APPROVAL
CITY & SOUTHWEST ACOUSTICS ADVISOR

Review of:	Sydney Metro City and South West Line Wide Works - CNVIS Addendum Report - Chatswood Tunnel Civil and M&E	**Document**	TK685-03-17F03 CNVIS_ADD C2B_P3 CHW (r3)
Prepared	Daniel Weston Acoustics Advisor		Prepared by Renzo Tonin & Associates Pty Ltd
Date of	19 September 2022		19 September 2022

As approved Acoustics Advisor for the Sydney Metro City & Southwest project, and as required under A27 (d) of the project approval conditions (SSI 15-7400), I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement (CNVIS) Addendum Report for the proposed Chatswood Tunnel Civil and M&E works.

I am satisfied that the CNVIS Addendum Report is technically valid and includes appropriate noise and vibration mitigation and management. On this basis, I endorse the CNVIS Addendum Report referenced herein.

Daniel Weston, City & Southwest Acoustics Advisor

19 September 2022
TK685-03-17F03 CNVIS_ADD C2B_P3 CHW (r3)

Systems Connect
Level 1 116 Miller Street
North Sydney, NSW 2060

Sydney Metro City and Southwest Line Wide Works - CNVIS Addendum Report - Chatswood Tunnel Civil and M&E

1 Introduction

1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Portion* 3 - *Chatswood Station* (*Chatswood CNVIS*[1]) and 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] for the Design and Construction of the Line-Wide Works (LWW) of the Sydney Metro City & Southwest Project (the Project).

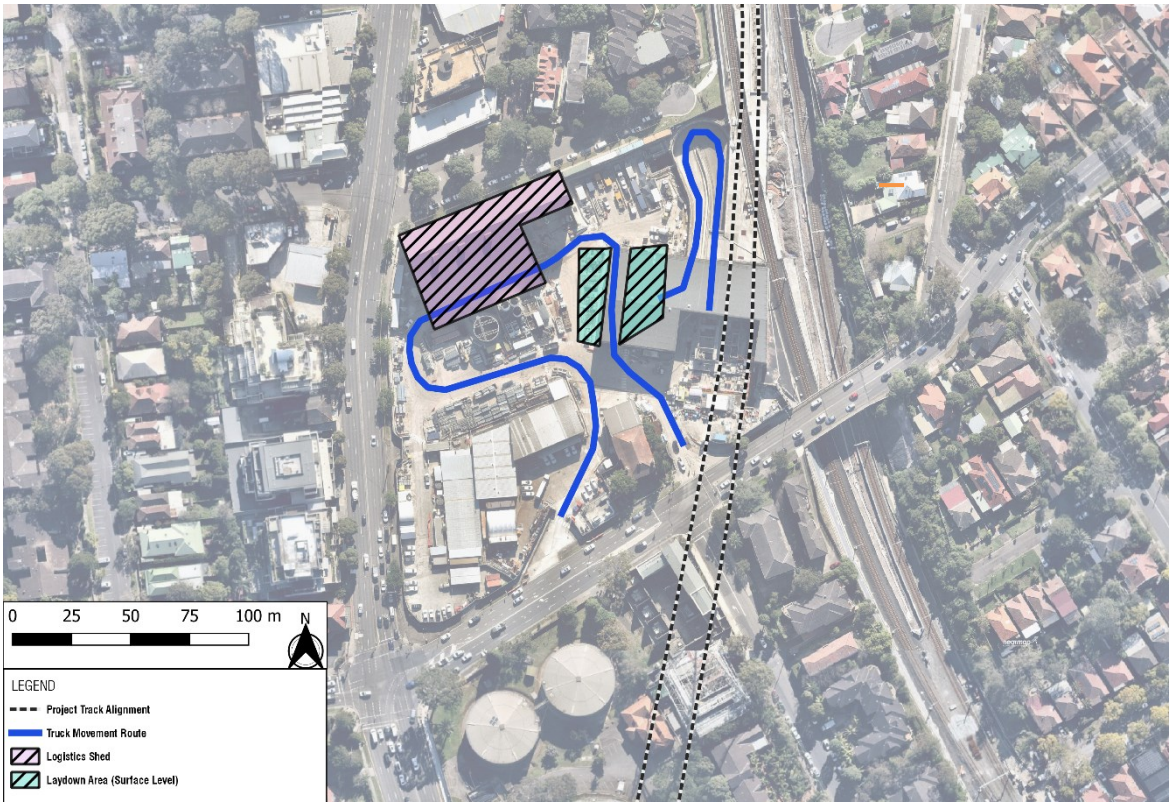
Systems Connect is proposing to undertake tunnel fit out works from Chatswood Dive site during and outside standard construction hours. The proposed works will occur inside the tunnels 24 hours per day, 7 days per week. All surface support works are undertaken during standard construction hours except for the delivery of materials from the surface laydown area into the tunnels which is required to occur outside standard construction hours due to space constraints within the Chatswood dive and tunnels (Figure 1).

This memorandum has been prepared to address the potential construction noise impacts from the tunnel fit out works and associated surface support works at Chatswood Dive site.

The works are anticipated to commence in September 2022 and conclude in January 2023.

[1] *Sydney Metro City & Southwest – Line Wide Works, Construction Noise and Vibration Impact Statement: Portion 3 - Chatswood, reference: TK685-03-17F01 CNVIS C2S_P3 CHW(r2), revision 2, dated 8 April 2021*

Figure 1: Tunnel fit out works at Chatswood Dive site



1.2 Justification for OOH construction works

Out of hours (OOH) works are required as part of the tunnel fit out works at Chatswood. Works are planned to keep disturbances to the community at a minimum throughout the works with all the works occurring inside the tunnels except for the delivery of materials.

The construction hours for the Project are defined by Project Planning Approval (PPA) Conditions E36, E37, E38, E41, E42, E44 and E48. CSSI-7400 Condition E44 and E48 allow standard construction hours to be varied under specific conditions. Condition E48(d) allows station and tunnel fit out works to be carried out 24 hours per day, 7 days per week at Chatswood Station. Consistently, EPL Condition L4.7 allows station and tunnel fit out works, ancillary surface support works and haulage and delivery of material at the Chatswood Dive site to be undertaken 24 hours a days 7 days per week.

2 Construction noise and vibration assessment

2.1 Proposed construction activities

Key details regarding the location and layout of the noise generating plant that will operate during these works were informed by the Construction and Environmental Teams. Table 2-1 presents the list of plant proposed to be used for these works and their assumed sound power levels.

Table 2-1: Construction activities and equipment sound power levels used in noise modelling

Work activity	Indicative timing/duration	Plant/ Equipment	Day	Evening 1	Evening 2	Night	Sound Power Level (Lw re: 1pW), dB(A)		Notes
			7am – 6pm	6pm – 8pm	8pm – 10pm	10pm – 7am	L_{Aeq}	L_{Amax}	
Tunnel civil works									
Fire separation wall -Formwork, reinforcement works and concrete pours	Sept22 – Oct22	EWP	3	3	3	3	97	102	Inside dive and tunnel (20m from daylight portal)
		Hand tools	Various	Various	Various	Various	107	112	Inside dive and tunnel (20m from daylight portal)
		Power tools[1]	Various	Various	Various	Various	107	112	Inside dive and tunnel (20m from daylight portal)
		Telehandler	1	1	1	1	99	104	Inside dive and tunnel (20m from daylight portal)
		Concrete Agitator	2	-	-	-	108	113	At Ground level dayworks only
		Concrete Pump	1	-	-	-	104	109	At Ground level dayworks only
		Vibrator	2	-	-	-	100	105	At Ground level dayworks only
Rail dampers -Cleaning, distributing and installation works	Sept22– Sept22	Pressure Washer - Diesel	2	2	2	2	107	112	Inside dive and tunnel
		Excavator 20T Hi-rail	1	1	1	1	105	110	Inside dive and tunnel
Four-foot panel installation -Loading and installation works	Sept22– Jan23	Pressure Washer – Diesel	2	2	2	2	107	112	Inside dive and tunnel
		Excavator 20T Hi-rail	2	2	2	2	105	110	Inside dive and tunnel
		Hi-rail trailer	2	2	2	2	103	108	Inside dive and tunnel
Rail grinding	Nov22 – Dec22	Rail Grinder	1	-	-	-	115	120	Inside dive and tunnel
Tunnel M&E works									
Cable containment and cable pulling -Installation of brackets and trays -Cable pulling	Sept22 – Nov22	Hi-rail truck	2	1	1	1	103	108	Inside dive and tunnel
		Excavator 20t Hi-rail	1	1	1	1	105	110	Inside dive and tunnel
		Hi-rail trailer	1	1	1	1	103	108	Inside dive and tunnel
		EWP	3	3	3	3	97	102	Inside dive and tunnel
		Hand tools	Various	Various	Various	Various	107	112	Inside dive and tunnel
		Power tools[1]	Various	Various	Various	Various	107	112	Inside dive and tunnel
Hydraulics	Sept22 – Dec22	Hi-rail truck	2	1	1	1	103	108	Inside dive and tunnel

Work activity	Indicative timing/duration	Plant/ Equipment	Day	Evening 1	Evening 2	Night	Sound Power Level (Lw re: 1pW), dB(A)		Notes
			7am – 6pm	6pm – 8pm	8pm – 10pm	10pm – 7am	L_{Aeq}	L_{Amax}	
-Installation of rising main and hydrant -Sump fit out		Excavator 20T Hi-rail	2	1	1	1	105	110	Inside dive and tunnel
		Hi-rail trailer	1	1	1	1	103	108	Inside dive and tunnel
		Hand tools	Various	Various	Various	Various	107	112	Inside dive and tunnel
		Power tools[1]	Various	Various	Various	Various	107	112	Inside dive and tunnel
Deliveries for Tunnel M&E and civil works									
Moving materials from ground level to rail level	Sept22 – Jan23	Forklift / material handler	-	2	1	1 (contingency)	103	117	At Ground level
		Forklift / material handler	-	24 p.h	8 p.h	4 p.h (contingency)	103	117	OOH material trips from surface laydown area to tunnels
		20T Franna	-	1	-	-	99	104	Only during evening 1 period
Deliveries to logistic shed	Sept22 – Jan23	Delivery trucks	4 p.h.	4 p.h. (contingency)	4 p.h. (contingency)	4 p.h. (contingency)	102	111	Daytime (OOH for contingency)

Notes: 1) Power hand tools include grinders. An additional 5dB(A) penalty has been considered in the modelling.

2.2 Predicted construction noise levels

2.2.1 ICNG, PPA conditions E37 and E42

Predicted construction noise levels at the closest noise sensitive receivers are summarised in Table 2-2 and Table 2-3 and compared to the ICNG NMLs, PPA Conditions E37/E38 and E42 noise goals at the most noise affected receivers. Detailed noise predictions are presented in APPENDIX B.

Surface works consists of concrete works and deliveries to the logistic shed during standard construction hours. The remaining civil and M&E works are to be undertaken inside the dive and tunnels during standard construction hours and outside of standard construction hours. The material deliveries to the tunnels have been proposed to be mostly undertaken during the early evening (E1 - 6pm to 8pm) period due to space constraints within the dive and tunnels. Reduced movements of material have been proposed for the late evening period (E2 – 8pm to 10pm) and night-time period to reduce the potential noise impacts.

Noise levels are predicted to comply in the evening period at all receivers except for two residential receivers (2 Nelson Street and 355 Mowbray Road) with levels up to 6dB(A) above the relevant evening NMLs. Predicted noise levels during the night-time period are expected to comply or be up to 6dB(A) above the relevant NMLs. There is one residential receiver at 2 Nelson Street where predicted level may be up to 13dB(A) above the night-time NMLs. The predicted noise levels at this receiver are mainly controlled by noise egress from the daylight portal within the rail corridor. Construction noise will decrease as the works get deeper into the dive/tunnel and further away from the portal. It is noted that this property has also received at-property treatment.

The predicted noise levels at the closest noise sensitive receivers are expected to comply with the PPA Condition E37/E38 and E41/E42.

Table 2-2: Predicted noise levels at the closest noise sensitive receivers (PPA Conditions E37/E38 and ICNG NMLs)

NCA	Address	Type of receiver	Predicted levels $L_{Aeq,15min}$, dB(A)						PPA condition E37/E38	ICNG NML	
			Civil and delivery works CD		M&E and delivery works MED		Civil, M&E and delivery works CMED		NML 7am-8pm	Day (D)	E1 (Early evening)
			Day (D)	E1 (Early evening)	Day (D)	E1 (Early evening)	Day (D)	E1 (Early evening)			
CDS_02	544 Pacific Highway	Residential	56	56	56	56	56	56	70[1]	65	59
CDS_06	2 Orchard Road	Residential	56	56	56	56	56	52	80[2]	60(70[3])	52(62[3])
CDS_03	2 Nelson Street	Residential	63	63	61	61	63	63	80[2]	60(70[3])	52(62[3])
CDS_03	7-11 Nelson Street	Residential	54	54	54	54	54	54	80[2]	60(70[3])	52(62[3])
CDS_06	344 Mowbray Road	Residential	59	59	58	58	59	59	70[1]	60	52

Notes:
1. Properties with unknown at-property treatments, the external equivalent NML has been calculated considering a building façade loss of at 10dB (open windows)
2. Properties with at-property treatments, the external equivalent NML has been calculated considering a building facade loss of at least 20dB (closed windows)
3. ICNG NMLs can be adjusted by 10dB(A) due to at-property treatments for the identification of suitable additional mitigation measures.

D: 7am – 6pm, E1: 6pm – 8pm

Table 2-3: Predicted noise levels at the closest noise sensitive receivers (PPA Conditions E41/E42 and ICNG NMLs)

NCA	Address	Type of receiver	Predicted levels $L_{Aeq,15min}$, dB(A)						PPA condition E42	ICNG NML	
			Civil and delivery works CD		M&E and delivery works MED		Civil, M&E and delivery works CMED		NML 8pm – 7am[1]	E2 (Late evening)	N (Night)
			E2 (Late evening)	N (Night)	E2 (Late evening)	N (Night)	E2 (Late evening)	N (Night)			
CDS_02	544 Pacific Highway	Residential	50	47	50	47	50	47	55[1]	59	47
CDS_06	2 Orchard Road	Residential	52	50	52	50	52	50	65[2]	52(62[3])	44(54[3])
CDS_03	2 Nelson Street	Residential	58	57	56	53	58	57	65[2]	52(62[3])	44(54[3])
CDS_03	7-11 Nelson Street	Residential	50	47	50	47	50	47	65[2]	52(62[3])	44(54[3])
CDS_06	344 Mowbray Road	Residential	52	50	52	50	52	50	55[1]	52	44

Notes:
1. Properties with unknown at-property treatments, the external equivalent NML has been calculated considering a building façade loss of at 10dB (open windows)
2. Properties with at-property treatments, the external equivalent NML has been calculated considering a building facade loss of at least 20dB (closed windows)
3. ICNG NMLs can be adjusted by 10dB(A) due to at-property treatments for the identification of suitable additional mitigation measures.

E2: 8pm – 10pm, N: 10pm – 7am

2.2.2 Sleep disturbance

The maximum noise levels associated with on-site heavy vehicle movements may potentially cause sleep disturbance at nearby residential receivers. However, it is noted that deliveries to sites are planned to occur during standard construction hours with limited number of deliveries at night as contingency.

The number of heavy vehicles associated with the proposed works are less than what was assessed in the *Chatswood CNVIS*. Therefore, the risk of sleep disturbance is consistent with the *Chatswood CNVIS* and it is not further addressed in this addendum.

2.3 Noise mitigation and management

2.3.1 Site noise control measures

Table 2-4 presents the noise mitigation and management measures recommended to reduce and manage potential noise impacts for the proposed construction activities.

Table 2-4: Noise mitigation and management measures

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
At source control measures							
Site planning and layout	Locate noise-generating activities away from sensitive receivers. Plan traffic flow, parking, loading/unloading, and other vehicle movements to keep vehicles away from sensitive receivers where possible and to minimise reversing movements.	This measure could be feasibly implemented.	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	Fixed noise sources will be located away from sensitive receiver. One directional traffic flow through site (to avoid reversing).
Noise control kits	Plant that is brought to site for works should meet the sound power limits identified in Table 2-1. Where plant are above limits then the plant may require installation of 'noise control kits' to comply with the noise limits in this assessment.	This measure could be feasibly implemented. Subject to availability for each equipment item.	Yes		Yes	Yes	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.
Limit equipment in use	Only the equipment necessary during each stage of the works will be used.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Cost effectiveness to be determined on a case-by-case basis.	Yes	Yes	Excess equipment will be avoided where it is not needed for the works and where it is reasonable to do without it.
Timing of equipment in use	Where practicable, activities and plant will be scheduled/limited as outlined in Table 2-1 of this assessment.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective. - Verification monitoring to confirm OOH impacts.	Yes	Yes	-
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.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	Equipment that is not directly needed for works at a given time will be switched off.
Equipment selection	Use quieter and less noise/vibration emitting construction methods where feasible and reasonable.	This measure could be feasibly implemented. To be determined on a case-by-case basis.	Yes		Yes	Yes	Project team shall review plant and equipment on a case-by-case basis and find opportunities to use items with lower noise impacts.

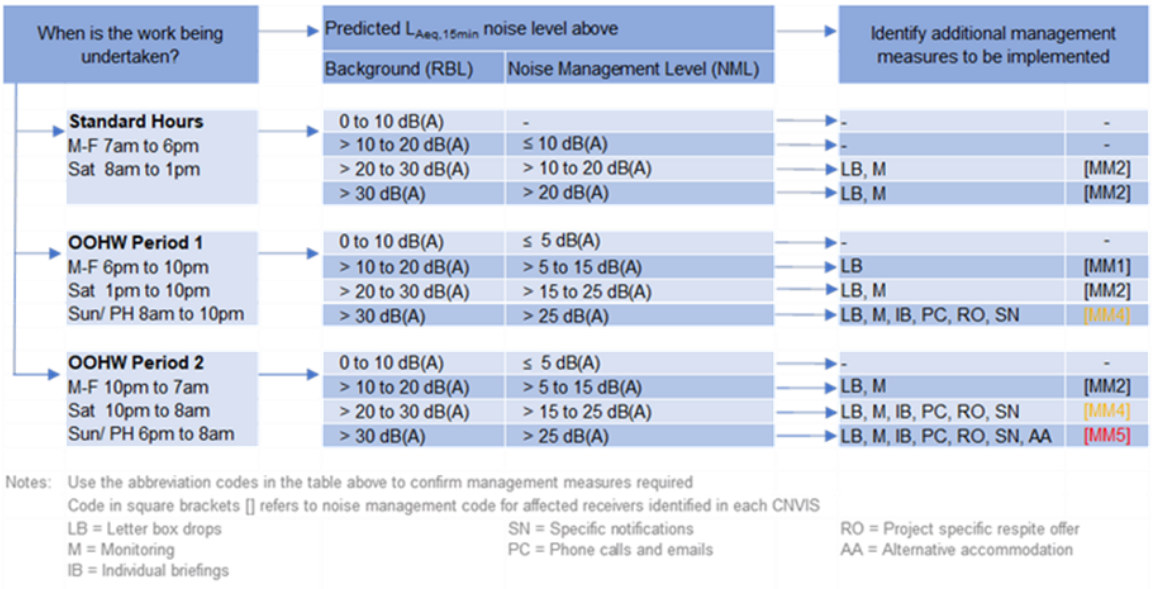
Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
Truck movements	Where practicable, avoid the use of park air brakes at night. Set up relevant traffic management measures to minimise the use of air brakes when leaving site. Air brake silencers are to be correctly installed and fully operational for any heavy vehicles (as per CNVMP). Minimise unnecessary acceleration on site and avoid vigorous slamming of truck doors.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	Drivers will be reminded to drive responsibly on-site, especially when accessing and departing the site.
Non-tonal reversing alarms	Alternative reverse 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.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	Project team will prioritise use of non-tonal reversing alarms on equipment.
OOH delivery to site	Reduction of heavy vehicle movements to site as much as practicable to maintain 24/7 tunnel fit out works. OOH delivery trucks assessed at 4 per hour have been included in the noise modelling as contingency.	This measure could be feasibly implemented.	Yes	- Potential benefit of at least 3-6 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	-
Forklift transporting material to tunnel (material movements)	The material deliveries to the tunnels have been proposed to be mostly undertaken during the early evening (E1 - 6pm to 8pm) period due to space constraints within the dive and tunnels. Reduced movements of material have been proposed for the late evening period (E2 – 8pm to 10pm) and night-time period to reduce the potential noise impacts.	This measure could be feasibly implemented.	Yes	- Sufficient noise reduction could be achieved at enough receivers - Deemed to be cost effective.	Yes	Yes	Material movements only proposed to be undertaken outside of standard construction hours due to space constrains within dive and tunnels. 24 trips per hour during E1 period, 8 trips per hour during E2 period and 4 trips per hour (as contingency) during the night period.
Stillage/pipe movement on site	Movements of stillage have been restricted during evening and night-time periods. Locations where stillage are stored, movements between laydown areas and work front and times when stillage can be moved will be assessed in each OOHWA.	This measure could be feasibly implemented.	Yes	- Deemed to be cost effective.	Yes	Yes	
Path mitigation measures							
Noise barriers or temporary noise screens	Existing noise barriers at the Chatswood Dive site have been included in the noise modelling.	This measure could be feasibly implemented.	Yes	- Potential benefit of 5-10 dB(A). - Sufficient noise reduction could be achieved at enough receivers. - Deemed to be cost effective.	Yes	Yes	-

Control measure	Description of the control measure	Feasible mitigation test	Deemed feasible?	Reasonable mitigation test	Deemed reasonable?	Adopted?	Justification and commentary
At-receiver							
At-property treatments	Design and installation of architectural treatments to sensitive receiver buildings to reduce internal noise levels to key rooms.	This measure has already been implemented by TfNSW	Yes	Sufficient noise reduction could be achieved at affected receivers	Yes	Yes	Receivers at 2 Nelson Street and 7-11 Nelson Street, Chatswood have received at-property treatments.
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 (but is not limited to): • 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.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Inductions and toolbox talks will continue to be conducted for the project.
Community consultation - disseminating information	Provide information to community of construction activity and potential impacts.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Updates will be distributed regularly for the duration of the project.
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.	This measure could be feasibly implemented.	Yes	Routine task for project team.	Yes	Yes	Project team shall monitor site behaviour and advise supervisors if issues arise, or additional behavioural practices are needed.
Noise monitoring	Noise monitoring to be conducted at key locations to quantify noise impacts at sensitive receivers.	This measure could be feasibly implemented.	Yes	Deemed to be cost effective.	Yes	Yes	Noise monitoring shall be carried out as detailed in this assessment.

2.3.2 Additional mitigation measures

Figure 2-1 will be used to advise the appropriate additional mitigation during construction. ICNG NMLs can be adjusted by 10dB(A) due to at-property treatments for the identification of suitable additional mitigation measures.

Figure 2-1: Additional airborne noise mitigation measures



APPENDIX C presents a summary of the additional noise mitigation measures applicable for construction activities where, after application of all reasonable and feasible mitigation options, construction noise levels are still above the relevant NMLs.

2.3.3 Noise monitoring

Attended noise monitoring will be undertaken to verify that the construction activities are consistent with the assessed noise modelling scenarios and that noise levels resulting from construction works are not higher than the levels predicted in this addendum. Attended monitoring on private property is subject to obtaining the property owner/occupier's consent (where required).

Attended noise monitoring will be undertaken in the NCAs most impacted by the works. The nominated monitoring locations are identified in Table 2-5, and have been selected as they present the best opportunity to validate the predicted noise levels, depending on the location of the plant.

Table 2-5: Nominated verification monitoring locations

NCA	Nominated receiver address
CDS_02	544 Pacific Highway, Chatswood
CDS_06	2 Orchard Road
CDS_03	2 Nelson Street, Chatswood

NCA	Nominated receiver address
CDS_03	7-11 Nelson Street, Chatswood
CDS_06	344 Mowbray Road, Artarmon
Note:	Monitoring on private property is subject to owner consent and where relevant, occupier consent. If property access is denied, monitoring will still be carried out outside property boundaries.

If verification monitoring shows that the external noise levels from the construction works are above the predicted levels, investigation will be undertaken to understand the cause of the exceedance and relevant reasonable and feasible mitigation measures will be implemented.

2.4 Construction vibration impact

The proposed works are not vibration intensive, therefore the risk of vibration impact is negligible.

2.5 Ground-borne noise impact

The proposed works are not vibration intensive, therefore the risk of ground-borne noise impact is negligible.

2.6 Construction related road traffic assessment

The number of heavy vehicles associated with the proposed works are less than what was assessed in the *Chatswood CNVIS*. Therefore, construction traffic noise on the local road network associated with the works is predicted to have minimal impact on receivers in proximity to public roads.

3 Conclusion

This technical memorandum is an addendum to the report *Chatswood CNVIS* to review the potential construction noise and vibration impacts associated with the tunnel fit out works at Chatswood Dive site.

Construction noise

Predicted noise levels are expected to be below PPA Condition E37/E38 and E42 during standard construction hours and outside standard construction hours.

Construction vibration and ground-borne noise

The proposed works are not vibration intensive, therefore the risk of ground-borne noise or vibration impact is negligible.

Construction traffic

The number of heavy vehicles associated with the proposed works are less than what was assessed in the *Chatswood CNVIS*. Therefore, construction traffic noise on the local road network associated with the works is predicted to have minimal impact on receivers in proximity to public roads.

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
05.09.2022	Initial issue	0	1	R. Zhafranata	M. Tabacchi	M. Tabacchi
16.09.2022	AA's comments	-	2	R. Zhafranata	M. Tabacchi	M. Tabacchi
19.09.2022	AA's comments	-	3	R. Zhafranata	M. Tabacchi	M. Tabacchi

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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 Detailed predicted construction 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 C Additional noise mitigation

The additional mitigation measures have been provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.