

## ENDORSEMENT CITY & SOUTHWEST ACOUSTIC ADVISOR

Review of	<b>Construction Noise and Vibration Impact Statement for Line-Wide works (C2S) Portion 3 Surry Hills Bulk Power Supply Works</b>	Document reference:	<b>Construction Noise and Vibration Impact Statement Portion 3 – Surry Hills Bulk Power Supply Works. Prepared by Renzo Tonin and Associates for Systems Connect.</b>
Prepared by:	Larry Clark, Alternate Acoustics Advisor		
Date of issue:	23 November 2020		<i>TK685-03-05F01 CNVIS C2S_P3 BPS Surry Hills (r10) Dated 17 November 2020</i>

As approved Alternate Acoustics Advisor for the Sydney Metro City & Southwest project, I have reviewed the Construction Noise and Vibration Impact Statement (CNVIS) for Line-Wide works Portion 3 – Surry Hills Bulk Power Supply Works, as required under A27 (d) of the project approval conditions (SSI 15-7400).

The Surry Hills BPS construction activities will include:

- Minor Ancillary Facility – site office activities, carparking, storage, delivery;
- Site establishment – installation of environmental controls/ traffic controls;
- Waterloo to Surry Hills BPS Route;
  - Cable routes excavation, conduits installation, temporary surface reinstatement;
  - Cable Installation and Jointing.

I previously endorsed revision 6 of the CNVIS. Revision 6 has been updated to revision 10, which includes revised minor ancillary facility and route locations.

I am satisfied that revision 10 of the CNVIS is technically valid, and includes appropriate noise and vibration mitigation and management. On this basis I endorse this revision of the CNVIS.



Larry Clark, City & Southwest Alternate Acoustics Advisor

# SYDNEY METRO CITY AND SOUTH WEST - LINE-WIDE WORKS

## Construction Noise and Vibration Impact Statement Portion 3 - Surry Hills Bulk Power Supply Works

17 November 2020

Systems Connect

TK685-03-05F01 CNVIS C2S\_P3 BPS Surry Hills (r10)

## Document details

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## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Authorised
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25.03.2020	Update following AA review	-	2	T. Gowen	T. Gowen	M. Tabacchi
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29.07.2020	Revised work areas and new ancillary facility	-	7	T. Gowen	-	M. Tabacchi
24.08.2020	Address minor comments	-	8	T. Gowen	-	M. Tabacchi
17.09.2020	Respond to AA comments	-	9	T. Gowen	-	M. Tabacchi
17.11.2020	Revised minor ancillary facility and route locations	-	10	B. Carlyle	-	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.

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# 1 Introduction

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

## 1.1 Relevant requirements and purpose of this CNVIS

As defined in the CNVMP, the works covered by this CNVIS are part of the Portion 3 – Chatswood to Sydenham Bulk Power Supply Works 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 Surry Hills Bulk Power Supply Works (Surry Hills BPS), which includes works to be undertaken along the Bulk Power Supply route between Ausgrid's Surry Hills Sub-Transmission Substation to the bulk supply infeed substation within Waterloo Station. 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.



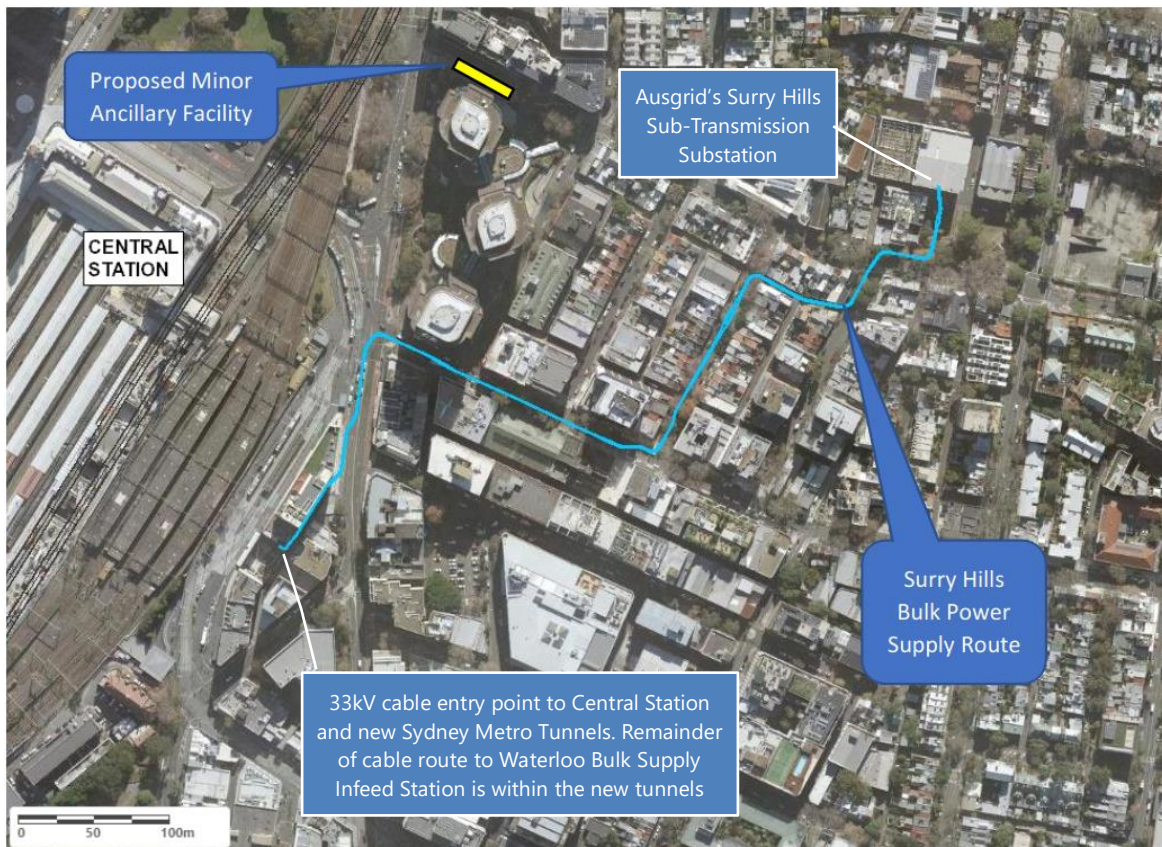
## 2 Description of construction works and hours

### 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 Surry Hills Bulk Power Supply Works, which includes providing cable routes and cable protection, feeder cables and cable joints, control and pilot cable and connections and terminations 33kV feeders from Ausgrid's Surry Hills Sub-Transmission Substation to the bulk supply infeed substation within Waterloo Station. Figure 2.1 shows the construction route. Details on activities carried out within each stage follow the figure.

Figure 2.1: Surry Hills Bulk Power Supply Route and Minor Ancillary Facility



The Surry Hills BPS construction activities will include:

- **Minor Ancillary Facility** – site office activities, carparking, storage, delivery
- **Site establishment** – installation of environmental controls/ traffic controls.
- **Waterloo to Surry Hills BPS Route**
  - Cable routes excavation, conduits installation, temporary surface reinstatement

- Cable Installation and Jointing.

The proposed works, likely plant and equipment and estimated Project timing is summarised in APPENDIX C. Works are planned to occur during standard construction hours, however due to the proximity of the works area to the arterial roads, some works will need to occur under Road Occupancy License, as outlined in Section 2.2.3 and APPENDIX C.

### **2.1.2 Construction traffic**

The Surry Hills BPS 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 Section 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 8.

### **2.1.3 Ground-borne noise assessment**

Due to the nature of the Surry Hills BPS 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.

### **2.1.4 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 Surry Hills BPS worksite have also been considered, as discussed in Section 9.

## 2.2 Construction hours

The construction hours for the Project are defined by Project Planning Approval (PPA) Conditions E36, E37, E38, E41, E42, E44 and E48.

### 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), including Road Occupancy License. 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

Construction works for the Surry Hills BPS will be undertaken where reasonable and feasible during standard construction hours, as described above. However, some works will need to be undertaken outside of standard construction hours due to safety or quality control considerations, or to comply with regulatory requirements.

Out of Hours Works that apply to the Surry Hills BPS works include for example, where works cross intersections of arterial roads, road traffic would impose major risks to construction workers due to the extremely close proximity between all parties involved. Conducting works under a Road Occupancy License would minimise the risks of road traffic and work site interaction, however this disruption to traffic could not occur during standard construction hours without impacting the road traffic network. Works would need to be conducted outside peak road traffic periods (i.e. between 8:00pm and 5:00am) to reduce the impact on the road network.

Oversize deliveries may need to take place outside of standard construction hours in order to comply with RMS requirements for oversize vehicle movements.

The minor ancillary site at Surry Hills will support the BPS out of hours works. Out of Hours Works is required for the establishment of the facility. In this case a Road Occupancy License is required for the operation of telehandler and crane. Once established, the operation of the facility works will be limited to minimise impacts to nearby residential receivers at night.

Any work outside standard construction hours must be undertaken in accordance with the Out of Hours Works Protocol and the CNVMP [1].

### 3 Nearest sensitive receivers

#### 3.1 Residential receivers

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

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

#### 3.2 Other sensitive receivers (PPA Condition E34)

Additional to residential receivers above, 'other' noise and vibration sensitive receivers such as passive recreation areas and places of worship surrounding the construction area have been identified and are summarised and identified 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 and will continue to undertake 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 and in APPENDIX B of this CNVIS.

## 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] 08 August 2016 and as set out in the CNVMP.

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

**Table 4-1: Application of NMLs at C2S Surry Hills BPS (CSSI 7400 Conditions of Approval)**

Time Period	Area	Receiver Type	Condition	Noise management level <sup>3</sup>
Day <sup>1</sup> (D/ D(O))	All	All	CEMF 9.2a <sup>3</sup>	ICNG (see Table B1 in APPENDIX B)
Evening <sup>1</sup> 6pm to 8pm (E1)	All	All	CEMF 9.2a <sup>3</sup>	ICNG (see Table B1 in APPENDIX B)
Evening <sup>1</sup> 8pm to 10pm (E2)	All	All	CEMF 9.2a <sup>3</sup>	ICNG (see Table B1 in APPENDIX B)
Night <sup>1</sup> 10pm to 7am (N)	All	All	CEMF 9.2a <sup>3</sup>	ICNG (see Table B1 in APPENDIX B)
Evening <sup>1</sup> 8pm to 9pm (E2)	Non-residential zones <sup>2</sup>	Residential	SSI-7400 E41	$L_{Aeq(15minute)}$ 60 dB(A) (internal)
Evening <sup>1</sup> 9pm to 10pm				$L_{Aeq(15minute)}$ 45 dB(A) (internal)
Night <sup>1</sup> 10pm to 7am (N)				
Evening <sup>1</sup> 8pm to 10pm (E2)	Residential zones <sup>2</sup>	Residential	SSI-7400 E42	$L_{Aeq(15minute)}$ 45 dB(A) (internal)
Night <sup>1</sup> 10pm to 7am (N)				
All	All	All	SSI-7400 E43	$L_{Aeq(8hour)}$ 85 dB(A) (external) near the CCSI

- 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.
- These are identified by the applicable Local Environmental Plan land zoning of the receiver.
- Construction Environmental Management Framework – City & Southwest (Sydney Metro 2017)
- 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

#### **ICNG NMLs**

For residential receivers, the ICNG NMLs are based on the background noise levels derived from long-term noise logging conducted by SLR on behalf of Transport for NSW (TfNSW) to quantify ambient noise levels for the Environmental Impact Statement (EIS) [2]. Additional pre-construction noise monitoring was carried out prior to the Tunnels and Stations Excavation (TSE) works to establish more accurate noise goals. This additional long-term, unattended noise monitoring was carried out in July

2017 by RT&A following a review of the EIS noise monitoring and has been incorporated into the CNVMP.

The NMLs for 'other' sensitive receivers are from the ICNG, as reported in Section 5.2.3 of the CNVMP. These are applicable when the other sensitive receiver is in use.

Receivers are considered 'noise affected' where construction noise levels are greater than the NMLs identified in APPENDIX B. The noise affected level represents the point above which there may be some community reaction to noise. Where predicted and/or measured construction noise levels are above the NMLs, all feasible and reasonable work practices will be applied to meet the NMLs.

Where construction activities are tonal or impulsive in nature and are described in the ICNG as being particularly annoying, 5 dB(A) must be added to the activity noise. Activities that are defined in the Interim Construction Noise Guideline (ICNG) [3] as particularly annoying include but are not limited to the use of 'beeper' style reversing or movement alarms; power saws; vibratory rolling; jack hammering, rock hammering or rock breaking; impact piling.

During standard construction hours, a highly affected noise objective of  $L_{Aeq(15min)}$  75 dB(A) applies in relation to airborne noise at all residential receivers.

#### ***Respite for high noise impact works (CSSI-7400 Conditions E37 and E38)***

CSSI-7400 Conditions E37 and E38 require that, for proposed day-time works, consultation will be undertaken with receivers predicted to experience internal noise levels greater than  $L_{Aeq(15minute)}$  60 dB(A), between 7am and 8pm, to determine appropriate hours of respite. Receivers have been identified using the following process:

- An external NML equivalent to an internal noise level of  $L_{Aeq(15minute)}$  60 dB(A) was established for all identified receivers:
  - For residential receivers, the equivalent external NML is based on a 10 dB(A) minimum (conservative) difference between external and internal noise levels (assuming windows open)
  - For non-residential receivers with light weight glazing, the equivalent external NML is based on a 20 dB(A) minimum (conservative) difference between external and internal noise levels (assuming windows closed)
  - For non-residential receivers with heavy glazing, the equivalent external NML is based on a 25 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 predicted to be above the equivalent external NML are identified in APPENDIX F as requiring consultation.

***Internal NMLs (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.

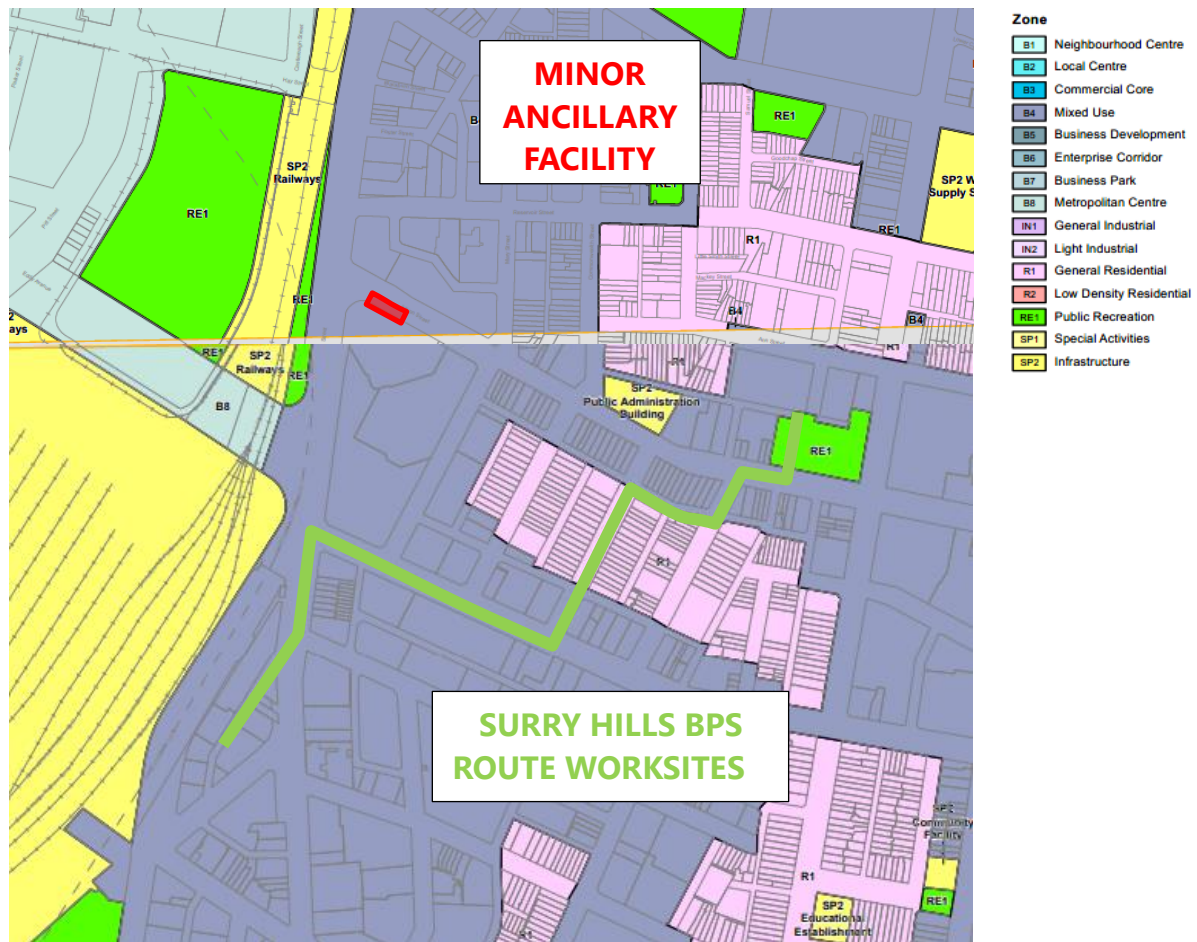
Where the above internal noise levels cannot be achieved, additional mitigation in accordance with the *Sydney Metro City and South West Noise and Vibration Strategy (SMCSNVS)* [8] is to be offered.

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 City of Sydney Local Environmental Plan (2012) land zoning map (accessed 14/02/2020) is provided in Figure 4.1. Purple and blue areas (R1 and B4) indicate residential and mixed use.

The zoning map indicates that the nearest residential receivers along the Surry Hills BPS works are in residential areas.



Figure 4.1: Extract from the City of Sydney Local Environmental Plan (2012) 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  $L_{Aeq(15\text{minute})}$  45 dB(A) between 8pm and 7am. Based on a minimum (conservative) external to internal noise difference of 10 dB(A) (assuming windows open), an equivalent external noise threshold of  $L_{Aeq(15\text{minute})}$  55 dB(A) is applicable between 8pm and 7am for all receivers. Where these external equivalent levels are above the external noise threshold, additional mitigation are required in accordance with the SMCSNVS.

For some residential receivers along Elizabeth Street, Foveaux Street and Albion Street, it is likely that the design of the buildings included upgraded window glazing and air conditioning systems to reduce the potential impact of road traffic noise and rail noise. At these locations, the external to internal noise reduction is expected to be more than the assumed 10dB(A).

The assessment presented in Section 5.4 has assessed all receivers against the approach outlined in the SMCSNVS [8] and the CNVMP [1] which achieves the requirements of PPA Conditions E41 and E42, and is consistent with the ICNG [3] and the EIS [2].

#### 4.1.2 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 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.

#### 4.1.3 National Standard for exposure to noise

In accordance with PPA Condition E43, Systems Connect worksites will be managed to ensure that noise generated by construction will not be above the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of  $L_{Aeq,8h}$ , of 85 dB(A) for any employee working at a location near a Systems Connect worksite.

#### 4.1.4 Construction related road traffic noise objectives

On the roads immediately adjacent to construction sites, the community may associate heavy vehicle movements with the Surry Hills BPS works. 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)' [4].

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 <sup>1</sup>	Vibration Dose Value (VDV), m/s <sup>1.75</sup>	
		Preferred values	Maximum values
Critical areas <sup>2</sup>	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 to be located near the assessed works. If they are identified, relevant vibration criteria should be established for each item in line with Section 5.5.3 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. A plan of the likely timing of each activity is presented in Table C.2, based on information of timing of activities provided by the Design and Construction Teams. Table C.2 outlines the key construction noise and vibration management measures included in the predictions.

### 5.2 Construction activities

The Surry Hills BPS works is a linear worksite that will move progressively between Ausgrid's Surry Hills Sub-Transmission Substation to the bulk supply infeed substation within Waterloo Station. The active worksite will at any time be between 50 metres and 250 metres long. Typically, a temporary worksite will be established, the works will be undertaken, then the temporary worksite will be closed and relocated to the next work area. The construction work areas are identified in the land use survey drawings presented in APPENDIX B.

The Surry Hills Minor Ancillary Facility, located at the western end of Albion Street, will be established to support the temporary worksites.

Table 5-1 presents a summary of the construction activities and aspects that are proposed to take place. Each aspect was subdivided into two categories with similar overall sound power levels (i.e. High impact activities and Typical activities). A representative High impact activities sound power level of 123 dB(A) and a Typical activities sound power level of 109 dB(A) were adopted.

As described above, for each work area, predictions have been undertaken for the following two categories:

- High impact activities, which will include rock hammer, concrete saw;
- Typical activities, which will exclude high impact sources (e.g. rock hammer, concrete saw).

**Table 5-1: Summary of construction activities**

Works Area (see APPENDIX B)	Activity	Aspect	Assessment reference		Duration
			High <sup>3</sup>	Typical <sup>4</sup>	
Surry Hills Minor Ancillary Facility (MAF) SE – Site establishment <sup>1,2</sup>	Site Establishment	Delivery and Installation of Site Shed	No	Yes	Nov 2020 to Dec 2020 (1 week)
Op – Site operation <sup>1,2</sup>	Operation	Site office activities, minor materials storage, limited construction vehicles parking	No	Yes	Dec 2020 to Aug 2022
A1 – Frog Hollow Reserve <sup>1</sup> A2 – Albion St <sup>2</sup> A3 – Bellevue St / Albion Way/Belmore St <sup>1</sup> A4 – Foveaux St/Elizabeth St <sup>2</sup>	Site Establishment	Installation of enviro controls / traffic controls	No	Yes	Dec 2020 to Mar 2022
A5 – Randle Ln <sup>2</sup>	Construction	Cable routes excavation, conduits installation, temporary surface reinstatement.	Yes	Yes	Dec 2020 to Dec 2021
		Cable Installation and Jointing	No	Yes	Dec 2021 to Mar 2022

Notes

1 Work period: Standard Hours

2. Work period: OOHW Periods 1 and 2

3 High impact activities which will include rock hammer and concrete saw

4 Typical activities, which will exclude high impact sources (e.g. rock hammer and concrete saw)

### 5.3 Predicted noise levels

A High impact activity and a Typical activity prediction was undertaken for each work area. 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.

### 5.3.1 ICNG NMLs

#### 5.3.1.1 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 residential receiver in each NCA. The results are presented in terms of level above the NML. 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 clearly moderately intrusive
- > 75dB(A) - highly noise affected (for residential receivers)

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

NCA	MAF		A1		A2		A3		A4		A5	
	SE	Op	T <sup>2</sup>	H <sup>1</sup>	T <sup>2</sup>	H <sup>1</sup>	T <sup>2</sup>	H <sup>1</sup>	T <sup>2</sup>	H <sup>1</sup>	T <sup>2</sup>	H <sup>1</sup>
CS_A	●	●	●	●	●	●	●	●	●	●	●	●
CS_B	●	●	●	●	●	●	●	●	●	●	●	●
CS_D	●	●	●	●	●	●	●	●	●	●	●	●
CS_G	□	●	□	□	□	□	□	□	□	□	□	□
CS_H	●	●	●	●	●	●	●	●	●	●	●	●
CS_I	●	●	●	●	●	●	●	●	●	●	●	●
CS_J	●	●	●	●	●	●	●	●	●	●	●	●
OSR	○	●	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆

Notes: 1 High impact activities which will include rock hammer and concrete saw  
 2 Typical activities, which will exclude high impact sources (e.g. rock hammer and concrete saw)  
 Standard hours (7am to 6pm Monday to Friday and 8am to 6pm Saturday)  
 OSR: this includes all commercial, industrial and other sensitive receivers.

Noise levels are predicted to be below the NMLs in all NCAs, except for the receivers within NCA CS\_G and nearby OSRs during typical and high impact activities. For operation of the MAF, noise levels are predicted to be below the NMLs in all NCAs.

#### 5.3.1.2 OOHW period 1

As part of the Surry Hills BPS construction works, there are some planned out of hours work periods, as noted in Table 5-1 between November 2020 and March 2022.

Predicted construction noise level were compared with the project NML to give an indication of the likely noise impact at receiver locations from the construction stages identified in Table 5-1. The impacts presented in Table 5-3 are as follows:

- 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

**Table 5-3: Summary of construction noise impacts at nearby receivers – OOHW period 1 (ICNG)**

NCA	MAF		A1		A2		A3		A4		A5	
	SE	Op	T <sup>5</sup>	H <sup>4</sup>	T <sup>5</sup>	H <sup>4</sup>	T <sup>5</sup>	H <sup>4</sup>	T <sup>5</sup>	H <sup>4</sup>	T <sup>5</sup>	H <sup>4</sup>
CS_A	●	●	-	-	●	●	-	-	●	●	●	●
CS_B	●	●	-	-	●	●	-	-	●	●	●	●
CS_D	●	●	-	-	●	●	-	-	●	●	●	●
CS_G	■	●	-	-	□	□	-	-	■	□	□	□
CS_H	●	●	-	-	●	●	-	-	●	●	●	●
CS_I	●	●	-	-	●	●	-	-	●	○	●	◆
CS_J	●	●	-	-	●	●	-	-	●	●	●	●
OSR	◆	●	-	-	■	□	-	-	□	□	□	□

- Notes:
- 1) E1: early evening period from 6pm to 8pm.
  - 2) E2: late evening period from 8pm to 10pm. Assessment against ICNG NMLs for this period is used to guide additional mitigation measures (Section 5.4.3). PPA Conditions E41/42 are applicable for this assessment period (see Section 5.3.3)
  - 3) OSR: this includes all commercial, industrial and other sensitive receivers.
  - 4) High impact activities which will include rock hammer and concrete saw
  - 5) Typical activities, which will exclude rock hammer and concrete saw

Exceedances of the NMLs have been predicted at the closest noise sensitive receivers around the work locations, especially in NCA CS\_G and nearby OSRs during typical and high impact activities. For NCA CS\_I, noise levels are predicted to be below the NMLs except when high impact activities are occurring at work area A4 and A5. Noise levels are predicted to be below the NMLs for the rest of the NCAs throughout all work areas. For operation of the MAF, noise levels are predicted to be below the NMLs in all NCAs.

Specific mitigation measures outlined in Table C2 (APPENDIX C) and in Section 5.4 are to be incorporated into the construction work plan to assist in reducing noise impacts during the works period, where practicable. However, as some of these works include partial road closure, the options for mitigation are limited and impacts need to be managed.



Proposed measures for managing potential noise impacts are provided in Section 5.4. For more detailed predictions, see APPENDIX D. For more detailed additional noise mitigation measures, refer to APPENDIX E.

### 5.3.1.3 OOHW period 2

Predicted construction noise levels were compared with the ICNG NMLs during the night time period to determine applicable additional mitigation measures (Section 5.4.3) at the noise affected receivers from the construction stages identified in Table 5-1. The impacts presented in Table 5-4 are as follows:

- 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

Where reasonable and feasible, high impact activities (i.e. H) should be undertaken prior to 12am. However, due to late ROLs this may not always be possible. Therefore, high impact, as well as typical activities, have been assessed during the night period in this CNVIS.

**Table 5-4: Summary of construction noise impacts at nearby receivers – OOHW period 2 (ICNG)**

NCA	MAF		A1		A2		A3		A4		A5	
	SE	Op	T <sup>3</sup>	H <sup>2</sup>	T <sup>3</sup>	H <sup>2</sup>	T <sup>3</sup>	H <sup>2</sup>	T <sup>3</sup>	H <sup>2</sup>	T <sup>3</sup>	H <sup>2</sup>
CS_A	●	●	-	-	●	●	-	-	●	●	●	●
CS_B	●	●	-	-	●	●	-	-	●	●	●	●
CS_D	●	●	-	-	●	●	-	-	●	●	●	●
CS_G	□	●	-	-	□	□	-	-	□	□	□	□
CS_H	●	●	-	-	●	●	-	-	●	●	●	●
CS_I	●	●	-	-	●	○	-	-	●	◆	○	◆
CS_J	●	●	-	-	●	●	-	-	●	●	●	●

- Notes:
- 1) Assessment against ICNG NMLs for this period is used to guide additional mitigation measures (Section 5.4.3). PPA Conditions E41/42 are applicable for this assessment period (see Section 5.3.3)
  - 2) High impact activities which will include rock hammer and concrete saw
  - 3) Typical activities, which will exclude rock hammer and concrete saw

Exceedances of the NMLs have been predicted at the closest noise sensitive receivers around the work locations, especially in NCA CS\_G. For NCA CS\_I, noise levels are predicted to be within 5 dB(A) of the NMLs except when high impact activities are occurring at work area A4 and A5. Noise levels are predicted to be below the NMLs for the rest of the NCAs throughout all work areas. For operation of the MAF, noise levels are predicted to be below the NMLs in all NCAs.

Specific mitigation measures outlined in Table C2 (APPENDIX C) and in Section 5.4 are to be incorporated into the construction work plan to assist in reducing noise impacts during the works period, where practicable. However, as some of these works include partial road closure, the options for mitigation are limited and impacts need to be managed.

Proposed measures for managing potential noise impacts are provided in Section 5.4. For more detailed predictions, see APPENDIX D. For more detailed additional noise mitigation measures, refer to APPENDIX E.

### 5.3.2 PPA Conditions E37/38

Table 5-5 summarises the predicted noise impacts for each construction stage in each NCA compared with the internal NMLs in CSSI-7400 Conditions E37 and E38. Where predicted levels are above the NMLs at receivers, consultation will be undertaken with affected receivers to determine appropriate hours of respite in accordance with PPA Conditions E37 and E38.

The impacts presented are as follow:

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

Table 5-5: Noise level summary for PPA Conditions E37/38

NCA	D <sup>1</sup>						E1 <sup>2</sup>							
	MAF		A1		A3		MAF		A2		A4		A5	
	SE	Op	T <sup>4</sup>	H <sup>3</sup>	T <sup>4</sup>	H <sup>3</sup>	SE	Op	T <sup>4</sup>	H <sup>3</sup>	T <sup>4</sup>	H <sup>3</sup>	T <sup>4</sup>	H <sup>3</sup>
CS_A	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CS_B	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CS_D	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CS_G	□	●	□	□	□	□	□	●	□	□	□	□	□	□
CS_H	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CS_I	●	●	●	●	●	●	●	●	●	●	●	●	●	●
CS_J	●	●	●	●	●	●	●	●	●	●	●	●	●	●
OSR <sup>5</sup>	●	●	□	□	□	□	●	●	●	□	□	□	□	□

- Notes:
- 1) Standard hours (7am to 6pm Monday to Friday and 8am to 6pm Saturday)
  - 2) E1: early evening period from 6pm to 8pm.
  - 3) High impact activities which will include rock hammer and concrete saw
  - 4) Typical activities, which will exclude rock hammer and concrete saw
  - 5) OSR: this includes all commercial, industrial and other sensitive receivers.

The results in Table 5-5 indicate that construction noise is predicted to be above the internal noise threshold of PPA Conditions E37/E38 at the nearest residential receivers within NCA CS\_G for both typical and high impact activities. Nearby OSRs are also predicted to be above the internal noise

threshold of PPA Conditions E37/38. For operation of the MAF, noise levels are predicted to be below the internal noise threshold of PPA Conditions E37/E38 in all NCAs.

Consultation with all noise affected receivers with predicted internal  $L_{Aeq(15\text{minute})}$  noise levels greater than 60 dB(A) (see APPENDIX F) will be undertaken to determine appropriate hours of respite in accordance with PPA Conditions E37 and E38 (additional details are presented in Section 5.4.1).

Proposed measures for managing potential noise impacts are provided in Section 5.4. For more detailed predictions, see APPENDIX D. For more detailed additional noise mitigation measures, refer to APPENDIX E.

### 5.3.3 PPA Conditions E41/42

Table 5-6 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 NMLs at residential receivers, additional mitigation measures will be implemented in accordance with the documented procedure in Addendum A of the SMCSNVS.

The impacts presented are as follow:

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

**Table 5-6: Noise level summary for PPA Conditions E41/42 (residential only)**

NCA	E21/N <sup>2</sup>							
	MAF		A2		A4		A5	
	SE	Op	T <sup>4</sup>	H <sup>3</sup>	T <sup>4</sup>	H <sup>3</sup>	T <sup>4</sup>	H <sup>3</sup>
CS_A	●	●	●	●	●	●	●	●
CS_B	●	●	●	●	●	●	●	●
CS_D	●	●	●	●	●	●	●	●
CS_G	□	●	□	□	□	□	□	□
CS_H	●	●	●	●	●	□	●	□
CS_I	●	●	●	●	●	□	●	□
CS_J	●	●	●	●	●	●	●	●

- Notes:
- 1) E2: late evening period from 8pm to 10pm.
  - 2) N: Night-time period from 10pm to 7am.
  - 3) High impact activities which will include rock hammer and concrete saw
  - 4) Typical activities, which will exclude rock hammer and concrete saw

The results in Table 5-6 indicate that construction noise is predicted to be above the internal noise threshold of PPA Conditions E41/E42 at the nearest residential receivers within NCA CS\_G for both typical and high impact activities. For NCA CS\_H and NCA CS\_I, noise levels are predicted to be below the NMLs except when high impact activities are occurring at work area A4 and A5. For operation of the

MAF, noise levels are predicted to be below the internal noise threshold of PPA Conditions E41/E42 in all NCAs.

Proposed measures for managing potential noise impacts are provided in Section 5.4. For more detailed predictions, see APPENDIX D. For more detailed additional noise mitigation measures, refer to APPENDIX E.

#### 5.3.4 Sleep disturbance

Construction equipment may produce instantaneous noise events during operation. Due to the proximity of the residential receivers to the works, it is likely that maximum noise levels from sources such as truck airbrakes and banging from metal on metal contact (ie. dropped chains, object & excavator usage) will exceed the sleep disturbance NML of 65 dB(A)  $L_{A1}$  (1 minute) during the night period works.

In regard to the Minor Ancillary Facility (MAF), the establishment works will only occur over a period of one week, during which time some works will be required under a Road Occupancy License (ROL) during the night-time. During the ROL, heavy vehicles and metal-on-metal bangs from the delivery/installation of the site office, may cause  $L_{max}$  noise levels greater than the sleep disturbance screening criterion at the nearest residential receivers. Once the MAF is operational, any sleep disturbance impacts will be infrequent as only two light vehicles and two heavy vehicles will utilise the site per night and will be restricted to parking only.

The nearest residences (including 242-254 Elizabeth Street) are already exposed to frequent maximum noise events from light and heavy vehicle traffic on Elizabeth Street and Albion Street, as well as noise from the railway and Central Station. Furthermore, these properties have already been designed to achieve significant mitigation from existing high levels of road traffic and rail noise.

These activities will be managed by setting up relevant traffic management measures to minimise the use of compression brakes when leaving the work area, installing air brake silencers and broadband reversing alarms on heavy vehicles, and minimising heavy vehicle movements where practicable. Truck drivers will be instructed to avoid excessive acceleration from a stopped position and vigorous slamming of truck doors. The potential of loose items or plant/equipment that could generate metal-on-metal bangs will be identified and managed accordingly.

In addition, Toolbox talks will be used to advise all personnel of the need to follow quiet work practices during OOHW periods, including warning personnel of the need to respect the residential receivers surrounding the local area work sites. Other management measures are outlined in Section 5.4.3 to aid in providing additional noise reduction benefits where predicted levels are above the objective.

## 5.4 Noise mitigation and management

### 5.4.1 Consultation with affected receivers (CSSI-7400 Condition E33)

CSSI-7400 Condition E33 requires consultation with affected receivers to assist in determining site-specific mitigation measures to be included in this CNVIS.

Systems Connect will continue consultation with affected sensitive receivers which commenced during early investigation works carried out prior to commencement of construction along the Surry Hills BPS route. That consultation has included doorknocking of affected residents and businesses prior to night time investigation works.

Systems Connect will continue to consult with potentially affected sensitive receivers, both prior to and following commencement of construction.

Consultation with affected sensitive receivers has informed and will continue to inform the identification of specific mitigation measures for the Surry Hill BPS works. These measures may include minimising high noise impact works during night time hours; limiting night time works in individual locations to no more than two consecutive nights; scheduling high noise impact works around sensitive periods where feasible and reasonable; offers of movie or dinner vouchers; alternative accommodation offers.

It must be noted that offers of such vouchers or alternative accommodation may not be viable during COVID-19 restrictions, in which case alternative respite arrangements may need to be developed in consultation with affected receivers.

### 5.4.2 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	Plant that is brought to site for regular use 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: <ul style="list-style-type: none"> <li>high performance 'residential-grade' exhaust mufflers,</li> <li>additional engine cowling / enclosure lined inside with sound absorbent industrial-grade foam, and</li> <li>air intake and discharge silencers / louvres.</li> </ul> The need to fit 'noise control kits' onto the identified plant, will be confirmed once each plant item is tested prior to its regular use on site.
	Limit equipment in use	Only the equipment necessary during each stage of the works will be used.
	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.

Control type	Control measure	Typical 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.
	Non-tonal reversing alarms	Alternative reverse alarms, such as 'quackers' will be installed on all vehicles & mobile plant regularly used on site and on all vehicles & mobile plant required for OOHV.
Path Control Measures	Temporary noise screens	Where practicable, temporary noise screens (e.g. Flexshield, Echo-barrier, or similar) should be used to provide additional noise reduction during works. The screen should be located around a minimum of 3 sides of the work area to ensure adequate shielding of the plant to sensitive receivers. Temporary noise screens can provide 5 to 10 dB noise reduction, where they can break line of sight.
	Mobile noise screens	Where practicable, a mobile noise screen/tent would be used to reduce noise from moving plant items e.g. concrete saw, road saw, pipe cutter. Mobile noise screens utilise aluminium mobile scaffold (or similar), with acoustic blanket/ quilt (e.g. Echo-barrier, FlexShield or similar) attached on up to 4 sides (including the top, where no solid platform). Mobile noise screens can provide 5 to 10 dB noise reduction, <u>where they can break line of sight</u> .
Noise Management Measures	Site inductions & Toolbox Talks	All employees, contractors and subcontractors will receive a Project induction. The environmental component may be covered in toolboxes and should include: <ul style="list-style-type: none"> <li>location of nearest sensitive receivers</li> <li>relevant project specific and standard noise and vibration mitigation measures;</li> <li>permitted hours of work;</li> <li>OOHV Procedure and Form</li> <li>construction employee parking areas.</li> </ul>
	Community consultation	Inform community of construction activity and potential impacts (see Section 5.4.1 and APPENDIX F.
	Respite periods	During standard construction hours, high noise impact activities (i.e. above 75dB(A) at the closest residential receivers) are carried out in continuous blocks of up to 3 hours. Respite from high noise impact activities will be provided between each block for at least 1 hour. No high noise impact activities will be carried out during this 1 hour respite period.
	Respite for OOHV	Timing of Road Occupancy Licence would mean that where OOHV is required, the start time will be delayed until after 9pm. Where practicable, high noise impact works such as road sawing would be limited to before midnight, to reduce impacts during the most sensitive period of the night.  As noted 'Path Control Measures' above, where practicable, temporary noise screens and mobile noise screens would be used to reduce high noise impact sources such as the excavator with rockhammer and road saw.  Noise affected receivers are identified in Table D1 of Detailed predicted noise levels. Table E1 in Additional noise mitigation identifies receivers where additional mitigation measures are triggered in accordance with the Sydney Metro CNVS (see Section 5.4.3).
	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.

Control type	Control measure	Typical use
	Noise monitoring	Noise monitoring is to be carried out as detailed in Section 5.4.4.

### 5.4.3 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].

**Table 5-8: Additional Airborne Noise Mitigation Measures**

When is the work being undertaken?	Predicted $L_{Aeq,15min}$ noise level above		Identify additional management measures to be implemented	
	Background (RBL)	Noise Management Level (NML)		
<b>Standard Hours</b> M-F 7am to 6pm Sat 8am to 1pm	0 to 10 dB(A)	-	-	-
	10 to 20 dB(A)	< 10 dB(A)	-	-
	20 to 30 dB(A)	10 to 20 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 20 dB(A)	LB, M	[MM2]
<b>OOHW Period 1</b> M-F 6pm to 10pm Sat 1pm to 10pm Sun/ PH 8am to 10pm	0 to 10 dB(A)	< 5 dB(A)	-	-
	10 to 20 dB(A)	5 to 15 dB(A)	LB	[MM1]
	20 to 30 dB(A)	15 to 25 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
<b>OOHW Period 2</b> M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	0 to 10 dB(A)	< 5 dB(A)	-	-
	10 to 20 dB(A)	5 to 15 dB(A)	LB, M	[MM2]
	20 to 30 dB(A)	15 to 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN, AA	[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  
 IB = Individual briefings  
 SN = Specific notifications  
 PC = Phone calls and emails  
 RO = Project specific respite offer  
 AA = Alternative accommodation

APPENDIX E presents a summary of the additional noise mitigation measures applicable for construction activities where, after application of all reasonable and feasible mitigation options (as outlined in Section 5.4.2), predicted construction noise levels still exceed the NMLs.

Prior to the commencement of the site establishment works, residential receivers around the Surry Hills BPS worksite, in particular those identified in APPENDIX E will be notified to advise that noise from the works may at times be audible. 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 5.4.5).

### 5.4.4 Attended Noise Monitoring

Real time noise monitoring in accordance with CSSI-7400 Condition C11 is not proposed to be undertaken for the Surry Hills BPS worksite. 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 <sup>1</sup>	Monitoring location at 1 m from
<b>Minor Ancillary facility</b>		
CS_G	242-254 Elizabeth Street, Surry Hills	Southern property boundary
CS_G	270 Elizabeth Street, Surry Hills	Northern property boundary
<b>A1 – Frog Hollow Reserve</b>		
CS_G	102-104 Albion St, Surry Hills	Eastern property boundary
<b>A2 – Albion St</b>		
CS_G	99 Albion St, Surry Hills	Northern property boundary
<b>A3 – Bellevue St / Albion Way/ Belmore St</b>		
CS_G	87 Albion St, Surry Hills	Eastern property boundary
CS_G	8 Belmore Street, Surry Hills	Western property boundary
<b>A4 – Foveaux St/Elizabeth St</b>		
CS_G	26 Foveaux St, Surry Hills	Southern property boundary
CS_G	308 Elizabeth St, Surry Hills	Western property boundary
<b>A5 – Randle Ln</b>		
CS_G	403 Elizabeth St, Surry Hills	Western property boundary

Notes: 1. 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.

If verification monitoring shows that the external noise levels are consistently above the predicted levels (i.e. 2 or more consecutive verification monitoring events that find the works to be the primary contributor noise above the predicted levels), investigation will be undertaken to understand the cause of the exceedance. Additional mitigation and management measures will be implemented in accordance with Sydney Metro City and South West Noise and Vibration Strategy.

Periodic assessment of plant noise levels will be undertaken in accordance with Section 9.2.3 and Table 20 of the CNVMP to confirm the plant noise levels are within the APPENDIX C Table C1.

All noise monitoring will follow the procedures outlined in Appendix D of the CNVMP.

#### 5.4.5 Complaints Handling

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

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



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

## 6 Construction vibration impacts

### 6.1 Minimum working distances for vibration intensive plant

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

- Compactor / roller (4-12 tonnes)
- Excavator with rock hammer (12 tonnes).

It is noted that there is no potentially vibration generating plant operating within the minor ancillary facility.

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. These distances are conservatively based on excavation of hard rock. 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) <sup>1</sup>	Unreinforced or light framed structures (e.g. residential buildings) <sup>1</sup>	Sensitive structures (e.g. heritage structures) <sup>2</sup>
Compactor / roller (4-12t) - low vibration	5	5	10
Excavator with rock hammer (5T)	5	5	10
Excavator with rock hammer (12T)	5	10	15

- 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 <sup>1,4</sup>	Residences		Offices <sup>3,4</sup>	Workshops <sup>4</sup>
		Day <sup>2</sup>	Night <sup>2</sup>		
Compactor / roller (4-12t) - low vibration	25	10	15	10	5
Excavator with rock hammer (5T)	25	20	20	15	10
Excavator with rock hammer (12T)	45	30	40	20	15

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. More detailed results are presented in Minimum working distances.

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

Plant item	Work Area	Number of buildings <sup>1</sup>	
		Screening criteria for non-heritage structures	Screening criteria for heritage structures <sup>2</sup>
Excavator with rock hammer (5T)	A1	1	-
	A2	4	2
	A3	10	2
	A4	7	3
	A5	6	3
Excavator with rock hammer (12T)	A1	2	-
	A2	5	3
	A3	44	2
	A4	13	7
	A5	6	3

Note: 1. Site inspection should determine structural conditions of all potentially vibration affected buildings.

2. Potential heritage structures – reference (Land Use Survey in Annexure B of the CNVMP).

Heritage and non-heritage buildings potentially within the minimum working distances established for cosmetic damage during use of an excavator (5t) with rock hammer (or vibratory roller), and an excavator (12t) with rock hammer are summarised in Table 6-3. The buildings/structures are identified on aerial photographs in Minimum working distances.

CSSI-7400 Condition E29 requires owners of properties at risk of exceeding the screening criteria for cosmetic damage to be notified before the commencement of vibration-generating works.

Vibration monitoring is recommended to verify that vibration levels achieve compliance with the structural damage objectives where plant is required to operate within the safe working distance identified in Table 6-1. If the monitoring above identifies that vibration is likely to exceed the structural damage objectives, a different construction method with lower source vibration levels will be considered.

Vibration control and management measures are presented in Section 6.3.

### 6.2.2 Human annoyance

The assessing vibration guideline Department of Environment Conservation NSW 2006 Assessing Vibration; a technical guideline 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.

At properties near the worksite, it is likely that the nearest receivers will be able to feel vibration levels when vibration-generating equipment is being utilised. Properties where vibration levels may be above the vibration disturbance goals in Table 4-2 and there is a probability of adverse comment are shown in Table 6-4.

**Table 6-4: Number of buildings within minimum working distances for human annoyance**

Plant item	Work Area	Critical areas <sup>1,4</sup>	Residences <sup>5</sup>		Offices <sup>3,4</sup>	Workshops <sup>4</sup>
			Day <sup>2</sup>	Night <sup>2</sup>		
Excavator with rock hammer (5T)	A1	-	5	5	-	1
	A2	-	17	17	1	-
	A3	-	55	55	9	1
	A4	-	3	3	22	-
	A5	-	2	2	7	-
Excavator with rock hammer (12T)	A1	-	13	16	-	1
	A2	-	22	27	1	-
	A3	-	69	90	9	1
	A4	-	4	8	24	-
	A5	-	4	5	7	-

Plant item	Work Area	Critical areas <sup>1,4</sup>	Residences <sup>5</sup>		Offices <sup>3,4</sup>	Workshops <sup>4</sup>
			Day <sup>2</sup>	Night <sup>2</sup>		

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.

5: Hotels and childcare centres are included in the residence category.

Table 6-4 above shows that there are residential properties near the works where the occupants may experience vibration which can cause adverse comment when vibration-generating plant is operated nearby (roller; excavator (5t) with rock hammer; excavator (12t) with rock hammer) during the day or night. These properties are further identified on aerial photographs in APPENDIX G.

The above assessment is based on vibration-generating equipment being operating at the closest location to nearby receivers. When vibration-generating equipment operates further from the closest point, the predicted vibration levels will reduce along with the probability of adverse comment.

Attended vibration measurements are proposed to be carried out proactively and in response to vibration complaints. If measurement results indicate exceedances of the vibration objectives for human annoyance at these locations, vibration control and management measures will be provided to reduce vibration impact (see Section 6.3.1).

After applying all feasible and reasonable vibration mitigation measures, if vibration monitoring still identifies that measured vibration levels are above the relevant vibration criteria for human annoyance, appropriate additional mitigation measures should be considered (see Section 6.3.2).

### 6.2.3 Sensitive equipment

Vibration levels may be above vibration objectives for sensitive equipment at The University of Sydney, Surry Hills Campus and at Ausgrid's Surry Hills Sub-Transmission Substation at 37-59 Ann Street, Surry Hills during cable route excavation and surface reinstatement/compaction works. These facilities should be investigated prior to undertaking high vibration generating activities to determine the presence of potential vibration sensitive structures. Should such items be identified by Systems Connect, then relevant vibration criteria will be established for each item per Section 5.5.3 of the CNVMP [1], and any corresponding management or mitigation measures determined.

## 6.3 Vibration mitigation measures

### 6.3.1 Vibration control and management measures

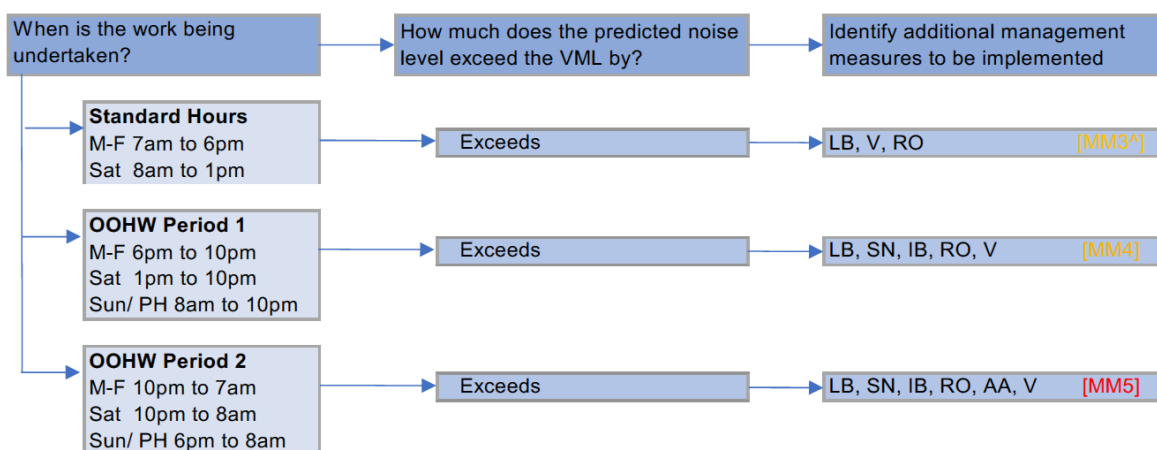
In addition to the vibration control measures presented in the CNVMP, the following vibration management measures are provided to minimise vibration impact from construction activities to the nearest affected receivers and to meet the relevant human comfort vibration and structural damage limits identified in Section 4.2.

**Table 6-5: Site vibration control measures**

Control type	Control measure	Typical use
Construction Planning	Building condition surveys	Undertake building dilapidation surveys on all buildings located within the minimum working distances established for cosmetic damage prior to commencement of activities with the potential to cause property damage (see Section 6.1 and APPENDIX G).
	Community consultation	Implement community consultation measures – inform community of construction activity & potential impacts – inform community that the level of vibration at which people perceive it, or at which loose objects may rattle, is far lower than the level at which minor cosmetic damage is expected to occur
	Equipment selection/construction method	Use less vibration emitting construction methods where feasible & reasonable, for example vibratory rollers can, where practicable, be operated with the vibratory mode switched off to reduce vibration impact.
	Plan work activities to minimise vibration.	Plan traffic flow, parking & loading/unloading areas to maximise distances between truck routes and sensitive receivers.
Complaints Management	Construction Complaints Management System	Complaints will be managed in accordance with the Construction Complaints Management System (see Section 6.3.4). Each complaint shall be investigated and where vibration levels are established as exceeding the set limits, appropriate amelioration measures shall be put in place to mitigate future occurrences. Management measures may include modification of construction methods such as using smaller equipment and establishment of minimum working distances as mentioned above.

### 6.3.2 Additional vibration mitigation measures

After applying all feasible and reasonable mitigation measures identified in Table 6-5, if vibration monitoring at representative locations are still above relevant vibration objectives for human annoyance, the appropriate additional vibration mitigations measures, as outlined in Section 8.2 of the CNVMP.

**Table 6-6: Additional vibration mitigation measures**

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 monitoring

SN = Specific notifications  
IB = individual briefing

RO = Project specific respite offer  
AA = Alternative accommodation

### 6.3.3 Vibration monitoring

Attended vibration monitoring is to be undertaken to determine and verify site specific minimum working distances for cosmetic damage and human annoyance. Properties located within the minimum working distances for human annoyance are identified in APPENDIX G.

As a minimum, it is recommended that attended monitoring is undertaken at the locations identified in Table 6-7, when vibration significant plant items operate close to or within the minimum working distances. Additional monitoring may also be required in response to vibration complaints.

Real-time vibration monitoring in accordance with PPA Condition C11 is not proposed for this site.

**Table 6-7: Attended vibration monitoring – nominated representative locations**

Plant	Work areas	Address	Vibration objectives to check		
			Heritage structures	Unreinforced or light framed structures	Human annoyance <sup>1</sup>
Excavator with rock hammer (5T)/ Excavator with rock hammer (12T)	A1	37 ANN STREET, SURRY HILLS, NSW	-	√	-
	A1/A2	102-104 ALBION STREET, SURRY HILLS, NSW	-	√	√
	A2	100 ALBION STREET, SURRY HILLS, NSW	-	√	√
	A2	106 ALBION STREET, SURRY HILLS, NSW	-	√	√
	A2	108 ALBION STREET, SURRY HILLS, NSW	-	√	√
	A2	92-96 ALBION STREET, SURRY HILLS, NSW	√	-	√
	A2	98 ALBION STREET, SURRY HILLS, NSW	-	√	√
	A2/A3	87 ALBION STREET, SURRY HILLS, NSW	√	-	√
	A2/A3	89-91 ALBION STREET, SURRY HILLS, NSW	√	-	√
	A3	1 BELLEVUE STREET, SURRY HILLS, NSW	-	√	√
	A3	11 Albion Way, Surry Hills NSW 2010	-	√	√
	A3	11 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	12 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	13-13 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	14 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	15 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	16 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	17 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	1-7 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	18 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	19 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	20 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	21 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	22 BELMORE STREET, SURRY HILLS, NSW	-	√	√
	A3	23 BELMORE STREET, SURRY HILLS, NSW	-	√	√

Plant	Work areas	Address	Vibration objectives to check		
			Heritage structures	Unreinforced or light framed structures	Human annoyance <sup>1</sup>
	A3	2-4 BELLEVUE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	24 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	25 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	26 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	27 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	28 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	3 BELLEVUE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	30 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	32 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	34 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	36 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	38 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	40 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	42-44 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	5 BELLEVUE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	6 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	65 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	67 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	69 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	7 BELLEVUE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	71 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	75 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	79 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	81 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	8-10 BELMORE STREET, SURRY HILLS, NSW	-	✓	✓
	A3	83 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3	85 ALBION STREET, SURRY HILLS, NSW	-	✓	✓
	A3/A4	44 FOVEAUX STREET, SURRY HILLS, NSW	-	✓	✓
	A4	1-15 FOVEAUX STREET, SURRY HILLS, NSW	✓	-	✓
	A4	17-51 FOVEAUX STREET, SURRY HILLS, NSW	-	✓	✓
	A4	21 TERRY STREET, SURRY HILLS, NSW	-	✓	✓
	A4	2-12 FOVEAUX STREET, SURRY HILLS, NSW	✓	-	✓
	A4	26 FOVEAUX STREET, SURRY HILLS, NSW	✓	-	✓
	A4	302-306 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓
	A4	310 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓
	A4	314 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓



Plant	Work areas	Address	Vibration objectives to check		
			Heritage structures	Unreinforced or light framed structures	Human annoyance <sup>1</sup>
	A4	316 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓
	A4	318 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓
	A4	320-324 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	✓
	A4	328-342 ELIZABETH STREET, SURRY HILLS, NSW	✓	-	✓
	A4	51 FOVEAUX STREET, SURRY HILLS, NSW	-	✓	✓
	A4	55 FOVEAUX STREET, SURRY HILLS, NSW	✓	✓	✓
	A4	57 Foveaux St, Surry Hills NSW 2010	-	✓	✓
	A4	63 FOVEAUX STREET, SURRY HILLS, NSW	✓	-	✓
	A4/A5	2-18 CHALMERS STREET, SURRY HILLS, NSW	✓	✓	✓
	A4/A5	401 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	
	A5	11 RANDLE STREET, SURRY HILLS, NSW	✓	-	
	A5	1-5 RANDLE STREET, SURRY HILLS, NSW	-	✓	
	A5	28 CHALMERS STREET, SURRY HILLS, NSW	✓	-	
	A5	403 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	
	A5	405 ELIZABETH STREET, SURRY HILLS, NSW	-	✓	
	A5	7 Randle St, Surry Hills NSW 2010	-	✓	

Notes: 1: In the event of complaint related to vibration.

2. 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.

3: Should vibration sensitive equipment be found

### 6.3.4 Management of complaints

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

Transport for NSW operate a 24-hour construction complaints line (1800 171 386). Enquiries/ complaints may also be received through the Sydney Metro project email (linewide@transport.nsw.gov.au).

## 7 Ground-borne noise assessment

Due to the nature of the Surry Hills BPS 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

Low levels of heavy vehicle movements are likely to be associated with Surry Hills BPS works, and the majority of these will be at the start and end of the works period. As such, the increase in road traffic noise levels is likely to be less than 2 dB(A) and so construction traffic will have minimal impact on the main roads used to access the site.

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

## 9 Cumulative impacts

All concurrent Sydney Metro construction works have been considered and addressed in this CNVIS. There are no other construction works that are expected to occur concurrently with the Sydney Metro construction works.

## 10 Conclusion

Works associated with the Surry Hills BPS worksite have been identified and described in this report. Potentially affected noise and vibration sensitive receivers and relevant construction noise and vibration objectives have been identified and discussed to allow the assessment of potential construction impacts.

Expected construction noise levels have been predicted and presented in Section 5.3 and APPENDIX D. The expected duration of construction activities is outlined in Table C1 of APPENDIX C.

The highest noise impacts are predicted to occur when excavators with rock hammer attachments and road saws are utilised in proximity to sensitive receivers. Where possible, and subject to Road Occupancy Licence (ROL) approvals, these activities will be completed prior to midnight (where possible) to minimise impacts. The potential noise and vibration impacts associated with remaining activities are significantly reduced.

Noise mitigation and management measures have been presented in Section 5.4 to aid in providing additional noise reduction benefits where exceedance of the objective occurs.

Vibration impacts and management measures have been presented in Section 6 to aid in minimising any potential vibration impacts.

The potential impact of ground-borne noise from construction activities is expected to be negligible due to the expectation that airborne noise will be much higher than ground-borne noise levels at the nearest sensitive receivers.

Minimal construction vehicles are proposed as part of the works, and so construction traffic noise on the local road network associated with the works will have minimal impact on receivers in proximity to public roads.

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

## 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 <sub>Max</sub>	The maximum sound pressure level measured over a given period.
L <sub>Min</sub>	The minimum sound pressure level measured over a given period.

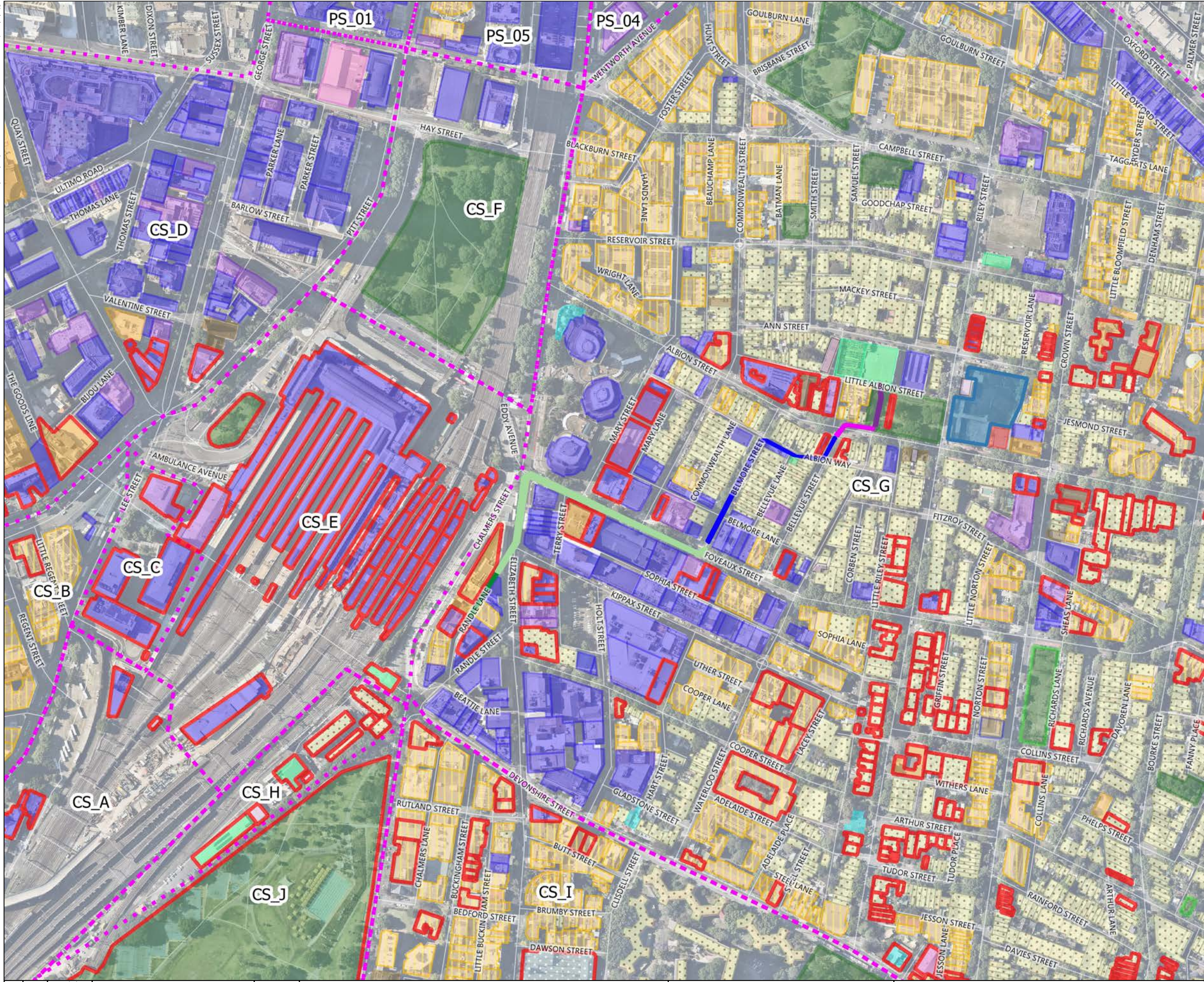
L <sub>1</sub>	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L <sub>10</sub>	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L <sub>90</sub>	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L <sub>eq</sub>	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 <sub>eq</sub> 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**



450 m  
400  
350  
300  
250  
200  
150  
100  
50  
0



### LEGEND

#### Noise sensitive receivers

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

NCA

BPS Surry Hills ancillary facility

#### Work areas

A1  
A2  
A3  
A4  
A5



Table B1: Noise Sensitive Receivers and Construction Noise Management Levels BULK POWER SUPPLY WORKS - SURRY HILLS

NCA	Receiver Type	Reference RBL	Existing Noise Levels, dB(A)			Residential NMLs based on ICNG (external)				Sleep Dist. L <sub>A1</sub>		Comments	
			RBL Day	RBL Evening	RBL Night	D(S)	D(O)	E	N	Screening	L <sub>A1max</sub>		
CS_A	Predominantly Central Station		63	56	52	68	63	61	57	55	65		
CS_B	Mixed Residential & Commercial		63	56	52	68	63	61	57	55	65		
CS_D	Mixed Residential & Commercial		63	56	52	68	63	61	57	55	65		
CS_G	Mixed Residential & Commercial		61	53	45	66	61	58	50	55	65		
CS_H	Industrial area		-	-	-	70	70	70	70	55	65		
CS_I	Mixed Residential & Commercial		61	53	45	66	61	58	50	55	65		
CS_J	Active recreation & Mixed Residential & Commercial		55	55	55	60	60	60	60	55	65		
Other sensitive receivers													
Studio building (music recording studio)						25							AS2107 'maximum' (internal noise level)
Studio building (film or television studio)						30							AS2107 'maximum' (internal noise level)
Cinema Space						35							AS2107 'maximum' (internal noise level)
Hotel (Sleeping areas: Hotels near major roads)						40							AS2107 'maximum' (internal noise level)
Classrooms at schools and other educational institutions						45							ICNG (internal noise level)
Hospital wards and operating theatres						45							ICNG (internal noise level)
Places of worship						45							ICNG (internal noise level)
Library (reading areas)						45							AS2107 'maximum' (internal noise level)
Office building (general office areas)						45							AS2107 'maximum' (internal noise level)
Community centres – Municipal Buildings						50							AS2107 'maximum' (internal noise level)
Cafe/ Restaurant/ Bar (bars and lounges) – indoor areas						50							AS2107 'maximum' (internal noise level)
Medical facilities						55							AS2107 'maximum' (internal noise level)
Railway platform and concourse areas						55							AS2107 'maximum' (internal noise level)
Cafe/ Restaurant/ Bar (bars and lounges) – outdoor areas						60							AS2107 'maximum' <sup>1</sup> (external noise level)
Passive recreation areas (e.g. area used for reading, meditation)						60							ICNG (external noise level)
Active recreation areas (e.g. sports fields)						65							ICNG (external noise level)
Commercial premises (including offices and retail outlets)						70							ICNG (external noise level)
Industrial premises						75							ICNG (external noise level)
Notes:													
1 - Outdoor noise level based on recommended maximum internal noise level in AS 2107 plus 10 dB (10dB is a conservative estimate of the difference between internal and external noise levels, taken from ICNG p13)													
D(S): standard construction hours from 7 am to 6 pm Monday to Friday and from 8 am to 6 pm Saturday													
E: evening period from 6pm to 10pm (Monday to Saturday) - OOHW P1													
N: night-time period from 10 pm to 7 am Monday to Friday, from 10 pm to 8 am Saturday, Sunday and Public holidays - OOHW P2													

APPENDIX C

Construction timetable/ activities/ management

Table C1: Construction Timetable/ Activities/ Equipment

## BULK POWER SUPPLY WORKS - SURRY HILLS

Activity/ Work Area	Aspect	Timing of Activity (Aproximate no. weeks/ months)	Plant/ Equipment	Net Power kW	Operating Weight kg	Day	Evening	Night	Sound Power Level (Lw re: 1pW) in Noise Model, dB(A)			Notes	
						7am - 6pm	6pm - 10pm	10pm - 7am	L <sub>Aeq</sub>	Penalty	L <sub>Amax</sub>		
MINOR ANCILLARY FACILITY													
Surry Hills BPS Minor Ancillary Facility Establishment and operation  Western end of Albion Street, Surry Hills	Delivery and Installation of Site Shed, barriers, fencing, signage, environmental controls	Nov 2020 to Dec 2020  (Completed within one week)	Franna Crane (25T)		25T	1	1	1	98				
			Flat top truck (Deliveries to site)			2	2	2	106				
			Hand tools			1	1	1	107				
			Light Vehicle			5	5	5	89				
	Ancillary facility operation to support Surry Hills BPS trenching, conduit and cabling installation activity along the route. Site office activities Minor materials storage Limited construction vehicles parking	Dec 2020 to Aug 2022	Forklift / telehandler			1	1	1	99				
			Flat top truck (Deliveries to site)			2/day	2/evening	2/night	106			During night hours: Entry, exit and parking only	
			Light Vehicle	80		2/day	2/evening	2/night	89			During night hours: Entry, exit and parking only	
			Portable site office with generator built-in			1	1	1	91			Located within a lined enclosure at the end of the site shed	
SITE ESTABLISHMENT													
Waterloo to Surry Hills BSP Route - Site Establishment	Installation of enviro controls / traffic controls	Dec 2020 to Mar 2022	Small Truck <20T			1	1	1	103				
			Telehandler		4T	1	1	1	98				
			Light Vehicle			3	3	3	89				
			Power Tools			Various	Various	Various	107				
CONSTRUCTION													
Waterloo to Surry Hills BSP Route - Cable route excavation, conduits installation, surface reinstatement.	Earthworks and Electrical Installation	Dec 2020 to Dec 2021	Truck/Tipper		15T	1	1	1	103				
			Excavator 12T with hammer			2	2	2	118	5			
			Excavator 12T			2	2	2	103				
			Road Saw	55kW		2	2	2	121	5			
			Compactor			1	1	1	108				
			Generator	10kVA		1	1	1	94				
			Light Vehicle			3	3	3	89				
			Crane			1	1	1	105				
			Concrete Truck			1	1	1	108				
			Concrete pump			1	1	1	104				
			Lighting Tower			1	1	1	93				
			Water Cart	5T		1	1	1	104				
			Grader			1	1	1	109				
			Roller	4T		1	1	1	109				
			Skidsteer bobcat	1T		1	1	1	101				
			Power Tools			Various	Various	Various	107				
			Waterloo to Surry Hills BSP Route - Cable Installation and Joining	Earthworks and Electrical Installation	Dec 2021 to Mar 2022	Truck			1	1	1	106	
Crane						1	1	1	105				
Cable Winch						1	1	1	98				
EWP						1	1	1	95				
Lighting Tower						1	1	1	93				
Generator	10kVA					1	1	1	94				
Light vehicle						1	1	1	89				
Power Tools						Various	Various	Various	107				

**Table C2: Construction Noise Management Schedule****BULK POWER SUPPLY WORKS - SURRY HILLS**

Mitigation/ Management Measure		Comments
1	Minor Ancillary facility	i. The site shed generator will be located within a lined enclosure at the end of the site shed. ii. There will be no loading or unloading of trucks during the night time period (22:00 – 07:00). Trucks and light vehicles may enter, exit and park during the night period. All loading and unloading will be done during the day or evening periods.
2	Temporary screens	Temporary noise screens (e.g. FlexShield, Echo-barrier or similar) will be installed around the work areas. The screen should be located on all sides of the work areas and as close as possible to the plant. This will reduce the noise from the construction activities by up to 10 dB(A) when there is no direct line of sight between construction plant and receivers. The exceptions are for areas where work is carried out during standard construction hours.
3	High noise impact works	High noise activities such as saw cutting and excavator with hammers are to be limited to before midnight, where feasible with consideration of the ROL. Where practicable, mobile noise screens will be used to provide localised screening of high noise impact sources.
4	Sleep Disturbance - Maximum noise level management	i. Maximum noise levels with potential to cause sleep disturbance may be caused by activities such as use of air brakes and general clangs and bangs on site. These activities will be managed by personnel of the need to respect the residential receivers surrounding the local area work sites as part of the toolbox talk for these works, stressing the lower night-time background noise levels in the works areas. ii. Minimise the use of air brakes when travelling to and from the site. iii. Identify and eliminate or manage the potential of loose items or plant/equipment that could generate metal-on-metal bangs during the night period.
5	Verification monitoring - Noise	Verification monitoring must be conducted to validate predictions in the nominated positions against the project requirements, as outlined in Section 5.4.4
6	Receiver notification/briefing - Noise	A large range of receivers may be impacted by the works. Some properties close to the work areas will be exposed to highly noise impacts during the OOHW period. All additional mitigation measures outlined in APPENDIX E should be applied. Sensitive receivers requiring consultation to satisfy CSSI-7400 Condition E33 (see Section 6.4.1) are identified in APPENDIX F.
7	Verification monitoring - Vibration	Plant and equipment have been identified to operate within the minimum buffer distances for both cosmetic damage and human annoyance. Verification monitoring must be conducted to validate predictions in the nominated positions against the project requirements, as outlined in Section 6.3.3
8	Receiver notification/briefing - Vibration	Plant and equipment have been identified to operate within the minimum buffer distances for human annoyance. Vibration may be perceivable at times. Notifications should be sent to receivers included within the minimum working distances shown in APPENDIX G, and additional mitigation measures where applicable following monitoring.

## APPENDIX D Detailed predicted noise levels

The impacts presented in the following table are identified by colour coding of the text.

For **Standard Hours**:

- XX Complies with NML
- **XX** < 10dB(A) above NML - construction noise clearly audible
- **XX** > 10dB(A) above NML - construction noise moderately intrusive
- **XX** > 75dB(A) - highly noise affected

For **OOH**

- XX Complies with NML
- **XX** < 5 dB(A) above NML - construction noise noticeable
- **XX** 5 to 15 dB(A) above NML - construction noise clearly audible
- **XX** > 15 to 25 dB(A) above NML - construction noise moderately intrusive
- **XX** > 25 dB(A) above NML - construction noise highly intrusive

*The detailed predicted levels have 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?	Predicted $L_{Aeq,15min}$ noise level above		Identify additional management measures to be implemented	
	Background (RBL)	Noise Management Level (NML)		
<b>Standard Hours</b> M-F 7am to 6pm Sat 8am to 1pm	0 to 10 dB(A)	-	-	-
	10 to 20 dB(A)	≤ 10 dB(A)	-	-
	20 to 30 dB(A)	10 to 20 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 20 dB(A)	LB, M	[MM2]
<b>OOHW Period 1</b> M-F 6pm to 10pm Sat 1pm to 10pm Sun/ PH 8am to 10pm	0 to 10 dB(A)	< 5 dB(A)	-	-
	10 to 20 dB(A)	5 to 15 dB(A)	LB	[MM1]
	20 to 30 dB(A)	15 to 25 dB(A)	LB, M	[MM2]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
<b>OOHW Period 2</b> M-F 10pm to 7am Sat 10pm to 8am Sun/ PH 6pm to 8am	0 to 10 dB(A)	< 5 dB(A)	-	-
	10 to 20 dB(A)	5 to 15 dB(A)	LB, M	[MM2]
	20 to 30 dB(A)	15 to 25 dB(A)	LB, M, IB, PC, RO, SN	[MM4]
	> 30 dB(A)	> 25 dB(A)	LB, M, IB, PC, RO, SN, AA	[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  
IB = Individual briefings  
SN = Specific notifications  
PC = Phone calls and emails  
RO = Project specific respite offer  
AA = Alternative accommodation

In the following results table, an additional management measure code (MM1, MM2 et al) is given to each receiver if construction noise levels are expected to exceed the Noise Management Level (NML). Each additional management measure code corresponds to a collection of measures identified in the CNVS [9]. The extent of the additional management measures is proportional to the exceedance of the NML and the period in which the exceedance is experienced.

For example, if a receiver experiences construction noise of 10 to 20 dB(A) above the NML during Standard Hours, then the letterbox drop (LB) and verification of predicted noise levels (V) measures are to be adopted for the receiver.

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



## APPENDIX F Consultation required under conditions E37/E38

Table F1 identifies ('E38 consultation required') the locations where consultation is required to determine appropriate hours of respite in accordance with Approval Conditions E37 and E38.

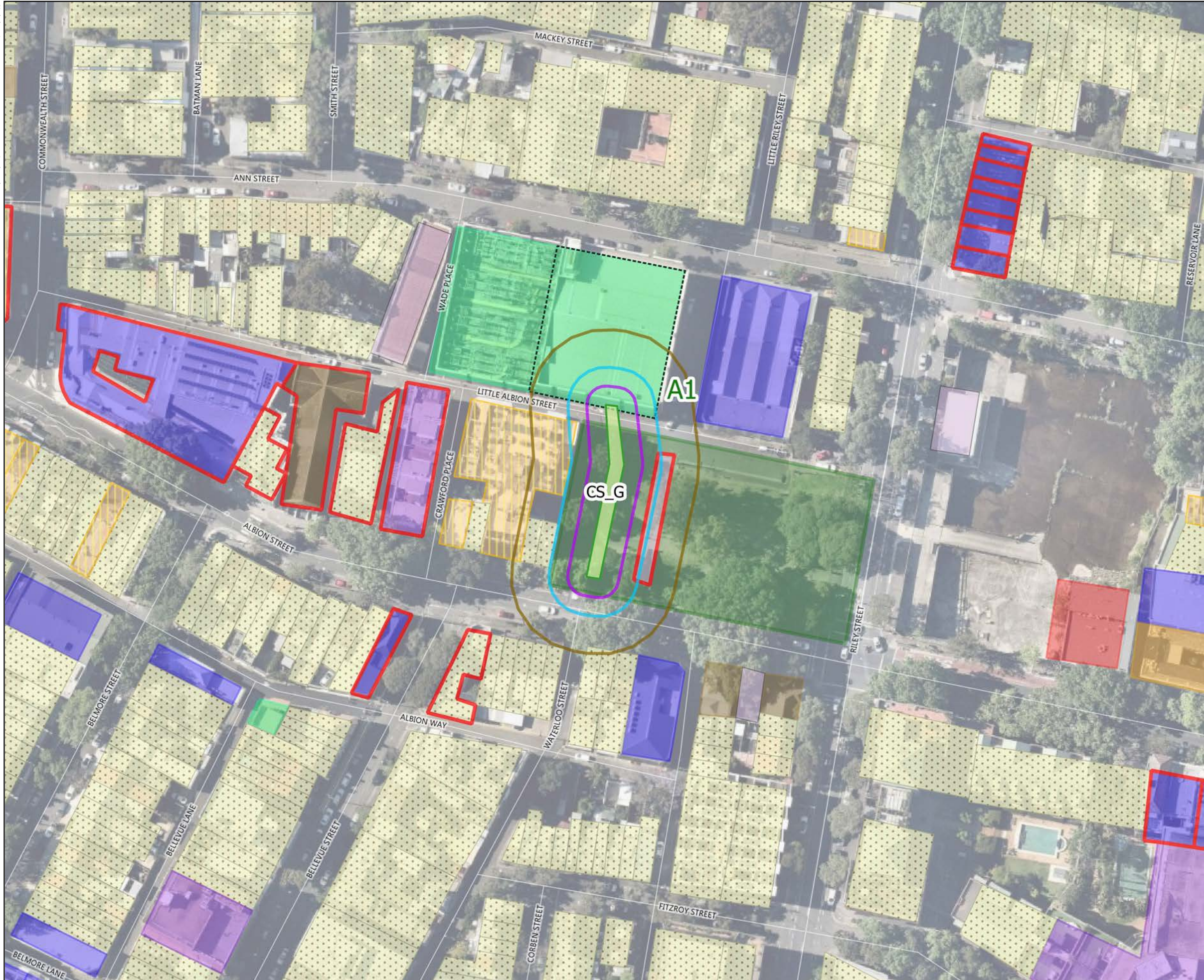
*The detailed additional noise and mitigation measures have provided to Systems Connect in a spreadsheet table in order to more adequately mitigate and manage potential noise impacts.*

## **APPENDIX G**      **Minimum working distances**

### **G.1      Minimum Working Distances for cosmetic damage and human annoyance - Excavator with rock hammer (5T)**



120 m  
100  
80  
60  
40  
20  
0



**LEGEND**

**Noise sensitive receivers**

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

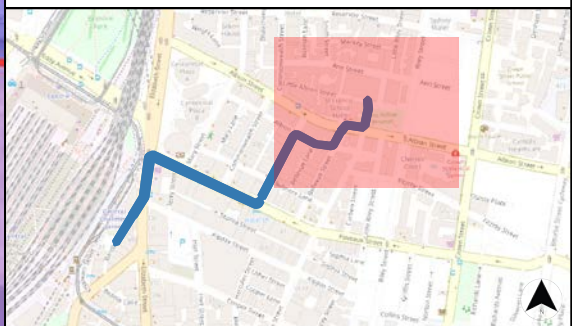
NCA

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (5T)

- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

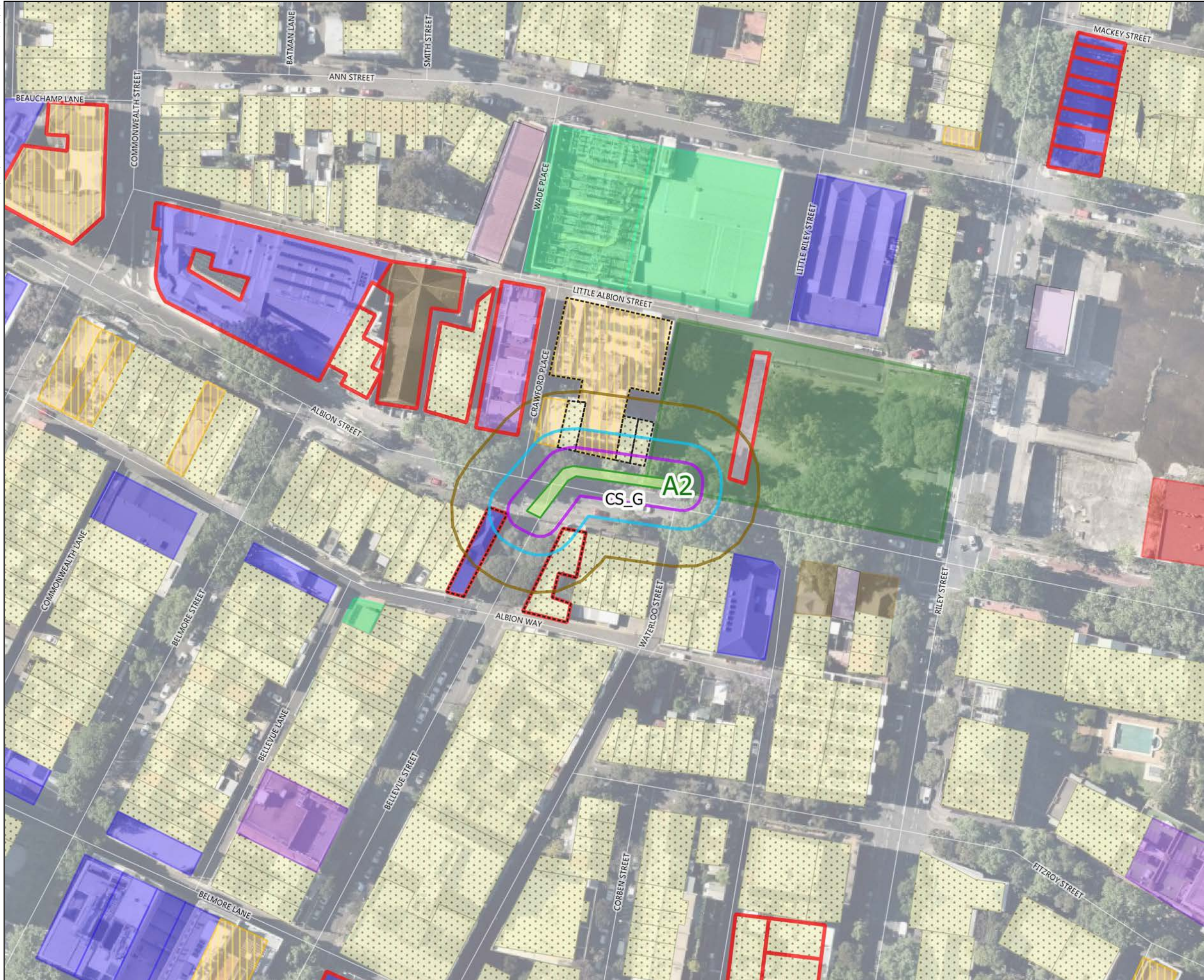
Work area



..	..	..	..	..	..	0	20	40	60 m			CLIENT	ACOUSTIC CONSULTANT	 <b>RENZO TONIN &amp; ASSOCIATES</b> <i>inspired to achieve</i>	SYDNEY METRO - CHATSWOOD TO SYDENHAM SURRY HILLS BULK POWER SUPPLY MWD for cosmetic damage and human annoyance Work area: A1
r3	MS	16/11/20	Update figure	TG	1:1000	FULL SIZE A3 NOTE: Do not scale from this drawing.									
r2	MS	17/07/20	Update figure	TG											
r1	MS	24/04/20	Update figure	TG											
r0	MS	24/03/20	Prepare figures	TG											
REV	BY	DATE	DESCRIPTION	APPROVER											
A3 Original			Co-ordinate System: MGA Zone 56			Sheet 1 of 10									



120 m  
100  
80  
60  
40  
20  
0



**LEGEND**

**Noise sensitive receivers**

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

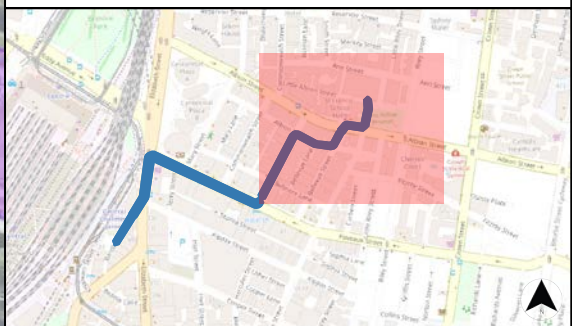
NCA

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (5T)

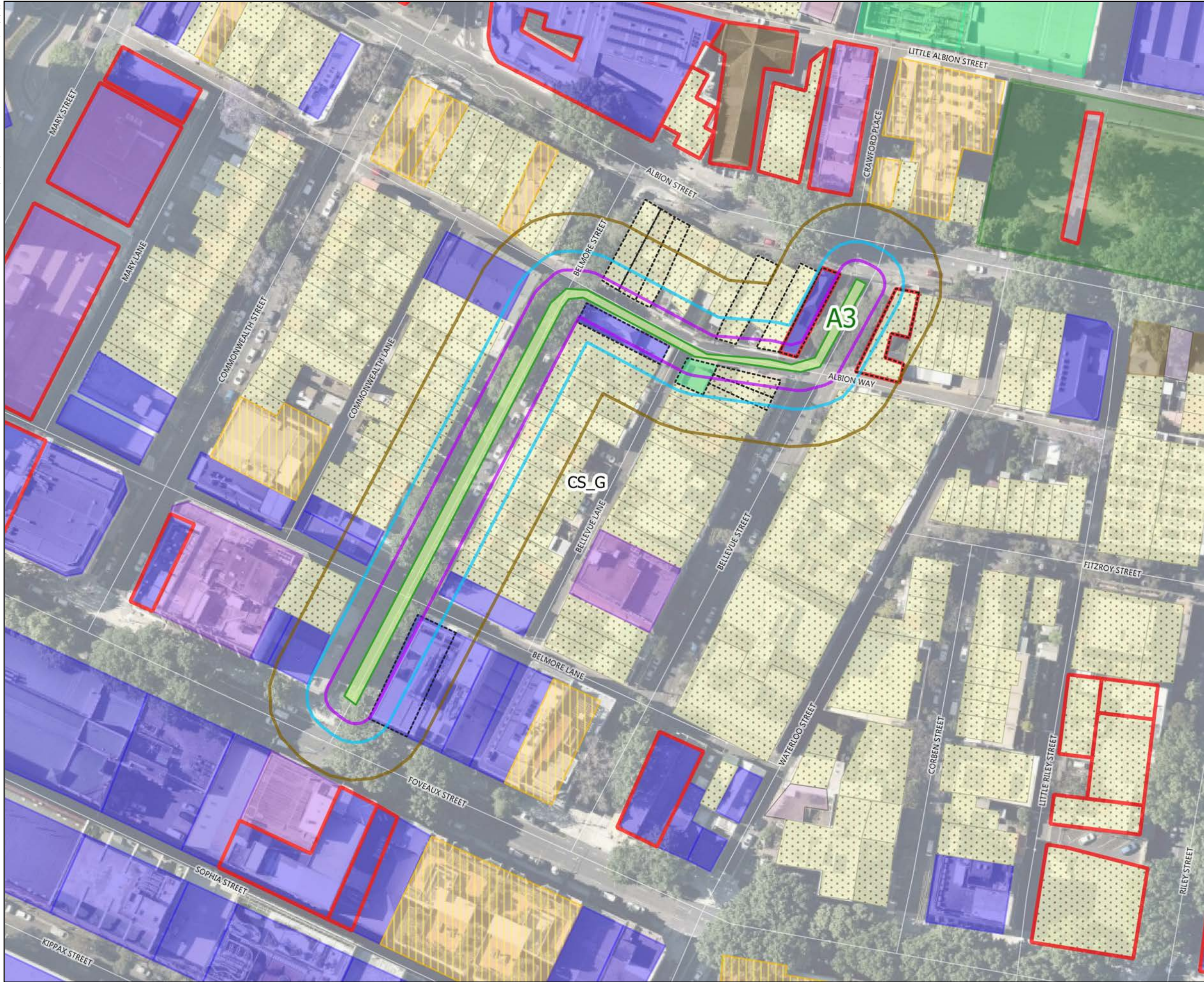
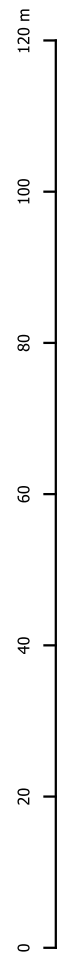
- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

Work area







**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

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (5T)

Unreinforced structures (7.5mm/s ppv)

Heritage structures (2.5mm/s ppv)

Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

Work area



..	..	..	..	..
r3	MS	16/11/20	Update figure	TG
r2	MS	17/07/20	Update figure	TG
r1	MS	24/04/20	Update figure	TG
r0	MS	24/03/20	Prepare figures	TG
REV	BY	DATE	DESCRIPTION	APPROVER
A3	Original		Co-ordinate System: MGA Zone 56	

0204060 m

1:1000

▲

CLIENT

Systems Connect

ACOUSTIC CONSULTANT

RENZO TONIN & ASSOCIATES

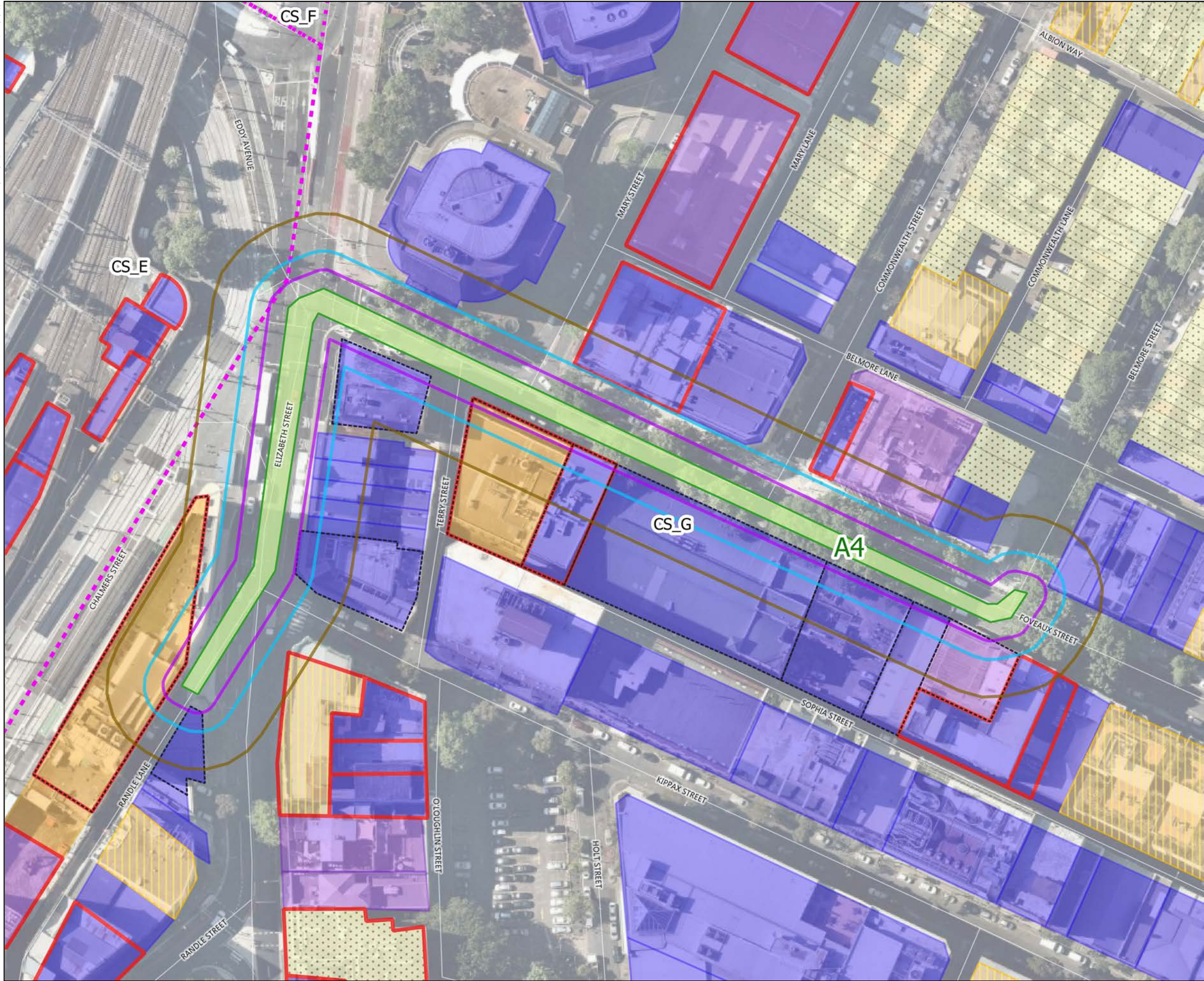
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Ph (02) 8218 0500 Fax (02) 8218 0501

FULL SIZE A3

NOTE: Do not scale from this drawing.





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

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (5T)

Unreinforced structures (7.5mm/s ppv)

Heritage structures (2.5mm/s ppv)

Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

Work area

SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY

MWD for cosmetic damage and human annoyance

Work area: A4

Sheet 4 of 10

..	..	..	..	..	..
r3	MS	16/11/20	Update figure	TG	
r2	MS	17/07/20	Update figure	TG	
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r0	MS	24/03/20	Prepare figures	TG	
REV	BY	DATE	DESCRIPTION	APPROVER	
A3	Original		Co-ordinate System: MGA Zone 56		

0204060 m

1:1000

FULL SIZE A3

NOTE: Do not scale from this drawing.

CLIENT

Systems Connect

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inspired to achieve

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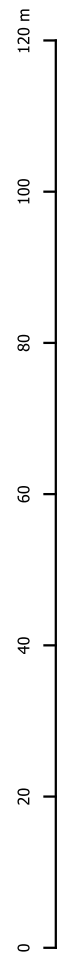
SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY

MWD for cosmetic damage and human annoyance

Work area: A4





### LEGEND

#### Noise sensitive receivers

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

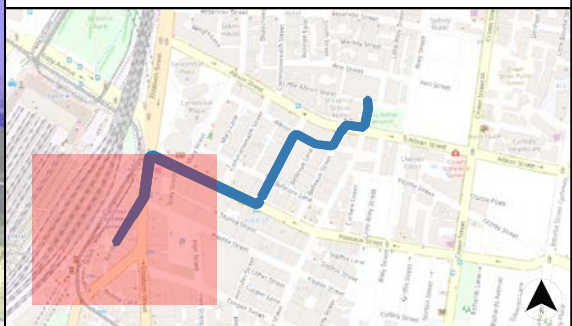
NCA

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (5T)

- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

Work area

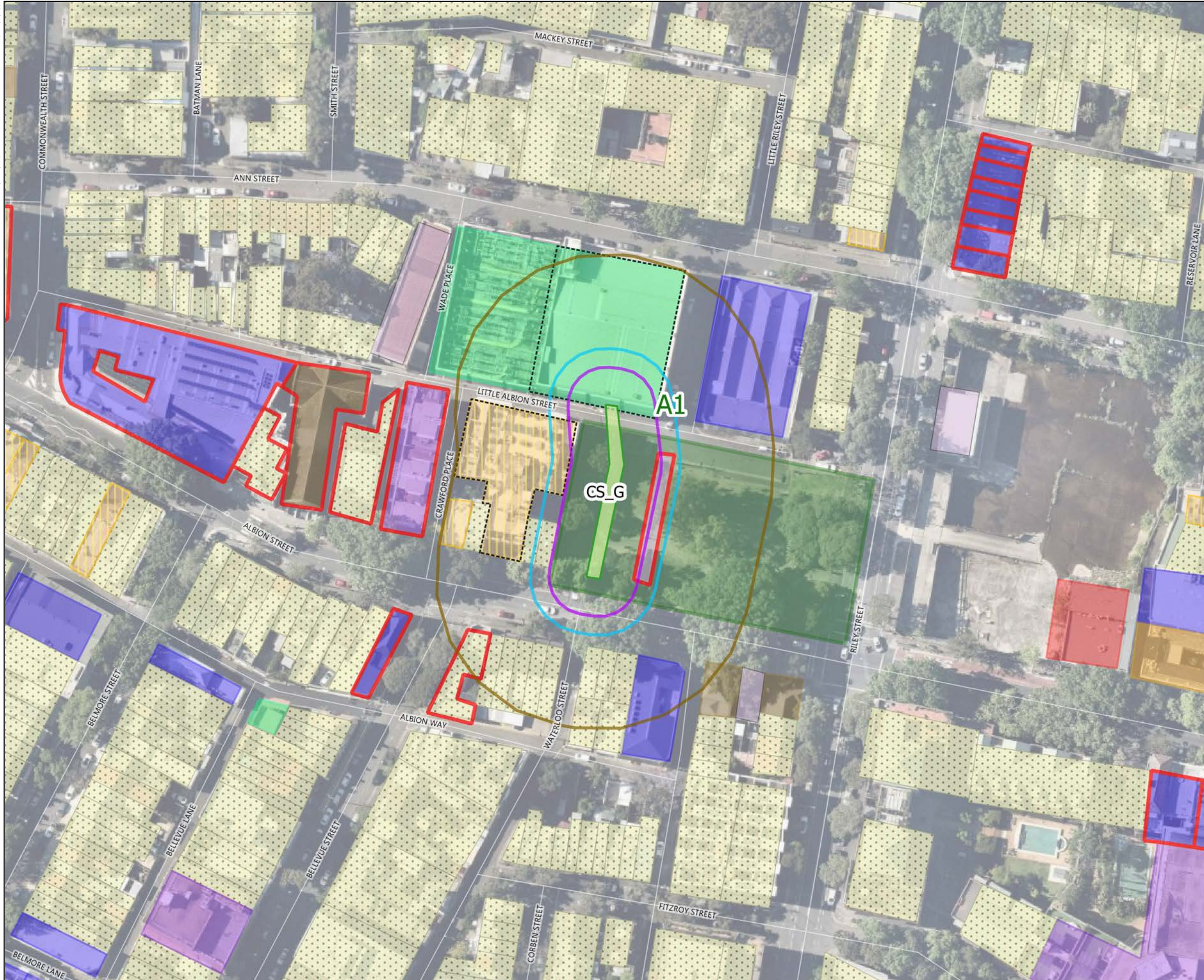




**G.2 Minimum Working Distances for cosmetic damage and human annoyance -  
Excavator with rock hammer (12T)**



120 m  
100  
80  
60  
40  
20  
0



**LEGEND**

**Noise sensitive receivers**

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

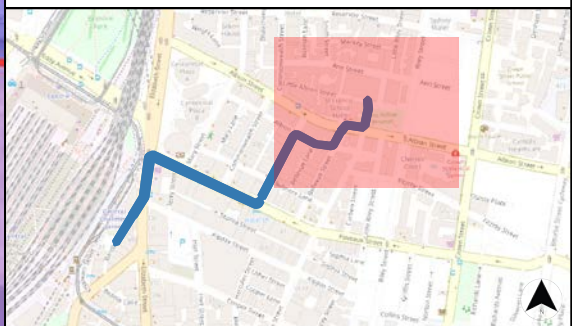
NCA

MWD for cosmetic damage and human annoyance for Excavator with rock hammer (12T)

- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)

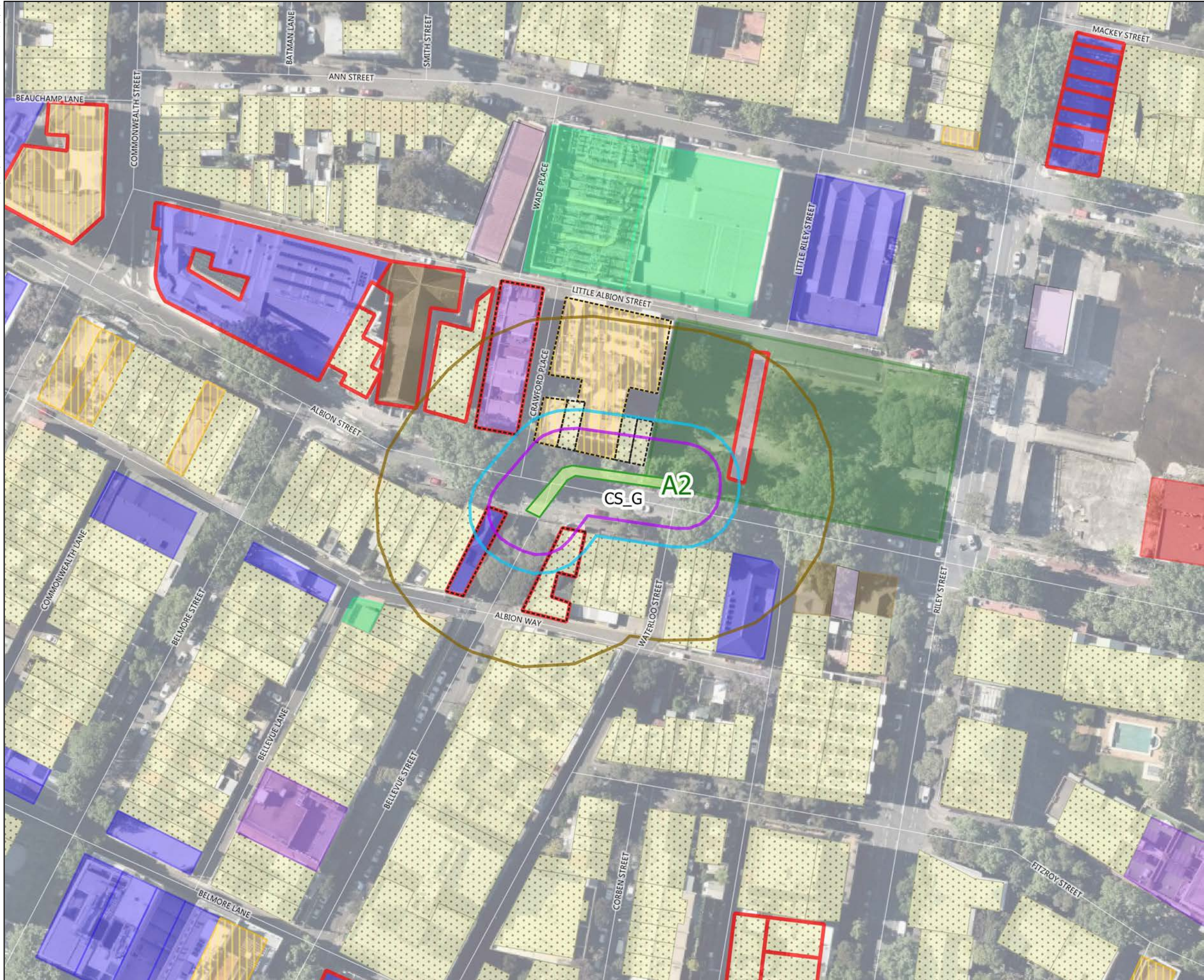
Receivers affected by MWD for cosmetic damage

Work area





120 m  
100  
80  
60  
40  
20  
0



## LEGEND

### Noise sensitive receivers

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

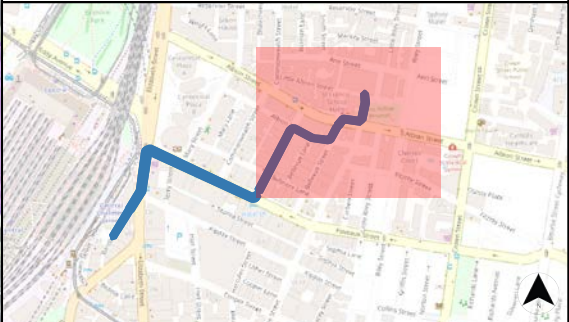
NCA

### MWD for cosmetic damage and human annoyance for Excavator with rock hammer (12T)

- |                                       |
|---------------------------------------|
| Unreinforced structures (7.5mm/s ppv) |
| Heritage structures (2.5mm/s ppv)     |
| Human annoyance - Residential (night) |

Receivers affected by MWD for cosmetic damage

Work area



REV	BY	DATE	DESCRIPTION	APPROVER
r3	MS	16/11/20	Update figure	TG
r2	MS	17/07/20	Update figure	TG
r1	MS	24/04/20	Update figure	TG
r0	MS	24/03/20	Prepare figures	TG
A3	Original		Co-ordinate System: MGA Zone 56	

0 20 40 60 m

1:1000

FULL SIZE A3

NOTE: Do not scale from this drawing.

CLIENT



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**RENZO TONIN & ASSOCIATES**  
*inspired to achieve*

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SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY  
MWD for cosmetic damage and human annoyance  
Work area: A2

Sheet 7 of 10



120 m  
100  
80  
60  
40  
20  
0



LEGEND

Noise sensitive receivers

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

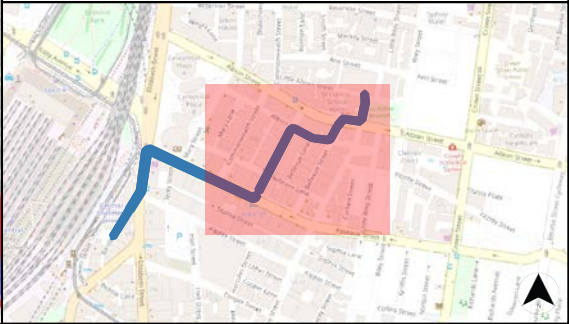
NCA

MWD for cosmetic damage and human annoyance  
for Excavator with rock hammer (12T)

- Unreinforced structures (7.5mm/s ppv)  
Heritage structures (2.5mm/s ppv)  
Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

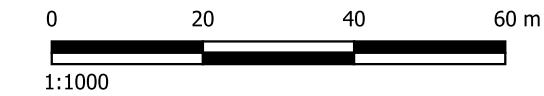
Work area



REV	BY	DATE	DESCRIPTION	APPROVER
r3	MS	16/11/20	Update figure	TG
r2	MS	17/07/20	Update figure	TG
r1	MS	24/04/20	Update figure	TG
r0	MS	24/03/20	Prepare figures	TG

A3 Original

Co-ordinate System: MGA Zone 56



FULL SIZE A3  
NOTE: Do not scale from this drawing.

CLIENT



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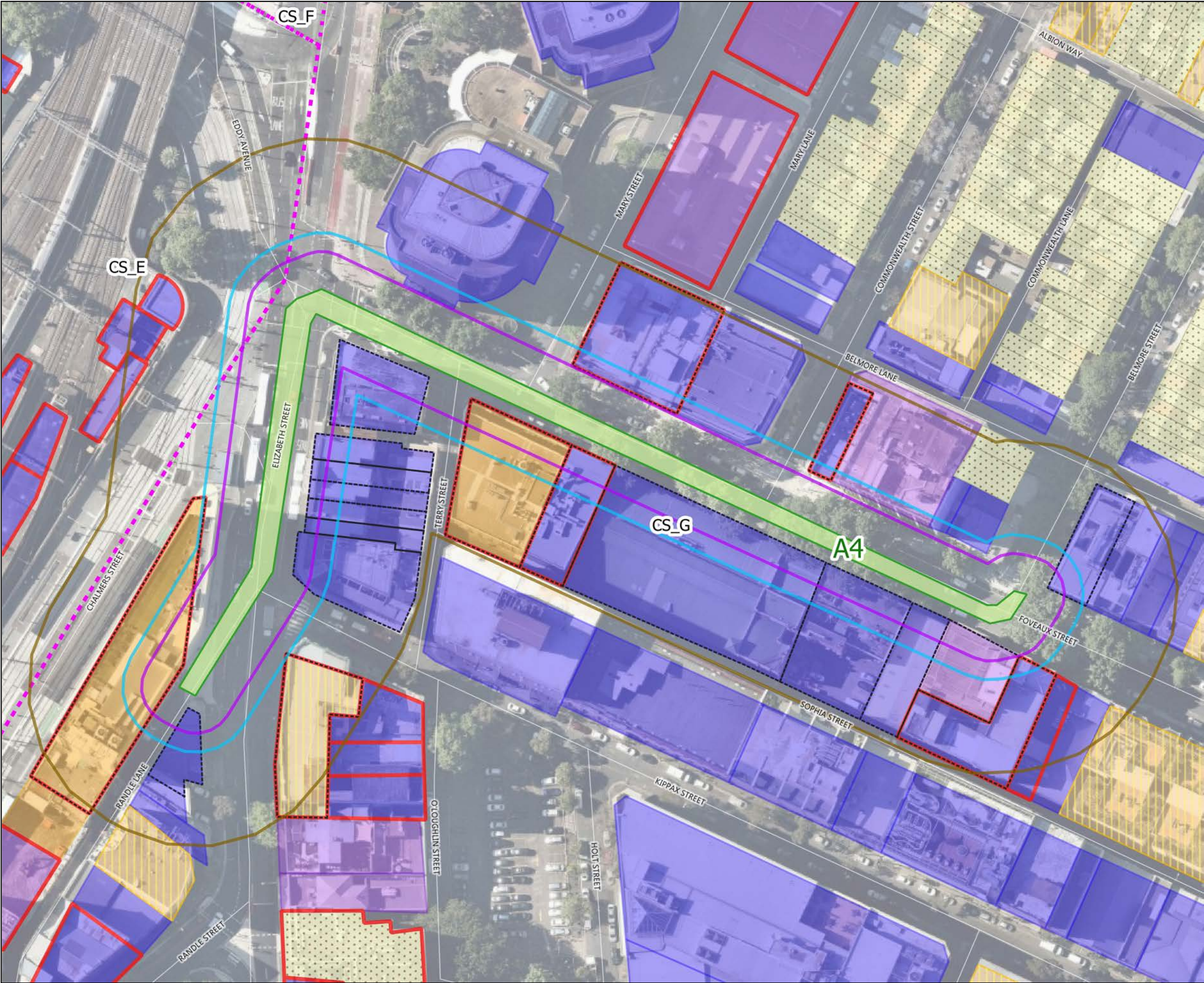
Ph (02) 8218 0500 Fax (02) 8218 0501

SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY  
MWD for cosmetic damage and human annoyance  
Work area: A3



120 m  
100  
80  
60  
40  
20  
0



## LEGEND

### Noise sensitive receivers

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

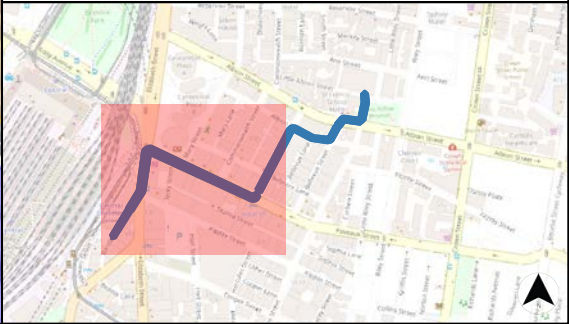
NCA

### MWD for cosmetic damage and human annoyance for Excavator with rock hammer (12T)

- |                                       |
|---------------------------------------|
| Unreinforced structures (7.5mm/s ppv) |
| Heritage structures (2.5mm/s ppv)     |
| Human annoyance - Residential (night) |

Receivers affected by MWD for cosmetic damage

Work area



REV	BY	DATE	DESCRIPTION	APPROVER
r3	MS	16/11/20	Update figure	TG
r2	MS	17/07/20	Update figure	TG
r1	MS	24/04/20	Update figure	TG
r0	MS	24/03/20	Prepare figures	TG
A3 Original			Co-ordinate System: MGA Zone 56	

0 20 40 60 m  
1:1000

FULL SIZE A3  
NOTE: Do not scale from this drawing.

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SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY  
MWD for cosmetic damage and human annoyance  
Work area: A4



120 m  
100  
80  
60  
40  
20  
0



## LEGEND

### Noise sensitive receivers

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

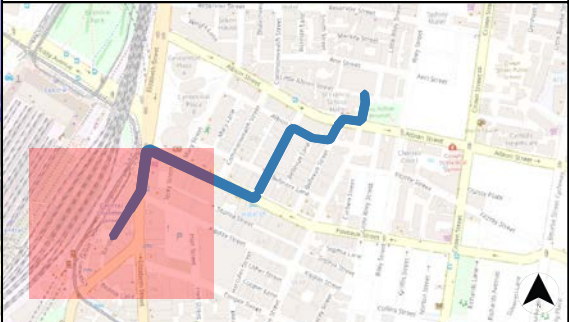
NCA

### MWD for cosmetic damage and human annoyance for Excavator with rock hammer (12T)

- Unreinforced structures (7.5mm/s ppv)
- Heritage structures (2.5mm/s ppv)
- Human annoyance - Residential (night)

Receivers affected by MWD for cosmetic damage

Work area



REV	BY	DATE	DESCRIPTION	APPROVER
r3	MS	16/11/20	Update figure	TG
r2	MS	17/07/20	Update figure	TG
r1	MS	24/04/20	Update figure	TG
r0	MS	24/03/20	Prepare figures	TG
A3 Original				

Co-ordinate System: MGA Zone 56

0 20 40 60 m  
1:1000

FULL SIZE A3  
NOTE: Do not scale from this drawing.

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SYDNEY METRO - CHATSWOOD TO SYDENHAM

SURRY HILLS BULK POWER SUPPLY  
MWD for cosmetic damage and human annoyance  
Work area: A5

Sheet 10 of 10



## ENDORSEMENT

### CITY & SOUTHWEST ACOUSTIC ADVISOR

Review of	<b>Construction Noise and Vibration Impact Statement for Line-Wide works (C2S) Portion 3 Surry Hills Bulk Power Supply Works</b>	Document reference:	<b>Construction Noise and Vibration Impact Statement Portion 3 – Surry Hills Bulk Power Supply Works. Prepared by Renzo Tonin and Associates for Systems Connect.</b>
Prepared by:	Larry Clark, Alternate Acoustics Advisor		
Date of issue:	23 November 2020		<i>TK685-03-05F01 CNVIS C2S_P3 BPS Surry Hills (r10) Dated 17 November 2020</i>

As approved Alternate Acoustics Advisor for the Sydney Metro City & Southwest project, I have reviewed the Construction Noise and Vibration Impact Statement (CNVIS) for Line-Wide works Portion 3 – Surry Hills Bulk Power Supply Works, as required under A27 (d) of the project approval conditions (SSI 15-7400).

The Surry Hills BPS construction activities will include:

- Minor Ancillary Facility – site office activities, carparking, storage, delivery;
- Site establishment – installation of environmental controls/ traffic controls;
- Waterloo to Surry Hills BPS Route;
  - Cable routes excavation, conduits installation, temporary surface reinstatement;
  - Cable Installation and Jointing.

I previously endorsed revision 6 of the CNVIS. Revision 6 has been updated to revision 10, which includes revised minor ancillary facility and route locations.

I am satisfied that revision 10 of the CNVIS is technically valid, and includes appropriate noise and vibration mitigation and management. On this basis I endorse this revision of the CNVIS.



Larry Clark, City & Southwest Alternate Acoustics Advisor