Waterloo Metro Quarter Over Station Development – Basement

Construction Noise and Vibration Management Plan

WMQ-BMNT-STA-PM-MPL-0018

Revision

Revision	Date	Comment	Prepared By	Approved By
A	23/01/2023	Issue	James Ashpole/Ali Ahmadi	Elle Hewett
B	31/01/2023	Re-issue responding to comments	James Ashpole/Ali Ahmadi	Elle Hewett
C	22/02/2023	Re-issue responding to DPE's comments	James Ashpole/Ali Ahmadi	Elle Hewett
D	01/03/2023	Re-Issue responding to WLD final comments	James Ashpole/Ali Ahmadi	Elle Hewett
E	14/03/2023	Further issue responding to additional DPE's comments	James Ashpole/Ali Ahmadi	Elle Hewett
F	15/03/2023	Further issue responding to additional DPE's comments	James Ashpole/Ali Ahmadi	Elle Hewett

Stantec is a proud member of the Association of Australian Acoustical Consultants (AAAC).

AAAC members are competent and capable in the acoustic field. Members of the AAAC provide professional unbiased advice and recommendations in order to deliver practical innovative and cost-effective solutions to their clients.

AAAC members are bound to a specific code of professional conduct which can be consulted on the AAAC website: http://www.aaac.org.au/au/aaac/ethics.aspx

Contents

Contents

Executive summary

This Construction Noise and Vibration Management Sub-Plan (CNVMP) has been prepared by Stantec (Australia) Pty Ltd for the Basement Car Park over station development (OSD) at the Waterloo Metro Quarter site.

Documents reviewed:

- Waterloo Metro Quarter Over Station Development – Environmental Impact Statement Appendix K – Noise and Vibration Impact Assessment, SSD-10438 Basement Car Park, prepared by Stantec dated 30th September 2020
- Foreseeable Equipment List for Basement Works – provided by John Holland
- Proposed Construction Activities for Basements – provided by John Holland
- CNVMP Program – provided by John Holland
- 20221111 Basement CMP Presentation R01 – provided by John Holland
- 20221212 Loading Zones and Lay Down Areas R0 – provided by John Holland
- Basement Works Staging R02 – provided by John Holland
- Waterloo Metro Quarter, Community Communication Strategy: Station Construction and Over Station Development – SMCSWSWL-JHG-SWL-CL-PLN-000001, prepared by John Holland, dated December 2022.

Standards/Guidelines/ policies:

- Interim Construction Noise Guideline (ICNG), NSW DECC, 2009
- Construction Noise Strategy, Transport for NSW, 2019
- Noise Policy for Industry (NPI) NSW EPA, 2017
- Assessing vibration: A Technical Guideline, NSW DEC, 2006
- AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance sites*
- British Standard BS 5228: Part 1:1997 *Noise and Vibration Control on Construction and Open Sites*
- British Standard BS 7358:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration*
- German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures*

The following construction noise and vibration assessments were conducted as part of this construction noise and vibration impact assessment:

- Noise generated during the construction of the proposed development and associated impacts on the surrounding noise sensitive receivers; and
- Vibration generated during the construction of the proposed development and associated impacts on the surrounding vibration sensitive receivers.

Construction noise impact assessment for the following stages has been carried out (See Section 1 for detailed description):

- Stage 1 – Archaeological Investigation and Remediation
- Stage 2 – Perimeter Piling
- Stage 3 - Shotcrete and Shoring
- Stage 4 – Excavation

- Stage 5 – Foundation Piling
- Stage 6 – Structure, Form, Reinforce and Pour Concrete (FRP) Works including cast-in services and incoming infrastructure

Based on the construction noise assessment, the proposed construction works have the potential to give rise to adverse noise impacts at identified receivers. Therefore, all reasonable and feasible measures should be made on site to assist in reducing the overall noise emissions on site, as per the recommendations in Section 8. It is noted, however, the Average-case scenario is expected to represent the average noise expected from the entire site at a receiver and expected to be representative of the longer-term average noise emissions. Therefore, this situation represents typical average construction noise emissions which are predicted to be below the 'Highly Noise Affected' criterion at the nearest identified residential receivers in most instances. However, at the most affected residential receivers located along Cope Street occasional exceedances above of the established criteria are expected up to 11dBA and 19dBA for the average-case and worst-case scenarios respectively.

Some residential receivers located north and east of the site are identified to be within the Human Response zone for vibration during the operation of vibratory roller only. The Waterloo Congregational Church is identified as a receiver within the Cosmetic Damage zones in the vicinity of the proposed works during the use of 10T Roller – vibratory and Sheet Piling activities. At other receiver locations surrounding the site, the vibration levels are expected to comply with both the human comfort vibration and cosmetic vibration targets. General vibration recommendations and vibration monitoring strategies are provided in Section 8..

The table below outlines the Conditions under SSD-10438 condition C22 for the construction noise and vibration management sub-plan for the Basement Car Park works for the Waterloo Metro Quarter Development.

Condition under C22(b)	**Report Section**
(i) identification of the specific activities that will be carried out and associated noise sources at the premises;	Section 1 Section 5.4
(ii) identification of all potentially affected sensitive residential receiver locations;	Section 2.2
(iii) quantification of the rating background noise level (RBL) for sensitive receivers, as part of the Sub-Plan, or as undertaken in the EIS;	Section 3 Section 3.2 Section 3.3
(iv) the construction noise, ground-borne noise and vibration objectives derived from an application of the EPA Interim Construction Noise Guideline (ICNG), as reflected in conditions of approval;	Section 4
(v) prediction and assessment of potential noise, ground-borne noise (as relevant) and vibration levels from the proposed construction methods expected at sensitive receiver premises against the objectives identified in the ICNG and conditions of approval;	Section 5 – Noise Section 7 – Vibration
(vi) where objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise and vibration impacts;	Section 8
(vii) description of management methods and procedures, and specific noise mitigation treatments/measures that can be implemented to control noise and vibration during construction;	Section 8 Section 8.4 Appendix A
(viii) where objectives cannot be met, additional measures including, but not necessarily limited to, the following should be considered and implemented where practicable; reduce hours of construction, the provision of respite from noise/vibration intensive activities, acoustic	Section 8

Condition under C22(b)	Report Section
barriers/enclosures, alternative excavation methods or other negotiated outcomes with the affected community;	
(ix) where night-time noise management levels cannot be satisfied, a report shall be submitted to the Planning Secretary outlining the mitigation measures applied, the noise levels achieved and justification that the outcome is consistent with best practice;	Section 5.2
(x) measures to identify non-conformances with the requirements of the Sub-Plan, and procedures to implement corrective and preventative action;	Section 8.4 Appendix D
(xi) suitable contractual arrangements to ensure that all site personnel, including sub-contractors, are required to adhere to the noise management provisions in the Sub-Plan;	Section 8.7
(xii) procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;	Section 8.4
(xiii) measures to monitor noise performance and respond to complaints;	Section 8.6
(xiv) measures to reduce noise related impacts associated with offsite vehicle movements on nearby access and egress routes from the site;	Section 6 Section 8
(xv) procedures to allow for regular professional acoustic input to construction activities and planning; and	Section 8.8
(xvi) effective site induction, and ongoing training and awareness measures for personnel (e.g. toolbox talks, meetings etc).	Section 8.5

Part 1: Construction Noise and Vibration Assessment

1. Introduction

Stantec Australia has been engaged to prepare a Construction Noise and Vibration Management Sub-Plan (CNVMP) for the Basement Car Park as part of the over station development (OSD) at the Waterloo Metro Quarter site.

The works as described below are expected to occur across approximately 12 months of work. The works are to be carried out in the following stages as detailed by the construction program dated 24/11/2022 prepared and provided by John Holland:

- Stage 1 – Archaeological Investigation and Remediation
  - Concrete Hardstand removal for archaeological works
  - Concrete Hardstand removal for piling guide
  - Concrete Hardstand removal for basement floor
  - Concrete Hardstand removal for remediation area
- Stage 2 – Perimeter Piling
  - Shoring Continuous flight auger piles (CFA) Wall
  - Sheet piling to TC5 base
- Stage 3 - Shotcrete and Shoring
  - Anchors to shoring walls
- Stage 4 – Excavation
  - Bulk Excavation
- Stage 5 – Foundation Piling
  - Foundation Piles
- Stage 6 – Structure, Form, Reinforce and Pour Concrete (FRP) Works including cast in services and incoming infrastructure:
  - Slab on ground
  - Walls up to basement 1
  - Basement Leve 1 slab and columns
  - Walls up to ground level
  - Ground floor slab
  - Cast-in hydraulic services into P2, P1 and ground slab vertical elements
  - Cast-in temporary services as required, such as dewatering wells, hold down bolts etc.
  - Cast-in electrical services into P2, P1 and ground slabs and vertical elements.

Certain tasks are expected to be carried out concurrently with time periods that are significant in duration. The approach of this assessment is to define and assess stages of work with tasks and use of equipment expected to occur simultaneously based on the provided the construction program.

In addition to the above tasks, additional phases for any fitout works are unlikely to cause significant impact on the surrounding sensitive receivers. Breakout of noise from fitout works are expected to be adequately attenuated by the external envelope of the proposed building once wall has been installed. As such, these works have not been assessed as part of the Construction Noise and Vibration Management Plan.

This Construction Noise and Vibration Management Sub-Plan provides:

i. identification of the specific activities that will be carried out and associated noise sources at the premises;

ii. identification of all potentially affected sensitive residential receiver locations;

iii. quantification of the rating background noise level (RBL) for sensitive receivers, as part of the Sub-Plan, or as undertaken in Appendix K of the EIS;

iv. the construction noise, ground-borne noise and vibration objectives derived from an application of the EPA Interim Construction Noise Guideline (ICNG), as reflected in conditions of approval;

v. prediction and assessment of potential noise, ground-borne noise (as relevant) and vibration levels from the proposed construction methods expected at sensitive receiver premises against the objectives identified in the ICNG and conditions of approval;

vi. where objectives are predicted to be exceeded, an analysis of feasible and reasonable noise mitigation measures that can be implemented to reduce construction noise and vibration impacts;

vii. description of management methods and procedures, and specific noise mitigation treatments/measures that can be implemented to control noise and vibration during construction;

viii. where objectives cannot be met, additional measures including, but not necessarily limited to, the following should be considered and implemented where practicable; reduce hours of construction, the provision of respite from noise/vibration intensive activities, acoustic barriers/enclosures, alternative excavation methods or other negotiated outcomes with the affected community;

ix. where night-time noise management levels cannot be satisfied, a report shall be submitted to the Planning Secretary outlining the mitigation measures applied, the noise levels achieved and justification that the outcome is consistent with best practice;

x. measures to identify non-conformances with the requirements of the Sub-Plan, and procedures to implement corrective and preventative action;

xi. suitable contractual arrangements to ensure that all site personnel, including sub-contractors, are required to adhere to the noise management provisions in the Sub-Plan;

xii. procedures for notifying residents of construction activities that are likely to affect their noise and vibration amenity;

xiii. measures to monitor noise performance and respond to complaints;

xiv. measures to reduce noise related impacts associated with offsite vehicle movements on nearby access and egress routes from the site;

xv. procedures to allow for regular professional acoustic input to construction activities and planning; and

xvi. effective site induction, and ongoing training and awareness measures for personnel (e.g. toolbox talks, meetings etc).

This report has been prepared with the following references:

- Waterloo Metro Quarter Over Station Development – Environmental Impact Statement Appendix K – Noise and Vibration Impact Assessment, SSD-10438 Basement Car Park, prepared by Stantec dated 30th September 2020
- Foreseeable Equipment List for Basement Works – provided by John Holland
- Proposed Construction Activities for Basements – provided by John Holland
- CNVMP Program – provided by John Holland
- 20221111 Basement CMP Presentation R01 – provided by John Holland
- 20221212 Loading Zones and Lay Down Areas R0 – provided by John Holland
- Basement Works Staging R02 – provided by John Holland
- Waterloo Metro Quarter, Community Communication Strategy: Station Construction and Over Station Development – SMCSWSWL-JHG-SWL-CL-PLN-000001, prepared by John Holland, dated December 2022.

Standards/Guidelines/ policies:

- *Interim Construction Noise Guideline* (ICNG), NSW DECC, 2009;
- *Noise Policy for Industry (NPI)*, NSW EPA, 2017
- *Assessing Vibration: A Technical Guideline*, NSW DEC, 2006
- AS 2436:2010 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*
- British Standard BS 5228: Part 1:1997 *Noise and Vibration Control on Construction and Open Sites*
- British Standard BS 7358:1993 *Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Ground-borne Vibration*
- German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures*

The predicted noise levels are based on the proposed construction program and equipment lists provided in this report.

2. Project Description – Waterloo Metro Quarter (WMQ) Over Station Development

2.1 The site

The site is located within the City of Sydney Local Government Area (LGA). The site is situated about 3.3 kilometres south of Sydney CBD and eight kilometres northeast of Sydney International Airport within the suburb of Waterloo.

The Waterloo Metro Quarter site comprises land to the west of Cope Street, east of Botany Road, south of Raglan Street and north of Wellington Street (refer to Figure 1). The heritage-listed Waterloo Congregational Church at 103–105 Botany Road is within this street block but does not form a part of the Waterloo Metro Quarter site boundaries.

The Waterloo Metro Quarter site is a rectangular shaped allotment with an overall site area of approximately 1.287 hectares. The description of the site is defined by Lot 190 in DP 1257150. The boundaries of the overall site are identified at Figure 1, and the subject site as per the detailed SSDA is identified at Figures 2 and 3. The site is reasonably flat with a slight fall to the south.

The site previously included three to five-storey commercial, light industrial and shop top housing buildings. All previous structures except for an office building at the corner of Botany Road and Wellington Street have been demolished to facilitate construction of the new Sydney Metro Waterloo station. As such the existing site is predominately vacant and being used as a construction site.

Construction of the Sydney metro station box and tunnel is currently underway on site in accordance with critical State significant infrastructure approval (CSSI 7400).

Figure 1 - Aerial image of the overall WMQ OSD site: Source: Urbis

The area surrounding the site consists of commercial premises to the north, light industrial and mixed-use development to the south, residential development to the east and predominantly commercial and light industry uses to the west.

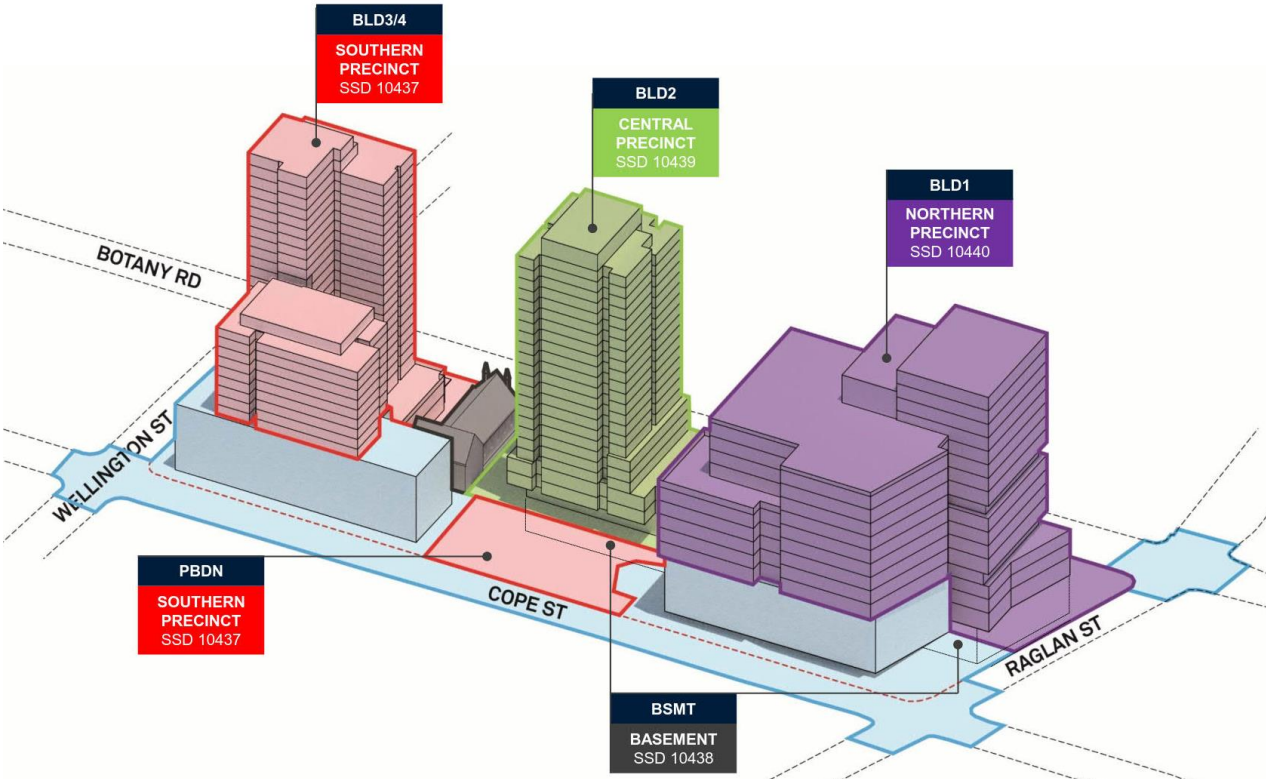


Figure 2- Waterloo Metro Quarter site, with sub-precincts identified

Source: HASSELL

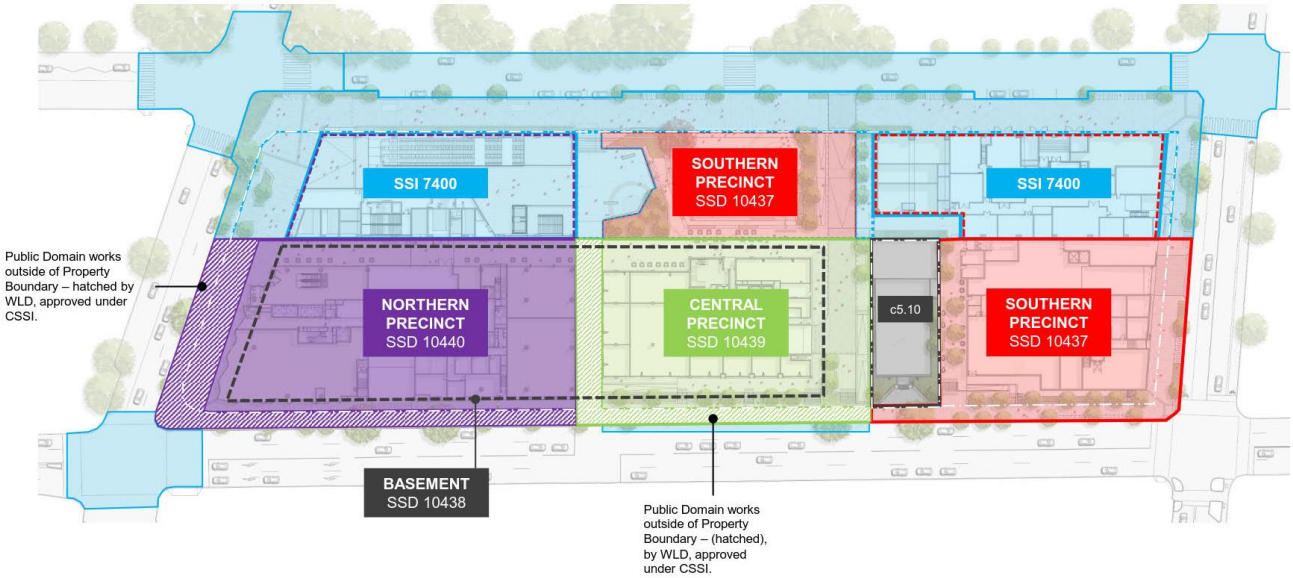


Figure 3- Waterloo Metro Quarter site, with sub-precincts identified

Source: Waterloo Developer Pty Ltd

2.2 Nearest potentially affected noise receivers

The subject project under study in this report includes the construction of the Basement Car Park as part of the Waterloo Metro Quarter Over Station Development located adjacent to the Waterloo Metro Station.

The site noise investigations are a key piece of information when understanding the existing ambient noise environment characteristic of the surrounding receivers to the proposed development. For the nominated criteria, where the measured results are required as the basis of establishing the criteria, historical site noise investigation results have been used because this more accurate data (pre-covid 19) reflects the ambient noise level for each noise catchment area. We have delineated the various environments into Noise Catchment Areas (NCAs) together with the Integrated Station Development and the other buildings assessed in separated SSDA's within the Waterloo Metro Quarter OSD precinct.

The nearest potentially affected noise receivers have been identified in Table 1 and shown in Figure 1.

Table 1: Summary of noise and vibration sensitive receivers

Noise Catchment Area (NCA)	Noise Catchment Area Receivers Description	Receiver ID	Most affected Address from the proposed construction noise works
NCA 01	Mix of commercial and retail receivers	C1	66 Botany Road
		C2	129 Ragland Street
NCA 02	Various Residential Receivers	R1	209 Cope Street
NCA 03	Various Residential Receivers	R2	219 Cope Street
Waterloo Congregational Church	Place of Worship	W1	103 Botany Road
Waterloo Metro Station Box*	Station	B1	Metro Station Box at either end adjacent Cope Street Plaza

*Only sensitive to vibration when vibration buffer distances associated with particular plant are not met

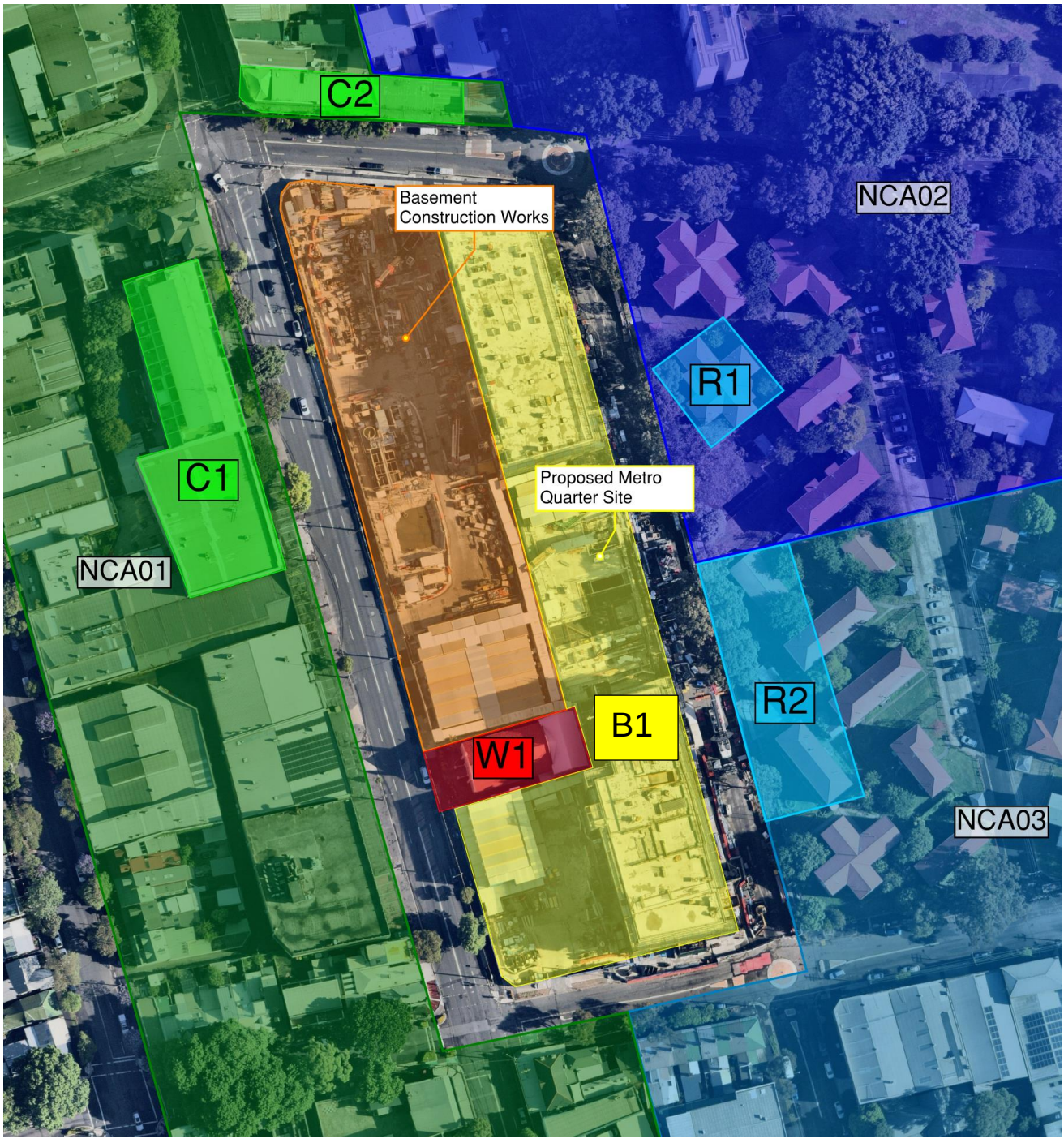


Figure 4: Site and surrounding Noise Catchment Areas for Noise Sensitive Receivers

2.3 Existing Noise & Vibration Environment

The local ambient noise and vibration environment is typically that of an urban/suburban environment, and is dominated by road traffic on Botany Road, which runs along the west of the site (urban). There are other surrounding roads (Wellington Road and Cope Street) which bound the site as well. Additionally, there is currently additional construction works in the vicinity, as well as operation of the nearby commercial and retail developments (i.e. café).

3. Site Noise Investigations

Previous noise monitoring was undertaken during the early works of the project. Site noise investigations were conducted to obtain background noise levels at the surrounding noise sensitive receivers together with characteristic noise emissions statistics associated with vehicle movements along Botany Road.

The results of the site noise investigations were acquired from a combination of noise monitoring conducted by Stantec Australia between the 7th and 13th April 2020, and previous noise monitoring conducted by SLR Consulting and presented in their report for the *Waterloo Station Development EIS*, Appendix N, dated 9 November 2019 accompanying the Concept SSD DA (SSD 9393), as these results were obtained prior to the COVID-19 pandemic and are a better representation of the traffic noise and typical background levels under typical conditions.

3.1.1 Historical Site Noise Investigations

Forming part of the Concept SSD DA (SSD 9393), both attended and unattended site investigations were conducted by SLR Consulting in November 2019, presented in their report for the *Waterloo Station Development EIS*, Appendix N, dated 9 November 2019. The results of these measurements are summarised below. As discussed above, the site investigations previously conducted by SLR Consulting are relevant as the monitoring were conducted prior to the COVID-19 pandemic.

3.1.2 Instrumentation

It is noted in the SLR Consulting Report that the following equipment was used for the noise surveys:

- Combination of Svantek 957 and Brüel and Kjaer 2250L noise loggers with serial numbers:
- S/N:20663
- S/N:3004636
- S/N:3003632
- S/N:3005908
- S/N:3005904
- S/N:3003389
- Brüel and Kjær 2270 Precision Sound Level Meter (S/N:3008204)

SLR consulting also notes:

> *'Calibration of the sound level meter was checked before and after each measurement and the variation in calibration at all locations was found to be within acceptable limits at all times'*

3.1.3 Locations

The locations of noise monitors installed by SLR Consulting referenced in the Waterloo Station Development EIS (Appendix N) dated 9 November 2019 are shown in Figure 5 and listed in Table 2 below:

Table 2 - SLR Consulting long-term noise measurement locations

Noise Monitoring Location ID	Noise Monitoring Location Address	Equipment Serial Number
L1	1 Phillip Street, Waterloo	20663
L2	3 Phillip Street, Waterloo	3004636
L3	200 Pitt Street, Waterloo	3003632
L4	113 Wellington Street, Waterloo	3005908
L5	130 Botany Road, Waterloo	3005904
L6	34 McEvoy Street, Waterloo	3003389

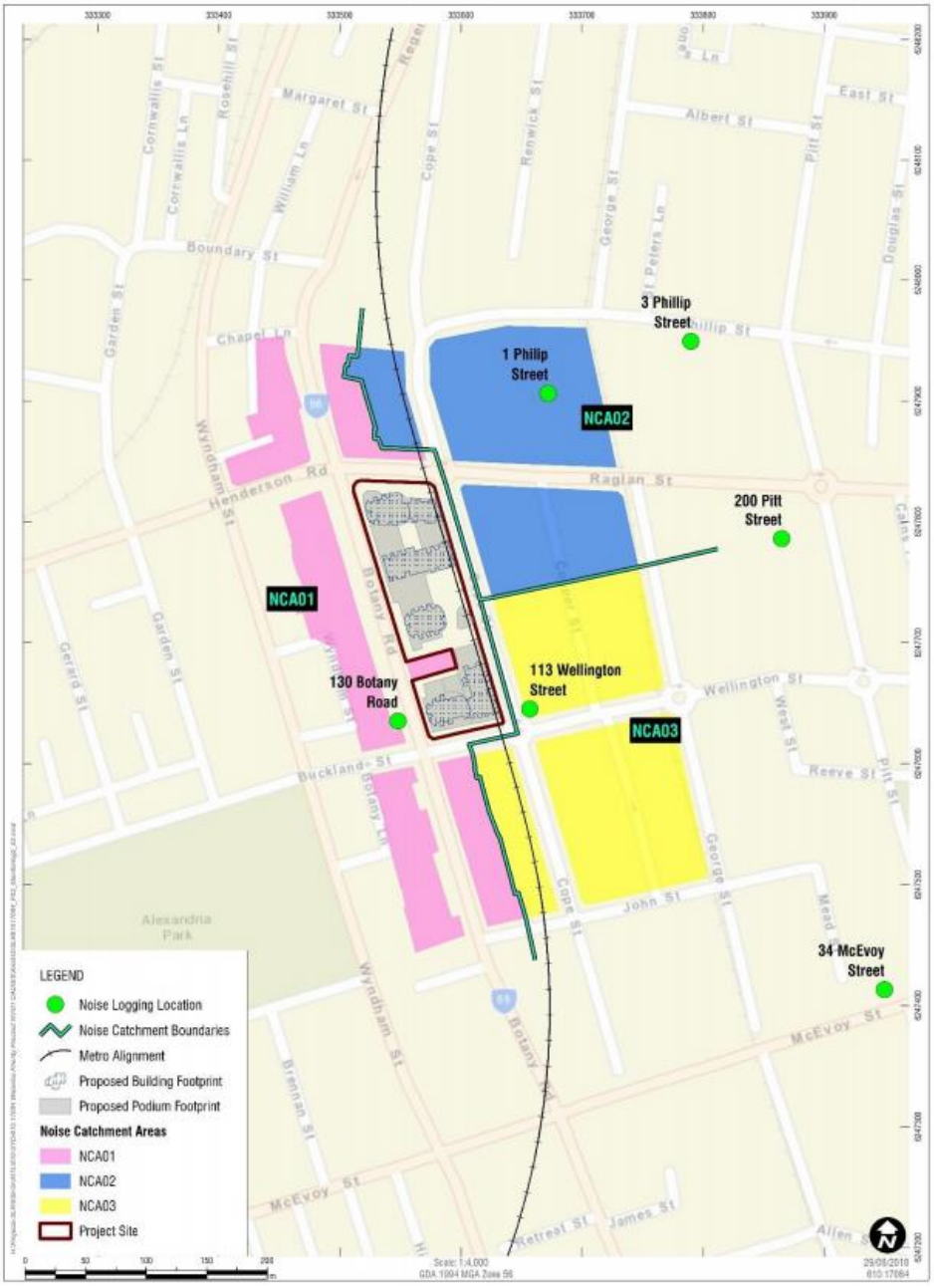


Figure 5 - Measurement locations conducted by SLR Consulting

3.1.4 Long-Term (Unattended) Noise Surveys

Outlined in SLR Consulting report, the results of the unattended ambient surveys are summarised in Table 3 as the Rating Background Level (RBL) noise levels for the Noise Policy for Industry (NPI) daytime, evening and night-time periods, and the L_{Aeq} (equivalent continuous level) noise levels for the DoP Interim Guideline daytime and night-time periods.

The 24-hour daily noise levels at each monitoring location are presented in the State Significant Development (SSD) Development Application (DA) prepared by Stantec, dated 30th September 2020.

Table 3 - Long-term noise measurement summary conducted by SLR Consulting

Noise Monitoring Location	Measured Noise Level (dB)							
	NPI Time Periods[1]						DoP Interim Guideline Time Periods[2]	
	Daytime – RBL	Evening - RBL	Night-time – RBL	Daytime - L_{Aeq}	Evening - L_{Aeq}	Night-time - L_{Aeq}	Daytime - $L_{Aeq(15hr)}$	Night-time - $L_{Aeq(9hr)}$
L1	50	46	40	57	53	50	56	51
L2	48	42	38	57	52	50	56	50
L3	47	43	37	61	58	59	60	59
L4[3]	50	46	41	65	57	54	64	54
L5	60	58	46	72	70	69	72	69
L6[4]	Failed	-	-	-	-	-	-	-

Note 1: Noise Policy for Industry (NPI) assessment periods – Daytime: 7:00 am to 6:00 pm Monday to Saturday, 8:00 am to 6:00 pm Sundays and Public Holidays; Evening: 6:00 pm to 10:00 pm; Night: 10:00 pm to 7:00 am Monday to Saturday, 10:00 pm to 8:00 am Sundays and Public Holidays.

Note 2: DoP Interim Guideline Assessment Time Periods – Day: 7.00 am to 10.00 pm; Night: 10.00 pm to 7.00 am (weekly data).

Note 3: Attended noise measurements at this location identified a bird feeder located on the wall of the residential building. This was not identified at the time the noise logger was deployed as it was raining. At the time of the attended measurements the bird feeder attracted a large number of Rosellas which were generating noise levels over 100 dBA. This significant noise source is the reason that the DoP noise levels for L4 are higher than other comparable noise environment areas of the Waterloo project area.

Note 4: The noise logger at location L6 was damaged during the logging survey and no data was recorded.

3.1.5 Short-Term (Attended) Noise Surveys

Short-term (attended) noise surveys have been conducted by SLR Consulting. The results of these surveys are outlined in Table 4.

Table 4 - Short-term noise measurement summary conducted by SLR Consulting

Measurement Location	Measured Noise Level (dB)[2]			Description of Ambient Noise Source during attended period
	L_{A90}	L_{Aeq}	L_{Amax}	
1 Phillip Street	48	58	75	Constant nature sounds with regular pedestrian movements. Intermittent traffic from Raglan Street and Phillip Street. Aircraft pass-bys are dominant sound source when present.
3 Phillip Street	52	61	85	Constant nature sounds with regular pedestrian movements. Intermittent traffic from Phillip Street. Dominant sound source is landscaping works in the area and aircraft pass-bys when present. It is expected that landscaping noise would not be present during night-time periods.
200 Pitt Street	55	62	81	Intermittent traffic noise from Raglan Street, particularly from vehicles travelling uphill. Landscaping works are dominant sound source during measurement. It is expected that landscaping noise would not be present during night-time periods.
34 McEvoy	58	66	80	Dominant sound source McEvoy Street traffic, with occasional pedestrian activity. Limited aircraft passbys during measurement.
113 Wellington Street	51	63	92	Constant parrot activity during measurement. Intermittent traffic noise from Wellington Road with some aircraft passby noise. Limited pedestrian activity.
130 Botany Road[1]	65	73	88	Traffic noise from Botany Road is dominant sound source, with limited aircraft passby.

Note 1: Monitoring location near to building facade. Measured noise levels considered to represent facade affected noise levels which are up to 2.5 dBA higher than the equivalent free-field condition

Note 2: Measured Noise Level is rounded to the nearest whole number

3.2 Site Noise Investigations

Site noise surveys have been conducted by Stantec to obtain current background noise levels. It should be noted that the site surveys were conducted during the COVID-19 pandemic. Please refer to Section 3.2.1 for further discussion surrounding consideration given to noise monitoring results affected by COVID-19.

Short-term and long-term noise surveys were carried out on and around the proposed development site to characterise the noise generated by nearby traffic noise sources (Botany Rd, Raglan St, and Wellington St), and background and ambient noise representative of the surrounding noise-sensitive receivers.

3.2.1 COVID-19 Pandemic and Effects on Noise Surveys

These noise surveys were carried out under noise-subdued circumstances as a result of the COVID-19 pandemic. For background and ambient noise, the noise statistics obtained will be lower than that of a typical day to day operation and hence can be considered the worst-case scenario.

For the traffic noise measurements, the noise statistics obtained will not be representative of typical traffic noise on Botany Road, Raglan Street, Wellington Street. As a result, the traffic noise measured on-site has been adjusted using comparisons between COVID-19 and standard peak hour traffic volumes on these roads.

3.2.2 Instrumentation

The following equipment was used for the noise surveys:

- ARL Environmental Noise Logger, NL-42EX, S/N 873125
- ARL Environmental Noise Logger, NL-42EX, S/N 521656
- ARL Environmental Noise Logger, NL-42EX, S/N 184109
- ARL Environmental Noise Logger, NL-42EX, S/N 184111
- ARL Environmental Noise Logger, NL-42EX, S/N 885460
- Hand-held sound spectrum analyzer B&K 2250, S/N 2709742
- Sound Calibrator B&K Type 4231, S/N 2709826

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

3.2.3 Monitoring Locations

The site location, measurement positions and surrounding noise and vibration sensitive receivers are shown in Figure 6.

Figure 6 - Overview of the site, surrounding noise-sensitive receivers and measurement locations conducted by Stantec Australia

3.2.4 Long-Term (Unattended) Noise Surveys

Background Noise

Noise monitors were placed at position L1 and L5 as shown in Figure 6 measure the background and ambient noise that is representative of the surrounding noise-sensitive receivers. Noise monitors L1 and L5 were installed from the 7th to the 13th of April 2020. The results of the unattended background and ambient noise survey is shown in

Table 5 below (for the day, evening and night periods).

Table 5 - Long-term noise survey summary – Background noise (Stantec Australia Monitoring)

Location	Equivalent Continuous Noise Level $L_{Aeq,period}$ - dB(A)			Background Noise Level RBL - dB(A)		
	Day	Evening	Night	Day	Evening	Night
L1	61	57	50	44	42	36
L5	72	73	67	54	48	41

The local ambient noise environment is dominated by traffic noise from Botany Road throughout the majority of the day, evening and night periods. Note that any rain affected data during the period of logging has been excluded from the calculations. Refer to Figure 7 for the noise data for the total period of measurement.

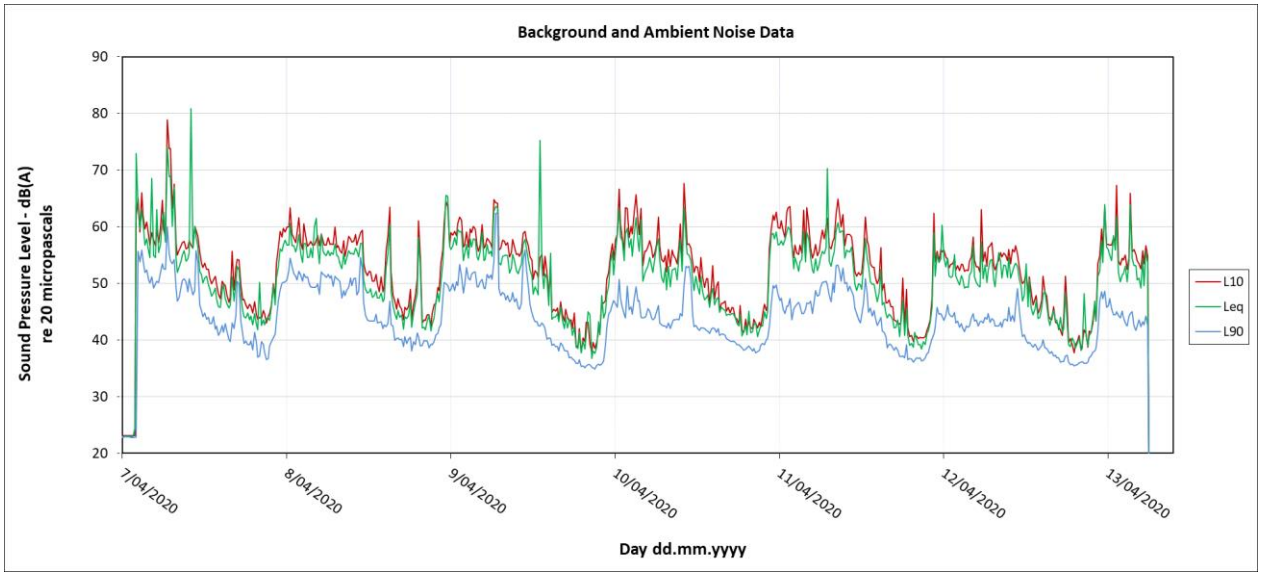


Figure 7 - Long-term background noise monitoring data – L1

3.3 Summary of Noise Investigations

The site noise investigations are a key piece of information when understanding the existing ambient noise environment at the surrounding receivers to the proposed development. For the nominated criteria outlined in Section 4 where the measured results are required as the basis of the criteria, historical site noise investigation results, have been used because this more accurately reflects the ambient noise level for each noise catchment area (historical site noise investigation results were not affected by the COVID-19 pandemic). Stantec delineated the various environments into Noise Catchment Areas (NCAs) together with the Integrated Station Development and the other buildings assessed in separate SSDDAs within the OSD precinct, which is outlined in Figure 8. The summary of the receivers within these catchments include:

- NCA01 - Mix of commercial and retail receivers
- NCA02 - Residential receivers
- NCA03 - Residential receivers
- SSD-10440 – Northern Precinct
- SSD-10439 – Central Precinct
- SSI-7400 – Integrated Station Development
- Waterloo Congregational Church

Figure 8 - Noise Catchment Areas (NCA)

4. Noise & Vibration Criteria

4.1 Construction Noise Criteria

The *Interim Construction Noise Guideline* (ICNG) by NSW DECC recommends the following standard hours of construction:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

The noise criteria associated with construction and its related activities are shown in Table 6, as presented in Section 4.1.1 Table 2 of the ICNG.

Table 6: Construction Noise Criteria at Residences

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours:	Noise Affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured **$L_{Aeq,15min}$** is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: - Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) - If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see section 7.2.2. of the ICNG

Note: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30m away from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Section 4.1.3 of the ICNG sets out the noise management levels for other land uses, including commercial premises and Hospital wards and operating theatres. The internal noise levels should be assessed at the most affected occupied point and the external noise levels are to be assessed at the most affected point within 50 m of the area boundary. However, for other noise-sensitive receivers (e.g. hotels), the guideline recommends the 'maximum' internal noise levels recommended in Australian/New Zealand Standard AS/NZS 2107:2000 *Acoustics—Recommended design sound levels and reverberation times for building interiors*, in determining relevant noise levels.

Based on the criteria in the tables above, the following noise management levels in Table 7 should be applied to the noise sensitive receivers. These criteria apply to airborne noise emissions related to construction activity during the recommended standard hours only. Where internal noise levels cannot be measured, external noise levels may be used. A conservative

estimate of the difference between internal and external noise levels is 10 dB for buildings other than residences. This assumes an open window.

Table 7: Project Specific Construction Noise Management Levels

Receiver	NCA	Land Use	Internal noise level criteria	Noise Management Level (external), $L_{Aeq,15min}$	Highly Noise Affected Level, $L_{Aeq,15min}$
C1	NCA 01	Commercial	-	70 dB(A)	N/A
C2	NCA 02	Commercial	-	70 dB(A)	N/A
R1	NCA 02	Residential	-	50 dB(A) + 10 dB = **60 dB(A)**	75 dB(A)
R2	NCA 03	Residential	-	47 dB(A) + 10 dB = **57 dB(A)**	75 dB(A)
W1	-	Place of Worship	45 dB(A)	55 dB(A)	N/A

4.2 Construction Vibration Criteria

The vibration emitted from construction works should be such that it does not exceed the maximum limits set out in the criteria presented in Table 8to Table 11. The assessment and mitigation for construction vibration are provided in Sections 7 and 8.

4.2.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Structural vibration in buildings can be detected by occupants and can affect them in many ways including reducing their quality of life and their working efficiency. Complaint levels from occupants of buildings subject to vibration depend upon their use of the building and the time of the day. The guide on preferred values for human comfort have been extracted from the NSW DEC *Assessing Vibration: A Technical Guideline* (2006). The criteria for continuous and impulsive vibration are summarized in Table 8.

Table 8: Criteria for Exposure to Continuous and Impulsive Vibration

Place	Time	Vibration Acceleration (m/s^2)			
		Preferred		Maximum	
Continuous Vibration		z axis	x and y axis	z axis	x and y axis
Residences	Day- or night-time	0.010 0.007	0.0071 0.005	0.020 0.014	0.014 0.010
Critical areas[1]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Offices, schools, educational	Day- or night-time	0.020	0.014	0.040	0.028
Impulsive Vibration		z axis	x and y axis	z axis	x and y axis
Residences	Day- or night-time	0.30 0.10	0.21 0.071	0.60 0.20	0.42 0.14
Critical areas[1]	Day- or night-time	0.0050	0.0036	0.010	0.0072
Offices, schools, educational	Day- or night-time	0.64	0.46	1.28	0.92

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

Disturbance caused by vibration will depend on its duration and its magnitude. This methodology of assessing intermittent vibration levels involves the calculation of a parameter called the Vibration Dose Value (VDV) which is used to evaluate the

cumulative effects of intermittent vibration. The criteria applicable when considering periods of intermittent vibration are presented in Table 9.

Table 9: Acceptable Vibration Dose Values for Intermittent Vibration (1.75 m/s)

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.13	0.26
Critical areas[1]	0.10	0.20	0.10	0.20
Offices, schools, educational	0.40	0.80	0.40	0.80

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

4.2.2 Structural Damage – Vibration Criteria

Ground vibration criteria are defined in terms of levels of vibration emission from construction activities that will not damage surrounding buildings or structures. It should be noted that human comfort criteria are normally expressed in terms of acceleration whereas structural damage criteria are normally expressed in terms of velocity. The human comfort criteria are also often exceeded before a risk of structural damage.

Structural damage criteria are presented in German Standard DIN 4150-Part 3 *Structural vibration in buildings – Effects on structures* and British Standard BS 7385-2:1993 *Evaluation and Measurement for Vibration in Buildings*. The British Standard BS 7385-2:1993 establishes vibration values for buildings based on the lowest vibration levels above which damage has been credibly demonstrated. These values are evaluated to give a minimum risk of vibration-induced damage, where the minimal risk for a named effect is usually taken as 95% probability of no effect. The aforementioned values are summarised in Table 10 and Table 11.

Table 10: Transient Vibration Guide Values for Cosmetic Damage – BS 7385-2:1993

Type of Building	**Peak component particle velocity in frequency range of predominant pulse**		
	Transient vibration sources		Intermittent vibration sources*
	4 Hz to 15 Hz	15 Hz and above	All frequencies
Reinforced or framed structures (Industrial or light commercial type buildings)	50 mm/s		25 mm/s
Unreinforced or light framed structures (Residential or light commercial type buildings)	15 mm/s	20 mm/s (50 mm/s at 40Hz and above)	7.5mm/s

Note: 1) For construction activities involving intermittent vibration sources (i.e. rock breakers, piling rigs, vibratory rollers, excavators), that may rise to resonant responses in structures and to low-rise buildings, guide values in Table 10 may need to be reduced by up to 50% as a conservative vibration damage screening levels.

Table 11 indicates the vibration limits presented in DIN 4150-Part 3 to ensure structural damage does not occur.

Table 11: Guideline Value of Vibration Velocity (V_i) for Evaluating Effects of Short-Term Vibration – DIN 4150-Part 3

Line	Type of Structure	Vibration velocity, v_i, in mm/s				
		At the Foundation At a frequency of			At the Plane of floor of highest floor	Long-term vibration[2] At the Plane of floor of highest floor
		Less than 10Hz	10 to 50Hz	50 to 100Hz [1]	All Frequencies	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	All Frequencies	40	10
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15	5
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8	2.5

Note: 1) For frequencies above 100Hz, at least the values specified in this column shall be applied.

2) All types of vibration that may cause structural fatigue and which may produce resonance

4.2.3 Heritage Items

Line 3 condition vibration guide in Table 11 is applicable to 'Structurally Unsound' items. The existing WISD report indicates that the Waterloo Congregational Church is “Structurally Sound” and therefore Line 2 of Table 11 applies.

4.2.4 Station Box

The Waterloo Metro Station Box sits either side of the Cope Street Plaza and is considered a reinforced industrial structure and therefore, the first line of Table 10 will apply.

5. Construction Noise Assessment

5.1 Proposed Construction Activities

The constructible plan and staging detailing the extent of work, time frames of stages, expected equipment and proposed locations of equipment has been provided by John Holland. Concurrent works have been grouped together and separated into stages for the purposes of the acoustic assessment. For the purpose of this assessment, the noise impact from the following anticipated general construction works is considered:

- Stage 1 – Archaeological Investigation and Remediation
  - Concrete Hardstand removal for archaeological works
  - Concrete Hardstand removal for piling guide
  - Concrete Hardstand removal for basement floor
  - Concrete Hardstand removal for remediation area
- Stage 2 – Perimeter Piling
  - Shoring Continuous flight auger piles (CFA) Wall
  - Sheet piling to TC5 base
- Stage 3 - Shotcrete and Shoring
  - Anchors to shoring walls
- Stage 4 – Excavation
  - Bulk Excavation
- Stage 5 – Foundation Piling
  - Foundation Piles
- Stage 6 – Structure, Form, Reinforce and Pour Concrete (FRP) Works including cast in services and incoming infrastructure:
  - Slab on ground
  - Walls up to basement 1
  - Basement Leve 1 slab and columns
  - Walls up to ground level
  - Ground floor slab
  - Cast in hydraulic services into P2, P1 and ground slab vertical elements
  - Cast-in temporary services as required, such as dewatering wells, hold down bolts etc.
  - Cast-in electrical services into P2, P1 and ground slabs and vertical elements.

The construction layouts and plans have been outlined in Appendix B.

5.2 Construction Hours

5.2.1 Standard Hours – Interim Construction Noise Guideline

The hours of work are expected to occur during '*Standard Hours'* as per ICNG:

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

5.2.2 Approved Hours – Environmental Impact Statement SSD-10438 Basement Car Park within Waterloo Metro Quarter

Construction hours for the site have been established in accordance with the concept DA approval and approved Noise and Vibration Report.

It is proposed to retain these hours for the construction of the OSD with the expected of extending Saturday construction hours from 8:00am to 7:30am and 1:00pm to 3:30pm in accordance with City of Sydney standard hours.

- Monday to Friday: 7:00am – 6:00pm
- Saturday: 7:30am – 3:30pm
- Sunday: No work

There will be times when out of hours works may be required. An out of hours protocol for the assessment, management and approval of work outside of the standard construction hours will be prepared and submitted as required.

The Consent Conditions D3-D7 Application No. SSD 10437, Construction of the Southern Precinct within Waterloo Metro Quarter are as follows and are applicable to the Basement scope of works:

D3 Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:

(a) between 7am and 6pm, Mondays to Fridays inclusive; and

(b) between 7:30am and 3:30pm, Saturdays.

D4 No work may be carried out on Sundays or public holidays.

D5 Activities may be undertaken outside of these hours if required:

(c) by the Police or a public authority for the delivery of vehicles, plant or materials; or

(d) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm.

D6 Notification of such activities must be given to affected residents before undertaking the activities or as soon as is practical afterwards.

D7 Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:

(e) 9am to midday, Monday to Friday;

(f) 2 pm to 5pm Monday to Friday; and

(g) 9am to midday, Saturday.

Construction work outside of these hours is not allowed unless there is a threat to safety. Out of hours work will require a separate assessment and subsequent approval by The Minister for Planning and Public Spaces

5.3 Construction Noise Evaluation Scenarios

Noise levels for each stage of the construction works are predicted and evaluated based on the following scenarios:

Worst-case: in this scenario, some of the noisiest equipment is assumed to be operating towards the boundary of the construction site (closest distance to a receiver).

Average-case: in this scenario, most of the equipment are assumed to be operating towards the middle of the site. This scenario is expected to represent the average noise expected from the entire site at a receiver and expected to be representative of the longer-term average noise emissions. It is noted that a receiver is not expected to be consistently exposed to the Average-case noise levels due to the transient nature of construction noise where construction activity moves around the site. This situation represents typical average construction noise emissions.

5.4 Expected Construction Equipment

The noise sources likely to be associated with the proposed works and the assumed operating duty rates for each equipment item are presented in Table 12. All plant and equipment sound power levels have been extracted from:

- AS 2436:2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;
- AS 2436:1981 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.

Table 12: Construction Equipment Sound Power Levels

Stages	Equipment	Sound Power Level – dB(A)	Average-case		Worst-case	
			Quantity	Usage in 15-minute (% Time)	Quantity	Usage in 15-minute (% Time)
Archaeological Investigation and Remediation	5t Excavator	124[2]	-	-	1	40
	15t Excavator with bucket	107	1	25	1	75
	Vacuum Truck	108	1	30	1	50
Perimeter Piling	Contiguous Piling Rig	116	1	40	2	50
	Vibratory sheet piling[1]	125	1	60	1	60
	Concrete Pump	110	1	40	1	40
	Diesel Crane	111	1	25	1	60
	Concrete Truck	112	1	25	1	50
Shotcrete and Shoring	Concrete Pump	110	1	40	1	50
	Concrete Truck	112	1	25	1	50
	Shotcrete rig	106	1	40	2	60
	Hand Tools	102	2	50	1	75
Excavation	40t Excavator with Bucket	117	1	40	2	40

Stages	Equipment	Sound Power Level – dB(A)	Average-case		Worst-case	
			Quantity	Usage in 15-minute (% Time)	Quantity	Usage in 15-minute (% Time)
	15Tt Excavator with Hammer[2]	124[3]	1	20	1	40
	5t Excavator with Hammer[2]	124[3]	1	20	1	40
	Truck and Dogs	108	1	30	2	30
	Pad Compactor	115	-	-	1	25
	Pad Foot Roller Compactor	112	1	25	1	40
	Smooth Drum Roller Compactor	112	1	25	1	40
	Hand Tools	102	2	50	2	75
Foundation Piling	Bored Piling Rig	116	1	40	1	60
	Concrete Pump	110	1	40	1	40
	Concrete Truck	112	1	25	1	50
	Diesel Crane	111	1	25	1	40
Structure FRP Works	Mobile Concrete Pump	108	1	40	1	40
	Telehandler	114	1	30	1	50
	Electric Crane	105	2	25	1	50
	Single/Twin Car Hoist	68	2	25	2	40
	Hand Tools	102	1	50	1	75

Note 1: Sheet piling is only proposed to be used around the base of TC 5 (column). This activity although noisy will only take place for a short time (less than a day). Therefore, this is not considered a long-term construction activity and has not been cumulatively assessed with other plant and equipment during the perimeter piling stge.

Note 2: Only one is expected to operate at any given time.

Note 3: A +5 dB correction factor has been included in accordance with recommendations given in Section 4.5 of the ICNG

5.5 Noise Prediction Model

The following assumptions were made and applied to the spreadsheet noise prediction model:

- The height of the receivers has been assumed as 1.5m from ground level at the boundary of the residential receivers and most affected façade of other sensitive receivers;
- The predicted noise levels at the nearby sensitive receivers have been assessed with the acoustic recommendations as shown in Section implemented 8.1.1.
- The effect of other mitigation measures (e.g. respite periods, flex shield barriers to any scaffolding which may be present) has not been included within the model;
- The predicted noise levels have been assessed using neutral weather conditions;
- Sound power levels and the operating duty rates used in the predictions are provided in Table 12.

5.6 Construction Noise Level Prediction Results

The predicted construction noise levels at the closest receiver within each NCA have been presented in Table 13 to Table 18. For assessment purposes, the Evaluation Scenarios, 'Worst-case' and 'Average-case', are also presented.

Table 13: Predicted Noise Levels – Stage 1: Archaeological Investigation and Remediation

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{eq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	66	81	70	-	11	75	Yes	No
C2	Commercial	69	84	70	-	14	75	Yes	No
R1	Residential	53	68	60	-	8	75	Yes	Yes*
R2	Residential	47	62	57	-	5	75	Yes	Yes*
W1	Place of Worship	56	71	55	1	16	75	Yes*	Yes*

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 14: Predicted Noise Levels – Stage 2: Perimeter Piling

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	73	77	70	3	7	75	Yes*	No
C2	Commercial	72	76	70	2	6	75	Yes*	No
R1	Residential	62	66	60	2	6	75	Yes*	Yes*
R2	Residential	66	69	57	9	12	75	Yes*	Yes*
W1	Place of Worship	81	81	55	26	26	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 15: Predicted Noise Levels – Stage 3: Shotcrete and Shoring

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	66	69	70	-	-	75	Yes	Yes
C2	Commercial	67	68	70	-	-	75	Yes	Yes
R1	Residential	56	58	60	-	-	75	Yes	Yes
R2	Residential	59	62	57	2	5	75	Yes*	Yes*
W1	Place of Worship	80	83	55	25	28	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 16: Predicted Noise Levels – Stage 4: Excavation

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	78	81	70	8	11	75	No	No
C2	Commercial	78	81	70	8	11	75	No	No
R1	Residential	66	69	60	6	9	75	Yes*	Yes*
R2	Residential	68	72	57	11	15	75	Yes*	Yes*
W1	Place of Worship	83	86	55	28	31	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 17: Predicted Noise Levels – Stage 5: Foundation Piling

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	73	75	70	3	5	75	Yes*	Yes*
C2	Commercial	72	75	70	2	5	75	Yes*	Yes*
R1	Residential	62	65	60	2	5	75	Yes*	Yes*
R2	Residential	66	76	57	9	19	75	Yes*	No
W1	Place of Worship	81	81	55	26	26	75	No	No

* Complies with highly noise affected criteria although exceeding the relevant NML

Table 18: Predicted Noise Levels – Stage 6: Structure, Form, Reinforce and Pour Concrete (FRP) Works including cast-in services and incoming infrastructure

ID	Receiver	Predicted Noise Level Range		Noise Management Level	Noise Management Level Exceedance (dB)		Highly Noise Affected Criteria L_{Aeq}	Compliance	
		Average-Case	Worst-case		Average-case	Worst-case		Average-Case	Worst-Case
C1	Commercial	69	73	70	-	3	75	Yes	Yes*
C2	Commercial	70	73	70	0	3	75	Yes	Yes*
R1	Residential	60	61	60	0	1	75	Yes	Yes*
R2	Residential	62	73	57	5	16	75	Yes*	Yes*
W1	Place of Worship	71	73	55	16	18	75	Yes*	Yes*

* Complies with highly noise affected criteria although exceeding the relevant NML

5.7 Discussion and Assessment

Based on the results of this noise assessment, the following conclusions are made:

- Noise levels are predicted to exceed the Highly Noise Affected criteria (75 dBA) during all the assumed stages of work at the nearest identified receivers for both average- and worst-case scenarios, the Church being the most affected receiver in most instances. Except in the case of the structure stage where compliance is expected to be demonstrated across all the adjacent receivers.
- ICNG does not set out the Highly Noise Affected Criteria for non-residential receivers. Nevertheless, it should be noted that noise levels are predicted to exceed the Highly Noise Affected criteria (75 dBA) during many of the proposed stages of works at the nearest identified non-residential (i.e. commercial, retail and places of worship) receivers for both average- and worst-case scenarios.
- Noise levels are predicted to exceed the NML during all the assumed stages of work at the nearest identified receivers for various works during both average- and worst-case scenarios.
- Noise levels during all the assumed stages of work are expected to exceed the Noise Management Level by up to 28 dB during the average noise emissions; and up to 31 dB during the Worst-Case assessment scenario for the adjacent Waterloo Congregational Church;
- Noise levels during all the assumed stages of work are expected to comply with the Highly Noise Affected Criteria (75dBA) in most instances during both the Average and Worst-case scenarios for the nearby residential receivers. Except in the Foundation Piling stage, where 1 dB(A) exceedance is expected at the Residential Receiver R2 during the worst-case scenario

- Noise levels do demonstrate higher noise levels of up to 86dB (Worst-case – Waterloo Congregational Church) during the Excavation stage. However, these works are expected to be short-term (20 days) and is expected to not have any prolonged impact.
- Highest noise levels are produced during the use of Excavators with breaker attachments;

Based on the above, the proposed construction works have the potential to give rise to adverse noise impacts at identified non-residential receivers. Therefore, all reasonable and feasible measures should be applied on site to assist in reducing the overall noise emissions on site, as per the recommendations in Section 8. It is noted, however, the Average-case scenario is expected to represent the average noise expected from the entire site at a receiver and expected to representative of the longer-term average noise emissions. Therefore, this situation represents typical average construction noise emissions which are predicted to be below the Highly Noise Affected criterion at the nearest identified residential receivers in most instances (R3 being the most affected residential receiver, with occasional minor exceedances of the established criteria).

6. Construction Traffic Noise Generation

Construction traffic movement prediction data is not available and the ICNG does not specify construction traffic noise criteria. However, based on the existing noise levels during the Day period, a typical heavy vehicle movement of four trucks per hour is assumed. On this basis, the construction traffic noise is unlikely to increase the existing traffic noise levels on surrounding roads by 2dB, as per the 'Relative Increase' limit imposed by the NSW Road Noise Policy. As an indication a 3dB increase would represent a doubling of traffic in the area.

7. Construction Vibration Assessment

7.1 Safe Working Distances

The following vibration intensive plant that are assumed for this project are assessed in this Section:

- 15t Excavator - with hammer
- 15t Excavator - with bucket
- Bored piling
- Sheet Piling
- 10t Roller (Pad Foot or smooth)

Indicative recommended 'Safe working' distances for the above vibration intensive plant boundaries are provided in Table 19. At distances beyond the Safe working distances, the recommended targets provided in Table 19 are unlikely to be exceeded.

Table 19: Recommended Safe Working distances for vibration intensive plant

Plant Item	Safe Working Distance (meters)			
	Cosmetic Damage - BS 7385		Cosmetic Damage - DIN 4150	Human Response (OH&E Vibration Guideline)
	Reinforced structures	Un-reinforced structures	Sensitivity to vibration structures	
15t Excavator with hammer	5	10	15	23
15t/ 40t Excavator with bucket	5	5	5	10
Bored piling	5	5	10	N/A
Sheet Piling	15	20	50	20
10T Roller – vibratory	10	19	30	100
10T Roller – Static	N/A	N/A	N/A	N/A

Note: When evaluating human response to intermittent vibration, the accumulated vibration energy over the course of day and night periods at the receiver location must be taken into account. As a result, the Safe working distances listed in Table 19 for Human Response, are influenced by the length of vibration exposure. Therefore, if a receiver within these safe working distances is subjected to strong vibration levels for most of the Day/Night period, the recommended vibration targets may exceed and potentially cause complaints.

The piling and excavation activities for the basement are programmed to be complete before the Metro Station is open to the public and therefore, human comfort vibration impact is not considered further.

7.2 Vibration Sensitive Receivers Closer than the Safe Working Distances

At receivers closer than the recommended 'Safe Working' a more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the structure is needed to determine the applicable safe vibration level. Additionally, site measurements and alternative equipment or methodologies, should be considered.

7.2.1 Cosmetic damage

It is noted that there are no unsound structures currently identified. On this basis, no structure near the site falls into the category of 'Sensitivity to vibration structures' in Table 19.

The adjacent Waterloo Congregational Church is identified as a heritage listed item. An assessment undertaken by a structural engineer confirms that the church is in Sound Structural condition (see Appendix C). On this basis the screening vibration levels for un-reinforced structures are adopted as per discussion in Section 4.2.3.

The Waterloo Metro Station Box sits either side of the Cope Street Plaza and is considered a reinforced industrial structure and therefore, at low risk from cosmetic or structural damage. There may be occasions where high vibration generating activities, such as sheet piling, 10T Roller – vibratory and excavation using rock hammer attachments are proposed to take place within the 'Safe Working Distance' shown in column 1 of Table 19. When this occurs attended vibration monitoring should take place by a qualified acoustic consultant and the structure should be checked for any signs of damage by a structural engineer when the criterion is exceeded. It may be that the structure can withstand vibration levels far greater than the conservative criteria allows with no damage. Therefore, providing the structural engineer gives their sign-off, the works may continue inside the 'Safe Working Distances.' Vibration monitoring in this way will allow work to proceed faster with less delay. Further, monitoring is not expected to be required often as, typically the 'Safe Working Distances' will be met.

Based on the assumptions made in this report, only Waterloo Congregational Church and the Station Box are identified as receivers within the Cosmetic Damage zones during the use of excavator with hammer attachment, 10T vibratory roller and sheet piling. Vibration recommendations and vibration monitoring strategies are provided in Section 8.

7.2.2 Human Comfort

The actual vibration level received at a habitable area of a property, highly sensitive to geotechnical conditions, vibration source, dominant frequencies, dynamic characteristics of a specific structure and length of time vibration-intensive machinery will be in operation. Therefore, unlike noise, it is not possible to predict Vibration Dose Value (VDV) within habitable areas around the site. At receivers closer than the recommended 'Safe Working' for Human Response (provided in Table 19), the recommended vibration targets provided in Section 4.2 can be exceeded.

The 10T Vibratory roller operating in the vibration mode, has been determined as the piece of equipment that generates the highest vibration level. While some residential receivers located north and east of the site are identified to be within the Human Response zone during the operation of the vibratory roller, no receiver will be within this zone during the operation of the other vibration-intensive plant. Based on the 'Safe Working' for Human Response (provided in Table 19), Figure 9 below shows the extent of the receivers that may experience some vibration due to the operation of the 10T Vibratory roller.

Figure 9 - Overview of the site and extent of the receivers closer than the Human Response zone for the operation of 10T Vibratory roller

Discussion

While receivers within the Human Response zone in Figure 9 may briefly feel some vibration, exceedance of vibration targets provided in Section 4.2.1 are unlikely.

The typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. Moreover, receivers within 50m of the site are identified as commercial receivers with higher VDV targets in Table 19. On this basis, there is a low risk of target exceedances when vibration rollers are in use. However, in the event of receiving a 'reasonable complaint' from an affected resident, site measurements and alternative equipment or method, should be considered. Vibration measurements should be done both within the site and at the receiver location to confirm the transmitted of vibration levels and VDV levels.

PART 2 – MANAGEMENT PLAN

8. Noise & Vibration Management Strategies

This construction noise and vibration management plan aims to minimise the impact of noise on the surrounding local environment. Project specific recommendations and required mitigation methods are outlined in the following subsections. Mitigation measures can be broadly categorized as physical measures and management measures.

Physical measures are action taken to reduce or control noise at the source or along its path. These measures f on limiting the amount of noise that is generated, transmitted, or received by the surrounding noise sensitive receivers to reduce any adverse impact to their amenity. Typically, these will control measures implemented to the extent of the site by limiting line of sight to receivers.

Management measures are non-physical actions taken to minimise the impact of noise on the environment and the noise sensitive receivers. These measures focus on planning, organization, and communication aspects of noise management. Effective communication and planning can also help to maintain good relationships with nearby communities and mitigate any potential conflicts or complaints. Where objectives cannot be met and after implementation of all reasonable and feasible mitigation, there is still potential to impact noise sensitive receivers as a worst case.

Where noise and vibration objectives are predicted to be exceeded (See section 5.6 and 5.7 for noise and section 7.2 for vibration) physical mitigation measures may not be sufficient alone to sufficiently minimise the impact on the community. Therefore, it is important to note that a combination of these strategies is necessary to effectively the control the extent of noise impact. The noise and vibration management measures (8.1.2 and 8.2.2) shall also be followed.

8.1 Noise

8.1.1 Noise Physical Measures

The following physical measures should be implemented as a minimum to reduce the impact to the surrounding noise sensitive receivers.

- *Site Hoarding* - The use of both A-class and B-class hoardings are required to be installed to mitigate the impact of the highest predicted noise levels. The extent of the hoardings is indicated by the construction plan markups provided by John Holland and presented in Figure 10 and Appendix B.

  B-class hoarding is proposed to be installed to the extent of the North (along Raglan Street) and West along Botany Road. An additional A-class hoarding is proposed to the site boundary on all sides.

  The construction of the barrier should be impervious of gaps and cracks, which would compromise its performance, and it will be comprised of acoustically suitable materials such as, 17 mm plywood. The barrier is able to reduce the noise levels experienced at the ground-level receivers directly around the site by 3-7 dB.

  Site shed being installed on the top of the hoarding on the work site boundaries can increase the effective height of the acoustic barriers shielding noise activities from receivers where feasible.

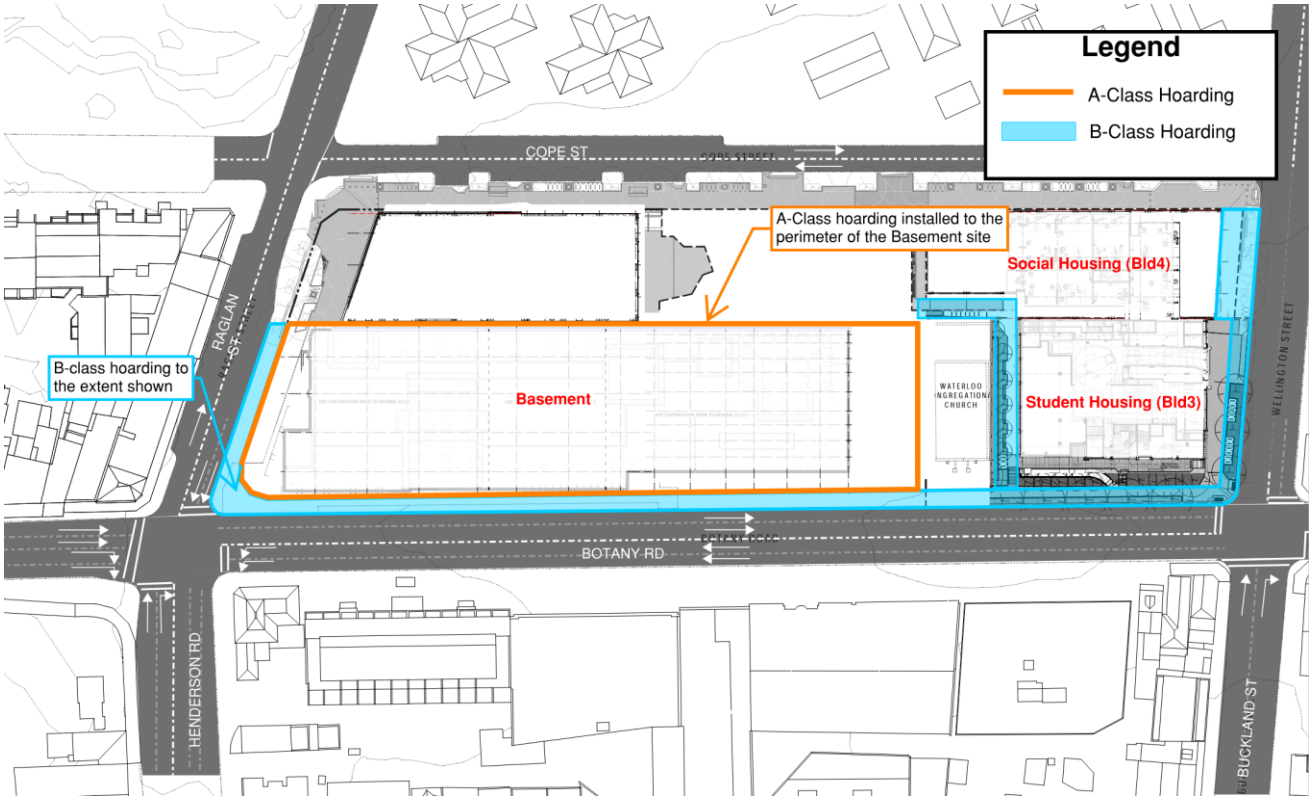


Figure 10: Extent of site hoarding for basement works

- *Temporary barriers* - Barriers should be mobile and extend to a height 1 m above the noise source. These barriers should envelop the work location to ensure no direct line of sight to nearby receivers (ground level). All practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source. Note that these localised noise barriers are proposed in addition to the site bounding hoarding outlined above.

  Where high noise impacts are expected, the ICNG requires that all feasible and reasonable work practices be employed. It is noted that the performance of noise barriers is compromised where there is a direct line of sight to a noise source. However, to protect the receiver closer to the ground level, localised noise barriers should be utilised when the following equipment is in use:

  - Pneumatic handheld breaker
  - Concrete pump

  Barriers should be mobile and extend to a height 1 m above noise source. These barriers should envelop the work location to ensure no direct line of sight to nearby receivers (ground level). Practical and feasible measures should be taken to allow the noise barrier to be located within 4 m of the noise source. Note that these localised noise barriers are proposed in addition to the site bounding hoarding outlined above.

- In addition to the sound attenuating barrier, at least one respite period such as, 12:00pm – 1:00pm or otherwise agreed with the community, should be offered per day during the most intensive periods of hammering and rock breaking. Frequent and proactive communication with the sensitive receivers is also encouraged, thus enabling tuning the works schedule to accommodate possible important religious events and allowing the tenants to prepare their expectations on the changing noise environment. More details regarding communication with the community can be found in Section 8.4.

- Selection of smaller equipment should be used where reasonable and feasible whilst maintaining efficiency of function.

- Where existing measures are not adequate to meet the noise goals, then modifications or alterations to the methodology should be implemented (e.g. consider use of alternative excavation methods, or alternate excavator attachments) or other negotiated outcomes with the affected community.
- Location of site access, egress and load out areas are to consider the noise sensitive receivers and where feasible and reasonable, to minimise the reversing movements within the site.
- All fixed plant at the work site is to be appropriately selected, and where necessary, fitted with silencers, acoustical enclosure and other noise attenuation measures in order to ensure that the total noise emission from the work site complies with conditions of approval requirements.
- Air break silencers are to be correctly installed and fully operational for any heavy vehicle that uses Sydney Metro construction site.
- Regular maintenance on plant and equipment to include compliance checks on plant noise emissions in accordance with predicted noise levels. Service and performance records are reviewed as per Incoming Plant Inspection Checklist. All plant and equipment are to be maintained in good order and in accordance with manufacturer's recommendations. Plant or equipment causing excessive noise are to be modified or if required removed from site.

Australian Standard AS 2436 – 2010 *Guide to noise and vibration control on construction, demolition, and maintenance sites* recommends the following techniques that could be applied to minimise the spread of noise and vibration to potential receivers.

The preferred order of actions taken to mitigate excessive construction noise emissions. If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimised. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures, such as screens. Practices that will reduce noise from the site include:

- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses using temporary barriers (stockpiles, shipping containers and site office transportable can be effective barriers).
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers, acoustic sheds, and enclosures.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. A few of these methods have been introduced in Figure 11 below.

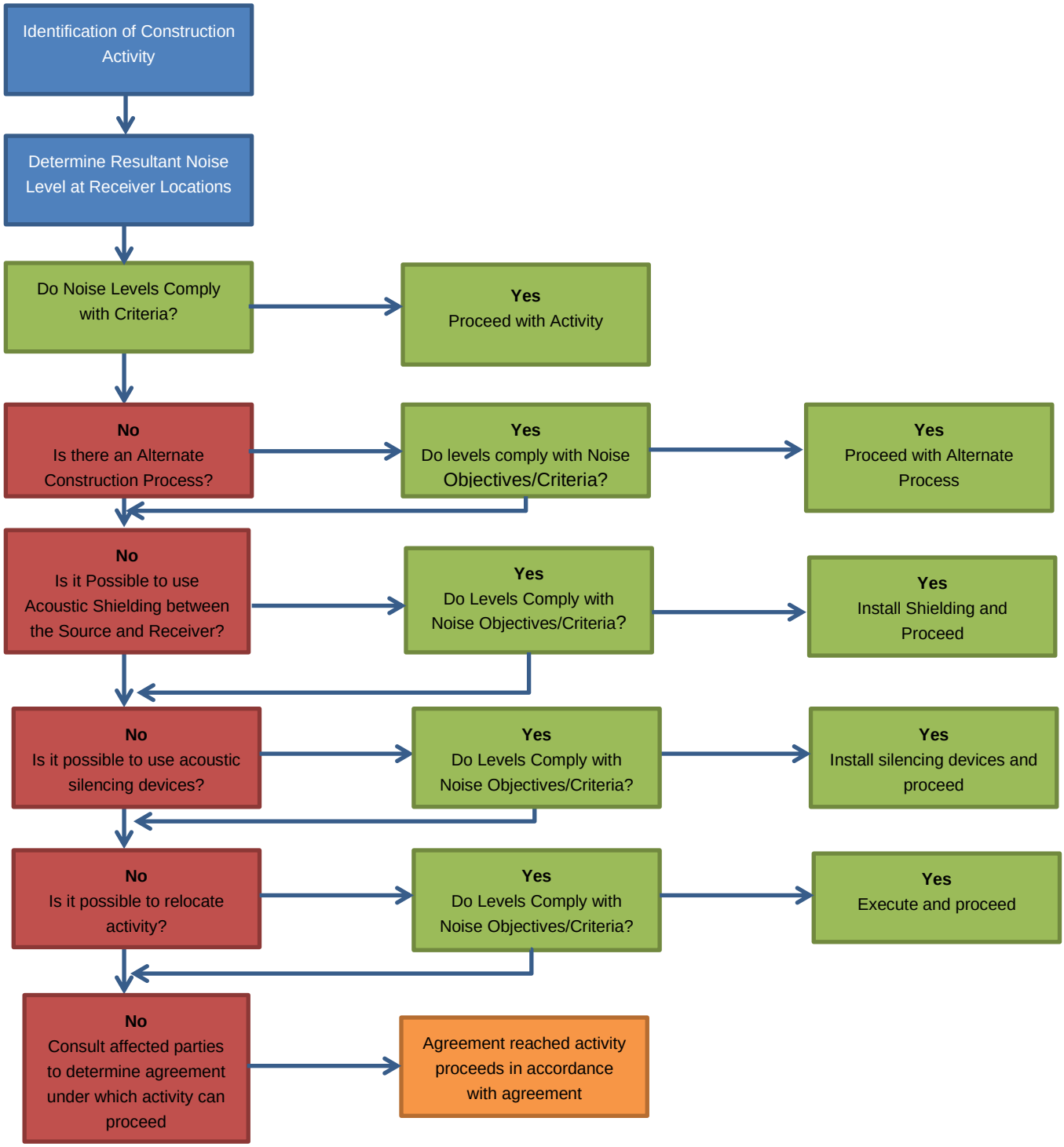


Figure 11: Noise Mitigation Management Flow Chart

Screening

On sites where distance is limited, screening of noise may be beneficial or even the only way to reduce construction noise impacts on the nearby receivers. Below, screening options for various situations have been introduced. Constructing and utilising these screening methods should be considered already during the planning stages.

Temporary buildings: One option to introduce screening is to position structures such as stores, storage piles, site offices and other temporary buildings between the noisiest part of the site and the nearest dwellings. Due to shielding provided by these buildings, some of the noise emission from the site can be reduced. If the buildings are occupied, however, sound insulation measures may be necessary to protect site workers inside the buildings.

Hoarding: Another way of implementing screening is to build hoarding that includes a site office on an elevated structure. This option offers superior noise reduction when compared with a standard, simple hoarding. The acoustic performance is further enhanced when the hoarding is a continuous barrier.

Partial building structures: On some sites, partially completed or demolished buildings can be used as noise shields for certain equipment. A noisy, stationary plant can be placed in a basement, the shell of which has been completed, provided reverberant noise can be controlled. Where compressors or generators are used in closed areas, it is also necessary to ensure that the exhaust gases are discharged directly to the outside air and that there is good cross-ventilation to prevent the build-up of poisonous carbon monoxide fumes and to allow an adequate air supply to maintain efficiency when operating the equipment.

Earth mounds and embankments: Where constructing noise barriers and using partial building shells is not practical, a worthwhile reduction in noise can be obtained by siting the plant behind and as close as possible to mounds of earth, which may effectively screen any noise sensitive areas from the plant. These mounds can often be designed into the construction schedule or site arrangement for future landscaping.

Long, temporary earth embankments can provide quite an effective noise screen for mobile equipment moving, for example, on a haulage road. When the earthworks are complete, the earth mounds should be removed, if possible, with smaller quieter excavators. A noise barrier like this may be a more reliable method of noise control than the imposition of restrictions on throttle settings.

Where earth noise barriers are not practical due to lack of space, consideration should be given to the possibility of constructing temporary screens from wood or any equivalent material in surface density.

Equipment operating 24h: When it comes to water pumps, fans and other plant equipment that operate on a 24-hour basis, they may not be an irritating source of noise during the day but can be problematic at night. They should therefore be effectively screened by either situating them behind a noise barrier or by being positioned in a trench or a hollow in the ground. Again, generated reverberant noise must be minimised and adequate ventilation should be ensured.

General remarks:

In many cases, it is not practical to screen earthmoving operations effectively, but it may be possible to partially shield a construction plant at the early stages of the project with protective features required to screen traffic noise.

The usefulness of a noise barrier will depend upon its length, its height, its position relative to the source and the receiver, and the material of which it is made. A barrier designed to reduce noise from a moving source should extend beyond the last property to be protected by at least ten times the shortest distance from the said property to the barrier. A barrier designed to reduce noise from a stationary source should, where possible, extend beyond the direct line of sight between the noise source and the receiver by a distance equal to ten times the effective barrier height, which is the height above the direct line between source and receiver.

If the works are already predominantly located within nominally closed structures, careful consideration should be given to reducing noise breakout at any openings.

Crane (diesel operated)

An appropriate silencer on the muffler and acoustic screen around the engine bay are recommended to attenuate the noise from the machine.

Reversing and warning alarms

Community complaints often involve the intrusive noise of alarms commonly used to provide a safe system of work for vehicles operating on a site. Beeper reversing alarm noise is generally tonal and may cause annoyance at significant distances from the work site.

There are alternative warning alarms capable of providing a safe system of work that are equal to or better than the traditional "beeper", while also reducing environmental noise impacts. The following alternatives should be considered for use on construction sites as appropriate:

- Broadband audible alarms incorporating a wide range of sound frequencies (as opposed to the tonal frequency 'beep') are less intrusive when heard in the neighbourhood.
- Variable-level alarms reduce the emitted noise levels by detecting the background noise level and adjusting the alarm level accordingly.
- Non-audible warning systems (e.g. flashing lights, reversing cameras) may also be employed, provided that safety considerations are not compromised.
- Proximity alarms that use sensors to determine the distance from objects, such as people or structures, and generate an audible alarm in cabin for the driver.
- Spotters or observers.

The above methods should be combined, where appropriate.

Noise levels of plant for onsite construction works

For plant and equipment brought on to site, the maximum noise levels provided in Schedule 1 of the City of Sydney Construction Hours/Noise within the Central Business District Code of Practice 1992 (reproduced in Appendix E) shall not be exceeded.

John Holland may require the Subcontractor to produce a Certificate of Acoustic Performance issued by a manufacture, supplier or qualified Acoustic consultant and member of the Australasian Acoustic Society (AAS) or Association of Australasian Acoustical Consultants (AAAC) for any appliance before permitting its used, or continued use, on the site.

Measurements on site shall be made in accordance with Schedule 1 – City of Sydney Construction Hours/Noise within the Central Business District Code of Practice 1992 guidance i.e. An $L_{A10\ 1\ minute}$ (Average Maximum) measured at 7m from the point nearest to the appliance.

8.1.2 Noise Management Measures

Where the above physical mitigation measures are not sufficient to reduce the impact towards the target NMLs the following management measures shall be undertaken:

- Regular communication with nearby noise sensitive receivers about the construction activities can help to manage their expectations and minimize the impact of noise on their daily lives. This includes informing them of the duration and intensity of the noise and any measures being taken to control it. The following principles should guide the approach with stakeholders and the community:
    - Proactive – identify issues and build solutions into the project where possible
    - Accessible – ensure the team is accessible for the duration of the project
    - Responsive – respond in an affective way to individual concerns. Resolve issues to the satisfaction of all involved in the shortest time possible
    - Sensitive – Understand the needs of stakeholders and the community to minimise disruptions and impacts where possible.
    - Transparent – record, publish and make information easily accessible to the community
- Letterbox notifications to the potentially affected stakeholders and community about the construction works and what can likely be expected. regular communication should be maintained with the community throughout the extent of works as phases progress including the following:
    - Investigations carried out on site
    - significant milestones or any changes to the scope of work
    - start of noisy work and duration
    - changes to traffic conditions
    - mitigation measures implemented to minimise impact to receivers.
    - Any out-of-hours works
- Engagement and consultation within a COVID-19 environment by implementing online communication channels to support robust engagement and consultation.
- Effective scheduling can help to minimize the impact of noise on the nearby noise sensitive receivers. This may involve scheduling noisy activities during time when there are fewer people around. This would require consultation with the surrounding noise sensitive receivers to identify appropriate periods.
- Application of consent condition D7 should be managed on site
    - Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:
        a) 9am to midday, Monday to Friday;
        b) 2pm to 5pm, Monday to Friday; and
        c) 9am to midday, Saturday.
- Consent Condition D18:
    - Applicant must ensure that any work generating high noise impact (i.e. work exceeding a NML of $L_{Aeq\ 75dBA}$) as measured at the sensitive receiver must only be undertaken in continuous blocks of no more than 3 hours, with at least a 1 hour respite between each block of work generating high noise impact,

where the location of the work is likely to impact the same receivers. For the purposed of this condition 'continuous' includes any period during which there is less than one hour respite between ceasing and recommencing any of the work subject of this condition.

- Where feasible and reasonable the layout and positioning of noise-producing plant and activities on the work site are organised to minimise noise emission levels. Also, avoidance of the use of noisy plant working simultaneously close together when close to sensitive receivers.
- Providing workers with training on noise control measures and equipment can help to minimize noise at the source. Workers should be trained on how to use equipment that produces lower noise levels and how to implement noise-reducing techniques.
- Site induction of all site personnel. Site Induction, Toolbox Talks and Team Meetings are to include a noise and vibration awareness/education component identifying impacts and implementation of control measures for the project. Site inductions are to include:
  - Project specific and standard noise and vibration measures
  - Construction hours of work
  - Nearest sensitive receivers
  - Relevant licence and approval conditions
  - Loading and unloading areas
- Deliveries will be carried out within the approved construction hours, unless directed by police or other relevant authority (RMS, Council, etc.)
- Monitoring of noise levels can help to identify any issues and allow for adjustments to be made to the construction activities. This includes monitoring the effectiveness of the noise control measures and making changes as needed.
- Reduction of the hours of construction to minimise the prolonged daily exposure of the nearby noise sensitive receivers.
- Refer to Section 8.4 for additional information regarding the communication strategy with the community.

By implementing management measures, construction noise can be effectively controlled and the impact on the surrounding environment can be minimized. Effective communication and planning can also help to maintain good relationships with the surrounding noise sensitive receivers and mitigate any potential conflicts or complaints.

8.2 Vibration

Vibration can be more difficult to control than noise, and there are few generalisations that can be made about its control. However, General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Where, there is a high risk of cosmetic damage, site measurements and monitoring to confirm the site-specific vibration transmission and propagation characteristics between source and receiver locations through measurements are recommended.

8.2.1 Vibration Physical Measures

Physical mitigation measures to limit vibration are limited. The most effective physical measure is to break the physical connection between the source of vibration and the receiver. This can be achieved by means of cutting a narrow trench in between the source of vibration and the receiver. The trench may be cut using a rock saw or dug using an excavator for example.

8.2.2 Vibration Management Measures

The following vibration management measures are provided to complement physical mitigation measures on site and minimise vibration impact on human comfort from construction activities and reduce the risk of structural cosmetic damage.

Many of the management measures are similar to the items outlined in Section 8.1.2 regarding regular communication with the community and nearby sensitive receivers. Refer to Section 8.4 for additional information regarding the communication strategy with the community

Building condition surveys

Prepare a dilapidation report for both exterior and interior of the Waterloo Congregational Church and the following buildings if cannot be categorised as 'structurally sound'. The dilapidation report must be prepared prior to the commencement of construction works as a risk minimisation strategy for future complaints/claims of damage. The purpose of the dilapidation report is to capture the pre-existing condition of a property.

Equipment selection and construction method:

- Use less vibration emitting construction methods where feasible & reasonable.
- Where possible, turn off the vibration mode of rollers. Larger static rollers may be used instead of vibratory rollers if additional compaction is required.
- Drilling/stitch drilling/rock sawing may be able to be used instead of sheet piling or rock breaking, particularly where sheet piling is proposed to TC5 base immediately adjacent the Church.
- Condition of consent condition D7 shall be managed on site:
  - Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:
    d) 9am to midday, Monday to Friday;
    e) 2pm to 5pm, Monday to Friday; and
    f) 9am to midday, Saturday.
- Condition of consent condition D21 shall be managed on site:
  - Vibratory compactors must not be used closer than 30 metres from residential or heritage buildings unless vibration monitoring confirms compliance with the vibration criteria specified above and noted in Section 4.2. These limits apply unless otherwise outlined in the amended CNVMP applicable to the CSSI approval (CSSI 7400) or the project specific CNVMP required by condition B51.

Residential Receivers

Some residential receivers located north and east of the site are identified to be within the Human Response zone during the operation of vibratory roller only. Since the typical operation of a roller is intermittent and continually moving, accumulated

vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, where a 'reasonable complaint' related to the human response to vibration from an affected resident is received, long-term vibration monitoring at the receiver location is recommended. See Section 8.6 for monitoring strategies to ensure no adverse impacts occur.

Effective scheduling can help to minimize the impact of vibration on the nearby vibration sensitive receivers. This may involve scheduling vibration-intensive activities during time when there are fewer people around. This would require consultation with the surrounding vibration sensitive receivers to identify appropriate periods.

Waterloo Congregational Church

Waterloo Congregational Church is identified as a receiver within the Cosmetic Damage zones in the vicinity of the proposed works during the use of a 10T vibratory roller and sheet piling rig/excavator attachment. General vibration recommendations and vibration monitoring strategies are provided in Section 8.6.3.

Metro Station Box

The Waterloo Metro Station Box sits either side of the Cope Street Plaza and is considered a reinforced industrial structure and therefore, at low risk from cosmetic or structural damage. The piling and excavation activities for the basement are programmed to be complete before the Metro Station is open to the public and therefore, human comfort vibration impact is not considered further. There may be occasions where high vibration generating activities, such as sheet piling, 10T vibratory roller and excavators using rock hammer attachments are proposed to take place within the 'Safe Working Distance' shown in column 1 of Table 19. When this occurs attended vibration monitoring should take place as per the recommendations in Section 8.6.3.

Vibration Monitoring

Short-term and Long-term monitoring programs are recommended in Section 8.6 where risk of cosmetic damage is identified. However, where a 'reasonable complaint' related to human response to vibration from an affected resident is received, long-term vibration monitoring at the receiver location is recommended.

- Consent Condition D20 stipulates that:
    - Vibration caused by construction at any residence or structure outside the Site must be limited to:

    a) For structural damage when considering sensitive structures, the latest version of DIN 4150-3 (1992-02) *Structural vibration – Effects of vibration on Structures.*

    b) For human exposure to vibration, the evaluation criteria set out in the Environment Noise Management Assessing Vibration: a Technical Guideline (Department of Environment and Conservation, 2006)

General management measures

- Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS 5228-2 or policy documents, such as the NSW DEC Assessing Vibration: A technical guideline.
- Site Induction of all site personnel. Site Induction, Toolbox Talks and Team Meetings are to include a noise and vibration awareness/education component identifying impacts and implementation of control measures for the project. Site inductions are to include:
    - Project specific and standard noise and vibration measures
    - Construction hours of work
    - Nearest sensitive receivers
    - Relevant licence and approval conditions
    - Loading and unloading areas

- Providing workers with training on vibration control measures and equipment can help to minimize noise at the source. Workers should be trained on how to use equipment that produces lower vibration levels and how to implement vibration-reducing techniques.
- Complaints management will be as per the protocol outlined in the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development.
- Reduction of the hours of construction to minimize the prolonged daily exposure of the nearby vibration sensitive receivers.

By implementing management measures, vibration associated with the construction works can be effectively controlled and the impact on the surrounding environment can be minimized.

8.3 Waterloo Congregational Church – Consultation

Effective communication with the adjacent Waterloo Congregational Church is crucial in minimising the impact of construction activities on their daily operations and ensure that any potential conflicts are mitigated. The communication strategy should include regular meetings and updates to inform the church administration of the construction activities. The construction team should also provide the church administration with contact information for any concerns or complaints that may arise during the construction period. Additionally, the construction team should be prepared to adjust the construction methodologies or implement additional noise and vibration control measures, as noted in the above sections, to accommodate the churches need, such as scheduling noisy activities during times outside of church service.

The following communication tools should be implemented during the design stages, and ongoing throughout the construction program as required:

- Pre- and post-construction property visual survey
- Regular progress updates
- Notifications
- Newsletters
- Ongoing detailed design meeting in relation to church operations and impacts.

8.4 Complaint Handling Procedures and Community Liaison

Community consultation will be carried out by the Waterloo Developer (WLD), with supporting information provided by John Holland Group (JHG) to ensure meaningful and effective consultation and communication processes are established and maintained throughout the life of the project in accordance with the Construction Environmental Management Plan (CEMP) and Project Planning Approval requirements. Community consultation and the fostering of positive cooperative relationships assists in managing impacts from noisier operations and alleviating community concerns thereby minimising complaints. This includes the following in consultation with the Sydney Metro:

- Periodic notification of construction activities
- Specific works notification prior to disruptive or noisy activities
- Community consultation meetings
- Notification in accordance with Waterloo Metro Quarter Southern Precinct SSD 10437 Approval Conditions:
  - D9 and D10 – Incident, Notification, Reporting and Response
  - D11, D12 and D13 – Non-Compliance Notification
  - Refer to Appendix D for the Construction Environment Management Plan (WMQ-SITE-JHG-PM-MPL-0005 Environmental Management Plan – Section 12 Improvement)

The Waterloo Developer (WLD) will take the lead on stakeholder and community liaison. JHG is to support the overall management and coordination of stakeholder community liaison and ensuring notifications and consultation are provided within adequate periods. JHG will display 24-hour phone number on site entry points.

All community consultation is to be in accordance with the Community Communication Strategy. Community Communication strategy is to be developed in accordance with contract requirements. Refer to CSWSWL-JHG-SWL-CL-PLN-000001 *Community Communication Strategy: Station Construction and Over Station Development.*

Table 20 presents the reporting and communication summary requirements during the project

Table 20: Reporting and Communication Summary Requirements

Reporting & Communication	Frequency	Responsibility	Report To
Daily Prestart Meetings	Daily	Site Supervisor	Place on Noticeboard
Site Inductions	As Required	Project Manager / Safety Manager	Project Manager / Safety Manager
Monitoring Reports	As occurs	Site Supervisor	Project Manager / HSEQ Manager

All complaints handling is to be in accordance with the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development, the Waterloo ISD CEMP and the Community Consultation Strategy. Complaints will be investigated, reported, documented, actioned and closed out as per the details provided in the Waterloo Metro Quarter Community Communication Strategy Station Construction and Over Station Development and CEMP.

Table 21 below outlines the communication activities and timeframes associated with each activities, as reproduced from the *Community Communication Strategy: Station Construction and Over Station Development* (CSWSWL-JHG-SWL-CL-PLN-000001). An internal review process will ensure the distribution of timely and accurate information within the required timeframes. The Key Issues and mitigation measures, as well as the proposed public communication and engagement tools outlined in the Waterloo Metro Quarter Community Communication Strategy (CSWSWL-JHG-SWL-CL-PLN-000001) has been included in Appendix F and Appendix G of this report.

Table 21: Communication Timelines

Communication timeframes	Timeframes
Planning – Community Communications Strategy	Uploaded on the WMQ website before major construction
Project contact details (1800-number, email and mailing address) hoardings, email updates, community notifications and newsletters	Ongoing
Letterbox notifications to potentially affected stakeholders and community about: • investigations (surveys, drilling, potholing) • vegetation clearing or tree removal • site establishment works including installing environmental controls • start of construction • significant milestones • changes to scope of work • noisy work • changes to traffic conditions • partial or full road closures • modifications to pedestrian routes, cycleways, and bus stops • out-of-hours work • disruption of residential or business access • changes to parking arrangements • changing or disrupting utility services	Delivered monthly to a 200m radius Uploaded on Sydney Metro's website on the day notification is distributed Emailed weekly to distribution list with a weekly lookahead
Traffic Signage and advising: • changes to pedestrian routes • impacts on cycle ways • changing traffic conditions • disrupted access to bus stops	Installed seven days before change

Traffic alert email advising of changes to traffic and access arrangements to transport and traffic stakeholders: • relevant authorities • transport operators (bus, coach, and point-to-point)	Issued seven days before change
Community email progress updates	At regular intervals according to the work activities, generally at least monthly
Condition surveys for eligible property owners	Reports provided to property owners no later than one month before construction commences
Utility service investigations and works – notification to utility authorities	Issued seven days before starting work
Emergency works – door knocks with written notice	Within two hours of starting emergency work
Project advertisements – as required to comply with approvals and advise of significant traffic management changes, detours, traffic disruptions or work outside of working hours contained in the environmental documents	Contact details advertised one month before start of construction Displayed seven days before change
Project update newsletters	Bi-annually
Project website	Updated as required

8.5 Site Inductions

To ensure that effective and consistent communication with the construction team and community, minimise the impact to the surrounding noise sensitive receivers, and mitigation measures are correctly implemented, a site induction is required. to all site personnel. Site inductions are required to ensure that all contractors, subcontractors and other personnel working on and visiting the site are aware of their obligations conveyed by this noise and vibration management sub-plan

The intent of the site induction is to raise awareness and educate site personnel by identifying the impacts of noise and vibration, and the implementation of project specific mitigation and control measures. Site inductions will include the following items to make site workers aware of the project's obligations as detailed in the Acoustic Noise and Vibration Management Plan:

- Site personnel should be made aware of the project specific and standard noise and vibration measures (i.e. site hoardings, localised barriers around high noise generating equipment)
- During periods of work which generate potential of high noise impact (I.e. work exceeding the highly noise affect criteria of L_{Aeq} 75dB) as measured at the nearby noise sensitive receivers. Works must only be undertaken in a continuous block of no more than 3 hours, with at least a 1-hour respite period between each block of work generating high noise impact, where the location of the work is likely to impact the same receivers.
- Standard Construction hours of works
- Construction vehicles must not arrive and depart the site or surrounding residential precincts outside the established construction hours.
- Access pathways to site on the boundary (hoarding / gates) should remain closed at all times when not in use.
- Identification of the nearby noise sensitive receivers
- Complaint handling and communication procedures

- Relevant licence and approval conditions
- Location of loading and unloading areas
- Selection of low-noise tools where possible. All equipment should be well maintained (e.g. serviced, lubricated) to reduce noise.
- Site safety (i.e. Hearing Protection, limiting amount of time an individual is exposed to loud noise sources).

8.6 Noise & Vibration Monitoring Strategy

8.6.1 General Methodology

Noise and vibration levels should be monitored from time to time to ensure that noise generated as a result of remediation and construction activities does not disturb local businesses and residents.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder and in response to any noise or vibration complaints. Where noise and vibration criteria are being exceeded or in response to valid complaints, noise and / or vibration monitoring should be undertaken. This would be performed at the affected property and on site adjacent to the affected receivers.

The results of any noise or vibration monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise and vibration monitoring can take two forms:

Short-term monitoring - Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site, telling them when the noise and vibration criteria are exceeded. Thus, the selection of alternative method on construction or equipment selection is allowed in order to minimise noise and vibration impacts.

Long-term monitoring - Similarly to short-term monitoring, long-term monitoring provides real-time alerts to the builder / site manager when the noise and vibration criteria are exceeded. Instead of someone being on site measuring, noise and vibration loggers are used. Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities.

Both methodologies are complementary and normally used simultaneously providing a significant amount of data via the long-term monitoring, but also providing information on the sources of noise and vibration generating exceedances via the short-term or attended monitoring.

8.6.2 Noise Monitoring Program

Short-term noise monitoring program

Short-term noise monitoring is recommended to:

- Provide real-time assistance and guidance to the subcontractor on site. It is recommended to carry out attended noise monitoring at various locations in proximity of the activity under investigation to determine the noise levels at the most impacted receivers. Measurements should be carried out at the start of each new construction stage or noisy activity as a minimum.
- Respond directly to complaints as part of the complaints handling procedure (Section 8.4 and Appendix A). The results of the short-term monitoring may indicate a requirement for long-term monitoring. This will be determined on a case-by-case basis with the input from the acoustic engineer.
- When a new noisy item of plant is brought onto site for the first time noise measurements may be required to determine compliance with Schedule 1 of the City of Sydney Construction Hours/Noise within the Central Business District (Appendix E).

Long-term noise monitoring program

It is expected that the surrounding noise sensitive receivers may be adversely impacted by the construction works during the excavation phase, with noise levels exceeding the Highly Noise Affected criterion in some phases during the operation of Average Works. As such, long-term monitors are proposed to be installed on the site hoarding to the north and the south of the site as detailed below in Figure 12.

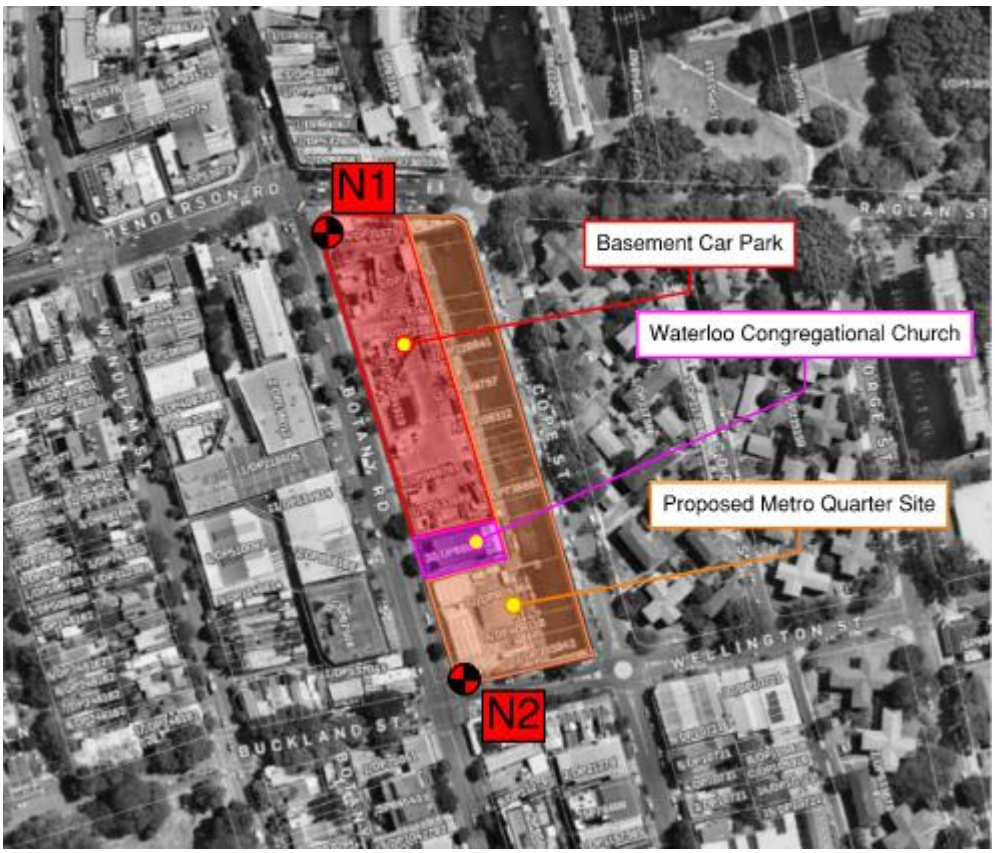


Figure 12: Long-Term Noise Monitoring

The long-term noise monitors are proposed to operate continuously throughout the extent of the construction noise works to assist in determining the impact of construction works on the local environment and communities. Further to this, attended noise monitoring at the various noise sensitive receivers surrounding the site can be conducted as required to assist in tuning the works to minimise impact.

8.6.3 Vibration Monitoring Program

The most at-risk vibration sensitive receivers have been identified and monitors are proposed to be located as close as possible to these receivers. Given the more stringent criteria established for these receivers, compliance with values within these properties will ensure criteria will be met at all other receivers.

It should be noted that additional monitoring locations have been identified in

Table 22 and Table 23 are in addition to what was outlined in *EIS Appendix K – Noise and Vibration Impact Assessment*. At the EIS level, the full extent of construction works (shoring and piling) were not fully known. As more information has been made available, a more detailed assessment has been able to be undertaken which forms the basis of this detailed construction assessment as opposed to the EIS which is conducted as a high-level assessment.

Considerations of Human Comfort

Based on the 'Safe Working' distances for Human Response (provided in Table 19), Figure 9 shows the extent of the receivers that may experience some vibration due to the operation of the 10T Vibratory roller. The typical operation of a roller

is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. Moreover, receivers within 50m of the site are identified as commercial receivers with the highest VDV targets in Table 19. On this basis, there is a low risk of target exceedances when vibration rollers are in use. However, in the event of receiving a 'reasonable complaint' from an affected resident, site measurements and alternative equipment or method, should be considered. Vibration measurements should be undertaken both at close distance of the vibration generating equipment and at the complainant's receiver location. Depending on the nature of the complaint and the receiver location, long and/or short term monitoring will be required. Advice from the acoustic consultant should be sought to determine the correct type of vibration monitoring procedure.

Considerations of Cosmetic Damage

Based on the assessment provided in Section 7.2.2 and Figure 7, Short-term and Long-term monitoring programs are recommended where risk of cosmetic damage is identified.

Short-term monitoring program

To ensure that the vibration generated by the construction activities are capable of meeting the criteria presented in Section 4.2,

Table 22 provides recommended short-term vibration monitoring at locations to be carried out at start of relevant works and when equipment is working at the closest location to the receiver.

Table 22 - Recommended short-term vibration monitoring locations

Sensitive Receiver Details	Equipment
• 125-127 Raglan Street • 47 Botany Road • 60 Botany Road	• 15t Excavator with hammer • Sheet Piling

Long-term monitoring program

To ensure that the vibration generated by the construction activities adhere to the criteria presented in this report, Table 23 provides recommended long-term vibration monitoring locations for high vibration receivers.

Table 23 - Recommended long-term vibration monitoring locations

Sensitive Receiver Details	Equipment
Waterloo Congregational Church*	• 15t/ 40t Excavator with hammer • 15t Excavator with bucket • Bored piling
	• Sheet Piling • 10T Roller – vibratory
Metro Station Box	• 15t/ 40t Excavator with hammer • Sheet Piling • 10T Roller – vibratory

Note: * There is currently a long-term vibration monitor is already installed at the Churched which is accessed and managed by John Holland.

- A suitable location is a location where equipment is working at closest location to the receiver to assess risk.
- As part of the long-term monitoring procedure, short-term attended monitoring at the start of works to establish the safe working distances are recommended. To prevent high vibration levels at a receiver, it is advised to create a

safe working distance by moving equipment closer to it in a gradual approach. If the criterion is exceeded but no damage is observed then a view may be taken to allow the work to proceed at progressively closer distances.

- The monitors should be configured to send a text message via SMS to the site manager or other nominated responsible party once the criterion for each monitor has been breached. By doing so, personnel on site get notified and can act promptly to stop the vibration causing activity and assess the situation as quickly as possible. Action can then be taken to reduce vibration levels and assess the risk of damage before resuming the activity if no further risk is perceived.
- It is important for personnel on site to be aware of vibration triggers that occur within the construction periods, so that they can adjust activities and mitigate impact on the surrounding receivers in a prompt manner.
- Monitoring equipment shall be equipped with visual and/or audible alarms that are triggered when the levels of vibration exceed the control criteria presented in Section 4.2. An operator warning level should be set to 70% of the allowable relevant criteria established in Section 4.2
- The attended vibration monitoring should be undertaken by a qualified acoustic consultant.

General monitoring program notes

- monitoring programme as shown above is to be carried out at locations within the premises listed in
- Table 22 and Table 23as agreed with the Acoustic Engineer and Contractor. Recommended measurement locations:
    - In consideration of cosmetic or structural damage: on the foundations of the most affected building as appropriate
    - In consideration of human comfort: on the occupied floor of the closest building as appropriate
- All vibration monitoring data should be recorded, and the results should be maintained to assess compliance with the criteria.
- If required, a monitoring system to measure vibration and assess the levels against the criteria for human comfort should be implemented.
- Where monitoring is triggered due to attended or un-attended vibration monitoring then the following approach to manage potential vibration impacts on structures shall be conducted prior to the commencement of those works:
    - If any exceedance of the cosmetic building damage criterion is measured, that vibration activity will cease as soon as safe and practicable to do so. A structural engineer should then undertake an inspection to assess relevant structures for movement and damage. Work can resume when and if the risk of damage can be discounted to a low risk and continued monitoring occurs to keep the activity under control.
- Where vibration-intensive equipment is to be used within or close to the Safe Working distances defined in Section 7, It is advised to consult a vibration specialist to determine the proper safe working distances based on attended vibration measurements on site.

8.7 Subcontractor Responsibilities for Noise and Vibration Management

This Construction and Vibration Management Plan (CNVMP) is appended to the document register forming part of subcontracts prepared and administered by John Holland in the delivery of the Waterloo Over Station Development (OSD) John Holland's obligations arising from the CNVMP are passed down onto subcontractors wherever applicable

8.8 Future Professional Acoustic Input

Regular professional acoustic input into the construction planning and construction activities is essential for successful project outcomes. The input can ensure that the project stays on track and that any issues or challenges are identified and addressed as early as possible and resolved in a timely manner.

Professional acoustic input including attended monitoring shall be required as a minimum when:

- Attended noise and/or vibration monitoring shall be undertaken by a professional acoustic consultant/engineer when;
    - a major new construction activity starts on-site,
    - or new noisy plant/machinery is brought onto site (Appendix E),
    - or when there is any major deviation from the noise and vibration assessment scenarios presented in Section 5 and Section 7 of this plan.
- In the event of a complaint, JHG will seek advice from a professional acoustic consultant/ engineer regarding any necessary follow-up actions and additional monitoring if required.

9. Conclusion

A Construction Noise and Vibration Impact Assessment has been provided for the assumed typical construction works for the Basement Car Park over station development (OSD) as part of the Waterloo Metro Quarter Site.

The details of the noise and vibration assessments undertaken to predict the impacts on sensitive receivers have been presented in Sections 5, to 7.

- Noise levels are predicted to exceed the Highly Noise Affected criteria (75 dBA) during all the assumed stages of work at the nearest identified receivers for both average- and worst-case scenarios, the Church being the most affected receiver in most instances. Except in the case of the structure stage where compliance is expected to be demonstrated across all the adjacent receivers.
- ICNG does not set out the Highly Noise Affected Criterion for non-residential receivers. Nevertheless, it should be noted that noise levels are predicted to exceed the Highly Noise Affected criterion (75 dBA) during many of the proposed stages of work at the nearest identified non-residential (i.e. commercial, retail and places of worship) receivers for both average- and worst-case scenarios.
- Noise levels are predicted to exceed the NML during all the assumed stages of work at the nearest identified receivers for various works during both average- and worst-case scenarios.
- Noise levels during all the assumed stages of work are expected to exceed the Noise Management Level by up to 28 dB during the average noise emissions; and up to 31 dB during the Worst-Case assessment scenario for the adjacent Waterloo Congregational Church;
- Noise levels during all the assumed stages of work are expected to comply with the Highly Noise Affected Criteria (75dBA) in most instances during both the Average and Worst-case scenarios for the nearby residential receivers. Except in the Foundation Piling stage, where 1 dB(A) exceedance is expected at the Residential Receiver R2 during the worst-case scenario
- Highest noise levels are produced during the use of concrete/road saws and excavators with breaker attachments;

Based on the above, the proposed construction works have the potential to give rise to adverse noise impacts at identified receivers. Therefore, all reasonable and feasible measures should be applied on site to assist in minimising the overall noise emissions on-site, as per the recommendations in Section 8. It is noted, however, the Average-Case scenario is expected to represent the average noise expected from the entire site at any receiver and expected to representative of the longer-

term average noise emissions. Therefore, this situation represents typical construction noise emissions, which are predicted to be below the Highly Noise Affected criterion at the nearest identified residential receivers in most instances.

A construction traffic noise impact on the surrounding roads has been qualitatively assessed. The traffic noise generated in association with the construction of the proposed development is unlikely to give rise to an adverse impact to nearby residents.

Some residential receivers located north and east of the site are identified to be within the Human Response zone during the operation of vibratory roller only. Since the typical operation of a roller is intermittent and continually moving, accumulated vibration energy over the course of the day at these receivers is unlikely to exceed the recommended targets. However, where 'reasonable complaint' related to human response to vibration from an affected resident is received, long-term vibration monitoring at the receiver location is recommended. Should different construction equipment to those proposed in Table 12 be used, long-term and attended vibration monitoring may be required. This is to ensure that the acceptable levels of vibration are maintained during the use of the vibration intensive equipment, as per vibration limits set out in Section 4.

Waterloo Congregational Church and Metro Station Box are identified as a receivers within the Cosmetic Damage zones in the vicinity of the proposed works during the use of 10T Roller – vibratory, excavator with hammer attachment and sheet piling. General vibration recommendations and vibration monitoring strategies are provided in Section 8.

At other receiver locations sounding the site, the vibration levels are expected to comply with the human comfort and cosmetic vibration targets. Therefore, vibration monitoring for the proposed works is not required. However, should different construction equipment to those proposed in Table 9 be used, long-term and attended vibration monitoring may be required. This is to ensure that the acceptable levels of vibration are satisfied during the use of the vibration intensive equipment as per vibration limits set out in Section 4.

To reduce the noise and vibration impacts on the sensitive receivers, noise and vibration management strategies have been proposed in Section 8. Erecting a sound attenuating barrier around the site and localised barriers around stationary equipment are recommended.

The information presented in this report shall be reviewed if any modifications to the features of the development specified in this report occur, including and not restricted to selection of equipment/machinery and modifications to the proposed construction program.

Appendix A Complaints Response Procedure (example)

All complaints regarding the relevant stage of the construction noise and/or vibration must be recorded in a form with the contact details of at least two main points of contact (e.g. the appointed contractor/developer) provided to the affected parties.

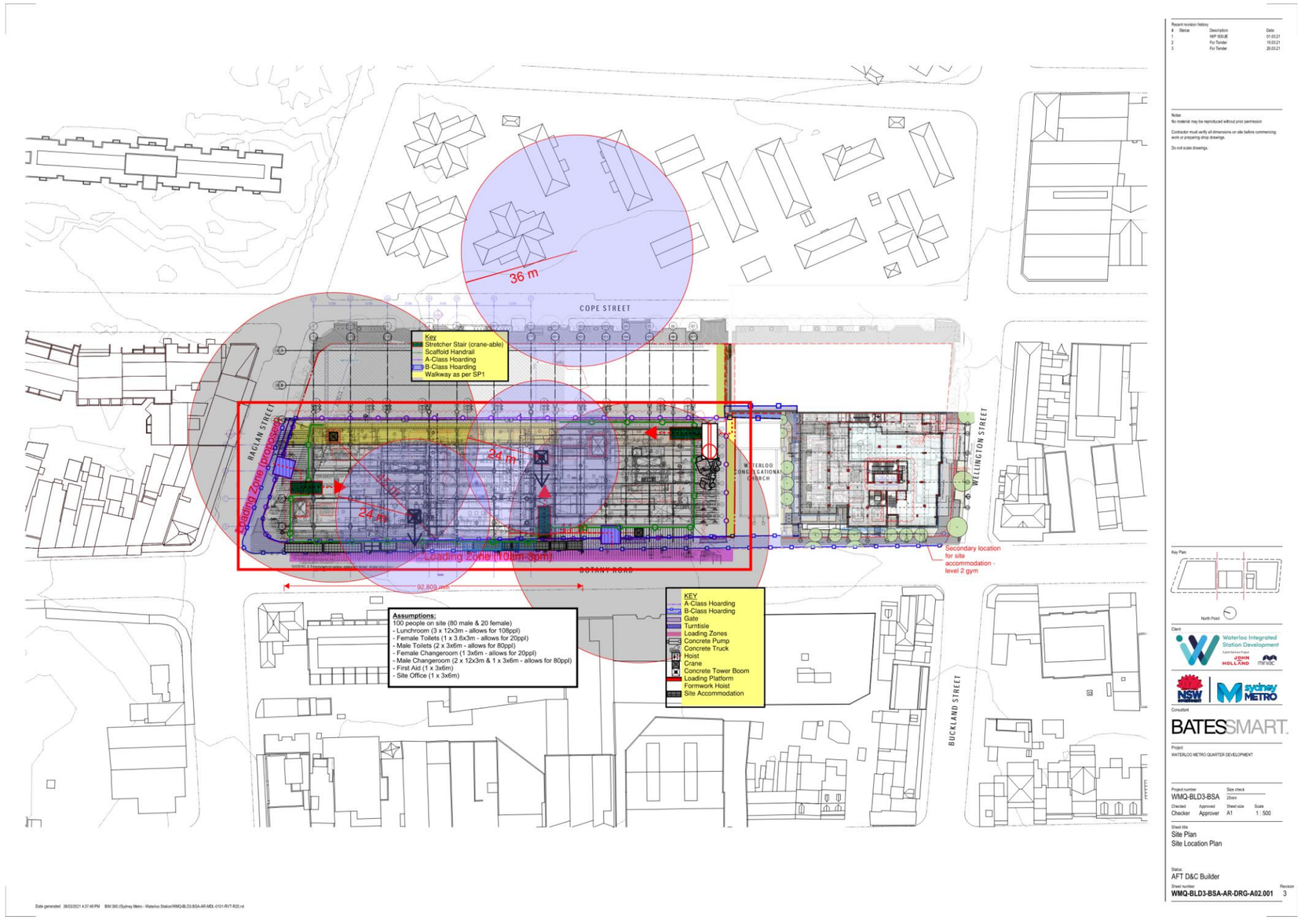
All construction noise and/or vibration complaints should be documented and the following information should be recorded:

- The name, address and contact details of the complainant;
- Time and date the complaint was received and who received it;
- Time and date of the activity that caused the complaint;
- The complainant's description of the activity and its effects;
- Any relief sought by the complainant (e.g. scheduling of the activity).

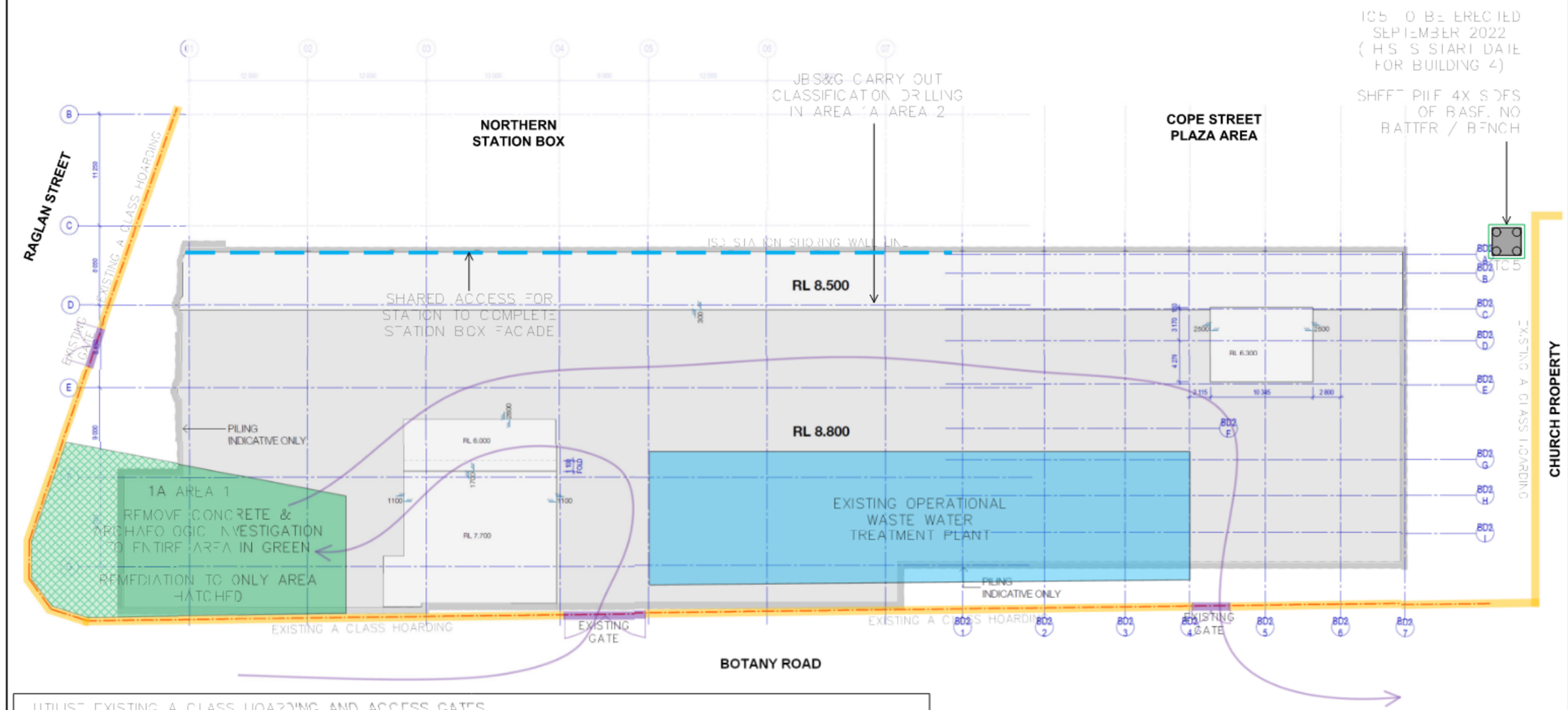
All complaints should be investigated by the appointed contractor/developer representative as soon as practicable using the following steps:

- Assess if the problem can be resolved by reducing noise levels through implementation of the various work practises detailed in this Construction Noise Management Plan.
- Advise the complainant of the action taken and record all details of the conversation.
- Identify the relevant activity and review the activity log to verify the complaint (or otherwise)
- Where it is not practical to stop work immediately, the complainant should be kept updated regularly during the time it takes to stop the activity.
- Review the predicted noise and/or vibration levels to determine if the activity was identified.
- Review the mitigation and management measures in place to ensure they have been applied.
- Review the relief sought by the complainant. Adopt further mitigation and management measures as appropriate.
- Attended monitoring to verify the underlying reference level assumptions
- Report the findings and recommendations to the Project Manager, implement changes and update this CNVMP as appropriate
- Report the outcomes of the investigation to the complainant, identifying where the relief sought by the complainant has been adopted or the reason(s) otherwise.

Appendix B Construction Plans



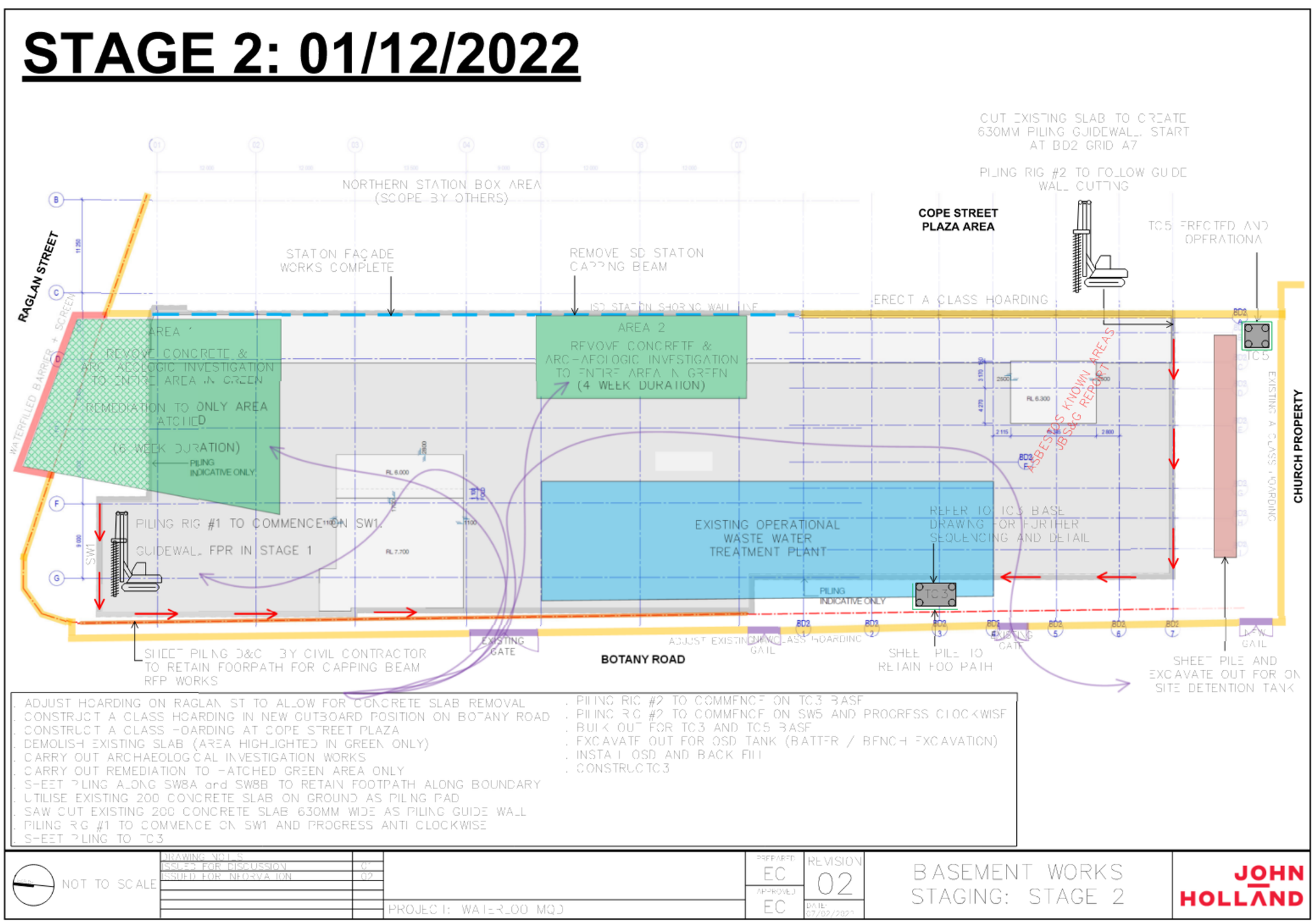
STAGE 1: 30/08/2022



. UTILISE EXISTING A CLASS HOARDING AND ACCESS GATES
. DEMOLISH EXSTING SLAB IN 1A AREA 1
. UTILISE WATERFILLED BARRIERS + GAWK SCREENS ALONG BOUNDARY AT AREA 1A AREA 1 ONLY. 10M LONG RUNS
. CARRY OUT ARCHAEOLOGICAL INVESTIGATION WORKS
. REINSTATE EXISTING A CLASS HOARDING ONTO BOUNDARY PROGRESSVILY
. REMEDIATE 1A AREA 1
. CONSTRUCT PILING PLATFORV IN 1A AREA 1
. CONSTRUCT GUIDE WALL
. SHEET PILE TC5 BASE
. PILES FOR TC5 BASE + TC5 BASE ERP
. ERECT TC5 FOR COMMENCEMENT OF BUILDING 4 WORKS

NOT TO SCALE	DRAWING NOTES			INITIALS EC	REVISION 02	BASEMENT WORKS STAGING: STAGE 1
	ISSUED FOR DISCUSSION	01				
	ISSUED FOR INFORMATION	02				
			PROJECT: WATERLOO MOD	APPROVED EC	DATE 14/02/2023	JOHN HOLLAND

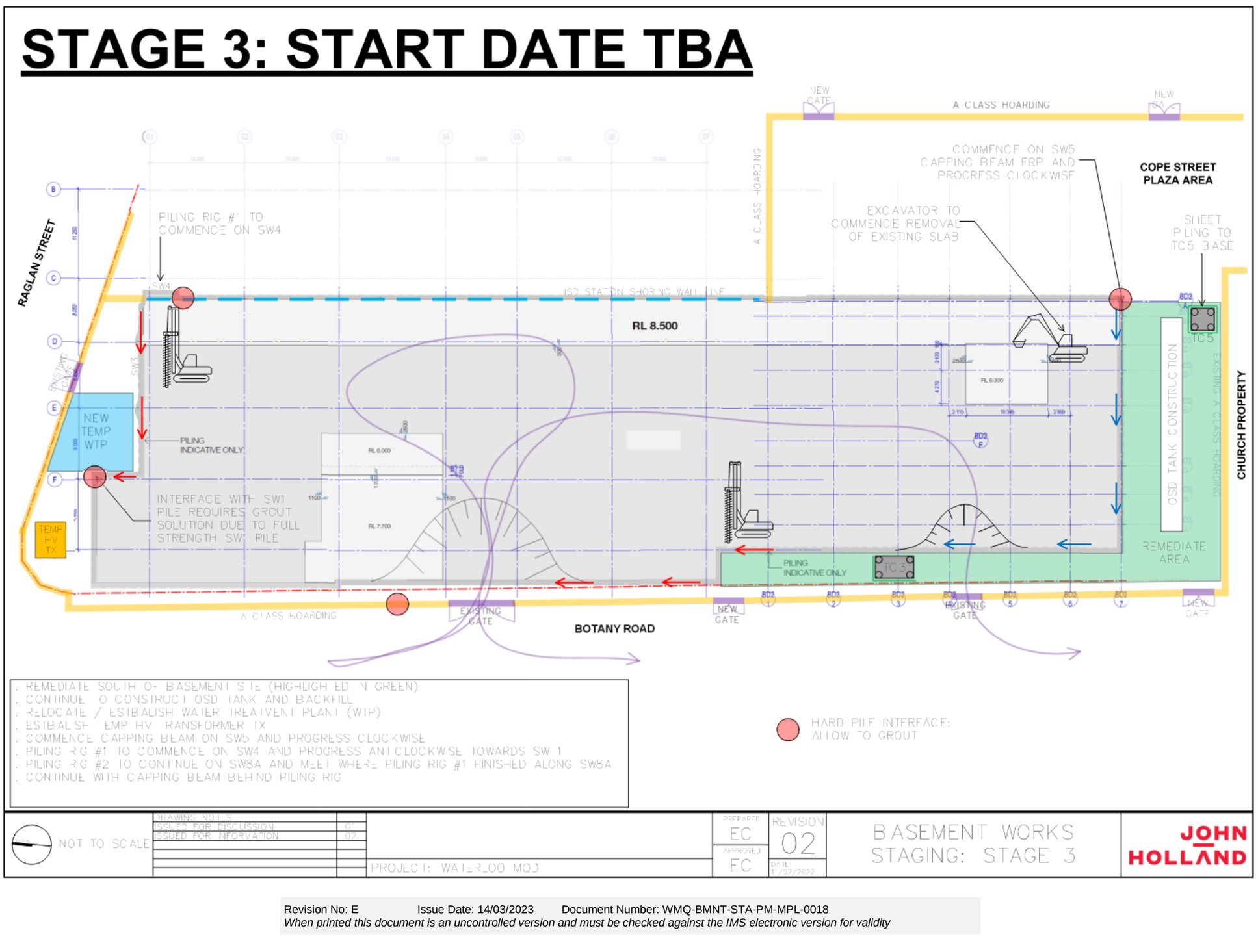
STAGE 2: 01/12/2022



- ADJUST HOARDING ON RAGLAN ST TO ALLOW FOR CONCRETE SLAB REMOVAL
- CONSTRUCT A CLASS HOARDING IN NEW OUTBOARD POSITION ON BOTANY ROAD
- CONSTRUCT A CLASS HOARDING AT COPE STREET PLAZA
- DEMOLISH EXISTING SLAB (AREA HIGHLIGHTED IN GREEN ONLY)
- CARRY OUT ARCHAEOLOGICAL INVESTIGATION WORKS
- CARRY OUT REMEDIATION TO HATCHED GREEN AREA ONLY
- SHEET PILING ALONG SW8A and SW8B TO RETAIN FOOTPATH ALONG BOUNDARY
- UTILISE EXISTING 200 CONCRETE SLAB ON GROUND AS PILING PAD
- SAW CUT EXISTING 200 CONCRETE SLAB 630MM WIDE AS PILING GUIDE WALL
- PILING RIG #1 TO COMMENCE ON SW1 AND PROGRESS ANTI CLOCKWISE
- SHEET PILING TO TC3
- PILING RIG #2 TO COMMENCE ON TC3 BASE
- PILING RIG #2 TO COMMENCE ON SW5 AND PROGRESS CLOCKWISE
- BULK OUT FOR TC3 AND TC5 BASE
- EXCAVATE OUT FOR OSD TANK (BATTER / BENCH EXCAVATION)
- INSTALL OSD AND BACK FILL
- CONSTRUCT C3

NOT TO SCALE	DRAWING NOTES ISSUED FOR DISCUSSION 01 ISSUED FOR NEGOTIATION 02	PROJECT: WATERLOO MQD	PREPARED: EC APPROVED: EC	REVISION 02 DATE: 07/02/2023	BASEMENT WORKS STAGING: STAGE 2	JOHN HOLLAND

STAGE 3: START DATE TBA

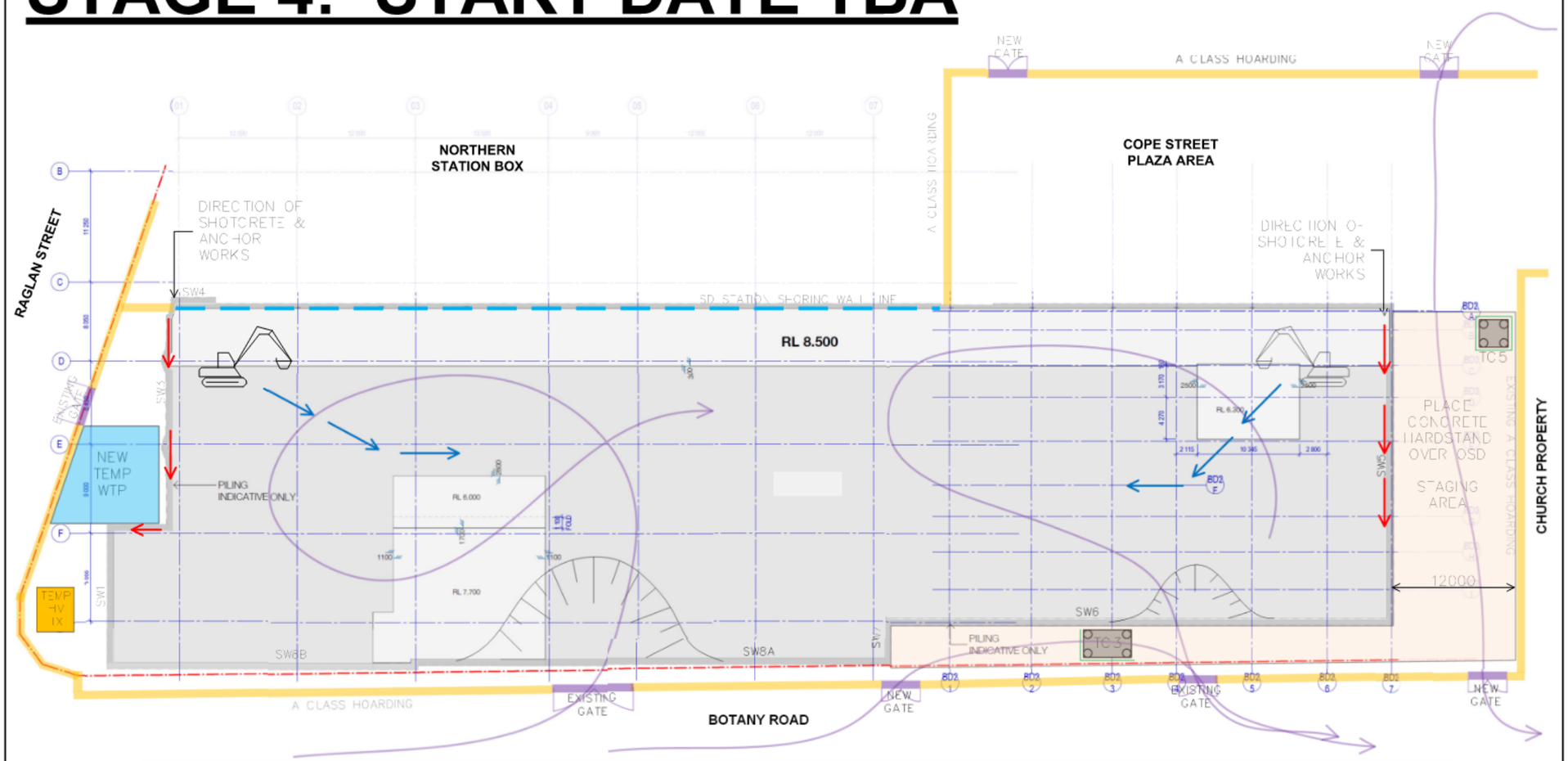


. REMEDIATE SOUTH OF BASEMENT SITE (HIGHLIGHTED IN GREEN)
. CONTINUE TO CONSTRUCT OSD TANK AND BACKFILL
. RELOCATE / ESTABLISH WATER TREATMENT PLANT (WTP)
. ESTABLISH TEMP HV TRANSFORMER TX
. COMMENCE CAPPING BEAM ON SW5 AND PROGRESS CLOCKWISE
. PILING RIG #1 TO COMMENCE ON SW4 AND PROGRESS ANTICLOCKWISE TOWARDS SW1
. PILING RIG #2 TO CONTINUE ON SW8A AND MEET WHERE PILING RIG #1 FINISHED ALONG SW8A
. CONTINUE WITH CAPPING BEAM BEHIND PILING RIG

HARD PILE INTERFACE: ALLOW TO GROUT

NOT TO SCALE	DRAWING NOTES: ISSUED FOR DISCUSSION 01; ISSUED FOR INFORMATION 02	PROJECT: WATERLOO MQ	PREPARED: EC	REVISION 02	BASEMENT WORKS STAGING: STAGE 3	JOHN HOLLAND
			APPROVED: EC	DATE: 1/02/2022		

STAGE 4: START DATE TBA

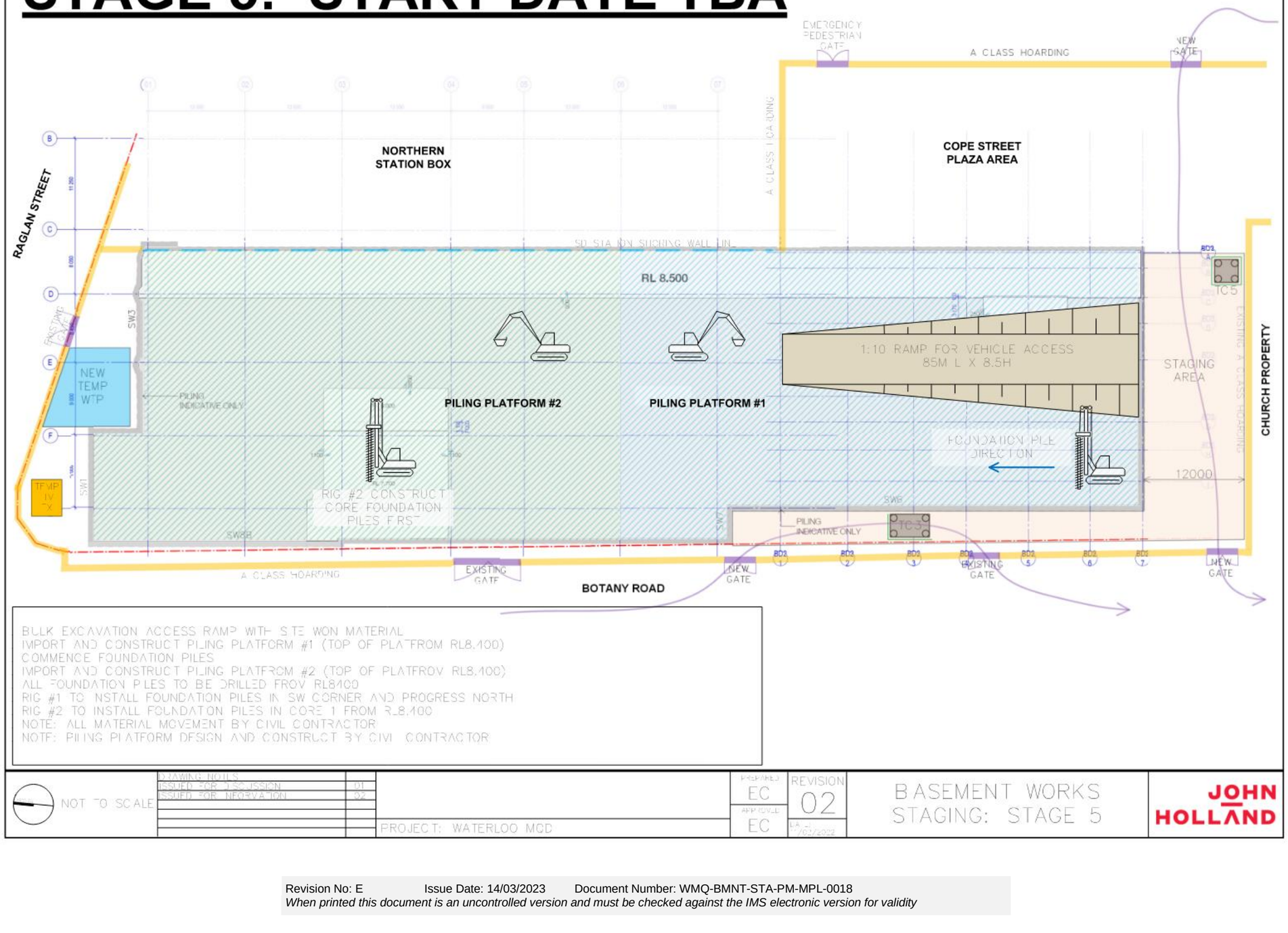


. EXCAVATOR #1 COMMENCE BULK EXCAVATION IN SE CORNER. DOWN 2400 (FIRST DROP)
. EXCAVATOR #2 COMMENCE BULK EXCAVATION IN NE CORNER. DOWN 2400 (FIRST DROP)
. SHOTCRETE SHORING WALL (2000).
. PLACE CONCRETE JERSEY BARRIERS AROUND TC5 BASE
. PLACE CONCRETE HARDSTAND OVER OSD AND FUTURE HAUL ROAD OFF BOTANY ROAD. COVER TC5 BASE
. NOTE: TOWER CRANES TC5 NOT YET ERECTED UNTIL FOUNDATION PILING COMPLETE
. NOTE: TOWER CRANE TC5 ERECTION DATE TBA PENDING HANDOVER OF STATION BOX
. NOTE: UTILISE BOTANY ROAD TO EXPORT MATERIALS VIA TRUCK AND TRAILER (DCG)

. INSTALL ANCHORS AT RL14.000
. CONTINUE TO BULK EXCAVATE 2400 AND SHOTCRETE (SECOND DROP)
. CONTINUE TO BULK EXCAVATE 2400 AND SHOTCRETE (THIRD AND FINAL DROP)
. INSTALL ANCHORS AT RL10.500

NOT TO SCALE	DRAWING NOTES			PREPARED EC	REVISION 02	BASEMENT WORKS STAGING: STAGE 4
	ISSUED FOR DISCUSSION	01				
	ISSUED FOR INFORMATION	02				
			PROJECT: WATERLOO MOD	APPROVED EC	DATE 1/02/2022	JOHN HOLLAND

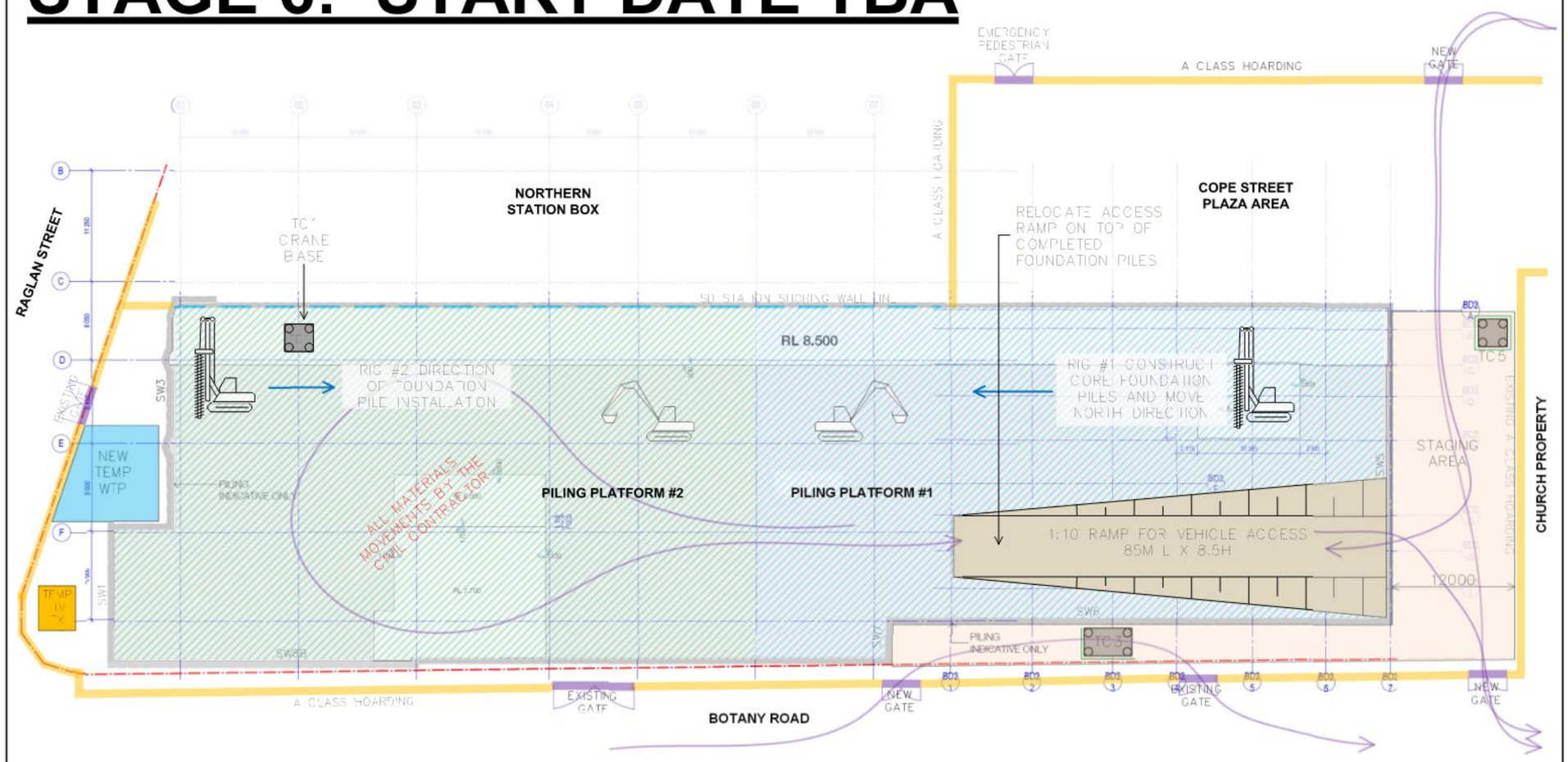
STAGE 5: START DATE TBA



BULK EXCAVATION ACCESS RAMP WITH STE WON MATERIAL
IMPORT AND CONSTRUCT PILING PLATFORM #1 (TOP OF PLATFROM RL8.100)
COMMENCE FOUNDATION PILES
IMPORT AND CONSTRUCT PILING PLATFROM #2 (TOP OF PLATFROV RL8.100)
ALL FOUNDATION PLES TO BE DRILLED FROV RL8100
RIG #1 TO NSTALL FOUNDATION PILES IN SW CORNER AND PROGRESS NORTH
RIG #2 TO INSTALL FOUNDATON PILES IN CORE 1 FROM R_8.100
NOTE: ALL MATERIAL MOVEMENT BY CIVIL CONTRACTOR
NOTF: PILING PLATFORM DESIGN AND CONSTRUCT BY CIVI CONTRACTOR

NOT TO SCALE	DRAWING NOTES ISSUED FOR TSS ISSION ISSUED FOR NFORVATION	01 02	PROJECT: WATERLOO MOD	PREPARED EC APPROVED EC	REVISION 02	BASEMENT WORKS STAGING: STAGE 5	JOHN HOLLAND

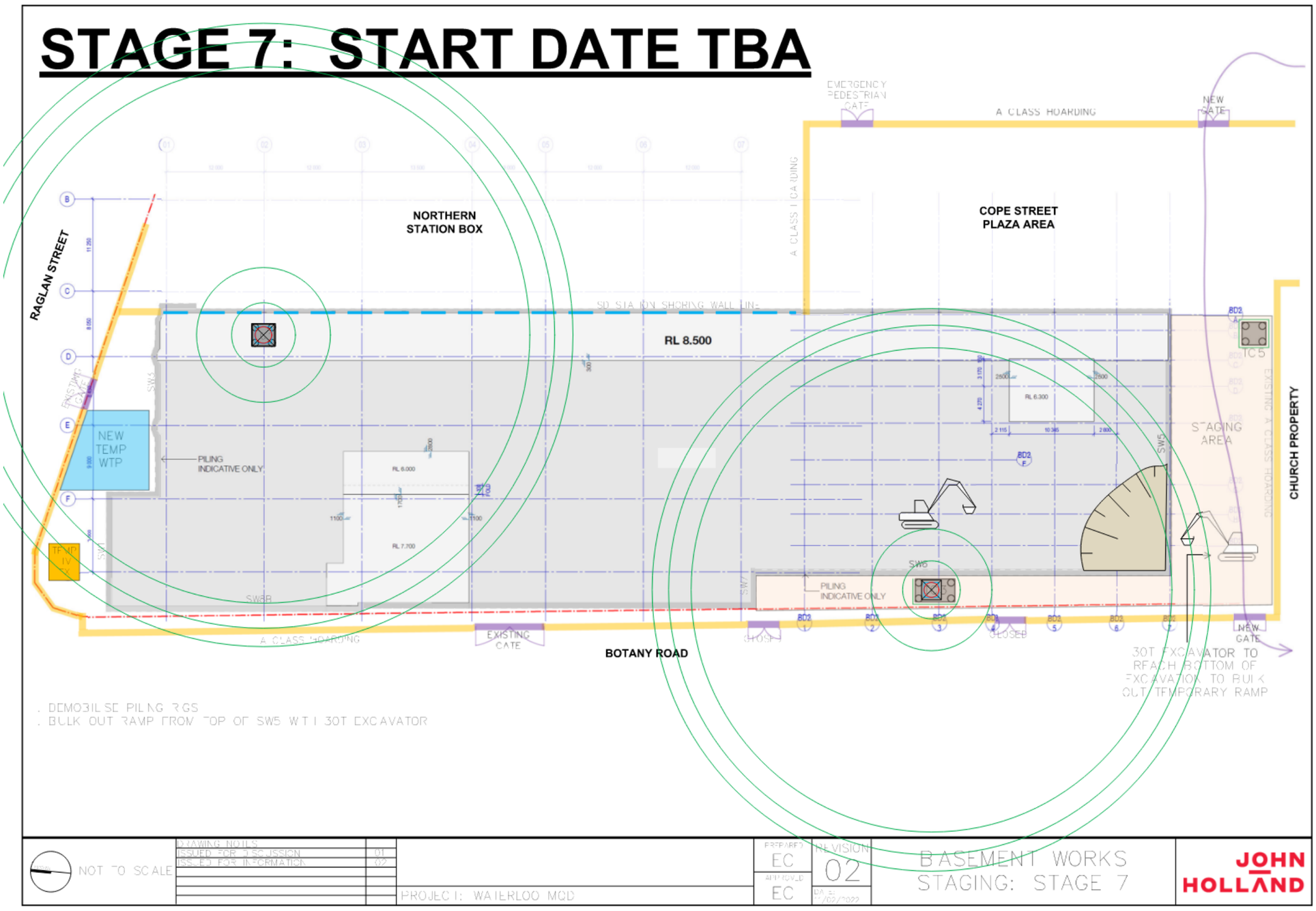
STAGE 6: START DATE TBA



1. RELOCATE TEMPORARY SITE ACCESS RAMP ON TOP OF COMPLETED FOUNDATION PILES (1:10)
2. RIG #1 TO INSTALL LOWER PILES AT CORE 2 AND PROGRESS NORTH
3. RIG #2 TO INSTALL PILES FROM NORTH EAST CORNER AND PROGRESS EAST
4. CONSTRUCT TC1 BASE
5. CONSTRUCT TC1 BASE (INCLUDING PILES) AND ERECT TC1 FROM WITHIN BASEMENT FOOTPRINT
6. ERECT TC3 TROV WITHIN BASEMENT FOOTPRINT
7. NOTE: ALL MATERIAL MOVEMENTS BY THE CIVIL CONTRACTOR

NOT TO SCALE	DRAWING NOTES			PREPARED EC	REVISION 02	BASEMENT WORKS STAGING: STAGE 6
	ISSUED FOR DISCUSSION	01				
	ISSUED FOR REVISION	02				
			PROJECT: WATERLOO MOD	APPROVED EC	DATE 7/03/2023	JOHN HOLLAND

STAGE 7: START DATE TBA



Appendix C Structural Engineer's Assessment of Waterloo Congregational Church

From: James Taylor <jtaylor@jamestaylorassociates.com.au>
Sent: Thursday, August 3, 2017 4:52:41 PM
To: Elliot Nuberg
Subject: Waterloo Congregational Chapel, Botany Road

Elliot
As you are aware I attended site yesterday morning in company with Brendan Jolliffe from Delta Group and several other parties.
I inspected the general condition of the church building.
There are several very minor brick cracks in brickwork which are certainly not new.
One, internal, lies over the lintel leading to the kitchen at the rear of the church.
Upstairs in the rear of the church there is cracking evident around some of the windows.
There is evidence of other very minor cracks over some of the windows in the external skin.
These have been repaired at some stage in the past.
However, the cracking described above represents very minor distress in the building fabric.
Generally the building is in sound condition and obviously adequately founded. Demolition works alongside, as planned, would not need to have any extra conditions placed upon them other than the standard care applied to building or demolition works abutting heritage buildings.
Should you require any further information please contact me
James
--

James Taylor

James Taylor and Associates

Civil and Structural Consulting Engineers

T +61 2 9969 1999

M +61 413 996931

www.jamestaylorassociates.com.au

Appendix D Incidents, non-conformity and corrective action

12 Improvement

12.1 Incidents, non-conformity and corrective action

EMS reference
Non-conformance and Corrective Action JH-MPR-SQE-007
Incident and Event Management JH-MPR-SQE-010

When a nonconformity (including an incident, or a verified complaint) occurs, the Project shall:

- react to the nonconformity and, as applicable:
  - take action to control and correct it;
  - deal with the consequences, including mitigating adverse environmental impacts;
- evaluate the need for action to eliminate the causes of the nonconformity, in order that it does not recur or occur elsewhere, by:
  - reviewing the nonconformity;
  - determining the causes of the nonconformity;
  - determining if similar nonconformities exist, or could potentially occur;
- implement any action needed;
- review the effectiveness of any corrective action taken;
- make changes to the environmental management system, if necessary

Corrective actions shall be appropriate to the significance of the effects of the nonconformities encountered, including the environmental impact(s).

12.1.1 Compliance Reporting

The Project shall retain documented information as evidence of:

- the nature of the nonconformities and any subsequent actions taken;
- the results of any corrective action

Nonconformities will be documented internally using the resources outlined in Table 16 Nonconformity management.

Table 16 Nonconformity management

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Event and Incident Records	Project Environment Representative	Soteria
Non Conformance (system) Records	Project Environment Representative	Soteria
Actions Arising	Project Environment Representative	Soteria

12.1.2 Reporting Non-Compliances

The monitoring and reporting programme prepared in accordance with the Compliance Reporting Post Approval Requirements (Department 2020) will be implemented during the project. Compliance Reports of the project will be carried out in accordance with the Compliance Reporting Post Approval Requirements (Department 2020).

DPE must be notified in writing to compliance@planning.nsw.gov.au within seven days after John Holland becomes aware of any non-compliance with the SSD approvals. Notification to DPE will be completed by WLD as the Proponent.

The Certifying Authority must also notify DPIE in writing to compliance@planning.nsw.gov.au within seven days after they identify any non-compliance. The notification must identify the development and the application number for it, set out the condition of consent that the development is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.

12.1.3 Reporting Incidents

DPE must be notified in writing to compliance@planning.nsw.gov.au immediately after John Holland becomes aware of an incident. Notification to DPE will be completed by WLD as the Proponent. The notification must identify the development (including the development application number and the name of the development if it has one) and set out the location and nature of the incident. Subsequent notification must be given and reports submitted in accordance with the requirements set out in Appendix 6

12.2 Accountable Culture Tool (ACT)

EMS reference
Incident and Event Management JH-MPR-SQE-010
Counselling and Disciplinary Procedure JH-MPR-PPL-012

The Accountable Culture Tool (ACT) is designed for line managers to help them to understand, categorise and address appropriate actions of their staff, work force and subcontractors in a fair and just way.

The ACT is a step-by step decision making tool that provides managers with a structured process to address an event and the people involved in a constructive way and not simply react on the outcome. It also encourages the recognition of positive performance. The management of the ACT is outlined in Table 17.

Table 17: Accountable Culture Tool management

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Event Records	Project Environment Representative	Soteria
Reward and recognition records	HR Representative	Success Factors Aconex
Counselling and disciplinary records	HR Representative	Success Factors Aconex

12.3 Continual improvement

EMS reference
Monitoring and Review JH-MPR-SQE-002
Project Completion Procedure JH-MPR-PMA-016

The Project will continually improve the suitability, adequacy and effectiveness of the John Holland EMS to enhance environmental performance. This will be documented and managed using the tools outlined in Table 18.

Table 18: Continual improvement

Required Project documentation	Responsibility	JH tools to be used by Project to manage documentation
Actions Arising	Project Environment Representative	Soteria
Lessons Learned	Project Environment Representative	SharePoint – HSE Alerts and Lessons Learned & Workplace

Appendix E City of Sydney Construction Hours/Noise within the Central Business District – Schedule 1

Group A (See Note 2)	Group B 90dB(A)	Group C 85dB(A)	Group D 80dB(A)	Group E 75dB(A)	Group F dB(A)
Pile Drivers Hydraulic Hammers Machine mounted rock breakers Sand blasters Steam Cleaners Mole borers	Earthmoving equipment of engine capacity above 200kW Warning sirens* Reversing alarms+ Trucks	Impulsive tools – air, electric or hydraulic Earthmoving equipment of engine capacity between 100kW and 200kW NEP Explosive power tools Impact wrenches Refuse chutes* Scabblers Chain saws Rock drills	Concrete agitators Concrete pumps Concrete saws Cranes (fixed) Cranes (mobile) Earthmoving equipment up to and including engine capacities of 100kW NEP Concrete Vibrators Portable hand tools Vibratory compacters	Air compressors above 170L/s capacity Construction dumpers over $1m^3$ capacity Public address system* Internal combustion or electrically driven equipment (unless group elsewhere) over 14kW NEP	Air compressors up to 170L/s capacity Fluid pumps Internal combustion or electrically driven equipment (unless group elsewhere) up to 14kW NEP

* To be measured at the site boundary closest to the affected area.

+ Reversing alarms must be controlled so that noise levels produced do not exceed the background sound level by more than 10dB(A)

Notes:

1. Where any appliance is unable to comply with the allowable noise level, para 43 applies.
2. A Certificate of Acoustic Performance shall be provided for each appliance listed in Group A.
3. All noise levels are to be $L_{A\ av\ max}$ (1 minute) measured at 7m from the point nearest to an Appliance.
4. "NEP" means the Net Engine Power and shall be determined in accordance with Australian Design Rule No.28/00 External Noise of Motor Vehicles, Other Than L-Group Vehicles dated March 1989

Para 43

Where an Applicant is required to undertake Noise Monitoring during Category 2, 3 and 4 Hours, the Applicant must ensure that Noise Monitoring is conducted:

a. During the hours required;
b. At the locations (if any) specified;
c. By a Noise Monitoring Technician; and
d. In accordance with Form B

Appendix F Communication - Key Issues and mitigation measures

8.4 Key issues and mitigation measures

Our aim during station construction and WMQ construction works is to minimise impacts to the community, nearby businesses, and residents. Our engagement strategies will provide opportunities to receive feedback throughout the construction stages.

The S&CLT will respond to the below issues by ensuring teams are briefed and aware of the local stakeholders, provide timely and transparent information and, where possible, reschedule noisy activities.

The issues management objectives are to:

- establish and maintain ongoing interfaces with internal stakeholders to identify potential issues or emerging concerns
- evaluate community feedback and/or complaints on a regular basis to identify emerging trends
- train personnel to be able to identify and resolve issues in consultation with the S&CLT
- respond in a timely manner to internal and external stakeholder concerns to prevent the escalation of an issue.

Table 2 - Key issues and mitigation measures

Issues	Communication and mitigation measures
Engagement and consultation within a COVID-19 environment	• Implement online communication channels to support robust engagement and consultation
Community concerns about the over station development	• Reinforce the concept plan approval • Reinforce improvements to the concept design • Implementation robust engagement strategy and accompanying communication material to support the development approval, placemaking strategy and subsequent start to construction •
Cumulative impacts of other metro contractors, concurrent private or public local developments and Waterloo Estate social housing redevelopments	• Coordinate communications with Land and Housing Corporation and other government agencies via contractor interface meetings • Community notifications and email updates, wherever possible, to include other private or public contractors working in the area • Interface meetings with other Sydney Metro contractors to collaborate on communications and community notifications • Interface meetings with Waterloo Redevelopment Group about the Waterloo Estate social housing redevelopment • One-on-one meetings and doorknocks, as required • Attend key stakeholder meetings to communicate project information

Issues	Communication and mitigation measures
Changes to pedestrian, parking, and customer access for businesses	• Construction Traffic Management Plan • Construction Environmental Management Plan • Include information in induction packs and toolbox meetings to ensure customer parking on private property is unaffected • One-on-one consultation about business operations and requirements • Regular notifications about pedestrian, parking, or customer access • Wayfinding and directional signage
Construction traffic	• Construction Traffic Management Plan • Construction Environmental Management Plan • Implement site-specific traffic management plans • Construction traffic minimised in peak times, where possible • Heavy vehicle specific access and egress locations and routes to minimise local congestion • Truck driver inductions and toolbox meetings on localised conditions • Out-of-hours deliveries to minimise impacts of oversized vehicles on local roads • Traffic and Transport Liaison Group attendance • 24-hour community information line • Community notifications and newsletters to include any changes to construction traffic levels
Construction noise and vibration	• Construction Environmental Management Plan & Construction Noise and Vibration Impact Statements • Noise minimised through use of appropriate plant, tools selection, and construction techniques • Regular notifications and newsletters about upcoming work • Community site signage displaying 24-hour community information line • Early engagement with neighbouring stakeholders on likely noise and vibration impacts with specific focus on noise sensitive stakeholders • High impact noise staged with respite periods, as required • Staff induction and toolbox meetings before noisy activities to highlight acceptable workforce behaviour • Noise and vibration monitoring, as required • Respite offers e.g. alternative accommodation or vouchers, as required
Dust from worksite activities	• Construction Environmental Management Plan • Minimise dust using water carts, street sweepers, water hoses, hard stands, shade cloth and limiting activities on windy days, where possible • Community site signage displaying 24-hour community information line
Out-of-hours construction work (ISD CoA) Station works only.	• Construction Environmental Management Plan • Regular notifications and newsletters about upcoming work • One-on-one meetings, as required • Doorknocks, as required • Community contact information • Noise and vibration monitoring • Respite offers e.g. alternative accommodation or vouchers, as required
Duplication of information by Sydney Metro contractors working at Waterloo	• Weekly meeting with Sydney Metro to coordinate communications, public materials, work notifications and activities • Interface meetings with other project contractors • One-on-one meetings, on request

Issues	Communication and mitigation measures
Changes to the designs since consultation i.e. changes to road configuration or transport arrangements	• Regular notifications and newsletters about design elements and upcoming work • One-on-one meetings, as required.

Appendix G Public Communication and Engagement Tools

Table 5 - Public communication and engagement tools

Tool	Purpose	Responsibility	Frequency/ milestone
Community contact			
Sydney Metro Community Information Line 1800 171 386	All enquiries and complaints to the 1800 number will be referred to the WMQ S&CLT. Provides access to the WMQ S&CLT and included on all public communication material.	Sydney Metro S&CLT	Ongoing 24/7 on-call roster to respond to complaints
Sydney Metro project email address	All enquiries and complaints to the project email will be referred to the WMQ S&CLT at waterloometro@transport.nsw.gov.au. Provides access to the S&CLT team and included on all public communication material.	Sydney Metro S&CLT	Ongoing
Community post box	Postal address at Sydney Metro, PO Box K659, Haymarket, NSW 1240 allows stakeholders to access the Waterloo ISD team in writing. Public communication materials to include postal address.	Sydney Metro S&CLT	Ongoing
Sydney Metro social media	Sydney Metro social media posts, including upcoming activities, construction progress and unexpected changes to the construction program. Project updates to Sydney Metro.	Sydney Metro S&CLT	As required As required
Information tools			
Newsletter	Newsletters will include the progress of planning and construction works, such as key milestones and planned activities during the next six months, community contact details, relevant photos, maps, and illustrations. Newsletters distributed within a 500-metre radius of the site.	S&CLT	Bi-annually
Community emails	Email updates to inform the community of the progress of the Waterloo Station, Waterloo Metro Quarter planning approvals, and key milestones or upcoming activities. Stakeholders and community will register to receive these updates. Stakeholders registered in the Consultation Manager database will receive the community email updates.	S&CLT	As required

Tool	Purpose	Responsibility	Frequency/ milestone
Photography, time-lapse photography, and videography	Record construction progress and use to explain the works in consultation forums, publications, and media. S&CLT to coordinate, provide access and escort Sydney Metro photographers and videographers on site to capture images and videos.	S&CLT	Monthly or as required
Animation	Use animation to explain construction staging and works in consultation forums, publications, and media. S&CLT to coordinate and prepare animation on behalf of Sydney Metro.	S&CLT	As required for project status updates
Site signage and hoarding	Sydney Metro branding to identify the site. Site signage used to identify the project, provide contact information, and explain why the project is needed. Signage to advise of activities that could potentially impact stakeholders, for example, changes to pedestrian routes and traffic conditions.	S&CLT	Site establishment, then as required
Online tools			
Sydney Metro website	Sydney Metro website www.sydneymetro.info will be referenced in all communication materials as a source of information. Updates provided in pdf format to be uploaded onto the Sydney Metro website e.g. community notifications and newsletters.	Sydney Metro S&CLT	Throughout the project and 12 months after completion of the project
WMQ contractor website	Provides information about the project's activities along with required for compliance with Conditions of Approval or other planning requirements, including the approved CCS. Contractor website will display: • management plans and CCS • Contact information • artist's impressions of the WMQ • information provided to comply with the Minister's Conditions of Approval • executive summaries of publicly available reports about WMQ activities • employment or supplier opportunities.	S&CLT	Ongoing and available for 12 months after completion of the project

Tool	Purpose	Responsibility	Frequency/ milestone
John Holland and Mirvac corporate communications	Approval of marketing and promotional material and project updates displayed on parent company's online or print media.	S&CLT	Updates as required and approved
Microsoft Teams, Skype, Zoom, etc.	Use of Skype, Microsoft Teams and Zoom will be considered for stakeholders unable to meet face to face for health or other personal reasons.	S&CLT	On request
Face-to-face interactions			
Sydney Metro education program	Provide site personnel with construction knowledge to support the education program. Provide site-specific information and photographs to include in the school education program.	Sydney Metro S&CLT	On request
Door-knocks	Used to discuss potential high-impact activities of the project and primarily focused on neighbouring residents and businesses directly impacted by construction activities. Opportunity to provide written project information updates and proactive engagement.	S&CLT	As required
Meetings with individuals and groups	Discuss project activities, including work in progress, upcoming activities, and any associated issues. Meetings will also be used to discuss potential impacts and proposed mitigation measures.	S&CLT	As required
Site visits	Site visits planned and coordinated by Sydney Metro, John Holland and Mirvac for key stakeholders and local community. WMQ to provide safe access to site and personal protective equipment as required.	Sydney Metro S&CLT	As required
Presentations and forums	Inform stakeholders about the progress of the project and any key milestones or activities being carried out. Collateral for forums and presentations will be developed and appropriate project personnel / subject matter experts will attend and/or participate as requested.	S&CLT	As required

Tool	Purpose	Responsibility	Frequency/ milestone
Community events	Opportunities to participate in or provide information at local community events. Provide site-specific information at community events with appropriate personnel or subject matter experts from the project in attendance.	Sydney Metro S&CLT	Quarterly community connect session and monthly outreach program in partnership with Mission Australia and Oz Harvest.
Notifications			
Community notification	Written notifications provided about upcoming work likely to impact stakeholders, residents, businesses, and relevant utility service authorities. Project contact details will be referenced within communication material to inform readers on how to contact the project team. Notifications will confirm construction commencement, out-of-hours work, work locations, changes to pedestrian or traffic conditions, any planned disruption to business services or property access.	S&CLT	Monthly construction update distributed to 200m radius When required task specific notifications will be distributed 7 days prior to an activity commencing as a minimum.
Emergency works notification	Written and verbal notification provided to properties immediately adjacent to or impacted by emergency works.	S&CLT	Two hours prior
Authority notification	Notification to relevant authorities before commencement of any utility services work.	S&CLT	Five business days prior
Traffic communication			
Community signage	Signage that identifies changes to traffic and access arrangements before: • making changes to pedestrian routes • making changes to platforms or concourses • impacting on cycle ways • changing traffic conditions • disrupting access to bus stops.	S&CLT	Five business days prior

Tool	Purpose	Responsibility	Frequency/ milestone
Traffic alert email	Traffic alert emails advising of traffic and access arrangements must be sent to relevant authorities and transport operators, including bus, coach, and taxi operators.	S&CLT	Five business days before changes
Advertisements	Traffic notice in local print newspaper to inform the local community of detours, road closures or major changes to the existing traffic conditions.	S&CLT	Five business days before changes
Briefings and media			
Members of Parliament briefings	Provides project updates. Briefings and updates at Sydney Metro's request.	Sydney Metro S&CLT	As required
Media briefings or events	Provides project updates and/or access to site. Briefing and updates at Sydney Metro's request.	Sydney Metro S&CLT	As required
Training			
Site inductions/toolbox talks/training	Used to present information to workers about the project's stakeholder and community liaison requirements and obligations. Relevant hand-outs will be provided.	S&CLT	Before worker commences with the project

w

Level 6, Building B
207 Pacific Highway
St Leonards NSW 2065
Tel +61 2 8484 7000

Stantec

Connect with us

stantec.com/australia