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SYDNEY METRO CITY AND SOUTH WEST - LINE-WIDE WORKS

Construction Noise and Vibration Impact Statement Portion 3 - Southern Dive early access works

9 July 2020

Systems Connect

TK685-03-10F01 CNVIS C2S_P3 SDive Early Access (r5)

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1 Introduction

This Construction Noise and Vibration Impact Statement (CNVIS) has been prepared on behalf of Systems Connect in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWLWC-SYC-1NL-PM-PLN-000032] [1], for the Design and Construction of the Line-Wide Works (LWW) of the Sydney Metro City & Southwest Project (the Project).

1.1 Relevant requirements and purpose of this CNVIS

As defined in the CNVMP, the works covered by this CNVIS are part of the Portion 3 – Chatswood to Sydenham LWW delivered under Critical State Significant Infrastructure Approval CSSI 7400. Condition E33 of CSSI-7400 requires that:

> *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.*

This CNVIS applies to Southern Dive early access works package, which includes works to be undertaken on the site surface and within the dive structure and tunnels. Works will be completed during standard construction hours as well as works outside of standard construction hours. The construction hours of work are defined by the Project Planning Approval conditions as outlined in the CNVMP.

This CNVIS forms part of the CNVMP for the Project.

1.2 Structure of this CNVIS

This CNVIS is structured as follows:

- **Section 2** - Description of construction works and hours
- **Section 3** - Nearest sensitive receivers
- **Section 4** - Construction noise and vibration objectives
- **Section 5** - Construction noise assessment
- **Section 6** - Construction vibration impacts
- **Section 7** - Ground-borne noise assessment
- **Section 8 –** Traffic noise assessment
- **Section 9 –** Cumulative impacts.

1.3 Quality assurance

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Description of construction works and hours

2.1 Summary of works addressed in this CNVIS

2.1.1 Construction activities

This CNVIS provides an assessment of noise and vibration impacts from activities associated with the C2S Southern Dive early access site. These activities include:

- Early access activities on the surface and within in the dive and tunnels
  - Site establishment
  - Materials delivery and handling (including delivery of rail)
  - Track works (including flash butt welding).

The site location and layout is identified on an aerial photograph located in APPENDIX B.

The proposed works, likely plant and equipment and indicative Project timing is presented in APPENDIX C.

2.1.2 Construction traffic

The Southern Dive early access works construction works will generate additional traffic movements in the form of:

- Light vehicle movements generated by construction personnel travelling to and from work
- Heavy vehicle movements generated by delivery vehicles bringing materials, plant and equipment to the worksite

Construction traffic on-site (i.e. within the Project footprint) is included as part of the construction noise assessment of the works activities identified in Sections 5 and APPENDIX C. When construction related traffic moves onto the public road network, a different noise assessment methodology is appropriate as vehicle movements would be regarded as 'additional road traffic' rather than as part of the construction site's activities. Construction traffic noise is addressed in Section 7.

2.1.3 Cumulative construction impacts

CSSI 7400 Condition of Approval E39 requires Systems Connect to consult with proponents of other construction works in the vicinity of the worksite and take reasonable steps to coordinate works to minimise cumulative impacts of noise and vibration and maximise respite for affected sensitive receivers. Further to this, Condition E40 requires works to be coordinated to provide the required respite periods identified in accordance with the terms of the CSSI 7400 approval.

All concurrent Sydney Metro construction site works have been considered and addressed in Section 9 of this CNVIS. Potentially concurrent construction activities within the vicinity of the Southern Dive site have also been considered, as discussed in Section 9.

2.2 Construction hours

The construction hours for the Project are defined by Project Planning Approval (PPA) Conditions E36, E37, E38, E41, E42, E44 and E48. The Environment Protection Licence (EPL), should it be issued, is anticipated to be consistent with these conditions.

2.2.1 Standard construction hours

The standard construction hours of work are defined by the CSSI-7400 Condition E36. The standard construction hours for the Project are summarised in the table below.

Table 2-1: Standard construction hours

Construction Activity	Monday to Friday	Saturday	Sunday/ Public holiday
Above ground activities: construction sites and construction traffic	7:00 am to 6:00 pm	8:00 am to 1:00 pm	No work

2.2.2 Out of hours work periods

CSSI-7400 Condition E44 and E48 allow standard construction hours to be varied under specific conditions (where justified). Condition E48 allows the following activities to be carried out 24 hours per day, 7 days per week:

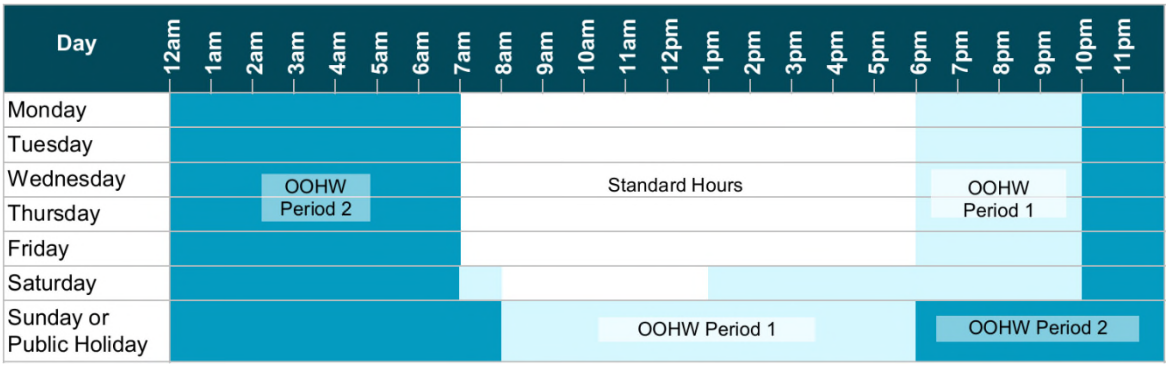
- Station and tunnel fit out, and
- Haulage and delivery of spoil and materials.

PPA Condition E44 and Condition E46 allow OOHW where it is permitted or required by an EPL. Systems Connect will not undertake OOHW until approved by an EPL or the Out of Hours Work Protocol. Oversize deliveries may need to take place outside of standard construction hours in order to comply with RMS requirements for oversize vehicle movements.

The Transport for NSW (TfNSW) Construction Noise and Vibration Strategy (CNVS) [9] provides a hierarchy of Out of Hours (OOH) work periods. The impact of OOH works may be reduced by scheduling work and activities with greater impact during the preferred periods when receivers are likely to be less sensitive to noise and vibration, such as in the day out of hours (OOHD) and evening out of hours (OOHE) periods.

Table 2-2 presents the construction work periods as Standard Hours, Out of Hours Work (OOHW) Period 1 and OOHW Period 2.

Table 2-2: Construction hours



1. Standard construction hours are defined in CSSI-7400 Condition E36 as: Monday to Friday 7:00am to 6:00pm and Saturdays from 8:00am to 1:00pm.
2. Work outside of standard construction hours is defined as Out-of-Hours Work (OOHW) and has been divided by the CNVS into 2 periods of sensitivity:
   - **OOHW Period 1** is the least sensitive OOH period and is defined as Monday to Friday 6:00pm to 10:00pm (evenings), Saturday 7:00am to 8:00am and 1:00pm to 10:00pm (day/ OOHD and evening/ OOHE) and Sunday and public holidays 8:00am to 6:00pm (day/ OOHD)
   - **OOHW Period 2** is the most sensitive OOH period and is defined as Monday to Saturday 10:00pm to 7:00am (night/ OOHN) and Sundays and public holidays 6:00pm to 8:00am (evening/ OOHE and night/ OOHN).

2.2.3 Justification for OOHW

The track works are an essential component of the Project due to be completed and open to rail traffic in 2024. This completion date has been calculated assuming track work, tunnel systems works and fit out works within the tunnel will be undertaken 24 hours a day, seven days per week. Due to time and space constraints it will not be possible to lift all materials into the dive structureand tunnel during standard hours, to allow track works to continue 24 hours per day. The process will need to continue during the evening period (6pm to 10 pm) and night period (10 pm and 7am).

OOHW activity on the surface and inside the dive structure, particularly after 10pm will be managed to minimise impacts on surrounding sensitive receivers. Stationary plant will be located at the bottom of the dive structure during the night period (10 pm to 7am) to reduce potential noise impact and manage noise from site to within the NMLs.

Allowing track works and tunnel fit out works to occur as OOHW will:

- Ensure key NSW Government program milestones are met.
- Ensure delivery of community and rail commuter user benefits.
- Allow increased project efficiency.
- Reduce the overall duration of the construction phase and in turn reduce the duration of impacts on the surrounding community.
- Minimise congestion impacts on the arterial road network.

The Project has been identified as Critical State Significant Infrastructure by the NSW Government and will provide an important commuter link connecting the existing Sydney Metro North West with the

CBD and South West. There are considerable benefits to the Project, NSW Government and the community from the prompt completion of construction of the Project. For the community particularly, completion of construction works will allow restoration of amenity and, in many respects, an increase in the quality of this amenity.

This, however, will be reviewed once works start and we have a better understanding of the logistics of the work (how efficiently they run and how heavily they are impacted by effects such as supply, traffic impact, etc).

Any work outside standard construction hours must be undertaken in accordance with an EPL, should it be issued, or the Out of Hours Works Protocol (for works not under an EPL) and the CNVMP [1].

2.2.4 COVID-19 extended construction hours

The Environmental Planning and Assessment (COVID-19 Development – Construction Work Days) Order 2020 is now in place and will continue until the COVID-19 pandemic is over, or the advice of NSW Health changes. The order permits standard construction hours on this project to be extended as follows:

- Saturday from 1pm to 6pm (no high noise work permitted)
- Sundays from 8am to 6pm (no high noise work permitted)
- Public holidays from 8am to 6pm (no high noise work permitted).

High noise work means activities such as rock breaking, rock hammering, sheet piling, pile driving or similar noisy activities, unless an existing consent or approval already allows these works to occur on any of the extended days.

The early access works that are the subject of this CNVIS are permitted 24 hours per day, 7 days per week under CSSI 7400 Condition E48 (see Section 2.2.2), with the exception of site establishment works (including set up of the gantry shed and crane, and the warehouse).

Appropriate noise management levels for the extended hours period (i.e. Sundays/ Public Holidays 8am to 6pm) are as outlined for the Day (D/ D(O)) period in Section 4.1.1.

3 Nearest sensitive receivers

3.1 Residential receivers

To assess and manage construction noise and vibration impacts, the residential areas surrounding the site have been divided into Noise Catchment Areas (NCAs) based on each area's similar acoustic environment prior to the start of construction work. The NCAs are based on those established in the EIS for the Project, with some modifications to allow for site specific characteristics.

All relevant residential sensitive receivers near the worksite are identified on an aerial photograph located in APPENDIX B.

3.2 Other sensitive receivers (PPA Condition E34)

Additional to residential receivers above, 'other' noise and vibration sensitive receivers such as passive recreation areas and places of worship surrounding the construction area have been identified and are summarised on an aerial photograph located in APPENDIX B.

CSSI-7400 Condition E34 states:

> *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.*

Sydney Metro and Systems Connect have undertaken consultation with identified sensitive receivers to determine sensitive periods. This has been taken into consideration in finalising respite strategies for high noise impacts.

3.3 Commercial and industrial premises

All commercial and industrial premises near the worksite have been considered in this assessment.

3.4 Heritage receivers

Heritage receivers have been identified in the Land Use Survey in ANNEXURE A.2 of the CNVMP. Table 3.1 identifies the heritage-listed structures close to work areas.

Table 3.1: Heritage receivers close to proposed work areas

Name	Address/Location	Significance
Flood storage reserve and brick drain (Sydenham Pit and Drainage pumping station 1)	Garden Street, Sydenham	Item 81 Marrickville LEP 2011; Item 4571743 Sydney Water S170; SHR Item 01644

4 Construction noise and vibration objectives

4.1 Noise goals

4.1.1 Noise management levels (NMLs)

Construction noise management levels (NMLs) have been determined using the Construction Environmental Management Framework (CEMF)[10], CSSI-7400 Conditions, in accordance with the Sydney Metro City & Southwest Construction Noise and Vibration Strategy (SMCSNVS) [8] and as set out in the CNVMP.

For the Southern Dive site, internal NMLs are applicable at residential receiver locations during the 7 am to 8 pm period through CSSI-7400 Conditions E37 and E38; and during the 8 pm to 7 am period per E41 and E42. During daytime and evening periods (between 7 am and 8 pm), external NMLs are derived from the ICNG, as identified in Section 5.1.1 of the CNVMP[1] and summarised in Table 4-1 below.

Table 4-1: Application of NMLs at CS2 Southern Dive (CSSI 7400 Conditions of Approval)

Time Period	Area	Receiver Type	Condition	Noise management level[3]
Day[1] (D/ D(O))	Identified precincts (inc Marrickville)	All	CSSI-7400 E38	Noise levels are required to be less than $L_{Aeq(15\ minute)}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq(15\ minute)}$ 55 dB(A). Noise equal to or above $L_{Aeq(15\ minute)}$ 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.[4]
Evening[1] 6pm to 8pm (E1)				
Evening[1] 8pm to 9pm (E2)	Non-residential zones[2]	Residential	CSSI-7400 E41	$L_{Aeq(15minute)}$ 60 dB(A) (internal)
Evening[1] 9pm to 10pm				$L_{Aeq(15minute)}$ 45 dB(A) (internal)
Night[1] 10pm to 7am (N)				
Evening[1] 8pm to 10pm (E2)	Residential zones[2]	Residential	CSSI-7400 E42	$L_{Aeq(15minute)}$ 45 dB(A) (internal)
Night[1] 10pm to 7am (N)				
All	All	All	CSSI-7400 E43	$L_{Aeq(8hour)}$ 85 dB(A) (external) near the CCSI

1. Day refers to 7am to 6pm Monday to Friday and 8am to 6pm Saturday, Sunday and Public Holidays; Evening refers to Monday to Sunday 6:00pm to 10:00pm; Night refers to Monday to Friday 10:00pm to 7:00am and Saturdays, Sundays and public holidays 10:00pm to 8:00am.
2. These are identified by the applicable Local Environmental Plan land zoning of the receiver.
3. Construction Environmental Management Framework – City & Southwest (Sydney Metro 2017)
4. Criteria as described in SSI 7400 Condition E38
5. A 5 dB penalty shall be applied if rock breaking or any other annoying activity likely to result in ground-borne noise or a perceptible level of vibration is planned

4.1.2 Sensitive receiver NMLs and respite for high noise impact works (CSSI-7400 Conditions E37 and E38)

Day-time works need to be assessed against the requirements of CSSI-7400 Conditions E37 and E38. Consultation will be undertaken with receivers predicted to experience internal noise levels greater than $L_{Aeq(15minute)}$ 60 dB(A), between 7am and 8pm, to determine appropriate hours of respite in accordance with CSSI-7400 Conditions E37 and E38. Receivers have been identified using the following process:

- An NML equivalent to an internal noise level of $L_{Aeq(15minute)}$ 60 dB(A) was established for all identified receivers:
  - For residential receivers, the equivalent external NML is based on a 10 dB(A) minimum (conservative) difference between external and internal noise levels (assuming windows open)
  - For non-residential receivers with light weight glazing, the equivalent external NML is based on a 20 dB(A) minimum (conservative) difference between external and internal noise levels (assuming windows closed)
  - Where additional information is available (e.g. if residential or non-residential properties have been acoustically treated), alternative outdoor to indoor noise difference will be determined to establish the equivalent external noise threshold
- Receivers where noise is predicted to be above the equivalent external NML are identified as requiring consultation.

The adopted difference between external and internal noise levels is identified in APPENDIX D.

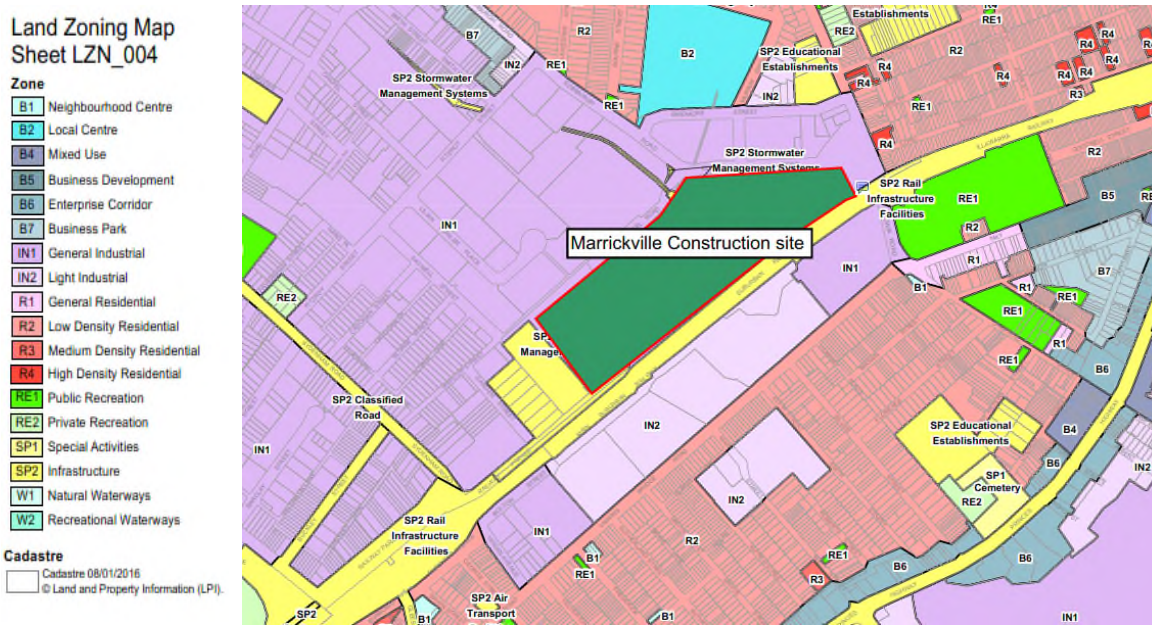
4.1.3 Residential receiver NMLs – 8pm to 7am (CSSI-7400 Conditions E41 and E42)

CSSI-7400 Conditions E41 and E42 require that residential receivers within non-residential zones or residential zones (respectively) are not above the internal noise levels identified in Table 4-1. In accordance with CSSI-7400 Conditions E41 and E42, if construction works are particularly annoying (as described in *ICNG NMLs* above) or include ground-borne noise or a perceptible level of vibration at the affected receiver, a 5 dB(A) penalty should be added to the predicted construction noise level.

Where the above internal noise levels cannot be achieved, additional mitigation in accordance with the *Sydney Metro City and South West Noise and Vibration Strategy (SMCSNVS)* [8] is to be offered.

Addendum A of the SMCSNVS notes that the applicable Local Environmental Plan land zoning of the receiver be used to identify if residential receivers are located within residential or non-residential zones. An extract from the Marrickville Local Environmental Plan (2011) land zoning map LZN_004 is provided in Figure 4.1. Red and pink areas (R2, R3 and R4) indicate residential zones. The zoning map indicates that the nearest residential receivers to the Southern Dive site are in low density residential areas (zone R2 in Figure 4.1).

Figure 4.1: Extract from the Marrickville Local Environmental Plan (2011) land zoning map



For this assessment, all residential receivers are conservatively assumed to be in residential zones, with a corresponding internal noise threshold level of $L_{Aeq(15minute)}$ 45 dB(A) between 8pm and 7am. Based on a minimum (conservative) external to internal noise difference of 10 dB(A) (assuming windows open), an equivalent external noise threshold of $L_{Aeq(15minute)}$ 55 dB(A) is applicable between 8pm and 7am for all receivers. Where these external equivalent levels are above the external noise threshold, additional mitigation may be required in accordance with the SMCSNVS.

The assessment presented in Section 5.2 has assessed all receivers against the approach outlined in the SMCSNVS [8] and the CNVMP [1] which achieves the requirements of PPA Conditions E41 and E42, and is consistent with the ICNG [3] and the EIS [2].

4.1.4 Sleep disturbance

Consistent with Section 5.1.3 of the CNVMP [1], an initial screening level of $L_{Amax} \leq L_{A90(15min)} + 15$ dB(A) is used. In situations where this results in an external screening level of less than 55 dB(A), a minimum screening level of 55 dB(A) is set. Note that this is equivalent to a maximum internal noise level of 45 dB(A) with windows open.

Where noise events are found to be above the screening level, further analysis is made to identify:

- the likely number of events above 45 dB(A) (internal) that might occur during the night assessment period
- whether events are above an 'awakening reaction' level of 55 dB(A) L_{Amax} (internal) that equates to NML of L_{Amax} 65 dB(A) (assuming open windows).

The ICNG recommends that where construction works are planned to extend over more than two consecutive nights, maximum noise levels and the extent and frequency of maximum noise level events above the RBL should be considered.

During construction works at night, attended noise monitoring will be undertaken at representative residences most impacted by the works during night-time periods (see Section 5). The noise monitoring will follow the procedures outlined in APPENDIX E of the CNVMP [1], which includes measurement of L_{Amax} noise metrics. If maximum noise levels are found to be above the sleep NML of 45 dB(A), the responsible noise source(s) will be identified and further analysis undertaken to quantify the extent and frequency of events above the NML. Additional feasible and reasonable mitigation measures may need to be considered to reduce potential impacts.

4.1.5 National Standard for exposure to noise

In accordance with PPA Condition E43, Systems Connect worksites will be managed to ensure that noise generated by construction will not be above 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 85 dB(A) for any employee working at a location near a Systems Connect worksite.

4.1.6 Construction related road traffic noise objectives

On the roads immediately adjacent to construction sites, the community may associate heavy vehicle movements with the Southern Dive site. Construction traffic movements on public roads will aim to limit any increase in existing road traffic noise levels to no more than 2 dB(A). All feasible and reasonable noise mitigation and management measures will be implemented.

4.2 Construction vibration goals

As reported in Section 5.4 and 5.5 of the CNVMP [1], construction vibration goals have been determined using:

- for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006) [4]
- for structural damage, 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 [5] and
    - German Standard DIN 4150-3: Structural Vibration - effects of vibration on structures [6].

4.2.1 Disturbance to building occupants (human annoyance)

For disturbance to human occupants of buildings, we refer to '*Assessing Vibration; a technical guideline*' [4]. This document provides criteria which are based on the British Standard BS 6472-1992, *'Evaluation of human exposure to vibration in buildings (1-80Hz)'* [7].

Intermittent vibration is assessed using vibration dose values (VDVs). For the assessment of potential vibration at the nearest vibration sensitive receivers preferred and maximum VDV goals for the day period (7:00am to 10:00pm) are presented in Table 4-2.

Table 4-2: Construction vibration disturbance goals

Location	Assessment period[1]	Vibration Dose Value (VDV), m/s$^{1.75}$	
		Preferred values	Maximum values
Critical areas[2]	Day or Night	0.10	0.20
Residences	Day	0.20	0.40
	Night	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or Night	0.40	0.80
Workshops	Day or Night	0.80	1.60

Notes: 1. Daytime is 7:00am to 10:00pm and night-time is 10:00pm to 7:00am

2. Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source: BS 6472-1992

4.2.2 Structural damage to buildings

A conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures (Line 1): 25.0 mm/s
- Unreinforced or light framed structures (Line 2): 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 would be required to determine the applicable safe vibration level.

It is noted that vibration levels required to cause minor cosmetic damage are typically 10 x higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

4.2.3 Heritage

Section 4.2.3 of the CNVMP [1] outlines the approach to manage potential vibration impacts on heritage items, where identified. The actions to be taken shall be to:

1) Identify heritage items where the 2.5 mm/s peak component particle velocity objective may be exceeded during specific construction activities

2) Structural engineering report to be undertaken on identified heritage items, to confirm structural integrity of the building and confirm if item is 'structurally sound'

3) If item confirmed as 'structurally sound', the screening criteria in Section 4.2.2 shall be adopted, or

4) If item confirmed as 'structurally unsound', the more conservative cosmetic damage objectives of 2.5 mm/s peak component particle velocity would be adopted.

4.2.4 Sensitive scientific and medical equipment

No sensitive scientific or medical equipment are known near the assessed works. If they are identified, relevant vibration criteria should be established for each item in line with Section 5.3.1 of the CNVMP [1], and any corresponding management or mitigation measures determined.

4.2.5 Utilities and other vibration sensitive structures

Where utilities or other vibration sensitive structures are identified, relevant vibration criteria will be established for each item per Section 5.5.4 of the CNVMP [1], and any corresponding management or mitigation measures determined.

5 Construction noise assessment

5.1 Noise prediction methodology

Modelling and assessment of airborne noise impacts from activities associated with the construction works were determined by modelling the noise sources, receiver locations, topographical features, and possible noise mitigation measures using a Cadna-A computer noise model developed for this project. The model calculates the contribution of each noise source at identified sensitive receiver locations and allows for the prediction of the total noise from a site for the various stages of the construction works.

The noise prediction models take into account:

- Location of noise sources and sensitive receiver locations.
- Height of sources and receivers referenced to one metre digital ground contours for the site area and surrounding area.
- Sound Power Levels (L_w) of plant and equipment likely to be used during the various construction activities (see Table C1 in APPENDIX C). Table C1 also identifies the plant and equipment that will operate during each assessment period and the likely timing of each activity/aspect.
- Separation distances between sources and receivers.
- Ground type between sources and receivers.
- Attenuation from barriers (natural and purpose built).

Key details regarding the construction site layout, the likely plant and equipment (including truck movements), and hours of operation were informed by the Design and Construction Teams. This information is presented in APPENDIX C and formed the basis for all modelling assumptions used in this assessment. Table C1 in APPENDIX C provides a list of activities for the tunnel fitout works which have been provided for completeness, however have not been included in the noise assessment as they occur underground.

5.1.1 Detailed design outcomes

During the site design process, Renzo Tonin & Associates played a key role in assisting Systems Connect to determine the noise mitigation measures required to reduce the site's noise impact, incorporating existing mitigation measures from previous stages of the project. The key noise mitigation measures that have been included in the noise modelling results presented in this CNVIS are the following:

- Existing 3m high noise wall along the between south eastern side of the dive structure and the rail corridor;
- Acoustic attenuators for ventilation fans required to support tunnel fit-out operations;
- Ventilation fan encasements to reduce fan casing noise.

The above listed mitigation measures are all existing measures which have previously been implemented for the Tunnels and Station Excavation (TSE) works will remain on site and will not be altered from the existing configuration.

The works include construction of a Gantry shed. This shed would have a roof, however all sides of the shed would mostly be open without a solid façade. For the purpose of this assessment, it has been assumed that the shed would not provide any benefit for mitigating noise from works occurring in around the shed.

In addition to the above, noise modelling of the welding and distribution works was conducted on the surface and within the dive structure. It was determined that for rail distribution welding and grinding works to occur on the surface, acoustic screening would be needed to enable works to occur during the E2 and night periods. As the final location of the welding activities is not yet known, this assessment has considered a worst case location of the welding activity on the surface with no welding or grinding in the E2 and Night periods. The locations of the welding on surface and within the dive are presented on the figure in APPENDIX B.

5.1.2 Construction activities

Table 5-1 presents a summary of the construction activities and aspects that are proposed to take place during the works. Table C1 in APPENDIX C provides a list of plant and equipment in use during the day, evening and night assessment periods for the construction activities summarised in Table 5-1.

Table 5-1: Summary of construction activities

Activity	Aspect	Assessment reference	Duration
Site establishment	General worksite & car parking Material handling and deliveries Relocation of gantry crane	S01	August 2020 to September 2020
Track works & tunnel	General worksite & car parking Material handling and deliveries FRP concrete, Material loading/Deliveries, gantry crane operation Weld production and rail distribution Tunnel fit out (inside tunnels, no noise assessment)	S02a Weld production on surface with sawing[1,2]	September 2020 to December 2020
		S02b Weld production on surface without sawing[1,2]	
		S03 Weld production in dive[2]	

Note: 1. Day and Evening-E1 period only, subject to verification monitoring confirming noise levels are within NMLS during Evening-E2 and night periods.

2. Weld production would occur either on the surface (S02) or in the dive (S03).

5.2 Predicted noise levels

Predicted L_{Aeq} noise levels from the worksite are assessed against the NMLs and summarised in the following sections, with colour coding to denote the highest level of exceedance of the NML. Detailed results for each receiver are given in APPENDIX D.

The noise predictions presented in this CNVIS represent a realistic worst-case scenario when construction occurs at work locations close to residences and other sensitive receivers. At each receiver, noise levels will vary during the construction period based on the position of equipment within the worksite, the distance to the receiver, the construction activities being undertaken and the noise levels of particular plant items and equipment. Actual noise levels will often be less than the predicted levels presented in this CNVIS.

5.2.1 CSSI-7400 Conditions E37 and E38

The following sections present the predicted worst-case construction noise levels for each of the construction stages identified in Table 5-1 at the most affected residential receiver in each NCA and other sensitive receivers (OSR). The results are compared with the internal NMLs in CSSI-7400 Conditions E37 and E38. Where the measured or predicted noise levels are above the equivalent external NML, consultation will be undertaken with affected receivers to determine appropriate hours of respite in accordance with PPA Conditions E37 and E38. The impacts presented are as follows:

- ◆ Noise levels predicted to be below internal NMLs in PPA Conditions E37 and E38
- ☐ Noise levels predicted to be above internal NMLs in PPA Conditions E37 and E38.

Table 5-2: Summary of construction noise impacts for the Day and E1 period – CSSI-7400 Conditions E37/ E38

NCA	S01	S02a	S02b	S03
MDS_01	◆	◆	◆	◆
MDS_02	◆	◆	◆	◆
MDS_03	◆	◆	◆	◆
MDS_04	◆	◆	◆	◆
OSR	◆	◆	◆	◆

Notes:
Day: 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays
E1: Evening period from 6pm to 8pm.
OSR: this includes all commercial, industrial and other sensitive receivers.

Based on the results presented in Table 5-2 above, noise levels from track works and tunnel works are predicted to be below the NMLs in PPA Conditions E37/E38 during the 7 am to 8 pm day/evening period. For more detailed predictions, see APPENDIX D.

5.2.2 PPA Conditions E41/42

Table 5-3 summarises the predicted noise impacts for each construction stage in each NCA compared with the internal NMLs in CSSI-7400 Conditions E41 and E42. Where predicted levels are above the E41/42 NMLs at residential receivers, additional mitigation measures will be implemented in accordance with the documented procedure in Addendum A of the SMCNVS.

The impacts presented are as follow:

- ◆ Noise levels predicted to be below internal NMLs in PPA Conditions E41 and E42;
- ☐ Noise levels predicted to be above internal NMLs in PPA Conditions E41 and E42.

Table 5-3: Summary of construction noise impacts for the E2 and Night period – CSSI-7400 Conditions E41/42 (residential only)

NCA	S01	S02a	S02b	S03
MDS_01	◆	◆	◆	◆
MDS_02	◆	◆	◆	◆
MDS_03	◆	◆	◆	◆
MDS_04	◆	◆	◆	◆

Notes:
E2: Late evening period from 8pm to 10pm.
N: Night-time period from 10pm to 7am.

The results in Table 5-3 indicate that construction noise is predicted to comply with the internal noise threshold of PPA Conditions E41/E42 at the nearest residential receivers within all NCAs. The noise predictions are based upon the activities and plant and equipment presented in APPENDIX C.

As detailed in Section 5.1.1, flashbutt welding has been assessed both on the surface and within the dive. The noise level predictions initially found that acoustic screening would be needed to perform flashbutt welding on the surface to be below the evening E2 and night-time period NML. Based on these predictions, flashbutt welding on the surface has been limited to the daytime and evening E1 period for this assessment. Flashbutt welding on the surface may be conducted during the evening E2 and night-time period, however this would be subject to verification monitoring confirming noise levels from site activities are below the evening E2 and night period NML.

Where Flashbutt welding activities occur within the dive (S03) they may be carried out 24 hours, with the exception of rail sawing. Rail sawing in the dive is predicted to be above the E2/ Night internal NMLs and has therefore been excluded during the evening E2 and night-time periods. Onsite measurements would be conducted to verify the source noise levels presented in APPENDIX C.

Based upon results presented in Section 5.2, additional noise mitigation is not required.

5.2.3 Sleep disturbance

The maximum noise levels associated with on-site heavy vehicle movements may potentially cause sleep disturbance at nearby residential receivers.

The L_{max} noise levels associated these events are expected to generally be below the screening levels except for trucks exiting the site. In this case, although maximum noise levels may be above the screening level of 45 dB(A) L_{Amax} (internal), they are well below the sleep disturbance 'awakening reaction' level of 55 dB(A) L_{Amax} (internal). Nonetheless, these activities will be managed by minimising unnecessary acceleration on site and installing air brake silencers on heavy vehicles. Toolbox talks will be used to advise all personnel of the need to follow quiet work practices during OOHW periods and of the

need to respect the residential receivers surrounding the work site. Other management measures are outlined in Section 5.3 to aid in providing additional noise reduction benefits where predicted levels are above the objective occurs.

5.3 Noise mitigation and management

5.3.1 Consultation with affected receivers (CSSI-7400 Condition E33)

CSSI-7400 Condition E33 requires consultation with affected receivers to assist in determining site-specific mitigation measures to be included in this CNVIS. It is noted that as there are no noise affected receivers, consultation would not include discussion of further specific mitigation measures.

Systems Connect will continue consultation with potentially affected sensitive receivers, both prior to and following commencement of early access works at Southern Dive LWW. That consultation would include email and phone calls whilst COVID-19 restrictions are in place. Where possible, doorknocking of affected residents and businesses will be carried out prior to night time early access works. “Sorry we missed you" slips and notifications of works will be left where contact with building occupants has not been made. As appropriate, drop in sessions will be carried out at local businesses.

5.3.2 Site noise control measures

Table 5-4 shows the noise control measures recommended to reduce potential noise impacts.

Table 5-4: Site noise control measures

Control type	Control measure	Typical use
At-source control measures	Noise control kits	Plant that is brought to site for early access works should meet the sound power limits identified in Table C1. Where plant are above limits then the plant may require installation of ‘noise control kits’ to comply with the noise limits in Table C1. Such ‘noise control kits’ comprise: • high performance ‘residential-grade’ exhaust mufflers, • additional engine cowling / enclosure lined inside with sound absorbent industrial-grade foam, and • air intake and discharge silencers / louvres. The need to fit ‘noise control kits’ onto the identified plant, will be confirmed once each plant item is tested prior to its regular use on site, in accordance with Section 8 of the CNVMP.
	Limit equipment in use	Only the equipment necessary during each stage of the works will be used.
	Timing of equipment in use	Where practicable, activities and plant will be limited as outlined in Table C1 (APPENDIX C).
	Limit activity duration	Any equipment not in use for extended periods shall be switched off. For example, heavy vehicles should switch engines off when not in use.
	Use and siting of plant	Avoid/ limit simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver. Direct noise-emitting plant away from sensitive receivers where practicable. Locate fixed location plant items as far from sensitive receivers as practicable.
	Equipment selection	Use quieter and less noise/ vibration emitting construction methods where feasible and reasonable.

Control type	Control measure	Typical use
	Truck movements	Where practicable, avoid the use of park air brakes at night. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site.
	Non-tonal alarms	Alternative alarms, such as 'quackers' will be installed on all vehicles & mobile plant regularly used on site and on all vehicles & mobile plant required for OOHW.
Path mitigation measures	Temporary noise screens	Where practicable, temporary noise screens (e.g. Flexshield, Echo-barrier, or similar) should be used to provide additional noise reduction during works. Temporary noise screens can provide 5 to 10 dB noise reduction, where they can break line of sight.
Noise management measures	Site inductions & Toolbox Talks	All employees, contractors and subcontractors will receive a Project induction. The environmental component may be covered in toolboxes and should include: • location of nearest sensitive receivers • relevant project specific and standard noise and vibration mitigation measures; • permitted hours of work; • OOHW Procedure and Form • construction employee parking areas.
	Community consultation	Inform community of construction activity and potential impacts.
	Respite periods	Noise levels are required to be less than $L_{Aeq(15\ minute)}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq(15\ minute)}$ 55 dB(A). Noise equal to or above $L_{Aeq(15\ minute)}$ 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.
	Behavioural practices	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.
	Noise monitoring	Noise monitoring is to be carried out as detailed in Section 5.3.4.

5.3.3 Additional noise mitigation measures

Table 5-5 below should be used to advise the appropriate additional noise mitigation during construction, based on the CNVS [9] and the CNVMP [1].

Table 5-5: Additional airborne noise mitigation measures

When is the work being undertaken?	How much does the predicted noise level exceed the ANML by?	Identify additional management measures to be implemented
Standard Hours M-F 7am to 6pm Sat 8am to 1pm	0 dB(A)	- -
	≤ 10 dB(A)	- -
	10 to 20 dB(A)	LB, M [MM2]
	> 20 dB(A)	LB, M [MM2]
OOHW Period 1 M-F 6pm to 10pm Sat 1pm to 10pm Sun/ PH 8am to 10pm	< 5 dB(A)	- -
	5 to 15 dB(A)	LB [MM1]
	15 to 25 dB(A)	LB, M [MM2]
	> 25 dB(A)	LB, SN, IB, RO, M [MM4]
OOHW Period 2 M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	< 5 dB(A)	- -
	5 to 15 dB(A)	LB, M [MM2]
	15 to 25 dB(A)	LB, SN, IB, RO, M [MM4]
	> 25 dB(A)	LB, SN, IB, RO, AA, M [MM5]

Notes: Use the abbreviation codes in the table above to confirm management measures required
Code in square brackets [] refers to noise management code for affected receivers identified in each CNVIS
LB = Letter box drops
M = Monitoring of predicted noise levels
SN = Specific notifications (personalised letter, phone call, email, individual briefing)
RO = Project specific respite offer
AA = Alternative accommodation

Predicted noise levels in Section 5.2 comply with E37/E38 and E41/E42 NMLs, therefore no AMMs are required. Note that all potentially impacted receivers will be kept informed of the nature of works to be carried out, the expected noise levels and duration, as well as be given the project enquiries and complaints 1800 numbers (see Section 5.3.5)

5.3.4 Attended noise monitoring

Real time noise monitoring in accordance with CSSI-7400 Condition C11 is not proposed to be undertaken for the Southern Dive site. Attended noise monitoring will be undertaken as required by this CNVIS. Noise monitoring is subject to obtaining the property owner/occupier's consent to access the property (where required). If consent to access property is denied, monitoring will be done on public land on the property boundary, provided it is safe to do so.

Attended noise monitoring will be undertaken during works at one of the representative residential receivers identified in the table below. Nominated attended measurement locations have been selected with the best opportunity to validate the predicted noise levels.

Table 5-6: Nominated verification monitoring locations

NCA	Nominated receiver address	Monitoring location at 1 m from
MDS_01	65 EDINBURGH ROAD MARRICKVILLE	South-eastern façade
MDS_02	358-360 EDGEWARE ROAD NEWTOWN	Western façade
MDS_03	119 MAY STREET ST PETERS	Western façade
MDS_04	74 UNWINS BRIDGE ROAD ST PETERS	Northern façade

Notes:
Monitoring on private property is subject to owner consent and where relevant, occupier consent. If consent to access property is denied, monitoring will be done on public land on the property boundary, provided it is safe to do so.

Noise monitoring will be undertaken to determine if the construction noise levels are higher than the external equivalent NML specified in CSSI-7400 Conditions E37/38 and E41/E42. If verification monitoring shows that the external noise levels are consistently above the predicted (or required) noise levels presented in 5.2 (i.e. 2 or more consecutive verification monitoring events/ occasions that find the works to be the primary contributor noise above the E37/E38 and E41/E42 NML), investigation will be undertaken to understand the cause of the exceedance and additional mitigation and management measures will be implemented in accordance with Sydney Metro City and South West Noise and Vibration Strategy.

5.3.5 Complaints Handling

Noise complaints received and responded to will be managed in accordance with the CNVMP and the Community Consultation Strategy.

Transport for NSW operate a 24-hour construction complaints line (1800 171 386).

Enquiries/ complaints may also be received through the Sydney Metro project email (linewide@transport.nsw.gov.au).

6 Construction vibration impacts

6.1 Minimum working distances for vibration intensive plant

From the plant and equipment listed in APPENDIX C, the dominant vibration generating plant and equipment include:

- Compactor / roller (12 tonnes)

Potential vibration generated to receivers is dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration, and the receiver structure.

The recommended minimum working distances for vibration intensive plant are presented in Table 6-1 and Table 6.2. Site specific minimum working distances for vibration intensive plant items must be measured on site where plant and equipment are likely to operate close to or within the minimum working distances for cosmetic damage (Table 6-1).

Unlike noise, vibration cannot be readily predicted. There are many variables from site to site, such as soil type and conditions, sub surface rock, building types and foundations, and actual plant on site.

The data relied upon in this assessment (tabulated below) is taken from a database of vibration levels measured at various sites or obtained from other sources (such as BS5228-2:2009). They are not specific to this project as final vibration levels are dependent on many factors including the actual plant used, its operation and the intervening geology between the activity and the receiver.

Table 6-1: Minimum working distances (m) for cosmetic damage (continuous vibration)

Plant item	Minimum working distance (m)		
	Reinforced or framed structures (e.g. commercial buildings)[1]	Unreinforced or light framed structures (e.g. residential buildings) [1]	Sensitive structures (e.g. heritage structures)[2]
Compactor / roller (4-12t) - low vibration	5	5	10

Notes 1) Initial screening test criteria reduced by 50% due to potential dynamic magnification in accordance with BS7385.

2) In accordance with Section 5.8.1 of CNVMP, a site inspection should determine whether a heritage structure is structurally unsound.

3) Minimum working distances are in 5m increments only to account for the intrinsic uncertainty of this screening method.

Table 6-2: Minimum working distances (m) for human annoyance (continuous vibration)

Plant item	Minimum working distances, m				
	Critical areas[1,4]	Residences		Offices[3,4]	Workshops[4]
		Day[2]	Night[2]		
Compactor / roller (4-12t) - low vibration	25	10	15	10	5

Notes 1: Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring.

2: Daytime is 7 am to 10 pm; Night-time is 10 pm to 7am.

3: Examples include offices, schools, educational institutions and place of worship.

4: Applicable when in use.

6.2 Vibration assessment

6.2.1 Structural damage

The numbers of buildings which are close to or within the minimum working distances for cosmetic damage are shown in Table 6-3.

Table 6-3: Number of buildings within minimum working distances for cosmetic damage

Plant item	Number of buildings	
	Screening criteria for non-heritage structures	Screening criteria for heritage structures
Compactor / roller (4-12t) - low vibration	0	0

The nearest receiver building to the site is located at 18-22 Lilian Fowler Place approximately 25 metres to the north west of the site where the warehouse shed is being constructed. This receiver is industrial and beyond the minimum working distance for cosmetic damage.

6.2.2 Human annoyance

The assessing vibration guideline [4] notes that inside dwellings, adverse comments often arise when occupants can perceive (feel) vibration, particularly when the vibration arises from a source located outside their home (or outside their control), and assume that the vibration has the potential to damage their building or contents.

However, it is noted that vibration levels required to cause minor cosmetic damage are typically 10 x higher than levels that will cause disturbance to building occupants. Many building occupants assume that building damage is occurring when they feel vibration or observe rattling of loose objects, however the level of vibration at which people perceive vibration or at which loose objects may rattle is far lower than vibration levels that can cause damage to structures.

There are no receivers within the minimum working distances established for human annoyance during the site establishment phase where rollers would be used.

7 Ground-borne noise assessment

Due to the nature of the Southern Dive works, which are surface works, airborne noise is expected to be much higher than ground-borne noise levels at the nearest sensitive receivers.

The risk of annoyance due to ground-borne noise is therefore considered low and has not been addressed further in this CNVIS.

8 Traffic noise assessment

8.1 Traffic sources

All heavy vehicles will access the Southern Dive worksite via the via May Street and Bedwin Road, which are sub-arterial roads with significant daytime flows, and turn into Edinburgh Road and Murray Street. Daytime (7am to 10pm) truck movements will involve up to six trucks per hour travelling on May Street, Bedwin Road, Edinburgh Road and Murray Street.

A maximum of six heavy vehicle movements per hour is required during night-time periods for the Track works support. These night-time vehicle movements will use the same route as during the daytime.

As outlined in Section 4.1.6 (and Section 5.3 of the CNVMP), the noise increase associated with construction traffic movements on public roads aims to limit any increase in existing road traffic noise levels to no more than 2 dB(A). An increase greater than 2 dB(A) may be permitted if construction-related road traffic noise levels are less than the allowable noise levels in the NSW Road Noise Policy (60 dB $L_{Aeq(15hour)}$ day and 55 dB $L_{Aeq(9hour)}$ night).

To predict road traffic noise levels on the existing road network, the most recent available traffic count data for each road forming part of the site access route was obtained by reviewing the following reference sources:

- Construction Traffic Impact Assessment – Marrickville Dive Site and Precinct [12];
- Traffic counts for May Street over the week of 10 December 2017 to 16 December 2017 provided by JHCPBG.

Traffic volumes are detailed in Table 8.1.

Table 8.1: Traffic noise modelling data - existing road network

Site	Road	Road category (RNP)	15-hour day period (7am-10pm)				9-hour night period (10pm-7am)			
			Existing		Project		Existing		Project	
			TOTAL	HV	TOTAL	HV	TOTAL	HV	TOTAL	HV
Marrickville	Bedwin Road	Sub-arterial	21242	2124	480	360	3749	187	180	108
Marrickville	May Street	Sub-arterial	14234	1508	480	360	2543	287	180	108

8.2 Predicted construction traffic noise

The potential impact of construction road traffic noise to nearby residential receivers has been estimated using the United Kingdom Department of Environment's 'Calculation of Road Traffic Noise' (1988) method. The method uses the average 1-hour traffic volume for the 'assessment period' (i.e. day or night) to predict the $L_{10,\ 1hour}$ noise levels. A correction of -3dB(A) is applied to obtain the $L_{eq,\ 1\ hour}$ noise levels which equate to the L_{Aeq} noise levels for the 'assessment period'.

For this assessment, the model has taken into account:

- traffic volume and heavy vehicle forecasts;
- posted vehicle speed;
- road gradient;
- ground reference levels of the road and receivers;
- separation distances of the road to receivers;
- ground type between the road and receivers; and
- angles of view of the road from the receiver's position.

For assessment purposes, residential receivers along Bedwin Road are assumed to be a typical worst-case distance of 25m from the road whilst residential receivers along May Street are assumed to be a typical-worst case distance of 6m from the road.

Predicted construction-related road traffic noise levels are provided in Table 8.2 for the nearest residential receivers exposed to noise from the Pacific Highway and construction traffic.

Table 8.2: Construction traffic assessment

Site	Road	Road category (RNP)	Increase, dB(A)	
			Day $L_{Aeq(15h)}$	Night $L_{Aeq(9h)}$
Marrickville	Bedwin Road	Sub-arterial	0.4	0.9
Marrickville	May Road	Sub-arterial	0.5	0.9

Notes:

* Predicted increases are based on the most impacted receiver

The predicted road traffic noise levels generally indicate a less than 2 dB(A) increase in overall day $L_{Aeq(15h)}$ and night $L_{Aeq(9h)}$ noise on the roads proposed to be used by construction traffic, and so construction traffic noise is predicted to have minimal impact on nearby receivers and complies with the traffic NMLs identified in Section 4.1.6.

Up to six trucks and hour will access the site during the night-time. This is significantly less than the 16 trucks per hour that was assessed during the TSE works for the tunnelling support at the site. Based on the previous assessment and the reduced volumes for the early access works, maximum noise levels events from construction related road traffic is not expected to generate a significant increase in sleep disturbance.

8.3 Traffic noise mitigation and management

The Heavy Vehicle Code of Conduct includes several measures, including limiting of compression braking, which will ensure that noise impacts of heavy vehicle traffic on surrounding streets are minimised.

9 Cumulative impacts

All concurrent Sydney Metro construction works have been considered and addressed in this CNVIS.

Systems Connect are aware of other ongoing, potentially concurrent construction activities within the vicinity of the Southern Dive site. These works, summarised in Table 9.1, may have the potential to generate cumulative noise impacts on receivers. These works have been considered but it has been determined that, due to the nature of the other unrelated construction works, no additional physical mitigation measures are deemed reasonable. Nevertheless, Systems Connect will endeavour to take all reasonable steps to collaborate with other Projects to minimise cumulative noise and vibration impact where Systems Connect are above management levels and coordinate respite for affected sensitive receivers, whenever practicable.

Table 9.1: Other construction works close to Southern Dive site

Construction company	Project	Timing of activities	Hours of works	Works location	Activity types	General plant types
CPB Dragados Samsung	WestConnex New M5 - Local Roads works	Current to June 2020	Standard construction hours, outside construction hours and Road Occupancy Licence (ROL) works.	Along Campbell Street, May Street, Unwins Bridge Road	Complete	
CPB Dragados Samsung	WestConnex New M5 - St Peter Interchange (SPI)	Current to Mid 2020	Standard construction hours, outside construction hours .	St Peter Interchange (SPI)	Tunnel support and civil works	Roadworks and earthworks, cut and cover works, Spoil handling, portal surface works, ventilation station works, northern ramp surface works
Lendlease Samsung Bouygues Joint Venture	WestConnex M4-M5 Link Tunnels	Current to Q1 2023	Standard construction hours, outside construction hours .	Campbell Road Civil and Tunnel Site	Tunnel support and civil works	Roadworks and earthworks, cut and cover works, tunnel support, spoil handling, portal surface works, ventilation station works, northern ramp surface works
JHCPBG JV	Sydney Metro TSE Works	February 2020 to February 2021	Standard construction hours, outside construction hours .	Marrickville Dive Site and Stabling Yard	Marrickville site demobilisation and stabling yard preparation works	Demolition of acoustic sheds and hardstands; Temporary Piling and permanent concrete pile installation; Bulk and detailed excavation for culverts and retaining walls; Cranage; FRP works
John Holland Laing O'Rourke	Sydenham Station Joint Venture (SSJV)	Current to February 2021	Standard construction and outside and rail possession works Intermittent out of hours works around Sydenham Railway Station and Railway Parade	Around Sydenham Railway Station	Rail and signalling modification works	Utility relocation, minor earthworks, signal and rail modification.
Sydney Trains	Sydney Trains maintenance works	Based on Sydney Trains trackwork schedule	Standard construction hours, outside construction hours and rail possession works.	Any point along the railway corridor. Immediately adjacent to LWW worksite	Rail and signalling maintenance works	Utility relocation, minor earthworks, signal and rail modification.

10 Conclusion

Works associated with the C2S Southern Dive early works have been identified and described in this report. Potentially affected noise and vibration sensitive receivers and relevant construction noise and vibration objectives have been identified and discussed to allow the assessment of potential construction impacts.

Expected construction noise levels have been predicted and presented in Section 5.2 and APPENDIX D. The expected duration of construction activities is outlined in Table C1 of APPENDIX C.

During the day-time/evening period (from 7am to 8pm), noise modellings of the flashbutt welding has been conducted on the surface with grinding and sawing activities having the greatest impacts. For these activities to occur on the surface during the evening period E2 and night-time, shielding would be required. Based on this, all flashbutt welding activities during the E2 and night-time have been assessed separately within the dive structure.

Construction noise is predicted to comply with Conditions E41 and E42 at all assessed residential receivers. Noise mitigation and management measures have been presented in Section 5.3 to aid in providing noise reduction benefits. Additional noise mitigation and management measures other than those outlined in Section 5.3 are not required.

Construction vibration impacts have been assessed a presented in Section 6. There are no receivers predicted to be within the minimum working distances for structural damage or human annoyance.

Due to the nature of the Southern Dive works, which are surface works, airborne noise is expected to be much higher than ground-borne noise levels at the nearest sensitive receivers.

Construction traffic has been assessed, indicating compliance with construction-related road traffic noise objectives at all residential receiver locations.

References

[1] Sydney Metro City & Southwest – Line Wide Works Contract Construction Noise and Vibration Management Plan (SMCSWLWC-SYC-1NL-PM-PLN-000032-A-CNVMP-C2B)

[2] SLR Consulting Australia Pty Ltd 2016 Sydney Metro Chatswood to Sydenham - Technical Paper 2: Noise and Vibration Report Number 610.14718R1 – 28 April 2016

[3] Department of Environment and Climate Change 2009 NSW Interim Construction Noise Guideline

[4] Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline

[5] British Standard BS 7385 Part 2 1993, Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

[6] German Standard DIN 4150-3:2016-12 Vibration in buildings – Part 3: Effects on structures

[7] British Standard BS 6472-2008, Evaluation of human exposure to vibration in buildings (1-80Hz)

[8] Transport for NSW Sydney Metro City & Southwest Construction Noise Strategy (ref: 610.14213-R3) 08 August 2016

[9] Transport for NSW Construction Noise and Vibration Strategy (ref: 7TP-ST-157/4.0) May 2018

[10] Transport for NSW Sydney Metro Construction Environmental Management Framework August 2016

[11] Department of Environment, Climate Change and Water 2011 NSW Road Noise Policy

[12] ARCADIS – Construction Traffic Impact Assessment – Marrickville Dice Site and Precinct (report number AA009699, dated 3 November 2017, revision A)

[13] NSW Department of Planning – Development near rail corridors and busy road – interim guideline 2008

[14] Eric Schreurs, Lex Browns and Deanna Tomerini – Maximum pass-by noise levels from vehicles in real road traffic streams: comparison to modelled levels and measurement protocol issues. Internoise 2011, Osaka Japan, September 4-7

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

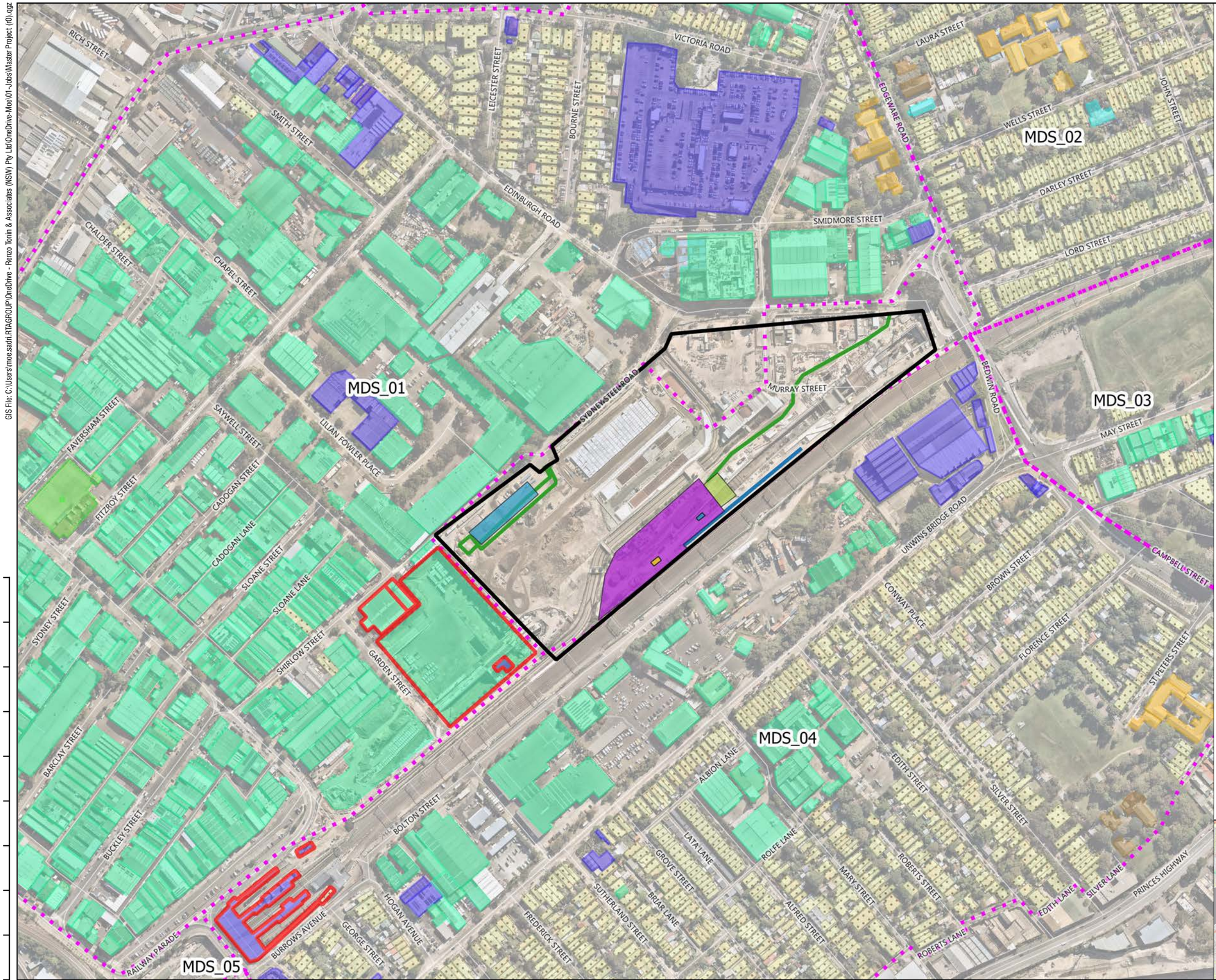
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Nearest sensitive receivers and noise management levels

Land-Use file revision_date: r11_18/06/20

Plot Date: 18/06/20 - 16:36 Layout: TK685-25 SDhive Figure B1 (r0)

GIS File: C:\Users\moe.sadri.RTAGROUP\OneDrive - Renzo Tonin & Associates (NSW) Pty Ltd\OneDrive-Moe\01-Jobs\Master Project (r0).qgz



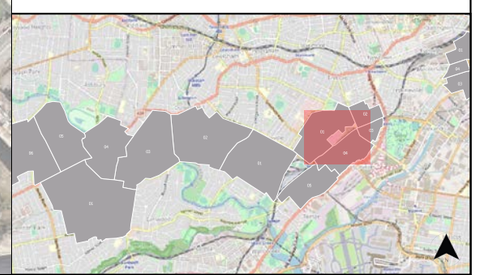
450 m
400
350
300
250
200
150
100
50
0

LEGEND

Noise sensitive receivers

- Childcare
- Commercial
- Educational
- Hotel/Motel/Hostel
- Industrial
- Medical
- Place of Worship
- Recording studio
- Recreational - Active
- Recreational - Passive
- Residential
- Theatre/Auditorium
- Mixed use
- Project acquisition
- Film/TV studio
- Cinema
- Community centre
- Library
- Laboratory
- Other
- Heritage

- NCA
- Marrickville site
- Warehouse
- Gantry shed
- Work area
- Existing 3m barrier
- Vehicle access
- FBW Surface
- FBW Dive



REV	BY	DATE	DESCRIPTION	APPROVER
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r0	MS	18/06/20	Prepare figures	TG

0 50 100 150 200 m

1:4200

FULL SIZE A3

A3 Original

Co-ordinate System: MGA Zone 56

NOTE: Do not scale from this drawing.

CLIENT

Systems Connect

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

inspired to achieve

Ph (02) 8218 0500 Fax (02) 8218 0501

SYDNEY METRO - CHATSWOOD TO SYDENHAM

LINE WIDE WORKS

Land Use, NCAs

Work area: Marickville easy access works

Table B1: Noise sensitive receivers and construction noise management levels

Marrickville early access works

NCA	Nearest construction work area	Receiver Type	Reference RBL	Existing Noise Levels, dB(A)			Residential NMLs based on ICNG (external)				Sleep Dist. L_{Amax}		Comments
				RBL Day	RBL Evening	RBL Night	NMLDS	NMLDO	NMLE	NMLN	Screening[1]	Max[1]	
Portion 2 & 3	**Chatswood to Sydenham (C2S)**												
MDS_01	Marrickville Dive	Residential north west of railway line, south west of Edgeware Rd	C2S EIS B.03	52	43	38	62	57	48	43	55	65	
MDS_02	Marrickville Dive	Residential north west of railway line, north east of Edgware Rd	C2S EIS B.02	58	52	38	68	63	57	43	55	65	
MDS_03	Marrickville Dive	Residential south of railway line and east of Bedwin Street	C2S EIS B.01	59	53	41	69	64	58	46	56	65	
MDS_04	Marrickville Dive	Residential south east of railway line and south west of Bedwin Street	C2S EIS B.01	59	53	41	69	64	58	46	56	65	
Other sensitive receivers													
Studio building (music recording studio)							45	45	45	45			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Studio building (film or television studio)							50	50	50	50			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Cinema space, theatre, auditorium							55	55	55	55			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Hotel (Sleeping areas: Hotels near major roads)							60	60	60	60			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Classrooms at schools and other educational institutions							55	55	55	55			Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Chilcare centre (internal play and sleeping areas)							50	50	50	50			Source: AAAC - guideline for Child Care Centre Acoustic Assessment, assuming a conservative façade loss of 10 dB(A)
Hospital wards and operating theatres							65	65	65	65			Source: ICNG, assuming a conservative façade loss of 20 dB(A)
Places of worship							55	55	55	55			Source: ICNG, assuming a conservative façade loss of 10 dB(A)
Library (reading areas)							65	65	65	65			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Office building (general office areas)							65	65	65	65			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Hotel (bars and lounges)							70	70	70	70			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Community centres – Municipal Buildings							60	60	60	60			Source: AS2107 'maximum', assuming a conservative façade loss of 10 dB(A)
Restaurant, bar (Bars and lounges/ Restaurant)							70	70	70	70			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Railway platform and concourse areas							75	75	75	75			Source: AS2107 'maximum', assuming a conservative façade loss of 20 dB(A)
Café/ Restaurant/ Bar (outdoors)							60	60	60	60			Source: AS2107 'maximum1'
Passive recreation areas (e.g. area used for reading, meditation)							60	60	60	60			Source: ICNG
Active recreation areas (e.g. sports fields)							65	65	65	65			Source: ICNG
Commercial premises (including offices and retail outlets)							70	70	70	70			Source: ICNG
Industrial premises							75	75	75	75			Source: ICNG

Notes:
1 - Levels are estimated assuming an open windows (i.e. 10dBA façade losss)
D(S): standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 6 pm Saturday
D(O): out-of-hours day period from 8 am to 6 pm Sunday and Public holidays - OOHW P1
E: evening period from 6 pm to 10 pm Monday to Sunday - OOHW P1
NS: night shoulder period from 10 pm to 12 am Monday to Sunday - OOHW P1
N: night-time period from 10 pm to 7 am Monday to Friday, from 10 pm am to 8 am Saturday, Sunday and Public holidays - OOHW P2
MS: morning shoulder period from 5 am to 7 am Monday to Friday, from 6 am to 8 am Saturday, Sunday and Public holidays - OOHW P1

APPENDIX C Construction details

Table C1: Construction Timetable/ Activities/ Equipment

Marickville early access works

Work acitvity	Aspect	Indicative timing/ duration	Modelling ID	Plant/ Equipment	Plant/ Equipment (as provided by client)	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)			High noise plant (EPL E1)	Vibration intensive plant	Notes
						7am - 6pm	6pm - 10pm	10pm - 7am	L_{Aeq}	Penalty	L_{Amax}			
GENERAL SITE														
Surface	General worksite and car parking	August 2020 to December 2020		Light vehicles / traffic control utes	Light vehicle	8 per hour	4 per hour	4 per hour	89	-	100	-	-	
				Forklift	Forklift	1	1	1	99	-	103	-	-	
SITE ESTABLISHMENT														
Surface	Installation of enviro controls, establish compound/Laydown areas, construction of Crane Pads,	August 2020 to October 2020		Backhoe	Backhoe	2	-	-	100	-	104	-	-	
				Hand tools	Hand Tools	1	-	-	107	-	111	-	-	
				Delivery truck	Small Truck	4 p.h.	-	-	106	-	111	-	-	
				Excavator w bucket (25t)	Excavator	1	-	-	103	-	108	-	-	
				Grader (140H)	Grader 12H	1	-	-	113	-	121	-	-	
				Roller smooth/padfoot (12t)	Roller	1	-	-	109	5	113	HN	X	
Gantry shed and warehouse shed construction	Installation of gantry crane and gantry shed, warehouse shed (installation of sheds approx 1 month)	August 2020; December 2020		EWP	EWP	2	-	-	95	-	98	-	-	Gantry shed and crane installation - August 2020
				Mobile crane (20t-250t)	Mobile crane (130t)	1	-	-	104	-	108	-	-	Warehouse installation - December 2020
TRACK WORKS														
Warehouse Shed				Forklift	Forklift	1	1	1	99	-	103	-	-	Inside shed
				Delivery truck	Road truck (deliveries to site)	4 p.h.	2 p.h.	2 p.h.	106	-	111	-	-	
Surface and Gantry shed works	Deliveries and material movement/distribution	August 2020 to December 2020		Gantry crane (40T)	Gantry crane (40t)	1	1	1	100	-	104	-	-	
				Light vehicles / traffic control utes	Hi Rail vehicles	5	5	5	89	-	100	-	-	
				Telehander / Franna crane (20t)	Franna crane	1	1	1	99	-	103	-	-	
				Delivery truck	Road truck (deliveries to site)	4 p.h.	2 p.h.	2 p.h.	106	-	111	-	-	
				Concrete Agi	Concrete truck and pump	4 p.h.	2 p.h.	2 p.h.	108	-	111	-	-	
Weld production and distribution to tunnel portal	S02a - Weld production on surface with sawing (day only)	September 2020 to December 2020		Handtool - grinder	Grinding	1	-	-	114	-	118	-	-	
				Telehander / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	
				Concrete / road / rail saw	Demolition saw	1	-	-	121	5	129	HN	X	
				Welding tools /oxy	Flash Butt Welder	1	-	-	102	-	105	-	-	
				Excavator w bucket (25t)	Rubber tyre Excavator	1	-	-	103	-	108	-	-	
				Front end loader	Front end loader	1	1	1	110	-	115	-	-	
				Light vehicles / traffic control utes	Rail trolleys	1	1	1	89	-	100	-	-	
				Hand tools	Hand tools	Various	-	-	107	-	111	-	-	
	S02b - Weld production on surface without sawing (day only)			Handtool - grinder	Grinding	1	-	-	114	-	118	-	-	Weld production on the surface may be extended to evening-E2 and night-time period subject to noise verification
				Telehander / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	
				Concrete / road / rail saw	Demolition saw	-	-	-	121	5	129	HN	X	
				Welding tools /oxy	Flash Butt Welder	1	-	-	102	-	105	-	-	
				Excavator w bucket (25t)	Rubber tyre Excavator	1	-	-	103	-	108	-	-	
				Front end loader	Front end loader	1	1	1	110	-	115	-	-	
				Light vehicles / traffic control utes	Rail trolleys	1	1	1	89	-	100	-	-	
				Hand tools	Hand tools	Various	-	-	107	-	111	-	-	
	S03 - Weld production in dive			Handtool - grinder	Grinding	1	1	1	114	-	118	-	-	
				Telehander / Franna crane (20t)	Telehandler	1	-	-	99	-	103	-	-	
				Concrete / road / rail saw	Demolition saw	1	-	-	121	5	129	HN	X	
				Welding tools /oxy	Flash Butt Welder	1	1	1	102	-	105	-	-	
				Excavator w bucket (25t)	Rubber tyre Excavator	1	-	-	103	-	108	-	-	
				Front end loader	Front end loader	1	1	1	110	-	115	-	-	
				Light vehicles / traffic control utes	Rail trolleys	1	1	1	89	-	100	-	-	
				Hand tools	Hand tools	Various	Various	Various	107	-	111	-	-	
TRACK WORKS - (inside tunnels)														
Rail distribution	Rail distribution from tunnel portal	September 2020 to December 2020		Handtool - grinder	Grinding	1	1	1	114	-	118	-	-	
				Telehander / Franna crane (20t)	Telehandler	1	1	1	99	-	103	-	-	
				Excavator w bucket (25t)	Rubber tyre Excavator	1	1	1	103	-	108	-	-	
				Front end loader	Front end loader	1	1	1	110	-	115	-	-	
				Light vehicles / traffic control utes	Rail trolleys	1	1	1	89	-	100	-	-	
				Hand tools	Hand tools	Various	Various	Various	107	-	111	-	-	
	Track Construction	September 2020 to December 2020		Concrete / road / rail saw	hand held saw	2	2	-	121	5	129	HN	X	
				Handtool - grinder	Hand held tools	Various	Various	Various	114	-	118	-	-	
				Excavator w bucket (25t)	Loader 950 Equ. = Excavator w bucket	1	1	1	103	-	108	-	-	
				Hiab	Hi-Ab Truck (Hi-Rail)	4 per hour	2 per hour	2 per hour	98	-	102	-	-	
				Light vehicles / traffic control utes	Light vehicle	8 per hour	4 per hour	4 per hour	89	-	100	-	-	
Tunnel Support Systems	Ventilation	August 2020 to December 2020		Vent Fan	Vent Fan	2	2	2	-	-	-	-	-	
Material Delivery and Handling	Material Handling	September 2020 to December 2020		Telehander / Franna crane (20t)	25t Franna Crane	1	1	-	99	-	103	-	-	
Rising Main Installation	Installation of Pipes	November 2020 to December 2020		Light vehicles / traffic control utes	Light vehicle	4 per hour	4 per hour	4 per hour	89	-	100	-	-	
Inside Tunnels				Mobile crane (20t-250t)	50 t Mobile Crane	1	1	1	104	-	108	-	-	
				#N/A	VMS 25 (solar)	2	2	2	#N/A	#N/A	#N/A	#N/A	#N/A	
				Welding tools /oxy	Butt Fusion Welding Rig	1	1	1	102	-	105	-	-	
				Jackhammer	Explosive Power Tools	4	4	4	115	5	120	HN	X	
Survey and Drilling				Drill gantry	Drill Gantry	1	1	1	-	-	-	-	-	
				Light vehicles / traffic control utes	Light vehicle	2	2	2	89	-	100	-	-	
Cross Passage Fitout	Base Slab and Blockwork Wall Construction	October 2020 to December 2020		Concrete / road / rail saw	Electric Saw	4	4	4	121	5	129	HN	X	
Inside Tunnels				Hand tools	Hand Tools	6	6	6	107	-	111	-	-	
		September 2020 to November 2020		Handtool - grinder	Grinder	4	4	4	114	-	118	-	-	
				Mobile crane (20t-250t)	25t Mobile Crane	2	2	2	104	-	108	-	-	
				Concrete Agi	Concrete truck and pump	4 p.h.	2 p.h.	2 p.h.	108	-	111	-	-	
				Concrete vibrator	Concrete vibrator	4	4	4	97	-	100	-	-	
				Hiab	Hi-Ab Truck	1	1	1	98	-	102	-	-	
				Light vehicles / traffic control utes	Light Vehicle	10	10	10	89	-	100	-	-	

APPENDIX D Detailed predicted noise levels

The detailed predicted levels have been provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.

APPENDIX E Additional noise mitigation

The table below is replicated from Table 5-5, and identifies the additional mitigation measures to be applied at construction noise affected receivers.

When is the work being undertaken?	How much does the predicted noise level exceed the ANML by?	Identify additional management measures to be implemented
Standard Hours M-F 7am to 6pm Sat 8am to 1pm	0 dB(A)	- -
	≤ 10 dB(A)	- -
	10 to 20 dB(A)	LB, V [MM2]
	> 20 dB(A)	LB, V [MM2]
	Highly noise affected	LB, SN, RO, V [MM4]
OOHW Period 1 M-F 6pm to 10pm Sat 1pm to 10pm Sun/ PH 8am to 10pm	< 5 dB(A)	- -
	5 to 15 dB(A)	LB [MM1]
	15 to 25 dB(A)	LB, V [MM2]
	> 25 dB(A)	LB, SN, IB, RO, V [MM4]
OOHW Period 2 M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	< 5 dB(A)	LB [MM1]
	5 to 15 dB(A)	LB, V [MM2]
	15 to 25 dB(A)	LB, SN, IB, RO, V [MM4]
	> 25 dB(A)	LB, SN, IB, RO, AA, V [MM5]

Notes: Use the abbreviation codes in the table above to confirm management measures required
Code in square brackets [] refers to noise management code for affected receivers identified in each CNVIS

LB = Letter box drops
V = Verification of predicted noise levels
SN = Specific notifications (personalised letter, phone call, email, individual briefing)
RO = Project specific respite offer
AA = Alternative accommodation

ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR

Review of	**Construction Noise and Vibration Impact Statement for Line-Wide works Portion 3 – Southern Dive early access works**	**Document reference:**	**Construction Noise and Vibration Impact Statement Portion 3 – Southern Dive early access works** **Prepared by Renzo Tonin and Associates for Systems Connect.** *TK685-03-10F01 CNVIS C2S_P3 SDive Early Access (r5)* *Dated 9 July 2020*
Prepared by:	Larry Clark, Alternate Acoustics Advisor		
Date of issue:	10 July 2020		

As approved Alternate Acoustics Advisor for the Sydney Metro City & Southwest project, I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement (CNVIS) for Line-Wide works Portion 3 – Southern Dive early access works, as required under A27 (d) of the project approval conditions (SSI 15-7400).

At this time NSW continues to respond to the COVID-19 situation. One outcome is that at least some of these works may take place whilst people are working from home. Sydney Metro, its contractors and other stakeholders should continue to work closely to review work practices and ensure that all feasible and reasonable noise and vibration mitigation measures are implemented, in light of the COVID-19 situation, at the time of the works. The details should be confirmed as part of the Out Of Hours Applications for the works.

I am satisfied that revision 5 of the CNVIS is technically valid, and includes appropriate noise and vibration mitigation and management. On this basis I endorse revision 5 of the CNVIS for Line-Wide works in respect of the Southern Dive early access works.

Larry Clark, City & Southwest Alternate Acoustics Advisor

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Hugh Chapman
Associate Director Environment
Sydney Metro
Transport for NSW
PO Box K659
HAYMARKET NSW 1240

14 July 2020

Ref: CSW LWW SDEAW CNVIS r5 Rev01

Dear Hugh

RE: Endorsement of Sydney Metro City & Southwest – Southern Dive Early Access Works - Construction Noise and Vibration Impact Statement Rev 5

Thank you for providing the following document for Environmental Representative (ER) review and endorsement as requested by Sydney Metro.

- Sydney Metro City & Southwest - Construction Noise and Vibration Impact Statement – Southern Dive Early Access Works r5

The document was prepared by Renzo Tonin & Associates on behalf of Systems Connect.

I have reviewed the CNVIS and can confirm that it complies with the requirements of SSI-7400 MCoA E33 and Section 9.2(b) of the Construction Environmental Framework (CEMF) Chatswood to Sydenham (February 2017).

As an approved ER for the Sydney Metro City & Southwest project, I consider that the CNVIS is consistent with the requirements under the CEMF and SSI-7400 and is endorsed for implementation.

Yours sincerely

Peter Hatton
Environmental Representative – Sydney Metro – City and South West