Planning Approval Consistency Assessment Form

SM-17-00000111

Metro Body of Knowledge (MBoK)

Assessment name:	Sydney Metro West – Seismic Refraction Outside Approved Construction Boundary
Prepared by:	GLC
Prepared for:	Sydney Metro
Assessment number:	GLC04
Status:	Final (October 2022)
Version:	C
Planning approval:	SSI 10038
Date required:	October 2022
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For information – do not alter:

Applicable to:	Sydney Metro
Document Owner:	Director, Environment, Sustainability & Planning
System Owner:	Deputy Chief Executive, Operations, Customer & Place-making
Status:	Final
Version:	3.0
Date of issue:	27 November 2020

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The Planning Approval Consistency Assessment Form should be completed in accordance with SM-17-00000103 Planning Approval Consistency Assessment Procedure.

1. Existing Approved Project

Planning approval reference details (Application/Document No. (including modifications)):

- SSI-10038 Sydney Metro West – Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process for Sydney Metro West)
- SSI-10038-Mod-1 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 1 (Administrative Modification)
- SSI-10038-Mod-2 The Sydney Metro West Westmead to The Bays and Sydney CBD – Modification 2 (Clyde Stabling and Maintenance Facility)
- SSI-10038-Mod-3 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 3 (Administrative Modification)

Date of determination:

- SSI 10038: 11 March 2021
- SSI-10038-Mod-1: 28 July 2021
- SSI-10038-Mod-2: 03 June 2022
- SSI-10038-Mod-3: 04 July 2022

Type of planning approval: Critical SSI (Division 5.2 “State significant infrastructure”, *Environmental Planning and Assessment Act 1979*)

Approved Project

The approved project includes the Concept and major civil construction works between Westmead and The Bays (Stage 1 of the planning approval process). This Consistency Assessment relates to Stage 1 works, as described below.

Approved Major Civil Construction Work for Sydney Metro West between Westmead and The Bays

Approved major civil construction works for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process) includes the following. Refer to Section 9 of the Environmental Impact Statement (EIS) for more detail.

- Enabling works, such as demolition, utility supply to construction sites, utility adjustments and modifications to the existing transport network
- Tunnel excavation including tunnel support activities between Westmead and The Bays
- Station excavation for new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities
- Civil work for the stabling and maintenance facility at Clyde.

Stage 1 Construction Sites and Tunnel Alignment

Sydney Metro West - Stage 1 involves major civil construction works for Sydney Metro West (Westmead to The Bays) at nine surface construction sites, including:

- Westmead Metro Station
- Parramatta Metro Station
- Clyde Maintenance and Stabling Facility
- Silverwater Services Facility
- Sydney Olympic Park Metro Station
- North Strathfield Metro Station
- Burwood North Metro Station
- Five Dock Metro Station
- The Bays Metro Station

The location and layout of these construction sites are described in Section 9 of this EIS, with the exception of:

- Westmead Metro Station which received approval for a revised construction site boundary in Consistency Assessment SMW04: Sydney Metro West – Revised Westmead Station Box (endorsed 16 February 2022); and
- Clyde Maintenance and Stabling Facility which received approval for, amongst other things, a revised layout and expanded construction site boundary in Consistency Assessment SMW01: Sydney Metro West – Tunnel boring machine drive strategy and future Rosehill crossover (endorsed 13 September 2021) and SSI-10038-Mod-2.

The location of Stage 1, including the underground tunnel and surface construction sites for the stations and services facilities are shown on Figure 1 below.

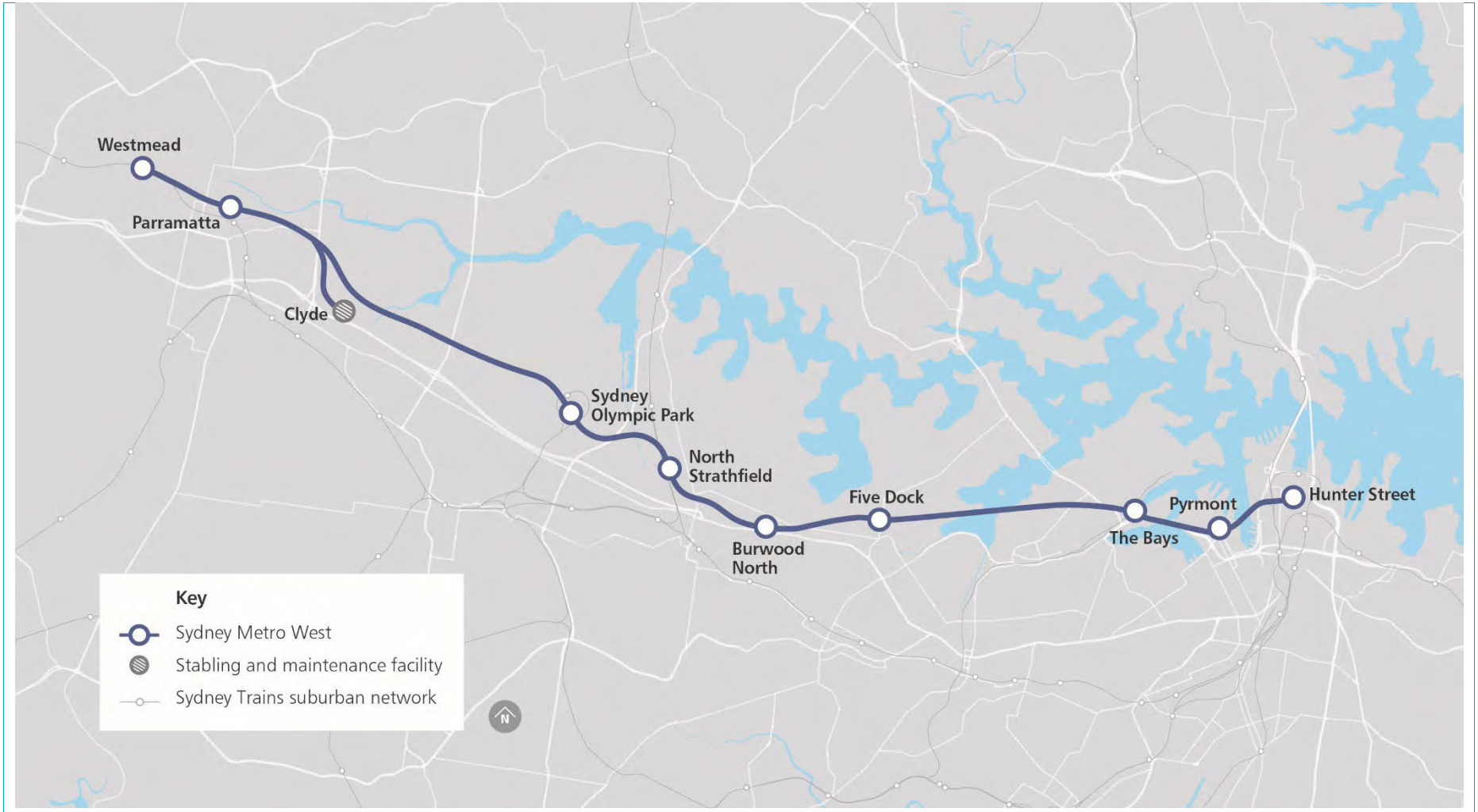


Figure 1: Location of Sydney Metro West - Stage 1

Stage 1 Delivery Phases

The Sydney Metro West - Stage 1 construction works were split into seven delivery phases, including:

- Phase A – Power Enabling Works
- Phase B1 – Central Tunnelling Early Works
- Phase B2 – Central Tunnelling Main Works
- Phase C – Parramatta and Clyde Enabling Works
- Phase D – Greater Sydney Road Works
- Phase E – Existing Rail Corridor Enabling Works
- Phase F – Western Tunnelling Works

This Consistency Assessment has been prepared to support a scope of works for seismic refraction (SR) geophysical testing, which is one aspect of the Detailed Site Investigations (DSI) required for Phase F – Western Tunnelling Works. This phase includes nine kilometres of twin railway tunnels between Sydney Olympic Park and Westmead, as well as station box excavation works, associated support works, retrieval of Tunnel Boring Machines, and construction works for the Clyde Maintenance and Stabling Facility / Rosehill Services Facility.

All SR sites (refer Figure 2 below) are located outside the surface construction site boundaries (but generally above the tunnelling alignment) as identified for the approved project. A targeted assessment of the SR scope of works was not conducted for the approved project, and as such, the existing environment, potential impacts and additional mitigation measures (if any) for these SR works are subject to the investigations undertaken in this Consistency Assessment.

This Consistency Assessment has been prepared using the approved project information and site descriptions for construction activities between Sydney Olympic Park and Westmead, as documented in the 'Relevant background information' section below.

Relevant background information (including EA, REF, Submissions Report, Director General's Report, MCoA):

This Consistency Assessment has been undertaken for the Sydney Metro West – Stage 1 Concept and major civil construction work for Sydney Metro. This includes consideration of the following planning approval documentation:

- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Environmental Impact Statement (15 April 2020)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Submissions Report (20 November 2020)

- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Amendment Report (20 November 2020)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 1 - Administrative Modification (28 July 2021)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 2 – Clyde Stabling and Maintenance Facility Modification Report (03 June 2022)
- Sydney Metro West - Westmead to The Bays and Sydney CBD (Concept and Stage 1) Modification 3 - Administrative Modification (04 July 2022)
- Consolidated Instrument of Approval (04 July 2022).

All documentation has been published on the Department of Planning and Environment Major Projects website located here (Major Project Number: SSI-10038): https://www.planningportal.nsw.gov.au/major-projects/project/25631

Other relevant documentation prepared as part of design development and construction planning include:

- Consistency Assessment SMW01: Sydney Metro West – Tunnel boring machine drive strategy and future Rosehill crossover (endorsed 13 September 2021).
- Consistency Assessment SMW02: Sydney Metro West – Revised Westmead Station Box (endorsed 16 February 2022).Consistency Assessment GLC02; Sydney Metro West – Clyde Dive and Portal Structure (endorsed 2 August 2022).
- Consistency Assessment SMW03: Sydney Metro West – Soil Resistivity Testing (submitted 17 August 2022).

All proposed works identified in this assessment would be undertaken in accordance with the mitigation measures identified in the EIS, Submissions Report, Amendment Report and the Ministers Conditions of Approval (MCoA).

2. Description of Proposed Development/Activity/Works

The purpose of this Consistency Assessment is to assess the location and methodology for the proposed SR sites, as shown on **Figure 2.** below. Refer to Appendix A for more detailed location and site context for each SR site.

The proposed SR works are required to gather data for the detailed tunnel design and provide additional input into the geotechnical model.

The proposed activity involves SR above the tunnel alignment. This method involves the measurement of travel times of refracted seismic compressional waves (P-waves). Seismic energy is generated on the surface using a sledge hammer or a drop weight and in marine environments using an air gun or boomer. The generated seismic waves propagate through the subsurface at a certain velocity. On reaching

a geological boundary the wave is critically refracted and when it returns to the surface it is able to be detected as vibrations by a linear array of geophones.

Analysis of refracted wavelet arrival times, velocities, and geophone geometries can be used to resolve:

- Bedrock mapping
- Mapping weathered zones
- Stratigraphic mapping
- Indicative material hardness for piling, tunnelling and excavation works
- Identification of fault / fractured zones

The output of the testing is a cross-section showing lateral changes in the depth to the various refracting interfaces and the seismic velocities within them.

SR5
SR4b
SR4a
SR6
SR2
SR1
Westmead
Parramatta
Mays Hill
Harris Park
Holroyd
Granville
Merrylands
Rydalmere
Ermington
Melrose Park
Silverwater
Newington
Auburn
South Granville
Guildford
Homebush
James Ruse Dr
Silverwater Rd
Western Mtwy
n Mtwy

LEGEND

- Seismic refraction sites
- Tunnel alignment
- Approved construction boundary

CLIENT
TfNSW

PROJECT
SMW WTP

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

0 125 250 500 750 1,000 Meter

SCALE: 1:25,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

SHEETS SHEET 1 of 1

Rev. C

FIGURE

Path: C:\Live_Projects\wtp_gis\a_current\mapping\environment\WTP_Environment_CA_Seismic.aprx

Proposed Methodology

Surface seismic refraction

The SR surface sites will be small, temporary work areas located above the tunnel alignment.

At each surface site the seismic array will be placed on the ground using a 24 or 48 channel seismograph system. Geophones will be spaced at 3m intervals.

On grassed surfaces the geophones are pushed on a spike into the ground. The length of this spike is approximately 50-100mm, less than a standard tent peg. The geophones are only be placed where an unobstructed vertical placement is possible. Where the geophone is on a hard or compacted surface they are placed on a metal plate. No excavation of the soil is required.

The geophones are placed by hand (see Figure 3 to 6 below for indicative equipment to be used).

The majority of the locations for the SR are within grassed areas, either on public or private property. The location of the SR array is shown on the figures in Appendix A of this Consistency Assessment. The exact location of the geophones will be determined on site and will avoid built structures, heritage items, trees or other significant vegetation and the placement will ensure compliance with the mitigation measures outlined in Section 10. The array is connected, via cables, to a laptop for data collection and review.

Once the geophone array is laid out a seismic source is generated a number of times to initiate the seismic waves. In Parramatta Park and Robin Thomas Reserve the seismic source will be a sledgehammer striking a metal plate. In areas accessible by vehicle a weight drop (PEG-40) will be used as the seismic source. The vehicle will generally follow the centre line of the array to initiate the seismic wave.

Along the geophone array a shot location is established approximately every 12m. At each shot location the seismic source is generated between 3 – 15 times depending on background vibration. The sledgehammer will generally be used more times (upto 15 strikes), the weight dropper fewer times (maybe only 3). Within a 15min period the team may be able to operate at 3 shot locations.

A continuous geophone array maximises the depth and longitudinal extent of the data collected. For this reason a continuous array is preferred. However, to avoid major road crossings (eg SR4 Harris Street), the array may be split and placed in more than one line.

Each work site will be in operation for one to two days. In total, the SR works will take approximately 8 days to complete over all the sites.

Public safety measures and signage will be used at each site to reduce the potential for localised impacts. Orange safety cones or similar will be placed around the test site to demarcate potential trip hazards. Appropriate signage will be used at each site to notify the public of the proposed works.

All equipment is removed after the test is completed.

In summary, the methodology for the surface SR works is as follows:

1. Site establishment, including survey confirmation as required to place the geophone array, placing works signage and pedestrian signage.
2. Install geophones generally in a straight-line by hand.
3. Place witches hats or similar around work areas to ensure public safety.
4. Initiate seismic shot (approximately 5 – 15 strikes depending on results).
5. Repeat seismic shot along the length of the array.
6. Remove geophones.
7. Remove signage from work area.

The following equipment will be required:

- Light vehicles
- Hand tools
- Geophone arrays and associated cabling
- Seismic source (sledge hammer or PEG-40 weight drop)
- Health and safety documentation (i.e. SWMS/JSEA)
- Computer and data recording
- Camera
- Tape measure
- Measurement sheets

Marine seismic refraction

There is one marine SR site at Haslams Creek (SR1).

Similar to the land sites a seismic source and receiving array are required at this site.

A small metal or rubber dinghy with outboard will be used to access the creek. Boat access to Haslams Creek will be coordinated with SOPA and is likely to be via an existing gate and steps/rungs at the M4 litter boom, approximately 850m upstream of the SR1 worksite. Access

requirements will be finalised as part of further consultation with SOPA and all access will be in accordance with the SOPA Work Permit. Access to Haslams Creek, including any vehicle access along public pathways, will be facilitated by SOPA rangers.

From the dinghy a hydrophone array will be lowered to the creek perpendicular to the tunnel alignment approximately 200m long). The weight of the hydrophone will ensure it sits on the bed of the creek.

Once the array is laid a seismic source is generated a number of times to initiate the seismic waves. This will be via use of an airgun. The airgun will be a single unit operating at the lower pressure end (approximately 800psi). The dinghy will move over the centre line of the array to initiate the seismic wave.

A shot location is established approximately every 12m. At each shot location the seismic source is generated onceAlong the array pto 15 locations will be tested. This process will be repeated for a maximum of 3 arrays, within the area shown in Appendix A.

Continuous seismic reflection

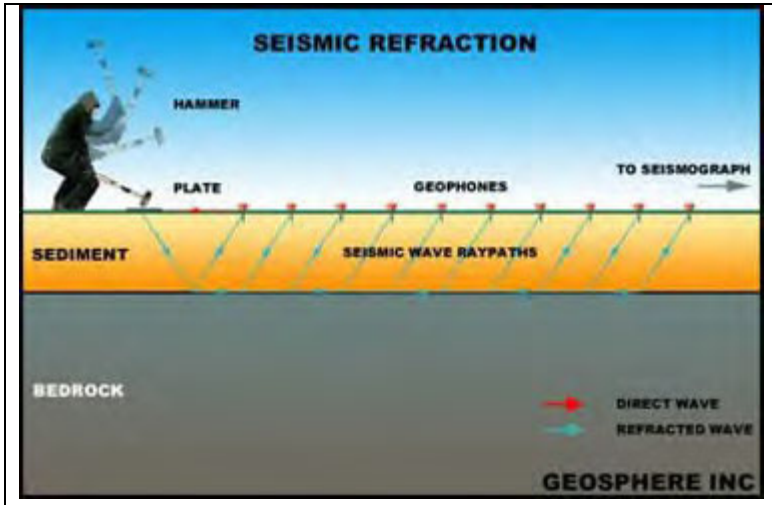
Continuous seismic reflection or sub-bottom profiling is another seismic method which offers rapid geotechnical coverage. Similar to the marine seismic refraction, a hydrophone array is used to collect data generated with a seismic source (or boomer). The boomer is an electrically powered seismic source which provides acoustic energy generally in the range of 650Hz to 15Khz. The boomer is a lower energy source than the air gun and is set to operate at a regular interval (between 4-10 seconds). The boomer is towed around the SR1 site, as shown in Figure 8 below. A number of runs will be made within the collection area (shown in Appendix A). Each run will generally be perpendicular to the tunnel alignment. The boomer is turned off while the boat is turning and resetting for each collection run.

The SR and continuous seismic reflection work in Haslams Creek will take 1 day to complete within a tidal period of approximately 6-7 hours. Work will be scheduled to take advantage of a morning rising tide, so work can be completed within standard working hours.

The following equipment will be required:

- Boat (small dinghy and outboard) and required safety and navigation aids
- Hand tools
- Hydrophone array and associated cabling
- Seismic sources (air gun and boomer)
- Health and safety documentation (i.e. SWMS/JSEA)
- Computer and data recording
- Camera

- Tape measure
- Measurement sheets



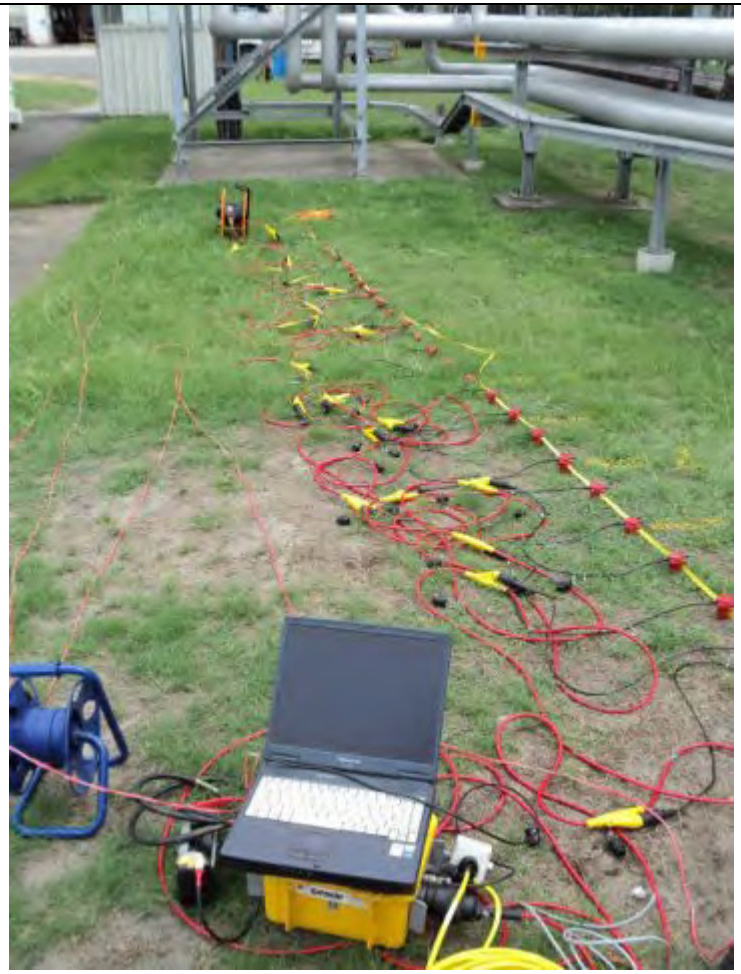


Figure 3: Schematic of seismic resistivity	Figure 4: Seismic resistivity equipment
	
Figure 4: Seismic source – sledgehammer	Figure 5: Seismic source – vehicle mounted weight drop

Figure 6: Airgun (typical) – seismic source

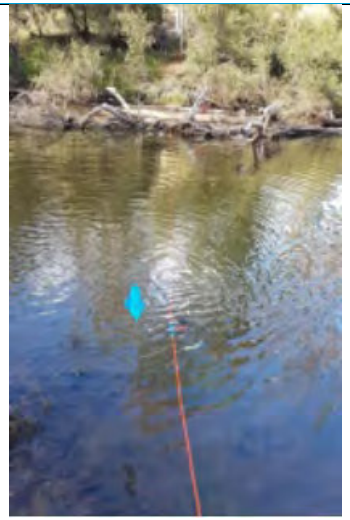


Figure 7: Hydrophone cable

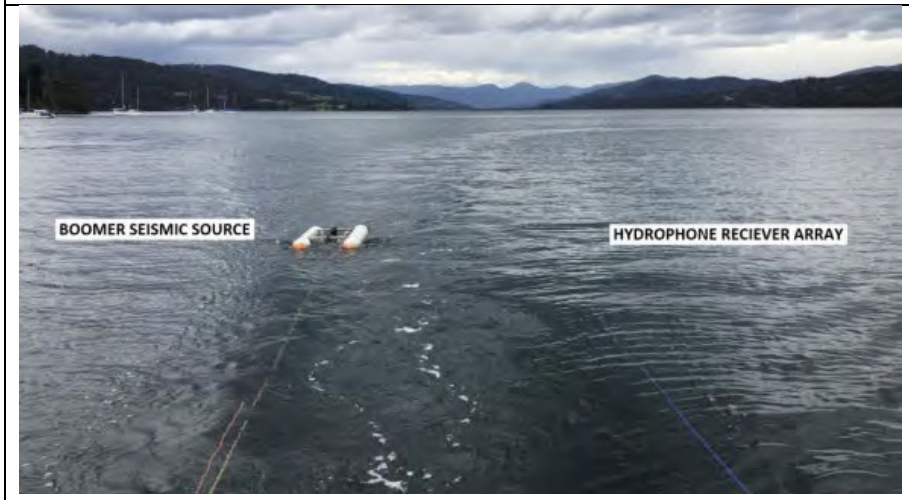


Figure 8: Continuous seismic reflection typical equipment	

3. Timeframe

The SR works will take approximately 1-2 days to complete at each site. It is expected that these works will be undertaken in October 2022, dependent on the approval timeline for this Consistency Assessment.

The SR works will occur within the approved standard hours for the project and comply with Condition D37 and D38 of the MCoA.

Should out-of-hours works be required for access (eg Parramatta Park in consultation with Parramatta Park Trust) this would be managed in accordance with the Project Noise and Vibration Management Plan, the EPL 21676 and the Out-of-hours Work Protocol.

4. Site Description

There are five SR sites between Westmead and Sydney Olympic Park, all of which fall within the City of Parramatta Local Government Area. Refer to Table 1 for the site description at each SR location and Appendix A for more detailed figures containing SR locations.

Table 1: Site Description

SR ID	Site Description
SR1	This site is located within Haslams Creek adjacent to the The Pyramid parkland in Sydney Olympic Park, and industrial premises to the east and Haslam Field in Sydney Olympic Park and Newington Public School to the west. The site is approximately 1.0km northwest of the surface construction site boundary for Sydney Olympic Park Metro Station. Haslams Creek at SR1 is a modified creekline which has been widened and naturalised as part of the construction of Sydney Olympic Park. The site is situated within 'C3 - Environmental Management zoned land under the State Environmental Planning Policy (Precincts—Central River City) 2021.
SR2	This site is located in Rosehill, within the Rosehill Garden Racecourse approximately 35m north of the surface construction site boundary for Clyde Maintenance and Stabling Facility. Rosehill Gardens Racecourse horse stables are located to the west and the Clyde MSF work site to the south. The site is bound by Unwin Street to the south. The site is situated within 'RE2 – Private Recreation' zoned land under the Parramatta Local Environmental Plan 2011.
SR4	The site is located to the east and west of Harris Street Parramatta approximately 720m east of the surface construction site boundary for Parramatta Station. SR4a, is within Robin Thomas Reserve, with SR4b within a carpark and commercial construction site. The site is situated within 'RE1 – Public Recreation' zoned land under the Parramatta Local Environmental Plan 2011 and B4 – Mixed Use zoned land under the Parramatta Local Environmental Plan 2011.

SR5	This site is located within Parramatta Park, Parramatta, generally on the northern side of Railway Parade, approximately 615m east of the surface construction site boundary for Westmead Metro Station. Parramatta River and Old Government House are located to the north of the site. The proposed array would cross Long Avenue and Federal Avenue within the Parklands. The site is situated within 'RE1 – Public Recreation' zoned land under the Parramatta Local Environmental Plan 2011.
SR6	This site is located in Parramatta, adjacent to the Clyde Dive site in the east and James Rouse Drive to the west. The site is generally located within a car parking area of the Rosehill Gardens Racecourse. The site is situated within 'B5 – Business Development zoned land under the Parramatta Local Environmental Plan 2011.

5. Site Environmental Characteristics

The proposed SR sites are generally located above the tunnel alignment between Westmead to Sydney Olympic Park. As these sites are located outside the surface construction site boundaries, environmental characteristics for each SR site have not been previously described as part of the approved project.

A desktop assessment, review of the EIS and supporting assessments, as well as a site inspection in July 2022 at publicly accessible SR locations was undertaken to understand the existing environment for each site and potential impacts associated with the proposed works.

A Heritage Due Diligence Assessment was also undertaken to understand the potential impacts of the proposed SR works on the listed heritage items and Aboriginal sites within the vicinity of the proposed works, which are identified in Appendix B of this Consistency Assessment. The full Heritage Due Diligence Assessment is attached as Appendix D of this Consistency Assessment.

The surrounding environmental characteristics is summarised below for the broader SR scope of works.

Land Use

A review of the NSW Spatial Services Historical Imagery Viewer was undertaken in August 2022 to understand the historic and current land use for each site.

The land surrounding these sites were typically used for agricultural purposes and residential areas prior to the 1950s. Parramatta CBD and Sydney Olympic Park gradually developed into commercial precincts leading up to the early 2000s. The land surrounding the SR sites in Rosehill were historically used as racecourses (for horses and vehicles) and developed into industrial areas between the 1950s and 1970s.

Currently, the majority of the SR sites sit within grassed areas generally removed from residential areas.

Non-Aboriginal Heritage

A review of the following publicly available online databases was undertaken in August 2022:

- Australian Heritage Database
- NSW State Heritage Inventory (SHI)

- Schedule 5 of relevant Local Environmental Plans (LEP)

Several SR sites are located within Local, State, National or World heritage areas, which are illustrated in Appendix B and assessed in Appendix C. In summary, the following SRs are located within a curtilage identified as having non-Aboriginal heritage significance:

- SR5: *Parramatta Park and Old Government House (World heritage - 106209), National Heritage ID: 105957, State heritage – 00596 and Parramatta LEP 2011 I00596)*
- SR4: *Robin Thomas Reserve / Ancient Aboriginal and Early Colonial Landscape (State heritage – 01863 and Parramatta LEP 2011 A2)*
- SR2, 4, 5 and 6: *Located within Archaeological Management Units*

Aboriginal Heritage

An AHIMS extensive search was undertaken in July 2022. Site cards and archaeological reports were obtained for sites within 50m of an SR location. The location of the AHIMS site, are illustrated on Appendix B and assessed in Appendix C.

In summary, the following SRs are located within 50m of one or more AHIMS sites: SR5 and SR4.

Noise and Vibration

A qualitative Construction Noise and Vibration Impact Assessment (NVIA) was prepared to assess the potential noise and vibration impacts associated with the seismic refraction scope (see Appendix E). The existing noise environment at and near each SR site is generally dominated by road traffic noise and background urban noise. Table 2 summarises the daytime approved construction hours Noise Management Level (NML) for each Noise Catchment Area (NCA) that the SR sites reside within, based on Technical Paper 2 (Noise and Vibration) of the EIS. Based on the scope of work described in Section 2 the $L_{Aeq(15min)}$ is expected to remain below project NMLs at nearby receivers. The scale of seismic investigation at Haslams Creek is considered minor and underwater noise impacts are not expected.

Vibration impacts were also considered and vibration impacts are expected to remain below the conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) at nearby receivers and heritage items.

Table 2: Noise Management Levels (NML)

Site	NCA	NML, dBA
SR1	NCA07	56
SR2	NCA07	56
SR4	NCA04 (a) and NCA03 (b)	61/68
SR5	NCA01 and NCA03	58/68

SR6	NCA07	56

Hydrology

The majority of SR sites are located within 150m of the Parramatta River or a southern tributary of Parramatta River, including Duck Creek and A'Becketts Creek. The Haslams Creek site (SR1) is within the waterway. Haslams Creek discharges to Homebush Bay and is noted in the EIS as having elevated nutrient levels and faecal coliform concentrations.

Soils and Contamination

In addition to reviewing the EIS and supporting documents, a search of the NSW EPA public registers and the NSW DPE eSPADE portal were undertaken in August 2022. The SR sites are located on the Cumberland Plain, an extensive low-lying plain within the Cumberland Basin, within four soil landscapes; Birrong, Blacktown, Disturbed Terrain and Glenorie. Several sites are located within 250m of an area of potential contamination risk, particularly around Sydney Olympic Park, Clyde and Rosehill. No areas of acid sulfate soil risk were identified for the proposed SR sites.

The SR works do not involve subsurface disturbance.

Biodiversity

A search of the NSW DPE State Vegetation Type Map was undertaken in July 2022. A site inspection was undertaken to observe ecological characteristics for each site. The majority of the SR sites are located in cleared grassland with scattered native trees.

Haslams Creek at SR1 has been widened and naturalised as part of the construction of Sydney Olympic Park. Prior to this naturalisation work Haslams Creek was a narrow concrete channel. Following hydrological rehabilitation, gabion walls and sandy soil with rubble were used to construct saltmarsh beds on the eastern bank in 1998, and saltmarsh plants were transplanted within the area. Restoration of this location has not been entirely successful and is the subject of ongoing maintenance. Saltmarsh is an endangered ecological community under the *Biodiversity Conservation (BC) Act 2016* and a vulnerable ecological community under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. This saltmarsh is not mapped as a PCT but would be avoided by the work.

Areas adjacent to SR 1 have been assessed as part of two separate Consistency Assessments (for geotechnical borehole works and soil resistivity testing outside the construction boundary). The assessments identified two threatened flora species (Narrow-leafed Wilsonia and *Zannichellia palustris*) and two threatened fauna species (Grey-headed Flying Fox and Green and Golden Bell Frog) as having a high likelihood of occurrence along Haslams Creek and adjacent terrestrial lands. This is discussed further in Appendix E and Section 10.SR5 is located within 50m of a mapped Plant Community Type (PCT) - (PCT 3320 Cumberland Plain Woodland which is a Critically Endangered Ecological Community under the BC Act 2016 and the EPBC Act 1999). Refer to Appendix H for the map containing PCTs near the SR sites.

Traffic, Transport and Access

Light vehicles will only be used for transport to each SR site, and access to the SR sites will avoid any impact to public roads. The impacts therefore are expected to be minimal. Appropriate controls will be in place to manage pedestrian impacts and any minor traffic management required (eg within Parramatta Park). Light vehicles will park in publicly available spots, either kerbside or in a parking lot.

Land access agreements will be in place for each of these SR sites prior to commencement of works.

6. Justification for the proposed works

The proposed SR works are required to gather data for the detailed tunnel design and provide additional input into the geotechnical model. Along the tunnel alignment, where highly weathered shale or sandstone as well as alluvium deposits are known, detailed information is required to fully understand the extent of rock cover above the tunnel to progress the detailed tunnel design. The SR locations target these areas so detailed geological information can be gathered including:

- Bedrock mapping
- Mapping weathered zones
- Stratigraphic mapping
- Indicative material hardness for piling, tunnelling and excavation works
- Identification of fault / fractured zones

The results of SR works will assist in understanding the geotechnical conditions of the tunnel alignment between Westmead and Sydney Olympic Park to inform the design. Without the SR works occurring these essential inputs will not be available.

7. Environmental Benefit

Due to the minor scope associated with the proposed SR works, no significant environmental benefits are expected.

8. Control Measures

An Environment Management Plan specific to the proposed SR works is not required. The Sydney Metro Construction Environmental Management Framework sets out the overall approach to environmental management.

9. Climate Change Impacts

No change in climate change risk (as identified in the EIS) will occur as a result of the proposed SR works.

10. Impact Assessment – Construction

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Flora and fauna	No pruning or removal of any trees or vegetation is proposed under this Consistency Assessment. For land based SR workthe geophones are placed by hand on a spike in the ground (a maximum of 100mm which is less than a tent peg), and will be placed in mown or cleared grassland areas. Works in Parramatta Park will not impact on the mapped Cumberland Plain Woodland as trees and vegetation will be avoided. For the marine SR work (SR1) in Haslams Creek the scope of work has been refined to use solely marine based methodologies that do not require access to the creek banks. Work will be carried out perpendicular to the tunnel alignment using two seismic methodologies (SR and continuous seismic reflection). There will be no impact to vegetation, including the Coastal saltmarsh community. Similarly, avoidance of the creek banks will avoid potential impact to Narrow-leafed Wilsonia, the threatened flora species with a high likelihood of occurrence in the area Access to Haslams Creek will be finalised in consultation with SOPA. Existing access tracks and cleared areas will be used to avoid impact to all vegetation. As the proposed scope of works is limited to Haslams Creek itself and no interaction with the terrestrial environment will occur, the likelihood of impact to the Narrow-leafed Wilsonia and Grey-headed Flying Fox is extremely low.	• Personnel will be given an overview of sensitive flora and fauna relevant to the worksite including the location of the Saltmarsh and Cumberland Plain EECs, Narrow-leafed Wilsonia, *Zannichellia palustris*and the Green and Golden Bell Frog. • Attend SOPA site induction for works within Sydney Olympic Park. • Access to Haslams Creek (SR1) will only be via the designated access point in the approved SOPA Work Permit • The creek banks at Haslams Creek (SR1) will be avoided to protect the saltmarsh community and *Zannichellia palustris*.To encourage fish and frogs to leave the investigation area in Haslams Creek (SR1) the contractor will undertake low pressure tests of the airgun prior to at pressure firing The marine operator will observe the waterway for fish or frog species and delay firing if fauna is in the area	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	Zannichellia palustris is an aquatic species with a high likelihood of occurrence in Haslams Creek. It is noted that while this species has been recorded in SOP there are no records for this species within Haslams Creek (see Appendix E). It is considered unlikely that works at SR1 would impact this species. The proposed boat launch location is from an existing maintenance access point to a litter boom (near the M4 overpass) The creek bank in this location is a concrete wall and no aquatic vegetation was observed. Works in Haslams Creek will take place at high tide and the placement of the hydrophones on the creek bed will be away from the creek banks and carried out to avoid any aquatic vegetation. The SR 1 location is also not a suitable breeding area for Green and Golden Bell Frog, which prefers open waterbodies with fringing vegetation such as anthropogenic waterbodies (dams, detention basins, drainage lines etc.) or natural coastal or floodplain wetland features such as swamps, ponded areas of intermittent creeklines, lagoons, billabongs and dune swales. The Grey-headed Flying Fox may use the area for foraging however as the works will have no interaction with the terrestrial environment potential impacts to this species are negligible. Haslams Creek is also an important habitat area for migratory shorebirds (as listed under the Biodiversity Values Map and Threshold Tool). Migratory shorebirds may forage and move through the vegetation surrounding Haslams Creek. The site is not known as a breeding site for these species and	The Sydney Metro West – Western Tunnelling Package – Flora and Fauna Management Plan (SMWSTWTP-GLO-1NL-NL000-EO-PLN-000001) will be implemented where applicable.			

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	as mobile species they may temporarily move from the site if disturbed by the works. The air gun, which is used to generate the seismic source, may have localised impact on fish and fauna species in Haslams Creek The air gun releases a compressed air bubble which can kill individual fish if they are directly within or adjacent to the bubble area. The air gun to be used within Haslams Creek is a low pressure air gun (approximately 800psi). By way of comparison, in ocean going marine seismic surveys up to 18-48 (or more) airguns are used simultaneously with an air pressure of between 2000-3000psi. Air guns in these arrangements are fired every 10-15 seconds. Sound and vibration impacts to marine life are generally concerned with these larger scale investigations which have a large direct and indirect noise and vibration footprint. Within Haslams Creek the air gun will be fired underwater next to the dinghy. Prior to firing at pressure the airgun is tested for safety with a number of low-pressure releases. The effect of these tests is that any fish or other fauna species in the area will be disturbed and leave the area prior to the tests being carried out at full pressure. In addition, each firing of the air gun is triggered manually from within the boat. The operator can observe the site and delay a firing if marine species are observed. Any frogs in the waterway may be similarly impacted however as described above it is considered very unlikely that frog species would be using the open main body of Haslams Creek.				

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	The use of the boomer, may also disturb marine species. The boomer is an acoustic noise source only, and emits at a lower energy than the airgun. Any fish disturbed by the noise may temporarily leave the area while testing is being carried out. Fish and other aquatic fauna may be temporarily impacted by noise from the air gun and boomer however with the implementation of mitigation measures the potential for direct impact to individuals or long-term impacts within Haslams Creek is considered negligible. As such, no additional impacts to flora and fauna are anticipated as a result of the proposed SR works.				
Water	The surface seismic refraction sites will have no additional impacts to the approved project, as these works will not interact with surface or groundwater. The testing in Haslams Creek requires dinghy access to creek and geophysical equipment to be used within the Creek. The hydrophones array will deployed three times in 1 day on the bed of the creek. When the array is lowered into the creek there may be very minor localised disturbance of sediment on the creek bed. The impact of this is considered very minor to negligible given hydrophones will be placed and then removed with care to create minimal disturbance.	• Hydrophone array will be deployed and removed in a manner to minimise any disturbance of the creek bed. The Sydney Metro West – Western Tunnelling Package – Soil and Water Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000001) and Sydney Metro West – Western Tunnelling Package – Groundwater Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000002) will be implemented where applicable.	Y	Y	
Air quality	No additional impacts to the approved project, as the proposed SR works will not generate any dust or gaseous emissions which could impact local air quality.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Air Quality Management Plan (SMWSTWTP-GLO-1NL-NL000-AH-PLN-000001)	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
		will be implemented where applicable.			
Noise and vibration	Potential noise and vibrational impacts to nearby sensitive receivers from the proposed SR have been addressed in Appendix F. Plant and equipment required to undertake the proposed SR works, include hand tools and light vehicles. The SR work require the generation of vibration (as the seismic source) via a sledgehammer against a metal strike plate or a weight dropper. Noise and vibration emissions from the project have been qualitatively assessed. It is expected that $L_{Aeq(15\ minute)}$ noise levels will remain below 40 dBA beyond 50 m from the seismic refraction testing activities. The seismic refraction testing activity is considered a 'low noise impact scenario' as noise levels are expected to remain below the project NMLs at nearby receivers Vibration levels are expected to remain below the conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) at nearby receivers and heritage items. The scope of work within Haslams Creek is considered minor and underwater noise and vibration impacts are not anticipated. No additional impacts to the approved project is anticipated with appropriate mitigations in place.	The following targeted control measures will be implemented: • Light vehicles will not idle when not in use, particularly when parked at the site. • Works will be undertaken during standard construction hours, unless otherwise assessed under the out-of-hours Protocol The Sydney Metro West – Western Tunnelling Package – Noise and Vibration Management Plan (SMWSTWTP-GLO-1NL-NL000-NV-PLN-000001) will be implemented where applicable.	Y	Y	
Indigenous heritage	SR4(a) and SR5 are located in proximity to registered Aboriginal sites. However, the SR works are temporary and require no ground disturbing	• The relevant mitigation measures and recommendations identified in	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	works. As such, there is no potential for the works to impact on areas of Aboriginal archaeological potential. Potential vibration impacts were assessed, and vibration levels are expected to remain below the conservative cosmetic damage criterion of 2.5 mm/s at nearby receivers and heritage items. Review of the site cards and existing condition of the AHIMS sites where works are proposed was undertaken as part of the Due Diligence assessment in Appendix D [redacted] The work was determined as having no impact to Aboriginal heritage. As such, there will be no additional impacts to the approved project.	the Aboriginal and Non-Aboriginal Heritage Due Diligence Assessment in Appendix D will be discussed during pre-start and implemented on site. • Work within Parramatta Park and Robin Thomas Reserve will not involve vehicle access across grassed areas. Vehicles will park in legal and designated parking areas. A sledgehammer will be used as the seismic source in these locations. The Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable.			
Non-indigenous heritage	It is acknowledged that several of the proposed locations for SR works are within the curtilage for significant and sensitive heritage items, including the World Heritage listed Old Government House and Domain. However, the temporary works would not directly impact any significant elements of the heritage items within the works locations, nor within the vicinity. Additionally potential vibration impacts were assessed, and vibration levels are expected to remain below the conservative cosmetic damage criterion of 2.5 mm/s at nearby receivers and heritage items. As such, there will be no additional impacts to the approved project. The works would not have any	• The relevant mitigation measures and recommendations identified in the Aboriginal and Non-Aboriginal Heritage Due Diligence Assessment in Appendix D will be discussed during pre-start and implemented on site. • Work within Parramatta Park and Robin Thomas Reserve will not involve vehicle access across grassed areas. Vehicles will park in legal and	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	impacts on the world or national heritage values and would therefore not require a referral to the Minister under the EPBC Act.	designated parking areas. A sledgehammer will be used as the seismic source in these locations. The Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable.			
Community and stakeholder	. Where the SR sites are located on publicly accessible land the sites will not be closed to the public during works. Parramatta Park Trust will be consulted and work in the park at SR5 will not commence until a Permit to Enter has been approved by the Trust. Consultation with ARCT for all works involving the Rosehill Gardens Racecourse is ongoing and will include specific discussion of the SR2 works. Sydney Olympic Park Authority (SOPA) are responsible for the management of Haslams Creek at SR1. Work within SOP will not commence until a Work Permit has been approved by SOPA.	Land access approvals will be sought prior to commencement of works. Consultation by GLC is occurring with Parramatta City Council and other stakeholders (including Parramatta Park Trust and SOPA) for detailed site investigations outside the approved construction site boundaries, including SR works. Updates will be regularly provided through communication streams for the approved project.	Y	Y	
Traffic	The use of light vehicles required to complete the proposed SR works will not significantly increase the volume of traffic utilising local roads during the day. A maximum of two public parking spaces will be required for light vehicles at each SR site during the proposed works. As such, no additional impacts to the approved project, as the SR scope of works only requires light vehicles to transport to and from each site.	The dinghy launch location to Haslams Creek (SR1) will be finalised in consultationwith SOPA. Vehicle access and use of public pathways will be facilitated by SOPA rangers and will be in accordance with the SOPA Work Permit.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
		The Sydney Metro West – Stage 1 Construction Traffic Management Framework will be implemented where applicable.			
Waste	No additional impacts to the approved project, as the SR scope of works will not generate any waste.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Waste Management Plan (SMWSTWTP-GLO-1NL-NL000-WM-PLN-000002) will be implemented where applicable.	Y	Y	
Social	Where the SR sites are located on publicly accessible land there is a potential for impact to social infrastructure. The sites will not be closed to the public during works, however there is a potential for short-term interference with public use of the space at Parramatta Park (SR5), Robin Thomas reserve (SR4) and during boat launching for access to Haslams Creek (SR1). The potential for impact is considered minor as the duration of any potential impact is limited at each site to one day only. In addition, the low impact nature of the work would have minimal effect on other social aspects such as noise and visual impacts.	No additional measures required.	Y	Y	
Economic	There is a minor interface with business at Rosehill Racecourse Gardens, however the SR scope of works will have no impact on and will not interact with other local businesses or contribute to the economical value of the project.	No additional measures required.	Y	Y	
Visual	There will be minor changes to each SR site when works are being undertaken, however these will be temporary in nature (i.e. one to two days to complete	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Visual Amenity Management Plan	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	works at each site) and once completed there will be no ongoing visual impact at the site. As such, no additional impacts to the approved project are anticipated as the SR scope of works will not permanently alter the visual landscape of each site.	(SMWSTWTP-GLO-1NL-NL000-EN-PLN-000003) will be implemented where applicable.			
Urban design	No additional impacts to the approved project, as the SR scope of works will not modify the existing urban design at each site.	No additional measures required.	Y	Y	
Geotechnical	No additional impacts to the approved project, as the SR scope of works will not physically interact with geotechnical aspects of the site.	No additional measures required.	Y	Y	
Land use	No additional impacts to the approved project, as the SR scope of works will not change the existing land use for each site.	No additional measures required.	Y	Y	
Contamination	There are no potential risks of polluting any receiving environments due to SR works. The SR scope of works will not require any excavation of contaminated soil. The work in Haslams Creek will be in a location with known poor water quality however the deployment of hydrophones will not change or add to the contamination risk in the waterway. As such, no additional impacts to the approved project are anticipated.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Soil and Water Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000001) will be implemented where applicable.	Y	Y	
Climate Change	The use of light vehicles required to access each SR site is the only anticipated source of any greenhouse gas emissions proposed under this Consistency Assessment. As such, no additional impacts to the approved project are anticipated.	No additional measures required.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed/activity, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Risk	No additional impacts to the approved project, as the risks associated with the SR works are consistent with the project risks for minor activities.	No additional measures required.	Y	Y	
Other	No additional impacts to the approved project.	No additional measures required.	Y	Y	
Management and mitigation measures	No additional impacts to the approved project.	No additional measures required.	Y	Y	

11. Impact Assessment – Operation

As noted in Section 3.0 above, the proposed SR works will not impact any aspects of operations and is entirely limited to the construction phase.

Furthermore, Stage 1 of the planning application for Sydney Metro West (subject of this Consistency Assessment) is for major civil construction work for Sydney Metro West between Westmead and The Bays.

As such, operational impacts of the proposal are not applicable, and therefore there are no changes from the approved project are anticipated.

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed activity/works, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Flora and fauna	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Water	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Air quality	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Noise vibration	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Indigenous heritage	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Non-indigenous heritage	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Community and stakeholder	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed activity/works, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Traffic	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Waste	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Social	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Economic	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Visual	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Urban design	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Geotechnical	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Land use	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Climate Change	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Risk	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed activity/works, relative to the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Other	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	
Management and mitigation measures	As the scope of works are temporary and limited to the construction phase, these works will not change the operation of the approved project.	No additional measures required.	Y	Y	

12. Consistency with the Approved Project

Based on a review and understanding of the existing Approved Project and the proposed modifications, is there is a transformation of the Project?	No. The proposal would not transform the project. The project would continue to provide major civil works between Westmead and The Bays as part of the approved project.
Is the project as modified consistent with the objectives and functions of the Approved Project as a whole?	Yes. The proposal would be consistent with the objectives and functions of the approved project.
Is the project as modified consistent with the objectives and functions of elements of the Approved Project?	Yes. The proposal would be consistent with the objectives and functions of the approved works for the project. The activities proposed to be undertaken are generally consistent with the activities identified for the approved project.
Are there any new environmental impacts as a result of the proposed works/modifications?	No. There would be no new environmental impacts as a result of the proposal. All impacts and risks identified for the approved project and the proposal would be adequately addressed through the application of the mitigation measures provided in the Environmental Impact Statement, Submissions Report, Amendment Report and the Instrument of Approval.
Is the project as modified consistent with the conditions of approval?	Yes. The proposal would be consistent with the conditions of approval.
Are the impacts of the proposed activity/works known and understood?	Yes. The impacts of the proposal are understood and will be accounted for by implementing the existing mitigation measures provided in the Environmental Impact Statement, Submissions Report, Amendment Report and the Instrument of Approval for the approved project. These would be implemented through the Sydney Metro Construction Environment Management Framework, Construction Traffic Management Framework and Construction Noise and Vibration Standard, as well as the CEMP and CEMP sub-plans.
Are the impacts of the proposed activity/works able to be managed so as not to have an adverse impact?	Yes. The impacts of the proposal can be managed to avoid an adverse impact.

13. Other Environmental Approvals

Identify all other approvals required for the project:	A Work Permit is required for activities within Sydney Olympic Park. GLC will seek a permit from the Sydney Olympic Park Authority (SOPA) prior to works commencing in Haslams Creek. Works within Parramatta Park require a Permit to Enter. GLC will seek a permit from the Parramatta Park Trust prior to works commencing at SR5.

Author certification

To be completed by person preparing checklist.

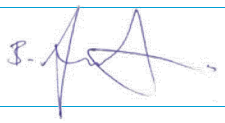
I certify that to the best of my knowledge this Consistency Checklist: • Examines and takes into account the fullest extent possible all matters affecting or likely to affect the environment as a result of activities associated with the Proposed Revision; and • Examines the consistency of the Proposed Revision with the Approved Project; is accurate in all material respects and does not omit any material information.			
Name:	Candice Somerville	Signature:	
Title:	Environmental Approvals Manager		
Company:	GLC	Date:	11 October 2022
As an approved ER for the Sydney Metro City & Southwest project, I have reviewed the information provided in this assessment. I am satisfied that mitigation measures are adequate to minimise the impact of the proposed work.			
Name:	Not required	Signature:	
Title:		Date:	

This section is for Sydney Metro only.

Application supported and submitted by			
Name:	Yvette Buchli	Date:	11/10/2022
Title:	Associate Director – Planning Approvals	Comments:	
Signature:			

Based on the above assessment, are the impacts and scope of the proposed activity/modification consistent with the existing Approved Project?

Yes	The proposed activity/works are consistent and no further assessment is required.
No	The proposed works/activity is not consistent with the Approved Project. A modification or a new activity approval/ consent is required. Advise Project Manager of appropriate alternative planning approvals pathway to be undertaken.

Endorsed by			
Name:	Ben Armstrong	Date:	12 October 2022
Title:	A/Director, Project ESP	Comments:	
Signature:			

Appendix A – SR Locations

LEGEND

- Marine seismic refraction sites
- Tunnel alignment
- Area for continuous seismic reflection

CLIENT
TfNSW

PROJECT
SMW WTP

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

0 12.5 25 50 75 100 Meter

SCALE: 1:2,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

SHEETS SHEET 1 of 5

Rev. C

FIGURE **SR1**

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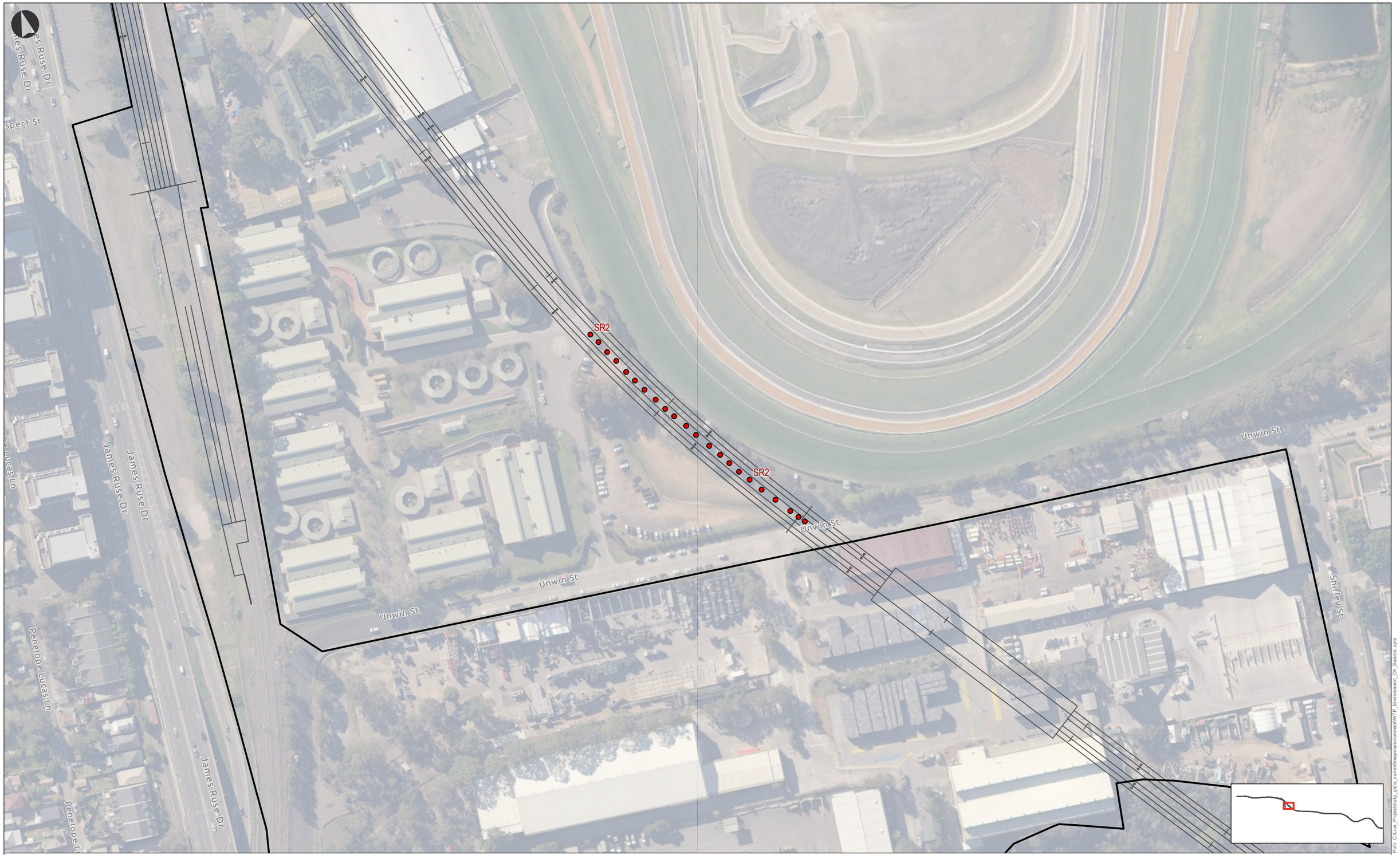

LEGEND

- Seismic refraction sites
- Tunnel alignment
- Approved construction boundary

CLIENT
TfNSW

PROJECT
SMW WTP

0 12.5 25 50 75 100 Meter

SCALE: 1:2,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

SHEETS SHEET 2 of 5

Rev. C

FIGURE **SR2**

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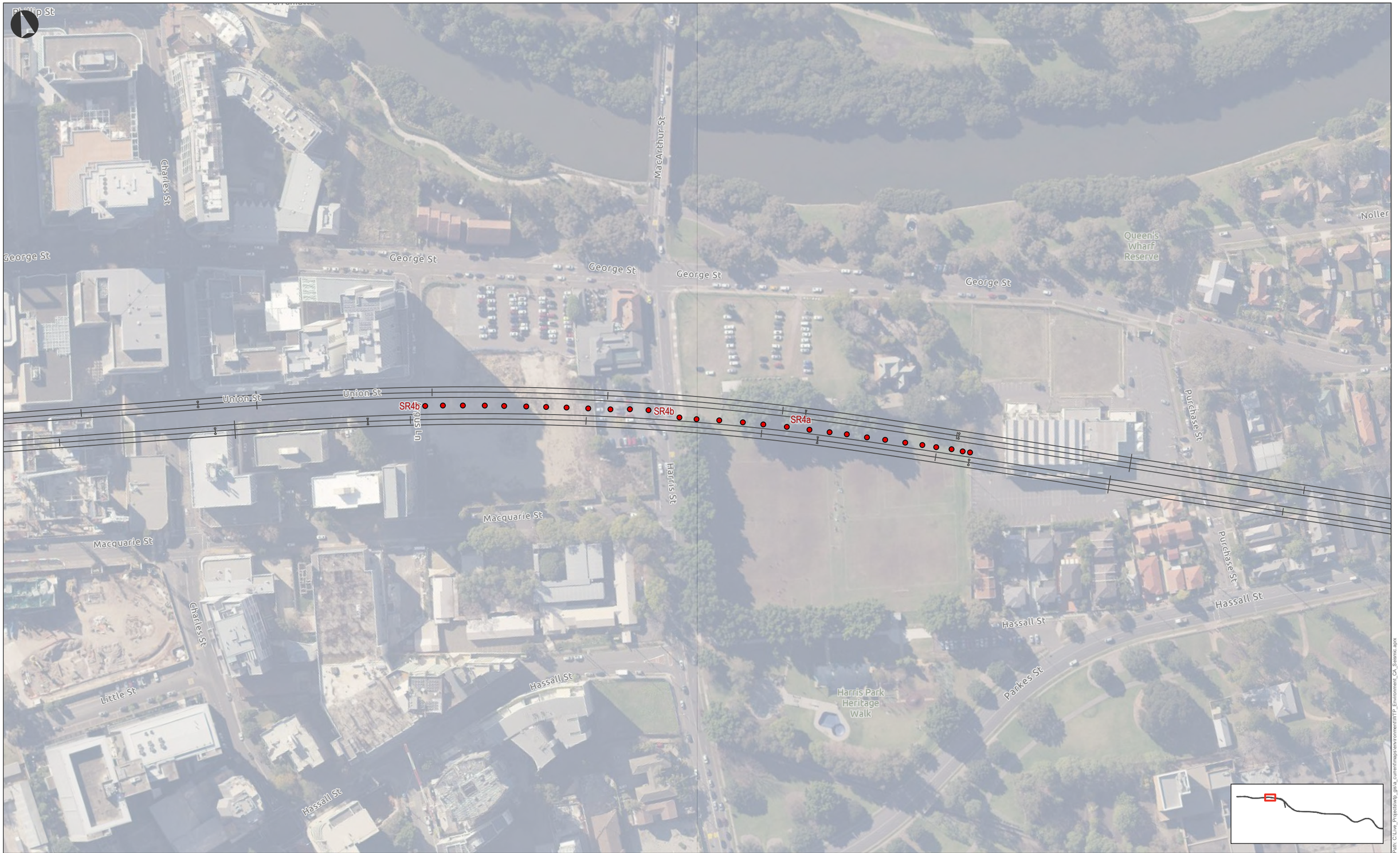


LEGEND

- Seismic refraction sites
- Tunnel alignment

CLIENT
TfNSW

PROJECT
SMW WTP

0 12.5 25 50 75 100 Meter

SCALE: 1:2,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

SHEETS SHEET 3 of 5

Rev. C

FIGURE **SR4a & SR4b**

Path: C:\Live_Projects\wip_gis\a_current\maps\environment\WTP_Environment_CA_Seismic.aprx

LEGEND

- Seismic refraction sites
- Tunnel alignment

CLIENT
TfNSW

PROJECT
SMW WTP

0 12.5 25 50 75 100 Meter

SCALE: 1:2,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

SHEETS SHEET 4 of 5

Rev. C

FIGURE **SR5**

Path: C:\Line_Projects\wtp_gis_current\maps\environment\WTP_Environment_CA_Seismic.aprx

LEGEND

- Seismic refraction sites
- Tunnel alignment
- Approved construction boundary

CLIENT
TfNSW

PROJECT
SMW WTP

0 12.5 25 50 75 100 Meter

SCALE: 1:2,000 (at A3)

PROJECTION: GDA2020 MGA Zone 56

TITLE
Location of SR sites between Westmead and Sydney Olympic Park

GAMUDA Australia

LAING O'ROURKE

DATE	21 SEPTEMBER 2022
DESIGN FILE	DESIGN_NAME
PREPARED	
REVIEW	REVIEWED BY
APPROVED	APPROVED BY

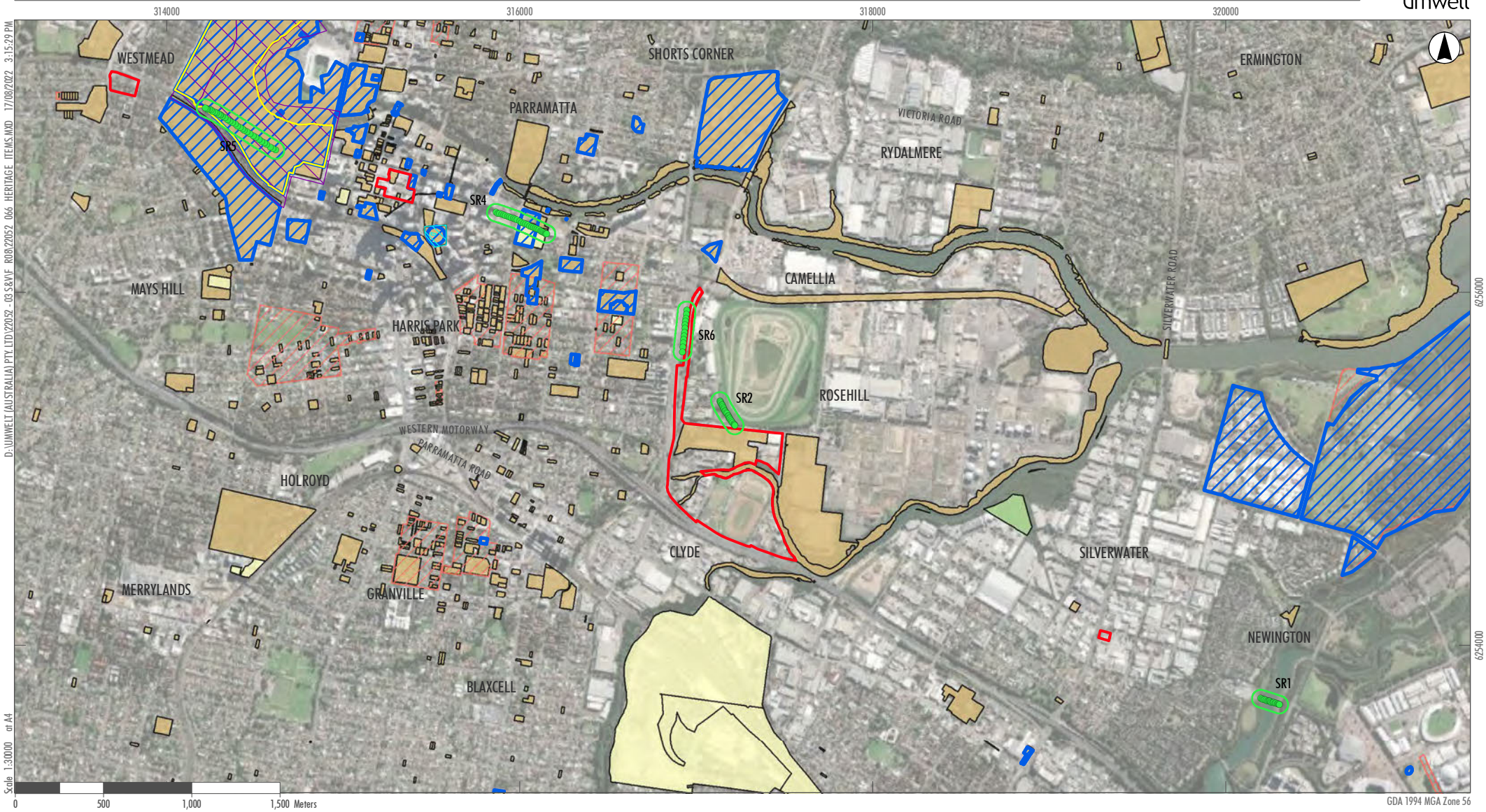
SHEETS SHEET 5 of 5

Rev. C

FIGURE **SR6**

Path: C:\Live_Projects\wtp_gis\a_current\maps\environment\WTP_Environment_CA_Seismic.aprx

Appendix B – Location of Heritage Items



Legend

- Approved Surface Construction Boundary
- 50m Search Buffer
- Seismic Refraction Test
- World Heritage Properties
- Commonwealth Heritage
- National Heritage Places
- State Heritage Act

Local Heritage

- Conservation Area - General
- Item - General
- Item - Archaeological
- Item - Landscape

APPENDIX B

Location of Heritage Items

Image Source: ESRI Basemap (2021) Data source: NSW LPI (2021), NSW DSFI (2021), Dept of Agriculture, Water and the Environment (2021)

Appendix C – Location of AHIMS Sites

Appendix D – Aboriginal and Non-Aboriginal Heritage Due Diligence

APPENDIX C

Sydney Metro Unexpected Heritage Finds Procedure (SM-18-00105232)

Sydney Metro Unexpected Heritage Finds Procedure

SM-18-001105232

Metro Body of Knowledge (MBoK)

Applicable to:	Sydney Metro
Document Owner:	Senior Heritage Advisor
System Owner:	Director Environment, Sustainability and Planning
Status:	Final
Version:	4.1
Date of issue:	May 2021
Review date:	May 2022 (every year or as required)

Table of contents

Figures

Tables

1. Introduction

1.1. Purpose

This procedure has been prepared to provide a consistent approach to the management of unexpected Aboriginal and non-Aboriginal heritage uncovered during Sydney Metro activities. It applies to all Sydney Metro activities, both the pre-construction (prior to the Construction Heritage Management Plan approval) and construction phase (post Construction Heritage Management Plan approval) and pre or post-approval activities that are subject to the NSW *Heritage Act (1977)* (Heritage Act) and the *National Parks and Wildlife Act 1974* (NPW Act).

In NSW, there are strict laws to protect and manage both Aboriginal and non-Aboriginal heritage. As a result, appropriate management measures need to be implemented to avoid or minimise impacts, ensure compliance with statutory requirements, and to minimise the risk of penalties to individuals, Sydney Metro and its contractors. This procedure includes Sydney Metro's heritage notification obligations under the Heritage Act, NPW Act and the *Coroner's Act 2009* and the requirements of the conditions of approval (CoA) issued by NSW Department of Planning, Industry and Environment.

Note that a Contractor must not amend the *Sydney Metro Unexpected Finds Procedure* or use a different procedure without the prior approval of Sydney Metro.

This procedure must be read in conjunction with the relevant approval conditions, contract documents and other plans and procedures including the *Sydney Metro Exhumation Management Procedure*, in addition to any other relevant documents as developed by the contractor for the delivery of Sydney Metro activities.

1.2. Scope

This procedure applies to the discovery of any unexpected heritage item, where the find is not anticipated in an approved Archaeological Research Design (ARD) or Archaeological Method Statement (AMS) or other project specific document related to heritage. It applies to all Sydney Metro activities.

This procedure must be followed by all Sydney Metro staff, contractors, subcontractors or any person undertaking work for Sydney Metro. It includes references to some of the relevant legislative and regulatory requirements, but is not intended to replace them.

This procedure *does not apply* to:

- the discovery and disturbance of heritage items as a result of investigations being undertaken in accordance with the *Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW4376 2010*[1]; an Aboriginal Heritage Impact Permit (AHIP) issued under the NPW Act; or a permit approval issued under the Heritage Act;
- the discovery and disturbance of heritage items as a result of construction related activities, where the disturbance is permissible in accordance with an AHIP or an approval issued under the Heritage Act or State Significant Infrastructure (SSI) /State Significant Development (SSD) planning approval; or

- the discovery and disturbance of a heritage item of local significance, where the find is identified and anticipated to occur in an AMS or ARD.

Construction Environment Management Plans (CEMP) should reference or include this procedure. Where there is an approved CEMP, it must be followed in the first instance. Where there is a difference between approved CEMPs and this procedure, the approved CEMP must be followed. Where an approved CEMP does not provide sufficient detail on particular issues, this procedure should be used as a reference.

1.3. Definitions and abbreviations

1.3.1. What is an unexpected heritage find?

An 'unexpected heritage find' can be defined as:

- any unanticipated discovery of an Aboriginal object or archaeological work or relic, which Sydney Metro does not have approval to disturb and/or is not covered under an existing management process or plan
- a find that has not been identified or assessed in a project assessment or document related to heritage
- a find that is not referenced in an archaeological research design (ARD) or archaeological method statement (AMS)
- a find that is not covered by an existing approval under the NPW Act or Heritage Act.

1.3.2. Abbreviations

All terminology in this document is taken to mean the generally accepted or dictionary definition. Other terms and jargon specific to this document are defined within the SM-17-00000203 Sydney Metro glossary. Acronyms specific to this document are listed below.

	Definitions
AHIP	Aboriginal Heritage Impact Permit
Aboriginal object	An Aboriginal object is any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains. An Aboriginal object may include a shell midden, stone tools, bones, rock art, Aboriginal-built fences and stockyards, scarred trees and the remains of fringe camps.
ARD	Archaeological Research Design
AMS	Archaeological Method Statement
CEMP	Construction Environmental Management Plan
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*

Disturbance	Disturbance is considered to be any physical interference to an item that results in it being destroyed, defaced, damaged, harmed, impacted or altered in any way (this includes archaeological investigation activities).
Excavation Director	A person that has been determined by the Heritage Council of NSW or delegate to meet the Criteria for Assessment of Excavation Directors (4 September 2019 and as updated) and can therefore competently archaeologically investigate a site of either local and/or state significance.
Heritage Act	NSW *Heritage Act 1977*
NPW Act	NSW *National Parks and Wildlife Act 1974*
Heritage NSW	Formerly Office of Environment and Heritage (OEH). Now Heritage NSW as part of the Department of Premier and Cabinet NSW.
IMS	Integrated Management System (IMS)
Relic (non-Aboriginal heritage)	A relic means any deposit, artefact, object or material evidence that: a) relates to the settlement of the area that comprises NSW, not being Aboriginal settlement, and b) is of State or local significance.
SSD	State Significant Development
SSI	State Significant Infrastructure
TfNSW	Transport for New South Wales
Work (non-Aboriginal heritage)	Archaeological features such as historic utilities or buried infrastructure that provide evidence of prior occupations such as former rail or tram track, timber sleepers, kerbing, road pavement, fences, culverts, historic pavement, buried retaining walls, cisterns, conduits, sheds or building foundations, but are also subject to assessment by the Excavation Director to determine its classification.

1.4. Accountabilities

The Director Environment, Sustainability and Planning is accountable for this document including approving the document, monitoring its effectiveness and performing a formal document review.

Direct Reports to the Chief Executive are accountable for ensuring the requirements of this document are implemented within their area of responsibility.

Direct Reports to the Chief Executive who are accountable for specific projects/programs are accountable for ensuring associated contractors comply with the requirements of this document.

2. Types of unexpected heritage finds and their statutory protections

Project, field and environmental personnel (including construction contractors) are critical to the early identification and protection of unexpected heritage finds.

Appendix 1 illustrates the wide range of heritage items uncovered to date during Transport for NSW projects and provides an understanding of what unexpected finds may look like.

Unexpected heritage finds are categorised as either:

(a) Aboriginal objects;
(b) Historic (non-Aboriginal) heritage items; or
(c) Human skeletal remains.

The relevant legislation that applies to each of these categories is described below.

2.1. Aboriginal objects

The NPW Act provides the basis for the care, protection and management of Aboriginal objects and places in NSW.

An Aboriginal object is defined as: *any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains*.

An 'Aboriginal place' is an area declared by the Minister administering the Act to be of special significance with respect to Aboriginal culture. An Aboriginal place does not have to contain physical evidence of occupation (such as Aboriginal objects).

Under section 87 of the Act, it is an offence to harm or desecrate an Aboriginal object or place. There are strict liability offences. An offence cannot be upheld where the harm or desecration was authorised by an AHIP and the permit's conditions were not contravened. Defences and exemptions to the offence of harming an Aboriginal object or Aboriginal place are provided in section 87, 87A and 87B of the Act. A person must notify Heritage NSW if a person is aware of the location of an Aboriginal object.

Penalties for some of the offences can include two years imprisonment and/or up to $550,000 (for individuals), and a maximum penalty of $1.1 million (for corporations).

Examples of Aboriginal objects include stone artefacts, shell middens, axe grinding grooves, pigment or engraved rock art, burials and scarred trees.

IMPORTANT!
All Aboriginal objects, regardless of significance, are protected under law.
If any impact is expected to an Aboriginal object, an AHIP is usually required from Heritage NSW. When a person becomes aware of an Aboriginal object they must notify the Director-General of Heritage NSW about its location. Assistance on how to do this is provided in section 4 (Step 5).

2.2. Historic (non-Aboriginal) heritage items

The Heritage Act provides for the care, protection and management of heritage items in NSW. Historic (non-Aboriginal) heritage items include:

- archaeological 'relics' as defined under the Heritage Act; and

- other items such as works, buildings or movable objects, which are not considered 'relics' under the Act.

2.2.1. Archaeological relics

Under section 139, it is an offence to disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed, unless the disturbance or excavation is carried out in accordance with an excavation permit issued by Heritage NSW under the Act.

A relic is defined as: *'any deposit, artefact, object or material evidence that: (a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and (b) is of State or local heritage significance.'*

A person must notify Heritage NSW, if a person is aware or believes that they have discovered or located a relic (section 146). Penalties for offences under the Heritage Act can include six months imprisonment and/or a fine of up to $1.1million.

IMPORTANT!
All relics are subject to statutory controls and protection.
If a relic is likely to be disturbed, an approval is usually required from the Heritage Council of NSW. When a person discovers a relic, they must notify the Heritage Council of NSW of its location.

2.2.2. Other items

Some historic heritage items are not considered to be 'relics', but are instead referred to as works, buildings, structures or movable objects. Examples of these items that may be encountered include culverts, historic pavements, retaining walls, tramlines, rail tracks, turn tables, timber sleepers, cisterns, fences, sheds, buildings and conduits.

Usually archaeological relics are uncovered via a process of excavation or soil removal. When an unexpected find is uncovered, an archaeological excavation permit under section 140 or section 60 of the Heritage Act may be required to further investigate or remove it if investigation is not covered by an existing approval. In contrast, 'other historic items' either exist above the ground surface (for example a shed), or they are designed to operate and exist beneath the ground surface (for example a culvert).They may also need a permit to alter, disturb or remove them if there is not an approval already in place.

2.3. Human skeletal remains

The *Sydney Metro Exhumation Management Procedure* provides a more detailed explanation of the approval processes related to human skeletal remains.

Human skeletal remains can be classified as:

- reportable deaths
- Aboriginal objects; or

- relics

Where it is suspected that less than 100 years has elapsed since death, human skeletal remains come under the jurisdiction of the State Coroner and the *Coroners Act 2009* (NSW). Under s35(2) of the Act, a person must report a death to a police officer, a coroner or an assistant coroner as soon as possible. This applies to all human remains less than 100 years old regardless of ancestry. Public health controls may also apply.

Where the remains are suspected of being more than 100 years old, they are considered to be either Aboriginal objects or non-Aboriginal relics, depending on the ancestry of the individual. Aboriginal human remains are protected under the NPW Act, while non-Aboriginal heritage remains are protected under the Heritage Act.
The discovery of Aboriginal human remains also triggers notification requirements to the Commonwealth Minister for the Environment under s20 (1) of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984.*

IMPORTANT!
All human skeletal remains are subject to statutory controls and protections.
All bones must be treated as potential human skeletal remains and work around them must stop while they are appropriately protected and investigated, the relevant authorities notified and approvals received.

3. Unexpected heritage finds procedure

In the event that an unexpected find is encountered on a Sydney Metro project, the steps summarised in Figure 1 and detailed in Table 1 must be followed. There are seven steps in the procedure.

IMPORTANT!
Sydney Metro may have approval to impact certain heritage items during construction. If you think that you may have discovered a heritage item and you are unsure whether an approval is in place or not, **STOP** work and follow this procedure.

Figure 1: Summary of steps to be taken on the discovery of an unexpected heritage item

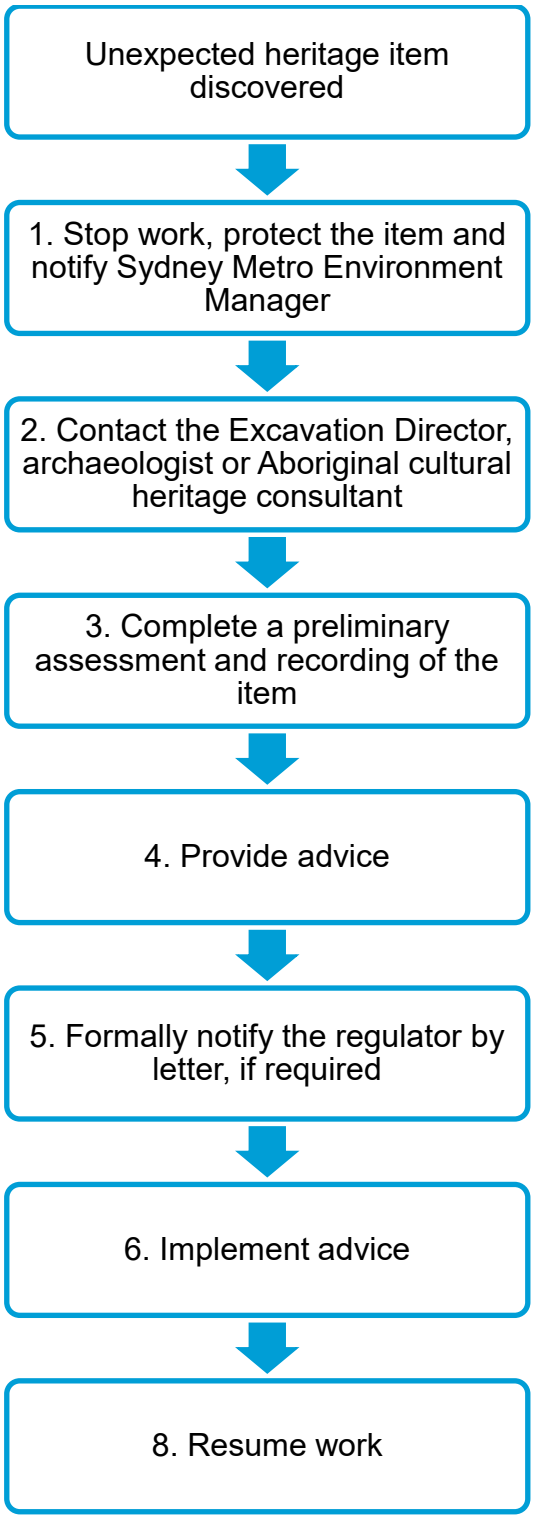


Table 1: Specific tasks to be implemented following the discovery of an unexpected heritage item

Step	Task	Responsibility	Guidance and tools
1	**Stop work and protect the item**		
1.1	Stop all work in the immediate area of the item and notify the Project Manager	Contractor / Supervisor	**Appendix 1** Identifying Unexpected Heritage Items
1.2	Establish a 'no-go zone' around the item. Use high visibility fencing, where practical. No ground disturbing work is to be undertaken within this zone until further archaeological investigations are completed, and if required, appropriate approvals are obtained. Inform all on-site personnel about the no-go zone.	Contractor's Project Manager or Supervisor	
2	**Engage an archaeologist**		
2.1	Contact the nominated Excavation Director, archaeologist or Aboriginal cultural heritage consultant to discuss the location and nature of the item and arrange an inspection. The project CEMP should contain the contact details of the archaeologist. Provide as much information as possible to the Excavation Director, archaeologist or Aboriginal cultural heritage consultant, including photographs of the item. Inform the Sydney Metro Environment Manager, and keep them involved in the process. The Environment Manager will inform the Sydney Metro Senior Heritage Advisor.	Contractor's Project Manager	
2.2	Where there is no project Excavation Director, archaeologist or Aboriginal cultural heritage consultant engaged for the work, engage a suitably qualified consultant to assess the find. If the find is likely to be an Aboriginal object, engage a suitably qualified and experienced Aboriginal cultural heritage consultant. If the find is a non-Aboriginal heritage item, engage a suitably qualified and experienced historical archaeological consultant.	Contactor's Project Manager	

Step	Task	Responsibility	Guidance and tools
3	**Preliminary assessment and recording**		
3.1	Occasionally, the Excavation Director, archaeologist or Aboriginal cultural heritage consultant may determine from the photographs provided at Step 2.1 that it is not necessary to inspect the item because no heritage constraint exists for the project (for example the item is not an Aboriginal object or archaeological relic). This advice should be provided in writing (for example via email or letter with the consultant's name and company clearly identifiable) to the Sydney Metro Project Manager, Environment Manager and Senior Heritage Advisor.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	Proceed to Step 7
3.2	Arrange access for the Excavation Director, archaeologist or Aboriginal cultural heritage consultant to inspect the item as soon as practicable. In most cases, a site inspection is required to conduct a preliminary assessment.	Contactor's Project Manager / Excavation Director	
3.3	Subject to the Excavation Director, archaeologist or Aboriginal cultural heritage consultant's assessment, work may recommence at a set distance from the item. This is to protect any other archaeological evidence that may exist in the vicinity, which may have not yet been uncovered. The 'no-go zone' established in Step 1.2 may need to be adjusted to reflect the area of archaeological potential, as determined by the Excavation Director, archaeologist or Aboriginal cultural heritage consultant.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
3.4	Has the item been damaged or harmed? If yes, record the incident in the Incident Management System. Implement any additional reporting requirements related to the planning approval and CEMP where relevant	Contractor's Project Manager / Excavation Director, archaeologist or Aboriginal cultural heritage consultant	
3.5	Can the work avoid further impact to the item? Project Manager to confirm with Sydney Metro Environment Manager.	Contractor's Project Manager	

Step	Task	Responsibility	Guidance and tools
3.6	Record the item and complete the Unexpected Heritage Item Recording Form.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	**Appendix 2** Unexpected Heritage Item Recording Form **Appendix 3** Photographing Unexpected Heritage Items
3.7	Is the item likely to be bone? If yes, follow the steps in Appendix 4 'Uncovering bones'. Where it is obvious that the bones are human remains, you must notify the local police by telephone immediately. They may take command of all or part of the site. Also refer to the Sydney Metro Exhumation Management Procedure. If no, proceed to the next step.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	
3.8	The Excavation Director, archaeologist or Aboriginal cultural heritage consultant may provide advice after the inspection and preliminary assessment that no heritage constraint exists for the project (for example the item is not an Aboriginal object or relic). This advice should be provided in writing (for example via email or letter with the consultant's name and company clearly identifiable) to the Sydney Metro Project Manager, Environment Manager and Senior Heritage Advisor.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	Proceed to Step 7
3.9	Where required, seek additional specialist technical advice (such as a forensic or physical anthropologist to identify skeletal remains). The Excavation Director, archaeologist or Aboriginal cultural heritage consultant can provide contacts for such specialist consultants.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	
4	**Provide advice**		
4.1	The Excavation Director, archaeologist or Aboriginal cultural heritage consultant should provide written advice with input from Registered Aboriginal Parties where appropriate. The plan should include as a minimum a) a description of the item, b) an assessment of the significance of the item, c) approval or statutory notification requirements, d) reporting requirements, e) consultation requirements, and f) relevance	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	**Appendix 4** Archaeological / heritage advice checklist **Other references** DECCW 2010, Aboriginal Cultural Heritage Consultation

Step	Task	Responsibility	Guidance and tools
	to other project approvals or management plans.		Requirements for Proponents 2010 DECCW 2010, Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW Heritage Branch 2009, Assessing Significance for Historical Archaeological Sites and 'Relics'
4.2	In preparing the advice, the Excavation Director, archaeologist or Aboriginal cultural heritage consultant must review the CEMP, heritage sub-plans, conditions of project approval and associated heritage assessment documentation (for example an Environmental Impact Statement Technical Paper). The Excavation Director, archaeologist or Aboriginal cultural heritage consultant must determine if the item is consistent with previous heritage or project approvals or management plans. The Project Manager must provide all relevant documents to the Excavation Director to assist with this.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
4.3	The Excavation Director, archaeologist or Aboriginal cultural heritage consultant must submit this advice as a report, letter or email to the Project Manager as soon as practicable.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant	
4.4	The Project Manager, Sydney Metro Environment Manager and Sydney Metro Senior Heritage Advisor should review the advice to ensure that all requirements are addressed and can be reasonably implemented.	Consultant's Project Manager / Sydney Metro Environment Manager / Sydney Metro Senior Heritage Advisor	
5	**Notify the regulator, if required**		
5.1	Based on the advice and any statutory requirements, is notification to Heritage NSW and the Secretary required? If no, proceed directly to Step 6. If yes, proceed to next step.	Sydney Metro Environment Manager / Sydney Metro Senior Heritage Advisor	

Step	Task	Responsibility	Guidance and tools
5.2	If notification is required, complete the template notification letter and forward with supporting documentation (including advice obtained at Step 4) to the Sydney Metro Environment Manager. The Environment Manager will seek the approval of the Sydney Metro Senior Heritage Advisor and the signature of the Director Project Environment, Sustainability & Planning or Director Environment, Sustainability & Planning	Sydney Metro Environment Manager	**Appendix 5** Template Notification Letter
5.3	Forward the signed notification letter to Heritage NSW once approved and cc Sydney Metro. Informal notification (via a phone call or email) to Heritage NSW prior to sending the letter is appropriate. The advice and completed Unexpected Heritage Item Recording Form (Appendix 2) must be submitted with the notification letter (for both Aboriginal objects and non-Aboriginal relics). If the item is an archaeological relic as defined under the Act, a section 146 notification form must also be completed and sent to Heritage NSW as part of the notification.	Sydney Metro Environment Manager	**Appendix 2** Unexpected Heritage Item Recording Form **Appendix 5** Template Notification Letter
5.4	A copy of the final signed notification letter, archaeological or heritage management plan and the Unexpected Heritage Item Recording Form is to be kept on file and a copy sent to the Sydney Metro Project Manager	Sydney Metro Environment Manager / Contractor's Project Manager	
6	**Implement advice**		
6.1	The advice should be modified to take into account any additional advice resulting from notification and discussions with the regulator if required.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
6.2	Implement advice. Where impact cannot be avoided, this could include a formal assessment of heritage significance and impact assessment, preparation of excavation or recording methodologies, consultation with Registered Aboriginal Parties and obtaining heritage approvals if required.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	DECCW 2010, Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 DECCW 2010, Code of Practice for the Archaeological Investigation of

Step	Task	Responsibility	Guidance and tools
			Aboriginal Objects in NSW
6.3	Where heritage approvals are required, contact the Sydney Metro Environment Manager for further advice and support. Please note there are time constraints associated with heritage approval preparation and processing.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
6.4	For SSI or SSD projects, or projects approved under Part 5 of the EP&A Act, assess whether the heritage impact is consistent with the project approval or if project approval modification is required from the Department of Planning, Industry and Environment or the relevant consent authority.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
6.5	Where statutory approvals (or project modifications) are required, impact upon Aboriginal objects or relics must not occur until heritage and planning approvals have been issued by the appropriate regulator.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
6.6	Where statutory approval is not required but where recording is recommended by the Excavation Director, archaeologist or Aboriginal cultural heritage consultant, sufficient time and resources must be allowed for this to occur.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
6.7	Ensure short term and permanent storage locations are identified for archaeological material or other heritage material recovered from site, where required. Interested third parties (for example local Aboriginal land councils, local councils or museums) should be consulted on this issue. Contact the Excavation Director, archaeologist or Aboriginal cultural heritage consultant for advice on this issue.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
7	**Resume work**		
7.1	Seek written clearance to resume project work from the Excavation Director, archaeologist or Aboriginal cultural heritage consultant. Clearance would only be given once all archaeological excavation or heritage recommendations and approvals (where required) are complete. Resumption of	Contractor's Project Manager	

Step	Task	Responsibility	Guidance and tools
	project work must be in accordance with all the relevant project and heritage approvals / determinations.		
7.2	If required, ensure archaeological excavation / heritage reporting and other heritage approval conditions are completed in the required timeframes. This includes artefact retention repositories, conservation and / or disposal strategies.	Excavation Director, archaeologist or Aboriginal cultural heritage consultant / Contractor's Project Manager	
7.3	If additional unexpected heritage items are discovered, this procedure must begin again from Step 1.	All	

4. Responsibilities

Table 2: Roles and responsibilities

Role	Responsibility
Contractor / Supervisor	Stop work immediately when an unexpected heritage item is encountered. Cordon off area until Contractor Environmental Manager / Excavation Director, archaeologist or Aboriginal cultural heritage consultant advises that work can recommence. Manage the process of the identification, protection and mitigation of impacts on the heritage item. Liaise with the Sydney Metro Project Manager, Environment Manager and Senior Heritage Advisor. Assist the Excavation Director, archaeologist or Aboriginal cultural heritage consultant with mitigation and statutory requirements. Complete Incident Report and review CEMP for any changes that may be required. Proposed amendments to the CEMP if any changes are required.
Contractor's Project Manager	Ensure all aspects of this procedure are implemented. Advise the Contractor / Supervisor to recommence work if all applicable requirements have been satisfied and the Contractor Environmental Manager/ Excavation Director, archaeologist or aboriginal cultural heritage consultant has approved recommencement of work.
Contractor's Excavation Director / archaeologist or Aboriginal cultural heritage consultant	Provide expert advice to the Contractor and Sydney Metro Environment Manager on find identification, significance, mitigation, legislative procedures and requirements.
Environmental Representative	Ensure compliance with relevant approvals (new and existing) and the Construction Environment Management Plan.
Sydney Metro Environment Manager	Notify the Director Project Environment, Sustainability & Planning of find and help support Contractor with managing Incident Reporting.
Sydney Metro Senior Heritage Advisor	Provide expert advice to Sydney Metro Environment Manager and project as required.

5. Seeking advice

Advice on this procedure should be sought from the Sydney Metro Environment Manager in the first instance. Contractors and delivery partners should ensure their own project environment managers are aware of and understand this procedure.

Technical archaeological or heritage advice regarding an unexpected heritage item should be sought from a suitably qualified and experienced archaeologist / Aboriginal heritage consultant.

6. Related documents and references

Related documents and references
• SM ES-PW-315/5.0 Sydney Metro Exhumation Management Procedure • SM-17-00000096 Sydney Metro Environmental Incident Classification and Reporting • 3TP-SD-015/7.0 Transport for NSW Guide to Environmental Control Map • Roads and Maritime Services, November 2015, Unexpected Heritage Items Heritage Procedure 02 • SM-17-00000203 Sydney Metro glossary • Department of Environment, Climate Change and Water 2010, Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 • Department of Environment, Climate Change and Water 2010, Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW • Heritage Branch Department of Planning 2009, Assessing Significance for Historical Archaeological Sites and 'Relics'

7. Superseded documents

Superseded documents
Sydney Metro Unexpected Heritage Finds Procedure v3.3

8. Document history

Version	Date of approval	Notes
1.1	June 2017	Incorporates Environmental Representative comments
1.2		Amends p13 step 8 reference to s146
1.3		Incorporates Planning Mods 1-4 including amended CoA E20
1.4	March 2018	Incorporates Environmental Representative comments
2.0		Removes SSI 15-7400 COA reference
3.0		Revises definitions
3.1		Revises procedure
3.2		Revises roles and responsibilities
3.3		Minor edits and corrections
4.0	April 2021	Revises definitions and procedure; references the Sydney Metro Exhumation Management Procedure v5 with amendments throughout for consistency with that document.
4.1	April 2021	Updates to related documents and references.

Appendix 1: Examples of unexpected heritage finds

Plate 1: Aboriginal stone artefacts found at the Wickham Transport Interchange, 2015

Plate 2: Aboriginal artefacts (shell material) found at the Wickham Transport Interchange, 2015

Plate 3: 1840s seawall and 1880s retaining wall uncovered at Balmain East, 2016

Plate 4: Sandstone pavers uncovered at Balmain East, 2016

Plate 5: Platform at Hamilton Station classified as a 'work' by the project archaeologist, Wickham Transport Interchange project, 2015

Plate 6: Sandstone flagging and cesspit, Wynyard Walk project, 2014

Plate 7: Chinese Ming Dynasty pottery and English porcelain / pottery dating back to the early nineteenth century, Wynyard Walk project, 2014

Plate 8: Pottery made by convict potter Thomas Ball during the early settlement, Wynyard Walk project, 2014

The following images, obtained from the Roads and Maritime Services Unexpected Heritage Items Heritage Procedure 02.

Plate 9: Top left hand picture continuing clockwise: Stock camp remnants (Hume Highway Bypass at Tarcutta); linear archaeological feature with post holes (Hume Highway Duplication), animal bones (Hume Highway Bypass at Woomargama); cut wooden stake; glass jars, bottles, spoon and fork recovered from refuse pit associated with a Newcastle Hotel (Pacific Highway, Adamstown Heights, Newcastle area)

Plate 10: Culturally modified stone discovered on Main Road 92, about two kilometres west of Sassafras. The remaining images shown a selection of stone artefacts retrieved from test and salvage archaeological excavations during the Hume Highway Duplication and Bypass projects from 2006-2010.

Appendix 2: Unexpected Heritage Find Recording Form

This form is to be completed by the Excavation Director on the discovery of an archaeological heritage find during construction or maintenance works			
Date:		**Recorded by:** (include name and position)	
Project name:			
Description of works being undertaken:			
Description of exact location of item			
Description of item found *(What type of item is it likely to be? Tick the relevant boxes).*			
A. A relic	☐	A 'relic' is evidence of a past human activity relating to the settlement of NSW with local or state heritage significance. A relic might include bottle, utensils, plates, cups, household items, tools, implements, and similar items	
B. A 'work', building or structure'	☐	A 'work' can generally be defined as a form infrastructure such as track or rail tracks, timber sleepers, a culvert, road base, a bridge pier, kerbing, and similar items	
C. An Aboriginal object	☐	An 'Aboriginal object' may include stone tools, stone flakes, shell middens, rock art, scarred trees and human bones	
D. Bone	☐	Bones can either be human or animal remains. **Remember that you must contact the local police immediately by telephone if you are certain that the bone(s) are human remains.**	
E. Other	☐		
Provide a short description of the item *(E.g. metal rail tracks running parallel to the rail corridor. Good condition. Tracks set in concrete, approximately 10 cm below the current ground surface).*			

Sketch *(Provide a sketch of the item's general location in relation to other road features so its approximate location can be mapped without having to re-excavate it. In addition, please include details of the location and direction of any photographs of the item taken)*			
Action taken (Tick either A *or* B)			
A. Unexpected item **would not** be further impacted on by the works	☐	**Describe how works would avoid impact on the item.** *(E.g. the rail tracks would be left in situ and recovered with paving).*	
B. Unexpected item would be further impacted by the works	☐	**Describe how works would impact on the item**. *(E.g. milling is required to be continued to a depth of 200 mm depth to ensure the pavement requirements are met. Rail tracks would need to be removed.)*	
Excavation Director, archaeologist or Aboriginal cultural heritage consultant		Name	
		Signature	

IMPORTANT

It is a statutory offence to disturb Aboriginal objects or relics (including human remains) without an approval. All work affecting Aboriginal objects and relics must cease until an approval is sought.

Appendix 3: Photographing unexpected heritage items

Photographs of unexpected finds in their current context (*in situ*) may assist archaeologists/Aboriginal heritage consultants to better identify the heritage values of the item. Emailing good quality photographs to specialists can allow for better quality and faster heritage advice. The key elements that must be captured in photographs of the item include its position, the item itself and any distinguishing features. All photographs must have a scale (ruler, scale bar, mobile phone, coin etc.) and a note describing the direction of the photograph.

Context and detailed photographs

It is important to take a general photograph (Figure 1) to convey the location and setting of the item. This will add value to the subsequent detailed photographs also required (Figure 2).

Removal of the item from its context (e.g. excavating from the ground) for photographic purposes is not permitted.

Photographing distinguishing features

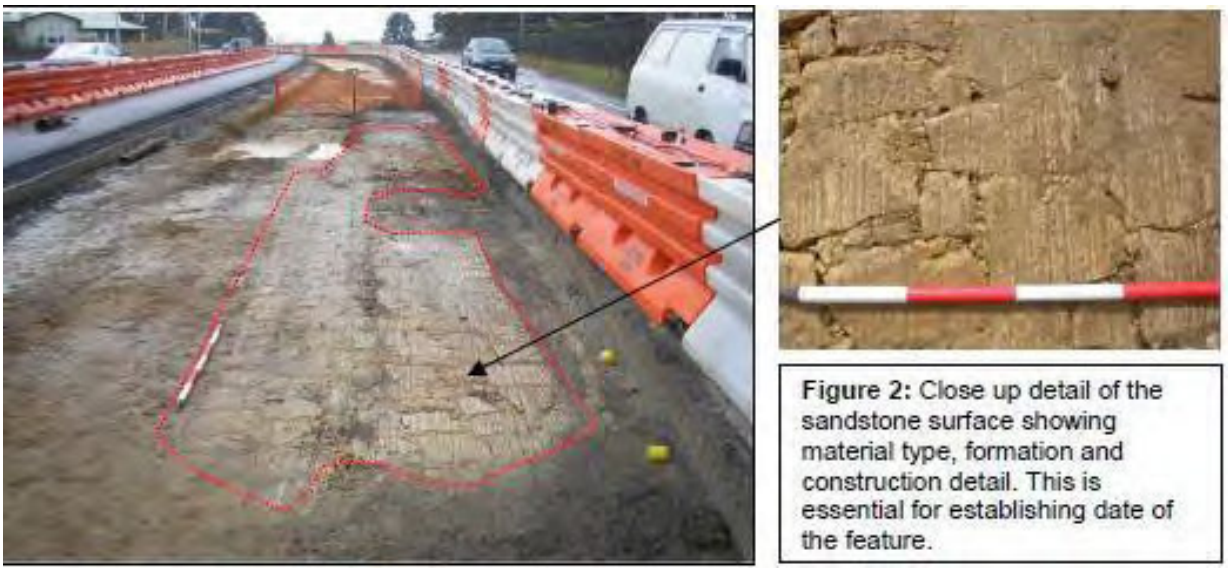


Figure 2: Close up detail of the sandstone surface showing material type, formation and construction detail. This is essential for establishing date of the feature.

Where unexpected items have a distinguishing feature, close up detailed photographs must be taken of these features, where practicable. In the case of a building or bridge, this may include diagnostic details architectural or technical features. See Figures 3 and 4 for examples.

Figure 3: Ceramic bottle artefact with stamp.

Figure 4: Detail of the stamp allows '*Tooth & Co Limited*' to be made out. This is helpful to a specialist in gauging the artefact's origin, manufacturing date and likely significance.

Photographing bones

The majority of bones found on site will be animal bones often requiring no further assessment (unless they are in archaeological context). However, if bones are human, the police must be contacted immediately (see Appendix 5 for detailed guidance). Taking quality photographs of the bones can often resolve this issue quickly. The project archaeologist can confirm if bones are human or non-human if provided with appropriate photographs.

Ensure that photographs of bones are not concealed by foliage (Figure 5) as this makes it difficult to identify. Minor hand removal of foliage can be undertaken as long as disturbance of the bone does not occur. Excavation of the ground to remove bone(s) should not occur, nor should they be pulled out of the ground if partially exposed.

Where sediment (adhering to a bone found on the ground surface) conceals portions of a bone (Figure 6) ensure the photograph is taken of the bone (if any) that is not concealed by sediment.

Figure 5: Bone concealed by foliage.

Figure 6: Bone covered in sediment

Ensure that all close up photographs include the whole bone and then specific details of the bone (especially the ends of long bones, the *epiphysis*, which is critical for species identification). Figures 7 and 8 are examples of good photographs of bones that can easily

be identified from the photograph alone. They show sufficient detail of the complete bone and the epiphysis.

Figure 7: Photograph showing complete bone.

Figure 8: Close up of a long bone's epiphysis.

Appendix 4: Archaeological / heritage advice checklist

The archaeologist/Aboriginal heritage consultant must provide advice to the Sydney Metro Environment Manager and Senior Advisor Heritage as soon as possible after an inspection of the site has been completed. This advice can include a range of activities and processes, which differ depending on the find and its significance.

In discussions with the archaeologist/Aboriginal heritage consultant the following checklist can be used as a prompt to ensure all relevant heritage issues are considered when developing this plan. This will allow the project team to receive clear and full advice to move forward quickly. Archaeological and/or heritage advice on how to proceed can be received in a letter or email outlining all relevant archaeological and/or heritage issues.

	Required	Outcome/notes
Assessment and investigation		
• Assessment of significance	Yes/No	
• Assessment of heritage impact	Yes/No	
• Archaeological excavation	Yes/No	
• Archival photographic recording	Yes/No	
Heritage approvals and notifications		
• AHIP, section 140, section 139 exceptions, section 60, exemptions etc.	Yes/No	
• Regulator Aboriginal objects / relics notification	Yes/No	
• Notification to the appropriate agency for s170 heritage conservation register	Yes/No	
• Compliance with CEMP or other project heritage approvals	Yes/No	
Stakeholder consultation		
• Consultation with Registered Aboriginal Parties	Yes/No	
Management		
• Retention or conservation strategy (e.g. items may be subject to long conservation and interpretation)	Yes/No	
• Disposal strategy	Yes/No	
• Short term and permanent storage locations (interested third parties should be consulted on this issue).	Yes/No	
• Control Agreement for Aboriginal objects	Yes/No	

Appendix 5: Template notification letter

Note: Notification of the discovery of a relic is required under section 146 of the Heritage Act 1977. The notification should be submitted through the Heritage Management System (HMS).

Insert on Sydney Metro letterhead

[Name]
Heritage NSW
[Address]

[Select and type salutation and name],

Re: Unexpected heritage item discovered during Sydney Metro activities

I write to inform you of an unexpected [select: Aboriginal object / relic] found during Sydney Metro activities at [insert location] on [insert date] in accordance with the notification requirement under select: [NPW Act, section 146 of the *Heritage Act 1977* (NSW)]. [Where the regulator has been informally notified at an earlier date by telephone, this should be referred to here].

NB: On finding Aboriginal human skeletal remains this letter must also be sent to the Commonwealth Minister for the Environment in accordance with notification requirements under section 20(1) of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth).

[Provide a brief overview of the project background and project area. Provide a summary of the description and location of the item, including a map and image where possible. Also include how the project was assessed under the *Environmental Planning and Assessment Act 1979* (NSW) (e.g. Part 5). Also include any project approval number, if available].

Sydney Metro [*or contractor*] has sought professional archaeological advice regarding the item. A preliminary assessment indicates [provide a summary description and likely significance of the item]. Please find additional information on the site recording form attached.

Based on the preliminary findings, Sydney Metro *[or contractor]* is proposing [provide a summary of the proposed archaeological/heritage approach (e.g. develop archaeological research design (where relevant), seek heritage approvals, undertake archaeological investigation or conservation, interpretation). Also include preliminary justification of such heritage impact with regard to project design constraints and delivery program].

The proposed approach will be further developed in consultation with a nominated Heritage NSW staff member.

Should you have any feedback on the proposed approach, or if you require any further information, please do not hesitate to contact [Environment and Planning Project Manager] on [add contact number].

Yours sincerely

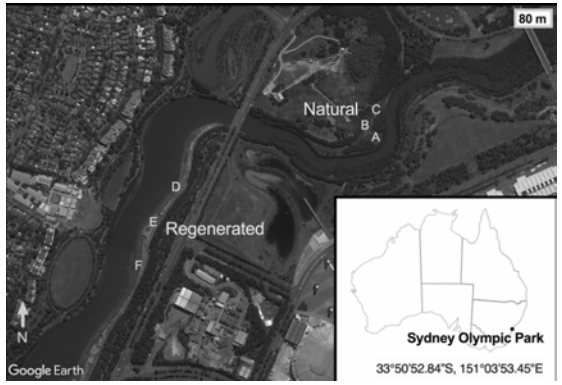
[Name]

Sydney Metro Director, Environment, Sustainability & Planning

[Attach the advice from the Excavation Director, archaeologist or Aboriginal cultural heritage consultant, completed recording form and section 146 notification]

Appendix E – SR Environmental Characteristics

Environmental Characteristic	Description
SR1	
Land use	• The east of Haslams Creek site has had agricultural land uses since at least 1930 until the early 1960s with a large abattoir established along Olympic Boulevarde. The areas around the abattoirs started developing into industrial land in the 1960s until the 1980s. In the late 1990s, the Sydney Olympic Park precinct was developed to host the 2000 Olympic Games. The east of the Creek is now a well-established town centre with commercial buildings, entertainment facilities and accommodation. is currently used as a public parkland with a walking track linking Hill Road to Pondage Link. Land use is generally mixed use with several entertainment venues, including Sydney Showground 400m to the southeast and Stadium Australia 350m to the south. The Cleanaway Sydney Olympic Park Industrial Waste Service and Cleanaway Auburn Resource Recovery Centre are located to the immediate east of the site. • West of Haslams Creek the site and surrounding areas were historically used for agricultural purposes since at least 1951 until 1998. By 1998, the site and surrounds underwent development into a residential area. This residential area was fully established by 2002 and a school was developed. Additionally, development of an industrial area had commenced prior to 1951, which is located 350m northwest of the site. By 1961, the industrial area was well developed. The west of the creek is currently used for public recreation, situated on Haslam Field. The site intersects the Louise Sauvage Pathway, which is a popular walking trail along the Haslams Creek. Land use surrounding the site is generally residential, educational facilities and public recreation. The Newington Public School is located 80m to the west of the site. Additionally, there are several residential properties along Devitt Avenue and Heidelberg Avenue that are 160m southwest of the site.
Noise and vibration	• The site is relatively quiet during the day when no special events are taking place. The site experiences some noise from road traffic along Hill Road and general noise from the sport and entertainment complex. Existing noise levels around are dominated by noise from the Newington Public School during break times and outside activities. • SR1 sits within NCA07 (as identified in the EIS), which has a NML of 56dBA for daytime standard construction activities. • The Newington Public School is located 80m to the west of the site. Additionally, there are several residential properties along Devitt Avenue and Heidelberg Avenue that are 160m southwest of the site. NMLs are not anticipated to be exceeded
Hydrology	• Haslams Creek at the SR1 site has been widened and realigned as part of the Sydney Olympic Park construction work. The banks of the site are a mix of constructed gabion walls, sheet piled walls and filled, tiered stabilised areas. The banks are revegetated and restored. A constructed saltmarsh flat has been incorporated into the channel design on the eastern bank of the Creek. Approximately 450m downstream the creek is fringed with a mangrove forest and wetlands.
Soils and contamination	• The EIS has identified several areas of potential contamination risk within 300m of the site: uncontrolled landfilling from the former Haslams Creek South Area 3, the former Kronos Hill Landfill, and Corner Pondage Link and Hill Road, all of which have a high contamination risk potential. Additionally, there is one area of moderate potential contamination risk which is a waste storage facility.

Environmental Characteristic	Description
	• There are two sites listed on the NSW Environment Protection Authority Contaminated Sites Register the former Haslams Creek South Area 3 and the former Kronos Hill Landfill. • There are two environment protection licences listed in the NSW EPA Protection of the Environment Operations Act public register for areas within 250m of the site. One includes Cleanaway Operations Pty Ltd, which is located 200m east of the site and has approval for waste storage activities. The other licence is for Suez Recycling and Recovery Pty Ltd which is located 300m southeast of the site and has approval for waste storage and activities associated with treatment and recovery of general waste. • There is no acid sulfate soil risk identified within site. The site is mapped as 'Disturbed Terrain'.
Biodiversity	• The site has no fringing mangrove and has been planted with Casuarina sp. and Melaleuca sp on the east and west banks. There is one patch of Grey Mangrove-River Mangrove Forest (PCT 4091) and Estuarine Swamp Oak Twig-rush Forest (PCT 4028) approximately 450m downstream of the site. • The occurrence of PCT 4023 on the western bank of Haslams Creek has been assessed as conforming to Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions, listed as endangered under the BC Act. • An area of planted and actively managed Saltmarsh is located on the east side of Haslams Creek at SR1. This section of Haslams Creek has been widened and naturalised as part of the construction of Sydney Olympic Park. Prior to this naturalisation work Haslams Creek was a narrow concrete channel heavily impacted by brickpit operations (between 1911 and 1988) and landfilling operations. Following the hydrological rehabilitation, in 1998 gabion walls and sandy soil with rubble were used to construct saltmarsh beds on the eastern bank of Haslams Creek, and saltmarsh plants were transplanted within the area. Restoration of this location has not been entirely successful and is the subject of ongoing maintenance. The area of regenerated saltmarsh is shown below.  

Environmental Characteristic	Description	
	From 2019 https://www.researchgate.net/publication/332336042_Natural_and_Regenerated_Saltmarshes_Exhibit_Similar_Soil_and_Belowground_Organic_Carbon_Stocks_Root_Production_and_Soil_Respiration	Eastern bank of Haslams Creek showing constructed saltmarsh habitat above gabion walls.
		
	Approximate location of SR1 overlaid on 1943 Imagery. Source https://maps.six.nsw.gov.au/.	PCT 4023: Coastal Valleys Swamp Oak Riparian Forest (indicative location)

Environmental Characteristic	Description
	 Area mapped under the Biodiversity Values Map and Threshold  *Zannichellia palustris* mapped occurrence https://www.environment.nsw.gov.au/ • Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is an endangered ecological community under the BC Act 2016 and Subtropical and Temperate Coastal Saltmarsh is listed as vulnerable under the Commonwealth EPBC Act 1999. • Haslams Creek was assessed in the EIS and found to be a highly modified second order estuarine stream. It is a Class 1 waterway (major fish habitat) however is not a habitat for threatened fish species. • SR 1 is located within Haslams Creek, which has been previously assessed as part of two separate Consistency Assessments (for geotechnical borehole works and soil resistivity testing outside the construction boundary). The assessments identified two threatened flora species (Narrow-leafed Wilsonia and *Zannichellia palustris*) and two threatened fauna species (Grey-headed Flying Fox and Green and Golden Bell Frog) as having a high likelihood of occurrence along Haslams Creek and adjacent terrestrial lands.

Environmental Characteristic	Description
	• A desktop assessment identified the Green and Golden Bell Frog (*Litoria aurea*) as having a high likelihood of occurrence in the area. The species may inhabit Haslams Creek however is more likely to be found within the artificial wetland near Hill Road and the associated riparian land along the eastern side of Haslams Creek. • Migratory bird species have a moderate potential to occur in the study area and a portion of Haslams Creek and associated riparian zones have been mapped as 'threatened species or communities with potential for serious and irreversible impacts' (SAII) under the Biodiversity Values Map and Threshold Tool. This includes the portion of Haslams Creek within the study area for SR1 (as shown in Figure above). This area is considered important habitat for specific migratory shorebirds listed under both the BC Act and EPBC Act.
Aboriginal heritage*	• There are no registered Aboriginal sites within 50m of SR1.
Non-Aboriginal heritage	• There are no heritage items or conservation areas within the site.
SR2	
Land use	• The site was historically used as a racecourse (Rosehill Gardens Racecourse) since at least the 1880s. Since at least the 1930s, the surrounding area was used for agricultural purposes. The Sydney Speedway was established in the 1930s, which is located to the south of the site. By 1951, the surrounding area had developed into a primarily industrial area to the north and south, with agricultural land to the east and a residential area to the west. Industrial development continued between 1951 and 1970, which spread into the surrounding areas east of the site. By 2002, the Rosehill Gardens Racecourse underwent some development to include stables. • The site is currently situated within the Rosehill Gardens Racecourse, which is still operational today. The surrounding land use is primarily industrial, with the old Sydney Speedway to the south, the Grand Pavilion to the north and a residential area 300m to the west.
Noise and vibration	• Existing noise levels around SR2 are dominated by road noise from James Ruse Drive, which is a high traffic area. The site also experiences noise from special events taking place at Rosehill Gardens Racecourse. • SR2 sits within NCA07 (as identified in the EIS), which has a NML of 56dBA for daytime standard construction activities. The stables area is assessed as a separated sensitive receiver with a NML of 60dBA. • The nearest sensitive receivers are horse stables within the Rosehill Gardens Racecourse, which are located approximately 70m to the west of the site. Noise management levels are unlikely to be exceeded.
Hydrology	• Duck Creek is located 290m to the south of the site and A'Becketts Creek located 350m to the southwest of the site.
Soils and contamination	• The EIS has identified several areas of potential contamination risk around the site, the closest being equestrian related activities associated with the Rosehill Gardens Racecourse, which has a low contamination risk potential. Additionally, there are potential leaks and spills associated with the former Sydney Speedway, Rosehill Helipad and Rapid Oil Distributors, as well as activities associated with former and existing structures, current industrial/commercial use (including chemical

Environmental Characteristic	Description
	storage) and land reclamation for areas within the surface construction site boundary for Clyde MSF (50m south of the site), all of which have a moderate contamination risk potential. • There are no sites listed on the NSW Environment Protection Authority Contaminated Sites Register within 250 metres of the site. • There are no environment protection licences listed in the NSW EPA Protection of the Environment Operations Act public register for areas within 250m of the site. • There is no acid sulfate soil risk identified within site. The site is mapped as 'Disturbed Terrain'.
Biodiversity	• The site is predominately cleared grassland and exposed dirt surface with several planted trees. There are no Plant Community Types (PCT) within 50m of the site.
Aboriginal heritage*	• There are no registered Aboriginal sites within 50m of SR2. • The Rosehill Gardens Racecourse was formerly part of early farming land, prior to the development of the racecourse in the 1800s. The level of modification of the racecourse in unknown however it is likely to have been limited. Due to the proximity of the site to the Parramatta River, and located close to former resources above the floodplain, the site is likely to contain areas of archaeological potential outside of areas of intensive ground disturbance.
Non-Aboriginal heritage	• There are no heritage items or conservation areas within the site, however the site is located 25m north of the locally listed RTA Depot (Parramatta Local Environmental Plan 2011 Listing No: I576).
SR4	
Land use	• The site was historically a public grassland area since at least 1951 with a row of residential properties in the northern section of the site (along George Street). There was also a building along Hassall Street and a waterbody in the eastern section of the site. The surrounding areas were primarily residential. By 1961, a petrol station was developed in the north-western corner of the site, which replaced several residential properties. The waterbody was removed and building along Hassall Street demolished. The grassland area of the site was repurposed as a space for two tennis courts. By 1970, a large commercial building was established adjacent to the eastern boundary of the site. By 1978, the remaining residential properties along George Street were demolished, except 'Ellangowan' which is still present today. By 1998, the tennis courts were removed. By 2005, the petrol station was demolished. The site is currently a public parkland known as Robin Thomas Reserve. West of Harris Street the Albion Hotel is located on the corner of Harris Street and George Street. The light rail has currently in construction in the vicinity of Harris Street and Macquarie Street. The location of SR4b is within a block of land where a commercial property development is currently underway. A church and childcare facility is approximately 70m to the east of the site accessed from Purchase Street.
Noise and vibration	• Existing noise levels around SR2 are dominated by road noise from Harris Street and Parkes Street, which are high traffic areas. • SR2 sits within NCA04 (as identified in the EIS), which has a NML of 61dBA for daytime standard construction activities.

Environmental Characteristic	Description
	• The nearest sensitive receivers are residential properties along Hassall Street, approximately 70m south of SR4a the Chrurch and Childcare Centre east of the boundary of Robin Thomas Reserve, immediately adjacent to the site. Noise management levels are unlikely to be exceeded.
Hydrology	• Parramatta River is located 55m north of the site.
Soils and contamination	• The EIS did not identify any areas within 250m of the site with a contamination risk potential. • There are no sites listed on the NSW Environment Protection Authority Contaminated Sites Register within 250 metres of the site. • There are two environment protection licences listed in the NSW EPA Protection of the Environment Operations Act public register for areas within 250m of the site, both of which are associated with the Parramatta Light Rail Stage 1 project and associated construction activities. • There is no acid sulfate soil risk identified within site. The site is mapped as 'Disturbed Terrain'.
Biodiversity	• The site is predominately cleared grassland with several planted trees. There are no Plant Community Types (PCT) within 50m of the site.
Aboriginal heritage*	• [redacted] • Robin Thomas Reserve is part of a highly significant cultural landscape for the Aboriginal people. Investigations have already yielded archaeological evidence of Aboriginal land use prior to and after the colonisation of the area and this is represented by the multiple registered sites within the vicinity of SR works. The open undisturbed areas of the reserve have a high potential to contain archaeological evidence and areas of intact Parramatta Sand Bed, a significant geomorphologically layer in the Parramatta area.
Non-Aboriginal heritage	• The site is within the curtilage for Ancient Aboriginal and Early Colonial Landscape (SHR Listing No: 01863 and Parramatta Local Environmental Plan 2011 Listing No: A2) • Tara (known as Ellengowan) is located approximately 25m north of SR4.
SR5	
Land use	• The site was historically a public grassland area since at least 1951, with the 'Old Government House' to the immediate south of the site. An internal road looped around the grassland. Residential properties, a hospital and commercial buildings had been established in the surrounding areas to the east, while surrounding areas to the west, north and south were also public grassland area. By 1970, the existing residential and commercial areas became more densely developed. By 1978, the western extent of the site underwent landscaping works.

Environmental Characteristic	Description
	• The site is currently public grassland within the Parramatta Park. The surrounding areas are predominately public grassland, with residential and commercial areas over 200m to the east of the site. Old Government House is located 40m north of the site.
Noise and vibration	• The site is relatively quiet during the day with low traffic along Railway Parade and Federal Avenue. • SR5 sits within NCA01 and NCA03 (as identified in the EIS). NCA01 has a NML of 58dBA for daytime standard construction activities. • The nearest sensitive receivers include Old Government House located 40m north of the site and The Crescent amphitheatre located 90m to the north of the site. Noise management levels are unlikely to be exceeded.
Hydrology	• Parramatta River is located 150m north of the site.
Soils and contamination	• The EIS did not identify any areas within 250m of the site with a contamination risk potential. • There are no sites listed on the NSW Environment Protection Authority Contaminated Sites Register within 250 metres of the site. • There are no environment protection licences listed in the NSW EPA Protection of the Environment Operations Act public register for areas within 250m of the site.
Biodiversity	• The site contains cleared grassland with patches of Cumberland Shale Plains Woodland (PCT 3320) adjacent to the site • There is no acid sulfate soil risk mapped for the site.
Aboriginal heritage*	• [redacted]
Non-Aboriginal heritage	• The site is within the curtilage for the Parramatta Park and Old Government House (World heritage Listing No: 106209) National heritage Listing No: 105957, SHR Listing No: 00596, Parramatta Local Environmental Plan 2011 Listing No: I00596).
SR6	
Land use	• The site is located approximately 500m north east of SR2. Similar to SR2 the site was historically used as a racecourse (Rosehill Gardens Racecourse) since at least the 1880s. Since at least the 1930s, the surrounding area was used for agricultural purposes. The Sydney Speedway was established in the 1930s, which is located to the south of the site. By 1951, the surrounding area had developed into a primarily industrial area to the north and south, with agricultural land to the east and a residential area to the west. Industrial development continued between 1951 and 1970, which spread into the surrounding areas east of the site. By 2002, the Rosehill Gardens Racecourse underwent some development to include stables. • The site is currently situated within the carpark area between James Ruse Drive and the Clyde Dive site. The surrounding land use is primarily residential with residential apartments approximately 60m to the west with Rosehill Gardens Racecourse to the east

Environmental Characteristic	Description
Noise and vibration	• Existing noise levels around SR2 are dominated by road noise from James Ruse Drive, which is a high traffic area, works at the Clyde Dive site and noise from special events taking place at Rosehill Gardens Racecourse. • SR6 sits within NCA07 (as identified in the EIS), which has a NML of 56dBA for daytime standard construction activities. • The nearest sensitive receivers are the residential apartments 60m to the west. Noise management levels are unlikely to be exceeded.
Hydrology	• Duck Creek is located 700m to the south of the site and A'Becketts Creek located 750m to the south. Parramatta River is approximately 560m north of the site.
Soils and contamination	• The EIS has identified several areas of potential contamination risk around the site, the closest being equestrian related activities associated with the Rosehill Gardens Racecourse, which has a low contamination risk potential. The former James Hardie factory, which is located 420m northeast of the site • There is one site listed on the NSW Environment Protection Authority Contaminated Sites Register which is the former James Hardie factory. • There is one environment protection licence listed in the NSW EPA Protection of the Environment Operations Act public register, which is the Statewide Planning Pty Ltd located 290m north of the site, which has approval for activities associated with treatment of contaminated soil. • There is no acid sulfate soil risk identified within site. The site is mapped as 'Disturbed Terrain'.
Biodiversity	• The site is within a carpark with some planted trees. There are no Plant Community Types (PCT) within 50m of the site.
Aboriginal heritage*	• There are no registered Aboriginal sites within the vicinity of SR6. • The Rosehill Gardens Racecourse was formerly part of early farming land, prior to the development of the racecourse in the 1800s. The level of modification of the racecourse in unknown however it is likely to have been limited. Due to the proximity of the site to the Parramatta River, and located close to former resources above the floodplain, the site is likely to contain areas of archaeological potential outside of areas of intensive ground disturbance.
Non-Aboriginal heritage	• There are no heritage items or conservation areas within the site.

**All SR sites are located within the curtilage for the Sydney Cultural Crescent Rock Art, which is undergoing assessment by Australian Heritage Council to be a nationally listed Indigenous heritage place. As this curtilage includes all sites, it was excluded from the description that identifies characteristics unique to each site.*

Appendix F – Noise Assessment Memo

Memorandum

To:	Jenny Bradford / Kieran Kerr	**At:**	GLC
From:	Steven Luzuriaga	**At:**	SLR Consulting Australia Pty Ltd
Date:	25 August 2022	**Ref:**	610.30644-M08-v3.0-20220825.docx
Subject:	Sydney Metro West WTP NVIA Seismic Refraction Testing		

1 Introduction

SLR Consulting has been engaged by Gamuda & Laing O'Rourke Consortium (GLC) to provide noise and vibration advice in relation to the Sydney Metro West Western Tunnelling Package.

This Construction Noise and Vibration Impact Assessment (NVIA) has been prepared to assess potential noise impacts associated with seismic refraction testing along the project alignment during approved hours and out-of-hours (OOH) assessment periods.

As the timing of all work locations has not yet been confirmed, noise impacts are considered for both approved hours and OOHW for all work locations. It is noted that most of the work locations will be undertaken during approved hours.

2 Overview of Proposed Works

Table 1 presents an overview of key information relevant to this NVIA. **Table 2** presents the testing locations and equipment. Layout maps of the testing locations are provided in **Appendix A**. The construction equipment and locations included in the assessment are based on information contained in the scope of works supplied on 9 August 2022 from project team. Further detail of existing conditions, management levels and assessment methodology are outlined in the Detailed Noise and Vibration Impact Statement (DNVIS).

Table 1 Details of proposed works

Item	Description		
CNIA Reference	M08		
Works Type	Seismic Refraction Testing		
Location	Westmead to Sydney Olympic Park		
Assessment Periods (refer CNVMP)	**Approved Project Hours**	**OOHW1 (Evening)**	**OOHW2 (Night)**
	Monday -Friday (7am – 6pm) Saturday (8am – 6pm) Sunday / Public Holidays (Nil)	Monday -Friday (6pm – 10pm) Saturday (6pm – 10pm) Sun. / P. Holidays (8am -6pm)	Monday -Friday (10pm – 7am) Saturday (10pm – 8am) Sun. / P. Holidays (6pm -7am)
Ambient Acoustic Environment at Nearest Receiver	The acoustical environment along the project alignment changes depending on the area of interest but is generally dominated by road traffic noise and 'urban hum'.		

Table 2 Testing Locations and Equipment

Location ID	Location Description[1]	Array Length	Approximate No. of Shot Locations[2]	Seismic Source
SR1	Haslams Creek	110m	5 to 6	Underwater air-gun (approximately 800 psi)
SR2	Rosehill Gardens Racecourse at Unwin Street	110m	9	Weight dropper
SR4a	Robin Thomas Reserve	165m	13	Sledgehammer
SR4b	Harris Street	125m	10	Weight dropper
SR5	Parramatta Park	450m	38	Sledgehammer
SR6	Adjacent to Clyde Dive Site	310m	26	Weight dropper

Note 1: refer **Appendix A** for testing location maps

Note 2: A maximum of 3 shot locations would occur in a 15 minute period. At each shot location the weight dropper may be used on average 3-5 times and the sledgehammer may be used up to 15 times.

3 Qualitative Impact Assessment

3.1 Noise

Based on the information provided by the project team, it is expected that $L_{Aeq(15\ minute)}$ noise levels will remain below 40 dBA beyond 50 m from the seismic refraction testing activities. The seismic refraction testing activity is considered a 'low noise impact scenario' as noise levels are expected to remain below the project NMLs at nearby receivers.

Due to the small scale of the seismic investigation in Haslams Creek underwater impacts are not expected and further assessment of underwater noise is not considered necessary.

This assessment has assumed the following:

- seismic refraction testing will consist of a weight dropper / hand tools (ie underwater air-gun, sledgehammer) and monitoring equipment
- all project vehicles will be turned off while on site.

3.2 Vibration

It is understood that at some sites (eg SR4 and SR5) there is concern about the potential impacts of the seismic sources on heritage items with respect to vibration. This includes Aboriginal and historic (non-Aboriginal) cultural heritage items and archaeology.

The response and vulnerability of heritage artefacts to vibrations is extremely variable. Each object responds differently to vibration input due to its particular size, shape, material composition, and mass distribution. There is also a very wide range in the possible condition of artefacts and objects: some are very robust, and others are extremely fragile and distressed.

Consequently, there are no recognised standards or guidelines that specifically address heritage artefacts. In order to establish a suitable vibration limit for heritage artefacts, SLR has taken guidance from *Vibration Limits for Historic Buildings and Art Collections* (Johnson & Hannen, 2015).

Johnson & Hannen note that:

> *The authors believe that a vibration limit of approximately 0.1 in/sec (baseline) is a conservative limit to protect most art objects in reasonable condition. The following caveats apply: walking of light objects on smooth surfaces can occur at lower levels; resonance of objects or building sub-assemblies with natural frequencies similar to continuous construction vibrations can be problematic; and objects that are particularly fragile or those with serious preexisting weaknesses might be susceptible at lower levels. Measures should be taken to protect against these risks on a case-by-case basis.*

Johnson & Hannen also note that this limit has been used "during several recent museum construction projects". Taking into consideration that the vibrations will be transient and that heritage artefacts would likely be embedded in the ground to some extent, 0.1 in/sec (or 2.5 mm/s) is considered to be a suitable vibration limit to protect objects that are in a reasonable condition. A peak component particle velocity limit of 2.5 mm/s also corresponds to the vibration limit for structurally unsound heritage structures from German Standard DIN 4150 *Part 3-2016 Structural vibration – Effects of vibration on structures, Deutsches Institute fur Normung, 1999*.

Vibration damage levels for museum objects (Thickett, 2002) suggest limits of 0.2g to 0.6g, which would correspond to lower limits of 32 mm/s (at 10 Hz) and 3 mm/s (at 100 Hz). Therefore, adopting a limit of 2.5 mm/s is considered conservative.

SLR has previously measured vibration of a 165 kg mass falling from a height of 0.9 m on to rubber pads on a concrete slab. The peak component particle velocity levels measured immediately adjacent to the impact (ie approximately 0.5 m offset distance) and at an offset distance of 14 m were 0.8 mm/s and 0.2 mm/s respectively. For an equivalent mass and drop height, impacts on soft soil would likely have more energy at low frequencies and correspondingly higher velocities, but it is anticipated that the masses used in the sledge hammer / weight dropper works will be much lower. On this basis, it is deemed unlikely that the conservative 2.5 mm/s criterion will be exceeded, unless the sledge hammer or dropped weights impact in very close proximity to an artefact. Other concerns not directly related to vibration such as the ground deforming due to light vehicles traversing the site are considered to be more likely to cause damage to any artefacts close to the surface.

4 Conclusion and Recommendations

Noise and vibration emissions from the project have been qualitatively assessed. Noise levels are expected to remain below noise management levels (ie RBL + 5dB) at nearby receivers during seismic refraction testing activities. Vibration levels are expected to remain below the conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) at nearby receivers and heritage items.

While noise and vibration impacts are not anticipated, best practice noise mitigation and management measures must be implemented where feasible and reasonable in accordance with the CNVMP and DNVIS. Mitigation and management measures would include the following:

- Ensure the minimum sized equipment necessary to complete the works are used
- Shut down vehicles when not in operation

Checked/
Authorised by: AMi

APPENDIX A – SEISMIC REFRACTION TESTING LOCATIONS

Figure A1 Seismic Refraction Testing (SR1)

Figure A2 Seismic Refraction Testing (SR2)

Figure A3 Seismic Refraction Testing (SR4a & SR4b)

Figure A4 Seismic Refraction Testing (SR5)

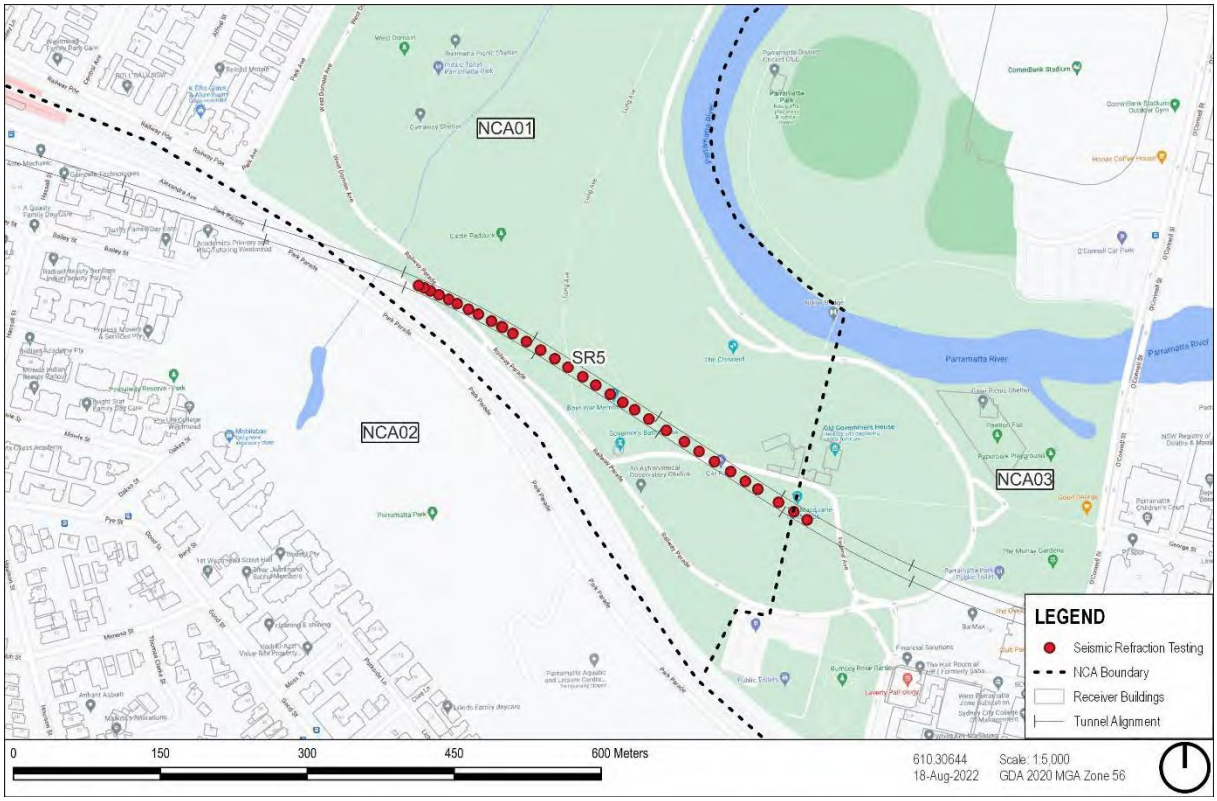
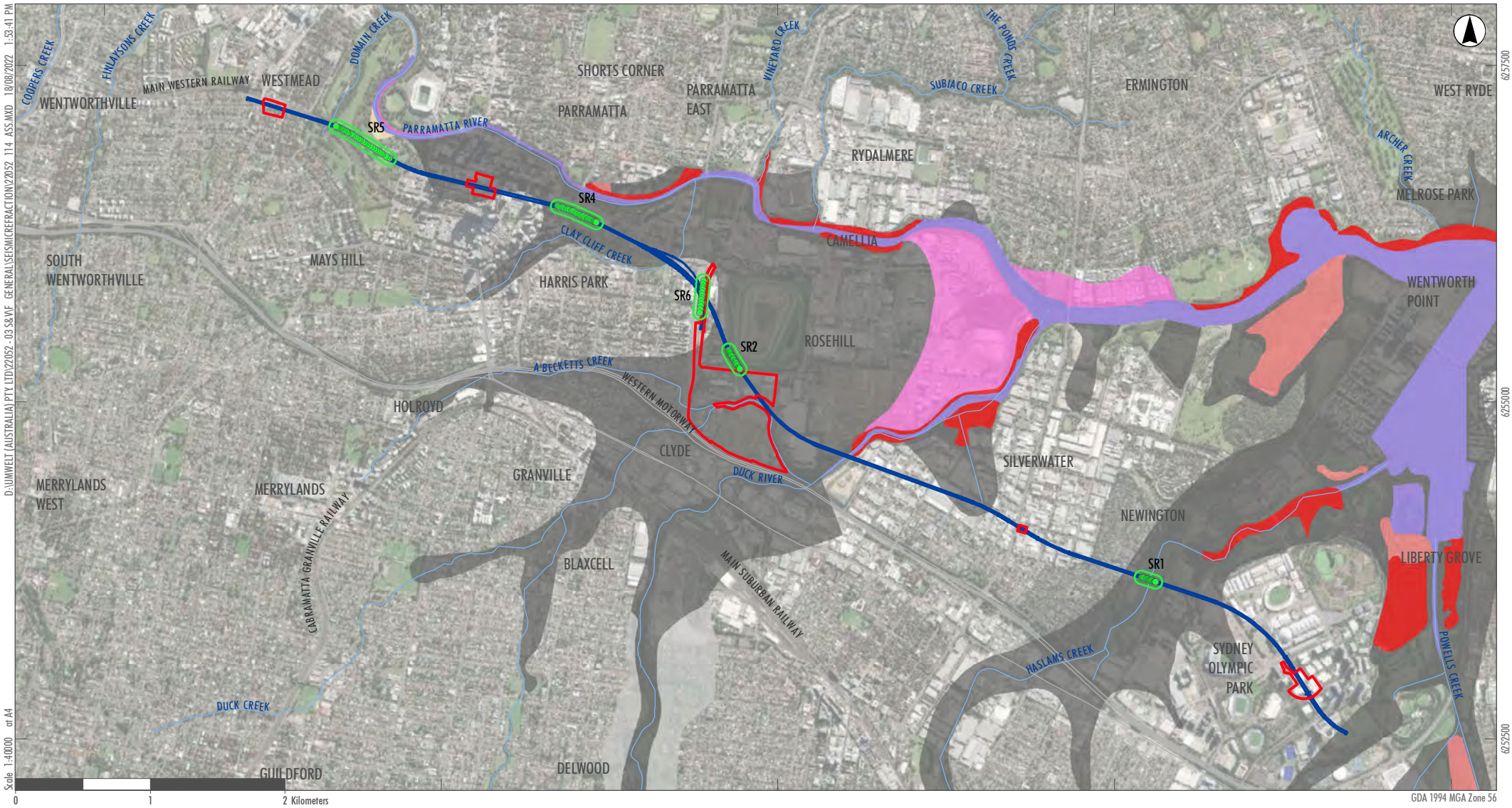


Figure A5 Seismic Refraction Testing (SR6)

Appendix G – Acid Sulfate Soil Risk Map



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- 50m Search Buffer
- Seismic Refraction Test
- Road
- Drainage Line

Acid Sulfate Soil Risk

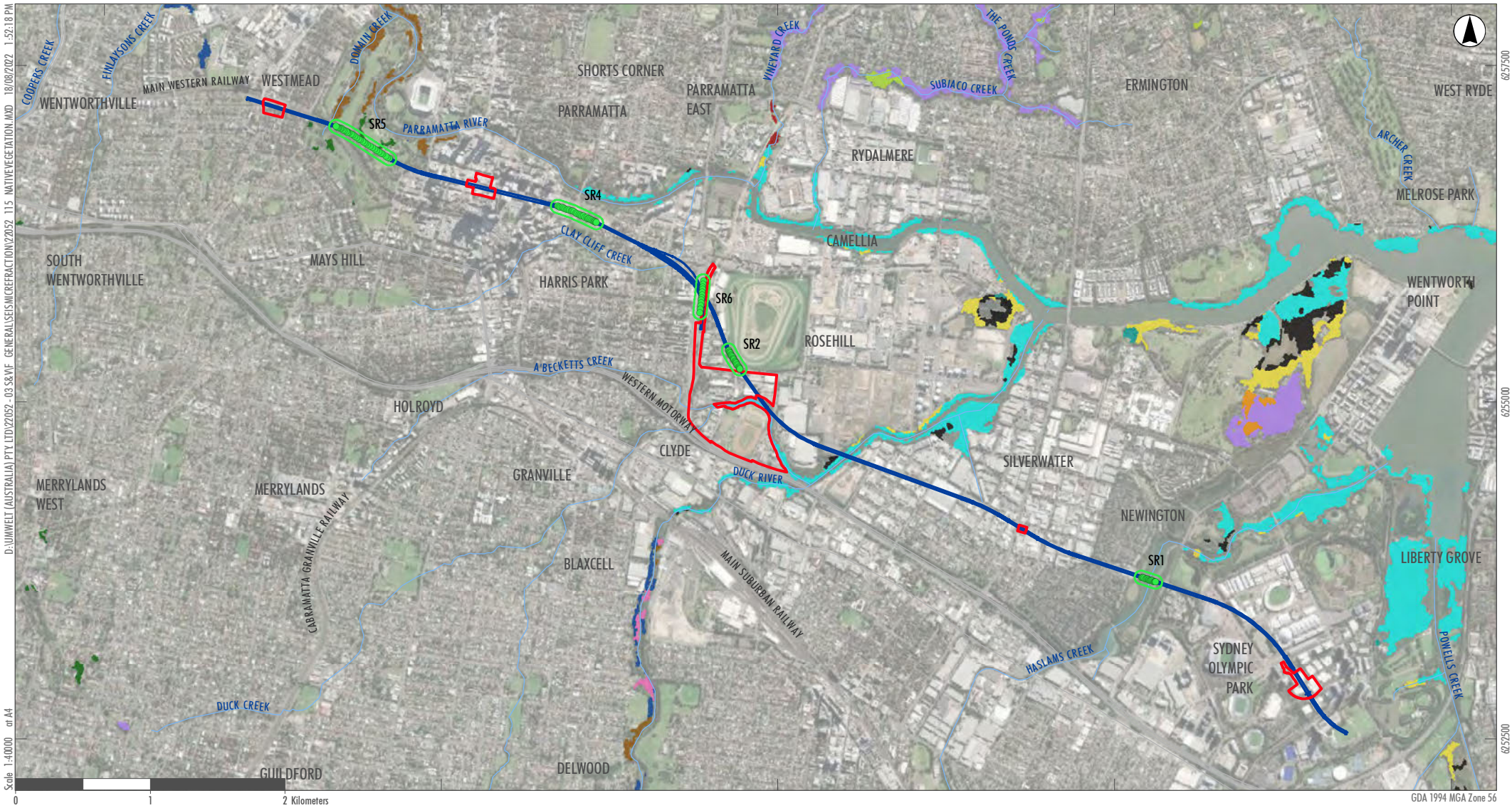
- High Risk 0-1m
- High Risk 1-2m
- High Risk 2-4m
- High Risk Sediments
- Low Risk above 4m
- No Risk
- Disturbed Terrain

Image Source: ESRI (2021) Data source: DFSI (2021)

APPENDIX G

Acid Sulfate Soil

Appendix H – Native Vegetation Map



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- 50m Search Buffer
- Seismic Refraction Test
- Road
- Drainage Line

Native Vegetation

- PCT : 3136, Blue Gum High Forest
- PCT : 3262, Sydney Turpentine Ironbark Forest
- PCT : 3320, Cumberland Shale Plains Woodland
- PCT : 3448, Castlereagh Ironbark Forest
- PCT : 3963, Estuarine Reedland
- PCT : 3972, Sydney Creekflat Wetland
- PCT : 4006, Northern Paperbark-Swamp Mahogany Saw-sedge Forest
- PCT : 4023, Coastal Valleys Swamp Oak Riparian Forest
- PCT : 4024, Cumberland Blue Box Riverflat Forest
- PCT : 4028, Estuarine Swamp Oak Twig-rush Forest
- PCT : 4091, Grey Mangrove-River Mangrove Forest
- PCT : 4097, Samphire Saltmarsh

APPENDIX H
Native Vegetation

Image Source: ESRI (2021) Data source: DFSI (2021); NSW Department of Planning (2022); State Government of NSW (2022)