

# **IMPACT ASSESSMENT REPORT & MONITORING PLAN**

## **SYDNEY METRO CITY & SOUTHWEST RAIL CORRIDOR**

### **PURPOSE BUILT STUDENT ACCOMMODATION**

#### **104-116 REGENT STREET REDFERN, SYDNEY NSW**

**December 2021**

<b>Site:</b>	104-116 Regent Street Redfern, Sydney NSW
<b>Developer:</b>	The Trust Company (Australia) Limited ATF WH Regent Trust
<b>Builder:</b>	TBA
<b>Report Ref:</b>	GKA REG 004
<b>Date:</b>	7 December 2021



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## Proprietary Information Statement

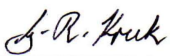
This Impact Assessment Report & Monitoring Plan has been prepared for The Trust Company (Australia) Limited ATF WH Redfern Trust (WH Redfern Trust) to satisfy Sydney Metro Underground Corridor Protection Technical Guidelines.

The document sets out the processes and procedures that will be put in place to ensure that the impact of excavation and construction works at 104-116 Regent Street Redfern, Sydney NSW adjacent to and over the Sydney Metro City & Southwest is limited to the specified performance requirements of the Sydney Metro approval. The document also satisfies the requirement for a Summary Report prescribed in section 7.8 of the Sydney Metro Underground Corridor Protection Technical Guidelines.

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## Authorisation and Revision History

### Authorisation Record

Role	Name	Organisation	Signature	Date
Approved by:	George Kruk	GKA Management		07.12.21

### Document Control

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### Issue Record

Copy No	Name	Position	Company	Date
1	Mark Surtees	Development Manager	WH Redfern Trust	07.12.21
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## 1.0 Executive Summary

The development at 104-116 Regent Street Redfern has been classified as a State Significant Development (SSD 12618001). As such the provisions of State Environmental Planning Policy (Infrastructure) 2007 do not apply and therefore Sydney Metro concurrence is not required.

Nevertheless, processes and procedures have been developed to assess and mitigate impacts on the Sydney Metro City & Southwest twin rail tunnels that run adjacent to and underneath the development.

The processes and procedures have been documented in this Impact Assessment Report & Monitoring Plan (IAR&MP). The purpose of the processes and procedures is to ensure the safety and integrity of railway infrastructure and future railway operations, and to mitigate within agreed limits any potential impact of demolition, excavation and construction activities related to the development.

The IAR&MP addresses the requirements set out in the Transport for New South Wales (TfNSW) Assets Standards Authority Development Near Rail Tunnels (T HR CI 12051 ST) Standard Version 2 dated 15 November 2018 (TfNSW Tunnel Standard) and the TfNSW Sydney Metro Underground Corridor Protection Technical Guidelines (iCentral SM-20-00081444) Version 2 dated April 2021 (Sydney Metro Technical Guidelines).

Engineering assessments undertaken by WH Redfern Trust consultants have determined that the impact of demolition, excavation and construction activities on railway infrastructure and future railway operations is within or can be managed within allowable limits prescribed in the Sydney Metro Technical Guidelines.

The IAR&MP is based on recommendations contained in consultant engineering reports including monitoring reports (where developed) and will be amended to address any additional requirements notified by Sydney Metro. In the event of any inconsistency between requirements documented in the engineering reports or comments provided by Sydney Metro and requirements set out in this IAR&MP then the requirements of the IAR&MP will take precedence. The conditions documented in the IAR&MP cannot be varied without prior consultation with, and endorsement by, Sydney Metro.

The IAR&MP must be read in conjunction with all relevant project management documents including but not limited to the Site Specific Work Health and Safety Management Plan (when produced) and the Rail Risk Management Plan (GKA REG 003).

## 2.0 Project Background

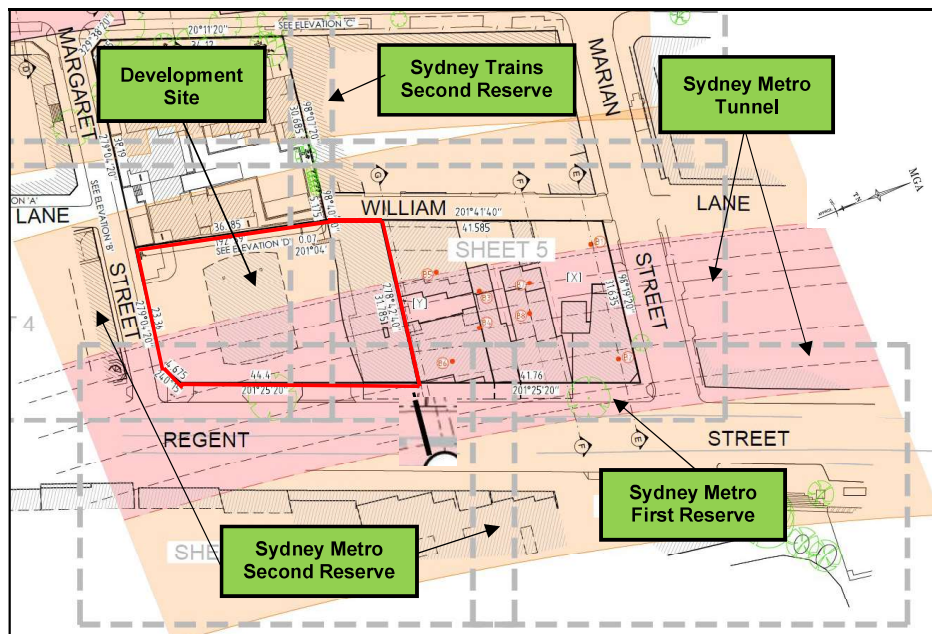
The project consists of the construction of an 18 storey mixed-use building accommodating ground floor retail premises and 411 bed student housing accommodation with indoor and outdoor communal spaces, on-site bicycle parking and ancillary facilities. student accommodation building.

In particular, the proposal comprises the redevelopment of the site as summarised below:

- Construction of an 18-storey building comprising a total of 9,562m<sup>2</sup> gross floor area with a mix of land use activities including:

- Ground (Level 1): 72m<sup>2</sup> of retail floor space, 490 m<sup>2</sup> of commercial area for the student accommodation, 102 bicycle parking spaces, loading and waste management facilities and ancillary services and facilities.
- Upper levels: student accommodation providing a total of 411 beds, including ensuite rooms, studios and two-bedroom configurations, with indoor and outdoor communal spaces on Levels 2, 4 and 16 and additional indoor communal areas on Levels 2 and 4.
- Hard and soft landscaping within the outdoor communal terraces on the roof-top of the podium level and Levels 4 and 16; and
- Public domain improvements including provision of a landscaped through-site link connecting William Lane to Margaret Street and associated improvements to the Regent Street and Margaret Street frontages, including awnings and footpath upgrades.

An overlay of the project site and Sydney Metro rail tunnels is shown in Figure 2-1.

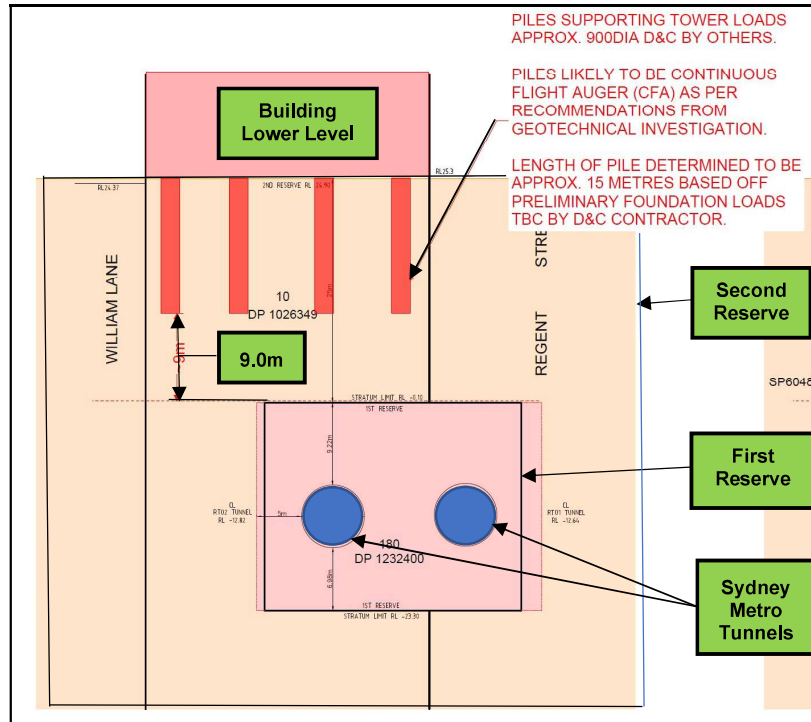


**Figure 2-1 Sydney Metro Property Overlay**

The site is bordered by Regent Street to the east and Margaret Street to the south. The site is roughly trapezoidal in shape with an area of approximately 1400 m<sup>2</sup>. It is understood that additional fill has been placed to level the southern part of the site with granular soils. The nature and extent of compaction undertaken during the placement of the fill is not known.

Two similar 18-storey student accommodation developments, each with a single basement, will be constructed to the north and west of the site. The two adjacent developments are expected to be constructed prior to works commencing on the site.

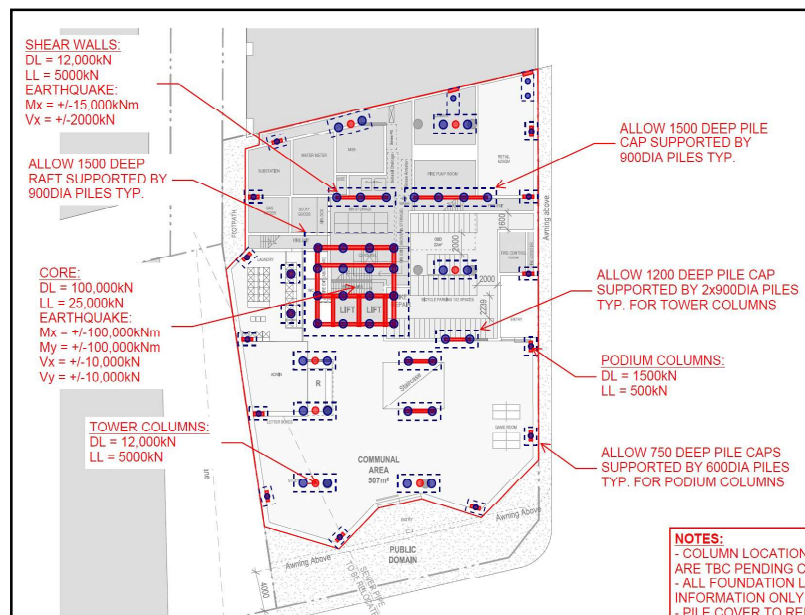
The Sydney Metro City & Southwest twin rail tunnels run adjacent to and underneath the site. The tunnels are approximately 7m in diameter and have a segmental concrete lining typical of this type of structure. A cross through the site is shown in Figure 2-2.



**Figure 2-2 Section 1 Cross Section**

All structural building support elements are clear of the Sydney Metro First Reserve protection zone thus ensuring the protection of rail infrastructure during construction and future operation of the development. The piled foundations will be founded some 9.0m clear of the First Reserve protection zone as shown in Figure 2-2.

The piled foundations will be constructed from ground level under proposed columns, walls and core raft to support the building loads. The basement general arrangement showing the location of piles, walls, footings and loads is shown in Figure 2-3.



**Figure 2-3 Basement General Arrangement**

The proposal does not include a basement therefore excavation of the site will be limited to:

- leveling of the site, currently proposed at less than 1m; and
- localised excavation for the lift pit and footings approximately 3m to 4m below existing ground level.

Given that the Second Reserve protection zone extends above the existing ground level all excavation works will be within the Second Reserve Protection Zone.

The site was formerly occupied by a BP Service Station which has undergone demolition and remediation works. It is understood that the remediation work included removal of the underground petroleum storage system and the associated facilities, as well as the contaminated soil and any perched groundwater surrounding the storage system. The only remaining demolition works are related to a two storey shop top office at the northern edge of the site.

Finite element modelling has been undertaken based on borelog information to determine the potential impact of the excavation and piling works on the Sydney Metro rail tunnels. A vibration assessment report and electrolysis impact report have also been produced.

### 3.0 Context

Sydney Metro is a fully automated rapid transit system. The network is controlled by the Sydney Metro agency under the umbrella of Transport for New South Wales (TfNSW). Services are operated by Metro Trains Sydney and integrated with the established Sydney Trains network.

Sydney Metro City & Southwest Line will be a 30 km section of the metro network. The project will extend the Metro North West Line from Chatswood on the North Shore, to Bankstown in the city's south-west through the Sydney central business district.

It is essential that the structural integrity of the metro rail tunnels remains intact during the course of project activities generally, and throughout the life of the building. It is also essential that train operations (when commenced) continue uninterrupted.

Further, it is of paramount importance that the safety of the travelling public, Metro Trains employees, Operator's employees and project personnel (including contractors and consultants) is ensured.

At the present time the metro rail tunnels have been constructed and are being fitted out. As such the tunnels are not operational and therefore operational risks have not been considered. Also, as the existing building is a low rise structure and the tunnel crowns are located some 34m below the ground surface, demolition risks have not been considered.

An engineering assessment has been undertaken to determine the impact on the metro tunnels due to excavation and construction activities on the site. The works within the development site are predicted to marginally affect the metro rail tunnels due to the application of building loads.

The metro rail tunnels are currently a construction site. As such, any access to the tunnels for the purpose of dilapidation surveys and monitoring would need to be under the authority of the principal contractor.

Based on the outcome of the engineering assessments monitoring within the tunnels does not appear to be warranted however this will be discussed with Sydney Metro. At present time a contract has not been let for the demolition works and construction of the building.

## 4.0 Constraints

Constraints are matters (contractual, regulatory, physical or social) that define the environment and conditions under which the works must be undertaken. This project is subject to the following constraints:

- *Transport Administration Act 1988;*
- *Environmental Impact Statement;*
- *Sydney Metro Underground Corridor Protection Technical Guidelines;*
- *Work Health and Safety Act 2011; and*
- *Work Health and Safety Regulation 2017.*

The additional following constraints apply for work within the rail corridor:

- *Rail Safety (Adoption of National Law) Act 2012;*
- *Rail Safety (Adoption of National Law) Regulation 2018; and*
- *Principal Contractor Rules and Procedures.*

This IAR&MP documents controls that will be implemented to ensure that the impact of site activities on the Sydney Metro rail tunnels is managed in accordance with the identified constraints.

## 5.0 Project Management

The site functional organisation chart for the project is included at Appendix B of the IAR&MP. It shows the interrelationship between the various positions, companies and stakeholders, including reporting requirements. The organisational chart only shows job titles of personnel. The names of incumbents and their contact details will be included in Appendix C of the IAR&MP as they become known.

A Builder for the development has not been appointed by WH Redfern Trust as of 7 December 2021. The primary rail safety objectives identified by WH Redfern Trust are:

- establish and implement a robust safety management system;
- ensure the safety of the travelling public, railway employees and project personnel;
- minimise impact on railway infrastructure; and
- allow rail operations to continue without interruption when commenced.

This IAR&MP establishes a robust regime to ensure that the project rail safety objectives can be achieved.

Sydney Metro and Metro Trains Sydney are viewed as clients in relation to rail infrastructure integrity and operations. To the extent that the public rely on those organisations to provide a safe and reliable train passenger service, they in turn require WH Redfern Trust to ensure the continuing integrity and safety of the rail infrastructure and operations through the implementation of the IAR&MP.

WH Redfern Trust engaged a number of consultants who are subject matter experts in their relevant field to provide project management services, evaluate site conditions and to document monitoring criteria in order to ensure rail safety and integrity are maintained. Consultants engaged for rail related aspects of the project as of 22 November 2021 include:



- GKA Management (GKA) to facilitate the development of the IAR&MP and RRMP;
- Antoniadis Architects to provide architectural services;
- Webber Design to provide structural services;
- Douglas Partners to conduct geotechnical investigations and assessments;
- Land Title Solutions (LTS) to undertake survey;
- Acoustic Logic Consultancy Pty Ltd to provide advice on acoustic matters and monitoring of vibration; and
- Cathodic Protection Services to provide advice on electrolysis matters.

Consultants have produced reports that document the expected impact from excavation and construction works on the rail tunnels. Monitoring plans have also been produced. All consultant reports and monitoring plans have been or will be reviewed and commented on by Sydney Metro. Requirements documented in consultant reports and monitoring plans have been incorporated into the IAR&MP.

The Builder will be managing the construction of the development and will engage a number of subcontractors. Inspection and test plans will be developed by the Builder or its subcontractors based on the associated work methodologies and used to provide a link between planning, contractual requirements, verification activities and records.

Various Work Method Statements will also be produced by the Builder or its subcontractors, and personnel will be inducted into the content to ensure that documented risk controls are captured and implemented. The Work Method Statements will include risk controls documented in the RRMP. Copies of Work Method Statements that relate to activities with potential to impact on infrastructure or operations will be provided to Sydney Metro as they are developed.

The Builder or its subcontractors will produce Safe Work Method Statements (SWMSs) as required by clause 299 of the WHS Regulation 2017 (Regulation). The Builder as principal contractor will review subcontractor SWMSs as required by clause 302 of the Regulation. Personnel will be inducted into the content of the SWMS applicable to their work activity by a safety delegate appointed by the company that produced the SWMS.

The Builder is responsible for ensuring appropriate measures are put in place to protect the safety of its personnel whilst accessing the worksite and undertaking activities at the worksite. It is envisaged that access to the rail tunnels will not be required.

All personnel working on site will be inducted to the site. The induction will include general awareness of the rail tunnels and relevant hazards identified in the RRMP.

## 6.0 Stakeholder Engagement

The project has been classified as a State Significant Development (SSD). Section 4.13(2A) of the Environmental Planning and Assessment Act 1979 excludes concurrence or consultation requirements from applying to development applications for SSD, unless an environmental planning instrument requires concurrence or consultation to SSD.

The provisions of clause 86 of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP) does not require concurrence to be provided in the context of a development application for SSD and therefore concurrence is not required.

Notwithstanding this, in order to ensure the appropriate management and mitigation of the proposed development's impacts on the Sydney Metro City & Southwest rail corridor consultation has been undertaken with Sydney Metro.

The contact for Sydney Metro is listed in Table 1.

**Table 1 Sydney Metro Contact**

Name	Email	Mobile
Ms Sophie Butcher	Sophie.Butcher@transport.nsw.gov.au	0481 158 616

On 2 November 2021 Sydney Metro was provided with a preliminary plan of the building foundation layout and loads by email. By email on 10 November 2021 Sydney Metro responded that the plan has been reviewed and significant issues have not been identified.

The Sydney Metro response also stated that the final design, impact statement and assessment of potential impacts on Sydney Metro assets will need to be submitted once completed.

## 7.0 Responsibility and Authority

Duties, responsibilities, accountabilities and authorities are also documented in this IAR&MP but only to the extent that they relate to the management of the impact of works on railway infrastructure and future railway operations.

### Construction Manager

The Construction Manager has overall responsibility for ensuring activities on site are adequately resourced, undertaken in accordance with approved work methodologies and completed to specified standards. The Construction Manager is responsible for implementing the provisions of the IAR&MP. The Construction Manager performs the following functions:

- acts as the project representative for matters related to rail safety;
- ensures sufficient resources are available to implement the requirements of the IAR&MP;
- assigns IAR&MP responsibilities to project personnel and monitors performance;
- maintains and distributes to stakeholders a current list of project personnel and their contact details;
- reviews the capabilities of subcontractors to comply with the provisions of the IAR&MP prior to award of contracts;
- confirms inspection and test plans, work method statements and safe work method statements have been produced and reviewed for works that impact on rail infrastructure and operations;
- arranges external audits of the IAR&MP implementation as deemed appropriate; and
- co-ordinates responses to monitoring alarms.

### Project Manager

The Project Manager has overall responsibility for ensuring activities on site are being undertaken in accordance with approved work methodologies and are completed to specified standards. The Project Manager reports to the Construction Manager. The Project Manager performs the following functions:

- acts as the point of contact for external stakeholders in relation to site activities that impact on rail infrastructure and future operations;
- establishes and maintains effective lines of communication with external stakeholders;

- determines and requests sufficient resources to implement the requirements of the IAR&MP;
- attends site meetings with Sydney Metro personnel and addresses any concerns raised by those personnel;
- reviews the implementation of rail safety risk controls developed for the project;
- directs project consultants to undertake monitoring activities at times documented in the IAR&MP;
- reviews monitoring reports and distributes the reports promptly to stakeholders;
- reviews performance to ensure continued effectiveness of processes and procedures;
- ensures the recording and management of documents for the project are in place and effectively controlled;
- coordinates the final pile design and distribution of the design to relevant parties;
- reviews inspection and test plans, work method statements and safe work method statements to confirm rail safety matters have been included and addressed;
- notifies Sydney Metro on the timing of agreed witness point inspections and manages the release of hold points documented in inspection and test plans;
- manages disposition of nonconforming work;
- monitors the implementation of rail safety risk controls developed for the project;
- ensures that the rail safety risk log is updated as required and that changes are communicated to relevant personnel;
- ensures that the project site safety induction includes relevant rail safety matters;
- encourages and promotes the reporting of all hazards associated with work activities that impact on rail interfaces and future operations;
- stops work where significant potential or actual hazards are identified and ensures that remedial action and corrective action are implemented;
- leads incident investigations and proposes recommendations for corrective action;
- confirms records are being generated for inspections and tests;
- authorises and implements project emergency response procedures;
- activates the site alarm when nominated personnel are not on site; and
- responds to and manages monitoring alarms.

### Site Manager

The Site Manager has direct responsibility for ensuring activities on site are being undertaken in accordance with approved work methodologies and are completed to specified standards. The Site Manager reports to the Project Manager. The Site Manager performs the following functions:

- ensures the implementation of rail safety risk controls developed for the project;
- monitors performance to ensure continued effectiveness of processes and procedures;
- establishes and maintains effective lines of communication with site personnel including subcontractors;
- reviews work method statements, safe work method statements and inspection and test plans to confirm rail safety matters have been included and addressed;
- ensures measuring and test equipment is within its current calibration period;
- manages disposition of nonconforming work;



- monitors the implementation of rail safety risk controls developed for the project;
- confirms that the project site safety induction includes relevant rail safety matters;
- programmes site surveillance to ensure that activities covered by safe work method statements are monitored;
- encourages and promotes the reporting of all hazards associated with work activities that impact on rail interfaces and operations;
- conducts daily visual inspection of the site and reports identified hazards, potential hazards and opportunities for improvement;
- stops work where significant potential or actual hazards are identified and ensures that remedial action and corrective action are implemented;
- confirms records are being generated for inspections and tests;
- implements project emergency response procedures;
- activates the site alarm; and
- responds to and manages monitoring alarms.

### **Project Engineer**

The Project Engineer has direct responsibility for liaison coordination, ensuring work activities are being undertaken in accordance with approved work methodologies and are completed to specified standards. The Project Engineer reports to the Site Manager. The Project Engineer performs the following functions:

- monitors the implementation of rail safety risk controls developed for the project;
- continually monitors performance to ensure continued effectiveness of processes and procedures;
- communicates requirements to consultants and subcontractors;
- reviews work method statements, safe work method statements and inspection and test plans to confirm rail safety matters have been included and addressed;
- manages disposition of nonconforming work;
- monitors the implementation of rail safety risk controls developed for the project;
- encourages and promotes the reporting of all hazards associated with work activities that impact on rail interfaces and operations;
- stops work where significant potential or actual hazards are identified and ensures that remedial action and corrective action are implemented;
- confirms records are being generated for inspections and tests; and
- responds to monitoring alarms.

### **General Foreman**

The General Foreman is responsible for monitoring all activities on site to ensure that activities are being undertaken in accordance with approved work methodologies and are completed to specified standards. The General Foreman reports to the Site Manager. The General Foreman performs the following functions:

- co-ordinates work activities on site;
- ensures personnel undergo project site safety induction prior to commencement of work;
- monitors construction activities to ensure that they are undertaken in accordance with approved work methods;
- ensures personnel have been inducted into company safe work method statements;

- ensures processes documented in work method statements, safe work method statements and inspection and test plans are implemented and relevant records are generated;
- encourages and promotes reporting of nonconforming works;
- identifies and records nonconforming work;
- conducts daily visual inspections of the site and documents identified and reported hazards, potential hazards and opportunities for improvement;
- undertakes surveillance of tasks to ensure compliance with work method statements and safe work method statements;
- manages remedial action through to close out of minor potential or actual hazards;
- stops work where significant potential or actual hazards are identified, reports the matter, manages remedial action and implements recommended corrective actions;
- ensures records are being generated for all inspections and tests;
- monitors the implementation of rail safety risk controls developed for the project;
- activates the site siren and flashing light on receipt of an alarm text message;
- communicates with contractors through use of two way radio to confirm that the alarm text message has been received; and
- responds to and manages monitoring alarms.

#### **Subcontractor Excavation Foreman**

The Subcontractor Excavation Foreman has direct responsibility for managing the excavation activities on site. The Excavation Foreman reports to the General Foreman. The Excavation Foreman performs the following functions:

- co-ordinates excavation activities on the site;
- selects plant and equipment in accordance with recommendations provided by the Acoustic Engineer;
- confirms that the surveyor has set out the excavation levels;
- ensures personnel undergo project site safety induction prior to commencement of work;
- monitors excavation activities to ensure that they are undertaken in accordance with approved work methods;
- ensures the Geotechnical Engineer inspects the excavation face and foundations areas at nominated intervals;
- ensures personnel have been inducted into company work method statements and safe work method statements;
- ensures processes documented in safe work method statements and inspection and test plans for company works are implemented and relevant records generated;
- encourages and promotes reporting of nonconforming works;
- identifies, records and manages disposition of nonconforming work;
- conducts daily visual inspections of the site and documents identified and reported hazards, potential hazards and opportunities for improvement;
- undertakes surveillance of tasks to ensure compliance with safe work method statements;
- manages remedial action through to close out of minor potential or actual hazards;

- stops work where significant potential or actual hazards are identified, reports the matter, manages remedial action and implements recommended corrective actions;
- monitors the implementation of rail safety risk controls developed for the project;
- participates in incident investigations related to excavation works;
- responds promptly to monitoring information and a breach of safety controls, and stops work where necessary; and
- responds to and manages monitoring alarms.

### **Subcontractor Piling Foreman**

The Subcontractor Piling Foreman has direct responsibility for installation of the piles. The Piling Foreman reports to the General Foreman. The Piling Foreman performs the following functions:

- co-ordinates activities for piling activities;
- confirms pile depth based on final pile design;
- confirms the surveyor has set out piles prior to commencement of drilling;
- monitors verticality of drilling in accordance with the inspection and test plan;
- confirms geotechnical engineer has checked pile founding level and class of material;
- ensures personnel undergo project site safety induction prior to commencement of work;
- monitors piling activities to ensure that they are undertaken in accordance with approved work methods;
- ensures personnel have been inducted into company work method statements and safe work method statements;
- ensures processes documented in safe work method statements and inspection and test plans for company works are implemented and relevant records generated;
- encourages and promotes reporting of nonconforming works;
- identifies, records and manages disposition of nonconforming work;
- conducts daily visual inspections of the site and documents identified and reported hazards, potential hazards and opportunities for improvement;
- undertakes surveillance of tasks to ensure compliance with safe work method statements;
- manages remedial action through to close out of minor potential or actual hazards;
- stops work where significant potential or actual hazards are identified, reports the matter, manages remedial action and implements recommended corrective actions;
- monitors the implementation of rail safety risk controls developed for the project;
- participates in incident investigations related to piling works;
- responds promptly to monitoring information and a breach of safety controls, and stops work where necessary; and
- responds to and manages monitoring alarms.

### **Structural Engineer**

The Structural Engineer has overall responsibility for determining building loads, establishing the supporting foundation layout and reviewing engineering assessments provided by external stakeholders. The Structural Engineer reports to the Project Manager. The Structural Engineer performs the following functions:

- determines building loads and foundation layout;
- carries out preliminary pile design and reviews final pile design produced by the piling contractor;
- reviews comments on engineering assessments provided by external stakeholders related to the impact on rail tunnel lining from induced movement; and
- provides advice on issues that arise from construction activities.

### **Acoustic Engineer**

The Acoustic Engineer is responsible for managing the monitoring of vibration impact. The Acoustic Engineer reports to the Project Manager. The Acoustic Engineer performs the following functions:

- proposes and obtains agreement on vibration impact criteria for rail infrastructure including warning and stop work limits;
- undertakes baseline monitoring for future comparison;
- ensures company personnel attend the site induction and are inducted into safe work method statements;
- manages remedial action through to close out of potential or actual hazards that arise from work activities undertaken by company personnel on site;
- ensures company personnel scheduled for work comply with the site drug and alcohol policy and are not fatigued;
- installs monitoring equipment, checks that equipment is working daily and replaces batteries as required;
- responds to vibration monitoring alarms and participates in work methods reviews where necessary;
- provides written report on alarms next business day;
- provides a summary of vibration readings on a weekly basis; and
- updates personnel on automatic text message distribution list as required.

### **Surveyor**

The Surveyor is responsible for managing the set out of piles and monitoring of surface site deformation points. The Surveyor reports to the Project Manager. The Surveyor performs the following functions:

- obtains locations and movement criteria for surface site deformation points including warning and stop work intervention limits;
- installs and protects monitoring prisms at nominated locations;
- establishes baseline measurements for surface site deformation points;
- ensures company personnel attend the site induction and are inducted into safe work method statements;
- manages remedial action through to close out of potential or actual hazards that arise from work activities undertaken by company personnel on site;
- ensures company personnel scheduled for work comply with the site drug and alcohol policy and are not fatigued;
- surveys deformation points at nominated frequencies;
- ensures that survey instruments used for monitoring are within current calibration period;

- services monitoring prisms regularly to preclude build up of dust;
- sends mobile text to nominated personnel where movement is detected beyond an intervention limit;
- provides a written report next business day on survey findings; and
- attends site to set out and check works as requested including pile locations.

### **Geotechnical Engineer**

The Geotechnical Engineer is responsible for determining the movement that takes place as a result of building loads and work activities in relation to surface deformation and the rail tunnels. The Geotechnical Engineer is also responsible determining the Induced loads in the rail tunnels that arise from the predicted movement and monitoring ground movements. The Geotechnical Engineer reports to the Project Manager. The Geotechnical Engineer performs the following functions:

- reviews geotechnical investigation data and establishes the geotechnical computer model for determining the impact on the rail tunnels;
- reviews comments on engineering assessments provided by external stakeholders and incorporates relevant comments into the geotechnical model;
- proposes and obtains agreement on movement criteria for surface site deformation points and rail tunnels including warning and stop work limits;
- reviews and accepts proposed vibration limits;
- certifies that encountered ground conditions based on piling bore logs are in accordance with the geotechnical report and piles have been drilled to specified depths;
- certifies that encountered ground conditions for self-supporting rock are in accordance with the geotechnical report and that nominated stabilisation measures have been implemented where directed;
- installs and protects inclinometers at nominated locations;
- establishes baseline measurements for inclinometers for future comparison;
- ensures company personnel attend the site induction and are inducted into safe work method statements;
- manages remedial action through to close out of potential or actual hazards that arise from work activities undertaken by company personnel on site;
- ensures company personnel scheduled for work comply with the site drug and alcohol policy and are not fatigued;
- monitors inclinometer movement at nominated frequencies;
- provides written reports where nominated criteria exceed warning and stop work limits;
- participates in work method reviews where new warning and stop work limits need to be established; and
- certifies that excavation base conditions and footings have been constructed in accordance with approved drawings and are adequate to sustain footing loads.

## **8 Engineering Assessments**

### **8.1 Geotechnical**

The Sydney Metro City & Southwest twin rail tunnels run underneath the site. The tunnels are approximately 7m in diameter and have a segmental precast concrete lining typical of this type of structure.

A geotechnical model was developed for the site based in part on the results of the site investigations documented in the Douglas Partners Report on Geotechnical Investigation (DP 99740.01.R.002.Rev0) October 2021. The investigation included a total of four rock cored boreholes to depths of between 9.5m and 24.8m below the existing ground surface level.

A previous geotechnical investigation on the site was carried out by PSM Consulting in July 2020. The investigation included drilling four shallow boreholes to maximum depths of 7.0m using augering techniques. No rock coring was undertaken.

Geotechnical investigations undertaken in the area surrounding the site at 13-23 Gibbons Street and 90-102 Regent Street were also considered in the development of the geotechnical model.

Douglas Partners undertook a geotechnical analysis to assess the impact of the excavation and building loads from the proposed development. A Finite Element Analysis (FEA) of the proposed excavation and construction sequence was undertaken using PLAXIS 2D commercially available software.

One cross-section towards the northern part of the site was analysed. The Analysis Section together with pile modelling identification numbers are marked up on LTS Drawing No. 51281.001DT included at Appendix A of the IAR&MP (page 36).

The modelling was undertaken using 5 different phases. The results of the modelling are documented in the Douglas Partners Preliminary Report on Numerical Modelling and Impact Assessment (R.001.Rev0) dated 16 November 2021 (DP Impact Assessment Report).

A summary of total displacements and differential displacements of tunnel liners at the analysis cross section is included at Table 5 and Table 6 of the DP Impact Assessment Report. The majority of movement takes place with the application of the building load.

The analysis demonstrates that the following maximum movements can be expected:

- total displacement of 8.0mm at the First Reserve;
- total displacement of 6.0mm at the rail tunnels; and
- total differential displacement in the tunnel linings of 3mm and 0.03%.

The predicted movements are below the maximum permitted movements for rail tunnels lined with precast concrete segments documented in section 9.1.2 of the Sydney Metro Technical Guidelines, namely 10mm total movement in any direction and differential movement in any plane of 10mm or 1:2000 (0.05%) whichever is less.

The summary of structural actions is included at Table 7 (western rail tunnel) and Table 8 (eastern tunnel) of the DP Impact Assessment Report. Section 8 of the DP Impact Assessment Report states that the impact on the rail tunnel liner is predicted to be:

- a maximum increase in axial force (compression) of approximately 306kN;
- a variation in shear force of 1kN; and
- a variation in bending moment of 1kN.m.

The DP Impact Assessment Report concludes that based on the numerical modelling it is considered that the proposed development will have a very minor impact on the rail tunnels.



## 8.2 Structural

As predicted movements are within allowable limits there would appear to be no need for a structural assessment of the impact on the rail tunnels. It is relevant to note that the particulars of the existing rail tunnel structural elements are not known and therefore the rail tunnel design engineers are the only personnel with the knowledge necessary to undertake a structural assessment. Sydney Metro will be advised accordingly and comments (if any) provided by Sydney Metro will be reviewed and addressed.

## 8.3 Noise and vibration

Acoustic Logic has produced a Metro Tunnel Vibration Management Plan (20210248.2/0511A/R1/AW) dated 5 November 2021 (AL Vibration Monitoring Plan). The monitoring plan references the vibration limits nominated in section 9.4.1 of the TfNSW Tunnel Standard and in Australian Standard AS2187.2 Explosives – Storage and Use – Part 2: Use of Explosives (AS2187.2).

The TfNSW Tunnel Standard (which is consistent with the upper limits of AS2187.2) permits a maximum peak particle velocity of 20 mm/s for rail tunnels supported by a precast concrete segment lining.

Section 9.3.1 of the Sydney Metro Technical Guidelines also refers to AS2187.2 and nominates a maximum peak particle velocity of 20 mm/s and an alert level of 15mm/s for monitoring purposes. A conservative approach has been adopted in the monitoring plan which nominates a vibration stop work limit of 15.0 mm/s and a vibration warning limit of 12.5 mm/s.

## 8.4 Electrolysis

Cathodic Protection Services undertook a desktop review to determine possible exposure of the site to stray current interference produced by rail infrastructure.

Cathodic Protection Services Preliminary Electrolysis & Stray Traction Current Report (A715-338) dated 19 November 2021 documents protection requirements. The report addresses potential corrosion hazards from stray traction current on slabs on ground, piles and incoming services.

The following findings are documented in section 4 of the report:

- the moisture barrier underneath on ground slabs will act as an electrical insulator to the conduction of stray traction current;
- the specified concrete strength for footings of 32MPa and 50mm cover to reinforcement will have sufficient electrical resistance to prevent the conduction of stray traction current;
- the specified concrete strength for piles of 32 MPa to 65MPa and 75mm cover to reinforcement will have sufficient electrical resistance to prevent the conduction of stray traction current;
- the specified concrete strength for shotcrete walls between piles of 32 MPa to 65MPa and 75mm cover to reinforcement on the ground side will have sufficient electrical resistance to prevent the conduction of stray traction current;
- gas services do not require any insulation as metallic services are fitted with a cathodic protection system incorporating an insulating joint at the meter and low pressure services are constructed using non-metallic pipe; and
- corrosion hazard to water and fire services can be eliminated by installation of an insulating fitting, or non-metallic sections in the water and fire services at or close to the boundary of the property, which is specified in clause 5.3 Electrolysis from Stray DC Current (T HR EL 12002 GU).

Concrete strengths and cover to reinforcement have been documented in the Webber Design structural drawings. Insulating fittings or non-metallic sections will be detailed in the services drawings.

## 8.5 Dilapidation

Due to the recent construction of the rail tunnels, the methodology of construction and the predicted small movements it is not proposed to undertake dilapidation inspections (see section 16 of the IAR&MP). An assessment to determine whether a dilapidation survey is required will however be undertaken should there be a stop work event.

It is also relevant to note that the recently constructed rail tunnels are currently being fitted out and therefore the site is a construction zone under the control of a principal contractor. As such access to the tunnels will need to be under the control of the principal contractor.

## 9 Risk Management

A separate Rail Risk Management Plan (GKA REG 003) has been developed for this project. The risk management process documented in the Rail Risk Management Plan (RRMP) satisfies the requirements of AS/NZ ISO 31000:2009 Risk management – Principles and guidelines. The analysis, evaluation and treatment of risks has been undertaken in accordance with processes documented in the TfNSW Risk Management System.

A variety of sources have been utilised to gather information for the compilation of the RRMP including engineering reports produced for the project. The RRMP does not specifically address other risks, such as project risks, unless they have been specifically identified as flowing from the works or associated monitoring activities. The RRMP only address those risks that may arise from activities related to excavation (including piling) and construction of the building.

Main events and hazards (together with collective causes) have been documented in the Rail Safety Project Hazard Log (PHL). The purpose of the Rail Safety PHL is to ensure that all hazards identified through the course of the project are documented and controlled. The Rail Safety PHL:

- documents events that give rise to hazards;
- identifies potential hazards in relation to those events;
- identifies causes that collectively support individual hazards;
- documents an assessment of risk;
- documents risk controls; and
- identifies responsible parties.

As the project progresses additional rail safety hazards may be identified. These additional hazards will be added to the Rail Safety PHL. The Builder will manage the Rail Safety PHL through the project lifecycle. Individual hazards will be monitored as they progress to final closure at project completion.

Risks have been eliminated where possible. Remaining risks associated with causes for associated hazards have been classified and documented in the Rail Safety PHL using TfNSW consequence and likelihood risk tables and the risk matrix evaluation table.

A total of five (5) events resulting in five (5) hazards arising from nineteen (19) possible causes have been identified. The hazards are typical in nature to those that may arise from this type of works.



After the application of risk controls all risks were assessed as being within a tolerable region or broadly acceptable region and reduced so far as is reasonably practical. The risk assessment was reviewed in light of final engineering assessments and it was not deemed necessary to make any changes.

The identified risk controls are considered to represent contemporary good practice through application of highly prescribed requirements in accordance with relevant codes and standards together with derived risk controls. Based on engineering judgement, all practicable risk controls have been identified and will be implemented.

Risk reviews will be undertaken by the Builder as a minimum on a two monthly basis (as required for Medium range risks) or at such other frequency as is required by the inclusion of additional higher risk classifications.

In addition reviews will be undertaken when:

- a warning or stop work limit is breached;
- there is evidence the risk assessment is no longer valid;
- events indicate the assessment of risk may not have been adequate;
- there is a change to an existing expert report or a new expert report is produced; and
- significant changes are proposed in the work to be carried out.

The IAR&MP will be updated to reflect any additional controls that are identified as a result of risk reviews.

## 10.0 Design

The design has taken into consideration Sydney Metro requirements and translated these requirements in a systematic and controlled manner into documentation that will enable the construction of the project with minimal impact on Sydney Metro infrastructure and future Sydney Metro operations.

Design activities have been controlled by detailed procedures to ensure the full documentation of the design in accordance with relevant standards that control the safety of the design as well as physical and functional tolerances. Reviews of the design may be undertaken by Sydney Metro Subject Matter Experts to assure adequacy of the design and inclusion of specified requirements.

Design inputs have included:

- relevant Standards issued by Standards Australia and TfNSW Assets Standards Authority;
- technical requirements stipulated by Sydney Metro;
- rail infrastructure alignment drawings provided by Sydney Metro;
- independent geotechnical investigation data;
- survey information;
- geotechnical assessments;
- noise and vibration assessments; and
- construction loadings.

Design control procedures include the actions to be taken in the event of design changes. Design changes are checked and the design intentions clearly communicated to all stakeholders including approval by authorised personnel and submission to Sydney Metro where required.

Key matters from a rail perspective that were discussed and refined as part of design development include but are not limited to:

- documenting the First and Second Protection Reserves to maintain the integrity of rail infrastructure;
- modelling the impact of excavation and building load application on the rail tunnels;
- using high strength concrete and suitable cover to reinforcement to preclude the impact of stray electrical currents; and
- isolating services at the property boundary to preclude the impact of stray electrical currents.

Design outputs have been primarily documented in the form of project drawings. A register of drawings that document measures to protect rail infrastructure is included at Appendix D of the IAR&MP.

## 11.0 Construction Process Control

### 11.1 Site Management

#### Construction processes

Construction process control is the mechanism by which the quality and sequence of construction will be monitored so that completed works meet specified requirements and the impact on rail infrastructure and operations is minimised.

A survey has been undertaken to establish the location of the Sydney Metro rail tunnels and external utility infrastructure in the vicinity of the site. A certified copy of the survey drawings will be submitted to Sydney Metro.

Individual Subcontractors will develop Work Method Statements (WMSs) related to their work activities. The WMSs will be reviewed by the Builder site management team to confirm that relevant safety controls included in the Rail Safety PHL have been incorporated. Each Subcontractor will induct its personnel into the content of the WMS developed for the project.

#### Safe work method statements

The Builder and individual Subcontractors will produce their own Safe Work Method Statements (SWMSs) as required by clause 299 of the WHS Regulation 2017 (Regulation) for all high risk work activities.

Personnel will be inducted into the content of the SWMS(s) applicable to their work activity by a safety delegate appointed by the company that produced the SWMS. Subcontractors will be required to keep SWMSs up to date and retrain personnel when the SWMS is changed. Subcontractors will also be required to conduct surveillance of SWMS implementation.

The Builder (as principal contractor) will review Subcontractor SWMSs as required by clause 302 of the Regulation to ensure (among other things) that the SWMSs address specific hazards identified in the Rail Safety PHL.

SWMSs will also be produced by consultants should a need arise to enter the rail tunnels. These SWMSs will be submitted to Sydney Metro in conjunction with the access application. Sydney Metro will arrange for the principal contractor to review the SWMSs and facilitate access.

## **Responsibility and authority induction**

Personnel responsibilities and authorities for supervising various aspects of construction works are set out in section 6.0 of the IAR&MP. The Builder will ensure that personnel are made aware of their responsibilities and authorities through a formal induction into the contents of the IAR&MP.

## **Inspection and testing**

The nature and extent of construction process control documentation produced for the project has been determined by taking into consideration the fact that industry specialist contractors will be used who have trained and experienced personnel. In determining the amount of inspection and testing necessary consideration has been given to the effect that substandard quality or unsafe work practices may have on meeting project objectives.

Inspection and Test Plans (ITPs) will be developed for works that impact or have the potential to impact on rail infrastructure. ITPs will identify requirements that need to be satisfied and records that need to be produced. ITPs will also detail for each appropriate step or work package the various inspections or tests that need to be undertaken and associated acceptance criteria.

Inspection and testing will be carried out progressively to ensure faulty work is not covered up unless there is the ability to correct defects at a later time without detriment to the finished works. An Inspection and Test Plan Register is included at Appendix E of the IAR&MP.

Inspection and test records will identify the inspection authority or individual responsible for verifying conformance and at what point in the process the inspection and testing will take place. This will allow for traceability and analysis should problems be discovered in later use. Records will also identify who has the authority for the final release of the completed works.

Where measuring or testing of physical properties is to be undertaken to verify conformance, inspection, measuring and test equipment will be properly controlled in its use, maintained in good working condition and calibrated where applicable.

Subcontractors will be required to have tools, equipment and plant that could affect the quality of work or safety of operations in good working order prior to commencement and subject to recorded checks during use.

## **Management of nonconformities**

Nonconformities may be identified through various situations and at various levels throughout the duration of the project. Nonconformities can arise through use of superseded drawings, failure to communicate design changes, material test failures, work process controls not being followed and site inspections (among others).

Nonconforming work which is detected either through inspection, verification or audit will be identified, its existence recorded, segregated where possible and a decision taken as to what should be done.

Nonconforming works will be recorded in a Nonconformance Report. The report serves as a means of recording defective work and providing evidence that the nonconformance has been rectified. The report also serves as a means of ensuring defective work is not used or incorporated into the final works until it is rectified.

Nonconforming work will be replaced, repaired or reworked and subject to further inspection, verification or audit. Nonconforming work that impacts rail infrastructure and cannot be delivered to specified requirements will be submitted to Sydney Metro with a request to “use as is”.

The system of control for nonconforming works ensures that in all instances information concerning such items is fed back to appropriate personnel so that action is taken to identify and correct the cause and to prevent recurrence.

## **11.2 Witness Points and Hold Points**

Hold Points documenting requirements that must be satisfied before subsequent work may commence will be documented in each ITP where deemed appropriate by RCC.

If requested by Sydney Metro Witness Points will also be agreed and documented in ITPs for relevant steps of construction processes. The Builder will provide 48 hours notice of a Witness Point to the Sydney Metro Corridor Protection Planner by email and phone.

The Douglas Partners Geotechnical Monitoring Plan for Ground Surface Deformations (DP Geotechnical Monitoring Plan) will also document project specific Hold Points. Hold Points will be released after verification by the design engineer. Typical Hold Points that may be applied have been documented below:

### **Hold Point 1**

Submission Details: Inspection of new shoring wall installation to confirm works have been constructed in accordance with the design drawings.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Geotechnical Engineer.

### **Hold Point 2**

Submission Details: Inspection of prop installation to the existing retaining wall to confirm works have been constructed in accordance with the design drawings.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Geotechnical Engineer.

### **Hold Point 3**

Submission Details: Installation of survey monitoring targets at 10 m centres at the top of the shoring walls, and on site boundaries at 20 m intervals. Baseline survey of monitoring targets before commencement of any basement demolition and bulk excavation works.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Surveyor.

### **Hold Point 4**

Submission Details: Survey of the relevant monitoring points during and after excavation:

- after the existing ground and basement floor slabs are demolished;
- after excavation to bulk excavation level;
- once new basement and ground slabs have been constructed and props are removed; and
- one month following completion of basement structure or after three consecutive measurements not less than a week apart showing no further movement, whichever is the later.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Surveyor.

#### **Hold Point 5**

Submission Details: Inspection of the base of the excavation at bulk excavation level to assess the geotechnical conditions.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Geotechnical Engineer.

#### **Hold Point 6**

Submission Details: Inspection of the foundation pile drilling to ensure required socket depths and material are achieved.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Geotechnical Engineer.

#### **Hold Point 7**

Submission Details: Inspection of prop removal to confirm that the props are removed from the structure.

Release of Hold Point: The Nominated Authority for release of the Hold Point is the Geotechnical Engineer.

### **11.3 Liaison committee**

A Liaison Committee may be established if requested by Sydney Metro so that there is a means of regular communication between the parties. The Liaison Committee will consist of the following personnel:

- The Builder's Construction Manager; and
- Sydney Metro Corridor Protection Planner.

Other persons may be requested to join the committee as deemed necessary. The Liaison Committee will be chaired by the the Builder's Construction Manager who will also take and distribute minutes of meeting. The Liaison Committee will have the following functions:

- to consider and provide advice in relation to the taking of any pre-emptive action that avoid risk to rail infrastructure and rail operations;
- to facilitate the timely consideration of applications and progressive submission of documentation the Builder makes or provides in relation to the works;
- to consider details of monitoring results and the taking of any corrective actions;
- to provide ongoing review of the Rail Safety PHL;
- to provide guidance and advice on the matters required to be done in order obtain approvals required from Sydney Metro; and
- otherwise to provide such assistance to Sydney Metro as may be requested or required.

The Liaison Committee would meet regularly as agreed between the parties.

## **12.0 Management of Site Hazards and Risks**

### **12.1 Site inspections**

Site inspections will be used to identify workplace hazards and assess safety compliance against regulatory requirements and best practice processes. Site inspections will focus on works that impact on work health and safety and rail safety.

Employees, subcontractor personnel and supervisors will conduct a daily visual site inspection of their work area and report any hazards or potential hazards to the relevant Foreman. The Foreman will take action to address the hazard or potential hazard.

A weekly site inspection will be conducted by the Builder utilising a Weekly Site Inspection Checklist. The checklist will include relevant aspects of risk controls documented in the Rail Safety PHL. Any hazards and deficiencies identified during the inspection will be recorded and immediately reported to the relevant subcontractor Foreman.

The Builder will also conduct task observations with each subcontractor Foreman in order to assess processes against those documented in Work Method Statements and Safe Work Method Statements. Work activities will be observed, observations recorded, feedback provided and corrective action implemented (where necessary).

Sydney Metro may inspect the works at times and dates at its discretion by agreement with the Builder's Construction Manager unless the inspection flows from an emergency situation in which case the Construction Manager will arrange immediate access to the site.

## **12.2 Hazard and improvement management**

Hazards and opportunities for improvement may be identified by any person, including employees, consultant and contractor personnel, suppliers and Sydney Metro. Open reporting of actual and potential hazards and areas for improvement will be encouraged.

Where the potential or actual hazard is minor in nature the relevant subcontractor Foreman will manage remedial action through to close out. Where the products, materials, equipment or work practices are identified as not complying with work health and safety and / or rail safety requirements work will be stopped.

The Builder will manage remedial action through to close out and are responsible for ensuring that all hazards and recommendations for improvement are recorded and addressed.

Communication with site personnel in relation to hazards and risks will be primarily through pre-start meetings and toolbox talks.

## **12.3 Site safety rules**

Site safety rules will be prepared and displayed on notice boards and other suitable locations on the work site. Personnel who work on the site or visit the site will be made aware of the site safety rules and they will form part of the project induction.

Site safety rules include emergency procedures. The stop work protocol used on site, namely activating a siren and flashing light, will be included in the site safety rules.

Safety requirements for working within the rail tunnels do not form part of the site safety rules but will be separately addressed in access applications and safe work method statements should a need arise to enter the rail tunnels.

## **12.4 Senior management visits**

Senior management will undertake "walk and talk" visits to demonstrate commitment to work health and safety and rail safety. The frequency of visits will be based on the risk profile of work activities in progress.

## **13.0 Work in Rail Tunnels**

It is not anticipated that entry into the rail tunnels will be required unless there is a stop work event however a process has nevertheless been documented.



### 13.1 Application

Access can only be obtained through the Sydney Metro Corridor Protection Planner with appropriate notice. A separate application is required for each access. The Planner will liaise with the principal contractor undertaking the rail tunnel fit out works who will facilitate access.

Applications will be submitted by representatives of companies requiring access direct to the Sydney Metro Corridor Protection Planner with a copy submitted to the The Builder's Construction Manager. Applications will include relevant documentation such as Site Safety Plans and Safe Work Method Statements.

***Work cannot be undertaken until the application is approved.***

### 13.2 Pre-start requirements

Personnel entering the rail tunnels will be required to attend the principal contractor's site induction and comply with all directions issued by the principal contractor. Personnel will need to hold current rail safety worker accreditation.

### 13.3 Drugs and alcohol

Personnel working in the rail tunnels will be subject to the provisions of the Rail Safety (Adoption of National Law) Act 2012 and in particular the Rail Safety (Adoption of National Law) Regulation 2018 (Regulation). In addition they will be subject to the principal contractor's drug and alcohol policy.

All personnel are responsible to present fit for duty. Any person who believes they are unfit for work due to drugs and / or alcohol must not come to work. Personnel will be required to declare that they are free of drugs and/or alcohol at the pre-work brief.

Personnel may be subject to random drug and alcohol testing by the principal contractor. It is important for personnel to be conscious of all prescription drugs that they are taking which may contain alcohol. Any person testing positive may have their safeworking certification and rail industry safety induction permanently cancelled. This will preclude the person from undertaking any further work within the Sydney Metro rail network.

### 13.4 Fatigue management

A strategy for the management of fatigue, safe hours of work and periods of rest between work will be implemented by companies whose personnel need to access the rail tunnels and on site generally.

Fatigue can arise from both work and non-work related activities and can have an effect on a person's state of alertness with consequential impacts on the persons work performance and well being. The management of fatigue ensures that all personnel are fit for work physically and mentally. Fatigue can arise from a number of sources including:

- work environment;
- work tasks;
- sleep patterns;
- non-work activities; and
- lifestyle.

Fatigue will be managed primarily by ensuring that personnel have had an adequate rest break prior to reporting for duty. All personnel are responsible to present fit for duty. Any person who believes they are unfit for work due to fatigue must not come to work. Personnel will be required to declare that they are not fatigued at the pre-work brief.

## 14.0 Project Induction

A rail safety module will be included in the site specific induction for workers, which will be conducted each time new workers commence on site. The induction will address key aspects of the IAR&MP including but not limited to:

- rail infrastructure in the vicinity of the works;
- identification of work activities that may impact on rail safety;
- approvals required for work activities to proceed;
- hold points and witness points;
- reporting of hazards and incidents;
- stop work protocol for the site; and
- procedures for recommencement of work.

## 15.0 Lessons Learnt

Lessons Learnt have been captured in the first instance by engaging subject matter experts and involving them in the development of processes and procedures. Any incidents that may occur will be thoroughly investigated and lessons learnt will be rolled out through toolbox talks.

## 16.0 Monitoring Intervention Limits

Intervention limits have been established for monitoring of specified criteria. Three intervention limits have been nominated, namely an Alarm Level 1 (Alert), Alarm Level 2 (Warning) and Alarm Level 3 (Stop).

Alarm Level 1 can be defined as:

*The limit of a requirement which if exceeded requires a review of monitoring frequency to ensure that further increases are recorded at intervals that allow a controlled approach to the warning limit.*

Alarm Level 2 can be defined as:

*The limit of a requirement which if exceeded requires action to be taken to ensure that further increases are managed in a controlled manner so as to preclude an impact on rail infrastructure or rail operations.*

Alarm Level 3 can be defined as:

*The limit of a requirement which if exceeded has the potential to impact on rail infrastructure or rail operations requiring the stoppage of works that have caused the limit to be exceeded.*

Intervention limits for movement of surface site deformation points and vibration have been established and are documented in Appendix G of the IAR&MP.

## 17.0 Monitoring and Reporting Protocol

Based on the predicted impacts it is anticipated that the DP Geotechnical Monitoring Plan will state that tunnel convergence, stress and liner crack width monitoring will not be required and will not nominate a requirement for dilapidation surveys. An assessment to determine whether a dilapidation survey is required will however be undertaken should there be a stop work event.

Due to the recent construction of the rail tunnels and the quality assurance applied to the manufacture and installation of the precast concrete panels any existing defects should have been identified and rectified.



Further, due to the nature of construction (precast concrete panels with gasket inserts) the predicted movement should be accommodated within the gaskets and as such should not result in any impact that needs to be monitored noting that the predicted movement is well within the permitted movement limits nominated in the Sydney Metro Protection Guidelines. Also, any impact such as compressed gaskets or seepage would be evident to personnel working in the rail tunnels and would be identified in the handover inspection.

It is also relevant to note that as the rail tunnels are an active construction site monitoring from within the tunnels would be subject to access constraints and access has not been permitted on similar projects.

Therefore it is anticipated that only monitoring of the following criteria will be undertaken from the site:

- ground deformation; and
- vibration from site activities.

Ground deformation monitoring will be documented in the DP Geotechnical Monitoring Plan. Survey targets will be established at nominated centres along the top of the basement retaining walls and at nominated centres on the site boundary. Survey targets will also be established along the sheetpile walls.

Monitoring of vibration from site activities is addressed in the AL Vibration Management Plan. In order to provide a representative location for monitoring vibration impacts it is proposed to install a geophone over each of the tunnels at a depth of 1m below the pile founding levels namely 16m based on the current design.

### **17.1 Baseline measurements**

#### **Ground deformation**

Survey markers will be installed prior to the commencement of work and baseline readings undertaken.

#### **Vibration**

The vibration monitors will be installed prior to the commencement of work and baseline readings undertaken. The AL Vibration Management Plan shows the indicative location of the monitors at Figure 4 and Figure 5 which have been included at Appendix A of the IAR&MP (pages 37 and 38).

### **17.2 Ground Deformation**

The DP Geotechnical Monitoring Plan will nominate the frequency of monitoring and the intervention limits for the movement of site survey markers. The intervention limits will be included at Appendix G of the IAR&MP. Details of responses to exceedances are outlined at Appendix H of the IAR&MP.

The Corridor Protection Planner (or delegate) and the Corridor Protection Incident Manager will be advised by phone within one hour of a warning limit or stop work limit exceedance being detected.

A Geotechnical Engineer will also review the nature of the excavated material and material retrieved from pile bore holes to confirm the assumptions made from geotechnical investigations.

### **17.3 Track Displacement**

The requirements for track monitoring are set out in RailCorp Engineering Specification SPC 207 Track Monitoring Requirements for Undertrack Excavation as amended by TfNSW Technical Note TN 004:2015 (SPC 207).

Section 3 of SPC 207 states that if a geotechnical assessment ascertains that a risk to displacement of the track is possible, a monitoring regime shall be implemented. The track is connected to the rail tunnel lining and will therefore move with the lining.

The results for the displacement of the rail tunnels are summarised in Table 5 and Table 6 of the DP Impact Assessment Report. The maximum predicted movement of the rail tunnels is 6.0mm and the maximum differential displacement is 3.0mm and 0.03%. These movements are well within the intervention limits of SPC207. In any event, undertaking track monitoring would serve no useful purpose as the Sydney Metro City & Southwest will not be operational until 2024.

It is anticipated that should any impact on the installed track become apparent then advice would be provided by Sydney Metro. Upon the receipt of such advice a Rail Surveyor will be engaged who works for a company which has been accredited as an Authorised Engineering Organisation by TfNSW Assets Standards Authority. A survey of the installed track will be undertaken and the results of the survey will be provided to Sydney Metro for review and comment.

#### **17.4 Tunnel Vibration**

Vibration protocols and vibration limits are set out in the AL Vibration Management Plan. Vibration loggers will be installed prior to commencement of works and remain operational on a continuous basis until at least one week after completion of excavation and piling activities. The need for ongoing monitoring will be reviewed based on measured results. If the measured levels of vibration are significantly below the nominated trigger level, or no vibration from construction is detected, then ongoing monitoring will cease.

The Vibration Engineer will be able to remotely access the vibration loggers to confirm that they are functioning and download readings. Downloading of the vibration logger will be conducted on a regular basis. In the event of intervention limits being exceeded downloading will be conducted more frequently.

Results obtained from the vibration loggers will be presented in a graph format and will be forwarded to Sydney Metro for review. Reports will be provided fortnightly. Where an exceedance in the vibration criteria occurs a preliminary report will be provided within 24 hours.

The vibration loggers will be fitted with a GSM modem that sends automatic SMS text messages when intervention limits are exceeded to personnel on a predetermined distribution list. The distribution list will include but not be limited to the Acoustic Engineer, site management personnel responsible for activating the site alarm and site foremen managing work activities generating vibration.

Up to two Sydney Metro representatives will be included in the SMS text distribution list if requested by Sydney Metro. Nominated Sydney Metro personnel will receive SMS texts of stop work limit exceedances. The Corridor Protection Planner (or delegate) and the Corridor Protection Incident Manager will also be advised by phone within one hour of a warning limit or stop work limit exceedance being detected.

In the event that a stop work vibration limit is exceeded site management personnel will trigger an audible and visual alarm on the site. Operators will also be contacted on the two way radio to confirm that they have ceased work.

For both warning limit and stop work limit exceedances the Acoustic Engineer will attend site and determine if mitigation measures need to be implemented. Trial testing will be undertaken to confirm that mitigation measures are effective. In the case of stop work limit exceedances mitigation measures will be submitted to Sydney Metro for review.

Section 4.4 of the AL Vibration Management Plan nominates the intervention levels for vibration. Details are documented in Appendix G of the IAR&MP.

### **17.5 Reporting**

Fortnightly summary reports will be issued for vibration readings and site surface deformation readings. Monitoring reports will include an assessment of results and identify any intervention limits that may have been exceeded. Progress summary reports for excavation and piling will also be issued on a fortnightly basis. The distribution list for monitoring reports is included at Appendix C of the IAR&MP and which will be populated when details are available.

Preliminary technical assessment reports for warning or stop work exceedances will be issued within 24 hours and final reports will be issued within 3 business days. Details of responses to exceedances and reporting of the exceedances are documented in Appendix H of the IAR&MP.

In the event of a warning limit being exceeded notification will be provided immediately by SMS text to relevant project personnel. In the event of a stop work limit being exceeded notification will be provided immediately to relevant project personnel and Sydney Metro personnel. Sydney Metro will be provided with revised work procedures for review where developed to address stop work exceedances.

### **17.6 Intervention Limits**

Intervention limits have been documented in consultants' reports and referenced technical standards. Intervention limits established for the project to date are summarised in Appendix G of the IAR&MP.

## **18.0 Response to Monitoring Alarms**

Responses to alarms are documented in detail at Appendix H of the IAR&MP for the following monitoring parameters:

- ground deformation; and
- vibration.

Responses have been categorised according to intervention limits. Responsibilities and actions for persons holding project roles have been documented including submission of reports and liaison with Sydney Metro.

## **19.0 Incident Management**

Where advice is received on site that a stop work intervention limit has been exceeded the General Foreman (or delegate) will activate the site siren and flashing light. Plant operators will also be contacted on the two way radio to ensure that they have stopped work.

Where an incident has occurred the Project Manager will co-ordinate an investigation by the relevant subject matter expert. Reports will be submitted to nominated Sydney Metro personnel. A toolbox talk will be held for site personnel and consultants (where relevant) to discuss the incident, the outcome of the investigation and any corrective action implemented. The distribution list for incident reports is included at Appendix C of the IAR&MP.

The Sydney Metro Corridor Protection Planner and Incident Manager will be advised of all stop work events. The Project Manager and Sydney Metro Corridor Protection Planner (or delegate) will agree on revised work methods and revised warning limits and stop work limits (if necessary). Recommencement of work will be subject to receipt of written advice from Sydney Metro that all matters have been addressed to its satisfaction.

## 20.0 Documentation and Records

The success of projects depends on accurate and detailed documents and data. Documents and data must be approved for adequacy before issue and made available at all appropriate locations and to all applicable personnel. Changes must be recorded and superseded documents and data removed from use.

The Project Manager is responsible for ensuring that a project filing system is established, which includes relevant registers of current documents in use on site.

Records provide documentary evidence of effective management system implementation and achievement of specified requirements in finished works. Records required to be kept under this IAR&MP include but are not limited to:

- project rail safety and rail risk plans;
- safe work method statements;
- training and induction records;
- toolbox meetings;
- emergency procedures;
- site inspection and surveillance records;
- audit records;
- hazard identification and risk assessments;
- incident and investigation reports;
- plant and equipment records;
- inspection, testing and servicing records;
- survey data;
- geotechnical monitoring data;
- excavation face mapping;
- vibration monitoring records;
- inspection and test plans;
- inspection and test records;
- equipment calibration records;
- non-conformance reports;
- corrective action requests;
- minutes of meeting; and
- management reviews.

## 21.0 Audit and Review

Audits of compliance with project management documents will be scheduled as deemed necessary by the Builder's Construction Manager. Sydney Metro will be invited to attend collaborative audits of the IAR&MP.

## 22.0 References

### 22.1 Legislative and Regulatory

1. Rail Safety (Adoption of National Law) Act 2012
2. Rail Safety (Adoption of National Law) Regulation 2018
3. Work Health and Safety Act 2011
4. Work Health and Safety Regulation 2017
5. State Environmental Planning Policy (Infrastructure) 2007
6. Sydney Metro Conditions 24 March 2021

### 22.2 Standards

1. AS/NZ ISO 31000:2009 Risk management – Principles and guidelines
2. AS/NZ 4801:2001 Occupational health and safety management systems – Specification with guidance for use
3. TfNSW Asset Standards Authority Development Near Rail Tunnels (T HR CI 12051 ST)
4. Sydney Metro Underground Corridor Protection Technical Guidelines (iCentral SM-20-00081444)
5. TfNSW Asset Standards Authority Airspace Developments (T HR CI 12075 ST)
6. TfNSW Asset Standards Authority System Safety Standard for New or Altered Assets (T MU MD 20001 ST)
7. SafeWork Australia Safe Design of Structures Code of Practice
8. TfNSW Asset Standards Authority Quantified Safety Risk Assessment (T MU MD 20003 GU)
9. TfNSW Asset Standards Authority Risk Criteria for Use by Organisations Providing Engineering Services (T MU MD 20002 ST)
10. TfNSW Asset Standards Authority Enterprise Risk Management (TERM) Standard (30-ST-164)
11. TfNSW Asset Standards Authority Railway Surveying (T HR TR 13000 ST)
12. TfNSW Asset Standards Authority Electrolysis from Stray DC Current (T HR EL 12002 GU)
13. RailCorp Engineering Specification SPC 207 Track Monitoring Requirements for Undertrack Excavation as amended by TfNSW Technical Note TN 004:2015

### 22.3 Policies and Guidelines

1. Principal Contractor Drug and Alcohol Policy
2. Principal Contractor Fatigue Management Policy
3. Independent Transport Safety Regulator Guidelines for Fatigue Management.

### 22.4 Project Documentation

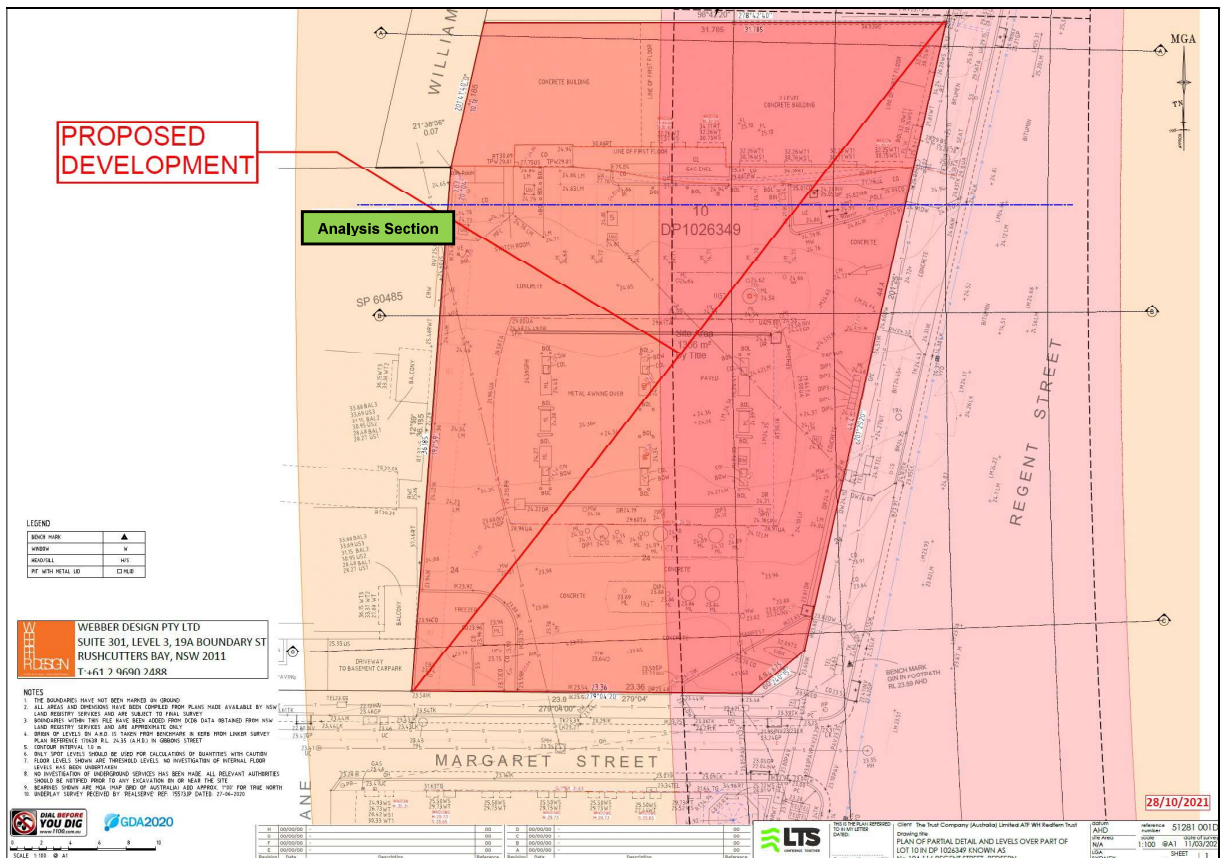
1. Geotechnical investigation by PSM Consulting dated July 2020
2. Douglas Partners Report on Geotechnical Investigation (DP 99740.01.R.002.Rev0) dated October 2021.
3. Acoustic Logic Metro Tunnel Vibration Management Plan (20210248.2/0511A/R1/AW) dated 5 November 2021.
4. Douglas Partners Preliminary Report on Numerical Modelling and Impact Assessment (R.001.Rev0) dated 16 November 2021.

5. Cathodic Protection Services Preliminary Electrolysis & Stray Traction Current Report (A715-338) dated 19 November 2021.
6. GKA Management Rail Risk Management Plan (GKA REG 003) dated 22 November 2021.

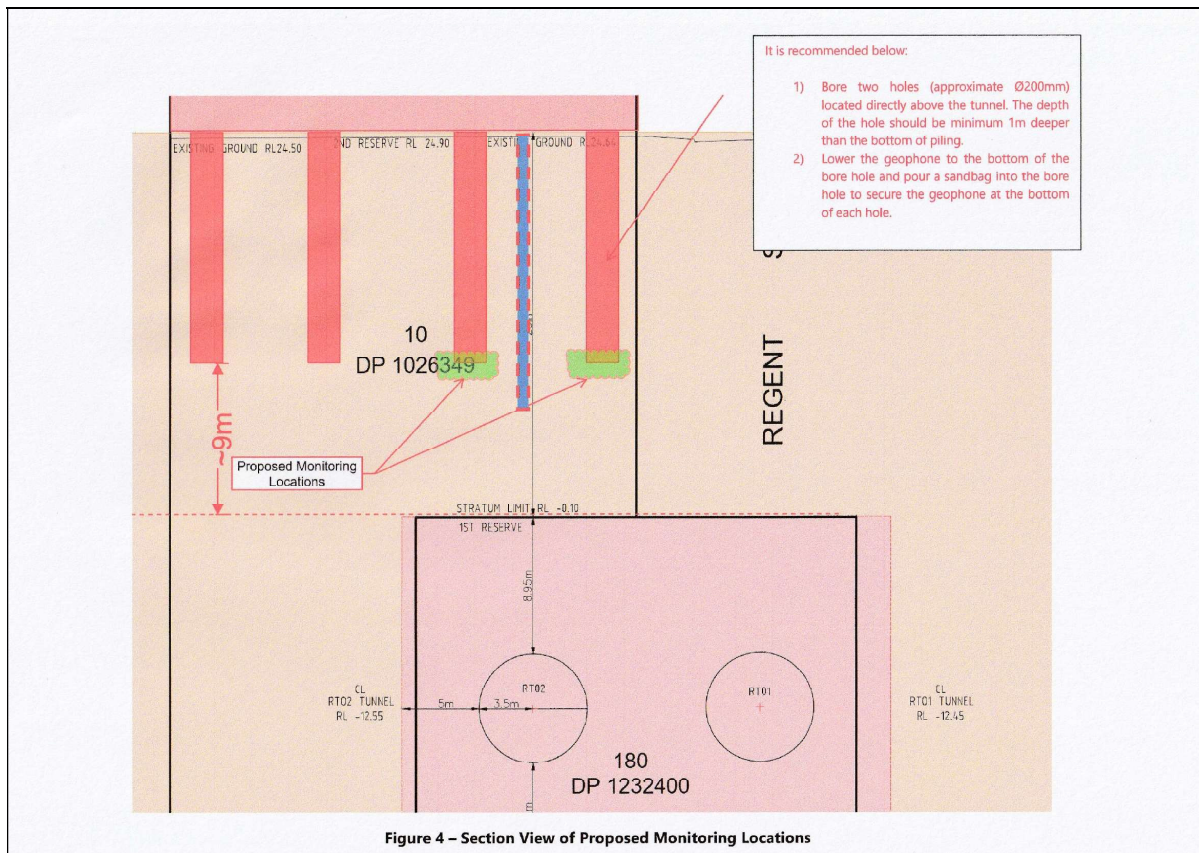
## Appendix A

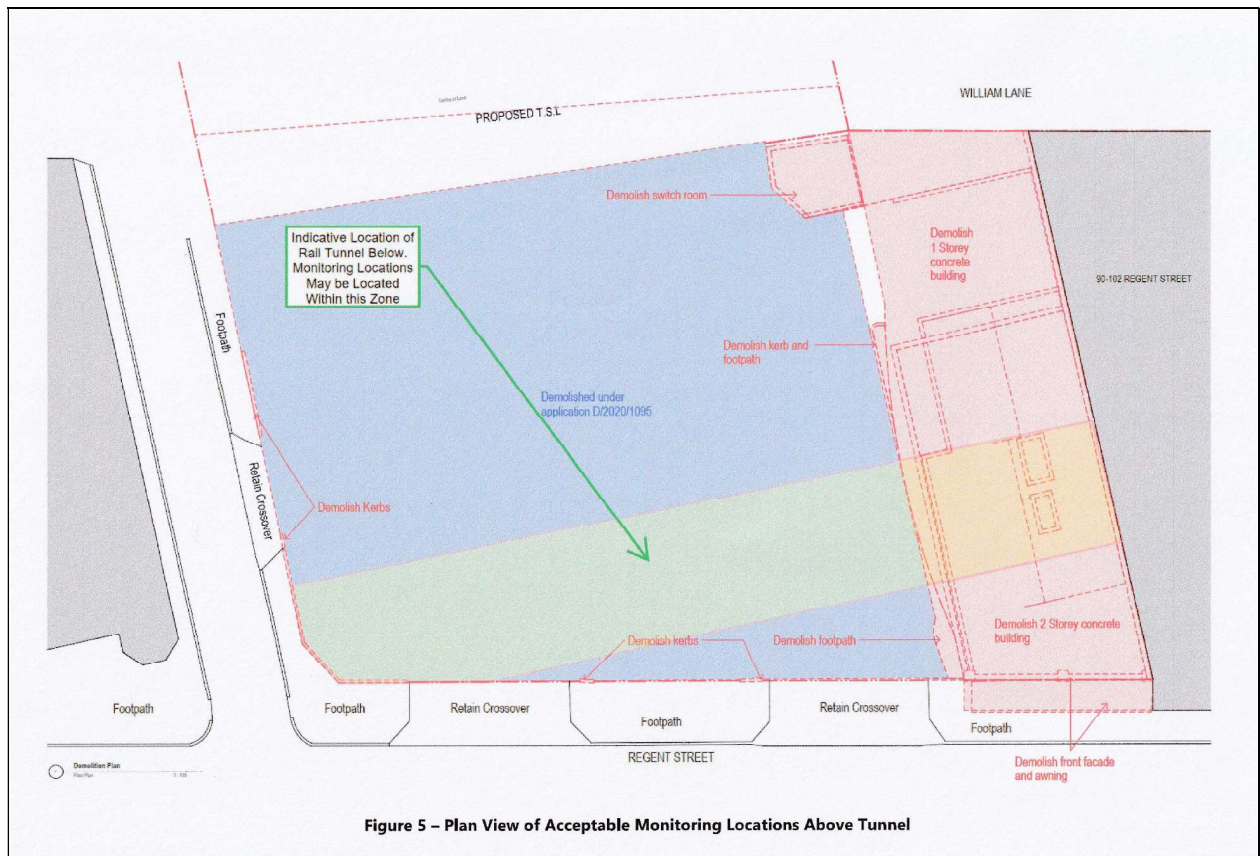
### Project Drawings





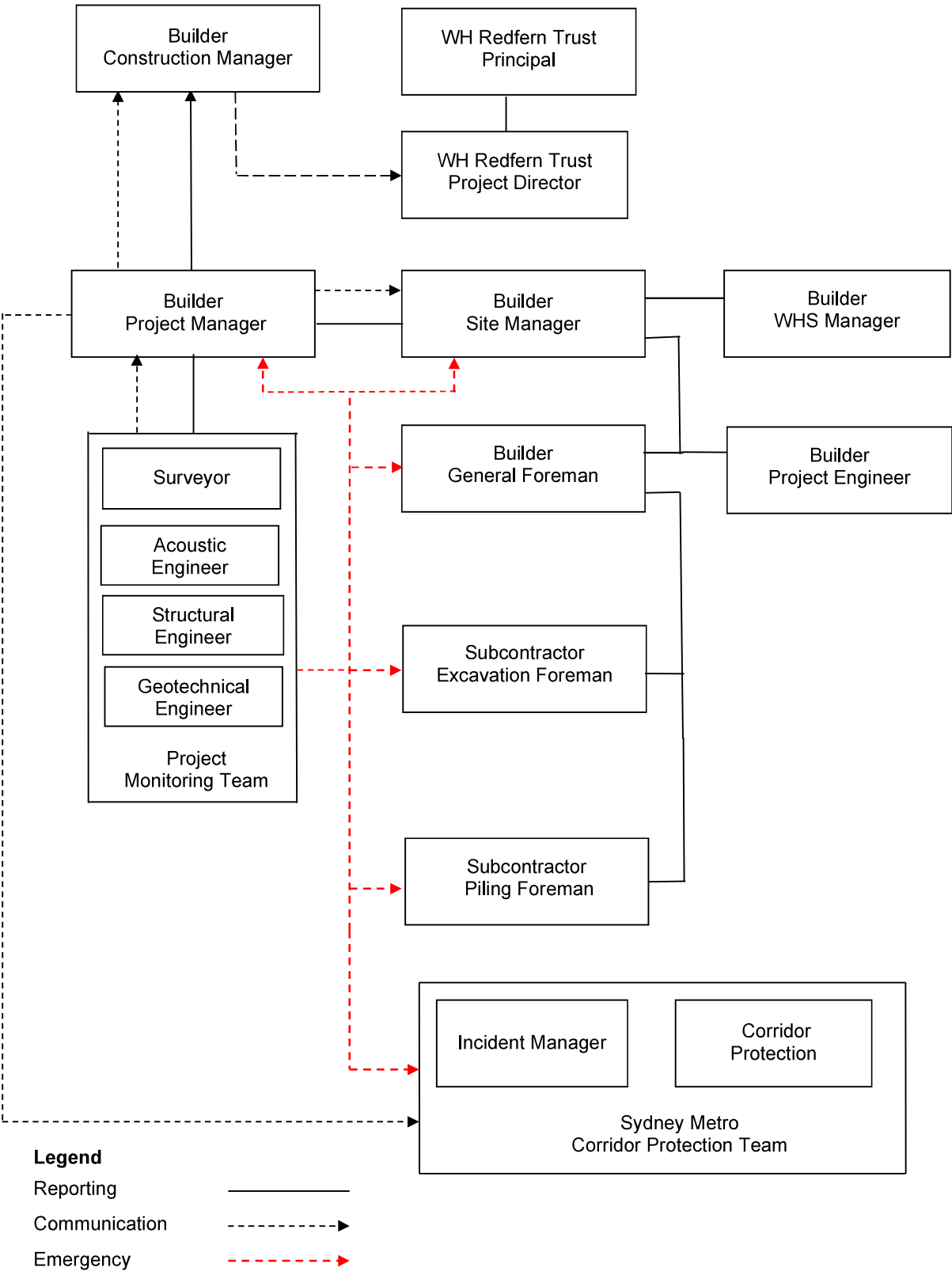






**Appendix B**

**Project Organisation Chart**



## Appendix C

### Contact and Communication List

NAME	POSITION	CONTACT NUMBER	EMAIL	COMMUNICATION							
				Warning Alert	Stop Work Alert	Vibration Report	Excavation and Piling Report	Ground Settlement Report	Inclinometer Report	Track Survey Report	Incident Report
BUILDER											
	Construction Manager			Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes
	Project Manager			Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes
	Site Manager			Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes
	General Foreman			Yes	Yes	No	No	No	No	N/A	No
DOUGLAS PARTNERS											
	Geotechnical Engineer			Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes
LAND TITLE SOLUTIONS											
	Surveyor			Yes	Yes	No	No	Yes	No	N/A	Yes
ACOUSTIC LOGIC											
	Vibration Engineer			Yes	Yes	Yes	No	No	No	N/A	Yes
WEBBER DESIGN											
	Structural Engineer			Yes	Yes	Yes	Yes	Yes	Yes	N/A	No
WH REDFERN TRUST											
	Project Director			Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes





NAME	POSITION	CONTACT NUMBER	EMAIL	COMMUNICATION							
				Warning Alert	Stop Work Alert	Vibration Report	Excavation and Piling Report	Ground Settlement Report	Inclinometer Report	Track Survey Report	Incident Report
SYDNEY METRO											
	Corridor Protection Planner			Yes	Yes	Yes	Yes	Yes	No	N/A	Yes
Various	Incident Manager	1800 171 386	Not applicable.	No	Yes	No	No	No	No	N/A	No

## Appendix D

### Drawing and Specification Register

[illegible][illegible]

## Appendix E

### Inspection and Test Plan Register

[illegible]

## Appendix F

### Work Method Statement / Safe Work Method Statement Register



[illegible]

## Appendix G

### Intervention Limits

## Ground Movement

Intervention limits for movement of the basement retaining wall will be documented in the DP Geotechnical Monitoring Plan and will be replicated in the table below.

CONTROL MEASURE	NOMINAL MAXIMUM	ALARM LEVEL 1 (ALERT LEVEL)	ALARM LEVEL 2 (ACTION LEVEL)	ALARM LEVEL 3 (EXCEEDANCE)
Survey of site markers	TBA	TBA	TBA	TBA

Intervention limits for sheetpile walls will be documented in the DP Geotechnical Monitoring Plan and will be replicated in the table below.

CONTROL MEASURE	NOMINAL MAXIMUM	ALARM LEVEL 1 (ALERT LEVEL)	ALARM LEVEL 2 (ACTION LEVEL)	ALARM LEVEL 3 (EXCEEDANCE)
Survey of site markers	TBA	TBA	TBA	TBA

Intervention limits for ground movement at site boundaries will be documented in the DP Geotechnical Monitoring Plan and will be replicated in the table below.

CONTROL MEASURE	NOMINAL MAXIMUM	ALARM LEVEL 1 (ALERT LEVEL)	ALARM LEVEL 2 (ACTION LEVEL)	ALARM LEVEL 3 (EXCEEDANCE)
Horizontal survey of site markers	TBA	TBA	TBA	TBA
Vertical survey of site markers	TBA	TBA	TBA	TBA

## Vibration

The intervention limits for peak particle velocity within the Sydney Metro rail tunnels documented in section 4.4 of the AL Vibration Management Plan are replicated in the table below.

CONTROL MEASURE	PREDICTED MAXIMUM	ALARM LEVEL 1 (ALERT)	ALARM LEVEL 2 (WARNING)	ALARM LEVEL 3 (STOP)
Monitoring with vibration logger (within tunnel)	N/A	< 12.5mm/sec	≥ 12.5mm/sec	≥ 15mm/sec

## Appendix H

### Response to Monitoring Alarms

## Ground movement

Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
1	The Surveyor will produce reports of the monitoring data within two business days and forward a copy to the Project Manager	If Alarm Level 2 monitoring criteria are reached the Surveyor will check survey instrument readings, stability of survey markers or prisms and take further readings to verify results	If Alarm Level 3 monitoring criteria are reached the Surveyor will check survey instrument readings, stability of survey markers or prisms and take further readings to verify results
		Unless Alarm Level 2 reading can be confirmed as false:	Unless Alarm Level 3 reading can be confirmed as false:
2	The Project Manager will review the Surveyor's report to confirm that movements are within the Alarm Level 1 range	The Surveyor will contact and send a SMS text on completion of the second round of survey readings to the Project Manager and Site Manager	The Surveyor will contact and send a SMS text on completion of the second round of survey readings to the Project Manager and Site Manager
3	The Project Manager will submit the reports to the Geotechnical Engineer and the Sydney Metro Corridor Protection Assistant Planner (or delegate) on a fortnightly basis	The Site Manager will advise personnel on site that a warning limit has been exceeded and implement necessary measures in relation to works progressing in the relevant area	The Site Manager (or delegate if not on site) will stop works in all site areas that may have affected ground movement
4		The Surveyor will document the survey readings and forward the report to the Project Manager within 24 hours	In the case of an emergency the Site Manager (or delegate if not on site) will activate the site siren and flashing light alarm, and will confirm with plant operators over the two way radio that work has ceased
5		The Project Manager will notify the Geotechnical Engineer and Structural Engineer immediately that Alarm Level 2 has been exceeded and forward a copy of the Surveyor's report when received	The Surveyor will document the survey results and forward the report to the Project Manager within 24 hours
6		The Project Manager will immediately notify the Construction Manager that Alarm Level 2 has been exceeded and forward the Surveyor's report when received	The Project Manager will notify the Geotechnical Engineer and Structural Engineer immediately that Alarm Level 3 has been exceeded and forward a copy of the Surveyor's report when received
7		The Construction Manager will immediately notify the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Planner (or delegate) that Alarm Level 2 has been exceeded and forward the Surveyor's report when received	The Project Manager will immediately notify the Construction Manager that Alarm Level 3 has been exceeded, advise which works have ceased and forward the Surveyor's report when received
8		The Geotechnical Engineer will correlate monitoring results with previous assessments and predicted movements	The Construction Manager will immediately notify the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Planner (or delegate) that Alarm Level 3 has been exceeded and forward the Surveyor's report when received



Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
9		The Geotechnical Engineer will assess the situation and determine whether continued movement will result in Alarm Level 3 being exceeded	The Geotechnical Engineer will correlate monitoring results with previous assessments and predicted movements
10		The Geotechnical Engineer will liaise with the Structural Engineer and produce a preliminary technical assessment report within 24 hours of receiving the survey report and a final report within 3 business days documenting (where applicable) remedial measures that need to be implemented and revised monitoring frequencies	The Geotechnical Engineer will assess the situation and determine the extent of continued movement to completion of the works
11		The Geotechnical Engineer will forward the technical assessment reports to the Project Manager	The Geotechnical Engineer will liaise with the Structural Engineer to determine whether a dilapidation survey of the rail tunnels is required and if required the Project Manager will request the Sydney Metro Corridor Protection Planner (or delegate) to facilitate access.
12		The Project Manager will forward the reports to the Construction Manager who in turn will forward the report to the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Planner (or delegate) by email	The Geotechnical Engineer will undertake the dilapidation inspection and provide a report to the Project Manager within 24 hours (subject to Sydney Metro facilitating access)
13		The Project Manager will implement all actions documented in the Geotechnical Engineer's report and increase the frequency of monitoring if specified	The Project Manager will forward the Geotechnical Engineer's report to the Structural Engineer and Construction Manager
14			The Construction Manager will provide a copy of the report to the WH Redfern Trust Project Director and the Sydney Metro Corridor Protection Planner (or delegate) by email
15			The Project Manager will arrange for all remedial actions documented in the Geotechnical Engineer's report to be implemented
16			The Geotechnical Engineer will liaise with the Structural Engineer and produce a technical assessment report within 24 hours of relevant data being available, including the outcome of the dilapidation inspection (if any), documenting relevant remedial measures, revised monitoring frequencies, predicted impact on the rail tunnels and an amended Alarm Level 3

Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
17			The Geotechnical Engineer will forward the technical assessment report to the Project Manager
18			Project Manager will forward the report to the Construction Manager who will in turn forward the report to the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Planner (or delegate) by email
19			The WH Redfern Trust Project Director and the Construction Manager will liaise with the Sydney Metro Corridor Protection Planner (or delegate) to obtain approval for a revised Alarm Level 3
20			The Construction Manager will advise the Project Manager, Geotechnical Engineer and Surveyor of the approved revision to Alarm Level 3
21			The Project Manager will implement all actions documented in the Geotechnical Engineer's report and increase the frequency of monitoring if specified

## Vibration

Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
1	Continuous monitoring will be undertaken and downloaded on a regular basis by the Acoustic Engineer	The Site Manager (or delegate if not on site) will on receipt of a SMS text from the vibration monitor advise personnel on site that a warning limit has been exceeded and implement necessary measures in relation to works progressing in the relevant area	The Site Manager (or delegate if not on site) will activate the site siren and flashing light alarm on receipt of a SMS text from the vibration monitor and will stop works in all site areas that may have created the vibration exceedance
2	The Acoustic Engineer will produce a report on fortnightly basis and submit the report to the Project Manager	The Project Manager will confirm that the Site Manager has received a SMS text message from the vibration monitor and confirm which work activities have affected on site	The Site Manager will confirm on the two way radio that relevant operators of plant have stopped work
3	The Project Manager will review the Acoustic Engineer's report to confirm that vibrations have been within the Alarm Level 1 range	The Project Manager will advise the Construction Manager that Alarm Level 2 has been exceeded and which activities have been affected on site	The Project Manager will confirm that the Site Manager has received a SMS text message from the vibration monitor and confirm which work activities have ceased
4	The Project Manager will submit the reports to the Geotechnical Engineer and the Sydney Metro Corridor Protection Planner (or delegate) on a fortnightly basis	The Construction Manager will notify the WH Redfern Trust Project Director and confirm with the Sydney Metro Corridor Protection Assistant Planner (or delegate) that the Alarm Level 2 SMS text has been received	The Project Manager will advise the Construction Manager that Alarm Level 3 has been exceeded and which activities have been stopped on site
5		On receipt of the SMS text from the vibration monitor the Acoustic Engineer will check the reading	The Construction Manager will notify the WH Redfern Trust Project Director and confirm with the Sydney Metro Corridor Protection Planner (or delegate) that the Alarm Level 3 SMS text has been received
		Unless Alarm Level 2 reading can be confirmed as false:	
6		The Acoustic Engineer will attend site, investigate the cause of the exceedance and agree on a revised work method with the Project Manager, Site Manager and relevant Foremen	On receipt of the SMS text from the vibration monitor the Acoustic Engineer will check the reading
			Unless Alarm Level 3 reading can be confirmed as false:
7		The Acoustic Engineer will produce a preliminary technical assessment report within 24 hours and a final report within three business days	The Acoustic Engineer will attend site, investigate the cause of the exceedance and agree on a revised work method with the Project Manager, Site Manager and relevant Foremen
8		The Acoustic Engineer will forward the technical assessment reports to the Project Manager who in turn will forward the report to the Construction Manager	The Acoustic Engineer will produce a technical assessment report within 24 hours and a final report within three business days

Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
9		The Construction Manager will provide a copy of the Acoustic Engineer's reports to the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Assistant Planner (or delegate) by email	The Acoustic Engineer will forward the technical assessment reports to the Project Manager who in turn will forward the reports to the Construction Manager
10		The Acoustic Engineer will monitor the work activity at the site to confirm the revised work method does not generate vibration in excess of Alarm Level 2	The Construction Manager will provide a copy of the Acoustic Engineer's reports to the WH Redfern Trust Project Director and Sydney Metro Corridor Protection Planner (or delegate) by email
11		The Acoustic Engineer will notify the Project Manager and Site Manager of the monitoring outcome	The Acoustic Engineer will liaise with the Geotechnical Engineer and the Structural Engineer to determine whether a dilapidation survey of the rail tunnels is required and if required the Project Manager will request the Sydney Metro Corridor Protection Planner (or delegate) to facilitate access.
12			The Geotechnical Engineer will undertake the dilapidation inspection and provide a report to the Project Manager within 24 hours (subject to Sydney Metro facilitating access)
13			The Project Manager will forward the Geotechnical Engineer's report to the Structural Engineer, Acoustic Engineer and Construction Manager
14			The Construction Manager will provide a copy of the report to the WH Redfern Trust Project Director and the Sydney Metro Corridor Protection Planner (or delegate) by email
15			The Project Manager will arrange for all remedial actions documented in the Geotechnical Engineer's report to be implemented
16			The Acoustic Engineer will determine a revised work method in consultation with the Project Manager and relevant Foremen taking into consideration the findings of the dilapidation inspection (if any)
17			The Project Manager will submit the revised work method to the Construction Manager who in turn will submit the work method to the WH Redfern Trust Project Director and the Sydney Metro Corridor Protection Planner (or delegate)

Step	Alarm Level 1 (Alert)	Alarm Level 2 (Warning)	Alarm Level 3 (Stop)
18			The WH Redfern Trust Project Director and the Construction Manager will liaise with the Sydney Metro Corridor Protection Planner (or delegate) to obtain approval for works to recommence
19			The Acoustic Engineer will monitor work activity at the site to confirm the revised work method does not generate vibration in excess of Alarm Level 2
20			The Acoustic Engineer will notify the site Project Manager of monitoring outcome
21			The Project Manager will provide the report to the Construction Manager who in turn will provide the report to the WH Redfern Trust Project Director and the Sydney Metro Corridor Protection Planner (or delegate) by email