

**APPROVAL**  
**CITY & SOUTHWEST ACOUSTICS ADVISOR**

<b>Review of:</b>	Sydney Metro City and South West Line Wide Works - CNVIS Addendum Report - Waterloo cable laying OOHW	<b>Document reference:</b>	TK685-03-07F02 CNVIS_ADD C2S_P3 Waterloo (r4)
<b>Prepared</b>	Daniel Weston Acoustics Advisor		Prepared by Renzo Tonin & Associates Pty Ltd
<b>Date of</b>	1 September 2022		31 August 2022

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

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



Daniel Weston, City & Southwest Acoustics Advisor

31 August 2022

TK685-03-07F02 CNVIS\_ADD C2S\_P3 Waterloo (r4)

Systems Connect

Level 1 116 Miller Street

North Sydney, NSW 2060

## Sydney Metro City and Southwest Line Wide Works - CNVIS Addendum Report - Waterloo cable laying OOHW

### 1 Introduction

#### 1.1 Overview of works

This technical memorandum is an addendum to the report *Construction Noise and Vibration Impact Statement: Portion 3 - Waterloo Station early access works (Waterloo CNVIS<sup>1</sup>)* and has been prepared on behalf of Systems Connect in accordance with the Construction Noise and Vibration Management Plan (CNVMP) [SMCSWLWC-SYC-1NL-PM-PLN-000032] for the Design and Construction of the Line-Wide Works (LWW) of the Sydney Metro City & Southwest Project (the Project).

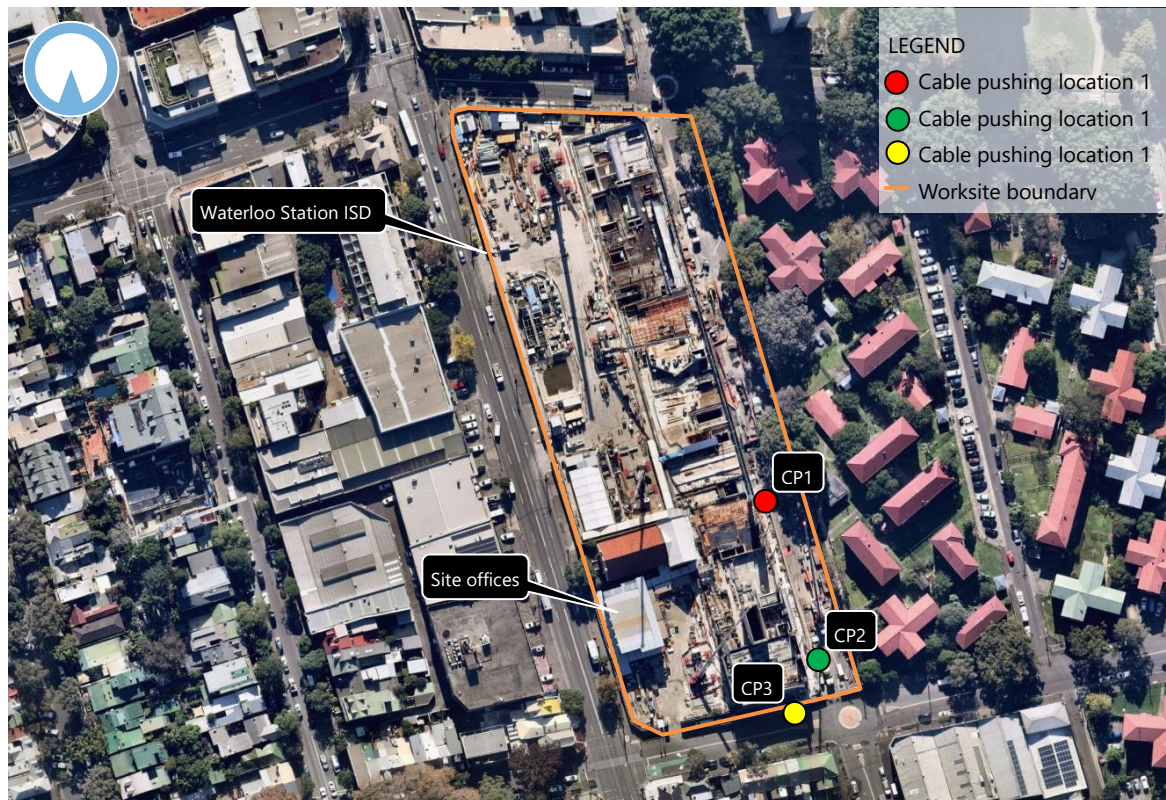
Sydney Metro have requested Systems Connect undertake out-of-hours high voltage (HV) cable laying works at the Waterloo Station worksite. The works are inside the work area assessed in the Waterloo CNVIS, and within the Waterloo Station Integrated Station Development (ISD) worksite managed by John Holland Group. The HV cable drum setup (Jinkers and cable pusher) is the only equipment located on the surface (2-3 personnel operating the drums on surface) required for this activity. The main works for cable pulling will be located below surface level (underground) within the station box and that will include the use of EWP and hand tools. The key area nominated for the works are shown in Figure 1.

The works are anticipated to commence 10 August 2022 and conclude on 15 September 2022 and will occur 24 hours per day over this timeframe, working every night except Sunday night. The works will be completed concurrently with the Waterloo ISD approved out of hours works to be completed by John Holland Group, as outlined in their Out of Hours Application Form OOHWA #43, dated 25/07/2022 (Rev B).

---

<sup>1</sup> *Sydney Metro City & Southwest – Line Wide Works, Construction Noise and Vibration Impact Statement: Portion 3 - Waterloo Station early access works, reference: TK685-03-07F01 CNVIS C2S\_P3 Waterloo, revision 4, dated 18 June 2020*

Figure 1: Waterloo Cable Laying OOHW



This memorandum has been prepared to address the potential construction noise impacts from the HV Cable laying works at Waterloo. Note that no vibration intensive works will be carried out as part of these works. Vibration is not further addressed in this Addendum report.

## 1.2 Justification for OOH construction works

As part of acceleration works requested by Sydney Metro to achieve the Waterloo Station HV energisation date, out of hours (OOH) works are required to achieve double shifts. Works are planned to keep disturbances to the community at a minimum through the set-up of the works, with only the use of plant on the surface being isolated to three key areas on the surface.

The construction hours for the Project are defined by Project Planning Approval (PPA) Conditions E36, E37, E38, E41, E42, E44 and E48. CSSI-7400 Condition E44 and E48 allow standard construction hours to be varied under specific conditions (where justified). Condition E48 allows the following activities to be carried out 24 hours per day, 7 days per week at Waterloo Station for Station and tunnel fit out works. The Waterloo Station HV energisation is part of the tunnel and station fit out works.

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

## 2 Construction noise assessment

### 2.1 Construction activities

Key details regarding the location and layout of the noise generating plant that will operate during these works were informed by the Construction and Environmental Teams. Table 2.1 presents the list of plant proposed to be used for these works and their assumed sound power levels.

**Table 2.1: Construction activities and equipment sound power levels using in noise modelling**

Activity	Plant/ Equipment	No. items	Duration (weeks)	Sound Power Level (Lw re: 1pW), dB(A)		High noise plant?	Vibration intensive plant?
				L <sub>Aeq</sub>	L <sub>Amax</sub>		
Cable laying	14T Drum Stand	1	2 weeks	-	-	No	No
	Diesel/hydraulic power unit	1		97 <sup>1</sup>	98	No	No

Note: 1. Sound power level measured during verification monitoring at the Waterloo worksite on 17.08.2022

The proposed works may be carried out concurrently with construction activities conducted by John Holland Group and assessed in the Waterloo ISD Out of Hours Work Application No 43 dated 25/07/2022 (Rev B).

It is proposed to install the surface cable laying equipment within a partial acoustic enclosure.

### 2.2 Predicted construction noise levels

Predicted construction noise levels at the closest noise sensitive receivers are summarised in Table 2.2 and compared to the PPA Conditions E41/E42 noise goals. Detailed noise predictions are also compared to ICNG NMLs and presented in APPENDIX B.

The predicted noise levels presented are with and without a 1.8 metre high, three-sided temporary noise screen surrounding the plant. The number in brackets represents the predicted noise level with the temporary noise screen. Predicted noise levels based on the plant operating at locations CP1 and CP2 comply with the PPA Condition E41/E42 noise goal both with and without the temporary noise barrier. At location CP3 the plant is located closer to the receivers and is less shielded by site boundary fencing and buildings. Predicted noise levels are below the E41/E42 noise goal only with the temporary noise barrier in place.

The predicted noise levels from the HV Cable laying works summarised in Table 2.2 can be compared with the predicted noise levels from the John Holland Group out-of-hours work associated with the Waterloo ISD. The HV cabling works are typically more than 10 dB below the predicted noise levels for the John Holland Group out-of-hours works and will not add to the noise levels from John Holland Group works.

**Table 2.2: Predicted noise levels at the closest noise sensitive receivers (PPA Conditions E41/E42)**

NCA	Address	Type of receiver	Predicted levels $L_{Aeq,15min}$ , dB(A)				NML 8pm – 7am <sup>1</sup>	
			CP1	CP2	CP3	JHG <sup>2</sup>	$L_{Aeq,15min}$ , dB(A)	
WS_01	125-131 Raglan Street Waterloo	Residential	41 (37)	40 (35)	<35	<b>61</b>	55	
WS_02	215 Cope Street Waterloo	Residential	<b>56</b> (50)	48 (43)	<35	-	55	
WS_02	219 Cope Street, Waterloo	Residential	<b>57</b> (51)	53 (48)	42 (42)	<b>76</b>	55	
WS_02	123 Wellington Street, Waterloo	Residential	54 (49)	<b>59</b> (51)	55 (53)	<b>69/75</b>	55	
WS_03	122 Wellington Street, Waterloo	Residential	49 (43)	53 (52)	<b>63 (57)</b>	-	55	
WS_03	124 Wellington Street, Waterloo	Residential	44 (40)	54 (53)	<b>64 (57)</b>	-	55	
WS_04	62-82 Botany Road, Waterloo	Residential	42 (42)	39 (38)	<35	<b>59</b>	55	

Notes: 1. External equivalent NML, Condition E41/E42

2. Predicted noise levels from John Holland Group Waterloo ISD Out of Hours Work Application OOHWA #43 (25/07/2022 Rev B) Appendix 3 Table 1 and 2. "-" denotes no predicted noise level was available in the OOHWA.

Bold text indicates exceedance of the PPA Conditions E41/E42 noise goal

The ICNG NML for NCA WS\_02 and WS\_03 is  $L_{Aeq(15min)}$  44 dB(A). Predicted noise levels are typically below or within 10 dB of the ICNG NML with the temporary noise barrier in place, except when the plant is located at CP3. It is recommended that Location CP3 be avoided if practicable.

In accordance with Planning Project Approval (PPA) Condition E32 and APPENDIX A2 of the *Sydney Metro City and Southwest Construction noise and Vibration Strategy (SMCSNVS)*<sup>2</sup>, additional mitigation measures must be considered. Recommended mitigation measures are presented in Section 2.3.

## 2.3 Noise mitigation and management

### 2.3.1 Site noise control measures

In addition to the noise mitigation measures identified in the CNVIS (see Section 5.4.2), the following Table 2.3 presents additional noise control measures recommended to reduce and manage potential noise impacts.

**Table 2.3: Site noise control measures**

Control type	Control measure	Typical use
Path mitigation measures	Temporary or Mobile noise screens	Where practicable, a temporary noise screen (or acoustic tent) would be used to reduce noise from the power unit. Temporary screens utilise temporary construction fencing, with acoustic blanket/ quilt (e.g. Echo-barrier, FlexShield or similar) attached to one side. The temporary noise barrier should be installed around a minimum of three sides of the plant. Where the barrier does not inhibit the use of the plant, the barrier should also be installed along the fourth side (or part thereof) to provide additional noise reduction. Predicted noise level found the temporary noise screens can provide 5 to 10 dB noise reduction.

<sup>2</sup> Transport for NSW Sydney Metro City & Southwest Construction Noise Strategy (ref: 610.14213-R3) 08 August 2016

Control type	Control measure	Typical use
Noise management measures	Respite coordination	All out-of-hours works will be coordinated with John Holland Group (and proponents of other construction works in the vicinity of the worksite) to minimise cumulative noise impacts and maximise respite for affected sensitive receivers (i.e. aligning respite evenings).
	Limit clangs and bangs at night	Identify potential of loose items or plant/equipment that could generate metal-on-metal bangs and manage accordingly.
	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>OOHW Procedure and Form</li> </ul> construction employee parking areas.
	Community consultation	Inform community of construction activity and potential impacts.
	Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.
	Noise monitoring	Noise monitoring is to be carried out as detailed in Section 2.3.4.

### 2.3.2 Consultation with affected receivers (PPA Condition E33)

As outlined in Section 5.3.1 of the *Waterloo CNVIS*, consistent with requirements in PPA Conditions E33, Systems Connect will consult with potentially affected stakeholders including business and residential receivers regarding specific mitigation measures applicable to the construction works.

### 2.3.3 Additional mitigation measures

Figure 2-1 will be used to advise the appropriate additional mitigation during construction.

Figure 2-1: 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 C presents a summary of the additional noise mitigation measures applicable for construction activities where, after application of all reasonable and feasible mitigation options, construction noise levels are still above the relevant NMLs.

### 2.3.4 Noise monitoring

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

Attended noise monitoring will be undertaken in the NCAs most impacted by the works. The nominated monitoring locations are identified in Table 2.4, and have been selected as they present the best opportunity to validate the predicted noise levels, depending on the location of the plant.

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

**Table 2.4: Nominated verification monitoring locations**

NCA	Nominated receiver address	Monitoring location at 1 m from
WS_02	219 Cope Street, Waterloo 123 Wellington Street, Waterloo	Western facade
WS_03	122 Wellington Street, Waterloo 124 Wellington Street, Waterloo	Northern facade

Note: Monitoring on private property is subject to owner consent and where relevant, occupier consent. If property access is denied, monitoring will still be carried out outside property boundaries.

## 2.4 Construction vibration impact

No vibration intensive plants have been proposed. As a result, the construction vibration impact has been assessed as negligible.

## 3 Conclusion

This technical memorandum is an addendum to the report *Waterloo CNVIS* to review the potential noise impacts for the proposed out-of-hours high voltage (HV) cable laying works at the Waterloo Station worksite. The works are anticipated to be completed concurrently with out of hours works to be completed by John Holland Group, as outlined in their Out of Hours Application Form OOHWA #43.

The noise levels from the proposed works are predicted to be below the PPA Conditions E41/E42 noise goals at the nearest noise sensitive. Predicted noise levels are typically below or within 10 dB of the ICNG NML with the temporary noise barrier in place, except when the plant is located at CP3. It is recommended

that Location CP3 be avoided if practicable. Furthermore, predicted noise levels will not add to the noise generated by John Holland Group out-of-hours work associated with the Waterloo ISD.



## Document control

Date	Revision history	Non-issued revision	Issued revision	Prepared	Instructed	Reviewed / Authorised
02.08.2022	Initial issue	-	0	T. Gowen	-	M. Tabacchi
3.08.2022	Respond to SCLWW comments	-	1,2	T. Gowen	-	M. Tabacchi
22.08.2022	Updated following verification monitoring	-	3	R. Zhafranata	T. Gowen	T. Gowen
30.08.2022	Respond to AA comments	-	4	T. Gowen	-	M. Tabacchi

File Path: R:\AssocSydProjects\TK651-TK700\TK685 PK SMCSW Linewide Works (CPB UGL)\1 Docs\100 CONSTRUCTION\3-07 CNVIS C2S\_P3 Waterloo Early Access\TK685-03-07F02 CNVIS\_ADD C2S\_P3 Waterloo (r4).docx

### Important Disclaimers:

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

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, 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.

External cladding disclaimer: No claims are made and no liability is accepted in respect of any external wall and/or roof systems (eg facade / cladding materials, insulation etc) that are: (a) not compliant with or do not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes; or (b) installed, applied, specified or utilised in such a manner that is not compliant with or does not conform to any relevant non-acoustic legislation, regulation, standard, instructions or Building Codes.

## 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 Detailed predicted construction noise levels

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

## APPENDIX C      Additional noise mitigation

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