

SYDNEY METRO CITY AND SOUTH WEST - LINE-WIDE WORKS

Construction Noise and Vibration Impact Statement Portion 3 - SMTF-S and southern dive

9 June 2021

Systems Connect

TK685-03-16F01 (r4) CNVIS C2S_P3 SMTF-S

Document details

Detail	Reference
Doc reference:	TK685-03-16F01 (r4) CNVIS C2S_P3 SMTF-S
Prepared for:	Systems Connect
Address:	Level 3, 116 Miller Street North Sydney NSW 2060 Australia
Attention:	Mathew Billings

Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
22.12.2020	First issue	0	1	R. Phillips	T. Gowen	T. Gowen
23.02.2021	Updated based on contractor and AA comments	-	2	R. Phillips	-	T. Gowen
16.03.2021	Updated based on AA comments	-	3	R. Phillips	-	T. Gowen
09.06.2021	Edit typos in Appendix C	-	4	R. Phillips	-	T. Gowen

Important Disclaimer:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for the particular requirements of our Client referred to above in the 'Document details' which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

In preparing this report, we have relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, we have not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

We have derived data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination and re-evaluation of the data, findings, observations and conclusions expressed in this report.

We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

Contents

1	Introduction	6
1.1	Relevant requirements and purpose of this CNVIS	6
1.2	Structure of this CNVIS	6
1.3	Quality assurance	7
2	Description of construction works and hours	8
2.1	Summary of works addressed in this CNVIS	8
2.1.1	Construction activities	8
2.1.2	Construction traffic	8
2.1.3	Cumulative construction impacts	9
2.2	Construction hours	9
2.2.1	Standard construction hours	9
2.2.2	Out of hours work periods	9
2.2.3	Justification for OOHW	10
2.2.3.1	Southern dive 24 hour operations	10
2.2.3.2	Surface OOHW	11
2.2.4	COVID-19 extended construction hours	11
3	Nearest sensitive receivers	13
3.1	Residential receivers	13
3.2	Other sensitive receivers (CSSI-7400 Condition E34)	13
3.3	Commercial and industrial premises	13
3.4	Heritage receivers	13
4	Construction noise and vibration objectives	14
4.1	Noise goals	14
4.1.1	Noise management levels (NMLs)	14
4.1.2	Sensitive receiver NMLs and respite for high noise impact works (CSSI-7400 Conditions E37 and E38)	15
4.1.3	Residential receiver NMLs – 8pm to 7am (CSSI-7400 Conditions E41 and E42)	15
4.1.4	Sleep disturbance	16
4.1.5	National Standard for exposure to noise	17
4.1.6	Construction related road traffic noise objectives	17
4.2	Construction vibration goals	17
4.2.1	Disturbance to building occupants (human annoyance)	18
4.2.2	Structural damage to buildings	18
4.2.3	Heritage	19
4.2.4	Sensitive scientific and medical equipment	19
4.2.5	Utilities and other vibration sensitive structures	19
5	Construction noise assessment	20

5.1	Noise prediction methodology	20
5.1.1	Detailed design outcomes	20
5.1.2	Construction activities	21
5.2	Predicted noise levels	23
5.2.1	ICNG NMLs	23
5.2.1.1	ICNG Standard construction hours	23
5.2.1.2	ICNG OOHW	24
5.2.2	CSSI-7400 Conditions E37/E38	26
5.2.3	CSSI-7400 Conditions E41/E42	27
5.2.4	Sleep disturbance	27
5.3	Noise mitigation and management	28
5.3.1	Consultation with affected receivers (CSSI-7400 Condition E33)	28
5.3.2	Site noise control measures	28
5.3.3	Additional noise mitigation measures	30
5.3.4	Attended noise monitoring	30
5.3.5	Complaints Handling	31
6	Construction vibration impacts	32
6.1	Minimum working distances for vibration intensive plant	32
6.2	Vibration assessment	33
6.2.1	Structural damage	33
6.2.2	Human annoyance	33
7	Ground-borne noise assessment	34
8	Traffic noise assessment	35
8.1	Traffic sources	35
8.2	Predicted construction traffic noise	35
8.3	Traffic noise mitigation and management	36
9	Cumulative impacts	38
10	Conclusion	40
	References	41
APPENDIX A	Glossary of terminology	42
APPENDIX B	Nearest sensitive receivers and noise management levels	44
APPENDIX C	Construction details	47
C.1	Construction timetable/ activities/ management	48
APPENDIX D	Detailed predicted noise levels	49
APPENDIX E	Additional noise mitigation	50

List of tables

Table 2-1: Standard construction hours	9
Table 2-2: Construction hours	10
Table 3.1: Heritage receivers close to proposed work areas	13
Table 4-1: Application of NMLs at CS2 SMTF-S (CSSI 7400 Conditions of Approval)	14
Table 4-2: Construction vibration disturbance goals	18
Table 5-1: Summary of construction activities	22
Table 5-2: Summary of construction noise impacts at nearby receivers – standard hours	23
Table 5.3: Summary of construction noise impacts at nearby receivers – OOHW	25
Table 5-4: Summary of construction noise impacts for the Day and E1 period – CSSI-7400 Conditions E37/ E38	26
Table 5-5: Summary of construction noise impacts for the E2 and Night period – CSSI-7400 Conditions E41/42 (residential only)	27
Table 5-6: CSSI-7400 Condition E33 consultation with affected receivers	28
Table 5-7: Site noise control measures	29
Table 5-8: Additional airborne noise mitigation measures	30
Table 5-9: Nominated verification monitoring locations	31
Table 6-1: Minimum working distances (m) for cosmetic damage (continuous vibration)	32
Table 6-2: Minimum working distances (m) for human annoyance (continuous vibration)	32
Table 6-3: Number of buildings within minimum working distances for cosmetic damage	33
Table 8.1: Traffic noise modelling data - existing road network	35
Table 8.2: Construction traffic assessment	36
Table 9.1: Other construction works close to SMTF-S	39

List of figures

Figure 4.1: Extract from the Marrickville Local Environmental Plan (2011) land zoning map	16
---	----

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 the Sydney Metro Trains Facility South works (SMTF-S) 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 SMTF-S site. These activities include:

- Site-wide activities on the surface
 - Site establishment
 - Materials delivery and handling (including delivery of rail)
- SMTF-S surface works
 - Earthworks and drainage
 - Overhead wiring (OHW)
 - Track construction on surface
- Southern Dive works
 - Track works within the southern dive
- Eastern bypass construction
 - Ballast and track construction
 - Overhead wiring (OHW)
 - Fencing
- Construction of operational buildings
 - dive services, administration, maintenance workshop, covered external storage, depot security centre and fire pump building and ground water treatment plant buildings.

A detailed description of the proposed works, likely plant and equipment, indicative Project timing and construction site layout is presented in APPENDIX C.

2.1.2 Construction traffic

The SMTF-S 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 SMTF-S site have also been considered, as discussed in Section 9.

2.2 Construction hours

The construction hours for the Project are defined by CSSI-7400 Conditions E36, E37, E38, E41, E42, E44 and E48. The Environment Protection Licence (EPL No. 21423) is 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.

CSSI-7400 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

Day	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
Monday																								
Tuesday																								
Wednesday																								
Thursday																								
Friday																								
Saturday																								
Sunday or Public Holiday																								

- 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.
- 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

2.2.3.1 Southern dive 24 hour operations

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 structure and 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 or the Out of Hours Works Protocol (for works not under an EPL) and the CNVMP [1].

2.2.3.2 Surface OOHW

In addition to the 24 hour operations within the southern dive, OOHW will be required for oversized deliveries, in particular for the construction of the dive services building and during demobilisation of the site. The preference will always be to park up on site and unload during the day. However, there may be a point where the site is too constrained and there may be multiple deliveries in the night further limiting the space on site. In these situations, it may be required to unload at night. This is not envisioned to be frequent and if it occurs, it will occur over one night at a time. This situation is a worst case scenario.

Furthermore, OOHW will be required for the eastern bypass as these works would occur adjacent to the live rail corridor and will require possession of the rail corridor to complete the works.

2.2.4 COVID-19 extended construction hours

The Environmental Planning and Assessment (COVID-19 Development – Infrastructure Construction Work Days) Order 2020 commenced on 9 April 2020 and will continue until 31 March 2022. The order permits standard construction hours on this project to be extended as follows:

- Saturday from 7am to 8am and from 1pm to 6pm (no high noise work permitted)

- Sundays from 7am to 6pm (no high noise work permitted)
- Public holidays from 7am 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.

Some of the 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).

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 (CSSI-7400 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[1].

For the SMTF-S site, external NMLs are derived from the Interim Construction Noise Guideline (ICNG)[3], as summarised in Table 4-1 below. Internal NMLs are also 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, as summarised in Table 4-1 below.

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

Time Period	Area	Receiver Type	Reference	Noise management level ³
ICNG				
Day ¹	All	All	CNVS ³ Section 5.3	ICNG (see Table B1 in APPENDIX B)
Day ¹ OOHW Period 1	All	All	CNVS ³ Section 5.3	ICNG (see Table B1 in APPENDIX B)
Evening ¹ OOHW Period 1	All	All	CNVS ³ Section 5.3	ICNG (see Table B1 in APPENDIX B)
Night ¹ OOHW Period 2	All	All	CNVS ³ Section 5.3	ICNG (see Table B1 in APPENDIX B)
CSSI-7400				
Day ¹ (D/ D(O))	Identified precincts (including Marrickville)	All	CSSI-7400 E38	Noise levels are required to be less than $L_{Aeq(15minute)}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq(15minute)}$ 55 dB(A). Noise equal to or above $L_{Aeq(15minute)}$ 60dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm. ⁴
Evening ¹ 6pm to 8pm (E1)				
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)				
Night ¹ 10pm to 7am (N)				
All	All	All	SSI-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. Sydney Metro City & South West Construction Noise and Vibration Strategy (Sydney Metro 2016)
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 $L_{Aeq(15\text{minute})}$ 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 $L_{Aeq(15\text{minute})}$ 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.

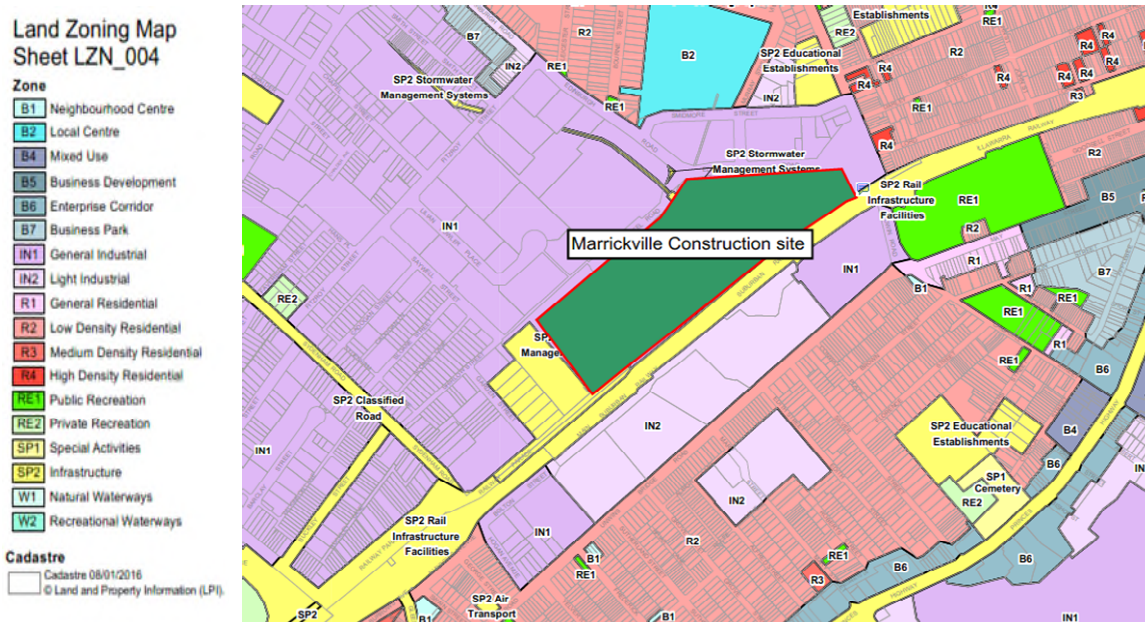
4.1.3 Residential receiver NMLs – 8pm to 7am (CSSI-7400 Conditions E41 and E42)

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 SMTF-S 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 $L_{Aeq(15min)} 45 \text{ dB(A)}$ 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 $L_{Aeq(15min)} 55 \text{ dB(A)}$ 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 CSSI-7400 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 $L_{Amax} \leq L_{A90(15min)} + 15 \text{ dB(A)}$ 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 $L_{Amax} 65 \text{ dB(A)}$ (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 CSSI-7400 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 $L_{Aeq,8h}$, 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 SMTF 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.

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:

- Acoustic attenuators for ventilation fans required to support tunnel fit-out works
- Roof cover over gantry crane
- Ventilation fan encasements to reduce fan casing noise.

It is understood that the existing 3m high noise wall between the south eastern side of the dive structure and the rail corridor would need to be removed to allow access to the gantry for deliveries. For the purpose of this assessment, this wall has been removed for all predictions.

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 detailed 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 C-2 presents the indicative program/ timeline for the completion of the works. The indicative program has informed the development of assessment scenarios representing the different work stages over the duration of the SMTF-S construction.

Figure C-1 shows the site layout, including the location of key work areas identified in Table C-1.

Table 5-1: Summary of construction activities

Aspect	Description of Activity	Daytime 7am to 6pm ICNG 8am to 1pm ICNG OOHW Period 1 7am to 8pm E37/E38						Evening and night-time 6pm to 10pm ICNG OOHW Period 1 ICNG OOHW Period 2 (night-time) 8pm to 7am E41/E42			
		V01	V02	V03	V04	V05	V6	V07	V08	V09	V10
		Mar 21 to May 21	June 22 to July 22	Aug 21 to Jan 22	Feb 22 to Jun 22	July 22 to Sep 22	Oct 22 to Dec 22	Dive services OOHW work	Eastern Bypass OOHW	Southern dive OOHW	Demobilisation OOHW
Site establishment	4000m^2 laydown relocated; concrete hardstand removed; offices set-up	X									
Earthworks and drainage	General fill and structural placement		X								
	RW3 Wall construction		X								
	Drainage, CSR/FRM install		X	X							
Over Head Wires	OHW works			X							
Track construction	Structural Placement Roads 1-8										
	Capping Placement Roads 1-8										
	Platform and wayside footing install				X						
	Ballast track construction				X						
	Track construction				X	X					
Eastern By-pass (SSJ Scope Transfer)	Trim Capping					X			X		
	Ballast track construction					X			X		
	Track construction					X			X		
	Fencing and GST Routes					X			X		
	OHW works						X		X		
Buildings	Admin building started		X	X	X	X					
	Maintenance Workshop and Covered External Storage buildings		X	X	X	X					
	Depot Security Centre and Fire Pump Building		X	X	X	X					
	Ground Water Treatment Plant Building		X	X	X	X					
	Dive services building	X	X	X	X	X		X			
Logistics	Delivery to Laydown	X	X	X	X	X		X	X	X	X
	Material Movement between laydown and gantry	X	X	X	X	X		X	X	X	X
	Delivery to gantry	X	X	X	X	X					
Southern dive works	Track construction	X	X	X	X	X				X	
Completion	Removal of gantry shed; offices; hoardings						X				X
	Demobilisation						X				X

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 ICNG NMLs

5.2.1.1 ICNG Standard construction hours

Table 5-2 presents the predicted worst-case construction noise levels for each of the construction stages identified in Table 5-1 at the most affected receiver in each NCA. The results are presented in terms of level above the ICNG standard daytime NMLs.

For **Standard Hours** construction noise impacts are presented as follows:

- Below NML
- < 10dB(A) above NML - construction noise clearly audible
- ◆ > 10dB(A) above NML - construction noise moderately intrusive
- > 75dB(A) - highly noise affected (for residential receivers)

Table 5-2: Summary of construction noise impacts at nearby receivers – standard hours

NCA	Construction scenario (see Table 5-1)					
	V01	V02	V03	V04	V05	V06
MDS_01	●	●	●	●	●	●
MDS_02	●	●	●	●	○	●
MDS_03	●	●	●	●	●	●
MDS_04	●	●	●	●	●	●
OSR	○	○	○	○	●	●

Notes: OSR: this includes all commercial, industrial and other sensitive receivers

During the standard daytime period, with the exception of works on the eastern bypass for residences in NCA MDS_02, noise levels are predicted to comply with the NMLs for assessed residential receivers. Noise levels in NCA MDS_02 are predicted to be less than 10dB(A) above the NMLS. The exceedance is a

worst case scenario when works are occurring in the northern end of the bypass and would not occur for the full extent of works.

Noise levels at nearby industrial and commercial receivers are predicted to be less than 10dB(A) above the NMLs during all assessed activities. Construction of the eastern bypass (assessed in V05) is predicted to cause the greatest impact to residential receivers.

5.2.1.2 ICNG OOHV

Table 5.3 presents the predicted worst-case construction noise levels for each of the construction stages identified in Table 5-1 at the most affected receiver in each NCA. The results are presented in terms of level above the ICNG NMLs for the OOHV period.

- Below NML
- < 5dB(A) above NML - construction noise noticeable
- ◆ 5 to 15dB(A) above NML - construction noise clearly audible
- > 15 to 25dB(A) above NML - construction noise moderately intrusive
- >25dB(A) above NML - construction noise highly intrusive

During the OOHV daytime, predicted noise levels are generally less than 5dB above the ICNG NMLs for all residences. During works on the eastern bypass (assessed in V05 and V06), noise levels are predicted to be between 5 to 15dB(A) above the ICNG NMLs at the most affected residences in NCA MDS_02.

Noise levels at nearby industrial and commercial receivers are generally predicted to be between 5 to 15dB(A) above the ICNG NMLs during all assessed activities. Construction of the eastern bypass is predicted to cause the greatest impacts.

During the OOHV evening period, noise levels are predicted to be between 5 to 15dB(A) above the ICNG NMLs at the most affected residences in NCA MDS_02 for deliveries at the dive services building and possession works for the eastern bypass. As mentioned in Section 2.2.3, OOHV deliveries during the evening for the dive services building would only occur when there is no other reasonable alternative. In addition, the eastern bypass works during the evening period would only occur during possessions when working near to the rail corridor.

Table 5.3: Summary of construction noise impacts at nearby receivers – OOHW

NCA	Construction scenario (see Table 5-1)									
	V01	V02	V03	V04	V05	V06	V07 Dive services	V08 Eastern bypass	V09 Southern dive	V10 Demobilisation
OOHW Period 1	OOHW Day D(O)					OOHW Evening E1/E2				
MDS_01	●	●	○	○	●	●	○	●	●	●
MDS_02	●	○	○	○	◆	○	◆	◆	●	●
MDS_03	●	●	●	●	●	●	●	●	●	●
MDS_04	●	●	○	○	○	●	○	●	●	●
OSR	◆	○	◆	◆	◆	○	◆	○	●	●
OOHW Period 2	OOHW Night N									
MDS_01	-	-	-	-	-	-	◆	○	○	●
MDS_02	-	-	-	-	-	-	■	■	◆	○
MDS_03	-	-	-	-	-	-	◆	◆	●	●
MDS_04	-	-	-	-	-	-	◆	◆	◆	○
OSR	-	-	-	-	-	-	◆	○	●	●

Notes: Day D(O): 1pm to 6pm Saturday and 8am to 6pm Sunday and Public Holidays
Evening)E1/E2): Evening period from 6pm to 10pm
N: Night-time period from 10pm to 7am Sunday to Thursday and 10pm to 8am Friday, Saturday and Public Holidays.

During the OOHW night-time period, noise levels are predicted to be between 15 to 25dB(A) above the ICNG NMLs at the most affected residences in NCA MDS_02 and MDS_04 for deliveries at the dive services building and possession works for the eastern bypass.

As mentioned in Section 2.2.3, OOHW deliveries for the dive services building would only occur when there is no other reasonable alternative. In addition, the eastern bypass works during the night period would only occur during possessions when working near to the rail corridor.

The southern dive works would occur 24 hours a day and all feasible and reasonable noise mitigation measures would be implemented to minimise impacts. The southern dive activities during the night-time period have been assessed to comply with CSSI-7400 Conditions E41 and E42 internal noise levels, as detailed in Section 5.3 below.

As the ICNG NMLs have not been achieved for all proposed activities on the site, all reasonable and feasible noise mitigation and management measures would be implemented. These mitigation and management measures are discussed in Section 5.1.1 and 5.3 of this report.

5.2.2 CSSI-7400 Conditions E37/E38

Table 5-4 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 CSSI-7400 Conditions E37 and E38. The impacts presented are as follows:

- ◆ Noise levels predicted to be below internal NMLs in CSSI-7400 Conditions E37 and E38
- Noise levels predicted to be above internal NMLs in CSSI-7400 Conditions E37 and E38.

Table 5-4: Summary of construction noise impacts for the Day and E1 period – CSSI-7400 Conditions E37/ E38

NCA	Construction scenario (see Table 5-1)					
	V01	V02	V03	V04	V05	V06
MDS_01	■	■	■	■	■	■
MDS_02	■	■	■	■	□	■
MDS_03	■	■	■	■	■	■
MDS_04	■	■	■	■	■	■
OSR	□	■	■	■	■	■

Notes: Day: 7am to 6pm Monday to Friday and 8am to 6pm Saturday, Sunday and Public Holidays
E1: Evening period from 6pm to 8pm

Based on the results presented in Table 5-4 above, noise levels are generally predicted to comply with CSSI-7400 E37 and E38. Noise levels are predicted to be above the noise goals for residences in MDS_02

for works on the eastern bypass. As previously mentioned, this would only be for high noise generating activities near the northern extent of works and would not occur for the full extent of the bypass.

The affected receivers requiring consultation are detailed in 5.3.1.

5.2.3 CSSI-7400 Conditions E41/E42

Table 5-5 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 CSSI-7400 Conditions E41 and E42;
- Noise levels predicted to be above internal NMLs in CSSI-7400 Conditions E41 and E42.

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

NCA	Construction scenario (see Table 5-1)			
	V07 Dive services	V08 Eastern bypass	V09 Southern dive	V10 Demobilisation
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 Sunday to Thursday and 10pm to 8am Friday, Saturday and Public Holidays.

From Table 5-5 above, noise levels during the Evening E2 and night-time period are predicted to be above the E41 and E42 noise goals during night-time deliveries at the dive services building and during possession works for the Eastern bypass. As previously mentioned, for deliveries at the dive services during OOHW, this would not be frequent and would only occur where there are no alternatives available. The OOH works on the Eastern bypass would only occur during possessions in where it is not possible to work near to the rail corridor during standard hours.

Where the E41 and E42 noise goals are exceeded, additional noise mitigation would be offered as detailed in Section 5.3.3.

5.2.4 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.

Systems Connect will continue consultation with potentially affected sensitive receivers, both prior to and following commencement of the SMTF-S works. That consultation would include email and phone calls should COVID-19 restrictions be in place. Where possible, doorknocking of affected residents and businesses will be carried out prior to night-time 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.

Receivers that require consultation to determine respite periods for daytime works are listed in Table 5-6 below.

Table 5-6: CSSI-7400 Condition E33 consultation with affected receivers

NCA	Address	Receiver type	Construction activity
MDS_02	356 EDGEWARE ROAD NEWTOWN	Residential	V05 – Eastern bypass (northern extent of works)
MDS_02	358 EDGEWARE ROAD NEWTOWN	Residential	V05 – Eastern bypass (northern extent of works)
MDS_02	358-360 EDGEWARE ROAD NEWTOWN	Residential	V05 – Eastern bypass (northern extent of works)
OSR	18-22 LILIAN FOWLER PLACE MARRICKVILLE	Industrial	V01 - Site setup / Hardstand removal
OSR	16 LILIAN FOWLER PLACE MARRICKVILLE	Industrial	V01 - Site setup / Hardstand removal

5.3.2 Site noise control measures

Table 5-7 shows the noise control measures recommended to reduce potential noise impacts.

Table 5-7: Site noise control measures

Control type	Control measure	Typical use
At-source control measures	Noise control kits	<p>Plant that is brought to site for SMTF-S 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:</p> <ul style="list-style-type: none"> • 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. <p>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.</p>
	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.
	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.
Path mitigation measures	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 OOHV.
	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	<p>All employees, contractors and subcontractors will receive a Project induction. The environmental component may be covered in toolboxes and should include:</p> <ul style="list-style-type: none"> • location of nearest sensitive receivers • relevant project specific and standard noise and vibration mitigation measures; • permitted hours of work; • OOHV 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 $L_{Aeq(15 \text{ minute})}$ 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below $L_{Aeq(15 \text{ minute})}$ 55 dB(A). Noise equal to or above $L_{Aeq(15 \text{ minute})}$ 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 0.

Control type	Control measure	Typical use
	Dive services building OOHW	For deliveries during OOHW periods, unloading to occur away from the northern extent of the site where possible. Unloading deliveries adjacent to the dive services building to occur where no alternatives are available.

5.3.3 Additional noise mitigation measures

Table 5-8 below should be used to advise the appropriate additional noise mitigation during construction, based on the CNVS [9] and the CNVMP [1]. Additional mitigation would be offered to receivers that are predicted to be above CSSI-7400 Condition E37/E38 and E41/E42. The additional mitigation would be offered based on the predicted noise level above the ICNG NMLs, in accordance with the CNVS.

Table 5-8: 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

Where exceedances are predicted, noise mitigation would be managed using the Gatewave software which would be used for more detailed noise predictions of specific works. The Gatewave software is currently being used for the early works on the site and would be updated to include additional works for the rest of the SMTF-S site.

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 SMTF-S 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 5-9: 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 (LinewideMetro@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 (15 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 (4-15t) - 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 site offices are 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 SMTF-S 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 SMTF-S worksite 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 Sydney Steel Road.

A maximum of six heavy vehicle movements per hour are required during night-time periods for the southern dive track construction and general deliveries to the site. 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 $L_{Aeq(15\text{hour})}$ day and 55 dB $L_{Aeq(9\text{hour})}$ 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 $L_{10, 1\text{hour}}$ noise levels. A correction of -3dB(A) is applied to obtain the $L_{Aeq, 1\text{ hour}}$ 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 an 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 SMTF-S 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. Systems Connect will coordinate with other contractors at SMTF-S to ensure that the number

of night-time truck movements is kept to a minimum and within the limits recommended in the Technical Note: Noise impact from heavy vehicle movements at Marrickville dive site, dated 28 June 2019.

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 SMTF-S 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 SMTF-S

Construction company	Project	Timing of activities	Hours of works	Works location	Activity types	General plant types
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 SMTF-S 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.

The expected construction activities and indicative construction program are outlined in Table C1 and Table C2 respectively of APPENDIX C. A site layout is also presented as Figure C1.

Based on the assumptions presented in Appendix C, construction noise levels have been predicted, presented and assessed in Section 5.2 and APPENDIX D.

During the day-time/evening period (from 7am to 8pm), construction noise at nearby residential receivers is generally predicted to be below the ICNG and the CSSI-7400 Conditions E37/E38 NMLs during the 7am to 8pm day/evening periods with the exception of works on the eastern bypass at the northern extent of works. Noise levels impacts would be highest for residences on Edgeware Road for works associated with the Eastern bypass.

Construction noise is predicted to be above the CSSI-7400 Conditions E41/E42 NMLs during the evening (8pm to 10pm) and night-time (10pm to 7am) for works on the Eastern bypass during possessions, and for deliveries to the dive services building.

Noise mitigation and management measures have been presented in Section 5.3 to aid in providing noise reduction benefits. Additional mitigation measures are described in Section 5.3.3 and detailed in APPENDIX E where noise levels are predicted to be above the CSSI-7400 conditions E37/E38 and E41/E42.

Construction vibration impacts have been assessed and 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 SMTF-S 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

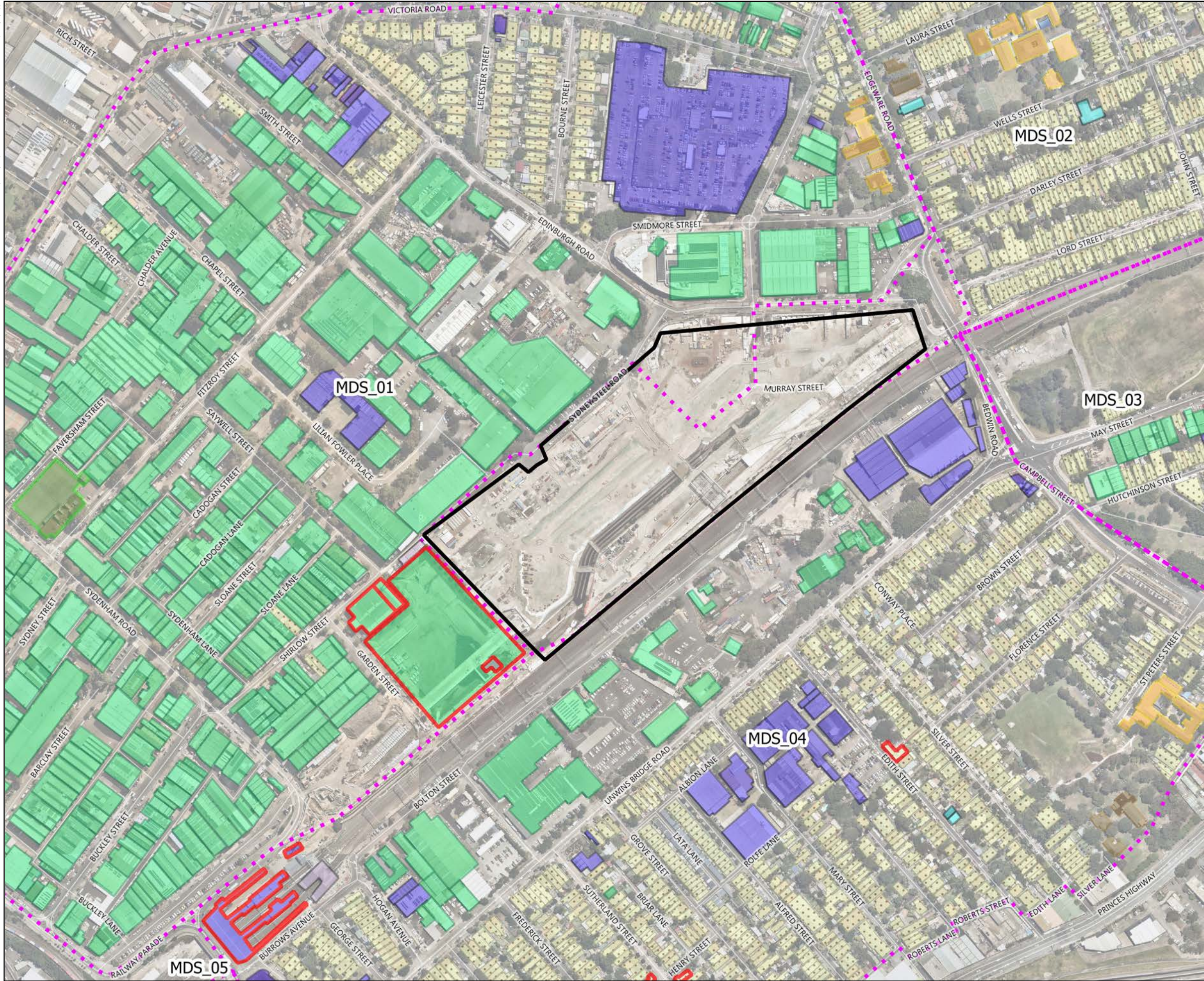
APPENDIX A Glossary of terminology

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 L _{eq} 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**



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

SYDNEY METRO - CHATSWOOD TO SYDENHAM

LINE WIDE WORKS

Land Use, NCAs

Work area: Marrickville SMTF and southern dive

Sheet 1 of 1

Table B1: Noise sensitive receivers and construction noise management levels												SMTF(S) AND SOUTHERN DIVE	
NCA	work area	Receiver Type	Reference RBL	Existing Noise Levels, dB(A)			Residential NMLs based on ICNG (external)				Sleep Dist. L _{Amax}	Comments	
Portion 2 & 3	Chatswood to Sydenham (C2S)												
MDS_01	Marrickville Dive	Residential north west of railway line, south west of Edgware 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 loss) 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 Activities/ Equipment SMTF(S) AND SOUTHERN DIVE

Work acitivity	Details	Indicative timing/ duration	Modelling ID	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}			
LOGISTICS													
Temporary services	Construction Water Treatment Plant	March 2021 - December 2022		Pumps	2	2	2	104	-	107	-	-	WTP from Crows Nest to be relocated to Marrickville
Deliveries	Delivery to laydown - access via Sydney Steel Road	March 2021 - December 2022		Flat bed truck - Hi ab	4 p.h.	4 p.h.	4 p.h.	102	-	111	-	-	Up to one delivery per hour at night for deliveries
				Telehandler/forklift	3	1	1	99	-	103	-	-	
				Franna	1	1	1	99	-	103	-	-	
				Semi truck	3	1	1	102	-	111	-	-	
				Body truck 16T	4 p.h.	1	1	102	-	111	-	-	
				Truck and dog	4 p.h.	-	-	106	-	111	-	-	
Material movement	Between laydown and gantry	March 2021 - December 2022		Flat bed truck	1	1	1	102	-	111	-	-	
				Telehandler/forklift	1	1	1	99	-	103	-	-	
				Franna	1	1	1	99	-	103	-	-	
				Body truck 16T	2	2	2	102	-	111	-	-	
				Truck and dog	1	1	1	106	-	111	-	-	
					1	1	1	102	-	111	-	-	
Deliveries	Delivery to gantry - access via Edinburgh Road/Railway Parade, Sydney Steel Road and Eastern By-pass	March 2021 - September 2022		Flat bed truck - Hi ab	1	1	1	102	-	111	-	-	Up to one delivery per hour at night for deliveries
				Franna	1	0.25	0.125	99	-	103	-	-	
				Body truck 16T	2	0.25	0.125	102	-	111	-	-	
				Gantry crane 40T	1	1	1	100	-	106	-	-	
SITE ESTABLISHMENT													
Laydown; roads; hardstand establishment		March 2021 - May 2021		Tracked excavator 30t w bucket	1	-	-	103	-	108	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Bobcat	1	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Grader	1	-	-	113	-	113	-	-	
				Vibratory Roller 15T	1	-	-	112	-	118	HN	X	
				Semi-trailer truck	4 per hour	-	-	102	-	111	-	-	
				Water Cart	1 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
Office relocation; utility connection Water treatment plant install		March 2021 - May 2021		Mobile crane 250T	1	-	-	104	-	108	-	-	
				Elevated work platform	2	-	-	95	-	98	-	-	
				Semi truck	10 deliveries	-	-	102	-	111	-	-	(deliveries to site)
				Generator	2	-	-	94	-	95	-	-	
				Workshop Hand Tools	various	-	-	105	-	111	-	-	
				Impact driver	3	-	-	107	-	118	-	-	
				Body truck 16T	2	-	-	102	-	111	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Hiab	2	-	-	98	-	102	-	-	
				Water Cart	1 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
Removal of concrete hardstand		March 2021 - May 2021		Excavator 25T w bucket	1	-	-	103	-	108	-	-	
				Excavator 30T with hammer	1	-	-	118	5	123	HN	X	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Haul offsite)
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Road profiler	1	-	-	110	5	124	HN	-	
				Crusher	1	-	-	118	5	124	HN	-	
EARTHWORKS													
General fill and structural placement		March 2021 - May 2021		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-	
				Bulldozer	2	-	-	-	-	-	-	-	
				Compactor	1	-	-	108	-	110	-	X	
				Telehandler	1	-	-	99	-	103	-	-	
				Bobcat	2	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Grader	1	-	-	113	-	113	-	-	
				Vibratory Roller 15T	2	-	-	112	-	118	HN	X	
				Water Cart	2 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Importing material)
Piling for buildings and OHW structures		April 2021 - June 2021		Piling rig	2	-	-	107	-	116	-	-	
				Crane (Grove GMK5130)	2	-	-	105	-	103	-	-	
				Excavator w bucket	2	-	-	103	-	108	-	-	
				Bobcat	2	-	-	104	-	107	-	-	
				Elevated work platform	2	-	-	95	-	98	-	-	
				Concrete Truck	2 p.h	-	-	108	-	111	-	-	
				Concrete Pump	2	-	-	103	-	107	-	-	
				Moxy Truck 38T	2 per hour	-	-	108	-	111	-	-	

Table C1: Construction Activities/ Equipment SMTF(S) AND SOUTHERN DIVE

Work activity	Details	Indicative timing/ duration	Modelling ID	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}			
Drainage install CSR/FRM Install	Sewer/ Potable / Recycled Water Excavation, installing and backfilling	June 2021 - December 2021		Excavator w bucket	4	-	-	103	-	108	-	-	
				Excavator 30T with hammer	2	-	-	118	5	123	HN	X	
				Demolition saw	1	-	-	121	5	129	HN	X	
				Generator	3	-	-	94	-	95	-	-	
				Concrete Pump	1	-	-	103	-	107	-	-	
				Vermeer T1055 trenching machine	1	-	-	111	-	117	-	-	
				Concrete truck	2 per hour	-	-	108	-	111	-	-	
				Vibrator	1	-	-	97	-	100	-	-	
				Sucker Truck	2	-	-	107	-	111	-	-	
				Wacker Packer	2	-	-	108	-	110	-	X	
				Hand tools	various	-	-	105	-	111	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Flex drive motors	2	-	-	94	-	100	-	-	
				Water pump 6"	2	-	-	104	-	107	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Skidsteer bobcat	1	-	-	104	-	109	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Compactor	1	-	-	108	-	110	-	X	
				Roller 17T	2	-	-	108	5	113	HN	X	
				Water Cart	2 per hour	-	-	104	-	107	-	-	
				Truck & Dog	2 p.h.	-	-	106	-	111	-	-	(Importing material)
				Hiab	1	-	-	98	-	102	-	-	
OHW													
Overhead Wiring (OHW)	Foundations, structures and wiring	March 2021 - May 2021		Delivery Truck	2 p.h.	-	-	102	-	111	-	-	Delivery of Masts & Structures
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Hi rail vehicle	4	-	-	89	-	100	-	-	
				Water Cart	1	-	-	104	-	107	-	-	
				Concrete Truck and Pump	2	-	-	111	-	114	-	-	
				EWP	4	-	-	95	-	98	-	-	
				Mobile crane	1	-	-	104	-	108	-	-	Crawler, rough terrain
				Ute	4 per hour	-	-	89	-	100	-	-	
TRACK CONSTRUCTION													
Structural Capping		December 2021 - February 2022		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-	
Placement				Compactor	1	-	-	108	-	110	-	X	
				Bobcat	2	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Grader	1	-	-	113	-	113	-	-	
				Vibratory Roller 15T	2	-	-	112	-	118	HN	X	
				Water Cart	2 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Importing material)
Capping Placement		February 2022- March 2022		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-	
				Compactor	1	-	-	108	-	110	-	X	
				Bobcat	2	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Grader	1	-	-	113	-	113	-	-	
				Vibratory Roller 15T	2	-	-	112	-	118	HN	X	
				Water Cart	2 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Importing material)
Platform and wayside footing install / Fencing / FRP for pavements, kerbs, footpaths		March 2022- April 2022		Delivery Truck	2 p.h.	-	-	102	-	111	-	-	Delivery of platforms
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Concrete truck	2 per hour	-	-	108	-	111	-	-	
				Vibrator	1	-	-	97	-	100	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Water Cart	1	-	-	104	-	107	-	-	
				Concrete Truck and Pump	1	-	-	111	-	114	-	-	
Ballast track construction		March 2022- June 2022		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-	
				Bobcat	2	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Grader	1	-	-	113	-	113	-	-	
				Vibratory Roller 15T	2	-	-	112	-	118	HN	X	
				Water Cart	2 per hour	-	-	104	-	107	-	-	
				Wacker Plate	2	-	-	108	-	110	-	X	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Importing material)

Table C1: Construction Activities/ Equipment SMTF(S) AND SOUTHERN DIVE

Work acitivity	Details	Indicative timing/ duration	Modelling ID	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}			
Track Construction	Tamping, Grinding & Turnouts	April 2022- July 2022		Tamper	1	-	-	115	-	118	HN	-	
				Regulator	1	-	-	108	-	112	HN	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Rail Grinder	1	-	-	107	-	118	HN	-	
				Ute	4 per hour	-	-	89	-	100	-	-	
				Sleeper/Track Layer	1	-	-	103	-	110	-	-	
				Rail Welder	2	-	-	93	-	103	-	-	
				Flat bed truck	1	-	-	102	-	111	-	-	for Rail delivery
				Forklift	1	-	-	99	-	103	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Front End Loader	2	-	-	110	-	115	-	-	
				High rail Excavator	2	-	-	103	-	108	-	-	
				Skidsteer bobcat	2	-	-	104	-	109	-	-	
				Fast Clip Machine	2	-	-	94	-	100	-	-	
				Flashbutt welder	1	-	-	110	-	113	-	-	
EASTERN BY-PASS (SSJ SCOPE TRANSFER)													
Trim Capping	June 2022- July 2022		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-		
			Bobcat	2	-	-	104	-	107	-	-		
			Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-		
			Grader	1	-	-	113	-	113	-	-		
			Vibratory Roller 15T	2	-	-	112	-	118	HN	X		
			Water Cart	2 per hour	-	-	104	-	107	-	-		
			Wacker Plate	2	-	-	108	-	110	-	X		
Ballast track construction	July 2022- August 2022		Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-		
			Bobcat	2	-	-	104	-	107	-	-		
			Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-		
			Grader	1	-	-	113	-	113	-	-		
			Vibratory Roller 15T	2	-	-	112	-	118	HN	X		
			Water Cart	2 per hour	-	-	104	-	107	-	-		
			Wacker Plate	2	-	-	108	-	110	-	X		
			Truck & Dog	5 p.h.	-	-	106	-	111	-	-	(Importing material)	
Track Construction	Tamping, Grinding & Turnouts	August 2022- October 2022		Tamper	1	-	-	115	-	118	HN	-	
				Regulator	1	-	-	108	-	112	HN	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Rail Grinder	1	-	-	107	-	118	HN	-	
				Ute	4 per hour	-	-	89	-	100	-	-	
				Sleeper/Track Layer	1	-	-	103	-	110	-	-	
				Rail Welder	2	-	-	93	-	103	-	-	
				Flat bed truck	1	-	-	102	-	111	-	-	for Rail delivery
				Forklift	1	-	-	99	-	103	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Front End Loader	2	-	-	110	-	115	-	-	
				High rail Excavator	2	-	-	103	-	108	-	-	
				Skidsteer bobcat	2	-	-	104	-	109	-	-	
				Fast Clip Machine	2	-	-	94	-	100	-	-	
				Flashbutt welder	1	-	-	110	-	113	-	-	
Overhead Wiring (OHW)	Foundations, structures and wiring including possession works	October 2022 - December 2022		Delivery Truck	2 p.h.	2 p.h.	2 p.h.	102	-	111	-	-	Delivery of Masts & Structures
				Crane (Grove GMK5130)	1	1	1	105	-	103	-	-	
				Hand tools	various			105	-	111	-	-	
				Power tools	various			107	-	118	-	-	
				Hi rail vehicle	4	4	4	89	-	100	-	-	
				Water Cart	1	1	1	104	-	107	-	-	
				Concrete Truck and Pump	2	2	2	111	-	114	-	-	
				EWP	4	4	4	95	-	98	-	-	
				Mobile crane	1	1	1	104	-	108	-	-	Crawler, rough terrain
				Ute	4 per hour	4 per hour	4 per hour	89	-	100	-	-	
Fencing and GST routes install	July 2022 - September 2022		Delivery Truck	2 p.h.	-	-	102	-	111	-	-		
			Crane (Grove GMK5130)	1	-	-	105	-	103	-	-		
			Hand tools	various	-	-	105	-	111	-	-		
			Power tools	various	-	-	107	-	118	-	-		
			Rattle gun	2	-	-	107	-	118	-	-		
			Concrete truck	2 per hour	-	-	108	-	111	-	-		
			Vibrator	1	-	-	97	-	100	-	-		
			Hiab	1	-	-	98	-	102	-	-		

Table C1: Construction Activities/ Equipment

SMTF(S) AND SOUTHERN DIVE

Work acitivity	Details	Indicative timing/ duration	Modelling ID	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}			
BUILDINGS (Dive services building, Administration Building, Maintenance Workshop Building, Covered External Storage, Depot Security Centre and Fire Pump Building and Ground Water Treatment Plant Building)													
Footings & Foundations Insitu Concrete slab Blockwork	Reinforced concrete works and blockwork	April 2021 - April 2022		Flatbed truck	2 per hour	-	-	102	-	111	-	-	for delivery of steelwork
				Ute	4 per hour	-	-	89	-	100	-	-	
				Water Cart	1	-	-	104	-	107	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Delivery truck	3	-	-	102	-	111	-	-	
				Concrete truck	2 per hour	-	-	108	-	111	-	-	
				Concrete Truck and Pump	1	-	-	111	-	114	-	-	
				Vibrator	5	-	-	97	-	100	-	-	
				Hiab	1	-	-	98	-	102	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
Structural Steel Installation	Installation of columns, mullions, girts, purlins, etc...	May 2021 - October 2022		Delivery Truck	2 p.h.	-	-	102	-	111	-	-	Delivery of steel
				Crane (Grove GMK5130)	2	-	-	105	-	103	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Scissor lift	4	-	-	95	-	98	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
External Walls, doors, windows,	Installation of façade, roof, gutters, downpipes, glazing, doors, windows, etc...	July 2021 - October 2022		Delivery truck	2 p.h.	-	-	102	-	111	-	-	
				Crane (Grove GMK5130)	2	-	-	105	-	103	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Scissor lift	4	-	-	95	-	98	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
Internal finishes	Walls, doors, painting, tiling, painting, lift install, waterproofing, floors, etc....	August 2021 - October 2022		Delivery Truck	2 p.h.	-	-	102	-	111	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Scissor lift	4	-	-	95	-	98	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Buildings Services	HVAC, electrical, hydraulics, fire, security, comms, gas suppression, etc...	October 2021 - October 2022		Delivery truck	2 p.h.	-	-	102	
Hand tools	various	-	-					105	-	111	-	-	
Power tools	various	-	-					107	-	118	-	-	
EWP	2	-	-					95	-	98	-	-	
Rattle gun	2	-	-					107	-	118	-	-	
Scissor lift	4	-	-					95	-	98	-	-	
Telehandler	1	-	-					99	-	103	-	-	
External finishes	Asphalt works	April 2022 - October 2022						Paver	1	-	-	105	-
				Shuttle buggies	1	-	-	102	-	111	-	-	
				Vibratory Roller 15T	5	-	-	112	-	118	HN	X	
				Delivery truck	4 p.h.	-	-	102	-	111	-	-	
				Watercart	2 p.h.	-	-	104	-	107	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Bobcat	2	-	-	104	-	107	-	-	
				Profiler	1	-	-	110	5	124	HN	-	
				Road sweeper	2	-	-	104	-	107	-	-	
	Line marking and signage	May 2022 - October 2022		Delivery truck	1	-	-	102	-	111	-	-	
				Hand tools	various	-	-	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	-	-	95	-	98	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Scissor lift	2	-	-	95	-	98	-	-	
				Road sweeper	1	-	-	104	-	107	-	-	

Table C1: Construction Activities/ Equipment SMTF(S) AND SOUTHERN DIVE

Work activity	Details	Indicative timing/ duration	Modelling ID	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}			
	Road furniture, footpaths, landscaping, etc...	April 2022 - October 2022		Delivery Truck	2 p.h.	-	-	102	-	111	-	-	(Importing material)
				Hand tools	various	-	-	105	-	111	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
				Bobcat	1	-	-	104	-	107	-	-	
				Moxy Truck 38T	4 per hour	-	-	108	-	111	-	-	
				Truck & Dog	5 p.h.	-	-	106	-	111	-	-	
				Tracked excavator 30T w bucket	2	-	-	103	-	108	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				Delivery truck	3	-	-	102	-	111	-	-	
				Concrete truck	2 per hour	-	-	108	-	111	-	-	
				Concrete Truck and Pump	1	-	-	111	-	114	-	-	
				Vibrator	5	-	-	97	-	100	-	-	
				Hiab	1	-	-	98	-	102	-	-	
Dive Services Building	Module installation	April 2022 - October 2022		Delivery Truck	2 p.h.	2 p.h.	2 p.h.	102	-	111	-	-	
				Crane (Grove GMK5130)	2	1	1	105	-	103	-	-	
				Hand tools	various	various	various	105	-	111	-	-	
				Power tools	various	-	-	107	-	118	-	-	
				EWP	2	1	1	95	-	98	-	-	
				Rattle gun	2	-	-	107	-	118	-	-	
				Scissor lift	4	-	-	95	-	98	-	-	
				Telehandler	1	-	-	99	-	103	-	-	
SOUTHERN DIVE WORKS													
Track construction	April 2022 - October 2022			Rail set (train)	1	-	-	115	-	118	-	-	Rubber tyre
				Telehandler	1	1	1	99	-	103	-	-	
				Excavator 20T	2	1	1	103	-	108	-	-	
				Front end loader	1	-	-	110	-	115	-	-	
				Rail trolley	1	-	-	-	-	-	-	-	
				Hand tools	Various	1	1	105	-	111	-	-	
				Hand held saw	2	-	-	107	-	118	HN	-	
				Hi-Ab Truck (Hi-Rail)/concrete truck	4 p.h.	4 p.h.	4 p.h.	108	-	111	-	-	
				Concrete pump	1	1	1	103	-	107	-	-	
				Exothermic welding set-up	1	-	-	102	-	105	-	-	
				Grinder	2	-	-	107	-	118	HN	-	
				Light vehicle	4 p.h.	1 p.h.	1 p.h.	89	-	100	-	-	
COMPLETION													
Finishing works	Removal of gantry shed; offices; hardstands;	November 2022 - December 2022		Flat bed truck - Hi ab	2 p.h.	1 p.h.	1	102	-	111	-	-	
				Telehandler/forklift	3	1	1	99	-	103	-	-	
				Franna	1	0.5	1	99	-	103	-	-	
				Semi truck	3	0.5	1	102	-	111	-	-	
				Body truck 16T	4	0.5	1	102	-	111	-	-	
				Truck and dog	3	-	-	106	-	111	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	
				Tracked excavator 30T w bucket	1	-	-	103	-	108	-	-	
Demobilisation	Demobilisation	November 2022 - December 2022		Flat bed truck - Hi ab	2 p.h.	1 p.h.	1	102	-	111	-	-	
				Telehandler/forklift	3	1	1	99	-	103	-	-	
				Franna	1	0.5	1	99	-	103	-	-	
				Semi truck	3	0.5	1	102	-	111	-	-	
				Body truck 16T	4	0.5	1	102	-	111	-	-	
				Truck and dog	3	-	-	106	-	111	-	-	
				Tracked excavator 30T w bucket	1	-	-	103	-	108	-	-	
				Crane (Grove GMK5130)	1	-	-	105	-	103	-	-	

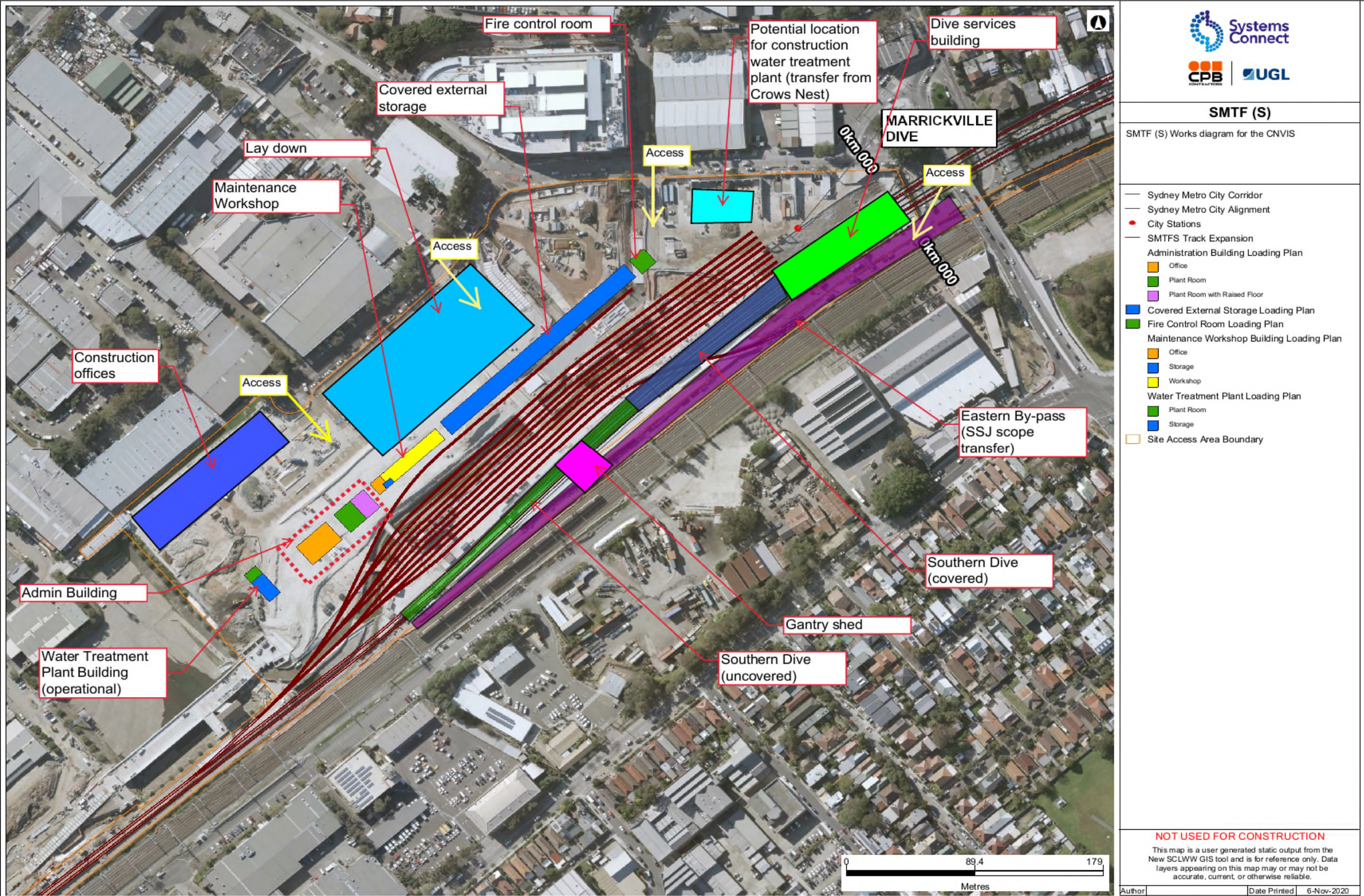
Table C2: Construction Timetable

		SMTF(S) AND SOUTHERN DIVE										
Work Activity	Description of Activity	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22
SITE ESTABLISHMENT	Site establishment											
LOGISTICS	Delivery to Laydown											
	Material Movement between laydown and gantry											
	Delivery to gantry											
EARTHWORKS AND DRAINAGE	General fill and structural placement											
	RW3 Wall construction											
	Drainage, CSR/FRM install											
OHW	OHW works											
TRACK CONSTRUCTION	Structural Placement Roads 1-8											
	Capping Placement Roads 1-8											
	Platform and wayside footing install											
	Ballast track construction											
	Track construction											
EASTERN BY-PASS (SSJ SCOPE TRANSFER)	Trim Capping											
	Ballast track construction											
	Track construction											
	Fencing and GST Routes											
	OHW works											
BUILDINGS	Admin building started											
	Maintenance Workshop and Covered External Storage buildings											
	Depot Security Centre and Fire Pump Building											
	Ground Water Treatment Plant Building											
	Dive services building											
SOUTHERN DIVE WORKS												
COMPLETION	Removal of gantry shed; offices; hoardings											
	Demobilisation											

		Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
SITE ESTABLISHMENT	Site establishment											
LOGISTICS	Delivery to Laydown											
	Material Movement between laydown and gantry											
	Delivery to gantry											
EARTHWORKS AND DRAINAGE	General fill and structural placement											
	RW3 Wall construction											
	Drainage, CSR/FRM install											
OHW	OHW works											
TRACK CONSTRUCTION	Structural Placement Roads 1-8											
	Capping Placement Roads 1-8											
	Platform and wayside footing install											
	Ballast track construction											
	Track construction											
EASTERN BY-PASS (SSJ SCOPE TRANSFER)	Trim Capping											
	Ballast track construction											
	Track construction											
	Fencing and GST Routes											
	OHW works											
BUILDINGS	Admin building started											
	Maintenance Workshop and Covered External Storage buildings											
	Depot Security Centre and Fire Pump Building											
	Ground Water Treatment Plant Building											
	Dive services building											
SOUTHERN DIVE WORKS												
COMPLETION	Removal of gantry shed; offices; hoardings											
	Demobilisation											

Figure C1: Construction Site Layout

SMTF(S) AND SOUTHERN DIVE



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 5-8, 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