleland Rd Stockpiling
- SCN26 - Lambs Rd Laydown Area
- SCN27 - St Leonards Yard Laydown Area

These scenarios were advised by LOR and are consistent with the current construction methodology of NCW as described in **Section 1.2.2**. Details of these construction works (reproduced from the CNVIS) and scenarios are summarised in **Table 7.1** below and presented in **Appendix D**. There may be some overlap between these work phases. The construction program as outlined in the CEMP is provided in **Appendix F**. **Section 8** outlines all mitigation and management measures required across all construction scenarios however **Table 7.1** below provides a summary of the additional mitigation measures required for each construction scenario. Further detail on additional mitigation measures is outlined in **Section 8.2**.

Table 7.1 Construction Works and Associated Activities

ID	Activity	OHW Required?	Schedule	Proposed Dates	Additional Mitigation Measures
SCN01	Clearing and Grubbing for site establishment	N	Standard Construction Hours	As required	The following additional mitigation measures will also be required at the closest and most affected receptors: M, LB
SCN02	Overhead Wiring Footings, Structures and Wiring	Y	Weekend Possessions, Day and Night	DEC 2018 - MAR 2020	The following additional mitigation measures will also be required during the night time period at the closest and most affected receptors i.e. R152, R165 and R170: AA, M, IB, LB, PC, RO, SN
SCN03	Drainage System Installation	Y	Weekend Possessions, Day and Night	JAN 2019 – MAR 2020	The following additional mitigation measures will also be required during the night time period at the closest and most affected receptors i.e. R.232, R.226, R.239, R.242, R.212, R.231, R.230, R.216, R.228, R.211, R.250, R.222, R.209 and R.220: AA, M, IB, LB, PC, RO, SN
SCN04	Track Slew or Switch	Y	Weekend Possessions, Day and Night	NOV 2018 – OCT 2019	The following additional mitigation measures will also be required during the night time period at the closest and most affected receptors i.e. R.181, R.144, R.152, R.170, R.165, R.209, R.127, R.134, R.211, R.212, R.122, R.128, R.149, R.157, R.159, R.163 and R.177 : AA, M, IB, LB, PC, RO, SN
SCN05	Removal of existing Tracks	Y	Weekend Possessions, Day and Night	JUN 2019 – OCT 2019	The following additional mitigation measures will also be required at the closest and most affected receptors i.e. R.179, R.250, R.186, R.226, R.231, R.239, R.251, R.257, R.260, R.266, R.270, R.185, R.232, R.242, R.212, R.272, R.181, R.216, R.108, R.144, R.152, R.170, R.209, R.211, R.165, R.228, R.230, R.245, R.265, R.114, R.122, R.157, R.159 and R.248: AA, M, IB, LB, PC, RO, SN
SCN06	HV Electrical Works	Y	Weekend Possessions, Day and Night	OCT 2018 – DEC 2019	The following additional mitigation measures will also be required at the closest and most affected receptors i.e. R.179, R.250, R.226, R.239, R.186, R.231, R.242, R.251, R.257, R.260, R.266, R.270, R.185, R.232, R.181, R.212, R.272, R.216, R.108 and R.144: AA, M, IB, LB, PC, RO, SN
SCN07	Construction of Combined Services Route (CSR)	Y	Weekend Possessions, Day and Night	APR 2019 – DEC 2019	The following additional mitigation measures will also be required during the night time period at the closest and most affected receptors i.e. R.152, R.144, R.159, R.165, R.170, R.179 and R.108: AA, M, IB, LB, PC, RO, SN

ID	Activity	OOHW Required?	Schedule	Proposed Dates	Additional Mitigation Measures
SCN08	Under Line Crossing (ULX) Works	Y	Weekend Possessions, Day and Night	JAN 2019 – DEC 2019	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.179, R.250, R.186, R.239, R.257, R.260, R.266, R.270, R.185, R.231, R.232, R.242, R.251, R.212, R.226, R.181, R.272 and R.216: AA, M, IB, LB, PC, RO, SN
SCN09	Relocation and Termination of Utilities in Nelson St Bridge	Y	Weekend Possessions, Day and Night	FEB 2019	The following additional mitigation measures will be required at the closest and most affected receptors i.e. R.179, R.185, R.177, R.186, R.187, R.170, R.174, R.175, R.181, R.172, R.180, R.171, R.165, R.152, R.163, R.184, R.182 and R.157: AA, M, IB, LB, PC, RO, SN
SCN10	Nelson St Bridge Demolition	Y	Standard Construction Hours + Weekend Possessions, Day and Night	23 - 24 FEB 2019 05 - 06 APR 2019 22 - 23 JUN 2019	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.179, R.185, R.177, R.186, R.170, R.174, R.187, R.175, R.181, R.172, R.180, R.171, R.165, R.163, R.152, R.182, R.184 and R.157: AA, M, IB, LB, PC, RO, SN
SCN11	Mowbray Rd Bridge Demolition of break Wall-OOHW	Y	Weekend Possessions, Day and Night	DEC 2019	The following additional mitigation measures will be required at the closest and most affected receptors i.e. R.195, R.198, R.202, R.186, R.179, R.209, R.185, R.181, R.212, R.207, R.175, R.211, R.216, R.170, R.177, R.204, R.231 and R.239: AA, M, IB, LB, PC, RO, SN
SCN12	Mowbray Rd Bridge Construction of base slab and deflection wall	Y	Standard Construction Hours + Weekend Possessions, Day and Night	OCT 2019 – DEC 2019	The following additional mitigation measures will be required at the closest and most affected receptors i.e. R.195, R.198, R.202, R.186, R.179, R.209, R.185, R.181, R.212, R.207, R.175, R.211, R.216, R.170, R.177, R.204, R.231 and R.239: AA, M, IB, LB, PC, RO, SN
SCN13	Mowbray Rd Bridge Install of Precast piles - Standard Hours	N	Standard Construction Hours	OCT 2019 – DEC 2019	No additional mitigation measures have been identified for this scenario.
SCN14	Mowbray Rd Bridge Install of Crash Barrier and Footpath -OOHW	Y	Weekend Possessions, Day and Night	DEC 2019	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.195, R.198, R.186, R.179, R.209, R.185, R.181, R.212 and R.207: AA, M, IB, LB, PC, RO, SN
SCN15	Mowbray Rd Bridge Footpath alterations / Road Works - Standard Hours	N	Standard Construction Hours	DEC 2019 – AUG 2020	The following additional mitigation measures will be required at the closest and most affected receptors: M, LB

ID	Activity	OOHW Required?	Schedule	Proposed Dates	Additional Mitigation Measures
SCN16	Rail Corridor Fence / Noise Walls Installation	Y	Standard Construction Hours + Weekend Possessions, Day and Night	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.179, R.242, R.251, R.232, R.250, R.239, R.186, R.226, R.257, R.260, R.266, R.270, R.231, R.185, R.212, R.265, R.272, R.245, R.181, R.216, R.228, R.230, R.248 and R.211: AA, M, IB, LB, PC, RO, SN
SCN17	Orchard Rd Ancillary Facility	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.186 and R.185: M, IB, LB, PC, RO, SN
SCN18	Brand St Ancillary Facility	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.274 and R.276: AA, M, IB, LB, PC, RO, SN
SCN19	Brand St Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.283, R.284, R.286, R.280, R.288, R.297, R.300, R.302, R.303, R.289, R.294, R.305, R.306, R.279, R.290, R.308, R.309, R.293, R.276, R.296, R.287, R.310, R.274, R.285, R.314, R.317, R.282 and R.323: M, IB, LB, PC, RO, SN
SCN20	Hampden Road Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.371, R.382, R.386, R.387 and R.391: AA, M, IB, LB, PC, RO, SN
SCN21	Elizabeth St Ancillary Facility	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.301: AA, M, IB, LB, PC, RO, SN
SCN22	Elizabeth St Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.371, R.382, R.391, R.402, R.405, R.387, R.397, R.400, R.404, R.406, R.407, R.409, R.410, R.412, R.386, R.393 and R.411: M, IB, LB, PC, RO, SN
SCN23	Cleland Rd Ancillary Facility	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.417, R.418, R.416, R.412, R.411 and R.410: M, IB, LB, PC, RO, SN
SCN24	Cleland Rd Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.402, R.405, R.400, R.404, R.412, R.397, R.406, R.411, R.416, R.407, R.409, R.410, R.417, R.391, R.393 and R.394: M, IB, LB, PC, RO, SN

ID	Activity	OOHW Required?	Schedule	Proposed Dates	Additional Mitigation Measures
SCN25	Cleland Rd Stockpiling	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.402 and R.405: AA, M, IB, LB, PC, RO, SN
SCN26	Lambs Rd Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.430, R.434, R.441 and R.447: M, IB, LB, PC, RO, SN
SCN27	St Leonards Yard Laydown Area	Y	Standard Construction Hours + OOHW	VARIOUS	The following additional mitigation measures will be required during the night time period at the closest and most affected receptors i.e. R.504, R.499, R.511, R.517 and R.496: M, IB, LB, PC, RO, SN

Source: CNVIS.

1. Additional mitigation measures are outlined in further detail in **Section 8.2**.
2. The additional mitigation measures outlined here (excluding SCN01, SCN13 and SCN15) are based on the requirement of night time works. If night time works are not required for any given scenario, the additional mitigation measured required will be reduced. Further detail is provided in the CNVIS.

7.2 Predicted Construction Impacts

In general, noise (and vibration) impacts are likely to occur due to the NCW project emissions that are considered offensive by the community and are likely to result in complaints being received, additional mitigation or management measures being implemented, or additional monitoring being required.

For noise impacting residential and other sensitive receptors, the potential impacts relate to annoyance or an unacceptable noise amenity. A summary of the most affected noise receptors considered in the CNVIS and the predicted value at each is presented in **Appendix C**. Due to the level of detail and the number of receptors in the CNVIS the full set of results has not been reproduced in the CNVMP.

For vibration impacting building structures, the potential impacts relate to structural or cosmetic damage. These however are unlikely to occur with good practice construction management, adherence to safe work distances and monitoring of significant vibration activities to verify compliant levels.

In all cases the assessment of vibration criteria (cosmetic/structural damage and human annoyance) is focused on the closest and/or potentially most affected vibration receptors being **R.170, R.174, R.175, R.177 and R.179** for SCN10 (Nelson St Bridge) and **R.198 and R.195** for SCN11 and SC12 (Mowbray Rd Bridge).

7.2.1 Potential Noise Impacts

The CNVIS provided a detailed breakdown of the key construction periods and associated equipment, and their source noise emission (Sound Power Levels, LW or SWL). These values and summary of the predicted LAeq, 15minute noise levels from the CNVIS (determined via modelling for each scenario) are reproduced in **Appendix C** and **Appendix D**.

All LW, dBA values have considered and applied the relevant INP modifying factors (penalties) for offensive noise characteristics, prior to modelling. All modelling inputs have also considered and applied the standard mitigation measures prior to modelling; this is reflected in the LW adopted for each item of equipment. Furthermore, the 3D noise model has incorporated the shielding provided by topography and the existing rail noise barrier situated to the north of Nelson Street on both the up and down side of the rail alignment. Values that exceed the HNAML in **Appendix C** (fixed at 75 dB for residential receptors) are highlighted in **bold and underlined** typeset.

In each scenario, it was assumed in the CNVIS that all plant will operate simultaneously, which is considered to be representative of potential worst-case conditions. The CNVIS results (reproduced in **Appendix C** of this CNVMP for ease of reference) indicated that construction noise emissions will exceed the project NMLs at a number of locations during each scenario. The magnitude by which they exceeded the NML did however vary depending on the work phase and necessary equipment. The extent by which they exceeded the NML is constrained to the closest receptors; although elevated levels are predicted at other more distance locations, the highest impacts are limited to those directly adjacent the site.

The highest predicted noise levels are associated with the demolition of the Nelson Street Bridge occurring in SCN10. Other scenarios with the highest predicted noise levels at receptors are associated with the Nelson Street and Mowbray Road Bridge works (i.e. SCN09, SCN11 and SCN12) where high noise generating works are being undertaken in close proximity to potentially sensitive receptors. These noise levels are predicted at the nearest receptors located in generally the first row of buildings with direct line of sight to NCW works.

The following scenarios are predicted to generate noise levels >30dBA above the RBL (as per the AMMM) at the closest and most affected receptors for works within the recommended standard hours of construction: SCN01, SCN03, SCN04, SCN05, SCN06, SCN08, SCN09, SCN10, and SCN16.

The following scenarios are predicted to generate noise levels >30dBA above the RBL (as per the AMMM) at the closest and most affected receptors for works outside the recommended standard hours of construction: SCN03 to SCN12, SCN16, SCN18, SCN20, SCN21 and SCN25.

Based on these general construction noise levels exceeding the NML it is also considered likely that sleep disturbance screening criteria will be exceeded at the nearest and most sensitive residential receptors during OOHW. Community and stakeholder consultation and notification processes outlined in the AMMM in **Section 8.2** will be required at these receptors. Mitigation and management measures from the AMMM will

also be required such as alternative accommodation, monitoring and respite offers. It should also be noted that where night time noise monitoring is required to occur, this will include sleep disturbance noise monitoring.

Some noise from construction sites is inevitable, such that the ICNG focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels. These results and noted exceedances identify that best-practice construction noise management and control techniques will be required to reduce noise levels as far as practicable. To minimise impacts additional noise control, mitigation and management measures may also be warranted. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes outlined in the AMMM in **Section 8.2**.

It is also a requirement under **CoA – E41** and **E42** that LOR must identify and consult with all receptors likely to experience internal noise levels greater than $L_{eq} 15 \text{ minute } 45 \text{ dBA}$ between 8pm and 7am, including regenerated (ground-borne) noise or a perceptible level of vibration. These receptors must be offered additional mitigation in accordance with AMMM in **Section 8.2**. As per **CoA – E41** the internal screening level for non-residential zones is increased to $L_{eq} 15 \text{ minute } 60 \text{ dBA}$ between 8pm and 9pm.

It is possible to estimate internal noise levels based on the predicted values presented in **Appendix C** for each scenario by deducting 10 dBA from these external values to represent windows being partially open and by deducting 20 dBA to represent windows being closed.

Ground-borne construction noise impacts from NCW works are not anticipated as vibration generating source/s with the potential to generate perceptible ground-borne noise, do not form part of the overall construction design. Due to the attention given to the airborne noise for the project it has been determined that the mitigation and management measures recommended for airborne noise will also be sufficient in managing impacts from potential ground-borne noise. Airborne noise will dominate ground borne noise in all instances and therefore is the driving consideration for noise and vibration mitigation.

Technical Note

At the time the P7b CNVIS was finalised (September 2018) and this CNVMP subsequently prepared, the removal of a portion of the existing rail corridor noise wall (by and third party) and subsequent installation of a temporary noise curtain was proposed/approved. As stated in the CNVIS a review of P7b works was conducted to address the potential effect of this feature. The review identified that P7b activities will not be occurring in the area near to the portion of barrier "noise wall" proposed to be removed, during the period of time when the noise wall is not there. Therefore the temporary removal of the noise wall, and/or a temporary noise curtain are not expected change the predicted construction noise levels presented in the CNVIS, which were referenced in the preparation of this CNVMP. Regardless, suitable safeguards and provisions are incorporated into this CNVMP and these will be actioned in the unlikely event that P7b emissions increase as a result of this noise wall removal circumstance.

Potential Effects of Concurrent Work

Air-borne noise levels have been predicted via 3D noise modelling for a range of works and activities associated with the projects construction. These predicted noise levels are detailed in **Appendix C** of this CNVMP and address each work area/activity so that any additional mitigation and management measures (to those already incorporated into the construction design and noise modelling) may be defined for each representative worst-case assessment scenario.

This method is typical of NSW construction projects especially those of the scale of NCW where there is a large spatial area (extending from Chatswood to St Leonards) and temporal boundary (three year construction program). In these cases there is limited potential for significantly increased noise levels and associated impacts to occur due to concurrent works.

This is primarily due to the dominant influence of the works conducted at or near the most affected receptor (on which the CNVIS and CNVMP is based), which will mask the influence of other works occurring at the time. The construction schedule / timing of works is also an influence when considering this potential as in many cases there are different activities that will be undertaken at the same location over the course of the construction schedule i.e. they will not occur concurrently.

The conservative nature of the predictive inputs that consider all plant, equipment and/or machinery operating concurrently for each scenario are also an influence when considering this feature. The predicted values do

not represent a constant noise emission that would be experienced by the community on a daily basis throughout the project's construction schedule, they will only be experienced for limited periods of time when those specific activities are occurring, and they will not be experienced over the whole daytime, evening or night time period.

When evaluating potential effects of concurrent work it is also important to consider how noise levels add together. For example, if two separate activities are occurring and the noise level from each is 55 dBA at the receptor, then the resultant noise level is 58 dBA. This increase in noise level (3 dBA) will be just perceptible and a significant change in impact unlikely. If two separate activities are occurring and the noise level from one is 55 dBA and the other is 53 dBA, then the resultant noise level is 57 dBA. This increase in noise level (2 dBA) will be hardly perceptible in practice and a significant change in impact is highly unlikely.

Based on the information presented above a set of provisions, safeguards and monitoring contingencies are provided in the unlikely event that additional issues associated with concurrent works are identified and further mitigation is required. These provisions, safeguards and contingencies are outlined in **Section 10.1** below.

Cumulative Impacts

The NCW contractor in accordance with **CoA - E39** will consult with other proponents of construction activities located in and around the NCW P7B project site. Specifically this will include the Tunnels and Station Excavation Works (TSE) contractor, Sydney Trains and any other contractors that will undertake works within the NCW project area. Cumulative impacts associated with nearby construction works will be managed through the community consultation process. Sydney Trains take the lead on communications that are occurring within Sydney Train land and LOR project works will be included as a combined notification. Further detail of the community consultation process are detailed in the overarching Stakeholder and Community Involvement Plan (Sydney Metro Community Consultation Strategy).

The NCW contractor attends ongoing construction interface meetings with other contractors to understand the scope and extent of impacts and works with Sydney Metro and the AA to modify works based on noise assessment results of the NCW contractor and other contractors if known. The approach allows each contractor to provide the required respite periods identified in accordance with **CoA - E40** and minimise impacts to sensitive receivers through the application of additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in **CoA - E32**.

To avoid any misunderstanding, the addition of noise levels from concurrent/cumulative works will be evaluated to determine appropriate AMM. This feature will be considered during the normal planning and application processes required by the project. To the extent possible, and if other works are identified to take place in the area, at the same time as P7b works, these third party works will be considered and assessed to determine the total predicted noise level at affected receptors. To the extent possible, the total predicted noise level will be determined and adopted to inform which AMM apply in accordance with the Sydney Metro CNVS. These third party contractors will be contacted where necessary to share these outcomes, especially if they are the dominant noise generating source/activity identified at the time.

In accordance with EPL 12208, **CoA – E40** and the SM CNVS, where the high noise impact generating construction works are planned to impact the same noise sensitive receptors in blocks of three hours, one hour respite is required between each block of work.

7.2.2 Potential Vibration Impacts

Activities undertaken on the site during construction may generate ground-borne vibration. With respect to the construction plant identified in **Appendix D**, the highest levels of vibration are expected to occur due to the use of the excavators with hydraulic hammers (SCN10, SCN11 and SCN12) and the track tamper (SCN04 and SCN05). The CNVIS noted that other construction activities were considered and deemed to produce insignificant levels of vibration with limited or no risk in terms of human comfort and certainly no risk of building damage issues.

The track tamping activity to be carried out as part of the Sydney Metro works is not anticipated to differ in any way from the track tamping carried out as part of Sydney Trains major periodic track maintenance. Therefore the vibration levels are not assumed to be higher than currently experienced during major track maintenance. Even if the tamping occurs in closer proximity to receptors than the general Sydney Trains

track maintenance, the method used throughout the Sydney Trains rail network and in close proximity to buildings will not differ.

To assess potential vibration impacts the CNVIS adopted the applicable safe work distances published in the TfNSW CNVS (I&S). These safe working distances do not provide guidelines on the track tamping activity, however based on the proposed equipment it is anticipated that vibration generated from track tamping will have a low to moderate risk of exceeding the human comfort criteria and a low risk of exceeding the cosmetic damage criteria. Based on this, attended vibration measurements are required at the commencement of track tamping activities (SCN04 and SCN05) to confirm that vibration levels satisfy the criteria outlined in **Section 5.3**. Where there is potential for exceedances of the criteria further vibration site law investigations would be undertaken to determine the site-specific safe working distances for the vibration generating activity. Continuous vibration monitoring (attended or unattended with audible and visible alarms) will be conducted at the nearest sensitive receptors whenever those vibration generating activities need to take place inside the calculated safe-working distances.

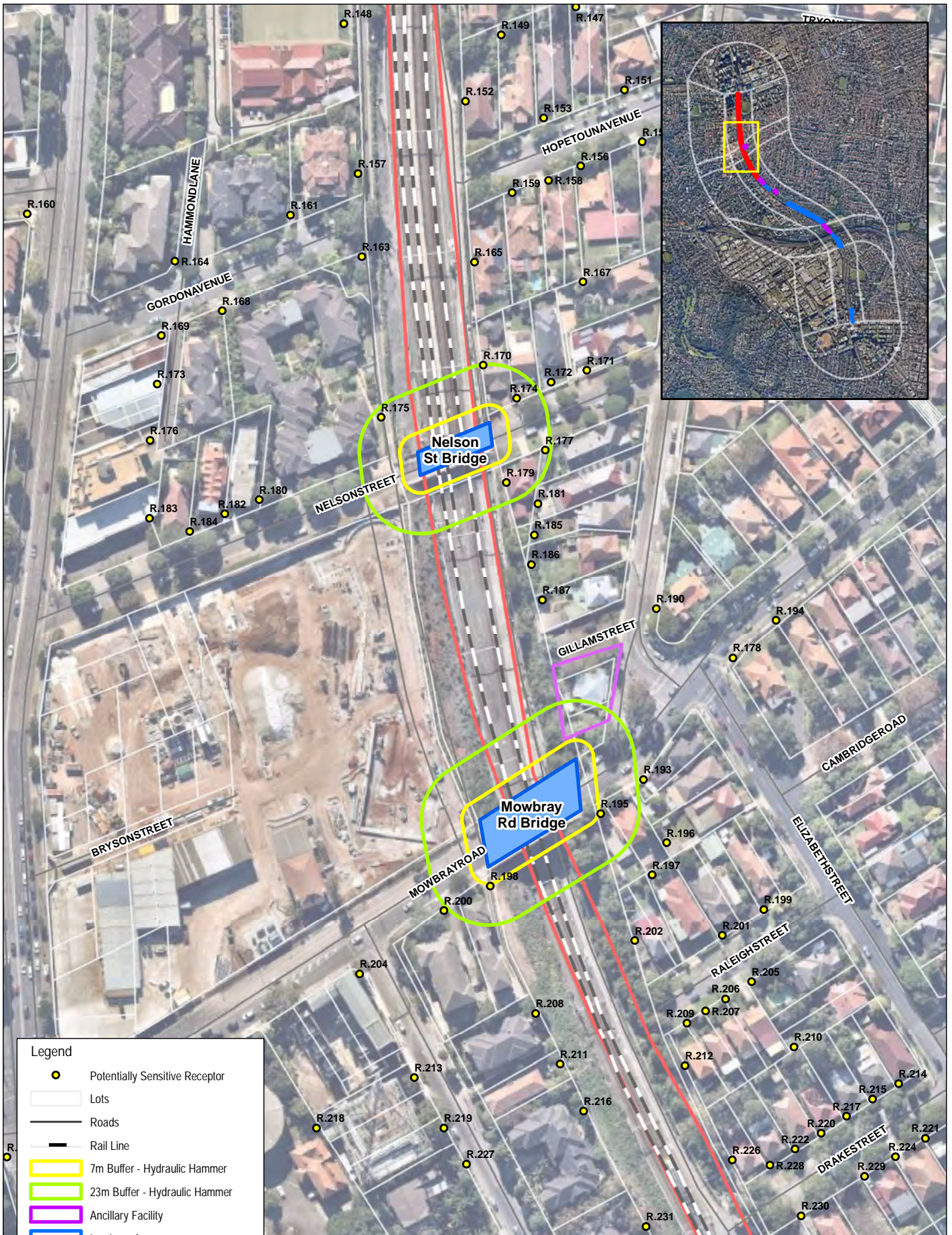
The CNVIS assessed potential vibration impacts associated with the hydraulic hammering activities against the safe working distances identified in the TfNSW CNVS (I&S). The hydraulic hammering works are not required within applicable safe work distances for cosmetic damage (7 m), therefore impacts to buildings are not anticipated, refer **Table 7.2** and **Figure 7.1** below. Hydraulic hammering activities will be required within the safe working distances for human comfort (23 m). This identifies that best-practice construction vibration management and control techniques will be required to reduce vibration levels as far as practicable. For example, vibration intensive activities may start at a position far away from a receptor and move closer as compliant levels are verified through monitoring. To minimise impacts additional mitigation and management measures will also be warranted. These will need to be implemented in conjunction with community and stakeholder consultation and notification processes outlined in the AMMM for Ground-borne Vibration in **Section 8.2** of this CNVMP.

It is also a requirement under **CoA – E41** and **E42** that LOR must identify and consult with all receptors likely to experience a perceptible level of vibration. These receptors must be offered additional mitigation in accordance with AMMM in **Section 8.2**. These human annoyance outcomes are typical of construction and hydraulic hammering works in close proximity to other buildings and highlights the need to monitor and establish compliant levels during the early stages of vibration significant activities.

The vibration monitoring and compliance assessment focus will initially be for excavators with hydraulic hammers (SCN10, SCN11 and SCN12) and the track tamping (SCN04 and SCN05). Additional monitoring of other work phases and activities will be considered on a case by case basis (i.e. if vibration generating activities are required).

During the works, impacts from vibration will be considered both in terms of the effects on building occupants (human comfort) and the effects on the building structures (structural/cosmetic damage). The applicable criteria (outlined in **Section 5.3**) will be evaluated, selected and applied based on the receptor type and potential impacts:

- **Human comfort criteria** will be assessed on a case by case basis, where necessary (i.e. if impacts have the potential to occur) and where appropriate to the vibration type being generated by the activity under assessment. The vibration type (impulsive, continuous or intermittent) and application of the relevant criteria will be evaluated and selected by a suitably experienced person or in consultation with a qualified technical specialist.
- **Cosmetic/Structural damage criteria** will be assessed on a case by case basis, where necessary (i.e. if impacts have the potential to occur) and where appropriate to the structure under assessment. The structure type and application of the relevant criteria will be evaluated and selected by a suitably experienced person or in consultation with a qualified technical specialist.



Legend

- Potentially Sensitive Receptor
- Lots
- Roads
- Rail Line
- 7m Buffer - Hydraulic Hammer
- 23m Buffer - Hydraulic Hammer
- Ancillary Facility
- Laydown Area
- Site Works Boundary
- Work Areas

Source:
 - (c) Department Finance, Services and Innovation, DCDB, DTDB 2017
 - Nearmap Imagery May 2018

Ground-Borne Vibration Safe Working Distances **F-7.1**

Drawing No: 0424696m_CNVMP_G011_R0.mxd	Northern Corridor Works CNVIS / CNVMP
Date: 18/06/2018	Drawing Size: A4
Drawn By: LT	Reviewed By: SDL
Client: Laing O'Rourke Australia Construction Pty	
Coordinate System: GDA 1994 MGA Zone 56	
<div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 5px;">0</div> <div style="margin-right: 20px;">25</div> <div style="margin-right: 20px;">50</div> <div>75m</div> </div> <div style="text-align: center; margin-top: 5px;"> N ↑ </div>	<p>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</p>



Table 7.2 Vibration Assessment Scenarios

Scenario ID	Work Phase Description	Vibration Generating Equipment / Plant Utilised	Applicable Safe work distance (Cosmetic)	Applicable Safe work distance (Human Comfort)	Vibration Assessment (nearest) distance (m)	Vibration Assessment (furthest) distance (m)	Works Required within applicable Safe work distances (Cosmetic)	Works Required within applicable Safe work distances (Human Comfort)	Potential OOHW Required?
SCN10	Nelson St Bridge Demolition	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	10	25	N	Y	Y
SCN11	Mowbray Rd Bridge - Demolition of Break Wall-	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	15	30	N	Y	Y
SCN12	Mowbray Rd Bridge - Construction of base slab and deflection wall	Excavator (with Medium Hydraulic Hammer)	7 m	23 m	15	30	N	Y	Y

1. Partial means that the equipment will operate within some of the applicable range of safe work distances for the works
2. Potential OOHW may occur during Period 1 (day non-standard), however piling is not envisaged to occur during Period 2 (night time).

8. Mitigation and Management Measures

This section describes the overall approach to managing and mitigating noise and vibration impacts as a result of the NCW project based on the predicted impacts as summarised in this CNVMP. It should be noted that all modelling inputs have also considered and applied the standard mitigation measures prior to modelling; this is reflected in the LW adopted for each item of equipment. Furthermore, the 3D noise model has incorporated the shielding provided by topography and the existing rail noise barrier situated to the north of Nelson Street on both the up and down side of the rail alignment.

The management measures discussed in this section are based on the applicable compliance matrices for the relevant project approval as presented in **Section 0** of this CNVMP, as well as the requirements of the ICNG and standards of LOR, including application of the SM CNVS as relevant to the works. These measures have been informed further by the outcomes and recommendations of the CNVIS.

The SM CNVS was developed to address the assessment requirements documented in the ICNG. It also identifies the thresholds by which impacts can be qualified and the level of mitigation and management that is required for each stage of works.

The mitigation and management measures are consistent with the intent and recommendations of the ICNG for own best-practice techniques to be developed for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

The SM CNVS assessment and mitigation approach has been adopted, in conjunction with the requirements of the ICNG, for the measured described in this CNVMP.

In accordance with the SM CNVS, where noise levels have been predicted above the noise management levels, the AMMM identified in **Section 8.2** is to be implemented. This will involve various methods of community consultation which are outlined in **Table 8.3**. All community consultation will be in accordance with Sydney Metro Stakeholder and Community Strategies. Consultation with businesses will be in accordance with the Sydney Metro Business Management Plan (BMP) and the small business owners support program.

The NCW contractor in accordance with **CoA - E39** consults with other proponents of construction activities located in and around the NCW Portion 7 project site. Specifically this includes the Tunnels and Station Excavation Works (TSE) contractor, Northwest Rapid Transport contractor, Sydney Trains and any other contractors that will undertake works within the NCW project area. An assessment of work activities and the expected noise impact is made based on activity type. Where possible the work methodology is alerted to mitigate the cumulative impact of works located within the same area. For example, this may include locating works in another location of the project until other contractor works has completed, or commencing works at a time when the other contractor works has finished.

The NCW contractor attends ongoing construction interface meetings with other contractors to understand the scope and extent of impacts and works with Sydney Metro and the AA to modify works based on noise assessment results of the NCW contractor and other contractors if known. The approach allows each contractor to provide the required respite periods identified in accordance with **CoA - E40** and minimise impacts to sensitive receivers through the application of additional mitigation in accordance with the Sydney Metro City and South West Noise and Vibration Strategy referenced in **CoA - E32**.

In accordance with **CoA – E33**, community consultation has commenced with the intention of identifying specific mitigation measures. Further detail of this consultation is outlined in **Section 1.4** of this CNVMP and Section 6.1 of the CNVIS.

Consultation with sensitive receptors will be undertaken as the project progresses where sensitive periods can be refined based on the type of activities, expected impacts and the particular circumstances of the receptor at that time. All consultation will be undertaken prior to the start of the relevant portion of works predicted to affect those receptors. Mitigation measures can then be tailored based on the consultation feedback. The updated information will be made available to the AA and ER four weeks prior to commencement of that scenario. Mitigation Consultation will be undertaken at receptors to which it applies prior to the activity commencing which has triggered it.

The following mitigation and management measures identified in the CNVIS will be implemented to minimise impacts as far as is feasible and reasonable:

- Extended periods of high noise level generating plant, equipment or machinery (excavators, hand tools, grinders etc.) will be avoided.
- Any site buildings, equipment or other useful obstacles/objects will be positioned to act as a temporary barrier to minimise noise emissions towards the residential receptors situated in the first row of buildings surrounding the NCW project (NCA01). Other barriers such as hoardings or temporary enclosures will also be used.
- A temporary acoustic barrier/material will be fitted to the site access gates. The gate will then need to remain closed as far as practical during works, with particular focus on the night time.
- Works will utilise the existing rail corridor noise barriers, particularly those near the Hopetoun Ave entrance. For example, equipment/plant will be positioned on the rail corridor level behind the barrier (at Hopetoun Ave) rather than on the ramp.
- The site will be orientated to minimise the need for reversing of equipment or vehicles, particularly during any out-of-hours work. Furthermore, in accordance with **REMM NV1**, Non-tonal reversing alarms will be fitted to all permanent mobile plant. Occupational health and safety requirements for use of warning systems must be followed.
- The site will be proactively managed to avoid plant, equipment or machinery being unnecessarily clustered together near receptors.
- All mechanical plant and equipment will be selected to provide quieter and less vibration emitting construction methods where feasible and reasonable.
- All mechanical plant and equipment is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, will be maintained to the manufacturer's specifications. In accordance with **REMM NV1**, residential grade mufflers will be fitted to all mobile plant.
- All plant, equipment or machinery (and heavy vehicles, trucks etc.) will be turned off when not being used.
- To manage the impacts of construction road traffic noise on local roads the following best practice mitigation and management measures will be implemented: keep truck drivers informed of the designated vehicle routes, parking locations, acceptable delivery hours; instruct truck drivers to travel through local roads without stopping unless absolutely necessary. If for whatever reason, truck drivers need to stop on local roads they will position the vehicle away from residential houses and limit extended periods of engine idling; and instruct truck drivers to limit engine revving and use of exhaust brakes when travelling to and from site, especially whilst travelling on local roads.
- In accordance with **CoA – E34** noise generating works in the vicinity of potentially-affected, religious, educational, community 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.
- Attended noise monitoring will be conducted across all shifts during track possession work, including the night time period where sleep disturbance impacts will be monitored.
- Attended vibration measurements will be required at the commencement of hydraulic hammering and track tamper activities (SCN04 and SCN05) to confirm that vibration levels satisfy the criteria outlined in **Section 5.3**. Where there is potential for exceedances of the criteria further vibration site law investigations will be undertaken to determine the site-specific safe working distances for the vibration generating activity.
- Continuous vibration monitoring (attended or unattended with audible and visible alarms) will be conducted at the nearest sensitive receptors whenever vibration generating activities need to take place inside the relevant safe-working distances for that activity.

8.1 Standard Mitigation Measures

The standard mitigation (and management) measures that will be adopted during the NCW project (in accordance with the SM CNVS) are described in **Table 8.1** and will be implemented for the works to manage and potentially reduce construction noise and vibration impacts. For each item the NCW personnel responsible is nominated. For each item a unique identification number (ID) is provided, which correlates to the document references shown in the traceability matrix.

Sydney Metro has also developed principles for managing construction noise and vibration. These principles will apply to the NCW project and are listed below:

- All personnel and community will be informed of the effort and methods undertaken to reduce noise and vibration for the works undertaken.
- Good engagement with the community will be maintained to facilitate effective project delivery with balanced community impacts.
- Construction noise and vibration levels at sensitive receivers will be minimised where feasible and reasonable.
- Feasible and reasonable mitigation will reflect the time of day, and the degree and duration of the impact.
- The community will be informed of the dates for the intended works, sequencing and timing of noisy events. Where possible this will include an indicative schedule over a 24 hour period.
- Minimising construction noise and vibration will be viewed as a continuous improvement exercise that is inclusive of stakeholders where no idea is too small to be considered.
- Any operational noise and vibration improvements resulting from the works will be promoted to the community.

Table 8.1 Standard Noise and Vibration Mitigation (and Management) Measures

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV1	Management	Implement community consultation measures	Noise and Vibration	<p>The project must consult with all receptors identified in non-residential zones in accordance with CoA – E41 likely to experience internal noise levels of Leq, 15 minute 60 dBA between 8pm and 9pm or Leq, 15 minute 45 dBA between 9pm and 7am with the objective of offering additional mitigation.</p> <p>The project must consult with all receptors identified in non-residential zones in accordance with CoA – E42 likely to experience internal noise levels of Leq, 15 minute 45 dBA between 9pm and 7am with the objective of offering additional mitigation.</p> <p>In accordance with CoA – E29 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.</p> <p>In accordance with CoA - E39 LOR 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 receptors (e.g. scheduling works so that predicted high impact works from both sites are not occurring at the same time or during respite periods).</p> <p>Consultation is also a requirement under CoA - E45 where variations to standard construction hours occur.</p> <p>A register of all noise and vibration sensitive receptors will be kept on site. This register will include the address, category, contact name and phone number for each receptor.</p>	Community Place Manager	All Scenarios. The predicted highest impacts are associated with the Nelson St and Mowbray Rd Bridge Works i.e. SCN09, SCN10, SCN11 and SCN12.	<p>Ensures stakeholders know what to expect and keeps stakeholders informed of the likely impact.</p> <p>Community my identify solution to assist in managing impacts.</p>

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV2	Management	Site Inductions	Noise and Vibration	<p>In accordance with CoA – C2 (k), a site specific induction will be provided to all site personnel, contractors and sub-contractors with an emphasis on understanding and managing noise impacts from the work activities being undertaken.</p> <p>This will include the location of receptors, specific mitigation measures, site hours of operation, noise complaints procedure, etc. as well as the consequences of not complying with these mitigation measures. The following behavioural practices will also be enforced:</p> <ul style="list-style-type: none"> - No swearing or unnecessary shouting or loud stereos/radios; on site. - No dropping of materials from height; throwing of metal items; and slamming of doors. - No excessive revving of plant and vehicle engines. - Controlled release of compressed air. <p>In accordance with CoA – E43, noise generated by construction must not exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of Leq, 8h of 85dBA for any employee working at a location near the Project.</p> <p>Refer to Section 9 of this plan for further detail.</p>	Environment Manager	All Scenarios	Keeps construction workforce informed of actions required to minimise noise and vibration impact.
CNV3	Management	Behavioural Practices	Noise and Vibration	<ul style="list-style-type: none"> - No swearing or unnecessary shouting or loud stereos/radios; on site. - No dropping of materials from height; throwing of metal items; and slamming of doors. - No excessive revving of plant and vehicle engines. - Controlled release of compressed air. <p>In accordance with CoA – E43, noise generated by construction must not exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of Leq, 8h of 85dBA for any employee working at a location near the Project.</p> <p>Refer to Section 9 of this plan for further detail.</p>	Environment Manager	All Scenarios	0-20dB reduction Reduce annoyance + sleep disturbance.

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV4	Management	Noise Monitoring	Noise	<p>Refer to Section 8 of this plan for further detail.</p> <p>Operator attended noise monitoring and vibration monitoring will be undertaken during in the early phases of work to verify predicted noise levels and confirm that vibration levels satisfy the criteria. This will determine the appropriate mitigation and management measures required for remaining works.</p> <p>If vibration levels are predicted to exceed screening criteria, a more detailed assessment of the structure and attended vibration monitoring will be carried out to ensure vibration levels remain below appropriate limits for that structure, in accordance with REMM NV3.</p>	Environment Manager	<p>The focus will be for all scenarios in the early stages of work to verify predicted noise levels and confirm that noise levels satisfy the criteria</p> <p>Attended monitoring will be conducted across all shifts during track possession work, including the night time period where sleep disturbance impacts will be monitored.</p>	<p>Limits risk of annoyance to receivers.</p> <p>Provides real-time information regarding noise levels and allows for immediate action to be undertaken.</p>
CNV5	Management	Vibration Monitoring	Vibration	<p>In accordance with CoA – E41 and 42, the ICNG penalties identified for 'particularly annoying' activities (that require the addition of 5dBA to the predicted level before comparing to the construction NML) will be applied.</p> <p>In accordance with CoA – E30 LOR 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.</p>	Environment Manager	<p>The focus will be SCN04, SCN05, SCN11 and SCN12. Additional monitoring for other scenarios will be considered on a case by case basis (e.g. where vibration generating equipment is required)</p> <p>No heritage items have been identified to have potential impact from NCW.</p>	<p>Reduces vibration impact + risk of building damage.</p>

CNV6	Source Control	Construction Hours and Scheduling	Noise and Vibration	<p>Where feasible and reasonable, construction will be carried out during the standard daytime working hours. The approved CoA – E36 and EPL - 12208 standard construction hours are as follows:</p> <p>All general construction works and activity will be scheduled to occur between these hours, unless OOHW becomes necessary:</p> <ul style="list-style-type: none"> • 7:00am to 6:00pm Mondays to Fridays, inclusive; • 8:00am to 1:00pm Saturdays; and • at no time on Sundays or public holidays. <p>High noise generating activities will be scheduled for less sensitive period considering the nearby receptors as per REMM NV1</p> <p>Modifying demolition works sequencing / hours to minimise impacts during peak pedestrian times and / or adjoining neighbour outdoor activity periods as per REMM NV7.</p> <p>Sequencing works to shield noise sensitive receptors by retaining building wall elements as per REMM NV7.</p> <p>In accordance with CoA - E46 rock breaking and other particularly annoying activities are not permitted outside of standard construction hours, unless the noise management level derived from the ICNG can be achieved at sensitive receptors.</p> <p>Refer Section 6 of this plan for further detail.</p>	Environment Manager Site Supervisor	All Scenarios (The Appendix B OOHW Protocol will also be applied for any work outside the approved hours)	Minimise high noise impact and reduce risk of annoyance.
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ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV7	Source Control	Construction Respite Period	Noise and Vibration	<p>Provide respite periods for noise intensive works in accordance with REMM NV7.</p> <p>High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block.</p> <p>In accordance with CoA – E39 and E40 LOR will take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receptor (e.g. consulting with proponents of nearby construction sites and scheduling works so that predicted high impact works from both sites are not occurring at the same time or during respite periods).</p> <p>Refer Section 6 of this plan for further detail.</p>	Environment Manager Site Supervisor	<p>The focus will initially be for SCN09, SCN10, SCN11 and SCN12.</p> <p>Additional respite for other scenarios will be considered on a case by case basis (i.e. where monitoring verifies high noise/vibration impacts)</p>	Minimise noise and vibration impact and reduce risk of annoyance.
CNV8	Source Control	Maximum Noise Levels	Noise	The noise levels of plant and equipment will be selected to have operating Sound Power Levels compliant with the values presented in Table 7.2 of this CNVMP.	Environment Manager	All Scenarios	Varies depending on plant sound power level.
CNV9	Source Control	Rental Plant and Equipment	Noise	Table 11 and 12 of the SM CNVS (or AS2436) will be utilised where necessary e.g. new equipment are introduced to the works.	Environment Manager	All Scenarios	0-20dB reduction depending on selected equipment.

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV10	Source Control	Plan worksites and activities to minimise noise and vibration.	Noise	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.	Environment Manager	All scenarios	Reduce noise/vibration impact + risk of annoyance.
CNV11	Source Control	Non-tonal reversing alarms.	Noise	Non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on all construction vehicles and mobile plant regularly used on site (and for any out of hours work) where appropriate.	Site Supervisor	All Scenarios	5-10dB reduction + reduce vibration.

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV12	Source Control	Equipment Selection	Noise	<p>Quieter and less vibration emitting construction methods will be used where feasible and reasonable. The following will occur:</p> <ul style="list-style-type: none"> • Selection of plant and equipment based on least noise emission levels where reasonable, such as hydraulic concrete shears in lieu of hammers/rock breakers as per REMM NV7 • Select materials which require lower vibration generating activities to occur e.g. less compaction etc. • Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including excavators and trucks as per REMM NV1. • Plant and equipment will be regularly maintained and repaired or replaced if it becomes noisy • Silenced generators and compressors will be used where possible • Quiet plant and processes will be selected wherever feasible, specifically, reversing alarms will be procured or retrofitted that are quieter and display less annoying characteristics. Such alarms will include “smart alarms” and “quacker alarms” will occur where possible. 	<p>Environment Manager Site Supervisor</p>	<p>All Scenarios – these measures will be considered on a case by case basis and incorporated into the construction design if feasible and reasonable.</p>	<p>0-20dB reduction/ less vibration impact + risk of annoyance.</p>

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV13	Source Control	Use and siting of plant.	Noise and Vibration	<p>The Construction Noise and Vibration Strategy will be implemented with the aim of achieving the noise management levels where feasible and reasonable. This will include the following standard mitigation measures where feasible and reasonable:</p> <ul style="list-style-type: none"> • Provision of hoarding or noise barriers around the site where reasonable and feasible, in particular the sheet piling site, as per REMM NV7. • Where feasible, simultaneous operation of noisy plant will be avoided. • The offset distance between noisy plant and adjacent sensitive receptors will be maximised. (e.g. Locating demolition load out areas away from the nearby noise sensitive receptors as per REMM NV7 • Plant used intermittently to be throttled down or shut down. • Noise-emitting plant to be directed away from sensitive Receptors. • Select and use lower vibrating generating equipment • Adhere to the safe working distances identified in Section 8.1.2 where reasonable and feasible • Residential grade mufflers will be fitted to all mobile plant in accordance with REMM NV1. • Dampened rock hammers will be used • Non-tonal reversing alarms will be fitted to all permanent mobile plant • The layout of construction sites will consider opportunities to shield receptors from noise. 	Environment Manager Site Supervisor	All Scenarios	Reduce noise/vibration impact + risk of annoyance.

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV14	Source Control	Minimise disturbance arising from delivery of goods to construction sites.	Noise	<p>Construction vehicles will be operated so as to minimise any construction noise impacts from the construction site. To achieve this the following will occur:</p> <ul style="list-style-type: none"> • Select site access points and roads as far as possible away from noise sensitive receptors. • Loading and unloading of materials/deliveries will occur as far as possible from receptors. • Dedicated loading/unloading areas to be shielded if close to receptors. • Delivery vehicles will be fitted with straps rather than chains for unloading, wherever reasonable and feasible. • Delivery personnel and truck drivers to be made aware of approved haulage routes and access in and out of the construction site. • Prevention of vehicles and plant queuing and idling outside the site prior to the morning start time. • Pre-determined delivery times will be issued to suppliers and radio communication will be used to confirm status of the delivery. • Any unsatisfactory noise performance for specific vehicles and/or the operators will be dealt with on a case by case basis. • In accordance with REMM NV2, unless compliance with the relevant traffic noise criteria can be achieved, night time heavy vehicle movements will be restricted to the Pacific Hwy and Mowbray Rd. 	Environment Manager Site Supervisor	All Scenarios	<p>Reduce noise/vibration impact + risk of annoyance.</p> <p>Reduce annoyance + sleep disturbance.</p>

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV15	Emission Path (source to receptor)	Shield stationary noise sources such as Cranes and Concrete Pumps etc.	Noise	<p>This may include a site boundary fence optimised to reduce construction noise, and other feasible and reasonable measures to minimise ground borne noise where exceedances are predicted, as per REMM NV4.</p> <p>Where item specific shielding becomes necessary, stationary noise sources will be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.</p> <p>Guidance for noise reducing shielding/barriers will be taken from AS2436 or other relevant standards where necessary.</p>	Environment Manager	All Scenarios – this measure will be considered on a case by case basis and incorporated into the construction design if feasible and reasonable.	5-10dB reduction.

ID	Measure	Action Required	Applies To	Details	Responsible	Applicable to NCW Phase or Activity	Estimated Noise Benefit
CNV16	Emission Path (source to receptor)	Shield sensitive receptors from noisy activities.	Noise	<p>This may include a site boundary fence optimised to reduce construction noise, and other feasible and reasonable measures to minimise ground borne noise where exceedances are predicted, as per REMM NV4.</p> <p>Where shielding becomes necessary, structures will be used to shield residential receptors from noise.</p> <p>This may include site shed placement; fencing; when situating plant.</p> <p>Minimise structural-borne noise to adjacent buildings during demolition as per REMM NV7</p> <p>Guidance for noise reducing shielding/barriers will be taken from AS2436 or other relevant standards where necessary.</p>	Environment Manager	All Scenarios – this measure will be considered on a case by case basis and incorporated into the construction design if feasible and reasonable.	5-10dB reduction.
CNV17	Emission Path (source to receptor)	Safe Working Distances	Vibration	Refer Section 8.1.2	Environmental Manager	The focus will be SCN04, SCN05, SCN11 and SCN12. Additional management for other scenarios will be considered on a case by case basis (i.e. where vibration generating equipment is required)	Limits building damage and risk of annoyance to receivers.

8.1.1 Construction Observed to Exceed Management Levels

Where construction is observed to exceed management levels for air-borne noise, ground-borne noise or vibration, the following will occur:

- Alternate work methodologies and plant will be investigated and considered to lower noise levels of construction works at the relevant receptors.
- Excessively noisy or vibration generating activities will cease or be reduced under direction of the Environment Manager or Site Supervisor. Remedial measures will be implemented prior to recommencing work, and monitoring undertaken to verify noise or vibration levels if necessary.
- Plant and machinery will be checked and verified for noise levels and appropriate exhaust/fittings/noise attenuators.
- In the event of appreciable vibration levels arising, measures will be put in place to reduce vibration to within acceptable levels. Such measures may include reducing equipment size, changing operational settings, using other plant in lieu of that which is generating the vibration or a combination of these.
- Where vibration levels are observed to exceed (or are predicted to exceed) the structural screening criteria, a more detailed assessment of the structure will be undertaken and attended vibration monitoring will continue to ensure vibration levels remain below appropriate limits for that structure.

These actions are the responsibility of the Environment Manager and Site Supervisor and will be documented with the monthly environmental reporting refer Section 10.1 and Construction Noise and Vibration Monitoring Program.

8.1.2 Ground Vibration – Safe Working Distances

In accordance with the SM CNVS, attended vibration measurements are required at the commencement of vibration generating activities to confirm that vibration levels satisfy the criteria for that vibration generating activity. Where there is potential for exceedances of the criteria further vibration site law investigations will be undertaken to determine the site-specific safe working distances for that vibration generating activity. Continuous vibration monitoring with audible and visible alarms will be conducted at the nearest sensitive receptors whenever vibration generating activities need to take place inside the calculated safe-working distances.

The TfNSW I&S CNVS defines safe working distances for vibration intensive activities. As was adopted for the CNVIS and reproduced in **Table 8.2**. These safe work distances will be adopted during the NCW project as a guideline to determine further mitigation. The safe working distances are defined for both cosmetic damage (BS 7385) and human comfort (the NSW Vibration Guideline).

Table 8.2 Safe Working Distances

Plant Item	Rating/Description	Safe Working Distance – metres (m)	
		Cosmetic Damage (BS 7385)	Human Comfort (the NSW Vibration Guideline)
Vibratory Roller	1-2 tonnes	5 m	15 m to 20 m
	2-4 tonnes	6 m	20 m
	4-6 tonnes	12 m	40 m
	7-13 tonnes	15 m	100 m
	13-18 tonnes	20 m	100 m
	18 tonnes	25 m	100 m
Small Hydraulic Hammer	300 kg (5 to 12t excavator)	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18t excavator)	7 m	23 m
Large Hydraulic Hammer	1600 kg (18 to 34t excavator)	22 m	73 m
Pile Driver - Vibratory	Sheet piles	2 m to 20 m	20 m
Piling Rig – Bored	≤ 800 mm	2 m (nominal)	n/a
Piling Rig – Hammer	12t down force	15 m	50 m
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Source: TfNSW I&S CNVS, 2018

These safe working distances are indicative only and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

For significant equipment not listed above or for any highly sensitive receptors identified during works, specific assessment may be undertaken during works to ensure satisfactory operation of the equipment and to determine if any other mitigation or management measures are required to minimise the potential impacts.

In relation to human comfort, the safe working distances above relate to continuous vibration. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods may be allowed. A targeted assessment may be undertaken during works to evaluate any decrease in human comfort safe work distance offsets and to determine if any other mitigation or management measures are required to minimise the potential impacts.

The TfNSW CNVS (I&S) safe work distances were derived from BS7385 as relevant to cosmetic damage to buildings. BS7385 is a frequency (Hz) dependant criteria (less stringent at higher frequencies) and as such, works and activities may be able to occur at distances closer than those nominated in **Table 8.2** without any cosmetic or structural damage impacts occurring. This is typical of construction and demolition works in close proximity to other buildings and highlights the need to monitor and establish compliant levels during the early stages of vibration significant activities. Refer to **Section 10** for vibration monitoring requirements.

8.1.3 Managing Potential Impacts to Heritage Structures

Details of specific monitoring requirements for heritage structures are described in the stand alone noise and vibration monitoring program **LOR-NCW-Monitoring Program**. The monitoring is designed to prevent damage to any heritage items and includes procedures for identifying minimum working distances.

No heritage items have been identified within close proximity to the NCW project. Impacts to heritage structures are therefore not expected, such that detailed options for any alteration of construction methodology will be evaluated and implemented on a case-by-case basis and if specific circumstances arise that deem it necessary. This management practice will be based on the monitoring procedures described in **Section 10** of this CNVMP.

In accordance with **CoA – E31**, where monitoring of heritage items becomes necessary LOR 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. For heritage items, a 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

8.2 Additional Mitigation Measures

The CNVIS has concluded that noise and vibration impacts associated with the NCW project are likely to occur. A range of feasible and reasonable mitigation (and management) measures designed to minimise noise and vibration levels at the nearest receptors have been established as documented in **Section 8** of this CNVMP. These standard measures will be implemented during the NCW project in accordance with Section 7 of the SM CNVS, consistent with the intent of the ICNG and to achieve all CoA.

The implementation of the standard mitigation measures and community consultation should significantly reduce the noise and vibration impacts on nearby sensitive receptors. Nevertheless, due to the highly variable nature of activities associated with the NCW project; noise and vibration exceedances could occur.

As this potential exists a number of additional measures to mitigate such exceedances (primarily aimed at pro-active engagement with affected sensitive receptors) will be explored as per the requirements of Section 8 of the SM CNVS and have been included in this CNVMP. The additional mitigation measures to be applied are outlined in **Table 8.3** below.

Table 8.3 Additional Mitigation Measures

Measure	Description	Abbreviation
Alternative Accommodation	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.	AA
Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals, noise or vibration monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibration goal has been exceeded so that additional management measures may be implemented.	M
Individual Briefings	Individual briefings are 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. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.	IB
Letter Box Drops	For each Sydney Metro project, a newsletter is produced and distributed to the local community via letterbox drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage and inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. Each newsletter is graphically designed within a branded template.	LB
Project-specific Respite Offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact.	RO
Phone Calls	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within 7 days of proposed work. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.	PC
Specific Notifications	Specific notifications would be letterbox dropped or hand distributed to identified stakeholders no later than 7 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.	SN

Source: SM CNVS

In circumstances where, after the application of the standard mitigation measures, the construction noise and vibration levels are still predicted to exceed the noise or vibration objectives, the relevant Additional Mitigation Measures Matrix (AMMM) from the SM CNVS are to be used to determine the additional measures to be implemented.

Using the relevant AMMM, the following steps will be carried out to determine the additional mitigation measures that will be implemented prior to the commencement of construction activities:

- Determine the time period when the work is to be undertaken;
- Determine the level of exceedance; and
- Identify the relevant additional mitigation measures from **Table 8.3**, **Table 8.4**, **Table 8.5** and **Table 8.6**.

The relevant AMMM for air-borne noise is reproduced in **Table 8.4** and the relevant AMMM for the ground-borne noise and ground-borne vibration are reproduced in **Table 8.5** and **Table 8.6**.

Table 8.4 Additional Mitigation Measures Matrix (AMMM) – (Airborne Construction Noise)

Time Period		Mitigation Measures			
		LAeq, 15minute Noise Level above Background (RBL) in dBA			
		0 to 10	11 to 20	21 to 30	>30
Standard	Mon-Fri (7am-6pm)	-	-	M, LB	M, LB
	Sat (8am-1pm)				
	Sun/Pub Hol (Nil)				
OOHW Period 1	Mon-Fri (6pm-10pm)	-	LB	M, LB	M, IB, LB, PC, RO, SN
	Sat (7am-8am & 1pm-10pm)				
	Sun/Pub Hol (8am-6pm)				
OOHW Period 2	Mon-Fri (10pm-7am)	LB	M, LB	M, IB, LB, PC, SN	AA, M, IB, LB, PC, RO, SN
	Sat (10pm-8am)				
	Sun/Pub Hol (6pm-7am)				
Source: SM CNVS					

Table 8.5 Additional Mitigation Measures Matrix (AMMM) – (Ground-borne Construction Noise)

Time Period		Mitigation Measures		
		L _{Aeq} , 15minute Noise Level above NML in dBA		
		0 to 10	10 to 20	>20
Standard	Mon-Fri (7am-6pm)	LB	LB	M, LB, SN
	Sat (8am-1pm)			
	Sun/Pub Hol (Nil)			
OOHW Period 1	Mon-Fri (6pm-10pm)	LB	M, LB, SN	M, IB, LB, PC, RO, SN
	Sat (7am-8am & 1pm-10pm)			
	Sun/Pub Hol (8am-6pm)			
OOHW Period 2	Mon-Fri (10pm-7am)	M, LB, SN	AA, M, IB, LB, PC, RO, SN	AA, M, IB, LB, PC, RO, SN
	Sat (10pm-8am)			
	Sun/Pub Hol (6pm-7am)			

Source: SM CNVS

Table 8.6 Additional Mitigation Measures Matrix (AMMM) – (Ground-borne Vibration)

Time Period		Mitigation Measures
		Predicted Vibration Levels Exceed Human Comfort Criteria (BS 6472:1992)
Standard	Mon-Fri (7am-6pm)	M, LB, RO
	Sat (8am-1pm)	
	Sun/Pub Hol (Nil)	
OOHW Period 1	Mon-Fri (6pm-10pm)	M, IB, LB, PC, RO, SN
	Sat (7am-8am & 1pm-10pm)	
	Sun/Pub Hol (8am-6pm)	
OOHW Period 2	Mon-Fri (10pm-7am)	AA, M, IB, LB, PC, RO, SN
	Sat (10pm-8am)	
	Sun/Pub Hol (6pm-7am)	

Source: SM CNVS

9. Training

As per the **CoA – C2 (k)**, recommendations of the CNVIS and commitments made in the EIS, training will be undertaken in accordance with the NCW CEMP and any additional measures set out in the NCW sub-plans, including this CNVMP.

In summary, all site personnel, contractors and sub-contractors shall undergo site specific induction training, which will include noise and vibration management training developed with an emphasis on understanding and managing impacts from the work activities being undertaken.

This site specific induction training will include:

- the location of potentially sensitive receptors.
- site hours of operation i.e. the permissible hours of work, including deliveries.
- any limitations on high noise generating activities.
- construction employee parking areas.
- details of the complaints handling procedure.
- details of the environmental incident procedures.
- OOHW Protocol, including review and approvals pathways.
- awareness of performance targets, REMMS and EPL requirements.

The site specific induction will also outline the consequences of not complying with these measures.

Toolbox meetings will also be undertaken as and when required; covering specific environmental issues and will include noise and vibration control measures where required, including but not limited to:

- Ensuring work occurs within approved hours.
- Relevant noise and vibration mitigation measures.
- Locating noisy equipment away from sensitive receptors.
- Ensuring plant and equipment is well maintained and not making excessive noise.
- Emphasis that there should be no swearing, shouting or loud stereos/radios on site.
- Turning off machinery when not in use.
- Designated loading/unloading areas and procedures.

Toolbox training on noise and vibration management requirements and measures will be completed by the Environmental Manager (or nominated delegate) during the NCW project.

Personnel directly involved in implementing noise and vibration control measures on site will be given specific training in the various measures to be implemented. Records of all training will be filed in accordance with LOR project filing system.

10. Noise and Vibration Monitoring

Monitoring for NCW works will be implemented at the commencement of works and at regular intervals throughout the project (i.e. when new construction activities commence) to quantify the airborne noise, ground-borne noise and vibration levels associated with construction activities. Monitoring will also be required in the event of a complaint being received or during OOHW where the AMMM has identified monitoring.

Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals (as is the case for select project works), noise or vibration monitoring may be conducted at the affected receptor(s) or a nominated representative location (typically the nearest receptor where more than one receptor have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the noise or vibration goals are being approached so that changes to the configuration of equipment or practices can be made in an effort to reduce noise levels to meet the noise or vibration goal. Additional management measures may also be required.

A construction noise and vibration monitoring program has been developed as a stand-alone document **LOR-NCW-P7b - Monitoring Program**.

There are no noise or vibration monitoring requirements within the EPL for maintenance and construction activities. The EPL focuses on noise monitoring for operational activities of the rail corridor (e.g. locomotives). Construction noise and vibration monitoring is not required under the EPL12208, however monitoring may be required for out of hours NCW works in accordance with the SM CNVS AMMM.

10.1 General Monitoring Requirements

All construction noise and vibration monitoring will be undertaken in accordance with the construction noise and vibration monitoring guideline which is included in Appendix A of the SM CNVS. This outlines the minimum requirements for contractors undertaking monitoring on the Sydney Metro Project.

In accordance with the CNVIS, attended measurements will be the focus of all noise monitoring however unattended noise (and vibration) monitoring may be undertaken where specific circumstances warrant. The benefit of attended noise monitoring is that the results can be fed back directly to the project team and actions taken without delay. Attended monitoring is also preferred for this project as there are a number of non-project related noise sources within the vicinity of the project (e.g. traffic and rail) that will influence the measured data set. Operator attended measurements will allow a site noise contribution to be determined with the exclusion of extraneous influences. This method of monitoring was proven to be effective during the preliminary works undertaken at the site in 2017, where attended noise monitoring results were fed back directly to the project team and actions were taken on site to manage and mitigate noise impacts.

For vibration it is typical that unattended monitoring is undertaken, however the device may be observed by LOR (or their specialist) during the early stages of certain works to provide feedback of results to the project team, based on which actions can be taken without delay. NCW vibration monitoring will be targeted to the sheet piling activity identified in SCN03. Additional monitoring for other scenarios will be considered on a case by case basis (e.g. where vibration generating equipment is required).

Attended monitoring will be conducted across all shifts during track possession work, including the night time period where sleep disturbance impacts will be monitored. Data from attended monitoring will be made available to the ER, AA, the Department of Planning and the EPA as required (i.e. if requested). All attended measurements will be conducted by appropriately trained personnel in the measurement and assessment of construction noise and vibration (i.e. Environmental Consultants). They will be familiar with the requirements of the relevant standards and procedures.

Unattended noise and/or vibration monitoring devices will be set up for works undertaken for each track possession. They will provide real time web-accessible monitoring with access available to the construction team i.e. LOR, Sydney Metro, AA, ER, DPE and EPA in accordance with **CoA - C11**. The locations of the monitoring devices will be determined in detail closer to implementation of the works which have been identified as requiring unattended noise and/or vibration monitors.

As discussed in the CNVIS monitoring and measurements will be conducted at the potentially most affected receptor(s) from the commencement of construction activities to confirm that the noise and/or vibration levels

in the adjacent community are consistent with the predictions in the CNVIS. Other potentially affected receptors will also be considered as part of the monitoring regime depending on the phase of works.

Based on the scenarios assessed in the CNVIS (which informed the preparation of this CNVMP) the closest and/or potentially most affected noise sensitive receptor locations situated within the potential area of influence of the site are:

- Receptor R.152 – residential dwelling receptor situated near the rail corridor on Hopetoun Avenue.
- Receptor R.179 - residential dwelling receptor situated near the rail corridor on Nelson Street.
- Receptor R.195 - residential dwelling receptor situated near the rail corridor on Mowbray Road.
- Receptor R.209 -residential dwelling receptor situated near the rail corridor on Raleigh Street.
- Receptor R.232 - residential dwelling receptor situated near the rail corridor on Drake Street.
- Receptor R.242 - residential dwelling receptor situated near the rail corridor on Hawkins Street.

These locations were identified in **Figure 3.4**, **Figure 3.5** and **Appendix E**. Noise monitoring will target these locations once works are occurring. The precise monitoring position will be selected on a case-by-case basis and adjusted where necessary to ensure that these locations remain valid, and if not, that alternate monitoring locations are selected. Consideration of this feature will occur prior to works occurring as part of the normal planning and application processes, and then verified during noise monitoring. The same approach will be adopted for any vibration monitoring that becomes necessary during the P7b works.

All monitoring results will be assessed against the nominated goals outlined in **Section 5**. Noise and vibration reporting requirements are outlined in **Section 10.2** below.

For further details on specific noise and vibration monitoring, refer to the stand alone noise and vibration monitoring program **LOR-NCW-Monitoring Program**. The monitoring program details how LOR and its sub-contractors will monitor noise and vibration impacts during the NCW project.

In accordance with **CoA – C14**, construction must not commence until the Secretary has approved all of the required construction monitoring programs, and all relevant baseline data for the specific construction activity has been collected.

Provisions, Safeguards and Monitoring Contingencies (Concurrent Works)

The purpose of this monitoring contingency is consistent with that of the stand-alone noise monitoring program **LOR-NCW-Monitoring Program**: it will inform the relevant personnel if the noise management levels are being approached (or exceeded) so that the work methodology or equipment being used can be altered, and / or additional management measures may be implemented. This will assist to reduce emissions and avoid/minimise any impacts (or future increase in impact to those addressed by this CNVMP) so that the surrounding community and broader acoustics environment are safeguarded against further nuisance, or temporary reduction in amenity.

As recommended by the CNVIS and addressed as commitments in this CNVMP, noise monitoring will occur as per the requirements and specification presented in **LOR-NCW-Monitoring Program**.

This monitoring will already occur for specific NCW construction activities that are likely to exceed the relevant noise management levels, as per the AMMM requirements, and in the form of either unattended monitoring or operator attended measurements.

All monitoring will enable the site noise level to be established in the absence of any influential source not associated with the NCW project, and comparison to the predicted values (refer **Appendix C**) and criteria presented in **Section 5** of this CNVMP. Monitoring will consider all NCW works occurring at the time “i.e. concurrent works” so that the overall site noise level contribution is established before further evaluation. Should circumstances arise during the works that the potential for increased air-borne noise emissions are identified, or valid complaints are received on this regards; additional noise monitoring will occur. The processes for measuring and evaluating the noise data as presented in **Section 10** and **LOR-NCW-Monitoring Program** will be adhered to.

10.2 Noise and Vibration Reporting

All noise and vibration monitoring results will be assessed against the nominated goals. Noise and vibration monitoring data, and any other relevant information, will be provided to the AA to assist the AA in producing and submitting a monthly Noise and Vibration Report in conjunction with the ER, to the Secretary and other relevant government agencies, as required under **CoA A27(g)(vi)**.

Additionally, the results of the construction noise and vibration monitoring must be submitted to the Secretary for information, and relevant regulatory agencies for information in the form of a Construction Monitoring Report every six months, in accordance with **CoA – C16**.

In accordance with the MR-minor E, within five business days of each Calendar Quarter Date, a register of ongoing Environmental Compliance Requirements (ECRs) must be submitted to the Environmental Representative for review in accordance with the Contract, which identifies progress and evidence of compliance against each ECR. The register of ECRs must classify each ECR as:

- i. Ongoing or Complete, to indicate their progress; and
- ii. Compliant or Non-Compliant, to indicate compliance.

The following information relating to noise and vibration monitoring will be provided to the AA by the Contractor as a minimum (where relevant):

- The type of monitoring conducted (for example, at a particular project stage or following complaints) and a brief statement of the measurement method;
- The noise/vibration conditions on the consent / licence, or the relevant noise management objectives;
- Descriptions of the nearest affected residences and other sensitive land uses or, in the case of complaints, description of the complainant location and complaint;
- Description of the instrumentation used;
- The results of monitoring at each monitoring location, including a comparison with the consent conditions or relevant noise management objectives;
- Vibration monitoring results summary together with notes describing any vibration intensive activities (if applicable);
- Summary of measurements exceeding the vibration criteria levels and descriptions of the plant or operations causing these exceedances (if available);
- Details of corrective action applicable to vibration criteria exceedances and confirmation of its successful implementation. Where corrective action has not yet been implemented, it may be shown as pending and the status of its implementation will be carried forward to following reports;
- The location of the construction works in relation to the monitoring position. (sketch plan & sections, photos);
- Details of the various construction equipment in use during the measurement period;
- Details as to the likely dominant noise sources;
- Meteorological conditions (i.e. temperature, humidity, cloud cover, and wind speed and direction);
- A clear statement outlining the project's compliance or non-compliance with the conditions or objectives where the monitored level is higher than the conditions or objectives; and
- The reasons for non-compliance will be stated, strategies for minimising noise identified and stated, and the appropriate actions to implement the mitigation and or management strategies.

11. Enquiries, Complaints and Incident Management

All complaints handling will be in accordance with the Sydney Metro Construction Complaints Management System. All community consultation will be in accordance with the Sydney Metro Overarching Stakeholder and Community Strategy and the Sydney Metro Community Consultation Strategy – Early Works. Consultation with businesses will be in accordance with the Sydney Metro Business Management Plan (BMP) and the small business owners support program. Various lines of communication will be made available for enquiries and complaints during construction of the Project with suitably qualified or experienced personnel made available to manage and respond, refer **Table 12.1**.

Complaints arising from project works will be treated sensitively and in a manner that recognises the potential for noise and vibration to cause environmental impacts. Special consideration will be given to complaints related to noise and vibration during highly intrusive works (particularly those activities when increased impacts are predicted) in order that any necessary additional mitigation can be implemented in a timely manner.

Incident management and notification will be undertaken in accordance with **CoA – A41-A44**, including notification to the Secretary within 24 hours of any incident. Additional information is provided throughout Section 16.3 of the NCW CEMP.

12. CNVMP Administration

12.1 Roles and Responsibilities

In accordance with **CoA – C2 (j)**, the relevant roles and responsibilities associated with this CNVMP are presented in **Table 12.1**.

Table 12.1 Roles and responsibilities

Roles	Responsibilities
Environment Manager / Site Supervisor	<ul style="list-style-type: none"> • Oversee the overall implementation of this CNVMP. • Ensure that sufficient resources are allocated for the implementation of this CNVMP. • Consider and advise senior management on compliance obligations. • Ensure that the outcomes of compliance monitoring / incident reporting are systematically evaluated as part of ongoing management of construction activities. • Ensure all appropriate noise and vibration mitigation measures are implemented. • Where standard mitigation measures are deemed insufficient, undertake reasonable steps to manage adverse impacts and implement all additional measures. • Authorise cessation of construction activities on-site if exceedances are identified. • Ensure construction activity records / monitoring records/ incident reports are kept and maintained on-site. • Ensure audits of construction site activity records / monitoring records/ incident reports are undertaken as needed, findings are shared with relevant site personnel and corrective actions are implemented. • Ensure all relevant personnel have and understand the most up-to-date copy of this CNVMP. • Ensure that all requirements of this CNVMP are effectively implemented. • Ensure that any required actions arising from incident investigation processes during compliance construction monitoring are reported to the relevant personnel for further action and ensure that the actions are effectively implemented. • Coordinate the implementation of monitoring requirements and corrective actions.

	<ul style="list-style-type: none"> • Ensure that experienced, trained or qualified personnel conduct the noise (or vibration) monitoring. • Ensure all monitoring reporting requirements are met and maintained on site. • Acts as a primary site contact for any valid complaints received via the Community Place Manager. • Authorise all monitoring reports and any revisions to this CNVMP.
<p>Site personnel and subcontractors</p>	<ul style="list-style-type: none"> • Understand and implement mitigation as required in the CNVMP and any additional required measures identified during construction. • Participate (or conduct if authorised) in relevant training to implement the requirements of this CNVMP.
<p>Noise and Vibration Monitoring Personnel (LOR / consultants)</p>	<ul style="list-style-type: none"> • Undertake relevant training to implement the requirements of this CNVMP. • Undertake all monitoring activities in accordance with this CNVMP. • Ensure regular maintenance of monitoring equipment. • Ensure all relevant monitoring quality control / assurance procedures are effectively implemented.
<p>Community Place Manager</p>	<ul style="list-style-type: none"> • Provide key stakeholders and the community with information about construction progress. • Ensure people understand the scope of the works and mitigation measures. • Ensure key stakeholders and the community understand the proposed timing of the works. • Take steps to minimise potential impacts from construction works. • Work closely with the Northern Corridor Works to coordinate consultation activities with the community and other stakeholders. • Be the single point of contact for affected stakeholder and the community and the project team, who will proactively doorknock properties and also respond quickly to any issues or complaints raised. • Be available at all times that any activities are being performed on any construction site to answer any questions, concerns, complaints or enquires in relation to activities. • Produce and distribute all community notifications relating to contractor activities. • Develop, produce and distribute site specific quarterly newsletters to inform the community of the progress and key milestones or activities taking place during the following three months. • Distribute newsletters to all affected commercial and residential properties within a minimum of 500m radius of the construction site. • Record all interactions with stakeholders on Consultation. • Provide an initial response to email/written correspondence (letters/faxes) within 48 hours. • Provide feedback to requests for information from the Sydney Metro Communication and Engagement team Sydney Metro Communication and Engagement team within two hours. • Refer enquiries not associated with contractor activities to Sydney Metro Project Communications team immediately. • Record all interactions with stakeholders on Consultation Manager in accordance with Consultation Manager data entry procedure within 48 hours. • Manage calls to the community information line and redirect to appropriate team members or contractors. • Provide at least an oral response to calls forwarded from the community information line within two hours unless otherwise agreed.

	<ul style="list-style-type: none"> Lead or be involved in any consultation activities arising from community enquiries as notified by the contractor.
Environment Representative	<p>In accordance with CoA - A24 the ER has the following roles and responsibilities:</p> <ul style="list-style-type: none"> receive and respond to communications from the Secretary in relation to the environmental performance of the CSSI. consider and inform the Secretary on matters specified in the terms of this approval. consider and recommend any improvements that may be made to work practices to avoid or minimise adverse impact to the environment and to the community. review all documents required to be prepared under the terms of the CoA, ensure they address any requirements in or under the CoA and if so, endorse them before submission to the Secretary (if required to be submitted to the Secretary) or before implementation (if not required to be submitted to the Secretary). For documents requiring specialist review and/or endorsement the ER is not required to endorse the specialist content. regularly monitor the implementation of all documents required by the terms of the CoA or implementation in accordance with what is stated in the document and the terms of the CoA. review the Proponent's notification of incidents in accordance with CoA - A41. as may be requested by the Secretary, help plan, attend or undertake Department audits of the CSSI, briefings, and site visits. if conflict arises between LOR and the community in relation to the environmental performance of the CSSI, follow the procedure in the Community Communication Strategy approved under CoA - B3 to attempt to resolve the conflict, and if it cannot be resolved, notify the Secretary. review any draft consistency assessment that may be carried out by LOR, and provide advice on any additional mitigation measures required to minimise the impact of the work. consider any minor amendments to be made to the CEMP, CEMP sub-plans and monitoring programs that comprise updating or are of an administrative nature, and are consistent with the terms of the CoA and the CEMP, CEMP sub-plans and monitoring programs approved by the Secretary and, if satisfied such amendment is necessary, approve the amendment. This does not include any modifications to the terms of the CoA. assess the impacts of minor ancillary facilities as required by CoA - A18. prepare and submit to the Secretary and other relevant regulatory agencies, for information, a monthly Environmental Representative Report detailing the ER's actions and decisions on matters for which the ER was responsible in the preceding month (or other timeframe agreed with the Secretary). The Environmental Representative Report must be submitted within seven (7) days following the end of each month for the duration of works and construction of the CSSI, or as otherwise agreed with the Secretary.
Acoustics Advisor	<p>In accordance with CoA - A25, CoA - A27 and NV6 the AA has the following roles and responsibilities:</p> <ul style="list-style-type: none"> assurance of contractor noise and vibration planning, modelling, management and monitoring practices verification of compliance with relevant guidelines and approval requirements audit noise and vibration management practices.

- receive and respond to communication from the Secretary in relation to the performance of the CSSI in relation to noise and vibration.
- consider and inform the Secretary on matters specified in the terms of this approval relating to noise and vibration.
- consider and recommend, to LOR, improvements that may be made to work practices to avoid or minimise adverse noise and vibration impacts.
- review all noise and vibration documents required to be prepared under the terms of this approval and, should they be consistent with the CoA, endorse them before submission to the Secretary (if required to be submitted to the Secretary) or before implementation (if not required to be submitted to the Secretary).
- regularly monitor the implementation of all noise and vibration documents required to be prepared under the terms of this approval to ensure implementation is in accordance with what is stated in the document and the terms of this approval.
- notify the Secretary of noise and vibration incidents in accordance with **CoA - A41**.

In conjunction with the ER, the AA must:

- consider requests for out of hours construction activities and determine whether to endorse the proposed activities in accordance with **CoA - E47**.
- as may be requested by the Secretary or Complaints Commissioner, help plan, attend or undertake audits of noise and vibration management of the CSSI including briefings, and site visits.
- if conflict arises between LOR and the community in relation to the noise and vibration performance during construction of the CSSI, follow the procedure in the Community Communication Strategy approved under **CoA - B3** to attempt to resolve the conflict, and if it cannot be resolved, notify the Secretary.
- consider relevant minor amendments made to the CEMP, relevant sub-plans and noise and vibration monitoring programs that require updating or are of an administrative nature, and are consistent with the terms of CoA and the management plans and monitoring programs approved by the Secretary and, if satisfied such amendment is necessary, endorse the amendment. This does not include any modifications to the terms of the CoA.
- assess the noise impacts of minor ancillary facilities as required by **CoA – A18**.
- prepare and submit to the Secretary and other relevant regulatory agencies, for information, a monthly Noise and Vibration Report detailing the AAs actions and decisions on matters for which the AA was responsible in the preceding month (or other timeframe agreed with the Secretary). The Noise and Vibration Report must be submitted within seven (7) days following the end of each month for the duration of construction of the CSSI, or as otherwise agreed with the Secretary.

12.2 CNVMP Review

The CNVMP (and Monitoring Program) will be reviewed annually or where circumstances arise during the works that require amends to the plan. The type of circumstances that may trigger a CNVMP review could include, but are not limited to, significant changes in construction procedures, management protocols or environmental requirements; trends in validated noise or vibration complaints are identified; and/or an increase in noise and vibration impacts is identified.

Where noise (or vibration) levels are repeatedly identified (e.g. via monitoring) to be above management levels or the predicted values in the CNVIS, a review of this CNVMP (and Monitoring Program) will be undertaken. The following steps will be completed:

- review and identify the cause of any noise (or vibration) exceedances. This will focus on the plant, equipment or machinery in use at the time, or activities undertaken so that any trends can be identified.
- confirm the type and extent of any mitigation or corrective actions implemented during the non-compliant events.
- identify, develop and implement any opportunities for improvement or additional mitigation or management measures that will assist to minimise impacts associated with any trends.
- revise this management plan document, or supplement this plan (e.g. with separate work instructions) to reflect the outcomes of the review.

The revised management plan (or supplementary documentation) will be developed to the satisfaction of the Environmental Manager, Sydney Metro Environmental Representative and the Acoustics Advisor, so that the management strategy and management measures continue to assist to minimise impacts at receptors and to ensure that the plan remains an effective instrument for noise management and mitigation. Any review of the CNVMP will also be undertaken in consultation with relevant government agencies (i.e. Willoughby Council).

The revised management plan (and Monitoring Program) will be developed in consultation with the relevant government agencies, endorsed by the ER and submitted to the Secretary, in accordance with **CoA – C3, C5, C6, C7 and C8**. Construction must not commence until the CEMP and associated sub-plan revisions have been approved by the Secretary.

The revised CNVMP (and Monitoring Program) will be referred to the Department of Planning and Environment (DPE) only where amendments are made to address significant changes to project works/schedule and impacts on (or complaints from) the community are verified, or at the request of the Environmental Manager, Environmental Representative or the Acoustics Advisor.

The CNVMP (and Monitoring Program) review will reflect these considerations and upon final approval of the revised CNVMP, the document will be circulated to relevant personnel.

13. References

British Standard (BS 6472–1992) – **Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)** dated 1992.

British Standard BS7385: Part 2-1993 (BS 7385) - **Evaluation and Measurement for Vibration in Buildings — Part 2 – Guide to Damage Levels from Ground-borne Vibration**, dated 1993.

German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150:3) – **Structural Vibration - Effects of Vibration on Structures**, dated 1999.

Laing O'Rourke - Sydney Metro City and Southwest - Northern Corridor Works (K38) **Construction Environmental Management Plan (CEMP)** (Rev 6), dated February 2018.

Laing O'Rourke - Sydney Metro City and Southwest - Northern Corridor Works Portion 7b - **Construction Noise and Vibration Impact Statement (CNVIS)**, prepared by ERM and dated June 2018.

Laing O'Rourke - Sydney Metro City and Southwest - Northern Corridor Works Portion 7b - **Construction Noise and Vibration Monitoring Program**, prepared by ERM and dated June 2018.

NSW Department of Environment and Climate Change – **NSW Interim Construction Noise Guideline (ICNG)**, July 2009.

NSW Department of Environment and Conservation – **NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline** (the NSW Vibration Guideline), February 2006.

NSW Department of Environment, Climate Change and Water – **NSW Road Noise Policy (RNP)**, March 2011.

NSW Environment Protection Authority – **NSW Environmental Noise Management – Industrial Noise Policy (INP)**, January 2000 and relevant application notes.

NSW Government – Transport for NSW (TfNSW) - Sydney Metro Construction Noise and Vibration Strategy (SM CNVS), August 2016 and CNVS Addendum June 2017.

NSW Government – Transport for NSW (TfNSW) Infrastructure and Services Division (I&S) - Sydney Metro Construction Noise and Vibration Strategy (I&S CNVS), May 2018.

Standards Australia AS 2436–2010™ (AS2436) – **Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites**.

Standards Australia AS1055–1997™ (AS1055) – **Description and Measurement of Environmental Noise**.

Standards Australia AS IEC 61672.1–2004™ (AS61672) – **Electro Acoustics - Sound Level Meters Specifications Monitoring** or Standards Australia AS1259.2-1990™ (AS1259) – **Acoustics – Sound Level Meters – Integrating/Averaging** as appropriate to the device.

Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard™ – **Electroacoustic – Sound Calibrators**.

TfNSW - Sydney Metro - Chatswood to Sydenham **Business Management Plan – Early Works**, dated November 2017.

TfNSW - Sydney Metro - Chatswood to Sydenham **Community Communications Strategy – Early Works**, dated October 2017.

TfNSW - Sydney Metro - Chatswood to Sydenham **Construction Environmental Management Framework (CEMF)** – Appendix B of SPIR, dated August 2016.

TfNSW - Sydney Metro - Chatswood to Sydenham **Environmental Impact Statement (EIS) – Chapter 10: Construction Noise and Vibration**, dated May 2016.

TfNSW - Sydney Metro - Chatswood to Sydenham **Environmental Impact Statement (EIS) – Technical Paper 2 Noise and Vibration**, Prepared by SLR, dated April 2016.

TfNSW - Sydney Metro – Northern Corridor Works **Management Requirement Minor - Environment (MR-minor E)**, dated April 2017.

TfNSW - Sydney Metro - **Chatswood to Sydenham: Staging Report**, dated April 2017.

TfNSW - Sydney Metro - Chatswood to Sydenham **Submissions and Preferred Infrastructure Report (SPIR)**, dated October 2016.

TfNSW - Sydney Metro - Chatswood to Sydenham **Overarching Community Communications Strategy**, dated September 2017.

TfNSW - Sydney Metro - Chatswood to Sydenham **Small Business Owners Support Program**, dated September 2017.

Appendix A – Acoustics: Glossary of Terms and Definitions

Noise is often defined as a sound, especially one that is loud or unpleasant or that causes disturbance or simply as unwanted sound, but technically, noise is the perception of a series of compressions and rarefactions above and below normal atmospheric pressure.

Vibration refers to the oscillating movement of any object. In a sense noise is the movement of air particles and is essentially vibration, though in regards to an environmental assessment vibration is typically taken to refer to the oscillation of a solid object(s). The impact of noise on objects can lead to vibration of the object, or vibration can be experienced by direct transmission through the ground, this is known as ground-borne vibration.

Essentially, noise can be described as what a person hears, and vibration as what they feel.

What Factors Contribute To Environmental Noise?

The noise from an activity, like construction works, at any location can be affected by a number of factors, the most significant being:

- How loud the activity is;
- How far away the activity is from the receptor;
- What type of ground is between the activity and the receptor location e.g. concrete, grass or water;
- How the ground topography varies between the activity and the receptor (is it flat, hilly, mountainous) as blocking the line of sight to a noise source will generally reduce the level of noise; and
- Any other obstacles that block the line of sight between the sources to receptor e.g. buildings or purpose built noise walls.

How To Measure And Describe Noise?

Noise is measured using a specially designed 'sound level' meter which must meet internationally recognised performance standards. Audible sound pressure levels vary across a range of 107 Pascals (Pa), from the threshold of hearing at 20 μ Pa to the threshold of pain at 200 Pa. Scientists have defined a statistically described logarithmic scale called Decibels (dB) to more manageably describe noise.

To demonstrate how this scale works, the following points give an indication of how the noise levels and differences are perceived by an average person:

- 0 dB - represents the threshold of human hearing (for a young person with ears in good condition);
- 50 dB – represents average conversation;
- 70 dB – represents average street noise, local traffic etc;
- 90 dB – represents the noise inside an industrial premises or factory; and
- 140 dB - represents the threshold of pain – the point at which permanent hearing damage may occur.

Human Response to Changes in Noise Levels

The following concepts offer qualitative guidance in respect of the average response to changes in noise levels:

- Differences in noise levels of less than approximately 2 dBA are generally imperceptible in practice, an increase of 2 dB is hardly perceivable;
- Differences in noise levels of around 5 dBA are considered to be significant;
- Differences in noise levels of around 10 dBA are generally perceived to be a doubling (or halving) of the perceived loudness of the noise. An increase of 10 dB is perceived as twice as loud. Therefore an increase of 20 dB is four times as loud and an increase of 30 dB is eight times as loud etc;
- The addition of two identical noise levels will increase the dB level by about 3 dB. For example, if one car is idling at 40 dB and then another identical car starts idling next to it, the total dB level will be about 43 dB;

- The addition of a second noise level of similar character which is at least 8 dB lower than the existing noise level will not add significantly to the overall dB level; and
- A doubling of the distance between a noise source and a receptor results approximately in a 3 dB decrease for a line source (for example, vehicles travelling on a road); and a 6 dB decrease for a point source (for example, the idling car discussed above). A doubling of traffic volume for a line source results approximately in a 3 dB increase in noise, halving the traffic volume for a line source results approximately in a 3 dB decrease in noise.

Terms to Describe the Perception of Noise

The following terms offer quantitative and qualitative guidance in respect of the audibility of a noise source:

- **Inaudible / Not Audible:** the noise source and/or event could not be heard by the operator, masked by extraneous noise sources not associated with the source. If a noise source is 'inaudible' its noise level may be quantified as being less than the measured LA90 background noise level, potentially by 10 dB or greater;
- **Barely Audible:** the noise source and/or event are difficult to define by the operator, typically masked by extraneous noise sources not associated with the source. If a source is 'barely audible' its noise level may be quantified as being 5 - 7 dB below the measured LA90 or LAeq noise level, depending on the nature of the source e.g. constant or intermittent;
- **Just Audible:** the noise source and/or event may be defined by the operator. However there are a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator;
- **Audible:** the noise source and/or event may be easily defined by the operator. There may be a number of extraneous noise sources contributing to the measurement. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator; and
- **Dominant:** the noise source and/or event are noted by the operator to be significantly 'louder' than all other noise sources. The noise level should be quantified based on instantaneous noise level contributions, noted by the operator.

The following terms offer qualitative guidance in respect of acoustic terms used to describe the frequency of occurrence of a noise source during an operator attended environmental noise measurements:

- **Constant:** this indicates that the operator has noted the noise source(s) and/or event to be constantly audible for the duration of the noise measurement e.g. an air-conditioner that runs constantly during the measurement;
- **Intermittent:** this indicates that the operator has noted the noise source(s) and/or event to be audible, stopping and starting intervals for the duration of the noise measurement e.g. car pass-by's; and
- **Infrequent:** this indicates that the operator has noted the noise source(s) and/or event to be constantly audible, however; not occurring regularly or at intervals for the duration of the noise measurement e.g. a small number of aircraft are noted during the measurement.

How to Calculate or Model Noise Levels?

There are two recognised methods which are commonly adopted to determine the noise at particular location from a proposed activity. The first is to undertake noise measurements whilst the activity is in progress and measure the noise, the second is to calculate the noise based on known noise emission data for the activity in question.

The second option is preferred as the first option is largely impractical in terms of cost and time constraints, notwithstanding the meteorological factors that may also influence its quantification. Furthermore, it is also generally considered unacceptable to create an environmental impact simply to measure it. In addition, the most effective mitigation measures are determined and implemented during the design phase and often cannot be readily applied during or after the implementation phase of a project.

Because a number of factors can affect how 'loud' a noise is at a certain location, the calculations can be very complex. The influence of other ambient sources and the contribution from a particular source in question can be difficult to ascertain. To avoid these issues, and to quantify the direct noise contribution from

a source/site in question, the noise level is often calculated using noise modelling software packages. The noise emission data used in each noise model of this assessment has been obtained from ERM's database of measured noise emissions.

Acoustics Terminology and Statistical Noise Descriptors

Environmental noise levels such as noise generated by industry, construction and road traffic are commonly expressed in dBA. The A-weighting scale follows the average human hearing response and enables comparison of the intensity of noise with different frequency characteristics. Time varying noise sources are often described in terms of statistical noise descriptors. The following descriptors are commonly used when assessing noise and are referred to throughout this acoustic assessment:

- **Decibel (dB is the adopted abbreviation for the decibel):** the unit used to describe sound levels and noise exposure. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure;
- **dBA:** the unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound-level measurement to approximate the response of the human ear;
- **dBC:** the unit used to measure 'A-weighted' sound pressure levels. C-weighting is an adjustment made to sound-level measurements which takes account of low-frequency components of noise within the audibility range of humans;
- **dBZ or dBL:** the unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear;
- **Hertz (Hz):** the measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz;
- **Octave:** a division of the frequency range into bands, the upper frequency limit;
- **1/3 Octave:** single octave bands divided into three parts;
- **Leq:** this level represents the equivalent or average noise energy during a measurement period. The Leq, 15minute noise descriptor simply refers to the Leq noise level calculated over a 15 minute period. Indeed, any of the below noise descriptors may be defined in this way, with an accompanying time period (e.g. L10, 15 minute) as required;
- **Lmax:** the absolute maximum noise level in a noise sample;
- **LN:** the percentile sound pressure level exceeded for N% of the measurement period calculated by statistical analysis;
- **L10:** the noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels;
- **L90:** the noise level exceeded for 90 per cent of the time and is approximately the average of the minimum noise levels. The L90 level is often referred to as the "background" noise level and is commonly used as a basis for determining noise criteria for assessment purposes;
- **Sound Power Level (LW):** this is a measure of the total power radiated by a source. The Sound Power of a source is a fundamental property of the source and is independent of the surrounding environment;
- **Sound Pressure Level (LP):** the level of sound pressure; as measured at a distance by a standard sound level meter with a microphone. This differs from LW in that this is the received sound as opposed to the sound 'intensity' at the source;
- **Background noise:** the underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the LA90 descriptor;
- **Ambient noise:** the all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far;
- **Cognitive noise:** the noise in which the source is recognised as being annoying;

- **Masking:** the phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
- **Assessment Background Level (ABL):** is defined in the INP as a single figure background level representing each assessment period (day, evening and night). Its determination is by the tenth percentile method (of the measured LA90 statistical noise levels) described in Appendix B on the INP;
- **Rating Background Level (RBL):** is defined in the INP as the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24hr period used for the ABL). This is the level used for assessment purposes. It is defined as the median value of:
 - all the day assessment background levels over the monitoring period for the day;
 - all the evening assessment background levels over the monitoring period for the evening; and
 - all the night assessment background levels over the monitoring period for the night.
- **Extraneous noise:** the noise resulting from activities that are not typical of the area. Atypical INP activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous;
- **Most affected location(s):** locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receptor, and any shielding between source and receptor;
- **Feasible and Reasonable measures:** feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:
 - noise mitigation benefits (amount of noise reduction provided, number of people protected);
 - cost of mitigation (cost of mitigation versus benefit provided);
 - community views (aesthetic impacts and community wishes); and
 - noise levels for affected land uses (existing and future levels, and changes in noise levels).

How to Measure and Control Vibration

Vibration refers to the oscillating movement of any object. In relation to construction projects, ground-borne vibration is the most likely outcome of works and potentially has three (3) effects on vibration sensitive Receptors, these are:

- ground-borne vibration that may cause annoyance;
- ground-borne vibration that may have adverse effect on a structure e.g. a building; and
- regenerated noise due to ground-borne vibration.

Each of these potential effects can be assessed in accordance with the relevant standard. Perceptible levels of vibration often create concern for the surrounding community at levels well below structural damage guideline values; this issue needs to be managed as part of the vibration monitoring program.

Vibration is typically measured using specific devices that record the velocity or acceleration at a designated receptor location – usually being the closest premises to works. Modern vibration monitoring devices will typically capture amplitude data for the three (3) orthogonal axes being, the transverse, longitudinal and vertical and also the frequency at which the measured vibration event occurs. Monitoring of this level of detail enables analysis of significant vibration events to determine compliance with relevant guidelines.

Vibration propagates in a different manner to noise and can be difficult to control depending on the frequency of the source in question, although identifying the strategy best suited to controlling vibration follows a similar approach to that of noise. This includes elimination, control at the source, control along the propagation path and control at the receptor and/or a combination of these, such as no work/respite periods.

Vibration Descriptors

The following terms are often used to describe measured vibration levels.

- **Parameter:** an attribute with a value - for example, weighting;
- **Particle Velocity:** the instantaneous value of the distance travelled by a particle per unit time in a medium that is displaced from its equilibrium state by the passage of a sound or vibration wave;
- **Peak Particle Velocity (PPV):** is the highest (maximum or peak) particle velocity which is recorded during a particular vibration event over the three (3) axes. PPV is measured in the unit, mm/s;
- **Phase:** the relative position of a sound wave to some reference point, the phase of a wave is given in radians, degrees, or fractions of a wavelength;
- **Acceleration:** the change in velocity over time. Acceleration is dependent on the velocity and the frequency of the vibration event (velocity is a vector), as such acceleration changes in two ways - magnitude and/or direction. Acceleration is measured in the unit; m/s²;
- **Perceptible:** vibration levels that a receptor of building occupant may 'feel'. 0.2 mm/s is typically considered to be the human threshold for perception of vibration;
- **Geophone or accelerometer:** the transducer/device typically used to measure vibration;
- **Damage:** is defined in DIN 4150-3 (1999-02) Structural vibration - Effects of vibration on structures to include minor non-structural effects such as cosmetic damage or superficial cracking in paint or cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls; and
- **Vibration Dose Value (VDV):** a concept outlined in the NSW Vibration Guideline which is a calculative approach to assessing the impact of intermittent vibration or extended periods of impulsive vibration. VDV require the measurement of the overall weighted RMS (Root Mean Square) acceleration levels over the frequency range 1Hz to 80Hz.

To calculate VDV the following formula (refer section 2.4.1 of “the guideline”) is used:

$$VDV = \left[\int_0^T a^4(t) dt \right]^{0.25}$$

Where VDV is the vibration dose value in m/s^{1.75}, a (t) is the frequency-weighted RMS of acceleration in m/s² and T is the total period of the day (in seconds) during which vibration may occur.

Appendix B – Out of Hours Works (OOHW) Protocol



Integrated
Management
System

City and Southwest Chatswood to Sydenham Out of Hours Work Protocol

SM ES-PW-317

Sydney Metro Integrated Management System (IMS)

Applicable to:	Sydney Metro City & Southwest
Document Owner:	Adam Koutsamanis
System Owner:	Fil Cerone
Status:	Final
Version:	2.0
Date of issue:	14 July 2017
Review date:	14 July 2018
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1. Introduction

This protocol outlines the process for preparing, assessing, managing and approving work on the Chatswood to Sydenham portion of the City & Southwest project that is undertaken outside of standard construction hours (i.e. Out of Hours).

1.1. Purpose

This protocol has been developed to comply with Condition E47 Out of Hours Work Protocol of the City & Southwest Chatswood to Sydenham planning approval. This condition (and other conditions that relate to Out of Hours work) is addressed in accordance with Table 1.

Table 1: Chatswood to Sydenham Out of Hours Work Planning Approval Conditions

Condition Number	Condition	Where this condition is addressed
A27(g)i.	The approved AA must in conjunction with the ER... consider requests for out of hours construction activities and determine whether to endorse the proposed activities in accordance with Condition E47.	Section 3.1.2.4 and Figure 1.
E36	Construction, except as allowed by Condition E48 (excluding cut and cover tunnelling), must only be undertaken during the following standard construction hours: (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.	Section 2.
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 $L_{eq(15\text{ minute})}$ 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.	Construction Noise and Vibration Impact Statements.
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: (a) $L_{eq(15\text{ minute})}$ 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) $L_{eq(15\text{ minute})}$ 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, unless an agreement is reached with those receivers. This condition does not apply to noise associated with the cutting surface of a TBM [Tunnel Boring Machine] as it passes under receivers. <i>Note this condition requires that noise levels be less than $L_{eq(15\text{ minute})}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{aeq(15\text{ minute})}$ 55 dB(A). Noise equal to or above $L_{eq(15\text{ minutes})}$ 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.</i>	Construction Noise and Vibration Management Plans and each OOH application as relevant (supported by a Construction Noise and Vibration Impact Statement or other type of quantitative impact assessment).

Condition Number	Condition	Where this condition is addressed
E41	The Proponent must ensure that residential receivers, located in non-residential zones, likely to experience an internal noise level exceeding $L_{eq(15\text{ minute})}$ 60 dB between 8pm and 9pm or $L_{eq(15\text{ minute})}$ 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 <i>Sydney Metro City and South West Noise and Vibration Strategy</i> referenced in Condition E32.	Construction Noise and Vibration Management Plans and each OOH application as relevant (supported by a Construction Noise and Vibration Impact Statement or other type of quantitative impact assessment).
E42	The Proponent must ensure that residential receivers in residential zones likely to experience an internal noise level of $L_{eq(15\text{ minute})}$ 45 dB or greater between 8pm and 7am (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 (including works associated with utility adjustments)) must be offered additional mitigation in accordance with the <i>Sydney Metro City and South West Noise and Vibration Strategy</i> referenced in Condition E32.	Construction Noise and Vibration Management Plans and each OOH application as relevant (supported by a Construction Noise and Vibration Impact Statement or other type of quantitative impact assessment).

Condition Number	Condition	Where this condition is addressed
E44	<p>Notwithstanding Condition E36 construction associated with the CSSI [Critical State Significant Infrastructure] 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 (c) where different construction hours are permitted or required under an EPL in force in respect of the construction; or (d) construction that causes $L_{Aeq(15\text{ minute})}$ noise levels: <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 <i>Interim Construction Noise Guideline</i> (DECC, 2009), and ii. no more than the noise management levels specified in Table 3 of the <i>Interim Construction Noise Guideline</i> (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 <i>Assessing Vibration: a technical guideline</i> (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 <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); or (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 (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>Sections 1.5.3, 2, 3.1, 3.2.1 and 3.3.</p>
E45	<p>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>	<p>Section 3.3 and Figure 2.</p>
E46	<p>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 <i>Interim Construction Noise Guideline</i> can be achieved at sensitive receivers.</p>	<p>Section 2 and each OOH application as relevant (supported by a Construction Noise and Vibration Impact Statement or other type of quantitative impact assessment).</p>

Condition Number	Condition	Where this condition is addressed
E47	<p>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 [NSW Environment Protection Authority] and submitted to the Secretary [of the NSW Department of Planning and Environment] for approval before construction commences for works not subject to an EPL [Environment Protection Licence]. 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 [Acoustic Advisor] 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 [Environmental Representative] 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>	<p>This document; particularly Sections 1.2, 3.1.2.3 and 3.1.2.4, Figure 1 and the Out of Hours Work Application Forms.</p>
E48	<p>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. 	<p>Section 2 and each OOH application as relevant (supported by a Construction Noise and Vibration Impact Statement or other type of quantitative impact assessment).</p>

1.2. Protocol Consultation, Endorsement and Approval

In accordance with Condition E47 of the Chatswood to Sydenham planning approval, this protocol must be prepared in consultation with the NSW Environment Protection Authority (EPA) and approved by the Secretary of the NSW Department of Planning and Environment (the Secretary).

The protocol is also required to receive endorsement from the Environmental Representative and the Acoustic Advisor in accordance with Conditions A24(d) and A27(d) respectively, prior to submission to the Secretary.

1.2.1. Consultation

A draft version of this protocol was provided to the EPA for consultation and comment on 7 March 2017. Given that the protocol (and Condition E47) is aimed at addressing work that is 'not subject to an EPL', the EPA responded on 21 March 2017 to state that "the EPA does not have comments on this protocol".

In the event that the protocol is revised to address work that is subject to an Environment Protection Licence (EPL), TfNSW will re-consult with the EPA.

1.2.2. Endorsement

Both the Environmental Representative and the Acoustic Advisor have reviewed and left comments on drafts of this protocol. All comments have been satisfactorily addressed in this final OOH Work Protocol.

Appendix A provides endorsements of this OOH Work Protocol from the Environmental Representative and the Acoustic Advisor.

1.2.3. Approval

Appendix B provides approval of this OOH Work Protocol by the Secretary.

Construction activities on the Chatswood to Sydenham portion of the City & Southwest project will not be undertaken outside of standard construction hours for works that are not subject to an EPL until this protocol has been approved by the Secretary. Following approval from the Secretary, all works on the Chatswood to Sydenham portion of the City & Southwest project that are not subject to an EPL (irrespective of whether the works are defined as 'construction' in accordance with the Chatswood to Sydenham planning approval) will be subject to this protocol.

1.3. Accountabilities

The Principal Manager, Sustainability, Environment & Planning, City & Southwest is accountable for this protocol. Accountability includes authorising the document, monitoring its effectiveness and performing a formal document review.

Roles reporting to the Principal Manager are accountable for ensuring the requirements of this document are implemented within their area of responsibility. The roles that are accountable for specific projects/programs are accountable for ensuring associated contractors comply with the requirements of this document.

1.4. Definitions and Acronyms

All terminology in this Protocol is taken to mean the generally accepted or dictionary definition, unless stated otherwise in accordance with the Definitions section of the Chatswood to Sydenham planning approval or the *Sydney Metro Integrated Management System Glossary*.

Acronyms and terminology specifically used throughout this Protocol are listed below.

	Definitions
AA	Acoustics Advisor
BMP	Business Management Plan
CEMF	Construction Environmental Management Framework (for the City & Southwest project)
CNVIS	Construction Noise and Vibration Impact Statement
CNVS	Construction Noise and Vibration Strategy (for the City & Southwest project)
CSSI	Critical State Significant Infrastructure
EPA	Environment Protection Authority (of New South Wales)
EPL	Environment Protection Licence
ER	Environmental Representative
ICNG	<i>Interim Construction Noise Guideline</i> (DECC, 2009)
OOH	Out of Hours (i.e. outside of the standard construction hours stipulated in planning approval conditions)
POEO Act	<i>Protection of the Environment Operations Act 1997</i> (NSW)
Secretary	The Secretary of the New South Wales Department of Planning and Environment
SPIR	Submissions and Preferred Infrastructure Report

1.5. Governance

This OOH Work Protocol should be used in conjunction with the Sydney Metro *Construction Environment Management Framework*, the *City & Southwest Construction Noise and Vibration Strategy* and any applicable Environment Protection Licences. These documents establish minimum requirements for managing noise and vibration impacts on the City & Southwest project.

1.5.1. Construction Environment Management Framework

The Chatswood to Sydenham Submissions and Preferred Infrastructure Report (SPIR) contains the *Sydney Metro Construction Environmental Management Framework* (CEMF) as Appendix B. The CEMF represents Sydney Metro's minimum requirements for environmental management and specifies a standard framework that each contractor must establish and document in their Construction Environmental Management Plan and sub-plans. These requirements include those relating to construction noise and vibration management as specified in Chapter 9.

1.5.2. Construction Noise and Vibration Strategy

Sydney Metro has developed a *Construction Noise and Vibration Strategy* (CNVS) for the City & Southwest project. The strategy:

- Establishes a framework for managing construction noise and vibration impacts and adopting appropriate mitigation measures (including minimum requirements),
- Forms Appendix C of the Chatswood to Sydenham SPIR,
- Forms part of the contract requirements that contractors must comply with, and
- Sets minimum requirements for all OOH work, including the need for and development of Construction Noise and Vibration Impact Statements.

1.5.2.1. Construction Noise and Vibration Impact Statements

A Construction Noise and Vibration Impact Statement (CNVIS) is a report that assesses and documents the anticipated noise and vibration impacts at sensitive receivers of proposed construction activities. In accordance with Condition E33 of the Chatswood to Sydenham planning approval, a CNVIS is to 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.

1.5.3. Environment Protection Licence

An Environment Protection Licence (EPL) is a regulatory approval issued to strategically control the localised, cumulative and acute impacts of pollution. The NSW Environment Protection Authority (EPA) is responsible for issuing EPLs for 'scheduled activities' under the *Protection of the Environment Operations (POEO) Act 1997* (NSW).

Some aspects of the City & Southwest construction and operation works will constitute 'scheduled activities' under the POEO Act and therefore need to be subject to an EPL. City & Southwest contractors are required to obtain and comply with any EPLs as applicable to their scope of works.

The process for approving OOH work outside of those already permitted in accordance with an EPL, is governed by the conditions of the EPL. In order for these types of OOH work to be approved, an application to vary the EPL is to be prepared and submitted to the EPA for approval. The application is to be in accordance with the CNVIS and EPL requirements.

OOH work that is subject to an EPL do not require approval in accordance with Condition E47 of the Chatswood to Sydenham planning approval (i.e. this protocol).

1.6. Roles and Responsibilities

1.6.1. TfNSW Place Manager

A TfNSW Place Manager will be allocated to each site on the Chatswood to Sydenham portion of the City & Southwest project. The Place Manager is responsible for ensuring that all project communication requirements with the surrounding community are being complied with.

1.6.2. TfNSW Environment Manager

A TfNSW Environment Manager will be allocated to each contract package on the Chatswood to Sydenham portion of the City & Southwest project. The Environment Manager is responsible for ensuring that all environmental management requirements associated with their contract package are being complied with.

1.6.3. Independent Environmental Representative

Condition A22 of the Chatswood to Sydenham planning approval requires an Environmental Representative (ER) to be appointed to the project to represent the NSW Department of Planning and Environment. The ER is to act as the Secretary's independent point of contact for all environmental and planning approval compliance matters. Refer to Condition A24 of the Chatswood to Sydenham planning approval for a comprehensive list of the ER's responsibilities.

Sections 3.1.2.3 and 3.1.2.4 include descriptions of the ER's responsibilities with respect to reviewing and approving OOH work.

1.6.4. Acoustic Advisor

Condition A25 of the Chatswood to Sydenham planning approval requires an Acoustic Advisor (AA) to be appointed to the project. The AA is to act as the Secretary's independent point of contact for all noise and vibration matters on the project. Refer to Conditions A25 and A27 for a comprehensive description of the AA's responsibilities.

Sections 3.1.2.3 and 3.1.2.4 include descriptions of the AA's responsibilities with respect to reviewing, identifying risk level, endorsing and deferring OOH work.

2. Standard Hours

Condition E36 of the Chatswood to Sydenham planning approval defines standard construction hours as:

- (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.

These hours are consistent with:

- The EPA's *Interim Construction Noise Guideline* (ICNG) 2009 'recommended standard hours' for construction in NSW, and
- The *City & Southwest Construction Noise and Vibration Strategy* (CNVS) 'standard daytime construction hours' (which were adopted by TfNSW as recommended by the ICNG).

Unless undertaken in accordance with Conditions E44, E46 or E48 of the Chatswood to Sydenham planning approval, construction is only permitted to be undertaken during standard construction hours.

If OOH work is to be undertaken in accordance with one or more of these conditions at the Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street or Central sites, the work must also comply with the specific requirements of Conditions E37 and E38 of the Chatswood to Sydenham planning approval. It should be noted however that the intent of Conditions E37 and E38 is to support certain types of work at these sites between 7am and 8pm. This should be considered when identifying risk levels for OOH work applications (refer to Section 3.1.2.3).

3. OOH Work

Out of hours (OOH) work is defined as any work that is undertaken outside of standard construction hours.

Some OOH work is permitted to be undertaken on the City & Southwest project in accordance with Conditions E44, E46 and E48 of the Chatswood to Sydenham planning approval. These works include:

- Delivery of materials as required by an authority for safety reasons,
- Emergency works,
- Works that are subject to different construction hours as permitted (or required) under an EPL,
- Low noise impact works,
- Works that are subject to a negotiated agreement with the substantial majority of affected sensitive receivers,
- Works undertaken in accordance with an Out of Hours Work Protocol approval and are the subject of a notification to the relevant council, local residents and other affected stakeholders and receivers at least five days prior to the works commencing and no more than 14 days prior to the works commencing.
- Rock breaking and other particularly annoying activities at the Central Station Site or, provided that the noise management level can be achieved at sensitive receivers, at any other site,
- 24 hour construction works in accordance with Condition E48, comprising:
 - Tunnelling and associated support activities (excluding cut and cover tunnelling),
 - Excavation within an acoustic enclosure,
 - Excavation at the Central Station Site without an acoustic enclosure,
 - Station and tunnel fit out, and
 - Haulage and delivery of spoil and materials,

In accordance with Condition E47 of the Chatswood to Sydenham planning approval and with the exception of OOH work that is subject to an EPL, all OOH work requires endorsement by the AA and approval by either the ER, or in the case of 'high risk' works undertaken after 9pm, the Secretary. This includes all work subject to Conditions E37, E38 and E48 of the Chatswood to Sydenham planning approval. The requirements of these conditions are to be specifically addressed in each OOH application (refer to Section 3.1.2) as relevant.

3.1. OOH Work Approval Process

Figure 1 provides the OOH work approval process for the Chatswood to Sydenham portion of the City & Southwest project. This includes a requirement to prepare an application that covers the assessment of noise and vibration impacts, mitigation measures (including community notification requirements), review and approval for all proposed OOH work.

All OOH work applications that are not subject to an EPL will be submitted to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for review and comment. These reviews will take into consideration a range of aspects, including reviewer experience and expert understanding, local knowledge of the area, current understanding of sensitive receiver requirements and other relevant documents (for example, the applicable Business Management Plan detailing predicted impacts to affected businesses, key issues and appropriate mitigation measures for implementation). This review process is further explained in section 3.1.2.3.

3.1.1. OOH Work subject to an EPL

For OOH work that is subject to an EPL, the EPL conditions will dictate the approval process. As a minimum however, for proposed OOH work that is not approved in the EPL and a variation is required, the contractor is expected to:

- Prepare an application to the EPA in accordance with the CNVS and EPL requirements,
- Submit the revised application to the EPA for approval and submit the application to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for information,
- Notify TfNSW, the AA and ER upon receiving EPA approval, and
- Ensure any required community notifications have been issued (by either TfNSW or the contractor directly) at least seven days prior to the works commencing.

3.1.2. OOH Work not subject to an EPL

For OOH work that is not subject to an EPL, the approval process is dictated by the requirements of Condition E47 of the Chatswood to Sydenham planning approval.

Contractors are required to prepare an OOH application using:

- A form consistent with the Sydney Metro *City & Southwest OOH Work Application Form* for proposed OOH work that is within the scope of a CNVIS, or
- A form consistent with the Sydney Metro *OOH Work Application Form* for proposed OOH work that is not within the scope of a CNVIS (or is within the scope of a CNVIS that is yet to be prepared).

Both of these forms require a noise and vibration impact assessment to be undertaken and contain a consolidated and conservative version of Table 14 from the CNVS. This facilitates simpler consideration of applicable additional noise and vibration mitigation measures to implement. The forms also require demonstration of how additional noise and vibration mitigation measures have been considered for implementation (including community notifications) in accordance with the CNVS.

3.1.2.1. OOH Work within the Scope of a CNVIS

The majority of OOH applications subject to this protocol are anticipated to be undertaken within the scope of a CNVIS.

For proposed OOH work that is within the scope of a CNVIS, the OOH application will outline the associated noise and vibration impacts of the proposed OOH work, based on the outcomes of the CNVIS. The applicable sections of the CNVIS are required to be appended to the OOH application.

The associated noise and vibration impacts will guide the consideration of standard and additional mitigation measures to implement, in accordance with the CNVIS.

3.1.2.2. OOH Work not within the scope of a CNVIS

In some circumstances, OOH work may be required that is not within the scope of a CNVIS. Examples of these situations include OOH works that:

- Are not defined as 'construction' under the Chatswood to Sydenham planning approval,
- Are not confined to a 'construction site' (e.g. power supply works, in-tunnel works, etc.), and
- Were not anticipated in a CNVIS at the time it was prepared.

For proposed OOH work that is not within the scope of a CNVIS (or is within the scope of a CNVIS that is yet to be prepared), the noise and vibration impacts of the proposed OOH work will generally have less certainty than those that are within the scope of a CNVIS. Therefore, greater due diligence is required in completing the OOH application form.

To ensure an adequate level of due diligence is applied to reviewing proposed OOH work that is not within the scope of a CNVIS, a form consistent with the generic Sydney Metro *OOH Work Application Form* is to be used. This form has been developed by TfNSW to ensure consistency with the *Interim Construction Noise Guideline* (DECC, 2009) and requires applicants to:

- Provide justification for the works to be undertaken OOH,
- Adequately assess the noise and vibration impacts at nearest sensitive receivers,
- Consider standard and additional noise and vibration mitigation measures to implement in accordance with the CNVIS, and
- Request formal review, endorsement and approval for the proposed OOH work prior to their commencement.

Furthermore, the Sydney Metro *OOH Work Application Form* requires a preliminary quantitative noise assessment to be undertaken in accordance with the *Interim Construction Noise Guideline* (ICNG) as a minimum. For assessments indicating that noise exceedance levels are greater than 10 dBA for more than 10 occasions at the same sensitive receiver, the need to undertake a detailed quantitative noise assessment will be considered by TfNSW, the contractor, the AA and the ER collectively. The term 'occasion' is defined in the *OOH Work Application Form*.

3.1.2.3. Review, TfNSW Endorsement and Identification of Risk Level

Review

Once the contractor has prepared an OOH work application, the application is submitted to the TfNSW Place Manager, TfNSW Environment Manager, AA and ER for review. Following their reviews, TfNSW, the AA and the ER may provide comments on the application, which need to be adequately addressed by the contractor in a resubmitted application to the satisfaction of the comment provider(s).

Prior to the TfNSW Principal Manager (Stakeholder & Community Liaison) indicating their endorsement (or otherwise) on the application, reference will be made to the applicable Business Management Plan (BMP) in accordance with Condition E64 of the Chatswood to Sydenham planning approval. The BMP will:

- Identify business stakeholders that may be affected by the project works and the issues specific to each business,
- Detail the strategies and activities to be used to facilitate open communication and engagement with businesses,
- Explain mitigation measures for identified business-related impacts, and
- Define roles and tools to enable TfNSW Place Managers to implement the BMP.

TfNSW Endorsement and Identification of Default Risk Level

Following endorsement from the TfNSW Principal Manager (Stakeholder & Community Liaison), the AA is required to identify a risk level for the proposed OOH work in accordance with Condition E47 of the Chatswood to Sydenham planning approval. This risk level will be categorised as either 'Low risk' or 'High risk'.

As a default risk level, the AA will identify OOH work as 'high risk' if all of the following three criteria apply:

- The type and sensitivity of the affected noise sensitive receivers is categorised as either Moderate Impact receivers (e.g. standard residential / typical density) or High Impact receivers (e.g. elderly / high density / persistent complainers / residents experiencing construction noise fatigue), and
- The predicted noise level of the OOH work has a likelihood for potential sleep disturbance (i.e. Rating Background Level + 15 dB or more), and
- The type of and intensity of noise emitted from the OOH work is categorised as High Impact (e.g. prolonged high noise and/or vibration intensive activities).

These criteria are based on Section 6.4 General Assessment Procedure of the CNVS.

For non-residential receivers the AA may consider OOH work as 'high risk' if undertaken during trading hours and in close proximity to their place of business (for example, during Saturday afternoon trading hours). Since each non-residential receiver has different business needs, it is imperative that the AA discusses each OOH work application with the TfNSW Place Manager to better understand how the proposed OOH works would impact the business.

Modification of Default Risk Level

Using the default risk level as a ‘starting point’, the AA will consider all other relevant factors in order to identify a final risk level. These relevant factors include:

- Those identified on Pages 24 and 25 in Section 6.4 of the CNVS (noting that the reference to ‘impact levels’ is independent of the ‘risk rating’ identified by the AA for the purposes of complying with Condition E47(c) of the Chatswood to Sydenham planning approval),
- Those listed in Table 2, and
- Any other factors the AA considers relevant in its professional opinion.

These factors may be cause for the AA to modify the default risk rating from either ‘high risk’ to ‘low risk’, or ‘low risk’ to ‘high risk’, as the AA deems appropriate in its professional opinion.

Table 2: Risk Level Considerations

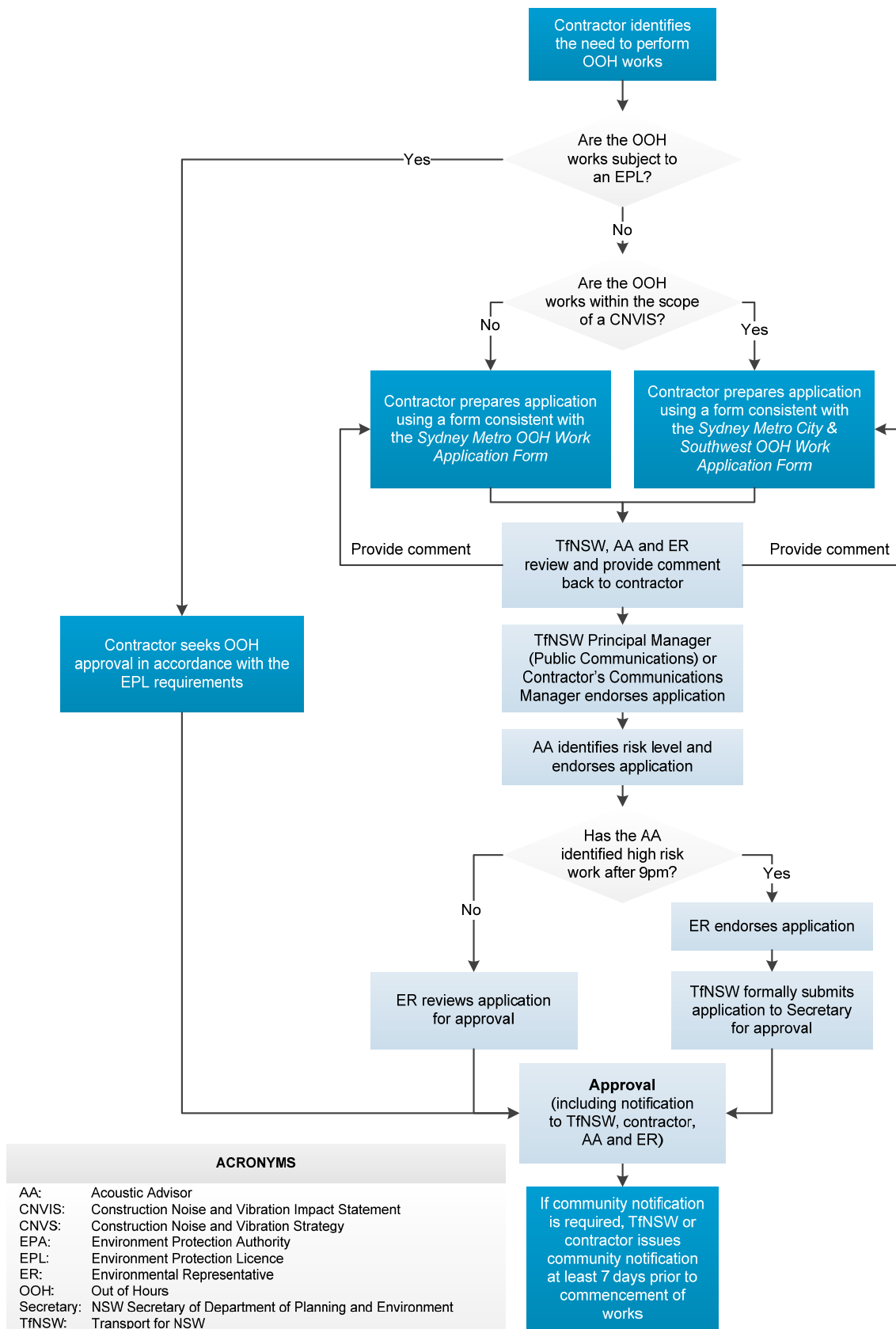
	Risk Level Considerations
Predicted Noise Exceedance	Degree of predicted noise level exceedance above the Rating Background Level or Noise Management Level as appropriate
Specific Scope of Work	Works that are not subject to Conditions E37 and E38
5 dBA Penalty	If 5 dBA penalty is required in accordance with Conditions E37, E38, E41 and E42
Certainty	Rating background levels, noise management levels or predicted noise impacts are not well understood
Past Experience	Nature of works are new, in a new location or have not been undertaken by the contractor on the project already
Negotiated Agreement with Sensitive Receivers	No negotiated agreement with sensitive receivers has been obtained in accordance with Condition E44(e)
Potential Sleep Disturbance	Likely to generate potential sleep disturbance (RBL + 15dB or greater)
Non-Residential Receivers	Impacted non-residential receivers operate during same period of proposed OOH works
Special Events	The timing and location of special events in the area of the proposed OOH works may be scheduled at the same time or immediately before or after the special event (e.g. festivals, public gatherings, etc.)
TfNSW Place Manager Feedback	Feedback from the Place Manager for the area will provide the AA an understanding of the types and requirements of surrounding sensitive receivers.
Sensitive Receivers	Moderate impact sensitive receivers (e.g. standard residential, medium density receivers) or high impact sensitive receivers (e.g. residential home for the elderly, high density unit blocks, persistent complainers, residents deemed to have ‘construction noise fatigue’)
High Impact Works	Prolonged high noise or vibration intensive activities
Other Impacts	Impacts other than noise and vibration impacts are likely to be generated (e.g. lighting, traffic, etc.)

Once the AA has identified a final risk level for the OOH work application, the AA indicates the risk level on the application (including any risk identification commentary), as well as whether the application includes works after 9pm, and signs and dates the application.

3.1.2.4. Endorsement and Approval

Figure 1 includes a process for the endorsement and approval of OOH work.

Following the identification of risk level by the AA, the AA endorses the OOH work application and provides any conditions or comments. If the AA identifies that the OOH work application is high risk and includes works after 9pm, the application is forwarded to the ER for endorsement only. Following the ER's endorsement, the application is then formally submitted by TfNSW via email to the Secretary for approval in accordance with Condition E47 of the Chatswood to Sydenham planning approval. For all other applications, the ER indicates their approval (or otherwise) on the application, including any conditions or comments, and forwards directly to TfNSW, the contractor and AA.



ACRONYMS	
AA:	Acoustic Advisor
CNVIS:	Construction Noise and Vibration Impact Statement
CNVS:	Construction Noise and Vibration Strategy
EPA:	Environment Protection Authority
EPL:	Environment Protection Licence
ER:	Environmental Representative
OOH:	Out of Hours
Secretary:	NSW Secretary of Department of Planning and Environment
TfNSW:	Transport for NSW

Figure 1: OOH Work Approval Process

3.2. Community Notifications

Community notifications can be used as a mitigation measure for receivers of noise and vibration impacts from OOH work.

Community notifications usually comprise of letterbox-dropped or hand-distributed notification letters to identified stakeholders prior to the commencement of works. Communities are more likely to understand and accept the impacts from noise and vibration if they are provided with honest detailed information and commitments on mitigation measures to be implemented that are adhered to by the project prior to the works commencing.

Community notification requirements are included in the CNVS and outlined in the *Community Communications Strategy* for the City & Southwest project in accordance with Condition B1 of the Chatswood to Sydenham planning approval.

Community notification is an example of an additional mitigation measure that may be considered for implementation in accordance with the CNVS and the additional mitigation measure tables contained in the OOH Work Application Forms. In the event that community notification is required as a mitigation measure prior to OOH work commencing, community notification is to be undertaken at least seven days prior to the works commencing.

3.2.1. Negotiated Agreements with Sensitive Receivers

Occasionally, a negotiated agreement for particular OOH work will be formed with the potentially affected sensitive receivers in accordance with Condition E44(e) of the Chatswood to Sydenham planning approval. These negotiated agreements would be undertaken and documented by either the contractor or TfNSW as part of an OOH application.

The negotiated agreement needs to reach a minimum 65% acceptance rate of those sensitive receivers that are contactable. 'Contactable' is defined as having received correspondence (either verbal or written) from receivers within a two week timeframe. The CNVIS process and the TfNSW Place Manager will advise of potentially affected sensitive receivers to be contacted.

Upon ER approval of any OOH applications containing negotiated agreements, TfNSW will forward the negotiated agreement documentation to the Secretary for information at least one week prior to the OOH work commencing. In the event that community notification is required as a mitigation measure prior to the OOH work commencing, this would be undertaken at the same time (i.e. at least seven days prior to the works commencing).

3.3. Emergency Works

Occasionally there may be a need to undertake emergency works outside of standard work hours. In this situation, the works are permitted to proceed without prior approval, provided that the works were:

- Unforeseen, and
- Required to avoid the loss of life, damage to property or prevent environmental harm.

Figure 2 outlines the emergency work process.

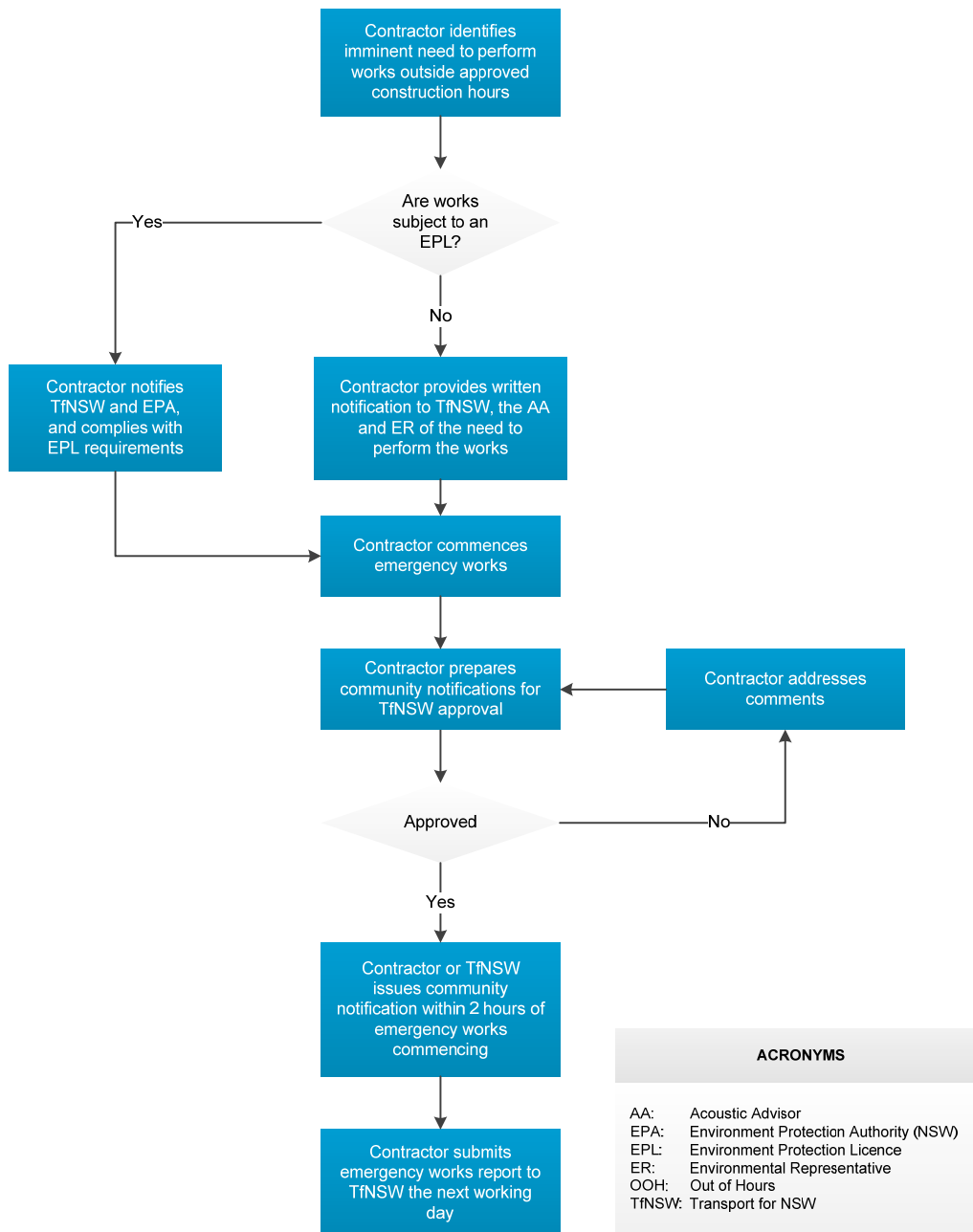
On becoming aware of the need to undertake emergency works in accordance with Condition E44(b) of the Chatswood to Sydenham planning approval, contractors must notify TfNSW, the AA, the ER and the EPA (if it is required under an EPL if relevant) of the need to undertake the works. This notification should be in the form of a written email or text message to TfNSW, the AA and the ER. The requirements for notifying the EPA will be dictated in the conditions of the EPL if relevant.

As a form of mitigation, community notification is to be undertaken within two hours of the commencement of emergency works. These notifications will generally be prepared by the contractor using a small hand-completed Sydney Metro card template for distribution to the immediate surrounding community. These cards will include the following details as a minimum:

- Scope,
- Location,
- Hours,
- Duration,
- Types of equipment to be used, and
- Likely impacts.

The day after any emergency works, the applicant is to provide a written emergency works report to TfNSW. The emergency works report is to include as a minimum:

- Date, time, duration and cause of the emergency,
- Description of emergency works undertaken,
- Mitigation measures implemented to address the impacts of the emergency works, and
- Actions/Measures taken or to be taken to prevent or mitigate recurrence of the emergency. If there are no appropriate actions/measures to be taken, explanation is to be provided as to why.



ACRONYMS	
AA:	Acoustic Advisor
EPA:	Environment Protection Authority (NSW)
EPL:	Environment Protection Licence
ER:	Environmental Representative
OOH:	Out of Hours
TfNSW:	Transport for NSW

Figure 2: Emergency Work Process

4. Related Documents and References

Related Documents and References

- [SM ES-MM-101 Environment & Sustainability Management Manual](#)
- [SM ES-ST-204 Construction Environment Management Framework](#)
- [SM ES-ST-210 City & Southwest Construction Noise and Vibration Strategy](#)
- [SM ES-FT-443 City & Southwest Out of Hours Work Application Form](#)
- [SM ES-FT-419 Out of Hours Work Application Form](#)
- [SM SC-ST-202 Overarching Community Communications Strategy](#)
- [SM QM-FT-435 Integrated Management System \(IMS\) Glossary](#)
- [EPA Interim Construction Noise Guideline](#)

5. Superseded Documents

Superseded Documents

There are no documents superseded as a result of this document.

6. Document History

Version	Date of approval	Summary of change
1.0	28/3/2015	New document
2.0	14/7/2017	Edits to address DP&E comments

Appendix A: OOH Work Protocol Endorsements

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

28 March 2017

Ref:170108_OOHW Protocol

Dear Stuart

RE: Endorsement of Sydney Metro City & Southwest Out of Hours Work Protocol

Thank you for providing the following document 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).

- Sydney Metro City & Southwest City & Southwest Out of Hours Work Protocol (SM ES-PW-317/1.0)

As an approved ER for the Sydney Metro City & Southwest project, I have reviewed and provided comment on these documents. As required under A27 (d), the Acoustic Advisor has also been involved in this process and has provided separate endorsement.

I now consider this Protocol appropriate for submission to the Secretary notwithstanding that the required Specific Out of hours Works Application Forms will continue to be developed, reviewed by Acoustic Advisor, endorsed by the ER, and submitted to the Secretary for approval as required.

Yours sincerely



Jo Robertson
Environmental Representative – Sydney Metro – City and South West

**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR (Interim)**

Review of	Out of Hours Work Protocol	Document reference:	Sydney Metro City & Southwest City & Southwest Out of Hours Work Protocol Document number SM ES-PW-317, version 1.0, 28 March 2017
Prepared by:	Dave Anderson		
Date of issue:	28 March 2017		

As approved (interim) Acoustic Advisor for the Sydney Metro City & Southwest project, I have reviewed and provided comment on the Out of Hours Work Protocol, as required under A27 (d) of the project approval conditions.

I consider that this Protocol is appropriate for submission to the Secretary, noting that the required Specific Out of hours Works Application Forms will continue to be developed, including review by the Acoustic Advisor and endorsement by the ER.



Dave Anderson, interim City & Southwest Acoustic Advisor

Appendix B: OOH Work Protocol Approval from the Secretary



Contact: Jacqui McLeod
Phone: 9274 6454
Email: Jacqui.mcleod@planning.nsw.gov.au

Mr Stephen Jones
Executive Director
Safety, Sustainability and Environment
Sydney Metro, Transport for NSW
PO Box 588
North Ryde BC NSW 1670

Our ref: SSI 15_7400

Dear Mr Jones

Sydney Metro City & Southwest Chatswood to Sydenham (SSI 15_7400): Approval of the Out of Hours Work Protocol under condition E47.

Thank you for your correspondence dated 30 March 2017, submitting the Out of Hours Work Protocol in accordance with Condition E47 for the Secretary's approval. I also note further revisions to this document, responding to the Department's detailed comments and requirements. The Department has reviewed the updated Out of Hours Work Protocol (Rev 1.3 dated 4 July 2017) and considers that it satisfactorily addresses the requirements of Condition E47. Therefore, in accordance with Condition E47, I approve the Out of Hours Work Protocol (Rev 1.3 dated 4 July 2017).

Please note that under condition E47, all out of hours construction that is not subject to an EPL, that the Acoustic Advisor deems to be "High Risk", and that occurs after 9pm must be submitted to the Secretary for approval.

If you have any further queries or require clarification on this matter, please contact me on 9274 6454 or by email jacqui.mcleod@planning.nsw.gov.au.

Yours sincerely

Jacqui McLeod 14/7/17

Jacqui McLeod
Acting Director Infrastructure Management
as delegate of the Secretary

Out of Hours (OOH) Work Application Form

This Form is to be used for formal review and approval of Sydney Metro OOH work as it may affect Residential and non-Residential receivers. For City & Southwest OOH work that is within the scope of a Construction Noise and Vibration Impact Statement, the project-specific SM ES-FT-443 C&SW Out of Hours Works Application Form is to be used. For all other OOH applications, this Form can be used. This form can be used in accordance with the SM ES-PW-317 City & Southwest Out of Hours Work Protocol. This application and all applicable appendices must be submitted to TfNSW as one PDF file at least 15 business days prior to the commencement of the proposed OOH work.

1. OOH Application	
Contractor:	
Project:	
Application Title: E.g. 'Smith St service relocation works'	
Application Number: E.g. 1, 2, 3, etc.	
Application Date: Original submission date (resubmission date in parentheses if applicable)	
2. Proposed OOH Work Details	
Description of works: Including: <ul style="list-style-type: none"> • Work methodologies. • List of plant/equipment to be used (worst case scenario). • Map (and/or ECM) attached as Appendix 1 indicating location of works, plant/equipment locations and sensitive receivers (including distance to nearest sensitive receiver for noisiest plant/equipment). • Traffic Management Plan or Traffic Control Plan if applicable as Appendix 2. • Road Occupancy License and/or Road Opening Permit application or approval if applicable as Appendix 3. 	
Timing of works: Including the proposed dates and times where works are anticipated to be undertaken outside standard hours.*	
Occasions: Refer to Section 3 and state the number of occasions anticipated (worst-case).	
Justification: Explain the need for the works to be undertaken during the proposed OOH periods and justify why works cannot occur during standard hours* or extended hours as per E37 and E38.	

* Unless specified otherwise in project specific documentation, work time periods are as follows:

- **Standard Hours:** 7am to 6pm weekdays and 8am to 1pm Saturdays.
- **Daytime OOH:** 1pm to 6pm Saturdays and 8am to 6pm Sundays and Public Holidays.
- **Evening OOH:** 6pm to 10pm every day.
- **Night Time OOH:** 10pm to 7am weekday mornings and 10pm to 8am weekend and Public Holiday mornings.

3. Noise and Vibration Assessment

A quantitative noise assessment for OOH work is to be carried out in accordance with the *Interim Construction Noise Guideline* (DECC, 2009). This section allows applicants to address these requirements through the following steps:

- 1) Establishing Rating Background Levels (RBLs) and Noise Management Levels (NMLs).
- 2) Predicting the anticipated noise levels using a quantitative noise assessment:
 - a. Works that are not likely to generate high noise impacts for a significant duration may use a preliminary quantitative noise assessment (facilitated within this form). This ensures that all applications, as a minimum, include a preliminary quantitative noise assessment in accordance with the *Interim Construction Noise Guideline* (ICNG).
 - b. Works that are likely to generate high noise impacts for a significant duration may require a detailed quantitative noise assessment (i.e. Construction Noise and Vibration Impact Statement) to be undertaken.
 - c. Works that are likely to generate ground-borne or structure-borne vibration and/or noise require specialist advice and assessment.
- 3) Comparing predicted noise levels against NMLs and applying standard mitigation measures as appropriate.
- 4) Considering additional mitigation when predicted noise levels exceed NMLs.

The need for a detailed quantitative noise and vibration assessment will be considered by TfNSW, the contractor and the Acoustic Advisor or Environmental Representative (if applicable) collectively when the predicted noise levels are anticipated to:

- Exceed an RBL at a residential receiver or an NML at a non-residential receiver by more than 10dBA, **AND**
- Affect the same receiver on 10 or more occasions. An occasion is considered to be anytime works are carried out between:
 - 6pm on a weekday and the start of standard hours the next day, **OR**
 - 1pm on a Saturday and 8am on a Sunday, **OR**
 - 8am on a Sunday or public holiday and the start of standard hours the next day.

A *detailed* quantitative noise and vibration assessment should generally include:

- Derivation of RBLs for residential receivers based on noise monitoring at representative locations and/or derivation of NMLs for non-residential receivers based on sensitivities.
- Detailed prediction of noise levels for daytime, evening and night time OOH periods (as applicable) in accordance with Section 4.5 of the ICNG (including a clear outline of timing, duration and predicted noise levels during each OOH period).
- For Night Time OOH Period works, a prediction of maximum noise levels and a review of potential sleep disturbance impacts in accordance with Section 4.3 of the ICNG.
- Detailed predictions of vibration levels for sensitive receivers.

Please complete Steps 1 to 4 below.

<p>Step 1: RBLs/NMLs</p>	<p>If RBLs for residential receivers or NMLs for non-residential receivers have already been established (e.g. in an Environmental Impact Statement, Review of Environmental Factors, detailed quantitative noise assessment or Construction Noise and Vibration Impact Statement for other work activities), enter into Table 3 and attach the supporting evidence as Appendix 4.</p> <p>If no RBLs/NMLs have been established, use Table 1 to estimate RBLs/NMLs and enter into Table 3.</p>
<p>Step 2: Predicted Anticipated Noise Levels</p>	<p>If predicted anticipated noise levels have already been established (e.g. in an Environmental Impact Statement, Review of Environmental Factors, detailed quantitative noise assessment), enter the predicted anticipated noise levels into Table 3 and attach the supporting evidence as Appendix 4.</p> <p>If predicted anticipated noise levels have not already been established, use Table 2 to estimate anticipated noise aspects for the noisiest plant/equipment and enter into Table 3. In Table 3, use these values to calculate the anticipated predicted noise levels.</p>

<p>Step 3: Exceedances and Mitigation Measures</p>	<p>Compare the anticipated predicted noise levels to the applicable RBLs/NMLs, calculate the exceedances and enter into Table 3. Provide a description of the mitigation measures that are planned to be implemented in order to mitigate the noise (and vibration if relevant) impacts.</p> <p>Standard Mitigation Measures:</p>
<p>Step 4: Consideration of Additional Mitigation Measures</p>	<p>Use Table 4 and the exceedances in Table 3 to determine the applicable Additional Mitigation Measures for consideration. Use Table 6 to indicate which of these measures are applicable, which will be implemented and provide justification for any applicable measures that will not be implemented.</p>

Table 1: Estimated RBLs for Residential Receivers and NMLs for Non-Residential Receivers

Sensitive Receiver Category	Estimated RBLs (dBA)		
Residential	Daytime OOH	Evening OOH	Night Time OOH
Urban (e.g. city hubs, near busy roads, near industrial activity)	55	50	45
Suburban	45	40	35
Quiet, rural or isolated	40	35	30
Non-Residential	ICNG NMLs (dBA)		
Industrial facilities	75 (only applicable when in use)		
Offices or retail	70 (only applicable when in use)		
Health and educational facilities	55 (only applicable when in use)		

Table 2: Noise Aspects for Predicted Noise Levels

Noise Aspect	If anticipated predicted noise levels have not already been established, select the most applicable value for each noise aspect below and enter these values into Table 3.	dBA Value
1. Estimated predicted plant /equipment noise level at 10 metres Including +5 dBA penalty for annoying activities as per ICNG (refer to Appendix B for other predicted noise level data)	Hand-held tamper, impact sheet piling rig	105
	Rail grinder, ballast regulator, concrete/rock saw, excavator hammer, jackhammer, rock-breaker	95
	Mainline tamping machine, pin puller, dynamic track stabiliser, large bulldozer, chainsaw, large excavator, pour fill/ballast, water cart, super-sucker, front-end loader, vibratory or bored piling	85
	Asphalt paver, backhoe, small bulldozer, mulcher, concrete pump/mixer/agitator, tower/mobile crane, small excavator, grader, forklift, welder, wheeled-loader, Standard Penetration Testing	80
	Truck, spreader, whacker packer, cherry-picker, fence post driver, electric drill, drill rig	75
	Lighting tower, small generator	70
	Light vehicle, hand-tools (no impact), small cement mixer	65
2. Noise source character	Non-continuous use (plant/equipment to operate for less than half the time)	- 5
3. Local screening	Existing screening between site and receiver (buildings, cuttings, canopies, etc.)	- 5
	Temporary screening to be implemented near work site	- 10
	Acoustic shed or enclosure	- 25
4. Distance attenuation	< 10 metres	0
	10 to 20 metres	- 5
	20 to 35 metres	- 10
	35 to 60 metres	- 15
	60 to 100 metres	- 20
	100 to 180 metres	- 25
	180 to 350 metres	- 30
	350 to 1,000 metres	- 40

Table 3: Predicted Noise Levels and Exceedances of RBLs or NMLs (dBA)

Period (only complete as applicable for each period)	Noisiest Plant /Equipment (state the noisiest plant/equipment to be used during each applicable OOH period)	Receiver Type (state 'Res' or 'Non-Res' as applicable for closest receiver to noisiest plant/equipment)	Enter the most applicable values from Table 2, then add to determine the Predicted Noise Level				Predicted Noise Level (1 + 2 + 3 + 4)	RBL (for Res)	NML (for Non-Res)	Exceedance (Predicted Noise Level minus RBL for Res or NML for Non-Res)
			1. Plant/ Equipment Noise Level	2. Noise Source Character	3. Local Screening	4. Distance Attenuation				
Daytime OOH										
Evening OOH										
Night Time OOH										

Table 4: Additional Mitigation Measures (AMM) requiring Consideration for Implementation

OOH Period	Additional Mitigation Measures (AMM)* that must be considered for implementation (apply the exceedances from Table 3 to the two OOH period categories below as applicable)			
	<= 10 dBA Exceedance	10 to <= 20 dBA Exceedance	20 to <= 30 dBA Exceedance	> 30 dBA Exceedance ^
Daytime OOH Period	–	LB	M, LB	M, IB, LB, PC, RO, SN
Evening and Night Time OOH Periods	–	M, LB	M, IB, LB, PC, SN, RO	M, IB, LB, PC, SN, RO, AA*

* AA is only applicable to Night Time OOH periods.

^ Where exceedances are greater than 45 dBA under the City & Southwest Chatswood to Sydenham planning approval, Conditions E41 and E42 mandate that applicable AMMs must be offered in certain circumstances.

Table 5: List of Additional Mitigation Measures (AMM)

AMM Abbrev.	AMM	AMM Descriptions and Guidance
LB	Letterbox-drop (generic to the project)	A newsletter is produced and distributed to the local community via letterbox-drop and the project mailing list. These newsletters provide an overview of current and upcoming works across the project and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on the community. Content and newsletter length is determined on a project-by-project basis. Most projects distribute notifications on a monthly basis. The geographic extent of letterbox-drops is generally centred on the immediate surrounding community and rarely extends beyond 100 metres from the works site.
M	Monitoring	Where it has been identified that specific construction activities are likely to exceed the relevant Rating Background Levels (RBL) and/or Noise Management Levels (NMLs), monitoring may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver have been identified). Monitoring can be in the form of either unattended logging or operator attended surveys. The purpose of monitoring is to inform the relevant personnel when the RBL/NML has been exceeded so that additional management measures may be implemented.
IB	Individual Briefings	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Communications representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
PC	Phone calls (and/or emails)	Phone calls and/or emails detailing relevant information would be made to identified/affected stakeholders within seven days of proposed work. Phone calls and/or emails provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs etc.
SN	Specific Notifications (specific to the OOH work)	Specific notifications would be letterbox-dropped or hand-distributed to identified stakeholders no later than seven days ahead of construction activities that are likely to exceed the RBLs/NMLs. This form of communication is used to support periodic notifications or to advertise unscheduled works. The geographic extent of specific notifications is generally centred on the immediate surrounding community and rarely extends beyond 100 metres from the works site.
RO	Respite Offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise and/or vibration impacts respite during OOH periods. Respite offers are offers made to affected receivers to provide a period of either no or limited noise impacts. This can be in the form of stopping or limiting works onsite or offering affected receivers dinner/movie vouchers. The first priority is to implement a period of no or limited noise impacts. If this cannot be achieved, dinner/movie vouchers may be offered on a case-by-case basis. Respite offers must be made in certain circumstances in accordance with Condition E38 of the Chatswood to Sydenham planning approval.
AA	Alternative Accommodation (residential only)	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts during night time OOH periods. Alternative accommodation will be considered on a case-by-case basis.

Table 6: Consideration of Additional Mitigation Measures

Additional Mitigation Measures	Applicable for Consideration? YES or NO (refer to Table 4)	To be Implemented? YES or NO	Justification (if applicable for consideration, but will not be implemented)
LB			
M			
IB			
PC			
SN			
RO			
AA			

4. Community Consultation

What community consultation has been undertaken already?

What community consultation is planned to be undertaken?

If drafted already, attach applicable Community Notification as Appendix 5.



(Uncontrolled when printed)

5. Contractor's Signature

<p>Contractor's Identification of Risk Level: If the work is subject to the Chatswood to Sydenham planning approval, use Section 3.1.2.3 of the Chatswood to Sydenham Out of Hours Work Protocol to identify a Risk Rating.</p>	<p>Circle: LOW or HIGH</p>
<p>Contractor's Signature:</p>	
<p>Name:</p>	
<p>Title:</p>	
<p>Contact Number:</p>	
<p>Date:</p>	

6. Contractor's Contact Details

Contractor Personnel	Name	Mobile
Manager Environment:		
Manager Communications:		
Contractor's Representative:		
Contractor's 24hr contact person:		



City & Southwest Determination Page (to be left blank by contractors)

	Step 1 – Endorsement from TfNSW Principal Manager Project Communications Contractor’s Communications Manager	Step 2 – Endorsement from Acoustic Advisor	Step 3 – Approval from Environmental Representative OR Secretary of Department of Planning & Environment
Risk Level:	N/A	<i>Circle: LOW or HIGH If works after 9pm are considered HIGH, TfNSW submits application to the Secretary of Department of Planning & Environment for approval.</i>	N/A
Signature:			
Name:			
Date:			
Comments: (including Acoustic Advisor Risk Level comments)			
Conditions:			



Generic Determination Page (to be left blank by contractors)

	Step 1 – TfNSW Principal Manager Project Communications	Step 2 – Acoustic Advisor (may be optional depending on planning approval or contract requirements)	Step 3 – Environmental Representative (may be optional depending on planning approval or contract requirements)	Step 4 – TfNSW Principal Manager, Sustainability, Environment & Planning (only required if not approved already)
Action:	Endorsement	Circle: Endorsement OR Approval	Circle: Endorsement OR Approval	Approval
Signature:				
Name:				
Date:				
Comments:				
Conditions:				

Appendix 1: Map (and/or ECM)

Appendix 2: Traffic Management Plan or Traffic Control Plan

(if applicable)

Appendix 3: Road Occupancy Licence and/or Road Opening Permit

(if applicable)

Appendix 4: Supporting Evidence for Noise and Vibration Impacts

(if applicable)

Appendix 5: Community Notification

(if applicable)

Appendix C – Summary of Predicted Noise Levels (source: CNVIS)

Clearing and Grubbing for site establishment		SCND1	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R-527_A	NCA06_Commercial	19	-51	-	-	-	-	-	-	-	-	-	-	-
R-528_A	NCA06_Commercial	20	-50	-	-	-	-	-	-	-	-	-	-	-
R-529_A	NCA06_Commercial	34	-36	-	-	-	-	-	-	-	-	-	-	-
R-530_A	NCA06_Commercial	15	-55	-	-	-	-	-	-	-	-	-	-	-

Overhead Wiring Footings, Structures and Wiring		SCN02	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
Table D.2	Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
	R.529_A	NCA06_Commercial	25	-45	-45	-45	-45	-	-	-	-	-	-	-	-
	R.530_A	NCA06_Commercial	7	-63	-63	-63	-63	-	-	-	-	-	-	-	-

Table D.3		Drainage System Installation	SCN03	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	28	-42	-42	-42	-42	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	8	-62	-62	-62	-62	-	-	-	-	-	-	-	-	

Table D.4		Track Slew or Switch	SCND4	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	31	-39	-39	-39	-39	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	

Table D.5		Removal of existing Tracks	SCNDS	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	32	-38	-38	-38	-38	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	

Table D.6: Comparison to NML and Mitigation/Management (AMMM) for NV Electrical Works. Columns include Name, Description, HV Electrical Works, SCND6 Predicted Noise Level, Comparison to NML (Day Standard, Day Non-Standard, Evening, Night), If NML Exceeded - Comparison to RBL (Day Standard, Day Non-Standard, Evening, Night), and Mitigation / Management (AMMM) (Day Standard, Day Non-Standard, Evening, Night).

Table D.6		HV Electrical Works	SCND6	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	29	-41	-41	-41	-41	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	10	-60	-60	-60	-60	-	-	-	-	-	-	-	-	

Construction of Combined Services Route		SCN07	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Table D.7	(CSR)	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
Name	Description	27	-43	-43	-43	-43	-	-	-	-	-	-	-	-
R.529_A	NCA06_Commercial	8	-62	-62	-62	-62	-	-	-	-	-	-	-	-
R.530_A	NCA06_Commercial													

Table D.8		Under Line Crossing (ULX) Works	SCN08	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	28	-42	-42	-42	-42	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	9	-61	-61	-61	-61	-	-	-	-	-	-	-	-	

Relocation and Termination of Utilities in Nelson St Bridge		SCND9	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)				
Table D.9	Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
	R.529_A	NCA06_Commercial	35	-35	-35	-35	-35	-	-	-	-	-	-	-	-
	R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-

Table D.10		Nelson St Bridge Demolition	SCN10	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	35	-35	-35	-35	-35	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-	

Table D.11		Mowbray Rd Bridge Demolition of break Wall: OOHW	SCN11	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	37	-33		-33	-33		-	-	-		-	-	-	
R.530_A	NCA06_Commercial	17	-53		-53	-53		-	-	-		-	-	-	

Mowbray Rd Bridge Construction of base slab and deflection wall		SCN12	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night
R.529_A	NCA06_Commercial	37	-33		-33	-33	-	-	-	-	-	-	-	-
R.530_A	NCA06_Commercial	17	-53		-53	-53	-	-	-	-	-	-	-	-

Table D.13		Mowbray Rd Bridge Install of Precast piles - Standard Hours	SCN13	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	72	-48	-	-	-	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	72	-68	-	-	-	-	-	-	-	-	-	-	-	

Table D.14		Mowbray Rd Bridge Install of Crash Barrier and Footpath - OOHW	SCN14	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	72	-48	-48	-48	-48	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	71	-68	-68	-68	-68	-	-	-	-	-	-	-	-	

Table D.15		Mowbray Rd Bridge Footpath alterations / Road Works - Standard Hours	SCN15	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	23	-47	-	-	-	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	41	-66	-	-	-	-	-	-	-	-	-	-	-	

Table D.16		Rail Corridor Fence / Noise Walls Installation	SCN16	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	29	-41	-41	-41	-41	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	10	-60	-60	-60	-60	-	-	-	-	-	-	-	-	

Table D.17		Orchard Rd Ancillary Facility	SCN17	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	75	-55	-55	-55	-55	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	71	-71	-71	-71	-71	-	-	-	-	-	-	-	-	

Table D.18		Brand St Ancillary Facility	SCN18	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	17	-53		-53	-53									
R.530_A	NCA06_Commercial	0	-70		-70	-70									

Table D.19		Brand St Laydown Area	SCN19	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	7	-63	-63	-63	-63	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	0	-70	-70	-70	-70	-	-	-	-	-	-	-	-	

Table D.20		Hampden Road Laydown Area	SCN20	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	17	-53		-53	-53	-53	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	51	-65		-65	-65	-65	-	-	-	-	-	-	-	

Table D.21		Elizabeth St Ancillary Facility	SCN21	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	18	-52	-52	-52	-52	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	21	-68	-68	-68	-68	-	-	-	-	-	-	-	-	

Table D.22		Elizabeth St Laydown Area	SCN22	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	14	-56	-56	-56	-56	-	-	-	-	-	-	-	-	

Table O.23		Cleland Rd Ancillary Facility	SCN23	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	15	-55	-55	-55	-55	-	-	-	-	-	-	-	-	

Table D.24		Citland Rd Laydown Area	SCN24	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	19	-51	-51	-51	-51	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	16	-54	-54	-54	-54	-	-	-	-	-	-	-	-	

Table D.25		Cleland Rd Stockpiling	SCN25	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	20	-50	-50	-50	-50	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	18	-52	-52	-52	-52	-	-	-	-	-	-	-	-	

Table D.26		Lambos Rd Laydown Area	SCN26	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	13	-57	-57	-57	-57	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	23	-47	-47	-47	-47	-	-	-	-	-	-	-	-	

Table D.27		St Leonards Yard Laydown Area	SCN27	Comparison to NML				If NML Exceeded - Comparison to RBL				Mitigation / Management (AMMM)			
Name	Description	Predicted Noise Level	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	Day Standard	Day Non-Standard	Evening	Night	
R.529_A	NCA06_Commercial	25	-45	-45	-45	-45	-	-	-	-	-	-	-	-	
R.530_A	NCA06_Commercial	30	-40	-40	-40	-40	-	-	-	-	-	-	-	-	

Appendix D – Assessment Scenarios

Schedule	Timing Details - OOHW?	Area of Works	Activity	Assessment Scenario ID	Potential (AB / GB / WB) Impacts	Equipment	LW Item	Quantity (Q)	Penalty (P)	Duty Factor (DF)	LW Modified (C1 / P1 / D1)	Spectral Data - dBA per 1/1 Octave - Frequency in Hertz (Hz)									
												31.5	63	125	250	500	1000	2000	4000	8000	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Ancillary Facility	SCN 23-A	AB Noise	Generator	99.0	1.0	0.0	100%	99.0	64.9	87.1	91.4	87.4	92.7	91.2	92.2	87.8	78.6	
				SCN 23-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 23-C	AB Noise	Light Vehicle	106.0	2.0	0.0	75%	107.8	76.9	84.9	93.0	95.4	100.7	103.4	101.8	96.1	90.8	
				SCN 23-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Ancillary Facility	↑ SCN 23	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	108.0	-	-	-	108.8	77.3	89.3	96.0	97.1	101.8	104.0	102.8	97.0	91.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Laydown Area	SCN 24-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 24-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 24-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 24-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Laydown Area	↑ SCN 24	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Stockpiling	SCN 25-A	AB Noise	16t Excavator	105.0	1.0	0.0	100%	105.0	62.5	83.2	91.9	94.5	99.8	100.8	96.1	90.8	83.6	
				SCN 25-B	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 25-C	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 25-D	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 25-E	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Cleland Road	Cleland Rd Stockpiling	↑ SCN 25	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	110.9	-	-	-	108.9	66.3	87.6	94.9	99.1	103.8	103.8	101.7	93.8	87.5	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Lambs Rd + Francis Street	Lambs Rd Laydown Area	SCN 26-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 26-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 26-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 26-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off Lambs Rd + Francis Street	Lambs Rd Laydown Area	↑ SCN 26	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off St Leonards Station	St Leonards Yard Laydown Area	SCN 27-A	AB Noise	Heavy Vehicle	107.0	1.0	0.0	50%	104.0	59.7	85.1	89.4	95.8	99.1	96.4	98.4	87.4	80.6	
				SCN 27-B	AB Noise	Hand Tool	102.0	1.0	0.0	50%	99.0	60.1	74.9	87.6	90.3	91.8	93.7	92.8	85.9	78.2	
				SCN 27-C	AB Noise	Bobcat	104.0	1.0	0.0	50%	101.0	48.7	70.9	80.0	86.5	96.9	97.1	92.3	84.1	82.0	
				SCN 27-D	AB Noise	Lighting Tower	80.0	2.0	0.0	100%	83.0	56.7	65.9	72.0	74.5	76.9	76.1	77.3	68.1	62.0	
VARIOUS	Standard Construction Hours + OOHW	In rail corridor, off St Leonards Station	St Leonards Yard Laydown Area	↑ SCN 27	AB Noise	↑ TOTAL EMISSION (LW, 15minute in dBA)	109.6	-	-	-	106.6	64.0	85.7	91.9	97.3	101.6	100.7	100.2	90.8	85.3	

Appendix E – Potentially Sensitive Receptors

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.001	NCA03_Residential	331644.72	6259245.97	102
R.002	NCA03_Residential	331599.74	6259228.51	101
R.003	NCA03_Residential	331654.12	6259207.94	100
R.004	NCA03_Residential	331559.12	6259204.51	101
R.005	NCA03_Commercial	331495.91	6259196.20	104
R.006	NCA03_Residential	331634.95	6259191.33	98
R.007	NCA03_Residential	331658.52	6259187.50	98
R.008	NCA03_Residential	331601.91	6259179.71	99
R.009	NCA03_Commercial	331483.78	6259178.30	104
R.010	NCA03_Residential	331656.70	6259165.07	97
R.011	NCA03_Residential	331636.00	6259151.18	96
R.012	NCA03_Residential	331602.99	6259139.60	99
R.013	NCA03_Residential	331582.34	6259138.14	100
R.014	NCA03_Residential	331720.83	6259119.06	94
R.015	NCA03_Commercial	331515.71	6259115.61	98
R.016	NCA03_Residential	331640.94	6259101.11	94
R.017	NCA03_Commercial	331454.73	6259092.41	100
R.018	NCA03_Residential	331690.32	6259088.03	92
R.019	NCA03_Commercial	331606.85	6259087.61	97
R.020	NCA03_Commercial	331358.49	6259083.51	104
R.021	NCA03_Residential	331674.51	6259082.69	92
R.022	NCA03_Residential	331647.99	6259072.91	92
R.023	NCA03_Residential	331708.52	6259071.40	92
R.024	NCA03_Commercial	331533.54	6259070.19	96
R.025	NCA03_Commercial	331507.14	6259060.67	97
R.026	NCA03_Residential	331647.38	6259047.11	93
R.027	NCA03_Commercial	331343.96	6259043.22	104
R.028	NCA03_Residential	331585.63	6259042.83	100
R.029	NCA03_Commercial	331533.78	6259036.41	97
R.030	NCA03_Commercial	331757.71	6259028.11	90
R.031	NCA03_Commercial	331469.22	6259023.95	99
R.032	NCA03_Commercial	331715.90	6259011.59	92
R.033	NCA03_Commercial	331431.76	6259010.89	101
R.034	NCA03_Commercial	331327.36	6259004.70	106
R.035	NCA03_Commercial	331537.34	6258992.47	98
R.036	NCA03_Commercial	331406.21	6258990.76	103
R.037	NCA03_Commercial	331645.14	6258985.60	96
R.038	NCA03_Commercial	331592.73	6258976.43	100
R.039	NCA03_Commercial	331896.52	6258973.09	88
R.040	NCA03_Commercial	331387.53	6258971.90	104
R.041	NCA03_Commercial	331503.89	6258965.85	101
R.042	NCA03_Commercial	331786.57	6258962.50	90
R.043	NCA03_Commercial	331866.66	6258960.29	88
R.044	NCA03_Commercial	331533.01	6258940.84	101
R.045	NCA03_Commercial	331773.23	6258935.76	92
R.046	NCA03_Commercial	331821.30	6258930.38	90
R.047	NCA03_Commercial	331312.16	6258930.23	108

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.048	NCA03_Commercial	331695.13	6258924.53	95
R.049	NCA03_Commercial	331587.35	6258920.72	100
R.050	NCA03_Commercial	331466.04	6258918.36	104
R.051	NCA03_Commercial	331847.09	6258916.54	89
R.052	NCA03_Commercial	331646.40	6258908.67	98
R.053	NCA03_Commercial	331427.99	6258904.46	106
R.054	NCA03_Commercial	331701.28	6258902.45	95
R.055	NCA03_Commercial	331736.56	6258898.00	94
R.056	NCA03_Commercial	331675.29	6258892.18	97
R.057	NCA03_Commercial	331588.30	6258881.16	101
R.058	NCA03_Commercial	331373.52	6258881.01	108
R.059	NCA03_Commercial	331540.75	6258862.45	104
R.060	NCA03_Commercial	331868.10	6258861.83	88
R.061	NCA03_Commercial	331734.25	6258858.25	94
R.062	NCA03_Commercial	331528.50	6258857.31	104
R.063	NCA03_Commercial	331660.80	6258851.98	99
R.064	NCA03_Commercial	331754.98	6258851.07	93
R.065	NCA03_Commercial	331497.52	6258845.22	104
R.066	NCA03_Commercial	331424.53	6258838.85	107
R.067	NCA03_Commercial	331967.16	6258832.36	88
R.068	NCA03_Commercial	331641.32	6258828.65	100
R.069	NCA03_Commercial	331572.06	6258825.33	102
R.070	NCA03_Commercial	331718.19	6258821.53	95
R.071	NCA03_Commercial	331413.76	6258812.87	107
R.072	NCA03_Commercial	331403.75	6258809.18	108
R.073	NCA03_Commercial	331528.33	6258808.82	103
R.074	NCA03_Commercial	331386.85	6258804.38	108
R.075	NCA03_Commercial	331898.30	6258802.73	88
R.076	NCA03_Commercial	331674.98	6258799.42	97
R.077	NCA03_Commercial	331596.01	6258789.40	100
R.078	NCA03_Commercial	331648.51	6258789.04	98
R.079	NCA03_Commercial	331692.47	6258788.90	96
R.080	NCA03_Commercial	331582.63	6258781.57	100
R.081	NCA03_Commercial	331830.23	6258776.77	90
R.082	NCA03_Commercial	331463.81	6258771.73	104
R.083	NCA03_Commercial	331552.91	6258766.25	100
R.084	NCA03_Commercial	331415.20	6258762.38	106
R.085	NCA03_Commercial	331523.10	6258757.30	100
R.086	NCA03_Commercial	331507.60	6258751.00	100
R.087	NCA03_Commercial	331470.12	6258738.04	103
R.088	NCA03_Commercial	331666.32	6258734.68	95
R.089	NCA03_Commercial	331709.50	6258726.57	94
R.090	NCA03_Commercial	331582.06	6258721.42	98
R.091	NCA03_Commercial	331562.57	6258717.42	98
R.092	NCA03_Commercial	331423.17	6258716.70	106
R.093	NCA04_Commercial	331809.33	6258716.20	90
R.094	NCA04_Commercial	331775.54	6258703.98	91

Table E.1 Location ID	Description (NCA_Receptor Type)	GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
		Easting	Northing	
R.095	NCA01_Commercial	331720.48	6258702.01	93
R.096	NCA03_Commercial	331581.25	6258699.32	98
R.097	NCA03_Commercial	331493.27	6258690.44	102
R.098	NCA01_Commercial	331531.60	6258687.45	100
R.099	NCA03_Commercial	331469.67	6258711.33	103
R.100	NCA02_Commercial	331445.17	6258676.95	105
R.101	NCA03_Commercial	331456.13	6258705.92	104
R.102	NCA01_Residential	331730.63	6258667.45	92
R.103	NCA02_Commercial	331450.64	6258664.22	104
R.104	NCA01_Commercial	331545.59	6258662.97	99
R.105	NCA01_Commercial	331517.61	6258650.98	101
R.106	NCA02_Commercial	331457.80	6258647.48	104
R.107	NCA01_Educational	331739.97	6258642.97	92
R.108	NCA01_Residential	331589.30	6258638.02	97
R.109	NCA04_Residential	331780.12	6258635.48	91
R.110	NCA01_Commercial	331462.66	6258629.00	103
R.111	NCA01_Residential	331755.07	6258621.35	92
R.112	NCA01_Residential	331569.19	6258616.97	98
R.113	NCA01_Residential	331519.17	6258601.32	100
R.114	NCA01_Residential	331590.80	6258601.10	96
R.115	NCA01_Residential	331476.71	6258600.56	102
R.116	NCA01_Residential	331551.86	6258599.28	98
R.117	NCA01_Recreational	331638.65	6258595.71	94
R.118	NCA02_Commercial	331417.04	6258589.24	103
R.119	NCA01_Residential	331485.57	6258576.55	101
R.120	NCA02_Residential	331278.01	6258572.03	95
R.121	NCA04_Residential	331770.88	6258563.76	93
R.122	NCA01_Residential	331592.85	6258557.68	96
R.123	NCA01_Residential	331495.48	6258557.64	100
R.124	NCA01_Recreational	331634.66	6258548.49	94
R.125	NCA01_Recreational	331695.82	6258544.37	93
R.126	NCA01_Residential	331543.83	6258544.34	98
R.127	NCA01_Recreational	331634.84	6258530.73	94
R.128	NCA01_Residential	331584.56	6258527.40	96
R.129	NCA04_Residential	331809.21	6258504.14	95
R.130	NCA04_Residential	331865.42	6258503.80	94
R.131	NCA04_Residential	331771.53	6258501.29	94
R.132	NCA01_Residential	331499.02	6258497.55	98
R.133	NCA01_Residential	331525.93	6258486.46	96
R.134	NCA01_Recreational	331590.78	6258475.52	96
R.135	NCA02_Residential	331461.22	6258457.11	96
R.136	NCA01_Residential	331535.48	6258457.02	96
R.137	NCA01_Residential	331715.56	6258443.03	96
R.138	NCA01_Residential	331537.04	6258442.07	96
R.139	NCA02_Residential	331324.35	6258440.28	88
R.140	NCA01_Residential	331539.22	6258429.29	96
R.141	NCA01_Residential	331678.46	6258414.74	97

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.142	NCA01_Residential	331540.46	6258414.33	96
R.143	NCA01_Residential	331704.15	6258398.93	98
R.144	NCA01_Residential	331642.28	6258390.32	97
R.145	NCA01_Residential	331538.59	6258379.12	97
R.146	NCA01_Residential	331703.90	6258377.92	99
R.147	NCA01_Residential	331685.79	6258367.65	99
R.148	NCA01_Commercial	331594.26	6258361.09	97
R.149	NCA01_Residential	331656.33	6258356.57	99
R.150	NCA01_Residential	331727.15	6258342.78	101
R.151	NCA01_Residential	331704.99	6258334.94	101
R.152	NCA01_Residential	331642.28	6258330.50	99
R.153	NCA01_Residential	331673.09	6258323.86	101
R.154	NCA01_Residential	331712.01	6258314.40	102
R.155	NCA04_Residential	331812.10	6258307.23	105
R.156	NCA01_Residential	331687.69	6258304.94	102
R.157	NCA01_Residential	331599.87	6258301.85	99
R.158	NCA01_Residential	331674.98	6258299.26	101
R.159	NCA01_Residential	331660.66	6258294.40	101
R.160	NCA02_Residential	331469.34	6258286.02	100
R.161	NCA01_Residential	331573.16	6258285.57	99
R.162	NCA05_Residential	332035.65	6258279.61	104
R.163	NCA01_Residential	331601.36	6258269.11	100
R.164	NCA01_Residential	331527.58	6258267.33	100
R.165	NCA01_Residential	331645.82	6258267.03	100
R.166	NCA02_Residential	331277.34	6258261.52	104
R.167	NCA01_Residential	331688.66	6258259.21	103
R.168	NCA01_Residential	331546.35	6258247.75	100
R.169	NCA01_Commercial	331522.35	6258238.02	100
R.170	NCA01_Residential	331649.22	6258226.31	101
R.171	NCA01_Residential	331690.13	6258224.30	104
R.172	NCA01_Residential	331676.07	6258219.60	103
R.173	NCA01_Commercial	331520.62	6258218.83	100
R.174	NCA01_Residential	331662.47	6258213.22	103
R.175	NCA01_Residential	331608.98	6258205.77	102
R.176	NCA01_Residential	331517.87	6258196.66	101
R.177	NCA01_Residential	331673.74	6258192.79	104
R.178	NCA05_Mixed Use	331747.75	6258110.89	106
R.179	NCA01_Residential	331658.41	6258179.98	102
R.180	NCA01_Residential	331560.87	6258173.24	101
R.181	NCA01_Residential	331670.89	6258171.66	104
R.182	NCA01_Residential	331547.37	6258167.70	101
R.183	NCA01_Commercial	331517.60	6258165.97	102
R.184	NCA01_Residential	331533.53	6258160.78	102
R.185	NCA01_Residential	331669.46	6258159.38	104
R.186	NCA01_Residential	331668.32	6258147.67	104
R.187	NCA05_Residential	331672.60	6258133.67	104
R.188	NCA02_Mixed Use	331450.25	6258079.47	104

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.189	NCA02_Residential	331340.24	6258115.87	106
R.190	NCA05_Residential	331717.51	6258130.24	106
R.191	NCA04_Residential	331850.00	6258097.81	97
R.192	NCA04_Residential	332117.22	6258065.80	84
R.193	NCA05_Residential	331712.47	6258062.88	106
R.194	NCA05_Residential	331764.81	6258125.64	106
R.195	NCA05_Residential	331695.60	6258049.39	104
R.196	NCA05_Residential	331721.55	6258037.97	106
R.197	NCA05_Residential	331715.84	6258025.26	105
R.198	NCA05_Residential	331652.01	6258020.79	104
R.199	NCA01_Residential	331759.95	6258011.51	104
R.200	NCA05_Residential	331633.73	6258011.15	104
R.201	NCA01_Residential	331743.61	6258001.39	103
R.202	NCA05_Residential	331709.10	6257999.31	101
R.203	NCA04_Residential	331885.98	6257989.24	100
R.204	NCA05_Industrial	331600.49	6257986.22	104
R.205	NCA01_Residential	331755.10	6257983.08	101
R.206	NCA01_Residential	331744.84	6257976.33	100
R.207	NCA01_Residential	331736.92	6257971.52	100
R.208	NCA05_Residential	331669.95	6257970.60	102
R.209	NCA01_Residential	331729.65	6257966.72	99
R.210	NCA01_Residential	331771.85	6257957.37	98
R.211	NCA01_Residential	331679.59	6257950.66	100
R.212	NCA01_Residential	331728.87	6257949.97	96
R.213	NCA05_Industrial	331622.09	6257945.34	102
R.214	NCA01_Residential	331813.16	6257942.85	96
R.215	NCA01_Residential	331802.80	6257936.81	96
R.216	NCA01_Residential	331688.90	6257932.05	97
R.217	NCA01_Residential	331792.60	6257930.07	95
R.218	NCA05_Industrial	331583.54	6257925.40	104
R.219	NCA01_Industrial	331633.73	6257925.40	100
R.220	NCA01_Residential	331782.58	6257923.33	93
R.221	NCA01_Residential	331823.72	6257921.36	94
R.222	NCA01_Residential	331772.21	6257917.11	93
R.223	NCA05_Residential	331329.65	6257916.59	104
R.224	NCA01_Residential	331811.83	6257914.08	93
R.225	NCA05_Place of Worship	331461.40	6257913.94	104
R.226	NCA01_Residential	331747.50	6257912.79	92
R.227	NCA01_Residential	331642.70	6257911.11	98
R.228	NCA01_Residential	331762.36	6257910.71	92
R.229	NCA01_Residential	331799.64	6257906.35	92
R.230	NCA01_Residential	331774.67	6257890.75	90
R.231	NCA01_Residential	331713.49	6257886.51	92
R.232	NCA01_Residential	331768.71	6257872.94	88
R.233	NCA01_Residential	331855.55	6257870.82	90
R.234	NCA04_Residential	331937.37	6257867.19	98
R.235	NCA01_Residential	331843.34	6257863.26	88

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.236	NCA04_Residential	332084.42	6257858.56	93
R.237	NCA01_Residential	331831.13	6257855.70	87
R.238	NCA01_Residential	331869.21	6257854.17	90
R.239	NCA01_Residential	331733.77	6257849.62	88
R.240	NCA01_Residential	331818.91	6257848.14	86
R.241	NCA01_Residential	331858.60	6257847.47	89
R.242	NCA01_Residential	331785.57	6257843.48	86
R.243	NCA01_Residential	331677.26	6257843.31	92
R.244	NCA01_Residential	331849.66	6257841.88	87
R.245	NCA01_Residential	331805.53	6257839.80	85
R.246	NCA01_Residential	331839.23	6257835.18	86
R.247	NCA01_Residential	331829.54	6257828.47	85
R.248	NCA01_Residential	331820.23	6257822.33	84
R.249	NCA01_Residential	331929.02	6257815.80	92
R.250	NCA01_Residential	331754.04	6257815.06	87
R.251	NCA01_Residential	331811.29	6257805.01	84
R.252	NCA01_Residential	331900.82	6257804.42	89
R.253	NCA01_Residential	331705.18	6257799.77	90
R.254	NCA01_Residential	331890.67	6257796.84	88
R.255	NCA01_Residential	331667.63	6257793.12	93
R.256	NCA01_Residential	331882.33	6257789.57	86
R.257	NCA01_Residential	331773.60	6257785.12	86
R.258	NCA01_Residential	331908.40	6257782.19	88
R.259	NCA01_Residential	331873.08	6257781.84	85
R.260	NCA01_Residential	331781.08	6257774.75	85
R.261	NCA01_Residential	331863.68	6257773.95	83
R.262	NCA01_Residential	331725.12	6257769.52	90
R.263	NCA01_Residential	331888.80	6257767.65	84
R.264	NCA01_Residential	331855.20	6257766.98	82
R.265	NCA01_Residential	331840.76	6257765.61	82
R.266	NCA01_Residential	331788.31	6257765.10	85
R.267	NCA04_Residential	332070.98	6257759.91	85
R.268	NCA01_Residential	331686.90	6257759.55	93
R.269	NCA01_Residential	331968.20	6257756.70	88
R.270	NCA01_Residential	331795.55	6257754.97	84
R.271	NCA02_Residential	331564.72	6257755.15	102
R.272	NCA01_Residential	331805.92	6257740.02	83
R.273	NCA01_Residential	331745.73	6257738.28	89
R.274	NCA01_Residential	331887.32	6257731.14	80
R.275	NCA02_Residential	331643.46	6257729.23	95
R.276	NCA01_Residential	331911.07	6257709.17	80
R.277	NCA01_Residential	331769.33	6257703.82	86
R.278	NCA01_Residential	331767.14	6257682.99	85
R.279	NCA01_Residential	331921.46	6257697.60	79
R.280	NCA01_Residential	331929.17	6257688.40	78
R.281	NCA01_Residential	331809.70	6257697.04	82
R.282	NCA01_Residential	331826.49	6257679.79	81

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.283	NCA01_Residential	331937.78	6257678.60	78
R.284	NCA01_Residential	331945.80	6257670.29	77
R.285	NCA01_Mixed Use	331843.44	6257665.16	80
R.286	NCA01_Residential	331955.00	6257663.16	76
R.287	NCA01_Mixed Use	331852.75	6257656.52	80
R.288	NCA01_Residential	331962.42	6257655.15	76
R.289	NCA01_Residential	331969.54	6257648.92	76
R.290	NCA01_Residential	331974.88	6257642.68	76
R.291	NCA02_Residential	331689.33	6257637.73	87
R.292	NCA01_Residential	331788.27	6257635.58	83
R.293	NCA01_Residential	331973.99	6257633.78	76
R.294	NCA01_Mixed Use	331872.97	6257633.59	80
R.295	NCA01_Residential	332050.43	6257629.51	74
R.296	NCA01_Commercial	331991.11	6257621.80	76
R.297	NCA01_Mixed Use	331880.56	6257626.12	80
R.298	NCA02_Residential	331495.82	6257620.65	101
R.299	NCA01_Commercial	332021.48	6257662.43	76
R.300	NCA01_Mixed Use	331889.94	6257614.72	81
R.301	NCA01_Residential	332061.32	6257603.73	74
R.302	NCA01_Mixed Use	331902.86	6257602.22	82
R.303	NCA01_Mixed Use	331914.39	6257594.69	82
R.304	NCA01_Residential	331823.39	6257593.85	87
R.305	NCA01_Mixed Use	331920.83	6257588.71	82
R.306	NCA01_Mixed Use	331927.49	6257582.72	82
R.307	NCA02_Residential	331599.77	6257582.25	96
R.308	NCA01_Mixed Use	331932.10	6257578.85	82
R.309	NCA01_Mixed Use	331937.04	6257574.68	82
R.310	NCA01_Mixed Use	331942.24	6257570.30	82
R.311	NCA01_Residential	332084.32	6257577.55	73
R.312	NCA01_Residential	331861.60	6257562.08	90
R.313	NCA02_Residential	331766.52	6257556.62	94
R.314	NCA01_Commercial	331963.61	6257556.66	82
R.315	NCA01_Residential	332119.38	6257549.65	72
R.316	NCA01_Residential	332141.65	6257542.49	70
R.317	NCA01_Mixed Use	331977.10	6257542.40	83
R.318	NCA01_Residential	332156.02	6257539.63	69
R.319	NCA01_Commercial	331934.69	6257538.47	85
R.320	NCA01_Residential	332171.51	6257537.75	69
R.321	NCA01_Residential	332187.01	6257535.87	68
R.322	NCA01_Residential	331820.98	6257535.53	94
R.323	NCA01_Mixed Use	331987.46	6257534.44	84
R.324	NCA01_Residential	332201.10	6257532.58	68
R.325	NCA01_Residential	332217.54	6257529.77	68
R.326	NCA01_Mixed Use	331997.86	6257526.70	83
R.327	NCA02_Residential	331713.60	6257524.67	95
R.328	NCA01_Mixed Use	332005.72	6257521.11	83
R.329	NCA01_Residential	331912.15	6257520.91	90

Table E.1 Location ID	Description (NCA_Receptor Type)	GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
		Easting	Northing	
R.330	NCA01_Mixed Use	332010.22	6257517.91	82
R.331	NCA02_Residential	331792.43	6257515.02	98
R.332	NCA01_Mixed Use	332014.46	6257514.89	82
R.333	NCA01_Residential	332327.30	6257514.52	72
R.334	NCA01_Mixed Use	332018.68	6257511.91	82
R.335	NCA01_Mixed Use	332022.86	6257508.95	82
R.336	NCA01_Mixed Use	332030.62	6257503.87	82
R.337	NCA01_Mixed Use	332041.98	6257496.69	81
R.338	NCA04_Residential	332463.49	6257494.60	76
R.339	NCA01_Residential	331874.49	6257490.79	94
R.340	NCA02_Residential	331744.57	6257488.08	98
R.341	NCA01_Mixed Use	332068.64	6257481.77	80
R.342	NCA01_Residential	332254.17	6257480.92	68
R.343	NCA04_Residential	332567.19	6257480.15	73
R.344	NCA01_Residential	332271.50	6257472.69	66
R.345	NCA01_Residential	331973.90	6257470.46	90
R.346	NCA01_Residential	332290.19	6257465.21	66
R.347	NCA01_Residential	332103.42	6257461.87	81
R.348	NCA02_Residential	331819.52	6257458.41	98
R.349	NCA01_Residential	332310.37	6257456.98	66
R.350	NCA01_Residential	332325.55	6257453.72	66
R.351	NCA01_Residential	332111.33	6257451.73	81
R.352	NCA01_Residential	332351.35	6257449.81	64
R.353	NCA01_Residential	332366.98	6257447.47	67
R.354	NCA01_Residential	332128.12	6257447.43	80
R.355	NCA01_Residential	332381.83	6257445.12	68
R.356	NCA01_Residential	332395.61	6257444.27	68
R.357	NCA02_Residential	331908.38	6257444.10	93
R.358	NCA01_Residential	332410.94	6257442.03	68
R.359	NCA01_Place of Worship	332181.59	6257440.19	78
R.360	NCA01_Residential	332424.77	6257439.41	68
R.361	NCA02_Residential	331834.96	6257438.83	97
R.362	NCA01_Residential	332441.97	6257437.17	68
R.363	NCA02_Residential	331785.26	6257435.82	100
R.364	NCA01_Residential	332456.17	6257435.30	68
R.365	NCA01_Residential	332472.25	6257433.43	68
R.366	NCA01_Residential	332486.08	6257430.44	68
R.367	NCA01_Residential	332148.66	6257429.46	80
R.368	NCA01_Residential	332502.90	6257428.57	68
R.369	NCA04_Residential	332794.43	6257426.48	69
R.370	NCA01_Residential	332516.73	6257425.96	68
R.371	NCA01_Residential	332199.23	6257425.17	78
R.372	NCA02_Residential	331797.68	6257424.90	99
R.373	NCA01_Residential	332532.06	6257424.09	69
R.374	NCA01_Residential	332547.76	6257421.84	69
R.375	NCA02_Residential	331763.42	6257420.38	100
R.376	NCA01_Residential	332562.72	6257419.23	69

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.377	NCA04_Residential	332578.04	6257416.61	69
R.378	NCA04_Residential	332591.50	6257414.37	69
R.379	NCA01_Residential	332121.07	6257413.10	84
R.380	NCA04_Residential	332607.58	6257412.87	69
R.381	NCA02_Residential	331848.51	6257412.85	95
R.382	NCA01_Residential	332222.53	6257412.53	76
R.383	NCA04_Residential	332621.78	6257410.63	68
R.384	NCA02_Residential	331956.56	6257409.21	91
R.385	NCA04_Residential	332637.11	6257408.76	68
R.386	NCA01_Residential	332245.22	6257399.35	74
R.387	NCA01_Residential	332262.63	6257389.35	74
R.388	NCA02_Residential	331808.98	6257383.48	94
R.389	NCA04_Residential	332877.83	6257368.05	78
R.390	NCA01_Residential	332256.50	6257365.82	76
R.391	NCA01_Residential	332325.49	6257361.31	76
R.392	NCA01_Residential	332269.40	6257356.15	77
R.393	NCA01_Residential	332319.05	6257349.06	77
R.394	NCA01_Residential	332312.28	6257336.48	77
R.395	NCA01_Residential	332274.88	6257336.16	78
R.396	NCA02_Educational	332006.82	6257335.40	90
R.397	NCA01_Residential	332343.40	6257329.13	77
R.398	NCA01_Residential	332307.44	6257327.13	78
R.399	NCA01_Residential	332278.43	6257324.88	80
R.400	NCA01_Residential	332352.50	6257323.63	78
R.401	NCA04a_Residential	332869.44	6257321.05	71
R.402	NCA01_Residential	332363.50	6257317.49	78
R.403	NCA01_Residential	332290.03	6257308.76	81
R.404	NCA01_Residential	332381.69	6257307.76	78
R.405	NCA01_Residential	332400.09	6257299.94	78
R.406	NCA01_Residential	332421.74	6257288.32	78
R.407	NCA01_Residential	332447.03	6257272.97	78
R.408	NCA01_Residential	332350.02	6257268.42	82
R.409	NCA01_Residential	332466.70	6257260.72	78
R.410	NCA01_Residential	332481.85	6257251.05	78
R.411	NCA01_Residential	332496.03	6257241.38	76
R.412	NCA01_Residential	332512.15	6257233.32	74
R.413	NCA04a_Residential	332854.50	6257226.19	56
R.414	NCA02_Residential	332282.48	6257223.95	86
R.415	NCA01a_Residential	332492.81	6257217.85	74
R.416	NCA01a_Residential	332534.72	6257212.37	72
R.417	NCA01a_Residential	332546.97	6257201.73	70
R.418	NCA01a_Residential	332554.71	6257188.83	69
R.419	NCA02a_Residential	332317.97	6257172.83	79
R.420	NCA02a_Residential	332360.64	6257101.41	71
R.421	NCA04a_Residential	332861.55	6257120.95	54
R.422	NCA01a_Residential	332749.73	6257108.72	57
R.423	NCA04a_Residential	332857.74	6257108.41	55

Table E.1 Location ID	Description (NCA_Receptor Type)	GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
		Easting	Northing	
R.424	NCA01a_Residential	332834.29	6257098.59	57
R.425	NCA01a_Residential	332852.83	6257091.50	57
R.426	NCA01a_Residential	332791.94	6257080.69	60
R.427	NCA01a_Residential	332849.01	6257080.60	58
R.428	NCA01a_Residential	332755.11	6257079.43	60
R.429	NCA01a_Residential	332846.83	6257070.78	59
R.430	NCA01a_Residential	332764.67	6257049.55	63
R.431	NCA01a_Residential	332839.97	6257046.67	62
R.432	NCA01a_Commercial	332641.39	6257035.93	61
R.433	NCA01a_Residential	332814.55	6257034.88	64
R.434	NCA01a_Residential	332773.64	6257028.62	64
R.435	NCA01a_Residential	332833.35	6257026.07	65
R.436	NCA01a_Commercial	332596.30	6257022.67	61
R.437	NCA01_Residential	332845.31	6257006.22	66
R.438	NCA01a_Commercial	332660.31	6257005.41	67
R.439	NCA01a_Industrial	332713.51	6257001.99	70
R.440	NCA02a_Commercial	332557.32	6256998.79	63
R.441	NCA01_Residential	332789.18	6256992.16	68
R.442	NCA01_Residential	332854.72	6256991.72	67
R.443	NCA01_Residential	332835.43	6256982.12	69
R.444	NCA01_Residential	332860.83	6256981.29	68
R.445	NCA01a_Commercial	332681.05	6256975.86	70
R.446	NCA01_Residential	332867.44	6256971.63	69
R.447	NCA01_Residential	332798.75	6256971.24	70
R.448	NCA02a_Commercial	332499.53	6256965.11	68
R.449	NCA01_Residential	332873.04	6256960.94	70
R.450	NCA01a_Commercial	332636.00	6256958.62	67
R.451	NCA01_Residential	332878.64	6256952.80	70
R.452	NCA01_Residential	332804.13	6256949.72	71
R.453	NCA01_Commercial	332696.26	6256948.10	73
R.454	NCA01_Residential	332834.85	6256944.43	72
R.455	NCA01_Residential	332883.98	6256944.15	71
R.456	NCA01_Residential	332810.10	6256932.98	73
R.457	NCA01_Residential	332891.10	6256932.96	72
R.458	NCA02a_Commercial	332593.73	6256931.89	69
R.459	NCA01_Residential	332896.44	6256925.07	73
R.460	NCA01_Residential	332842.39	6256924.72	74
R.461	NCA01_Residential	332901.78	6256915.41	74
R.462	NCA01_Residential	332813.09	6256915.05	75
R.463	NCA01_Residential	332849.34	6256906.74	75
R.464	NCA01_Residential	332907.13	6256906.25	75
R.465	NCA01_Commercial	332726.00	6256901.83	77
R.466	NCA02_Commercial	332533.98	6256896.72	74
R.467	NCA01_Residential	332914.99	6256895.73	75
R.468	NCA01_Residential	332886.09	6256894.37	76
R.469	NCA01_Residential	332819.07	6256891.14	77
R.470	NCA01_Residential	332875.97	6256888.22	77

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.471	NCA01_Residential	332859.20	6256888.19	77
R.472	NCA01_Residential	332863.31	6256879.55	77
R.473	NCA01_Residential	332850.83	6256873.53	78
R.474	NCA01_Residential	332824.45	6256873.21	78
R.475	NCA01_Residential	332901.27	6256868.34	77
R.476	NCA01_Residential	332840.97	6256866.59	78
R.477	NCA01_Residential	332890.79	6256864.36	78
R.478	NCA02_Commercial	332479.05	6256862.13	74
R.479	NCA01_Residential	332876.33	6256852.80	79
R.480	NCA01_Residential	332828.04	6256841.52	80
R.481	NCA01_Commercial	332766.27	6256836.79	79
R.482	NCA01_Residential	332846.68	6256833.64	80
R.483	NCA01_Commercial	332686.81	6256817.30	78
R.484	NCA01_Residential	332832.22	6256808.65	81
R.485	NCA01_Recreational	332838.37	6256768.92	83
R.486	NCA01_Commercial	332700.05	6256765.43	78
R.487	NCA01_Commercial	332768.86	6256668.04	76
R.488	NCA01_Commercial	332770.44	6256616.69	77
R.489	NCA01_Commercial	332779.86	6256557.67	77
R.490	NCA01_Residential	332854.36	6256511.84	76
R.491	NCA01_Commercial	332795.39	6256484.37	76
R.492	NCA01_Residential	332854.72	6256419.66	74
R.493	NCA01_Recreational	332963.49	6256396.54	68
R.494	NCA01_Residential	332810.92	6256389.94	78
R.495	NCA01_Residential	332864.92	6256367.99	76
R.496	NCA01_Residential	332886.67	6256344.20	75
R.497	NCA01_Residential	332971.65	6256316.33	66
R.498	NCA01_Residential	332915.23	6256314.97	74
R.499	NCA01_Residential	332825.21	6256308.57	78
R.500	NCA01_Residential	332955.33	6256286.41	66
R.501	NCA01_Hospital	332771.97	6256274.48	83
R.502	NCA04_Residential	333031.43	6256271.73	74
R.503	NCA01_Commercial	332944.56	6256270.95	67
R.504	NCA01_Residential	332830.80	6256260.73	78
R.505	NCA04_Residential	333020.10	6256259.33	74
R.506	NCA04_Residential	333010.89	6256243.76	76
R.507	NCA01_Commercial	332919.25	6256237.74	68
R.508	NCA01_Commercial	332893.07	6256234.91	74
R.509	NCA01_Residential	332992.79	6256233.42	74
R.510	NCA01_Residential	332979.08	6256218.72	74
R.511	NCA01_Residential	332832.67	6256212.90	78
R.512	NCA01_Residential	332975.04	6256205.67	75
R.513	NCA01_Commercial	332921.68	6256194.36	71
R.514	NCA01_Residential	332978.21	6256189.47	76
R.515	NCA01_Residential	332980.07	6256176.05	77
R.516	NCA01_Hospital	332788.60	6256174.71	81
R.517	NCA01_Residential	332838.88	6256171.28	77

Table E.1		GPS Co-ordinates (Zone 56H)		Ground Height (AHD) m
Location ID	Description (NCA_Receptor Type)	Easting	Northing	
R.518	NCA01_Commercial	332924.58	6256166.33	73
R.519	NCA01_Residential	332982.31	6256162.26	78
R.520	NCA06_Commercial	332923.01	6256142.60	75
R.521	NCA06_Residential	332845.71	6256125.31	74
R.522	NCA06_Commercial	332990.11	6256124.44	79
R.523	NCA06_Commercial	332996.04	6256099.56	80
R.524	NCA06_Residential	332908.45	6256088.03	76
R.525	NCA06_Residential	332847.57	6256078.71	74
R.526	NCA06_Commercial	332969.99	6256069.92	80
R.527	NCA06_Commercial	333001.38	6256056.61	82
R.528	NCA06_Commercial	332888.38	6256012.19	76
R.529	NCA06_Commercial	332820.53	6256002.03	76
R.530	NCA06_Commercial	333006.16	6256012.39	84

1. All GPS coordinates are in UTM, Zone 56H
2. Australian Height Datum in metres (m).

Appendix F – Construction Program

Sydney Metro City & Southwest North Corridor Works (VPR007) Contract Programme (7A&7B)

Activity ID	Activity Name	Start	Finish	At Completion Duration	2017							2018							2019							2020							2021														
					M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A	M	J	Jul	A	S	Oct	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N
Sydney Metro City and Southwest - NCW Contract Programme - 7B rev 2					26-May-17 A	21-Apr-20	711																																								
KEY MILESTONES					26-May-17 A	21-Apr-20	711																																								
Contract Key Dates 7A					26-May-17 A	08-Apr-19	458																																								
CNCW-K1035	Submit Draft Tender Portion 7a	26-May-17 A		0	◆ Submit Draft Tender Portion 7a																																										
CNCW-K2460	Submit Draft Tender Early Works Portion		02-Jun-17 A	0	◆ Submit Draft Tender Early Works Portion																																										
CNCW-K2470	Client Tender Review Early Works Tender	02-Jun-17 A	06-Jun-17 A	2	■ Client Tender Review Early Works Tender																																										
CNCW-K2480	Re-submit Draft Tender Early Works Portion	07-Jun-17 A	09-Jun-17 A	2	■ Re-submit Draft Tender Early Works Portion																																										
CNCW-K2440	Variation Order Issued for Early Works (Site Investigation)	16-Jun-17 A		0	◆ Variation Order Issued for Early Works (Site Investigation)																																										
CNCW-K1075	Variation Order Issued for Portion 7a Main Works (Including contract execution)		01-Sep-17 A	0	◆ Variation Order Issued for Portion 7a Main Works (Including contract execution)																																										
CNCW-K1045	Client Tender Review Period 7a	26-May-17 A	01-Sep-17 A	69	■ Client Tender Review Period 7a																																										
CNCW-K2530	Variation Order Issued for Early works for Acoustic Fencing Design and Investigation (VPR#001)		29-Jan-18 A	0	◆ Variation Order Issued for Early works for Acoustic Fencing Design and Investigation (VPR#001)																																										
CNCW-K1200	Start Construction Phase (Commence Construction Works on Site)		10-Feb-18 A	0	◆ Start Construction Phase (Commence Construction Works on Site)																																										
CNCW-K1590	Portion 7a Construction Complete		08-Apr-19*	0	◆ Portion 7a Construction Complete																																										
Contract Key Dates 7B					20-Mar-18	21-Apr-20	512																																								
CNCW-K2610	Submit Draft Tender Portion 7b	20-Mar-18*		0	◆ Submit Draft Tender Portion 7b																																										
CNCW-K2650	Client Tender Review Period 7b	20-Mar-18	04-Apr-18	10	■ Client Tender Review Period 7b																																										
CNCW-K2620	Variation Order Issued for Portion 7b		05-Apr-18	0	◆ Variation Order Issued for Portion 7b																																										
CNCW-K2625	Start 7b Procurement Phase	20-Jul-18		0	◆ Start 7b Procurement Phase																																										
CNCW-K2640	Start 7b Construction Phase (Commence Construction Works on Site)	27-Aug-18		0	◆ Start 7b Construction Phase (Commence Construction Works on Site)																																										
CNCW-K3150	Portion 7b - Final up Slew Construction Complete		23-Jun-19*	0	◆ Portion 7b - Final up Slew Construction Complete																																										
CNCW-K2630	Portion 7b Construction Complete		08-Mar-20*	0	◆ Portion 7b Construction Complete																																										
CNCW-K3160	Portion 7b - Temp Dn Slew Construction Complete		08-Mar-20*	0	◆ Portion 7b - Temp Dn Slew Construction Complete																																										
CNCW-K2720	Portion 7b Documentation Hand Over		21-Apr-20*	0	◆ Portion 7b Documentation Hand Over																																										
Portion Specific Milestones TBC					26-Jun-17 A	09-Aug-19	523																																								
PROJECT MANAGEMENT					14-Jul-17 A	08-Mar-20	647																																								
Available Possessions					15-Jul-17 A	08-Mar-20	646																																								
Config 8 (SMC&SW)					15-Jul-17 A	08-Mar-20	646																																								
CNCW-K1230	Config 8 (15-16 Jul. 17) WE03	15-Jul-17 A	16-Jul-17 A	1	■ Config 8 (15-16 Jul. 17) WE03																																										
CNCW-K1250	Config 8 (04-05 Nov. 17) WE19 (HV Isolation required)	04-Nov-17 A	05-Nov-17 A	1	■ Config 8 (04-05 Nov. 17) WE19 (HV Isolation required)																																										
CNCW-K1280	Config 8 (10-11 Feb. 18) WE33 (HV Isolation required)	10-Feb-18 A	11-Feb-18 A	2	■ Config 8 (10-11 Feb. 18) WE33 (HV Isolation required)																																										
CNCW-K2490	Config 8 (24-25 Feb. 18) WE35 - Additional Possession Granted (HV Isolation required)	24-Feb-18 A	25-Feb-18 A	2	■ Config 8 (24-25 Feb. 18) WE35 - Additional Possession Granted (HV Isolation required)																																										
CNCW-K1360	Config 8 (19-20 May. 18) WE47 (HV Isolation required)	19-May-18	20-May-18	2	■ Config 8 (19-20 May. 18) WE47 (HV Isolation required)																																										
CNCW-K1460	Config 8 (25-26 Aug. 18) WE08 (HV Isolation required)	25-Aug-18	26-Aug-18	2	■ Config 8 (25-26 Aug. 18) WE08 (HV Isolation required)																																										
CNCW-K1500	Config 8 (06-07 Oct. 18) WE14 (HV Isolation required)	06-Oct-18	07-Oct-18	2	■ Config 8 (06-07 Oct. 18) WE14 (HV Isolation required)																																										
CNCW-K1520	Config 8 (27-28 Oct. 18) WE17 (HV Isolation required)	27-Oct-18	28-Oct-18	2	■ Config 8 (27-28 Oct. 18) WE17 (HV Isolation required)																																										
CNCW-K1540	Config 8 (03-04 Nov. 18) WE18 (HV Isolation required)	03-Nov-18	04-Nov-18	2	■ Config 8 (03-04 Nov. 18) WE18 (HV Isolation required)																																										
CNCW-K1580	Config 8 (17-18 Nov. 18) WE20 (HV Isolation required)	17-Nov-18	18-Nov-18	2	■ Config 8 (17-18 Nov. 18) WE20 (HV Isolation required)																																										
CNCW-K1640	Config 8 (15-16 Dec. 18) WE24 (Not Utilised Due to SMNW CW Commissioning)	15-Dec-18*	16-Dec-18	2	■ Config 8 (15-16 Dec. 18) WE24 (Not Utilised Due to SMNW CW Commissioning)																																										
CNCW-K1650	Config 8 (23-24 Feb. 19) WE34 (HV Isolation required)	23-Feb-19	24-Feb-19	2	■ Config 8 (23-24 Feb. 19) WE34 (HV Isolation required)																																										
CNCW-K1660	Config 8 (06-07 Apr. 19) WE40 (HV Isolation required)	06-Apr-19	07-Apr-19	2	■ Config 8 (06-07 Apr. 19) WE40 (HV Isolation required)																																										
CNCW-K1670	Config 8 (22-23 Jun. 19) WE51 (HV Isolation required)	22-Jun-19	23-Jun-19	2	■ Config 8 (22-23 Jun. 19) WE51 (HV Isolation required)																																										
CNCW-K2670	Config 8 (3-4 Aug. 19) WE05 (HV Isolation required)	03-Aug-19	04-Aug-19	2	■ Config 8 (3-4 Aug. 19) WE05 (HV Isolation required)																																										
CNCW-K2540	Config 8 (7-8 Dec 19) WE23 (HV Isolation required)	07-Dec-19	08-Dec-19	2	■ Config 8 (7-8 Dec 19) WE23 (HV Isolation required)																																										
CNCW-K2680	Config 8 (7-8 Mar. 20) WE36 (HV Isolation required)	07-Mar-20	08-Mar-20	2	■ Config 8 (7-8 Mar. 20) WE36 (HV Isolation required)																																										
Interface Dates & Documentation					14-Jul-17 A	06-Mar-20	647																																								
Possession Documentation TBC					14-Jul-17 A	09-May-19	444																																								
Interface Milestones & Events TBC					05-Nov-17 A	29-Mar-19	338																																								
CCB Documentation (Combined Gate 4 & 5)					14-Jan-19	06-Mar-20	282																																								
CSG 4 Deliverables					23-Jan-19	06-Mar-20	275																																								
Separable Portion 7a					23-Jan-19	08-Apr-19	52																																								

- Remaining Level of Effort
- Critical Remaining Work
- Possession Complete - CNCW
- Actual Work
- Possession Normal
- ◆ Milestone
- Remaining Work
- Possession Critical

Date	Revision	Checked	Approved
27-Mar-18	NCW Programme P7A&B	HA/NS	TD

Sydney Metro City & Southwest North Corridor Works (VPR007) Contract Programme (7A&7B)

Activity ID	Activity Name	Start	Finish	At Completion Duration	2017												2018												2019												2020												2021											
					M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A	M	J	Jul	A	S	Oct	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A												
Separable Portion 7b					18-Mar-19	06-Mar-20	238																																																									
Final Up					18-Mar-19	21-Jun-19	65																																																									
Temporary Down					11-Dec-19	06-Mar-20	51																																																									
CSG 5 Deliverables					14-Jan-19	06-Mar-20	282																																																									
Separable Portion 7a					14-Jan-19	08-Apr-19	59																																																									
Separable Portion 7b					07-Mar-19	06-Mar-20	245																																																									
Final Up					07-Mar-19	21-Jun-19	72																																																									
Temporary Down					02-Dec-19	06-Mar-20	58																																																									
PRELIMINARIES					13-Jun-17 A	07-May-18	220																																																									
Planning Approval					13-Jun-17 A	26-Mar-18	193																																																									
Management Plans					04-Sep-17 A	07-May-18	161																																																									
DESIGN					26-Jun-17 A	23-Jul-18	264																																																									
Services Mobilisation					03-Aug-17 A	18-Dec-17 A	96																																																									
SURVEYS / INVESTIGATIONS					26-Jun-17 A	25-Feb-18 A	163																																																									
Project Inputs Provided (by Others)					02-Aug-17 A	03-Oct-17 A	43																																																									
Early Services					28-Jul-17 A	14-Mar-18	151																																																									
Management - Meetings and Reporting updates					15-Nov-17 A	04-Apr-18	88																																																									
Overhead Wiring and Overhead Wiring Structures (Portion 7a)					06-Oct-17 A	23-Feb-18 A	89																																																									
Drainage Works Design (Portion 7a)					09-Oct-17 A	26-Jun-18	172																																																									
Main Works Design					06-Nov-17 A	23-Jul-18	170																																																									
Temporary Works					09-Jan-18 A	27-May-18	95																																																									
Hebel acoustic Fence					02-Feb-18 A	13-Apr-18	49																																																									
PROCUREMENT					21-Jul-17 A	02-Apr-19	415																																																									
Procured as Variation to Existing Portion 1-6 Contract - till December 2017					07-Aug-17 A	02-Nov-17 A	62																																																									
Procured as Variation to Existing Portion 1-6 Contract - till WE35					04-Dec-17 A	15-Jan-18 A	20																																																									
Misc Subcontract Package Procurement					23-Oct-17 A	30-Apr-18	122																																																									
Environmental					21-Jul-17 A	28-Mar-18	167																																																									
Signalling & Comms					20-Jul-18	28-Sep-18	51																																																									
Civil & Structure					23-Oct-17 A	28-May-18	142																																																									
OHW					27-Oct-17 A	28-Sep-18	226																																																									
Drainage					08-Mar-18	03-Aug-18	103																																																									
Track					23-Jul-18	28-Sep-18	50																																																									
Bridge Works					20-Jul-18	05-Oct-18	55																																																									
Electrical					23-Jul-18	28-Sep-18	50																																																									
Long Lead Items					21-Dec-17 A	02-Apr-19	307																																																									
Drainage					15-May-18	03-Aug-18	58																																																									
Stormwater Basin					07-May-18	18-Sep-18	96																																																									
HV/LV Cable					02-Oct-18	05-Feb-19	80																																																									
Signalling					28-Sep-18	19-Feb-19	91																																																									
OHW					21-Dec-17 A	19-Feb-19	277																																																									
Track					02-Oct-18	02-Apr-19	120																																																									
CONSTRUCTION					20-Dec-17 A	08-Mar-20	535																																																									
Site office					20-Dec-17 A	18-Jun-18	114																																																									
Portion 7a					10-Feb-18 A	23-Jun-19	335																																																									
OHW					10-Feb-18 A	08-Apr-19	284																																																									
CNCW-C1775	P7a - Construction Commencement		10-Feb-18 A	0	◆ P7a - Construction Commencement																																																											
CNCW-C4685	P7a - Down Main Track Albert Ave to Hopetoun Ave (From MH11+584 to MH11+224) OHW Footings & Legs Complete		19-May-18	0	◆ P7a - Down Main Track Albert Ave to Hopetoun Ave (From MH11+584 to MH11+224) OHW Footings & Legs Complete																																																											
CNCW-C4505	P7a - Albert Ave to Hopetoun Ave OHS Complete (7 No Portals)		20-May-18*	0	◆ P7a - Albert Ave to Hopetoun Ave OHS Complete (7 No Portals)																																																											
CNCW-C4525	NRT Transfer Wires From Albert Ave to Hopetoun Ave (From MH11+584 to MH11+224)		25-Aug-18	2	◻ NRT Transfer Wires From Albert Ave to Hopetoun Ave (From MH11+584 to MH11+224)																																																											
CNCW-C4515	P7a - Hopetoun Ave to Brand Street OHS Complete (From MH11+224 to MH10+729)		19-Nov-18	0	◆ P7a - Hopetoun Ave to Brand Street OHS Complete (From MH11+224 to MH10+729)																																																											

Remaining Level of Effort	Critical Remaining Work	Possession Complete - CNCW
Actual Work	Possession Normal	Milestone
Remaining Work	Possession Critical	

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Sydney Metro City & Southwest North Corridor Works (VPR007) Contract Programme (7A&7B)

Activity ID	Activity Name	Start	Finish	At Completion Duration	2017												2018												2019												2020												2021			
					M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A	M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A				
CNCW-C4586	P7a - OHS Removal From Albert Ave to Hopetoun Ave (From MH11+584 to MH11+224) Complete		08-Apr-19	0	◆ P7a : OHS Removal From Albert Ave to Hopetoun Ave(From MH11+584 to MH11+224), Complete																																																			
Footings																																																								
Albert Ave - Hopetoun Ave (MH11+584 - MH11+224)		10-Feb-18 A	28-Oct-18	180																																																				
Possession Works																																																								
Frank Channon Walk (Mid-week Works - Outside the danger zone)		10-Feb-18 A	26-Aug-18	8																																																				
Mid-week Works (Outside the danger zone)		23-Mar-18	12-Apr-18	13																																																				
Hopetoun Ave - Brand St (MH11+224 - MH10+729)		19-Mar-18	19-Apr-18	22																																																				
Hopetoun Ave - Brand St (MH11+224 - MH10+729)		30-Apr-18	28-Oct-18	128																																																				
Structure																																																								
Albert Ave - Hopetoun Ave (MH11+584 - MH11+224)		12-Feb-18 A	18-Nov-18	195																																																				
Albert Ave - Hopetoun Ave (MH11+584 - MH11+224)		12-Feb-18 A	06-Oct-18	165																																																				
Possession Works																																																								
Frank Channon Walk (Mid-week Works - Outside the danger zone)		12-Feb-18 A	06-Oct-18	165																																																				
Mid-week Works		16-Apr-18	17-May-18	21																																																				
Mid-week Works (Outside the danger zone)		26-Feb-18 A	11-May-18	52																																																				
Mid-week Works (Outside the danger zone)		27-Mar-18	30-Apr-18	20																																																				
Hopetoun Ave - Brand St (MH11+224 - MH10+729)		04-May-18	18-Nov-18	139																																																				
Overhead Structure Removal																																																								
Albert Ave - Hopetoun Ave (MH11+584 - MH11+224)		06-Apr-19	07-Apr-19	2																																																				
Mid-week Works (Outside the danger zone)		06-Apr-19	07-Apr-19	2																																																				
Civil																																																								
Fencing		18-Apr-18	05-Oct-18	120																																																				
Devegetation		14-May-18	05-Oct-18	103																																																				
Devegetation		18-Apr-18	03-Aug-18	76																																																				
Drainage																																																								
CNCW-C3855	Portion 7a Drainage Works Complete		08-Apr-19	0	◆ Portion 7a Drainage Works Complete																																																			
Stormwater Attenuation System																																																								
Stormwater Attenuation System		30-Apr-18	21-Dec-18	168																																																				
Drainage by TSE (TBC)		07-Nov-18	23-Jun-19	148																																																				
Drainage System (10.725 - 11.500)		25-Aug-18	08-Apr-19	149																																																				
Portion 7b																																																								
LV/HV																																																								
Cable Pulling (11kV and 33kV)		19-May-18	08-Mar-20	441																																																				
Cable Pulling (11kV and 33kV)		25-Feb-19	05-Apr-19	30																																																				
Bridgeworks																																																								
Mowbray RD Bridge		08-Oct-18	21-Apr-19	128																																																				
Mowbray RD Bridge		08-Oct-18	22-Feb-19	89																																																				
Demolition and Piling																																																								
Demolition and Piling		08-Oct-18	18-Nov-18	30																																																				
North		19-Nov-18	21-Dec-18	23																																																				
South		07-Jan-19	22-Feb-19	33																																																				
Nelson St Bridge																																																								
Nelson St Bridge		17-Nov-18	21-Apr-19	98																																																				
Preparation		17-Nov-18	21-Feb-19	58																																																				
Demolition		23-Feb-19	21-Apr-19	39																																																				
Track																																																								
CH 11.050 km to 11.250 km Existing Turnout by Others		27-Oct-18	08-Mar-20	328																																																				
CH 11.050 km to 11.250 km Existing Turnout by Others		27-Oct-18	28-Oct-18	2																																																				
CH 10807.044 - 11009.967 Modifications Existing Up Shore		06-Apr-19	23-Jun-19	4																																																				
CH 11009.967 - 11255.402 Up Shore		08-Apr-19	23-Jun-19	51																																																				
CH 11255.402 - 11372.882 Up Shore		06-Apr-19	23-Jun-19	4																																																				
CH 11235.000 - 11375.122 Existing Dn Shore		07-Dec-19	08-Mar-20	4																																																				
CH 10632.044 - 10722.044 Existing Dn Shore		03-Aug-19	08-Mar-20	6																																																				
CH 10722.044 - 11235.000 Temporary Down		03-Aug-19	08-Mar-20	6																																																				
Civil																																																								
Enabling Works		25-Aug-18	07-Apr-19	148																																																				
Enabling Works		25-Aug-18	07-Apr-19	14																																																				
Hi rail Access		06-Apr-19	07-Apr-19	2																																																				
GST Protection		25-Aug-18	26-Aug-18	2																																																				
Signal Base		03-Nov-18	24-Feb-19	6																																																				
CSR / Local Routes		27-Oct-18	18-Nov-18	15																																																				

Remaining Level of Effort	Critical Remaining Work	Possession Complete - CNCW
Actual Work	Possession Normal	Milestone
Remaining Work	Possession Critical	

Date	Revision	Checked	Approved
27-Mar-18	NCW Programme P7A&B	HA/NS	TD

Sydney Metro City & Southwest
North Corridor Works (VPR007) Contract Programme (7A&7B)

Activity ID	Activity Name	Start	Finish	At Completion Duration	2017												2018												2019												2020												2021			
					M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	O	N	D	J	F	M	A	M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	O	N	D	J	F	M	A				
	Final Up	27-Oct-18	02-Nov-18	5																																																				
	Temporary Down	03-Nov-18	18-Nov-18	10																																																				
	Up Side Permanent Route 11.100km to 11.300km	29-Oct-18	02-Nov-18	5																																																				
	Hopetoun Avenue Access Ramp	07-Jan-19	22-Feb-19	33																																																				
	Retaining Wall	25-Aug-18	07-Apr-19	148																																																				
	Retaining Wall 11.235km - 11-320km	25-Aug-18	16-Nov-18	59																																																				
	Piling	25-Aug-18	02-Nov-18	49																																																				
	Remove Existing	25-Aug-18	28-Oct-18	6																																																				
	Install Panels and Posts	27-Oct-18	28-Oct-18	2																																																				
	FRP	27-Oct-18	16-Nov-18	15																																																				
	Retaining Wall 11.070km - 11-200km	17-Nov-18	24-Feb-19	59																																																				
	Piling	17-Nov-18	24-Feb-19	59																																																				
	Remove Existing	17-Nov-18	24-Feb-19	59																																																				
	Install Panels and Posts	17-Nov-18	24-Feb-19	59																																																				
	Retaining Wall 11.200km - 11-235km	23-Feb-19	07-Apr-19	30																																																				
	Piling	23-Feb-19	05-Apr-19	30																																																				
	Remove Existing	06-Apr-19	07-Apr-19	2																																																				
	Install Panels and Posts	06-Apr-19	07-Apr-19	2																																																				
	Signals & Comms	19-May-18	08-Mar-20	441																																																				
	Up Shore	19-May-18	28-Jun-19	273																																																				
	Cable Test on Drums	29-Oct-18	28-Jun-19	155																																																				
	Track Circuit 10.820km to 11.424km	27-Oct-18	23-Jun-19	155																																																				
	Equipment Installation / Relocation	27-Oct-18	28-Oct-18	2																																																				
	Cable Installation	29-Oct-18	18-Nov-18	15																																																				
	Bonding	22-Jun-19	23-Jun-19	2																																																				
	Singal and Train Stop SH6.76(10.871km)-SH6.86(11.039km)-SH7.10(11.409km)-SH6.86(11.139km)	19-May-18	23-Jun-19	268																																																				
	Signal Sighting	19-May-18	20-May-18	2																																																				
	Cable Installation	05-Nov-18	18-Nov-18	10																																																				
	Train Stop Installation	12-Nov-18	18-Nov-18	5																																																				
	Signal Installation	23-Feb-19	24-Feb-19	2																																																				
	Testing	23-Feb-19	23-Jun-19	6																																																				
	Circuit Modification and Testing	05-Nov-18	21-Feb-19	65																																																				
	Temporary Dn Shore	25-Aug-18	08-Mar-20	372																																																				
	Signal and Train Stop Temp Dn SH6.91(11.045km), SH7.05(11.356km)	25-Aug-18	04-Aug-19	229																																																				
	Signal Sighting	25-Aug-18	26-Aug-18	2																																																				
	Train Stop Installation	23-Feb-19	24-Feb-19	2																																																				
	Cable Installation	25-Jan-19	24-Feb-19	20																																																				
	Signal Installation	06-Apr-19	07-Apr-19	2																																																				
	Testing	06-Apr-19	04-Aug-19	6																																																				
	Track Circuit Temporary Dn 10.830km to 11.500km	17-Nov-18	08-Mar-20	313																																																				
	Equipment Installation / Relocation	17-Nov-18	18-Nov-18	2																																																				
	Cable Installation	21-Dec-18	07-Apr-19	65																																																				
	Bonding	07-Mar-20	08-Mar-20	2																																																				
	Drainage	02-Nov-18	08-Dec-19	270																																																				
	OHW	03-Nov-18	08-Mar-20	323																																																				
	OHW Protection	03-Nov-18	18-Nov-18	4																																																				
	Footings	23-Feb-19	07-Apr-19	4																																																				
	Structures	04-Apr-19	23-Jun-19	53																																																				
	OHW Wire Run	17-Nov-18	08-Mar-20	14																																																				
	Final Up Slew	17-Nov-18	23-Jun-19	8																																																				

	Remaining Level of Effort		Critical Remaining Work		Possession Complete - CNCW
	Actual Work		Possession Normal		Milestone
	Remaining Work		Possession Critical		

Date	Revision	Checked	Approved
27-Mar-18	NCW Programme P7A&B	HA/NS	TD



Sydney Metro City & Southwest North Corridor Works (VPR007) Contract Programme (7A&7B)

Activity ID	Activity Name	Start	Finish	At Completion Duration	2017												2018												2019												2020												2021			
					M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A	M	J	Jul	A	S	O	N	D	Jan	F	M	A	M	J	Jul	A	S	Oct	N	D	J	F	M	A				
Temporary Down Slew																																																								
OHW Removal																																																								
COMMISSIONING																																																								
Portion 7a																																																								
Portion 7b																																																								
Final Up Slew																																																								
Temporary Down Slew																																																								
HANDOVER / COMPLETION																																																								
Portion 7a Handover																																																								
Portion 7b Handover																																																								
Final Up																																																								
Temporary Dn																																																								

Remaining Level of Effort	Critical Remaining Work	Possession Complete - CNCW
Actual Work	Possession Normal	Milestone
Remaining Work	Possession Critical	

Date	Revision	Checked	Approved
27-Mar-18	NCW Programme P7A&B	HA/NS	TD

Appendix G – Sydney Metro Stakeholder Comment Register

Sydney Metro City & Southwest Stakeholder Comment Tracker



Document: NCW Portion 7b - Construction Noise and Vibration Management Plan
 Version: 1
 Date of review: 10/08/2018

RESPONSE STATUS
 O Open
 C Closed

Item No	Contract	Contractor	Doc Rev	Item Description, Page, Para, Drg ref	Stakeholder	Reviewer	Date	Requirement Ref (COA or REMM)	Stakeholder comment	T/NSW/Contractor Response	Date	Response Status (date)
1	NCW	LOR	V1	All	WCC	MH	10-Aug-2018	C11	<p>Dear Christopher,</p> <p>I refer to your request to Council for comments for the Sydney Metro City and Southwest – North Corridor Works documents “Construction Noise and Vibration Management Plan (CNVMP)” and Construction Noise and Vibration Monitoring Program”</p> <p>I have reviewed documentation. Please be advised that Council does not have appropriately accredited personnel in this field to fully review all aspects of the documentation however I have, as the most appropriate officer within Council regarding noise issues, reviewed the attached documentation which is noted. The documentation provided appears comprehensively prepared by a qualified acoustic engineer and I am satisfied the Management Plan and Monitoring Program comply with the relevant standards.</p> <p>If you have any further queries please contact me.</p> <p>Mark Hayward - Compliance Team Leader WILLOUGHBY CITY COUNCIL</p>	Noted and thanks	13-Aug-2018	C
2	NCW	LOR	V1	All	WCC	MH	10-Aug-2018	C11	<p>Hi Chris,</p> <p>I refer to the Sydney Metro City and Southwest – Northern Corridor Works – Construction Noise and Vibration Management Plan (Document Reference No. MNNSCW - Portion 7b - CNVMP_V0.2.docx) forwarded to EPA via email on 31 July 2018. I apologise for the delay in responding.</p> <p>Thank you for forwarding the CNVMP for our records. The EPA encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, it is not EPA policy to approve or endorse these documents. The EPA's role is to set environmental objectives/requirements for environmental management, rather than being directly involved in the development of strategies to achieve those objectives/requirements.</p> <p>You may however wish to submit the CNVMP, or parts thereof, as supporting information for your future Environment Protection Licence (EPL) application. Information in the CNVMP would be a relevant consideration for EPA in exercising its functions under Section 45 of the Protection of the Environment Operations Act 1997.</p> <p>Any required application to EPA to issue a licence for scheduled development work or a licenced activity should be made in a timely manner to allow for processing of the application. The Act provides that a licence application is deemed to have been refused after 60 days.</p> <p>Thank you for your email and please do not hesitate to contact me should you wish to discuss.</p> <p>Best regards</p> <p>Gordon</p> <p>Gordon Downey Senior Operations Officer - Metropolitan Infrastructure Metro, NSW Environment Protection Authority</p>	Noted and thanks	13-Aug-2018	C

From: Gordon Downey <Gordon.Downey@epa.nsw.gov.au>
Sent: Friday, 10 August 2018 3:05 PM
To: Standing, Christopher; Claire Miles
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Hi Chris,

I refer to the Sydney Metro City and Southwest – Northern Corridor Works – Construction Noise and Vibration Management Plan (Document Reference No. MNNSCW - Portion 7b - CNVMP_V0.2.docx) forwarded to EPA via email on 31 July 2018. I apologise for the delay in responding.

Thank you for forwarding the CNVMP for our records. The EPA encourages the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, it is not EPA policy to approve or endorse these documents. The EPA's role is to set environmental objectives/requirements for environmental management, rather than being directly involved in the development of strategies to achieve those objectives/requirements.

You may however wish to submit the CNVMP, or parts thereof, as supporting information for your future Environment Protection Licence (EPL) application. Information in the CNVMP would be a relevant consideration for EPA in exercising its functions under Section 45 of the Protection of the Environment Operations Act 1997.

Any required application to EPA to issue a licence for scheduled development work or a licenced activity should be made in a timely manner to allow for processing of the application. The Act provides that a licence application is deemed to have been refused after 60 days.

Thank you for your email and please do not hesitate to contact me should you wish to discuss.

Best regards

Gordon

Gordon Downey

Senior Operations Officer - Metropolitan Infrastructure

Metro, NSW Environment Protection Authority

+61 2 9995 5783

gordon.downey@epa.nsw.gov.au www.epa.nsw.gov.au [@EPA_NSW](https://twitter.com/EPA_NSW)

Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555



From: Standing, Christopher [mailto:cstanding@laingorourke.com.au]
Sent: Friday, 10 August 2018 2:56 PM
To: Claire Miles <Claire.Miles@epa.nsw.gov.au>
Cc: Gordon Downey <Gordon.Downey@epa.nsw.gov.au>
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Dear Claire,

In reference to the request below for review of the Construction Noise & Vibration Management Plan for the Sydney Metro City & Southwest Northern Corridor Works – Portion 7b and its monitoring program.

Would you be able to please provide your comments today.

Thanks and regards,
Chris

Chris Standing
Environment and Sustainability Manager

Laing O'Rourke Australia
Level 8, 100 Christie Street
St Leonards NSW 2065
www.laingorourke.com.au

mobile: +61 431 338 578

From: Standing, Christopher
Sent: Thursday, 2 August 2018 6:29 AM
To: 'Claire Miles' <Claire.Miles@epa.nsw.gov.au>
Cc: Gordon Downey <Gordon.Downey@epa.nsw.gov.au>
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Morning Claire,

Thank you for the email.
Regards,
Chris

Chris Standing
Environment and Sustainability Manager

Laing O'Rourke Australia
Level 8, 100 Christie Street
St Leonards NSW 2065
www.laingorourke.com.au

mobile: +61 431 338 578

From: Claire Miles <Claire.Miles@epa.nsw.gov.au>
Sent: Wednesday, 1 August 2018 4:36 PM
To: Standing, Christopher <cstanding@laingorourke.com.au>
Cc: Gordon Downey <Gordon.Downey@epa.nsw.gov.au>
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Hello Christopher.

The EPA has received the documents and will respond shortly.

Regards,

Claire Miles

Unit Head - Metropolitan Infrastructure
Metro, NSW Environment Protection Authority
Ph: 02 9995 5167 Mob: 0436 682 226



From: Standing, Christopher [<mailto:cstanding@laingorourke.com.au>]

Sent: Wednesday, 1 August 2018 4:33 PM

To: Claire Miles <Claire.Miles@epa.nsw.gov.au>

Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Dear Claire,

In addition to the Construction Noise & Vibration Management Plan for the NCW – Portion 7b package component of the project, please also find attached the Noise and Vibration Monitoring program.

If you could also please provide your comments on the program as required by C11 of project approval SSI 15_7400

Thank you for your help and understanding and please do not hesitate in contacting me if required to discuss.

Regards,
Chris

Chris Standing
Environment and Sustainability Manager

Laing O'Rourke Australia
Level 8, 100 Christie Street
St Leonards NSW 2065
www.laingorourke.com.au

mobile: +61 431 338 578

From: Standing, Christopher

Sent: Tuesday, 31 July 2018 7:13 AM

To: 'Claire Miles' <Claire.Miles@epa.nsw.gov.au>

Subject: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Importance: High

Dear Claire,

Laing O'Rourke has been engaged by Sydney Metro Delivery Office for the Northern Corridor Works (NCW) as part of the approved Sydney Metro City and Southwest project.

Please see attached Laing O'Rourke's Construction Noise & Vibration Management Plan for the NCW – Portion 7b package component of the project which has been developed for the City and Southwest project as per the planning approval requirement condition C9 of project approval SSI 15_7400. This condition also requires the project to develop Construction Monitoring Programs in consultation with the EPA.

A copy of the planning approval conditions for the project can be found [here](#).

As such, Laing O'Rourke would like to formally submit the attached documents for comment. The earliest EPA response would be very much appreciated however the project team need comments back by no later than Friday August 10th 2018.

Thank you for your help and understanding and please do not hesitate in contacting me if required to discuss.

Yours sincerely,
Chris

Chris Standing
Environment and Sustainability Manager

Laing O'Rourke Australia
Level 8, 100 Christie Street
St Leonards NSW 2065
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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

From: Hayward, Mark <mark.hayward@willoughby.nsw.gov.au>
Sent: Friday, 10 August 2018 4:24 PM
To: Standing, Christopher
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Dear Christopher,

I refer to your request to Council for comments for the Sydney Metro City and Southwest – North Corridor Works documents “Construction Noise and Vibration Management Plan (CNVMP)” and Construction Noise and Vibration Monitoring Program”

I have reviewed documentation. Please be advised that Council does not have appropriately accredited personnel in this field to fully review all aspects of the documentation however I have, as the most appropriate officer within Council regarding noise issues, reviewed the attached documentation which is noted. The documentation provided appears comprehensively prepared by a qualified acoustic engineer and I am satisfied the Management Plan and Monitoring Program comply with the relevant standards.

If you have any further queries please contact me.

Mark Hayward - Compliance Team Leader

WILLOUGHBY CITY COUNCIL

PO Box 57 Chatswood NSW 2057

P +61 2 9777 7991

E mark.hayward@willoughby.nsw.gov.au

willoughby.nsw.gov.au | visitchatswood.com.au | theconcourse.com.au



From: Standing, Christopher [mailto:cstanding@laingorourke.com.au]
Sent: Friday, 10 August 2018 2:56 PM
To: Hayward, Mark
Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Dear Mark,

In reference to the request below for review of the Construction Noise & Vibration Management Plan for the Sydney Metro City & Southwest Northern Corridor Works – Portion 7b and its monitoring program.

Would you be able to please provide your comments today.

Thanks and regards,
Chris

Chris Standing
Environment and Sustainability Manager

Laing O'Rourke Australia

Level 8, 100 Christie Street
St Leonards NSW 2065
www.laingorourke.com.au

mobile: +61 431 338 578

From: Standing, Christopher

Sent: Wednesday, 1 August 2018 4:33 PM

To: 'mark.hayward@willoughby.nsw.gov.au' <mark.hayward@willoughby.nsw.gov.au>

Subject: RE: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Dear Mark,

In addition to the Construction Noise & Vibration Management Plan for the NCW – Portion 7b package component of the project, please also find attached the Noise and Vibration Monitoring program.

If you could also please provide your comments on the program as required by C11 of project approval SSI 15_7400

Thank you for your help and understanding and please do not hesitate in contacting me if required to discuss.

Regards,
Chris

Chris Standing

Environment and Sustainability Manager

Laing O'Rourke Australia

Level 8, 100 Christie Street
St Leonards NSW 2065
www.laingorourke.com.au

mobile: +61 431 338 578

From: Standing, Christopher

Sent: Tuesday, 31 July 2018 7:18 AM

To: 'mark.hayward@willoughby.nsw.gov.au' <mark.hayward@willoughby.nsw.gov.au>

Subject: REQUEST FOR RVEIEW: Sydney Metro City & Southwest // Northern Corridor Works - Construction Noise and Vibration Management Plan

Importance: High

Dear Mark,

Laing O'Rourke has been engaged by Sydney Metro Delivery Office for the Northern Corridor Works (NCW) as part of the approved Sydney Metro City and Southwest project.

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As such, Laing O'Rourke would like to formally submit the attached documents for comment. The earliest council response would be very much appreciated however the project team need comments back by no later than Friday August 10th 2018.

Thank you for your help and understanding and please do not hesitate in contacting me if required to discuss.

Yours sincerely,
Chris

Chris Standing
Environment and Sustainability Manager

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