Planning Approval Consistency Assessment Form

SM-17-00000111

Metro Body of Knowledge (MBoK)

Assessment name:	Sydney Metro West – High Risk Boreholes and Monitoring Well Sites Outside Approved Construction Boundary
Prepared by:	GLC
Prepared for:	Sydney Metro
Assessment number:	GLC07
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For information – do not alter:

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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)
- SSI-10038-Mod-4 The Sydney Metro West Westmead to The Bays and Sydney CBD - Modification 4 (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
- SSI-10038-Mod-4: 23 December 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 (i.e. demolition, utility supply to construction sites, utility adjustments and modifications to 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
- 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.

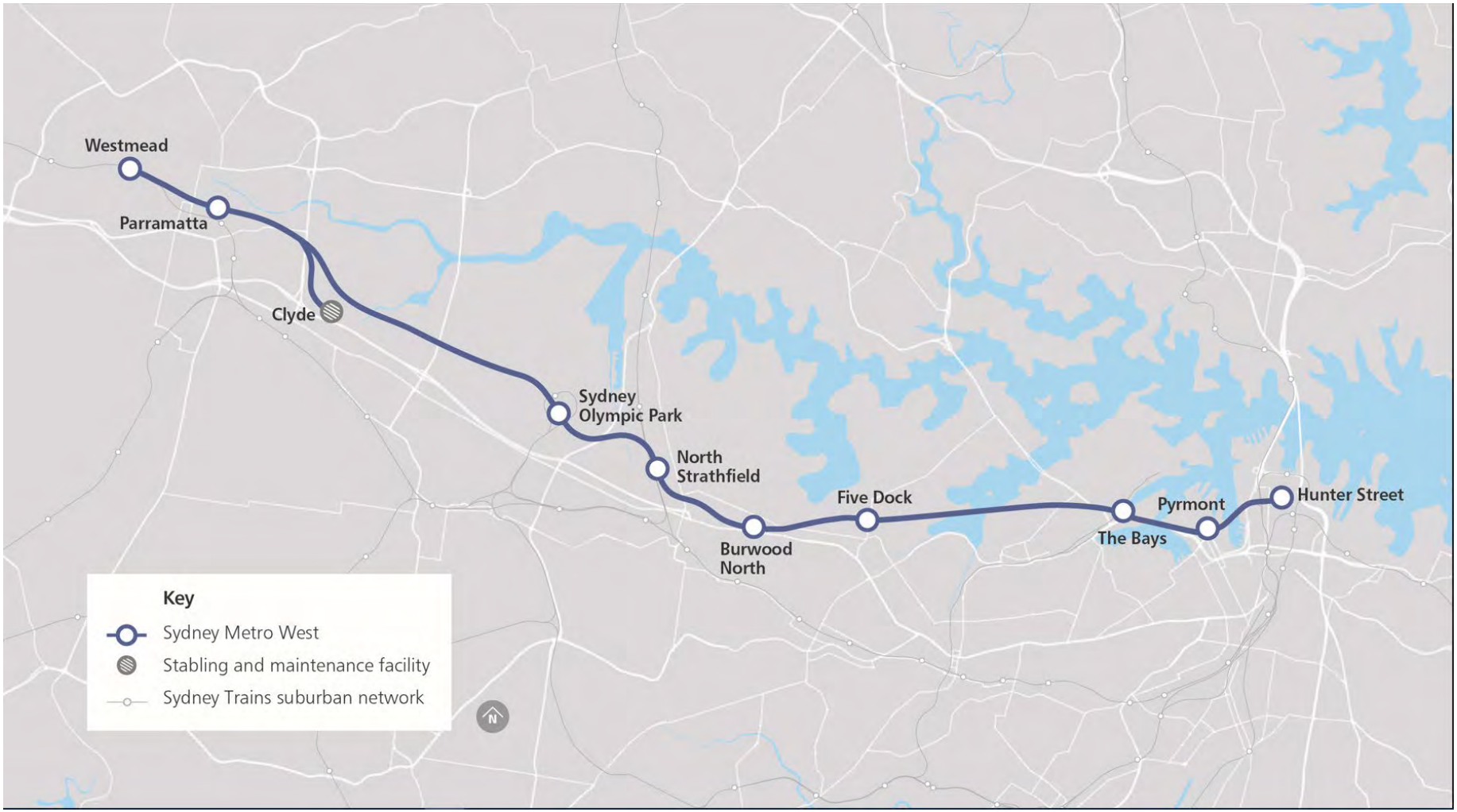


Figure 1: Location of Sydney Metro West - Stage 1

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 E – Existing Rail Corridor Enabling Works
- Phase F – Western Tunnelling Works

This Consistency Assessment has been prepared to support a scope of works to carry out geotechnical services (e.g. borehole investigations or monitoring well installations) at five (5) priority locations within Parramatta Park and three (3) within the Parramatta Streetscape environs (including Robin Thomas Reserve) in Parramatta, NSW, 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 borehole/monitoring well sites (refer Figure 2 below) are located outside the surface construction site boundaries (but in the vicinity of the tunnelling alignment) as identified for the approved project. A targeted assessment of the borehole/monitoring well 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 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:

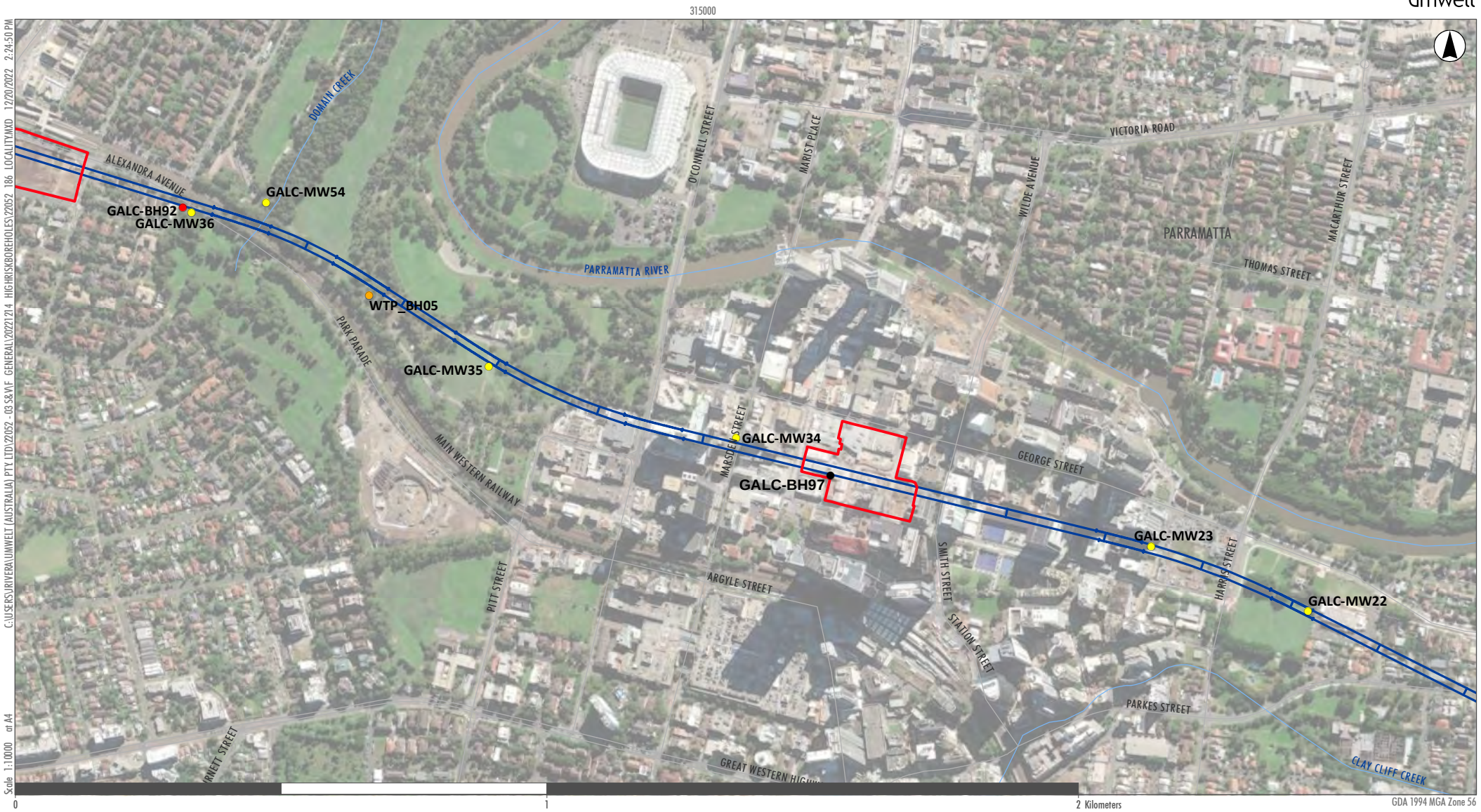
- Consistency Assessment GLC05 Low Risk Boreholes and Monitoring Well Sites (endorsed 14 October 2022)
- Consistency Assessment GLC06 Moderate Risk Boreholes and Monitoring Well Sites (endorsed 21 October 2022)

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 borehole/monitoring well sites, as shown on Figure 2 below. Refer to Appendix A for figures of site locations.

43 borehole/monitoring well locations were originally proposed as part of the DSI scope required to support the Western Tunnelling Package phase, however three (3) locations were either completed by Sydney Metro or were no longer required and subsequently removed from the package. Of the remaining 40 locations, eight (8) locations were deemed as high environmental risk following the completion of a heritage and ecological constraints review undertaken across all borehole/monitoring well sites (refer to Appendix B). The low and moderate environmental risk sites have been assessed in separate Consistency Assessments and are not addressed within this Consistency Assessment that specifically addresses those deemed to have a high environmental risk.



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Road
- Drainage Line
- High Risk Borehole
- High Risk Borehole (proposed by SM)
- High Risk Borehole with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA

FIGURE 2

Location of high risk borehole and monitoring well sites in Parramatta

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

Proposed Methodology

The geotechnical services involve borehole investigations and the installation of permanent monitoring wells above the underground tunnel alignment to understand groundwater conditions and soil profile to inform the project design. The proposed methodology for the geotechnical services is discussed below.

- Undertake pre-condition surveys
- Undertake site setup including traffic control, temporary site fencing, heritage buffers, shade cloths, erosion/sediment controls and noise blankets
  Undertake onsite service location, service clearance and proving activities (to determine service location, depth, and type) using an accredited service locator and non-destructive digging (NDD) method using either dry or wet vacuum excavation trucks. NDD would also be undertaken with a suitably qualified archaeologist present to ensure the works are completed appropriately, and to ensure no unidentified Aboriginal objects or historical archaeological remains are impacted by the work, should they unexpectedly be located within the borehole/monitoring well footprint.
- Transport drill rig to each site via a float truck. Track mats will be placed to prevent ground disturbance from machinery and drill boreholes using a truck or tractor mounted augur drill rig
- Drilling operation – drilling of boreholes and installation of groundwater monitoring wells where required
- Surplus soil from drilling operation to be managed as per the approved SWMP and WMP
- Any excess water will be removed from site using a vacuum truck
- Reinstate each borehole/monitoring well site, including:
  - Demobilisation of drill rig and other plant and equipment from the site including removal of any waste related to the drilling activities
  - Backfill drilled hole with grout to just under surface level
  - Reinstate surface area around drill location
  - Clean site and undertake post-construction dilapidation survey
  - Remove traffic controls and environmental controls
- Undertake fortnightly manual dripping and groundwater sampling (only required for monitoring well sites – refer to Section 4 – Site description for details on location and number of monitoring wells)
- Decommissioning of the monitoring well post completion including backfilling of the drilled hole and reinstatement of surface area consistent with the surrounding

Each drilling site will be in operation for a duration of approximately 2 weeks, inclusive of pre-works, drilling and reinstatement phases. For proposed monitoring well sites, the monitoring well will stay in place for the duration of the project (monitoring well flush to ground). The monitoring well will be decommissioned as required once redundant.

The location of the proposed boreholes/monitoring wells has been selected based on detailed design considerations and consultation within project teams, supported by field inspections where required. It is expected that these locations will be fit for purpose to undertake the required geotechnical investigation. However, in the event that the locations become inadequate to safely undertake the geotechnical investigations (i.e. existing services that need to be avoided), a nearby location within the vicinity of the proposed site and within the same or less risk category would be selected to carry out the geotechnical services. Each revised location would be assessed against a Health, Safety and Environment (HSE) Checklist to ensure that works could safely proceed, in accordance with the approved project.

Public safety measures and signage will be used at each site to reduce the potential for localised impacts during drilling operation. Safety cones will be placed around each site to demarcate potential trip hazards. Appropriate signage will be used at each site to notify the public of the proposed works. Community notification will also be undertaken as required. The plant and equipment required to carry out the different phases of the proposed geotechnical services include but are not limited to:

Site Setup

- Safety water barriers
- ATF fencing
- Road plates

NDD

- 1 x Road saw
- 1x vacuum truck
- 1 x 2t tipper
- 1x 5t excavator
- Hammer attachment
- 1 x watercart (occasionally if required)
- 1 x sweeper (occasionally if required)

Operations

- 1 x Drill rig
- Up to 4x light vehicles (Surveillance officer, Safety officers and field manager to conduct inspections of the work site where required)
- 1x light vehicle for the purpose of periodic groundwater well monitoring (for monitoring wells only)

Reinstatement

- Plate compactor
- General hand power tools

Nightshift (if required)

- Lighting towers

Figure 3 and Figure 4 showing an example borehole/monitoring well site set-up, as well example monitoring well installation and sampling, are provided below:

Figure 3: Example of a borehole/monitoring well set-up required for the proposed geotechnical services

Figure 4: Example of an installed monitoring well (left) and periodic monitoring well sampling (right)

3. Timeframe

The geotechnical services activities are estimated to take approximately two weeks per borehole/monitoring well site, inclusive of pre-works, drilling and reinstatement phases. It is expected that these works will be undertaken from January 2023, dependent on the approval timeline for this Consistency Assessment.

The geotechnical services are proposed to occur within the approved standard hours for the project and will comply with MCoA D37 and D38, however out-of-hours works (OOHW) may be required to carry out the proposed works at certain sites. All OOHW would be managed in accordance with the Project Noise and Vibration Management Plan and the Project EPL 21676.

4. Site Description

There are eight (8) high risk borehole/monitoring well sites within Parramatta Park and the broader Parramatta area, all of which fall within the City of Parramatta Local Government Area (LGA). These borehole/monitoring well sites have been separated into two portions being Parramatta Park and Parramatta Streetscapes, based on shared geographic locations and characteristics across borehole/monitoring well sites within each of these portions. Refer to Table 1 for the description at each site, Appendix A for figures presenting each site, and Section 5 for further detail of the environmental characteristics.

Table 1: Site Description

BH/MW ID	Site Description
Portion 1 (Parramatta Park)	
BH05, BH92, MW35, MW36, MW54	Portion 1 is located in Parramatta, with all borehole/monitoring well sites situated within Parramatta Park. BH92 and MW36 are located in the southwestern portion of Parramatta Park, directly south of the railway corridor connecting Westmead and Parramatta railway stations. MW54 is located on the northern side of the aforementioned rail corridor, approximately 140 m northeast of MW36. BH05 is located near the Billy Hart Memorial in the grassed area between Railway Parade and Long Avenue within Parramatta Park, approximately 260 m southeast of MW54. MW35 is located on the eastern side of the pedestrian path near the Macquarie Landmark, approximately 60 m south of Old Government House, a significant historic heritage feature within Parramatta Park. MW54 is located approximately 260 m southeast of BH05, and is the closest Portion 1 site to the Parramatta Metro Station surface construction site, located approximately 600 m to the east of MW54. All five Portion 1 sites fall within the 'RE1 Public Recreation' land use zone under the Parramatta Local Environmental Plan 2011.
Portion 2 (Parramatta Streetscapes)	
MW22, MW23, MW34	Portion 2 is located generally within the Parramatta CBD in a primarily commercial/residential setting. MW34 is located along Marsden Street, adjacent to the Parramatta Mosque and is located approximately 130 m west of the western boundary of the Parramatta Metro Station surface construction site. MW23 is located along Union Street, approximately 20 m east of a Parramatta Light Rail construction site on Argus Lane. MW22 is located within Robin Thomas Reserve, approximately 35 m west of the Church of St John the Baptist. The Portion 2 sites fall within the following land use zones as described in the Parramatta Local Environmental Plan 2011. • MW23 and MW34 – 'B4 Mixed Use' • MW22 – RE1 Public Recreation'

5. Site Environmental Characteristics

The proposed borehole/monitoring well sites are generally located in proximity to the tunnel alignment between in Parramatta. As these sites are located outside the surface construction site boundaries, environmental characteristics for each 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 site inspections in July, August, October and November 2022 at publicly accessible locations was undertaken to understand the existing environment for each site and potential impacts associated

with the proposed works. A desktop heritage and ecological constraints review of the borehole/monitoring well sites was also undertaken to support the broader DSI scope of works (refer to Appendix B).

Land Use

A review of the NSW Spatial Services Historical Imagery Viewer was undertaken in December 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. The Parramatta CBD was gradually developed into commercial precincts leading up to the early 2000s. Currently, all borehole/monitoring well sites sit within mixed use and public recreation land use zones, as described under the Parramatta Local Environmental Plan 2011.

Aboriginal Heritage

The results of the heritage and ecological constraints review (Appendix B) indicated that the 'high risk' borehole/monitoring wells listed in this CA required further investigation of Aboriginal heritage. This has occurred as documented in the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and Appendix D, respectively), with the key findings summarised below.

<u>Portion 1 – Parramatta Park</u>

- The Parramatta Park environs contains several Aboriginal sites listed on the NSW Aboriginal Heritage Information Management System (AHIMS). This includes five (5) Aboriginal sites within 100 m from the proposed geotechnical testing locations. This indicates that the historical land use activities, although resulting in some disturbances, did not result in the removal of all archaeological evidence of Aboriginal occupation within Parramatta Park landscape, including around the Project area.
- The proposed geotechnical testing locations within Parramatta Park have not previously been assessed as part of the approved Project impacts. The proposed borehole/monitoring well locations are located within <100 m of five (5) Aboriginal sites recorded on AHIMS and are located in areas with the potential to contain previously unrecorded Aboriginal objects. However, based on a review of the environmental context and previous disturbances in the area, the likelihood of encountering Aboriginal objects is overall considered to be low.
- AHIMS site # 45-5-0762, a Culturally Modified Tree with associated potential archaeological deposit (PAD) is located within the vicinity of WTP_BH05. Description of this site included in AHIMS suggests that although partially destroyed, the extent of the PAD associated with this site likely extend into the Project area, specifically within the 50 m buffer zone of WTP_BH05.
- The actions required to install the five (5) borehole/monitoring wells would have the potential for minor but localised impacts to the potential Aboriginal archaeological remains that have been identified within Parramatta Park. These impacts, when considered in the context of the broader heritage significance of Parramatta Park, would be of little to no impact on the overall heritage values and

would have no material effect on the heritage item(s). Parramatta Park would continue to meet the threshold for State significance under the NSW State Heritage Criteria.

Portion 2 - Parramatta Streetscapes

- A search of the AHIMS database on 14 November 2022 centred on the Parramatta Park Project area returned 109 site entries. Of these, one (1) site was deleted, eight (8) have been destroyed and four (4) confirmed as 'not a site', leaving 95 Aboriginal sites as valid or partially destroyed. The most common site types are open artefact sites, accounting for 55.79% of all recorded sites within the Parramatta Park Project area.
- The proposed geotechnical sites are located within 50 m of six (6) Aboriginal sites, with GALC-MW22 being located within the boundary of AHIMS #45-6-3158 (Robin Thomas Reserve). This is an area of archaeological potential and a Gathering and Resource Site which has also been confirmed to contain intact deep deposits of the Parramatta Sand Body.
- GALC-MW23 is located within 50 m of two valid Aboriginal sites (AHIIMS site #45-6-2863 and #45-6-2673) and the vicinity of several more which have been identified as a continued landscape in the vicinity of Union Street, George Street, Macquarie Street and Angus Lane. It is likely to be located within the Parramatta Sand Body, with confirmed deposits of the alluvial and terrace sands located to the north and east of the proposed borehole/monitoring well location.
- No harm would occur to any Aboriginal objects listed on AHIMS as a result of the proposed geotechnical investigations. The borehole/monitoring well sites are generally located in areas with some potential to contain Aboriginal objects, however based on a review of the environmental context and previous disturbances in the area, the likelihood on encountering an Aboriginal object within the footprint of the proposed geotechnical works (approximately 250 mm diameter per borehole/monitoring well) is low.
- GALC-MW22 would have the potential for minor but localised impacts to the potential historical and Aboriginal archaeological remains that have been identified within Robin Thomas Reserve. These impacts, when considered in the context of the broader heritage significance of the Parramatta streetscapes, would be of little to no impact on the overall heritage values and would have no material effect on the heritage item.

Historical (non-Indigenous) Heritage

The results of the heritage and ecological constraints review (Appendix B) indicated that the 'high risk' borehole/monitoring wells listed in this CA required further investigation of non-Indigenous (historic) heritage. This has occurred as documented in the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and Appendix D, respectively), with the key findings summarised below.

Portion 1 - Parramatta Park

- The Parramatta Park Project area intercepts several statutory heritage registers including the World Heritage List as 'Australian Convict Sites (Old Government House and Domain), and the National Heritage List as 'Old Government House and the Government

Domain. Proposed geotechnical testing locations within Parramatta Park (including BH05, MW54 and MW35) are located within the Buffer Zone of the World Heritage listing.

- The Project area is identified as being of archaeological sensitivity within the Conservation Management Plan for the Parramatta Park and the Archaeological Zoning Plan for Parramatta Park. This includes historical archaeological sensitivity associated with the use of the Domain for early agricultural practices, which is mapped across all areas of the proposed works.
- MW54 and BH05 are located within key viewsheds associated with the Old Government House and The Domain. Additionally, these locations are within the vicinity of several significant built heritage elements of Parramatta Park, including Old Government House, the former Governors Bathhouse, the Boer War Memorial.
- A review of the archaeological context of the Parramatta Park Project area and environs suggest that the types of archaeological remains likely to be in the footprint of the proposed borehole/monitoring well sites would be of an ephemeral nature only and as such, any minor disturbances resulting from the proposed geotechnical works would constitute little to no overall impact to the heritage values of Parramatta Park.
- The installation of three (3) monitoring wells (including MW35, MW36 and MW54) will introduce new elements to the Parramatta Park, however the scale and nature of the works would not result in any changes to the character or setting of Parramatta Park in the proposed locations, nor would they result in any impacts on the significant views of Old Government House and other key landmarks within Parramatta Park. Additionally, the proposed works would not result in any impact to the overall heritage significance of Parramatta Park, Old Government House and the Domain at a World, National or State level.

<u>Portion 2 - Parramatta Streetscapes</u>

- The Parramatta landscape is layered with heritage items of varying significance, from local to World heritage significance. Searches of relevant historic heritage registers and lists, both statutory and non-statutory, were undertaken to identify any previously recorded historic heritage items within the Project Area. A total of 52 heritage items of State significance and 649 heritage items of local significance are currently registered within the City of Parramatta. However, the Streetscapes HIA only assessed potential impacts to heritage items located within or adjacent to the 50 m buffer of each geotechnical testing location.
- The area surrounding MW22 and MW23 has been identified as having high archaeological potential to contain nineteenth century remains of local significance. The area surrounding MW34 has been identified as having exceptional archaeological potential to contain eighteenth and nineteenth century remains of State significance.
- Minor ground disturbances associated with the proposed geotechnical works could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of each monitoring well within the Parramatta Streetscapes Project area. However, this impact would not result in extensive impact to or total removal of the potential archaeological resource within Robin Thomas Reserve, or the significance of the nineteenth and twentieth century development of the Parramatta CBD.

- One of the three monitoring well (GALC-MW22) is located within the curtilage of a heritage item, being Robin Thomas Reserve. The monitoring well site is located within an open grass section of the reserve and will not result in the introduction of new structural elements nor the removal of significant trees within Robin Thomas Reserve.

Noise and Vibration

A Construction Noise and Vibration Impact Assessment (CNVIA) was prepared by SLR Consulting in November 2022 to assess potential noise and vibration impacts associated with the geotechnical service scope of works along the project alignment during approved hours and out-of-hours (OOH) assessment periods. The CNVIA was prepared to assess potential noise and vibration impacts of the high risk borehole/monitoring well sites. Refer to Appendix D for the CNVIA prepared across the eight (8) high risk borehole/monitoring well sites.

Surface Water and Groundwater

The borehole/monitoring well sites are located at varying distances from local watercourses. The five sites within Portion 1 (Parramatta Park) are located within 150 m to 500 m of Parramatta River (which is north of the sites), with MW35 being the closest site to Parramatta River. Additionally, MW54 is located directly adjacent to the west of Domain Creek. The three borehole/monitoring well sites within Portion 2 (Parramatta Streetscapes) are within 100 m to 450 m of Parramatta River (also north of the sites), with MW22 being the closest site to Parramatta River. Parramatta River is considered to be a sensitive receiving environment due to its proximity to Coastal Wetlands, protected riparian lands and mapping by the NSW Department of Primary Industries (DPI) as Key Fish Habitat. There are also terrestrial groundwater dependent ecosystems associated with vegetation along Parramatta River and Domain Creek.

Soils and Contamination

In addition to reviewing the EIS and supporting documents, a search of the NSW Environmental Protection Authority (EPA) public registers and the NSW DPE eSPADE portal were undertaken in December 2022. The borehole/monitoring well sites are located on the Cumberland Plain, an extensive low-lying plain within the Cumberland Basin, within three soil landscapes; Blacktown, Disturbed Terrain and Birrong. MW34 and BH97 are located within approximately 150 m of an Area of Environmental Interest (AEI) with moderate contamination risk (as identified in the EIS) due to current and historical activities. No areas of acid sulfate soil risk were identified for the borehole/monitoring well sites. Refer to Appendix F for figures showing areas of acid sulfate soil risk in context to the borehole/monitoring well sites.

Biodiversity

Borehole/monitoring well locations with potential for ecological risk were identified as part of the heritage and ecological constraints review across all borehole/monitoring well sites (refer to Appendix B). Four (4) sites (including BH05, BH92, MW36 and MW54) were deemed as having high ecological risk and were subject to assessment within the biodiversity briefing note prepared to support this Consistency Assessment (refer to Appendix G). A summary of the key findings presented in the biodiversity briefing note is provided below.

Regional vegetation mapping identified two Plant Community Types (PCTs) within 50 m of the proposed works, including PCT 3320: Cumberland Shale Plains Woodland, and PCT 4024: Cumberland Blue Box Riverflat Forest. These PCTs conform to Threatened Ecological Communities (TECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including:

PCT 3320

- Cumberland Plain Woodland in the Sydney Basin Bioregion – listed as Critically Endangered under the BC Act
- Shale Gravel Transition Forest in the Sydney Basin Bioregion – listed as Endangered under the BC Act
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act

PCT 4024

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – listed as Endangered under the BC Act
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – listed as Critically Endangered under the EPBC Act.

A site inspection was undertaken in November 2022 which did not identify any native assemblages at each of the geotechnical investigation sites that conform to the TECs listed above. There are native species adjacent to the proposed sites, which may form part of assemblages consistent with the Cumberland Plain Woodland in the Sydney Basin Bioregion, and the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion. However, these assemblages are unlikely to meet the condition thresholds for the EPBC Act critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, or the River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria. Direct impacts to these PCT are expected to be negligible to nil, as no trimming of native trees or disturbance to the groundcover stratum within the patches of potential TECs are expected or proposed as part of the geotechnical investigations proposed under the Consistency Assessment.

The desktop assessment identified one threatened fauna species, being the Grey-headed Flying Fox, as having a high likelihood of occurrence within the study area, however evidence of this species was not recorded during the site inspection. There are no anticipated impacts to suitable habitat for the Grey-headed Flying Fox, as no trimming or clearing of native tree species is required (or proposed) for the works.

No other significant impacts to biodiversity or threatened species habitat have been identified as likely to occur as a result of the proposed works.

Traffic, Transport and Access

All borehole/monitoring well sites are located in publicly accessible locations with adequate parking to accommodate vehicle use required for the geotechnical services. Traffic control will be established at each borehole/monitoring well site to safety coordinate and mange local traffic whilst undertaking the necessary geotechnical services. Periodic visitation of monitoring wells following installation will also be required, which would involve the use of a standard fleet vehicle to access the monitoring well.
All work on or adjacent to roads would be carried out in accordance with a relevant Traffic Control Plan (TCP) and/or Road Occupancy Licence (ROL) to facilitate safe work near live traffic. Where an ROL cannot be obtained for the approved project hours and/or proposed works cannot be undertaken safely during these hours, some works will be required to be undertaken outside of approved project hours (i.e. Out of Hours Work, OOHW).
Land access agreements will be in place for each of these borehole/monitoring well site prior to commencement of works.

6. Justification for the proposed works

The proposed geotechnical services along the underground tunnel alignment between Parramatta and Sydney Olympic Park are required to collect geotechnical, groundwater and soil profile information deemed necessary to facilitate the design of the Project. The periodic visitation of the monitoring wells is also required to obtain real-time groundwater conditions, including groundwater levels and flow conditions, groundwater quality and enables the evaluation of hydraulic properties of water-bearing strata, as required.

Without the proposed geotechnical services scope of works occurring, these essential geotechnical inputs will not be available to inform the design of the project.

7. Environmental Benefit

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

8. Control Measures

The proposal would be undertaken in accordance with the mitigation measures and the conditions of approval for the approved Sydney Metro West – Stage 1 project. Any additional mitigation measures identified in this assessment will be implemented as required. The proposal would be managed in accordance with the approved Construction Environment Management Plan (CEMP) and CEMP Sub-plans.

9. Climate Change Impacts

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

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	Regional vegetation mapping identified two Plant Community Types (PCTs) within 50 m of the proposed works, including PCT 3320: Cumberland Shale Plains Woodland, and PCT 4024: Cumberland Blue Box Riverflat Forest. These PCTs conform to a range of TECs listed under the BC Act and EPBC Act as discussed in Section 5 of the Biodiversity Briefing Note (Appendix G). A site inspection was undertaken in November 2022 which did not identify any native assemblages at each of the geotechnical investigation sites that conform to the TECs listed in Section 5 of the Biodiversity Briefing Note (Appendix G). Direct impacts to these PCT are expected to be negligible to nil, as no trimming of native trees or disturbance to the groundcover stratum within the patches of potential TECs are expected or proposed as part of the geotechnical investigations proposed under the Consistency Assessment. The desktop assessment identified one threatened fauna species, being the Grey-headed Flying Fox, as having a high likelihood of occurrence within the study area, however evidence of this species was not recorded during the site inspection. There are no anticipated impacts to suitable habitat for the Grey-headed Flying Fox, as no trimming or clearing of native tree species is required (or proposed) for the works.	The Sydney Metro West – Western Tunnelling Package – Flora and Fauna Management Plan (SMWSTWTP-GLO-1NL-NL000-EO-PLN-000001) will be implemented where applicable. The following targeted mitigation and management measures will be implemented for works within Parramatta Park, as identified in Appendix G: • A no-go zone should be placed around canopy drip line of native tree species within the study area for each site to avoid unintended disturbance during proposed works. • A toolbox talk should be undertaken with all site personnel that includes information on the potential presence of PCT 4024 and PCT 3320, as well as the Grey-headed Flying Fox. • Implementation of hygiene controls for all vehicles, equipment and people working in the study area • Machinery will be washed following best practice hygiene protocols prior to being brought to site to prevent the spread of weeds, seeds, pathogens and fungi. • All weed material removed will be disposed of in a suitable waste facility and not mulched at each site, to avoid the reintroduction and further spread of weeds in the area.	Y	Y	

	No other significant impacts to biodiversity or threatened species habitat have been identified as likely to occur as a result of the proposed works.	• Establishment of appropriate erosion and sediment controls			
Water (surface and groundwater)	The proposed works would have negligible impact on surface water, as there will be minimal ground disturbance near watercourses. There is potential for erosion and sediment impacts, however these will be minimised with the implementation of appropriate control measures. The proposed geotechnical services will interact with groundwater during temporary borehole works and installation of permanent groundwater monitoring wells. The proposed geotechnical services are considered as minor and are unlikely to result in substantial groundwater impacts outside of those already assessed and understood under the approved project.	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. In addition, appropriate erosion and sediment controls will be implemented in accordance with the Blue Book and Attachment 3 (Erosion and Sediment Control Plan) of the Soil and Water Management Plan.	Y	Y	
Air quality	No additional impacts to the approved project, as the proposed geotechnical services will only generate minor, localised air quality emissions from the operation of plant and machinery required to undertake the geotechnical services.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Air Quality Management Plan (SMWSTWTP-GLO-1NL-NL000-AH-PLN-000001) will be implemented where applicable.	Y	Y	
Noise and vibration	A Construction Noise and Vibration Impact Assessment (CNVIA) was prepared by SLR Consulting in November 2022 to assess potential noise and vibration impacts associated with the geotechnical service scope of works along the project alignment during approved hours and out-of-hours (OOH) assessment periods. An assessment of predicted NML exceedances at NCA's in which the two Portions fall within is provided in Appendix B, and is summarised below: <u>Portion 1 (Parramatta Park)</u> • Exceedances of 11- 20 dBA above the NML may occur at one (1) receiver within NCA01 during approved construction hours. Exceedances of 20-30 dB above the NML may occur at two (2) receivers within NCA01 during night time OOHW.	The following targeted mitigation and management measures will be implemented where feasible and reasonable: • Implement mitigation measures identified within the CNVMP and DNVIS • Implement additional mitigation measures identified within the CNVMP and DNVIS • Ensure the minimum sized equipment necessary to complete the work are used • Implement portable noise barriers around noise intensive activities (i.e. drill rig)	Y	Y	

	• Exceedances of up to >30dB above the NML may occur at one (1) residential receiver within NCA02 during approved construction hours and night time OOHW. <u>Portion 2 (Parramatta Streetscape)</u> • Exceedances of 20-30 dB above the NML may occur at one (1) receiver within NCA03 during approved construction hours. Exceedances of up to >30 dBA above the NML may occur at up to (three) 3 residential receivers within NCA03 during night time OOHW • Exceedances of 1-10dB dB above the NML may occur at six (6) receivers within NCA04 during approved construction hours and exceedances of 11-20dB above the NML may occur at fourteen (14) receivers within NCA04 during night time OOHW Several mitigation and management measures have been recommended. Where feasible and reasonable these should be applied to the project to control and minimise the impacts during construction as far as practicable.	• Where multiple crews work simultaneously during the geotechnical investigations. Crews should avoid working within 500 m of each other to avoid cumulative impacts unless assessed accordingly. • Provide respite periods for noise intensive activities • Shut down plant and machinery, including vehicles when not in operation • Notification to potentially affected receivers prior to OOHW • Undertake noise monitoring during works to confirm noise predictions. Monitoring locations should be targeted to most affected receivers or representative locations nearby. The Sydney Metro West – Western Tunnelling Package – Noise and Vibration Management Plan (SMWSTWTP-GLO-1NL-NL000-NV-PLN-000001) will be implemented where applicable.			
Indigenous heritage	The results of the heritage and ecological constraints review (Appendix B) indicated that the 'high risk' borehole/monitoring well sites listed in this CA required further investigation of Aboriginal heritage. This has occurred as documented in the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and Appendix D, respectively). The nature and extent of potential Aboriginal heritage-related impacts during construction (in relation to the approved Project) are provided below, as summarised from Appendix C and Appendix D. The AHIMS search undertaken to support the HIAs identified five (5) Aboriginal sites recorded within 100 m of the proposed borehole/monitoring well locations within Parramatta Park (refer to Appendix	The relevant control measures Identified in the Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable. Based on the findings of the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and D respectively), additional mitigation measures (outside of those already provided in SMWSTWTP-GLO-1NL-HE-PLN-000001) have been provided and are reproduced below for clarity:	Y	Y	

	C). AHIMS site 45-5-0762 (a culturally modified tree with associated PAD) extends within the 50 m buffer for BH05. Additionally, MW35 is located within 100 m of a PAD included on AHIMS (AHIMS site #2856). The Parramatta Streetscapes borehole/monitoring well locations are located within <50 m of six (6) Aboriginal sites recorded on AHIMS, with MW22 located within the boundaries of Aboriginal site #45-6-3158 (refer to Appendix D). These locations also have potential to contain previously unrecorded Aboriginal objects. However, based on a review of the environmental context and previous disturbances in the area, the likelihood of encountering Aboriginal objects is overall considered to be low. The approved Project impacts, as set out within the EIS and associated technical papers and subsequent modifications, were limited to the assessment of impacts within the construction sites and immediate vicinity of the Sydney Metro West (SMW) Western Tunnelling Package (WTP) Metro Station sites and Clyde Maintenance and Stabling Facility site (Clyde MSF). No direct or indirect impacts were assessed for the Project on the heritage significance of Parramatta Park, Old Government House and Robin Thomas Reserve. Although the works within the curtilage of Parramatta Park and Robin Thomas Reserve were not assessed within the EIS or associated technical papers, the works are consistent with Condition D13 of the MCOA for the Project, as the proposed geotechnical investigations will not 'destroy, modify or otherwise affect any Aboriginal heritage item' not included in the Project approval. As noted in the consolidated consent for SSI-10038 the term 'affect' in Condition D13 means any impact	**Recommendation 1.** NDD for the purposes of locating underground utilities should be undertaken with a suitably qualified archaeologist present to ensure the works are completed appropriately, and to ensure no unidentified Aboriginal objects or historical archaeological remains are impacted by the work, should they unexpectedly be located within the borehole/monitoring well footprint. **Recommendation 2**. If, in the unlikely event that Aboriginal objects are located during the works, all works in the area must cease immediately and the Sydney Metro Unexpected Heritage Finds Procedure (SM-18-00105232) must be implemented. **Recommendation 3**. All contractors and GLC personnel undertaking the proposed geotechnical works within this assessment must be made aware of the heritage values of the Robin Thomas Reserve and the requirements of the Project approvals and HMP to prevent adverse impacts or damage to any heritage item or significant elements within Parramatta Park and/or the Parramatta streetscapes. **Recommendation 4**. All vehicles and plant must be parked on sealed surfaces to prevent impacts to the ground surface within the vicinity of the proposed works. Any equipment that is required to be driven or operated on grassed areas should only be manoeuvred on track mats in dry conditions to manage any ground disturbance associated with these movements. **Recommendation 5**. Any changes to the locations and methodology for any of the proposed boreholes/monitoring wells may			

	above "little to no impact" as defined in the Heritage NSW Material Threshold Policy. The proposed geotechnical investigations have been assessed with respect to this requirement and will have "little to no impact" on Aboriginal heritage, and thus comply with Condition D13.	require further assessment. Should any changes to the scope of works outlined in this report be identified, no works should be undertaken prior to review of the locations by the GLC environmental manager/s and/or heritage specialist.			
Non-Indigenous (historic) heritage	The results of the heritage and ecological constraints review (Appendix B) indicated that the 'high risk' boreholes/monitoring wells listed in this CA required further investigation of historic heritage. This has occurred as documented in the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and Appendix D, respectively). The nature and extent of potential historic heritage-related impacts during construction (in relation to the approved Project) are provided below, as summarised from Appendix C and Appendix D. The Parramatta Park Project area intercepts several statutory heritage registers; including the World Heritage List as 'Australian Convict Sites (Old Government House and Domain), and the National Heritage List as 'Old Government House and the Government Domain. Proposed geotechnical testing locations within Parramatta Park (including BH05, MW54 and MW35) are located within the Buffer Zone of the World Heritage listing. The Parramatta landscape is layered with heritage items of varying significance, from local to World heritage significance. Searches of relevant historic heritage registers and lists, both statutory and non-statutory, were undertaken to identify any previously recorded historic heritage items within the Project Area. A total of 52 heritage items of State significance and 649 heritage items of local significance are currently registered within the City of Parramatta. However, the Streetscapes HIA only assessed potential impacts to heritage items located within or	The relevant control measures identified in the Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) will be implemented where applicable. Based on the findings of the Parramatta Park and Parramatta Streetscapes HIAs (Appendix C and D respectively), additional mitigation measures (outside of those already provided in SMWSTWTP-GLO-1NL-HE-PLN-000001) have been provided and are reproduced below for clarity. **Recommendation 1.** NDD for the purposes of locating underground utilities should be undertaken with a suitably qualified archaeologist present to ensure the works are completed appropriately, and to ensure no unidentified Aboriginal objects or historical archaeological remains are impacted by the work, should they unexpectedly be located within the borehole/monitoring well footprint. **Recommendation 2**. If, in the unlikely event that historical relics are located during the works, all works in the area must cease immediately and the Sydney Metro Unexpected Heritage Finds Procedure (SM-18-00105232) must be implemented. **Recommendation 3**. All contractors and GLC personnel undertaking the proposed	Y	Y	

	adjacent to the 50 m buffer of each geotechnical testing location. The area surrounding MW22 and MW23 has been identified as having high archaeological potential to contain nineteenth century remains of local significance. The area surrounding MW34 has been identified as having exceptional archaeological potential to contain eighteenth and nineteenth century remains of State significance. The approved Project impacts, as set out within the EIS and associated technical papers and subsequent modifications, were limited to the assessment of impacts within the construction sites and immediate vicinity of the SMW WTP Metro Station sites and Clyde MSF site. No direct or indirect impacts were assessed for the Project on the non-Indigenous heritage significance of Parramatta Park, Old Government House and Robin Thomas Reserve. Although the works within the curtilage of Parramatta Park and Robin Thomas Reserve were not assessed within the EIS or associated technical papers, the works are consistent with Condition D13 of the MCOA for the Project, as the proposed geotechnical investigations will not 'destroy, modify or otherwise affect any non-Indigenous heritage item' not included in the Project approval. As noted in the consolidated consent for SSI-10038 the term 'affect' in Condition D13 means any impact above "little to no impact" as defined in the Heritage NSW Material Threshold Policy. The proposed geotechnical investigations have been assessed with respect to this requirement and will have "little to no impact" to non-Indigenous heritage, and thus comply with Condition D13.	geotechnical works within this assessment must be made aware of the heritage values of the Robin Thomas Reserve and the requirements of the Project approvals and HMP to prevent adverse impacts or damage to any heritage item or significant elements within Parramatta Park and/or the Parramatta streetscapes. **Recommendation 4**. All vehicles and plant must be parked on sealed surfaces to prevent impacts to the ground surface within the vicinity of the proposed works. Any equipment that is required to be driven or operated on grassed areas should only be manoeuvred on track mats in dry conditions to manage any ground disturbance associated with these movements. **Recommendation 5**. Any changes to the locations and methodology for any of the proposed boreholes/monitoring wells may require further assessment. Should any changes to the scope of works outlined in this report be identified, no works should be undertaken prior to review of the locations by the GLC environmental manager/s and/or heritage specialist.			

Community and stakeholder	Consultation would continue with stakeholders in line with the approved project, and updates would be provided through the existing communication streams. As such, no additional impacts to the approved project are anticipated as a result of the geotechnical services scope of works.	No additional measures required. Land access approvals will be sought prior to commencement of works. Consultation by GLC is occurring with relevant councils and stakeholders for geotechnical investigations outside the approved construction site boundaries. Updates will be regularly provided through communication streams for the approved project.	Y	Y	
Traffic	Minor, temporary traffic-related impacts are anticipated during the proposed geotechnical services scope of works. Periodic visitation of monitoring wells following installation will also be required, which would involve the use of a standard fleet vehicle to access the monitoring wells as required. Traffic control will be established at each borehole/monitoring well site to safety coordinate and mange local traffic whilst undertaking the necessary geotechnical services. As such, traffic related impacts are expected to be minimal and temporary in nature.	All work on or adjacent to roads would be carried out in accordance with a relevant TCP and/or ROL to facilitate safe work near live traffic. Where an ROL cannot be obtained for the approved project hours and/or proposed works cannot be undertaken safely during these hours, some works will be required to be undertaken outside of approved project hours (i.e. Out of Hours Work, OOHW). The Sydney Metro West – Stage 1 Construction Traffic Management Framework will be implemented where applicable.	Y	Y	
Waste	No additional impacts to the approved project. The geotechnical services scope of works will generate a small amount of waste which will be managed as per the approved WMP.	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	Some of the proposed works will have temporary impacts with the local community including businesses due to their locations (e.g. footpath, near sensitive receivers, Park users). Those impacts will be managed as per the approved CNVMP and DNVIS. Mitigation measures listed in the CNVIA (Appendix E) will also be implemented as required. Consultation would continue with stakeholders in line with the approved project, and updates would be provided through the existing communication streams.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Noise and Vibration Management Plan (SMWSTWTP-GLO-1NL-NL000-NV-PLN-000001) and the Overarching Community Communication Strategy will be implemented where applicable.	Y	Y	

	If OOHW are required, specific notifications will be sent to impacted receivers as per the approved project. The level of noise impacts will define the appropriate notification processes (e.g. door knock, respite offers).				
Economic	The geotechnical services scope of works will interact with local businesses at some locations. The impacts (e.g. parking spaces availability, noise) will be of short duration and will be managed via consultation processes. The scope will not contribute to the economic value of the project.	No additional measures required. Consultation by GLC is occurring with relevant businesses and stakeholders for geotechnical investigations outside the approved construction site boundaries. Updates will be regularly provided through communication streams for the approved project.	Y	Y	
Visual	There will be minor changes to each borehole/monitoring well site when works are being undertaken, however these will be temporary in nature and the sites will be reinstated to their previous condition once works are completed. As such, no additional impacts to the approved project are anticipated as the geotechnical services scope of works will not permanently alter the visual landscape of each site.	No additional measures required. The Sydney Metro West – Western Tunnelling Package – Visual Amenity Management Plan (SMWSTWTP-GLO-1NL-NL000-EN-PLN-000003) will be implemented where applicable.	Y	Y	
Urban design	No additional impacts to the approved project, as the geotechnical services scope of works will not modify the existing urban design at each site.	No additional measures required.	Y	Y	
Geotechnical	The proposed geotechnical services will interact with geotechnical aspects of the environment at each borehole/monitoring well, as expected due to the nature of the proposed works. However no impacts to geotechnical aspects are anticipated as a result of the proposed geotechnical services outside of those already assessed and understood under the approved project.	No additional measures required.	Y	Y	
Land use	No additional impacts to the approved project, as the geotechnical services scope of works will only temporarily change the existing land use for each site during construction.	No additional measures required.	Y	Y	

Contamination	MW34 and BH97 are located within approximately 150 m of an AEI with moderate contamination risk (as identified in the EIS) due to current and historical activities. As such, there is potential for the proposed works to interact with contaminated soil and groundwater. However, contamination impacts will be minimised with the appropriate mitigation measures in place. No sites are within areas at risk of encountering acid sulfate soils (refer to Appendix F).	The Sydney Metro West – Western Tunnelling Package – Soil and Water Management Plan (SMWSTWTP-GLO-1NL-EN-PLN-000001) will be implemented where applicable. The following targeted control measures will be implemented: • Any contamination identified will require management in accordance with the Soil and Water Management Plan and relevant guidance made or approved by the EPA under Section 105 of the *Contaminated Land Management Act 1997*. • In-situ waste classification will occur for each site in accordance with the Waste Classification Guidelines (NSW EPA, 2014), which will allow material to be excavated and transported offsite to an appropriate facility. • All spills and leaks from vehicles and machinery will be immediately contained and managed. • If any unexpected contamination is identified, the procedure in Attachment 4 of Soil and Water Management Plan will be implemented. • If acid sulfate soils are encountered, they would be effectively managed in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998).	Y	Y	
Climate Change	The use of minor plant/equipment and light vehicles required to undertake the geotechnical services at each site are 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	

Risk	No additional impacts to the approved project, as the risks associated with the geotechnical services scope of 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 geotechnical services works are predominantly limited to the construction phase, with the exception of the installation of permanent groundwater monitoring wells at six (6) of the eight (8) high risk sites identified in this Consistency Assessment.

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 discussed below, operational impacts of the proposal are negligible, 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	

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
Land use	The geotechnical services involve the installation of monitoring wells above the underground tunnel alignment to understand groundwater conditions to inform the project design, The monitoring wells will remain in position throughout the life of the project, and would be decommissioned following project completion. Monitoring well installation is proposed at the following sites: • MW22, MW23, MW34, MW35, MW36 and MW54 These locations would be accessed periodically (i.e. fortnightly) throughout the life of the project to undertake groundwater monitoring as required. The installation of small monitoring wells is not considered as a substantial change to the existing use of the land at each monitoring well site and will have a minimal impact on the existing land use at these locations.	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	
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 risks as a result of the proposal. All 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 Permit to Enter is required for all business activities within Parramatta Park. GLC will seek a permit from Parramatta Park Trust prior to works commencing at BH05, BH92, MW35, MW36 and MW54 • Road Occupancy Licences (ROL) will be obtained for all work on or adjacent to roads • Approval for works that are required outside of approved construction hours (i.e. OOHW) will be sought in accordance with Condition D37 and/or D38 of the Instrument of Approval.

Author certification

To be completed by person preparing checklist.

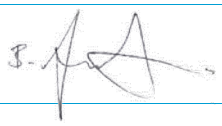
I certify that to the best of my knowledge this Consistency Checklist: • Examines and takes into account the fullest extent possible all matters affecting or likely to affect the environment as a result of activities associated with the Proposed Revision; and • Examines the consistency of the Proposed 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:	23 January 2023

This section is for Sydney Metro only.

Application supported and submitted by			
Name:	Yvette Buchli	Date:	24/01/2023
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:	25 January 2023
Title:	Director Environmental, Sustainability and Planning	Comments:	
Signature:			

Appendix A – Borehole and Monitoring Well Locations

Legend

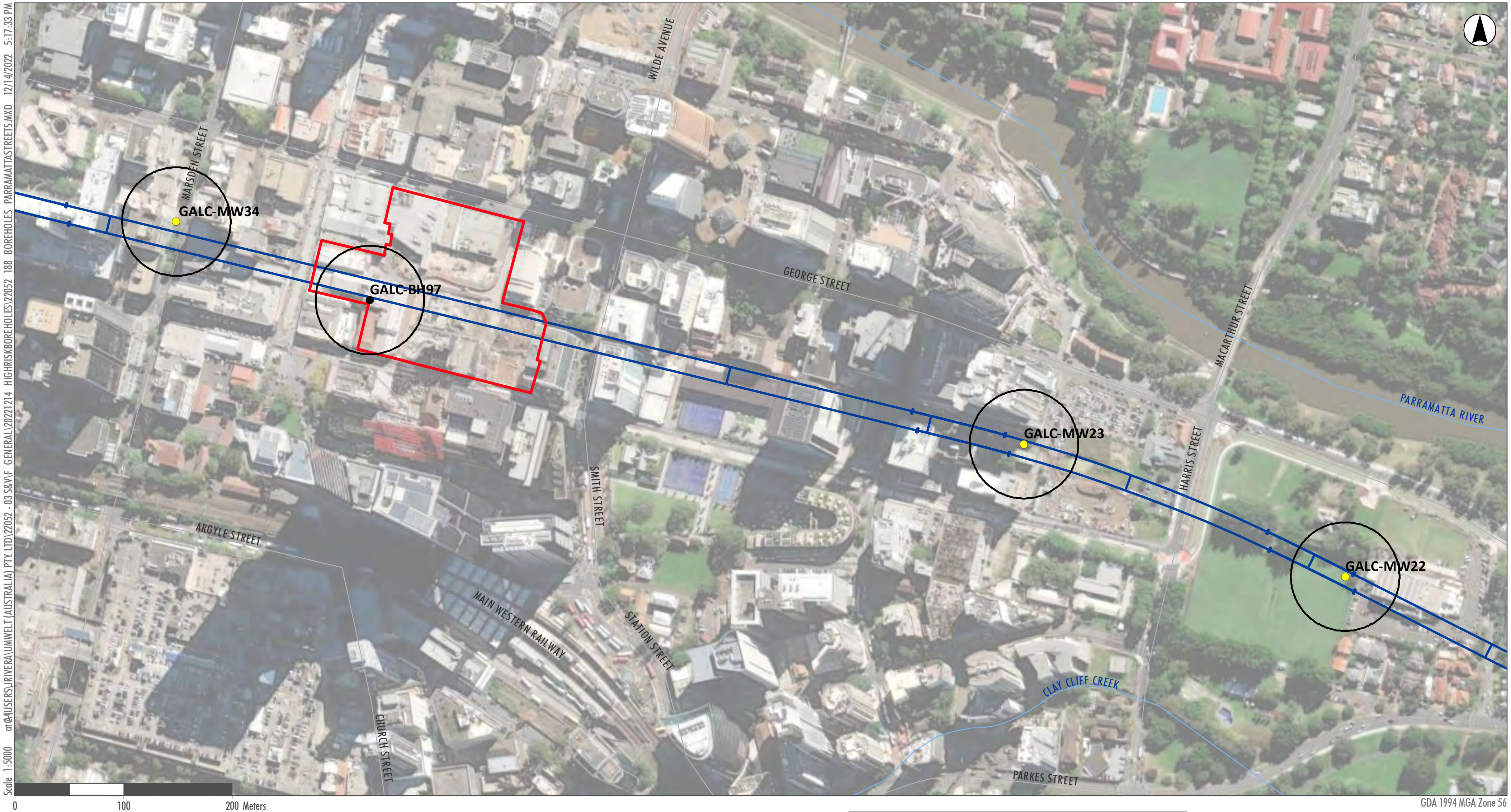
- Approved Surface Construction Boundary
- Tunnel Alignment
- Road
- Drainage Line
- High Risk Borehole
- High Risk Borehole (proposed by SM)
- High Risk Borehole with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA
- 50m Search Buffer

APPENDIX A.1

Borehole and Monitoring Well Locations Parramatta Park

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

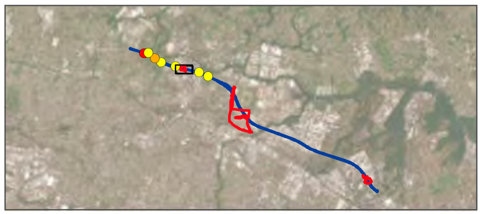
umwelt



GDA 1994 MGA Zone 56

Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Road
- Drainage Line
- High Risk Borehole
- High Risk Borehole (proposed by SM)
- High Risk Borehole with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA
- 50m Search Buffer



APPENDIX A.2

Borehole and Monitoring Well Locations Parramatta Streetscape

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

Appendix B – Ecology and Heritage Constraints Review

Borehole ID	Investigation Type	Heritage Constraint/s	Ecology Constraint/s	Heritage Constraint Rating	Eco Constraint Rating	Overall Risk	Recommendation
GALC-BH92	Borehole	Located within Parramatta Park curtilage, listed on the World and National heritage lists	CEEC mapped within and immediately outside 50m buffer. Vegetation within buffer has potential to be CEEC. High biodiversity constraint	**High**	**High**	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **Eco field survey and briefing note required**
GALC-BH97	Borehole	Located within mapped areas of the Parramatta Sand Body which is a known area of Aboriginal archaeological sensitivity. Located immediately adjacent to areas of archaeological potential identified within the Parramatta Metro Station Site. Located within mapped extent of an Aboriginal site (AHIMS ID#45-6-3582).	No native vegetation mapped within the 50 buffer. Little to no vegetation within buffer, any vegetation present is likely to be planted. Low biodiversity constraint	**High**	Low	**High**	**Moved to within Parramatta site boundary. No further assessment required**
GALC-MW22	Monitoring well	Located within an Aboriginal site (AHIMS #45-6-3158). Located within curtilage of Robin Thomas Reserve, listed as an Archaeological Item on Parramatta LEP 2011. Located adjacent to the NSW SHR curtilage of Robin Thomas Reserve (listed as Ancient Aboriginal and Early colonial landscape). * *note this is also identified as a conservation area for the Parramatta Sand Body* . Located within mapped areas of the Parramatta Sand Body which is a known area of Aboriginal archaeological sensitivity.	No native vegetation mapped within the 50 buffer. Vegetation within the buffer has already been cleared been cleared Low biodiversity constraint	**High**	Low	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **No further ecology assessment required**
GALC-MW23	Monitoring well	Located adjacent to an Aboriginal site (AHIMS #45-6-2863). Located within mapped areas of the Parramatta Sand Body which is a known area of Aboriginal archaeological sensitivity.	No native vegetation mapped within the 50 buffer. Little to no vegetation within buffer, any vegetation present is likely to be planted. Low biodiversity constraint	**High**	Low	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **No further ecology assessment required**
GALC-MW34	Monitoring well	Located adjacent to two AHIMS sites ID#45-6-2795; 45-6-1523. Located within mapped areas of the Parramatta Sand Body which is a known area of Aboriginal archaeological sensitivity.	No native vegetation mapped within the 50 buffer. Little to no vegetation within buffer, any vegetation present is likely to be planted. Low biodiversity constraint	**High**	Low	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment required **No further ecology assessment required**
GALC-MW35	Monitoring well	Located within Parramatta Park curtilage, listed on the World and National heritage lists	CEEC mapped immediately outside 50m buffer. If works occurs within grass area then ok Low biodiversity constraint	**High**	Low	**High**	**High Risk Heritage Site: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required** **No further ecology assessment required**
GALC-MW36	Monitoring well	Located within Parramatta Park curtilage, listed on the World and National heritage lists	CEEC mapped within and immediately outside 50m buffer. Borehole location falls within CEEC High biodiversity constraint	**High**	**High**	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **Eco field survey and briefing note required**
GALC-MW54	Monitoring well	Located within Parramatta Park curtilage, listed on the World and National heritage lists	CEEC mapped within and immediately outside 50m buffer. Borehole location in edge of CEEC High biodiversity constraint	**High**	**High**	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **Eco field survey and briefing note required**
WTP_BH05	Borehole	Located within Parramatta Park curtilage, listed on the World and National heritage lists	CEEC mapped within and immediately outside 50m buffer. Buffer is completely vegetated and vegetation within buffer has potential to be CEEC. High biodiversity constraint	**High**	**High**	**High**	**High Risk Heritage Site**: Aboriginal Cultural Heritage Assessment and Historical Heritage assessment required **Eco field survey and briefing note required**

Appendix C – Parramatta Park Heritage Impact Assessment

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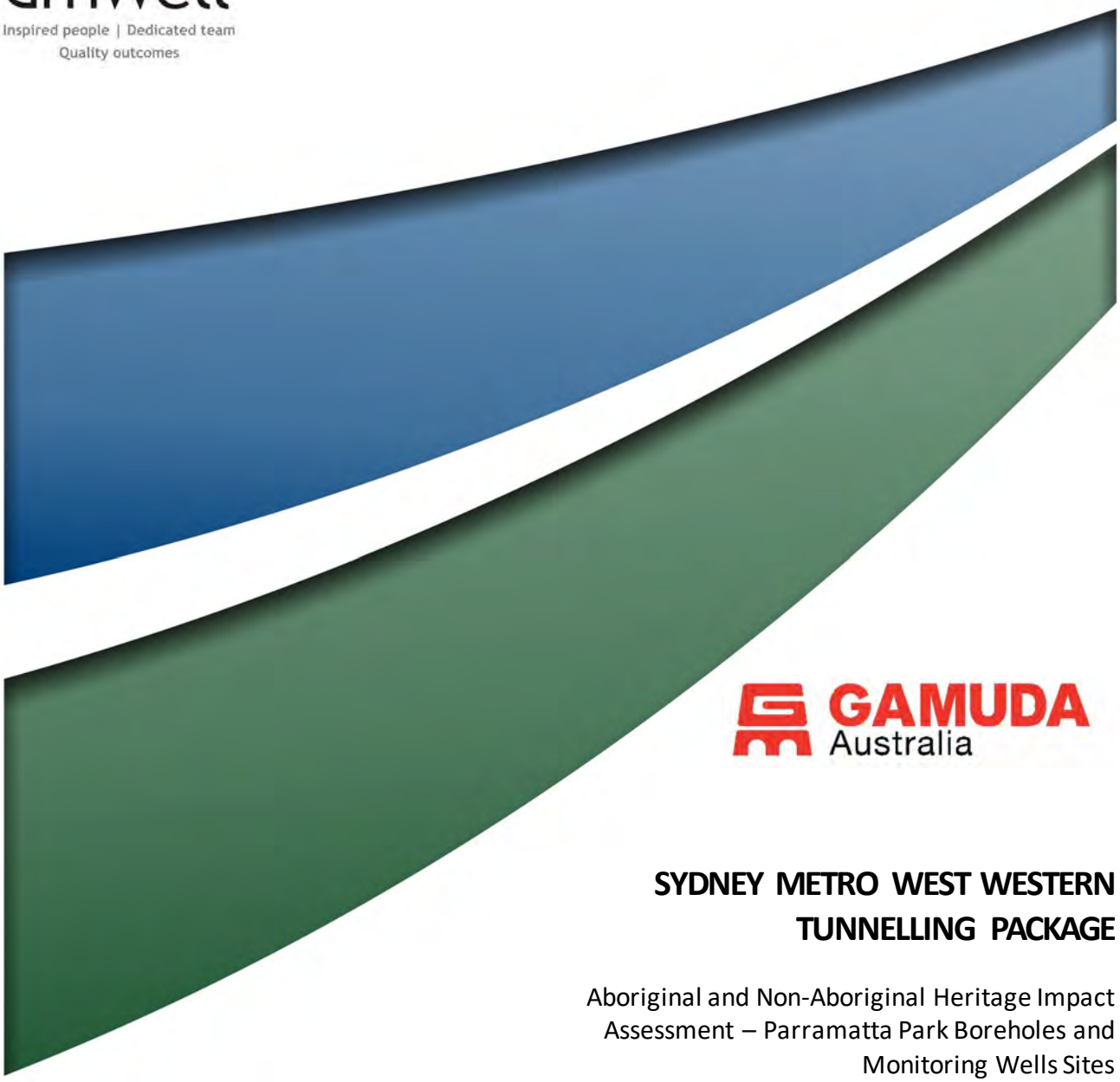

GAMUDA Australia

SYDNEY METRO WEST WESTERN TUNNELLING PACKAGE

Aboriginal and Non-Aboriginal Heritage Impact Assessment – Parramatta Park Boreholes and Monitoring Wells Sites

FINAL

December 2022

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Aboriginal and Non-Aboriginal Heritage Impact Assessment – Parramatta Park Boreholes and Monitoring Wells Sites

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Gamuda Australia Lang O'Rourke Consortium

Project Director: Nathan Baker
Project Manager: Thomas Buchan
Technical Director: Tim Adams
Technical Manager: Melissa Moritz
Report No. R18/22052
Date: December 2022

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
0.1	Tim Adams	18 November 2022	Nathan Baker	21 November 2022
0.2	Melissa Moritz	23 November 2022	Nathan Baker	25 November 2022
0.3	Luke Wolfe	16 December 2022	Nathan Baker	16 December 2022
1.0	Luke Wolfe	19 December 2022	Nathan Baker	19 December 2022

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1.0 Introduction

1.1 Background

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Gamuda Australia Laing O'Rourke Consortium (GLC) to undertake a combined Aboriginal and Historical (non-Aboriginal) Heritage Impact Assessment (HIA) of potential impacts associated with proposed geotechnical testing locations (boreholes and monitoring wells) located in Parramatta Park, Parramatta, New South Wales. The boreholes and monitoring wells are associated with the Sydney Metro West (SMW) Western Tunnelling Package (WTP) Project (hereafter referred to as 'the Project').

This HIA report documents the results of Umwelt's assessment and has been compiled with general reference to the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* 2010 (Department of Environment, Climate Change and Water NSW [former], 2010b). This code was developed to assist proponents in exercising due diligence when carrying out activities that may result in harm to Aboriginal objects. Where historical (non-Aboriginal) heritage matters are assessed, Umwelt have referred to *NSW Heritage Manual* (NSW Heritage Office 2002).

1.2 The Proponent

The geotechnical investigations will be undertaken by GLC, a joint venture tasked with delivering the WTP portion of the SMW project on behalf of Sydney Metro, the Proponent.

1.3 The Project

GLC are proposing to undertake geotechnical investigations above the tunnel alignment of the western portion of SMW — 'Westmead to The Bays' to understand groundwater conditions and inform the design for the tunnel/s (i.e., 'the geotechnical testing locations'). The geotechnical investigations across the broader Project will comprise the advancement of 202 boreholes, of which approximately 31 boreholes will be located outside the approved Project boundary. A number of the boreholes are to be converted to monitoring wells for the purpose of measuring groundwater fluctuations. The five (5) geotechnical investigations in Parramatta Park (i.e., the 'Park') (discussed below) are a component of this wider portfolio of works. For brevity this report generally refers to 'borehole locations' or 'geotechnical testing locations' but three (3) of the five (5) boreholes proposed within the Park will be converted to monitoring wells.

All planned borehole / monitoring well sites in the Park are located outside the SMW surface construction site boundaries (but in the vicinity of the tunnelling alignment) as identified for the approved Project. A targeted assessment of the 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 the geotechnical investigations are subject to the assessment undertaken in Umwelt's Consistency Assessments (2022). The Consistency Assessments examined the proposed geotechnical testing locations between Parramatta and Sydney Olympic Park for the Detailed Site Investigations (DSI) required for Phase F — Western Tunnelling Works. A preceding preliminary constraints assessment undertaken by Umwelt that informed the Consistency Assessments identified five (5) locations within the Park as representing 'high risk' to historical and/or Aboriginal cultural heritage values based on an initial desktop review of environmental and heritage/archaeological constraints.

1.3.1 Summary of Works

Prior to drilling, non-destructive digging (NDD) utility searching methods will be used to clear the location of the boreholes of any buried infrastructure such as gas, electricity or water. This is proposed to be achieved using a wet-vacuum truck with a pipe diameter of 200 mm over the footprint of the borehole. It is estimated that this will result in approximately 250 mm diameter hole to approximately 1.5 m depth.

Following on-site service location and clearance (using a scanning device), the advancement of the boreholes/monitoring wells will be undertaken using a rubber track-mounted drill rig equipped with 125 mm diameter drill rods. Works will also utilise a small excavator (~5 tonnes) to transfer spoil from the drilling into a dump truck for transportation off-site. Once borehole drilling is completed to the required depth (refer **Table 1.1**), the monitoring well materials will be installed, where required and grout would be used to fill boreholes to below ground level. The area will then be reinstated with backfill and topsoil and topped with grass seed to reinstate the grassed areas. Where proposed boreholes are located on existing hardstand, reinstatement will occur to match existing surfaces.

In order to minimise impacts of vehicle movements on non-paved surfaces, GLC will use sealed areas to travel wherever possible to minimise ground disturbance. Where works are located on non-paved surfaces, track mats will be placed to prevent ground disturbance from machinery. No works will be undertaken during rain events or when the ground surface is wet enough that works cannot be completed without impacting the surrounding ground surface.

Table 1.1 Depth of Proposed Boreholes and Monitoring Wells

Borehole Location	Drilling Depth (m)	Drilling Diameter (mm)	Vertical/Incline
GALC-MW35	40	125	Vertical
WTP_BH05	40	125	Vertical
GALC-MW54	3.5	125	Vertical
GALC-MW36	26	125	Vertical
GALC-BH92	40	125	Incline

1.4 The Project Area

The Project area for this assessment, shown in **Figure 1.1**, comprises the immediate footprints of five (5) boreholes and/or monitoring wells located in Parramatta Park (hereafter the 'Project area'). The proposed geotechnical testing locations are summarised below in **Table 1.2**.

Two boreholes (GALC-BH91 and GALC-BH92) are located on the western extent of the Project area south of Park Parade, and another (WTP-BH05) is adjacent to the carpark associated with Railway Parade and the Boer War Memorial. One (1) monitoring well (GALC-MW54) is located on the western bank of Domain Creek along West Domain Avenue, and the other (GALC-MW35) within the Macquarie Landscape abutting the pedestrian pathway leading south from Old Government House to Railway Parade.

Table 1.2 Proposed Investigation Locations

Scope ID	Investigation Type	Locality	Park Precinct	Easting	Northing
GALC-MW35	Borehole with monitoring well	Parramatta Park	The Domain	314597.0000	6256801.0000
GALC-MW54	Borehole with monitoring well	Parramatta Park	The Paddocks	314177.9087	6257095.2768
GALC-BH91	Borehole	Parramatta Park	Mays Hill	314037.1884	6257090.8677
GALC-BH92	Borehole	Parramatta Park	Mays Hill	314020.8497	6257099.9619
WTP-BH05	Borehole	Parramatta Park	The Domain	314371.4031	6256934.8549

1.5 Report Authorship

This report was prepared by Melissa Moritz (Umwelt, Senior Heritage Consultant), Alison Fenwick (Umwelt, Archaeologist) and Elise Jakeman (Umwelt, Archaeologist). Supplementary guidance and review of geomorphological components of the assessment were provided by Pam Dean-Jones (Umwelt, Senior Principal Consultant). Technical review was undertaken by Luke Wolfe (Umwelt, Principal Archaeologist) and Tim Adams (Umwelt, Principal Archaeologist, Historical Heritage). Approval to issue was provided by Thomas Buchan (Umwelt, Project Manager) and Nathan Baker (Umwelt, Project Director).

1.6 Limitations

Inspection of the borehole locations was limited to visual inspection only. No intrusive archaeological investigation (i.e., manual and/or mechanical excavation) was undertaken.

This assessment has been prepared in relation to the Aboriginal and non-Aboriginal impacts of the proposed geotechnical investigations within Parramatta Park. No consultation with the Aboriginal community or Registered Aboriginal Parties (RAPs) was undertaken as for the current assessment.

Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Boreholes
- Boreholes with Monitoring Wells

FIGURE 1.1

Boreholes in Parramatta Park

Image Source: Nearmap (May 2022) Data source: DFSI (2021)

2.0 Statutory Context

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the statutory protection of all items of National environmental significance, and includes protection to heritage items of Commonwealth, National, and World significance. The EPBC Act and its regulations also set out the processes for undertaking works within (or in the vicinity of) World, National or Commonwealth heritage items, including where approvals under the EPBC Act are required.

The full extent of requirements for environmental approvals are set out in Subdivision A and AA or Part 4 of the Act. The key trigger for requiring approval is whether works – referred to as an 'action' in the Act, will have a significant impact on a listed Matter of National Environmental Significance (MNES). If the proposed action is assessed as having, or likely to have, a significant impact, the matter must be referred to the Commonwealth Minister for the Environment and Water for approval.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) enables responsibility for heritage (both Aboriginal and non-Aboriginal) to be shared by state and local government agencies. The EP&A Act provides local government with the power to protect items and places of heritage significance in the local area through local environmental plans (LEPs) and development control plans.

The EP&A Act requires consideration be given to environmental impact – including heritage – as part of the land use planning process, and the provisions of the EP&A Act allow for the implementation of LEPs which provide the statutory framework for heritage conservation within a particular local government area (LGA).

2.2.2 Heritage Act 1977

The *Heritage Act 1977* (NSW) (Heritage Act) affords automatic statutory protection to 'relics' which form part of archaeological deposits, except where these provisions are suspended by other prevailing legislation. The Heritage Act defines a 'relic' as any deposit, object or material evidence that:

- Relates to the settlement of the area that comprises NSW, not being Aboriginal settlement.
- Is of State or local heritage significance.

Sections 139 to 145 of the Heritage Act prevent the excavation of a relic (on non-State Heritage Register listed (SHR) land), except in accordance with a gazetted exception or an excavation permit issued by the Heritage Council of NSW. Section 139 of the Heritage Act requires that:

- A person must not 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.
- A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.

As all 'relics' are protected under the Heritage Act, an Excavation Permit under Section 140 of the Act needs to be obtained prior to any works that would disturb or destroy them. However, if the proposed works are only minor in nature and will have minimal impact on the heritage significance of the place, they may be excepted from the provisions of Section 139.

The Heritage Council of NSW and delegate offices of Heritage NSW, Community Engagement, Department of Premier and Cabinet (Heritage NSW) are the approval authorities for issuing Excavation Permits and considering exceptions under Sections 139 and 140 of the Heritage Act.

As the Project has been approved as SSI under the EP&A Act, the requirements for approvals under the Heritage Act are generally not required, however the process and procedures required under the Act are followed as best practice in all designated State Significant projects.

2.2.2.1 Material Threshold Policy

Under the Heritage Act, the Heritage Council of NSW considers the term/s "materially affect/effect" when regarding the public notice and/or the determination of applications under sections s61(1) and s63(3) of the Heritage Act, respectively (Heritage NSW, Department of Premier and Cabinet, 2020). Under the Heritage Act, a number of these functions may be delegated through 'Instrument of Delegation' which allow certain delegates to grant approvals for changes to State Heritage Register (SHR) listed places. The power of delegation is only granted in relation to applications for approval to undertake activities that will not materially affect the significance of that item as an item of 'environmental heritage'.

As the Project has been approved as State Significant Infrastructure (SSI) under the EP&A Act, approvals under the Heritage Act generally are not required. However, the process and procedures required under the Heritage Act are followed as best practice in all designated State Significant projects.

Condition D13 of the modified Instrument of Approval for the Project references the Materials Threshold Policy (Heritage NSW, Department of Premier and Cabinet, 2020) and required the following consideration:

D13 The proponent must not destroy, modify or otherwise affect any Heritage item not identified in documents referred to in Condition A1. Unexpected heritage finds identified by the CSSI must be managed in accordance with the Unexpected Finds Protocol outlined in ***Condition D13 to D33*** *of this schedule [Modified Instrument of Approval]. Consideration of avoidance and redesign to protect state significant unexpected finds must be addressed where this condition applies.*

Note: Affect in this condition means any impact above 'little to no impact' as defined in the Material Threshold Policy (Heritage NSW 2020).

The definitions outlined in the Material Threshold Policy have been used to assess the impacts of the Project on the overall heritage significance of Parramatta Park.

2.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act), administered by the Department of Planning and Environment, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act is accompanied by the *National Parks and Wildlife Regulation 2019* (the Regulation). The NPW Act gives the Heritage NSW the responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as:

- An ***Aboriginal object*** is any deposit, object or material evidence (that is not a handicraft made for sale) relating to the Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).
- An ***Aboriginal place*** is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the National Parks and Wildlife Amendment Regulation 2010 (NPW Regulation), and the demonstration of due diligence.

In general, an Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened. Pursuant to Section 89J of the EP&A Act, AHIPs are not required for projects approved under Division 4.1 of Part 4 of the EP&A Act. However, as the Project has been approved as SSI under the EP&A Act, the requirements for approvals under the NPW Act are not required and are subsequently managed under a Heritage Management Plan (refer **Section 2.4**).

2.3 Local

The Project area falls within the Parramatta LGA, of which the relevant Environmental Planning Instrument (EPI) is the Parramatta LEP 2011. Part 5.10 of the LEP provides specific provisions for the protection of heritage items and relics in order to:

a. to conserve the environmental heritage,

b. to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,

c. to conserve archaeological sites,

d. to conserve Aboriginal objects and Aboriginal places of heritage significance.

Under the LEP, development consent is required for any of the following:

e. demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

   i. a heritage item,

   ii. an Aboriginal object,

   iii. a building, work, relic or tree within a heritage conservation area,

f. altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,

g. disturbing or excavating an archaeological site while 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,

h. disturbing or excavating an Aboriginal place of heritage significance,

i. erecting a building on land:

   i. on which a heritage item is located or that is within a heritage conservation area, or

   ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,

j. subdividing land:

   i. on which a heritage item is located or that is within a heritage conservation area, or

   ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Schedule 5 of the LEP provides a list of heritage items within the LGA. The curtilages of items currently listed on the Parramatta LEP 2011 that fall within the Project area are listed in **Section 4.3**.

2.4 Management Plans

2.4.1 Sydney Metro West Western Tunnelling Package HMP 2022

The Project is currently managed under a Heritage Management Plan (HMP) that was prepared and subsequently approved by the Department of Planning and Environment (DPE) in July 2022 (Umwelt 2021). Intended to provide robust heritage guidance, the HMP provides outlines the policies and strategies to assist GLC to undertake works associated with the WTP Project. Section 7.4.2 of the HMP states that additional assessment and approval is required for any potential impacts to Aboriginal cultural heritage outside of the approved construction activities for the Project. Similarly, Section 7.6.9 requires additional assessment and approval of any additional impacts to historical (non-Aboriginal) heritage items. Both measures in the HMP require the approval of the impacts prior to the commencement of any construction activities. This will occur under the Consistency Assessment approvals pathway.

2.4.2 Parramatta Historical Archaeological Landscape Management Study 2000

The Parramatta Historical Archaeological Landscape Management Study (PHALMS) (GML Heritage, 2000) is a non-statutory framework that was adopted by Parramatta City Council and the Heritage Council of NSW and subsequently integrated into the NSW State Heritage Inventory database to inform urban development in the Parramatta LGA. The PHALMS study area was divided into Archaeological Management Units (AMUs) defined by consideration of the historical development of a particular item / site and the current physical condition. The archaeological resources within each AMU have similar levels of archaeological significance, archaeological research potential and have undergone similar levels of disturbance. Generally, streets are included in PHALMS as either individual AMU's or within the same AMU as the adjacent allotment.

2.4.3 Your Parramatta Park 2030 Conservation Management Plan and Plan of Management 2020

An update to the 2008 Management Plan (The National Trust of Australia and Parramatta Park Trust 2008), the Conservation Management Plan (CMP) and Plan of Management (2020) (Parramatta Park Trust) guide future use, interpretation, and enhancement of the Park that enables for the retention and respect of its heritage values. It details an extensive program of public consultation that was undertaken about social attitudes towards the Park and outlines the opportunities and challenges for its future.

3.0 Aboriginal Heritage

3.1 Data Sources

Information regarding the known and potential Aboriginal heritage resource of the Project area was obtained from:

- A review of the landscape context of the Project area and surrounds.
- A review of existing Aboriginal Heritage Information Management System (AHIMS) data for land within and surrounding the Project area, obtained from Heritage NSW on 14 November 2022 (AHIMS search ID #732154).
- A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal (NNTT) for land within and surrounding the Project area (1 November 2022).
- A review of previous Aboriginal cultural heritage and archaeological investigations within the Project area and surrounds.
- A visual inspection of the Project area by Umwelt Archaeologist Melissa Moritz on 29 July 2022.

3.2 Landscape Context

Consideration of the landscape context of the Project area is predicated on the proposition that the nature and distribution of Aboriginal sites are connected to the environments in which they occur. Environmental variables such as topography, geology, hydrology and local vegetation and faunal communities are a key consideration to determining how Aboriginal peoples lived and utilised their Country. In practical terms, these variables would have influenced the suitability of campsites, drinking water, plant and animal resources, and raw materials for the manufacture of stone and organic implements. Equally critical is the identification of historical and contemporary land use activities, which contributors to the understanding of the integrity of archaeological deposits.

Key observations from a review of the landscape context of the Project area is presented in **Table 3.1**.

Table 3.1 Review of Landscape Context of the Project Area

Environmental Variable	Key Observations
Topography	The Project area lies within the Cumberland Plain, a geographic region broadly characterised by low, gently undulating slopes. The topography of the Project area falls within the Cumberland Lowlands physiographic region. Chapman and Murphy (1989) describe the area as comprising level to gently undulating alluvial floodplains draining Wianamatta Group shales. Local relief is usually less than 5 metres (m) with slopes generally less than 3%. The topography of land within the Project area relative to its suitability for Aboriginal occupation, suggests that landscape elements within it would have been favourable to occupation, being flat, open areas adjacent to Parramatta River and its associated tributaries. The boreholes to the north of the trainline are located on an elevated area between 200 m and 400 m south of the Parramatta River. The elevated area is behind a distinctive ridgeline referred to as 'The Crescent' due to its shape and runs from the north side of Old Government House, continuing west before curving to the north, similar to the alignment of the Parramatta River.
Hydrology	The primary watercourse within the Project area environs is the Parramatta River, a regionally significant tidal watercourse which flows east from its headwaters in North Parramatta/Northmead and drains to the Lane Cove River and ultimately, Sydney Harbour, approximately 11 km east from the Project area. The Parramatta River drains a considerable area of the Cumberland Plain and is a *c.* fourth-order stream as it passes the Project area. There are a number of first and second order watercourses which drain into the Parramatta River, including Domain Creek which runs through the western side of Parramatta Park north into Parramatta River. The tidal nature of the Parramatta River influences the respective confluences of each tributary, with tidal flats and expanses of mangroves swamp often present. Since European colonisation however, many of these waterways have been modified, either by channelisation or reclamation of adjacent tidal flats. The Parramatta River itself has experienced some localised channelisation, as well as impacts to its natural flood regime resulting from increased urban runoff. Contemporary condition notwithstanding, the Parramatta River and associated tributaries would have supported diverse plant and faunal resources, as well as providing an important transport network towards Sydney Harbour. The prevalence of recorded Aboriginal sites along the Parramatta River and environs attests to its regional significance as a focal point for Aboriginal occupation.
Geology and Soils	Reference to the 1:100,000 Geological Map Sheet for Penrith (9030) and Sydney (9130) indicates that the surface geology of the Project area is dominated by Wianamatta Group units with Quaternary alluvium dominating the valley fill portions associated with watercourses. Comprising (3) three formations, the Ashfield Shale, Minchinbury Sandstone and Bringelly Shale, the Wianamatta Group lies conformably over the Mittagong Formation and the Hawkesbury Sandstone. The Ashfield Shale is described as a black to dark grey siltstone and laminite. The Bringelly Shale comprises shale (claystone and siltstone), carbonaceous claystone, laminite and fine to medium-grained lithic sandstone. Quaternary valley fill (alluvium) comprising a superficial cover of unconsolidated sediments deposited over the Wianamatta Group shales, forms the contemporary floodplains of several of the Cumberland Plain's major drainage systems, including the Parramatta River and its tributaries.

Environmental Variable	Key Observations
	Raw materials suitable for flaked artefact manufacture are generally absent from the Project area and environs, though opportunistic alluvial sources (e.g., gravel deposits in creeks etc). Tertiary alluvial units known to contain raw materials (i.e., the St Marys formation) are mapped approximately 16 km northwest of the Project area. These geological formations/phenomena are of demonstrated Aboriginal archaeological significance. The St Marys formation consists of alluvial channel remnants incised into Triassic Wianamatta Group shales, and contains abundant quantities of silcrete, as well as silicified wood, quartzite and quartz (Corkhill, 1999):56). Recorded deposits, which occur on ridge flanks and crests across the northern Cumberland Plain, vary in thickness from approximately 1–10 m. Silcrete from the St Marys formation is typically light red or yellowish brown in colour, with a bleached weathering rind, and occurs in the form of complete and fragmentary pebbles, cobbles and boulders (Corkill 1999). Bannerman & Hazelton (1990) identify the dominant soils within the Project area as belonging to the Blacktown (bt) soil landscape. This soil landscape occurs extensively across the Cumberland subregion and is characterised by low hills and rises with broad rounded crests and ridges on Wianamatta Group Shales. On crests, the landscape comprises shallow (less than 30 cm) loam topsoil (A1 horizon) over 10–20 cm clay loams to silty clay loam (A2 horizon) over moderately deep (less than 100 cm) of clay loam to silty clay loam over shallow to deep (20–150 cm) clay. On lower side slopes, the soils are shallow (less than 30 cm) loam topsoil over 10–30 cm of clay loam to silty clay loam, over moderately deep to deep (40–140 cm) clay. Extensive geomorphological and archaeological research has been undertaken in the Parramatta CBD and along the Parramatta River which indicates a deep fluvial sand body variously referred to as the Parramatta Sand Body, Sheet or Terrace is present. From an archaeological perspective, the Parramatta Sand Body was first identified during excavations of a property on the corner of George and Charles Streets in 2003. It was identified as a deep fluvial coarse sand body, likely formed when sea levels were considerably higher during the Pleistocene, approximately 120,000–130,000 years ago (Jo McDonald Cultural Heritage Management Pty Ltd, 2005). These works, along with several other across the Parramatta Sand Body have shown that cultural deposits are distributed intermittently, are often constrained to the upper 1.5 m, and may date to approximately 30,000 years before present (BP), making them some of the oldest in NSW. The Parramatta Sand Body has largely been mapped by Dr Peter Mitchell (Groundtruth Consulting 2008) using a combination of landforms, contours and targeted excavations to determine the extent of the sand body. The terrace is considered to be largely situated between approximately 2 and 8 m AHD and constrained to within approximately 200 m of the Parramatta River however this has not been demonstrated across the predicted extend of the terrace, including several instances where expressions of the terrace have been encountered at distances of greater than 200 m from the Parramatta River.

Environmental Variable	Key Observations
Flora and Fauna	Vegetation within the Project area has been extensively cleared to accommodate the development of Old Government House, and the associated historical agricultural/horticultural lands in the late 18th Century, and later for activities associated with the use of Parramatta Park for public recreation. Much of the vegetation present today is regrowth grassland and is dominated by invasive weed species. Benson (1981) maps the pre-European vegetation communities of the Cumberland Plain area as comprising Grey Box and Forest Red Gum woodland with *Eucalyptus teraticornis* (Forest Red Gum). The understorey species comprised *Acacia parramattensis*, *Acacia floribunda, Casuarina cunninghamiana* (River Oak), *Bursaria spinosa* (Sweet Bursaria, Blackthorn) and *Hardenbergia violocea* (False Sarsaparilla). Grasses included *Themeda australis* (Kangaroo Grass) and *Lomandra longifolia.* As with vegetation, determining with any certainty the pre-European faunal landscape of the Project area and environs is difficult due to past land use practices. However, consideration of pre-European vegetation regimes and local archaeo-faunal assemblages suggests that a range of terrestrial faunal resources would have been present in the area. Locally occurring freshwater resources from Parramatta River, for example, are likely to have consisted of a wide range of fish and shellfish, and other freshwater mammals. A diverse array of terrestrial mammals (e.g., kangaroos, wallabies, possums), as well as birds, reptiles and amphibians, would have also been available in woodland areas.
Land Disturbance	Review of historical reference materials and field observations indicate that portions of the Project area have been impacted by anthropogenic activities. By the late 19th Century, the area had been cleared to accommodate the newly established town of Parramatta. Review of the historical aerial photography available for the Project area suggests that impacts in the 20th century were generally limited, with the declaration of Parramatta Park for public recreation sparing the Project area from the significant impacts seen elsewhere in Parramatta through the rapid urbanisation and development of the Parramatta CBD. While the archaeological implications of the early clearing and historical land uses is potential disturbance for pre-existing Aboriginal sites and archaeological deposits, the prevalence of recorded and intact and *in situ* Aboriginal sites within the Parramatta region, including Parramatta Park suggests that previous land disturbance has not been as significant as previously thought, and that the potential for Aboriginal cultural materials in Parramatta Park still remains.

FIGURE 3.1

Soil Landscapes and Hydrology in Parramatta Park

Image Source: Nearmap (May 2022) Data source: DFSI (2021)

3.3 Aboriginal Archaeological Context

3.3.1 Aboriginal Heritage Information Management System (AHIMS)

The AHIMS database, administered by Heritage NSW, contains records of all Aboriginal objects reported to Heritage NSW in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared to have Aboriginal cultural significance. Recorded Aboriginal objects and declared Aboriginal places are defined under the NPW Act as 'Aboriginal sites'.

A search of the AHIMS register undertaken on the 14 November 2022 for an area at Lat, Long From: -33.8346, 150.9836 – Lat, Long to: -33.7989, 151.0454, centred on the Project area (i.e., the 'AHIMS search area'; AHIMS Reference: 732154) identified 95 Aboriginal sites (summarised in **Table 3.2**). Extensive AHIMS search results are reproduced in **Appendix A** of this report.

The most common sites type represented within the AHIMS search area are areas of Potential Archaeological Deposit (PAD), which accounted for 53.68% (n = 51) of known sites. As is typical for south-eastern Australia, open artefact sites (comprising one or more artefacts) with and without other forms of archaeological evidence (i.e., PAD) were also common within the AHIMS search area, accounting for 41.05% (n=40) of the known sites. Culturally modified trees (n =1 and 1.05%) and hearths (n = 3 and 3.16%) (generally associated with PAD) are also included within the AHIMS search area. Of the 95 Aboriginal sites identified, five (5) were located within 100 m of the proposed works. **Section 3.3.2** provides the details of these Aboriginal sites.

Table 3.2 AHIMS Search Results

Aboriginal Site Type	Frequency (n)	Percentage
Potential Archaeological Deposit	51	53.68%
Open Artefact Site	39	41.05%
Hearth	3	3.16%
Culturally Modified Tree	1	1.05%
Grinding Groove	1	1.05%
Total	**95**	**100%**

Source: Department of Planning and Environment, 14/11/2022, AHIMS Search ID 732154).

3.3.2 Aboriginal sites within 100 m of the Project Area

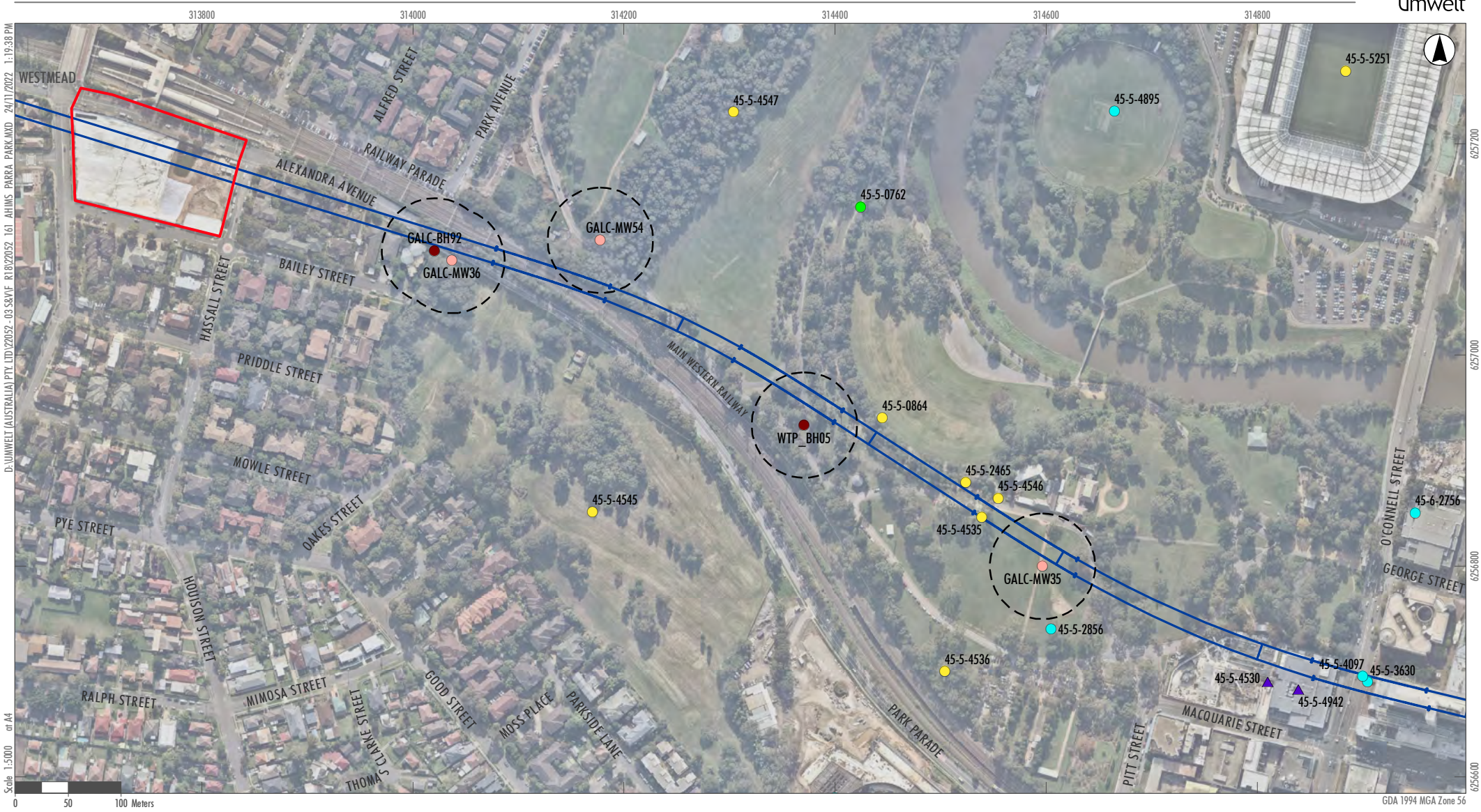
The results of the search identified five (5) Aboriginal sites within 100 m of the proposed borehole and/or monitoring well locations. The details of these Aboriginal sites are included in **Table 3.3**, which also provides a summary of the site description from the AHIMS site cards for each site, as well as any other information available of each site.

Table 3.3 Description of the AHIMS Sites Located within 100 m of Proposed Borehole Locations

Borehole ID	AHIMS ID	Site Name	Site Status	Site Type	Description	Located within borehole footprint
WTP_BH05	45-5-0864	Governors Bathhouse	Partially destroyed	Open artefact site – artefact scatter	This Aboriginal site was identified in 1992 during an archaeological survey of Metropolitan Sydney. It is described as being located on the northern side of the Governors bathhouse, in open ground. The Governors bathhouse is located inside Parramatta Park, west of the Old Government House. The Aboriginal site is situated in a highly disturbed context, being subject to pedestrian and natural erosional damage. A total of 13 artefacts were identified, consisting of red silcrete, white silcrete, chert and quartz. Potentially cultural shell material was also identified in proximity to the artefact deposit. As Old Government House was one of the first European structures in Parramatta, having been constructed in a known Aboriginal campsite, this Aboriginal site was recorded as having high cultural significance.	No. Approximately 40 m east of WTP_BH05 location.
GALC-MW35	45-5-2856	Parramatta Park Macquarie Entrance (PAD)	Partially destroyed	Potential Archaeological Deposit (PAD)	This Aboriginal site was recorded in 2003, following excavations works within a portion of the Macquarie Street Entrance Precinct to Parramatta Park. Although no Aboriginal objects were identified, the original soil profile was encountered. Potential Aboriginal materials, likely low density artefact scatters, may remain in situ in a subsurface context. The spatial extents of AHIMS Site ID: 45-5-2856 'Parramatta Park Macquarie Entrance (PAD)' is not clearly indicated in the associated site card /post excavation report (Dominic Steel Consulting, 2003). However, it is indicated that there is potential for low density artefact scatters to *in situ* in a subsurface context, particularly below existing road or path surfaces to the south of Old Government House.	No. Approximately 60 m southeast of GALC-MW35 location.

Borehole ID	AHIMS ID	Site Name	Site Status	Site Type	Description	Located within borehole footprint
GALC-MW35	45-5-4535	Parramatta Park – Location E	Valid	Open artefact site	This Aboriginal site was originally identified in 1993 as part of the investigation associated with the 'Parramatta Park: Management and Interpretation of Aboriginal Sites' report, however, was not formally registered until 2014. A single isolated red silcrete flake was identified, measuring 34 mm x 33 mm x 10 mm. The flaked piece showed potential evidence of use wear; however this was also noted to be caused by recent edge damage associated with the public nature of the location. The Aboriginal site is located in an area of exposure and eroding ground, to the south of the Old Government House complex. The artefacts are approximately 47 m from the corner of the 'cream building' within the complex and 2 m from an asphalt road.	No. Approximately 70 m northwest of GALC-MW35 location.
GALC-MW35	45-5-4546	Parramatta Park – Location D	Valid	Open artefact site	This Aboriginal site was originally identified in 1993 as part of the investigation associated with the 'Parramatta Park: Management and Interpretation of Aboriginal Sites' report, however, was not formally registered until 2014. No information is recorded regarding the raw material; however it is stated that this Aboriginal site consists of an isolated flake. The Aboriginal site was identified on the western side of the Government House complex, within an area of exposure overlooking Parramatta River.	No. Approximately 75 m northwest of GALC-MW35 location.

Borehole ID	AHIMS ID	Site Name	Site Status	Site Type	Description	Located within borehole footprint
GALC-MW35	45-5-2465	Parramatta Regional Park IF3	Partially Destroyed	Open artefact site	This Aboriginal site was originally recorded in 1999 during monitoring works undertaken within Paramatta Park. An isolated artefact was identified, consisting of an edge ground implement made from a metamorphic river cobble, measuring 97 mm x 48 mm x 20 mm. The body of the artefact retains its cortex, with no flaking noted. The recording states it may have been utilised as an anvil or hammerstone. The artefact was located on a small semi-grassed terrace above the ridgeline near Old Government House (the crescent), 5 m south of steps and 200 m south of the Governors bathhouse. Due to the public locality, it is unlikely to have been identified *in situ*. The artefact was salved in 1999 by the Parramatta Park Trust Office, and the site has been subject to shallow grading and bush regeneration. The Aboriginal site was recommended for deregistering due to being re-assessed as not a site.	No. Approximately 100 m northwest of GALC-MW35 location.



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- High Risk Boreholes
- High Risk Boreholes with Monitoring Wells
- Study Area

Aboriginal Sites

- Culturally Modified Tree
- Hearth
- Open Artefact Site
- PAD

FIGURE 3.2

Aboriginal Sites in Parramatta Park

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

3.4 Native Title

A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal was undertaken for the Parramatta LGA, inclusive of land within and surrounding the Project area. No current Native Title listings or claims were identified within or near the Project area.

3.5 Previous Aboriginal Archaeological Assessments

Several Aboriginal archaeological investigations have been carried out within and adjacent to the Project area. For contextual purposes, the results of a selection of these investigations, including those undertaken near the Project area, are summarised in **Table 3.4**.

Table 3.4 Previous Aboriginal Archaeological Assessments

Assessment	Description	Distance from Project area
AMBS, 1996 *Parramatta Park, Plan of Management and Interpretation Program – Aboriginal Sites – Stage 2*	An archaeological investigation into the prevalence and significance of Aboriginal sites within Parramatta Park was undertaken in order to support the development of the Parramatta Park Plan of Management. The assessment included background research, field survey and artefact identification, and conservation and management strategies. Over the course of the field survey, 15 Aboriginal sites and 66 artefacts were identified. The vast majority of Aboriginal sites were found to possess stone artefacts exposed on the ground surface, with sites designated as locations A to O. These 15 locations include two (2) previously reported isolated finds and the areas registered with the NSW National Parks and Wildlife Service as 45-5-762 and 45-5-864, at which 25 and 18 artefacts were recorded. Between one (1) and four (4) stone artefacts were found at the newly-identified locations. The type of artefacts found in Locations B to 0 include flakes, flaked pieces, broken Bondi points (proximal ends), and hand-held and bipolar cores. Artefact material varied from silcrete (80% of assemblages), quartzite, mudstone/chert and fossilized wood. AMBS suggests that the artefacts were likely manufactured in the south-western portion of the park, having been brought in from neighbouring regions. Two mature tree was also identified as having aged scars, potentially related to Aboriginal activities. AMBS suggests that the whole of the Park may have a sparse scatter of stone artefacts across its extent, with a relatively higher concentration along the Ridge overlooking Parramatta River on the south/western side. The report recommended that Parramatta Park undergo a rehabilitation program for areas of vegetation clearance, in addition to areas of exposure or erosion. In order to retain the Aboriginal sites, proposed developments and maintenance works that may disturb sub-surface deposits would require archaeological investigation.	Parramatta Park, adjacent to GALC-MW35

Assessment	Description	Distance from Project area
Dominic Steet Consulting Archaeology, 2002, *Parramatta Park Aboriginal Cultural Heritage Assessment– Storage Deport, Marquee and Car Parking Proposal, Macquarie Street Entrance Precinct*	An Aboriginal Cultural Heritage Assessment was prepared by Dominic Steel Consulting for the upgrades to the administration building and carpark at the Macquarie Street entrance to the Parramatta Park, in addition to the extension of the gardens in the vicinity of the Macquarie Street Gatehouse. The purpose of the assessment was to ensure that the proposed works did not adversely impact on the range of cultural heritage considerations that exist within grounds of the Park. It was acknowledged that due to the sensitive and complex heritage context of the works, it was likely that the proposal had the potential to result in considerable impacts upon the existing landscape of the Park and that the potential impacts to heritage required due consideration in the design, planning and implementation of the works. The results of the assessment indicated that there were no known Aboriginal sites within the vicinity of the proposed works, and archaeological zoning plans for the Parramatta Park had not indicated areas of Aboriginal archaeological sensitivity in the proposed works area. However, there was potential for evidence of Aboriginal visitation and use of the Park may remain in the area. This was predicted to consist of isolated items of flaked stone and/or low density distribution of artefacts. A program of archaeological test excavation was recommended prior to the commencement of the works to confirm the nature of the subsurface profile and determine if the works would impact upon any significant Aboriginal deposits. It is presumed that the program of archaeological testing was undertaken however results of these investigations have not been identified within the available information within the public domain.	Parramatta Park, 100 m southeast of MW35
GML Heritage, 2015, *Garden Precinct, Parramatta Park— Heritage Assessment and Impact Statement*	GML prepared a Heritage Assessment and Impact Statement (HIAS) for the upgrades to the Gardens Precinct, located in the southeast of Parramatta Park. The HIAS included the assessment of impacts to Aboriginal cultural heritage and archaeology associated with the works. Test excavations were undertaken in the Gardens Precinct to ascertain the full extent of the potential archaeological deposits identified in the area. Results of the test excavation identified four (4) distinct soil landscapes within the Gardens Precinct. This included the Paramatta Sand Sheet, the Blacktown soil landscape, recent channel alluvium and a recent fill comprised of locally derived materials. The four (4) test pits, of differing dimensions yielded a toral of 59 Aboriginal stone objects, from both the historical and Aboriginal archaeological excavations. However, as the test pits did not reach sterile soil horizons across the precinct, the extent of archaeological deposits and associated object densities were considered a minimum. The results indicated a distribution of Aboriginal artefacts across the entire Garden Precinct in all but one (1) of the archaeological contexts. The areas of Parramatta Sand Sheet held the majority of	Parramatta Park, 100 m east of MW35

Assessment	Description	Distance from Project area
	the objects. Displacement of Aboriginal objects from upstream locations was identified within the recent alluvium, which occurred in the bankfull channel zone of Murray Gardens Creek, a first order tributary of the Parramatta River. No objects were identified in the two (2) areas of Blacktown soil landscape, despite the high preservation of Aboriginal objects known to occur from archaeological sites across western Sydney. The absence of objects in the small area of exposed Blacktown soils within the test excavations was attributed to the disturbed nature of the Blacktown soils identified within the test excavation.	
GML Heritage, 2015, Aboriginal Archaeological Technical Report – Parramatta Leagues Club	An Aboriginal Cultural Heritage Assessment (ACHA) was prepared by GML on behalf of the Parramatta Leagues Club (care of APP Corporation Pty Ltd) in response to a proposed (now completed) redevelopment program. Prior investigation had assessed the subject site as possessing moderate to high Aboriginal archaeological potential and as such was identified as a PAD. The ACHA included background research and excavations methodology within the study area. No excavations results are included within the report. A preliminary archaeological survey could not be undertaken, due to the extent of asphalt, brick paving and historic fill. Geotechnic investigations confirmed the study area was situated within the Parramatta sand sheet (PSS). Background research of the PSS suggested that archaeological deposits could be encountered at depths of 1 – 16 m, dependant on the landform upon which excavation occurred. Prior to excavation, GML theorised the study area may contain archaeological evidence of the long-term deposition of artefactual materials, indicative of Aboriginal occupation over a period of 30,000 years.	1 Eels Place, Parramatta. 800 m north-east of GALC-MW54
Artefact, 2013*Aboriginal Archaeological Assessment – Parramatta RSL Club*	An Aboriginal archaeological assessment was prepared by Artefact prior to the construction of a hospitality venue on the site of the Parramatta RSL Club. The study area had been identified to be of high archaeological sensitivity on the Parramatta DCP 2011 Aboriginal Sensitivity map, and the eastern half of the study area had been assessed to be of high archaeological sensitivity in the Parramatta Aboriginal Heritage Study. The northern corner of the study area was included in the mapped extent of the PSS, with the potential to contain evidence of Aboriginal occupation of up to 30,000 years BP. The assessment included background research, survey results and excavations methodology within the study area. No excavations results are included within the report. The natural ground surface was not visible during the site survey, as the land had been excavated, built on, covered in concrete or bitumen or filled. No Aboriginal sites were identified. The predictive model states that artefact densities would be expected to increase in the northern portion of the study site, due to the presence of the PSS and would largely consist of silcrete, siliceous tuff, quartzite and volcanic in nature.	Corner of Macquarie and O'Connell Street, Parramatta. <250 m east of GALC-MW35

Assessment	Description	Distance from Project area
	Historical research identified that the subject site had previously been incorporated into Parramatta Park and as such had been subject to less disturbance related to development. However, in conclusion the archaeological significance of the study site could not be accurately assessed based on this singular investigation, and further archaeological investigation was recommended.	
Archaeological and Heritage Management Solutions, 2014 *Aboriginal Archaeological Report – 330 Church Street, Parramatta*	An Aboriginal Archaeological Report was prepared to assess Aboriginal heritage impacts associated with a proposed development in Parramatta, NSW. The assessment included background research and test excavations within the Parramatta Sand Body. 1m2 test pits were placed in ten (10) trenches within the Project area, which were excavated by hand in 10 cm spits. The soil was sieved through 5mm mesh, and all Aboriginal objects and possible Aboriginal objects were retained for analysis. The test excavations identified 43 Aboriginal objects and 32 non-diagnostic fragments of stone suitable for working. Three (3) trenches contained artefacts, which may have been washed into the study area with flood deposits. The test excavations found that the Parramatta Sand Body's depth extends lower than 4m AHD and contains Aboriginal objects at such depths, which is consistent with the findings from previous assessments for the area.	330 Church Street, Parramatta. Approximately 700 m north-east of GALC-MW35
Archaeological and Heritage Management Solutions, 2016, *Old Kings School, Parramatta Aboriginal Heritage Impact Assessment Report*	An Aboriginal Heritage Impact Assessment Report was prepared to assess Aboriginal heritage impacts associated with a proposed development and upgrade of a school in Parramatta, NSW. The assessment included background research and test excavations within the Project area, which is located in the Parramatta Sand Body. Twenty-three (23) mechanical test pits were excavated across the southern portion of the Project area, which were spaced 5-20 cm apart. A thin unit of sand was identified during the excavation works, which was around 1 m thick at a 40-70 cm depth. This unit was found to be characteristic of the Parramatta Sand Body. Sixty-one (61) Aboriginal objects were retrieved from this unit, 57 of which were obtained from a single test pit located along the western extent of the Project area. Further excavations were undertaken for this deposit, which found it to be 25 m2 in size and characteristic of a small hunting camp.	24a O'Connell Street, Parramatta (Old Kings School). Approximately 600 m north-east of GALC-MW35
Archaeological and Heritage Management Solutions and Futurepast, 2018, *Aboriginal Archaeological Salvage Excavation Report - O'Connell Street Public School (Old King's School), Parramatta*	An Aboriginal Archaeological Salvage Excavation Report was prepared describe the results of an Aboriginal archaeological salvage excavation undertaken at a school in Parramatta, NSW. The assessment included salvage excavations within the Project area. This included mechanical excavation of the uppermost historic fill layers (at a 40 cm–70 cm depth) and excavation of a 25 m^2 salvage area. Twenty-five (25) test pits were excavated, which were 1 m^2 squares excavated by hand in 5 cm spits. The salvage excavation found that the Project area contained a low density of artefacts and represented a discrete knapping event. The cultural assemblage identified in the Project area were restricted to a narrow 40 cm band between 7.85 and 7.55 m AHD.	24a O'Connell Street, Parramatta (Old Kings School). Approximately 600 m north-east of GALC-MW35

Assessment	Description	Distance from Project area
	Despite finding a high concentration of artefacts from the initial testing phase, the subsequent salvage excavation found the assemblage to be relatively sparse beyond this.	
Archaeological Management and Consulting Group and Streat Archaeological Services Pty Lt, 2018, *Aboriginal Archaeological Assessment – 93–95 Phillip Street & 32 Smith Street Parramatta NSW*	An ACHA and Aboriginal Archaeological Assessment was prepared to identify Aboriginal heritage items within a proposed development in Parramatta, NSW. The assessment included background research and test excavations within the study area. Test excavations were undertaken in 17 1 m^2 trenches, 14 of which were excavated to a depth of at least two (2) spits (200 mm). Thirteen (13) artefacts were uncovered, which have been quantified and undergone preliminary artefact analysis. These artefacts do not appear to represent intact occupation deposits, but instead appear to reflect considerable amounts of archaeological material moving through the bio-mantle. The assemblage is considered to be of low archaeological significance whilst still possessing higher cultural significance based on their intrinsic value within the Aboriginal community.	93–95 Phillip Street & 32 Smith Street, Parramatta. Approximately 900 m east of GALC-MW35

3.6 Key Observations

Key observations to be drawn from a review of both the environmental and Aboriginal archaeological context of the Project area and environs are as follows:

- The topography of the Project area suggests that landscape elements within it would have been favourable to occupation, being flat open areas adjacent to the Parramatta River, with elevated areas above the floodplains of the river and its tributaries.
- Parramatta River and its associated tributaries would have likely supported diverse plant and animal resources, as well as providing important transport networks towards Sydney Harbour. The prevalence of recorded Aboriginal sites along the Parramatta River and environs attests to these watercourses as local focal points for Aboriginal occupation.
- The Parramatta Park environs contains several Aboriginal sites listed on AHIMS. This includes five (5) Aboriginal sites within 100 m from the proposed geotechnical testing locations. This indicates that the historical land use activities, although resulting in some disturbances, did not result in the removal of all archaeological evidence of Aboriginal occupation within Parramatta Park landscape, including around the Project area.
- AHIMS site # 45-5-0762, a Culturally Modified Tree with associated PAD is located within the vicinity of WTP_BH05. Description of this site included in AHIMS suggests that although partially destroyed, the extent of the PAD associated with this site likely extend into the Project area, specifically within the 50 m buffer zone of WTP_BH05.
- Previous archaeological test excavations undertaken within Parramatta Park, located approximately 200 m to the east of the current Project area identified expressions of the Parramatta Sand Sheet which were outside of the mapped predicted extent. This suggests that the Parramatta Sand Sheet may be retained elsewhere in the landscape outside of the mapped extent in areas where landform and geomorphology is suitable.

4.0 Historical Heritage

4.1 Data Sources

Information regarding the known and potential historical (non-Aboriginal) heritage resource of the Project area was obtained from:

- Desktop searches of relevant heritage registers.
- Old Government House and Domain, Parramatta Park, Management Plan (MP) (The National Trust of Australia and Parramatta Park Trust 2008).
- Existing reports and management plans.
- Site inspection by Umwelt Senior Archaeologist Melissa Moritz, in order to assess the existing condition of the Project area and environs.

4.2 Historical Background

The historical context of Parramatta Park is detailed in the HMP (2008) and CMP (2020), and the Australian Heritage Database (AHD) entry. The following section summarises the key events information as relevant to the current assessment.

The primary task following the arrival of the First Fleet in 1788 was to locate suitable land to establish farms (MP 2008: 17). After three (3) months of investigations around the Port Jackson area, present-day Parramatta (then called 'Rose Hill') was selected as the ideal place for the settlement (MP 2008: 17). Within two (2) years, 100 convicts were engaged in clearing and cultivating the land, constructing the town of Parramatta, and building a small house for Governor Arthur Phillip (MP 2008: 17). Following the completion of the house, all surrounding earlier structures were demolished to allow the residence to be 'set in an extensive garden from which it commanded views of the settlement and river' (MP 2008: 18).

The original single-storey cottage did not survive for long. It had been primarily constructed from easily obtainable materials such as timber, wattle, and mud in a vernacular style, with a potential brick floor (AHD 2022). The cottage likely comprised two (2) rooms — each serviced by a fireplace on the rear wall — divided by a central hall (AHD 2022). By 1799, it was considered too small, and poorly kept, to be suitable for further use. Construction for a new two-storey brick residence commenced. The final structure 'contained reception rooms and bedrooms' with 'a suite of rooms upstairs and cellars under the house' (AHD 2022).

Throughout the early 19th century, the layout of Parramatta town centred around the siting of Phillip's residence (now known as Government House) on Rose Hill (CMP 2020: 27). High Street extended in a straight line from Government House, which connected it to the Queens Wharf and the Commissariat Stores (MP 2008: 18). A number of formal squared gardens were planted around Government House, whilst the lower flats were used for crops and cattle grazed in the western areas (CMP 2020: 30). These agricultural components were gradually removed and replaced with further formal landscaping features.

By 1812, Government House was once again in poor condition. Attempts were made to rehabilitate the building, with extensive repairs undertaken to the structure (AHD 2022). By 1815, however, it was decided that the existing footprint was not large enough and plans for a large extension were drawn up (AHD 2022). A substantial wing was constructed on the western façade of the house. This was designed to be an elegant Palladian-style country house in the English manner (AHD 2022). Now much larger, Government House had distinct organisational zones — the northern pavilion served to accommodate the Governor and his family, the servants occupied a southern pavilion and a rear building, and the central portion (the 1799 house) was used for receiving, entertaining, and accommodating guests (AHD 2022).

The layout of the gardens was considerably altered at this time too. In 1817, a stables and coach house were constructed on the grounds, which were swiftly followed by a pigeon house and 'rustic bark hut' (AHD 2022). The kitchen garden and orchards were relocated to be away from the main house (AHD 2022). This made way for the establishment of curvilinear carriage drives, rustic garden features, and extensive plantings of exotic species (CMP 2020: 40). In 1822, a bathhouse and observatory were constructed (MP 2008: 19). At the same time, the Officers' Quarters were also established to provide additional accommodation for the Governor's staff and household servants. The building consisted of two (2) wings, each one (1) room deep (AHD 2022). Due to differing construction techniques and dimensions within the Quarters, it is probable that it was either constructed in several stages or formed from earlier outbuildings (AHD 2022).

Following the death of Lady Mary Fitzroy — wife to Governor Charles Fitzroy — in the gardens in 1847, Government House was largely abandoned (MP 2008: 19). In 1857, a decision was made to confer Government House and the surrounding garden as a public park (MP 2008: 19). From then it became known as Parramatta Park. A portion of the land was sold to reduce the Park to 100 hectares, which was then further decreased by the construction of the Great Western Railway Line along the southern boundary (AHD 2022). A stables block and dog kennels were demolished to make way for the railway cutting (AHD 2022). Government House was leased to a number of tenants. It appeared that very little upkeep was undertaken on the dwelling, and by 1908 large sections of the external render were missing, the eaves had dropped, and the internal features were in poor condition (AHD 2022). In 1967, the National Trust assumed management for the property and undertook an extensive program of restoration works between 1968 and 1970. These works aimed to return Government House to its early nineteenth century configuration and condition (AHD 2022).

4.3 Register Searches

The Parramatta landscape is layered with heritage items of varying significance, from local to World heritage significance. Parramatta Park, which is protected under several heritage registrations as:

- Australian Convict Sites (Old Government House and Domain), World Heritage List ID 106209.
- Old Government House and the Government Domain, National Heritage List ID 105957.
- Parramatta Park and Old Government House, SHR 00596.

Parramatta Park and Old Government House, Paramatta LEP 2011 I00596. **Figure 4.1** shows the locations of the boreholes and/or monitoring wells in relation to the above curtilages.

The following statement of significance for Parramatta Park is taken from the National Heritage Listing for the Old Government House and Government Domain (Australian Heritage Database, 2008).

Old Government House and the Government Domain (also known as the Governor's Domain) at Parramatta Park are primary sites associated with the foundation of British colonial settlement and provide a tangible link to Australia's colonial development of 1788.

Old Government House at Parramatta is the oldest surviving public building on the Australian mainland, and the old early colonial Government House to have survived relatively intact. A section of the brick flooring of the Phillip era building of July 1790 survives while the three rooms at the font of the main section of the house date to Governor Hunter in 1799. The remainder of the main house and the two side pavilions date to Governor Macquarie in 1818.

Convicts built many of the structures in the place and were the labour force which operated the farming and other enterprises that occurred there. The house itself and the surrounding historic elements such as the bathhouse, carriageways and gatehouses, and the remains of Governor Brisbane's observatory, all reflect the establishment of agricultural production and the administration of the colony, the administration of the convict system in Australia, the commencement of town planning and the site of some of Australia's earlier astronomical and botanical endeavours.

The Government Domain is an extensive cultural landscape that has yielded archaeological evidence, and has the potential to yield more, particularly in terms of a convict workplace. Historical documents and images are available in public records which provide supporting information.

Old Government House in its setting of the Government Domain is significant as a cultural landscape of importance in Australia's history. Although the site has been reduced from the original 99.6 hectares to 85 hectares, it contains a number of historic elements that demonstrates cultural processes in Australia's development from a penal colony dependant on Great Britain to a self-governing colony. These elements include the house itself where the patterns of use and living established by the early Governors is still legible. Other elements include the establishment of the Government Garden which marked the commencement of successful agricultural production in Australia.

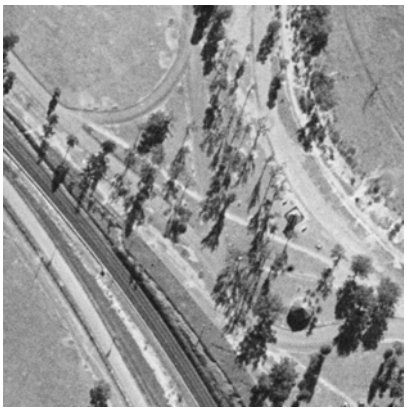
Old Government House also reflects early colonial and convict administration, and historic elements within the domain provide evidence of the beginnings of astronomical and botanical science in this country. The development of the house itself mirrors the growth and complexity of the process, both as the Governor's home and the sea of administration.

Old Government House and the Government Domain in Parramatta Park are significant for their association with the life and work in Australia of the early colonial governors. Governor Phillip, Hunter, Kind, Macquarie and Brisbane all resided and worked at the house, and all have left their mark on the site though their development of the fabric of the respective buildings and the enhancement of the Domain. Old Government House and the Domain provide a remarkable insight into the life and work of these governors. This insight is enhanced by the wealth of information available about the site, both in terms of its documentation and the pictorial representations and photographs of the various stages of its development.

4.4 Historical Aerial Imagery

A review of the 1941 aerial imagery is summarised below in **Table 4.1**.

Table 4.1 1941 Aerial Imagery of the Project Area

Scope ID	Discussion	Aerial Image
GALC-MW35	Several structures are depicted in the area, including the Boer War Memorial and Bath House interpretation pavilion. Since the photograph was taken, the Billy Hart Memorial and a memorial stone for the original cottage have also been installed. All four (4) structures are still extant. The formal plantings are still largely extant, although the area has been allowed to self-seed. The layout of access routes is largely unchanged.	
GALC-MW54	No structures are depicted in the area. The layout of the access routes has been altered, with the junction between West Domain Avenue and Railway Parade shifted north. The formal plantings are still extant and additional plantings have been established around Domain Creek.	
GALC-BH91	A white area adjacent to plantings may be a small structure or erosion scour, but further detail is unable to be determined. It was removed by 1951. Park Parade has since been shifted south to account for the widened railway corridor. Many of the plantings are still extant.	
GALC-BH92		

Scope ID	Discussion	Aerial Image
WTP-BH05	No structures are present on the surface, however, several possible cropmarks (which may be indicative of subsurface features) are visible. This includes: • a north-east to south-west linear feature perpendicular to the northernmost pathway, • several east to west linear striations extending west from Federal Avenue.	

4.5 Previous Historical Assessments

Several historical (non-Aboriginal) heritage investigations have been carried out within the Project area, the results of which are publicly available through the Heritage NSW library. For contextual purposes, the results of a selection of these investigations are summarised in **Table 4.2**.

Table 4.2 Previous Historical Heritage Assessments

Assessment	Description	Park Precinct
Godden Mackay, 1995 Parramatta Park, Parramatta Archaeological Zoning Plan	An archaeological zoning plan of Parramatta Park was prepared by Godden Mackay on behalf of Parramatta City Council. This plan was prepared to provide a consolidation of all historical archaeological assessments undertaken for the park today and provide archaeological sensitivity mapping for the Park. In addition, the Plan provides a management framework for the Park in line with the statutory obligations for managing and conserving archaeological remains in NSW. The plan identified that the potential for the survival of archaeological items to be high within the Park. The zoning plan identified and mapped individual items alongside areas of extreme archaeological sensitivity across the Park. Areas of extreme sensitivity were identified as a result of close proximity of a number of items, not always contemporary with each other. The areas of archaeological sensitivity focus on the centre and southeast section of the Park referred to as the Garden and the Domain Precinct, with some areas located at the Paddocks as well as further north. Forty-four (44) individual items were identified in the zoning plan as being of having potential to retain archaeological remains, being located both within, or separate to, the areas of extreme archaeological sensitivity.	Parramatta Park

Assessment	Description	Park Precinct
Parramatta Park Trust 2020 Your Parramatta Park, Conservation Management Plan and Plan of Management	The Conservation Management Plan (CMP) and Management Plan (MP) prepared for Parramatta Park provides an updated assessment of the archaeological potential for Parramatta Park, as well as outlining the World, National and state heritage values of the Park. This includes a consideration of the natural values of the site, as well as key plantings and significant views and access routes through throughout and into the Park. The significant values, archaeological landscapes and views are presented in updated maps, which are used to articulate the management and conservation requirements, opportunities and constraints of the Park in daily management as well as any capital works.	Parramatta Park
Bickford A 1997, Parramatta Park The Governor's Dairy: Excavation of Portion of Room 4C, prepared for Brian McDonald Architect Pty Ltd	As part of the conservation of the dairy, a portion of the sunken milk room was recommended for archaeological investigation to yield further information about the history and use of the structure. Excavation of the space revealed that it was not a sunken milk room, but actually functioned as a domestic space for staff. Moreover, the building was subject to several phases of alterations and had been substantially modified from its original form.	The Paddocks
Bickford, A 1988, Parramatta Park Observatory Site: Excavation of the Foundations, prepared for Brian McDonald Architect Pty Ltd	Following the demolition of the observatory in 1848, the two (2) sandstone piers for the transit instrument (known as the transit stones) were retained in situ. These piers were gradually being damaged by weathering processes, and it was proposed to install a cover over the remains. An archaeological excavation was undertaken to determine the location of the corners of the observatory building and whether any further features survived subsurface. Two trenches were excavated in the predicted positions of the north-west and south-west corners, and a third trench in the predicted position of the south-western segment of the southern dome. The excavations found that, during demolition of the observatory, the foundation stones were removed from the trenches. All that remained within the foundation trenches was demolition rubble consisting of a mixed brick, mortar, and plaster matrix.	The Domain
Edward Higginbotham & Associates 1995, Report on the Archaeological Excavation of the Building Materials Dump Associated with the 1908 Restoration of Old Government House, Parramatta, prepared for National Trust of Australia	A dump of materials was identified within the ground adjacent to Old Government House, believed to be associated with the 1908 renovation of the building. Three trenches were excavated within the dump. The artefactual materials dating to the early 20th century were strongly indicative of building activities, with 94% of the assemblage consisting of mixed building materials. Smaller quantities of alcoholic containers and tableware were also identified. Overall, the dating and range of materials present within the dump were consistent with the 1908 renovation. Moreover, several of the moulding and cornice types recovered during the excavation were able to be matched the extant moulding within Old Government House.	The Crescent

Assessment	Description	Park Precinct
Archaeology and Heritage 2009, Parramatta Park Observatory Site, Exemption Application s57(2)	No action was taken to install a cover above the observatory transit stones following the 1988 archaeological investigations (Bickford, A 1998 discussed above). Additional archaeological excavation was undertaken in 2009 to further inform the location and dimensions of piers for a protective cover. Rather than focusing on identifying corners, the excavation aimed to reveal the full outline of the building footprint. The excavations revealed that no part of the foundations had been left in situ during demolition of the observatory. Contrary to observations made during the 1988 investigations (Bickford, A 1998 discussed above), no foundation trench was identified. However, the full footprint was able to be identified and was highly consistent with the 1835 plans.	The Domain
GML Heritage 2013, Old Government House, Parramatta: Historical Archaeological Excavation Report, prepared for Parramatta Park Trust	Archaeological monitoring and investigation were undertaken as part of the implementation of stabilisation works to Old Government House. During the archaeological works, a number of 18th and 19th century features were uncovered. This included brick footings belonging to the 1793 outbuildings, an 1815 brick box drain and 1821 brick and slate box drain, and various components of early nineteenth century passageways and landscaping elements.	Old Government House
GML Heritage 2016, Parramatta Park Gardens Precinct: Historical Archaeological Test Excavation Report, prepared for Parramatta Park Trust	As part of proposed landscaping upgrades to the Gardens Precinct within the Park, archaeological test excavation was undertaken to inform the design process. The remains of several convict huts and road fabric for High Street and Pitt Row were expected to be present. Evidence of two (2) early convict huts was identified. The remains of one (1) hut consisted of a number of postholes and rubble, indicative of a two-roomed timber dwelling with a fireplace and brick chimney. The second hut was far more substantial, with evidence of a brick floor, earthenware roof tiles, and glass windows. This may suggest that it was a later phase of development or the rebuilding of an original timber hut. No evidence of road fabric associated with High Street or Pitt Row were identified. Compacted demolition material may have been indicative of the original George Street Gatehouse, which was replaced with the extant structure in 1885.	The Gardens

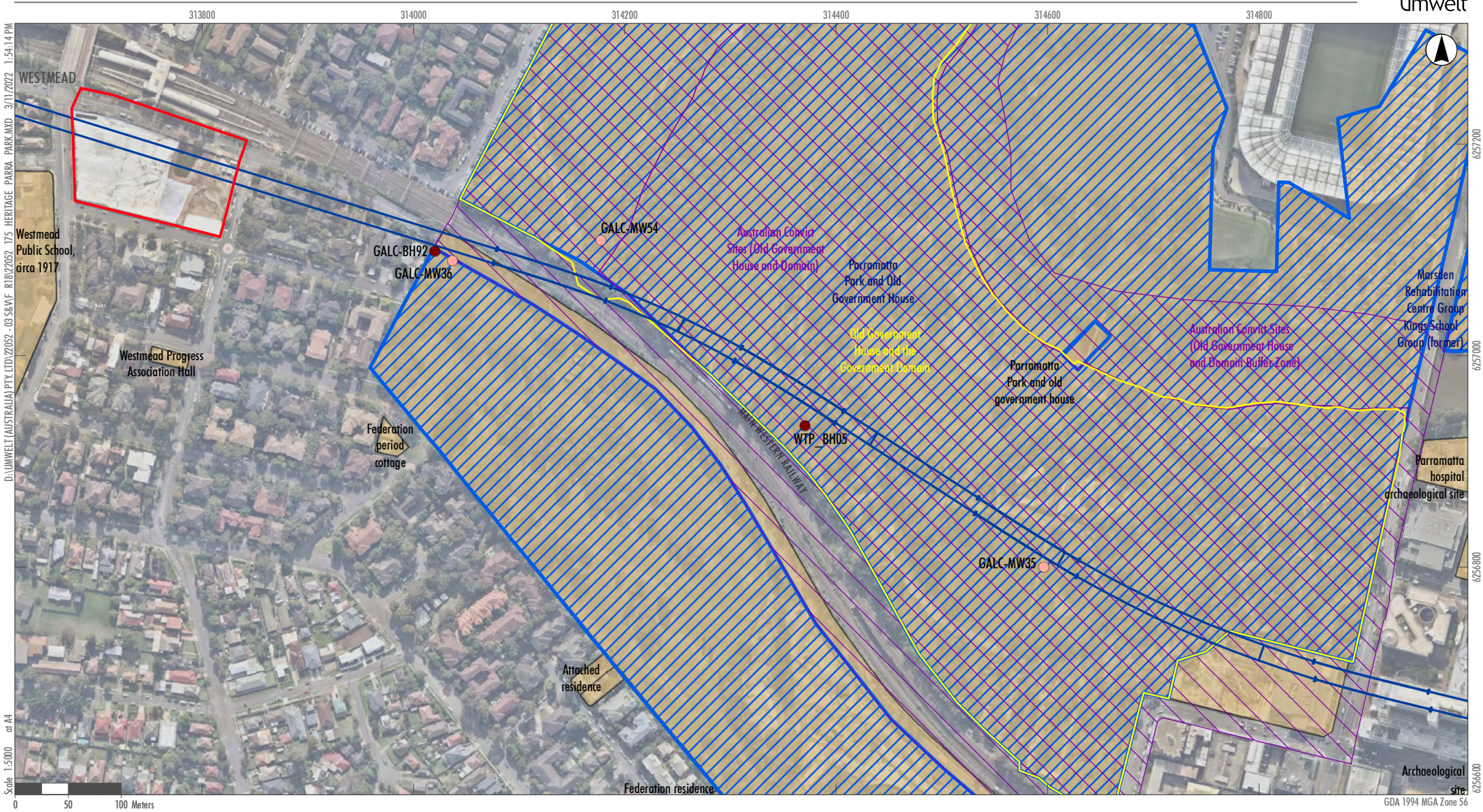
4.6 Key Observations

The five (5) geotechnical testing locations are distributed through the southern extent of Parramatta Park, which is subject to four (4) separate heritage listings and is of World Heritage significance. Key observations drawn from a review of the historical (non-Aboriginal) heritage context of the Project area and environs are detailed in **Table 4.3**.

Table 4.3 Summary of Key Observations for Each Geotechnical Testing Location

Scope ID	Historical Records	Aerial Imagery	Conservation Management Plan	Visual Inspection
GALC-MW35	This area was initially part of the agricultural operations of the Park, located within the enclosed Old Government House Domain, on Rose Hill. Near the location of the first government house in Parramatta, the monitoring well is located in an area of high intensity use in the early colonial period, with the construction of the current Old Government House, the former Governors Bathhouse, Observatory and war memorials nearby. It was also located within the pathways leading outside of the Domain to the Cattle Paddocks and agricultural land located to the west of the Park. These land uses were gradually shifted away, and once the Domain was transferred to Parramatta Park, the area was utilised for the public recreation as it is today.	A series of cropmarks are visible in the area, which may be indicative of subsurface features.	Located within Precinct 2 Setting of Old Government House, this area is identified as having significant archaeological potential and is provides a significant landscape setting within the Park. There are several significant roads and pathways, particularly Philips Drive which is located immediately adjacent to the proposed monitoring well.	This area has been disturbed in localised areas, but generally retains a high level of integrity. No indications of potential archaeological deposits were identified within the existing grass surface.

Scope ID	Historical Records	Aerial Imagery	Conservation Management Plan	Visual Inspection
WTP-BH05	This area was actively used, especially following the construction of the bathhouse in 1822. It has since been used to as the site for several memorials.	The layout of the pathways visible remains largely consistent with those present today.	This borehole is located at the junction of three (3) precincts within the CMP: Precinct 2: Setting of Old Government House, Precinct 4: The Crescent and Precinct 6: the Paddocks. The borehole is surrounded by significant roads and pathways on all sides, and sits within an area of significant archaeological potential and landscape setting.	This area has been disturbed in localised areas, but generally retains a high level of integrity. No indications of potential archaeological deposits were identified.
GALC-MW54	This area was initially part of the agricultural operations of the Park, referred to as the Cattle Paddocks, before these were gradually shifted away from the operations of Government House and the landscape was transformed into a scenic park.	West Domain Avenue and Railway Parade have been realigned slightly and a new pedestrian path established.	This monitoring well is located within Precinct 6: The Paddocks. It is significant for its historical archaeological potential of early agricultural practices of one of the oldest farmed European landscapes in the country. This monitoring well is also located in the vicinity of significant and early roads and pathways within the Park.	This area has been disturbed extensively through the establishment and movement of roads and pedestrian access routes, and tree planting. No indications of potential archaeological deposits were identified.
GALC-BH91	This area was initially part of the agricultural operations of the Park, before these were gradually shifted particularly the grazing of both government and private cattle, as part of the principal site in the early colony for animal husbandry. Once the land use shifted towards public recreation, it formed part of Parramatta Park, as well as hosting a golf course until its closure in the 2010s where it was reinstated as open passive recreation space.	A possible feature may have been present pre-1951.	The boreholes are located within the northwest-most corner of Precinct 8: Mays Hill. The north of this precinct is identified as having historical archaeological potential as the site of the grazing of government and private cattle herds, with potential to retain early fence lines and evidence of tilled farm practices.	This location proposed for the boreholes has been disturbed extensively through the establishment and movement of roads and pedestrian access routes, use of the gold course, and tree planting. No indications of potential archaeological deposits were identified.
GALC-BH92				



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Boreholes
- Boreholes with Monitoring Wells
- World Heritage Properties
- National Heritage Places
- State Heritage Act

Local Heritage

- Item - General
- Item - Archaeological

FIGURE 4.1

Historical Heritage Items in Parramatta Park

Image Source: Nearmap (May 2022) Data source: DFSI (2021); NSW DPIE (2022)

5.0 Visual Inspection

A visual inspection of the Project area was undertaken by Melissa Moritz, Umwelt Senior Consultant and Gemma Hopkins, Umwelt Environmental Consultant on 29 July 2022. The primary aim of the visual inspection was to identify and record any existing surface evidence of past-Aboriginal activity and/or historical (non-Aboriginal) heritage items/relics within the Project area.

The following key observations were made during the visual inspection:

- No Aboriginal objects or historical relics were observed during the visual inspection.
- Stone suitable for flaked and/or ground stone artefact manufacture is, at present, absent from the immediate vicinity of the Project area.
- Ground visibility within the proposed geotechnical testing locations was generally low, with grass providing high coverage of the ground surface. However, exposed ground surface was visible at the edges of the vehicle and pedestrian paths. Where visible, ground surface was generally sandy dark eroded soils, with construction rubble (i.e., road base) and modern refuse visible.
- The proposed MW36 and BH92 locations appeared heavily disturbed by previous modifications to the pathways, fences and underground services installed for adjacent residential properties.
- Areas within the north section of Parramatta Park appear to have been subject to lower levels of impact, however regular recreational use and maintenance would have likely resulted in some minor disturbance to surficial archaeological remains, if present.

Photo 5.1 **Approximate Location of BH92 and MW36**

Photo taken looking north across Parramatta Park, towards Park Parade.

Photo 5.2 **Approximate Location of BH92 and MW36**

Photo taken outside the park fence along Park Parade, looking east.

Photo 5.3 Approximate Location of MW34

Looking east towards Domain Creek and Railway Parade from the southern corner of The Paddocks.

Photo 5.4 Approximate Location of MW34

Looking northwest from Domain Creek and Railway Parade.

Photo 5.5 Pedestrian Path in Vicinity of BH05

Photo looking west from between the Billy Hart Memorial and Boer War Memorial.

Photo 5.6 Approximate Location of BH05,

Photo looking northwest towards the Paddocks.

Photo 5.7 Approximate Location of BH05

Photo looking east towards former Governors Bathhouse.

Photo 5.8 Historical Heritage Element Adjacent to BH05

Photo 5.9 Old Government House

Photo taken looking north from near proposed location of MW35

Photo 5.10 Approximate Location of MW35

Photo taken looking south over former Domain.

6.0 Key Findings

The key findings of this assessment are as follows:

- The Project area is located within Parramatta Park, which is on several statutory heritage registers; including the World Heritage List as 'Australian Convict Sites (Old Government House and Domain), and the National Heritage List as 'Old Government House and the Government Domain. Proposed geotechnical testing locations WTP_BH05, GALC-MW54 and MW35 are located within the Buffer Zone of the World Heritage listing.
- The AHIMS search results identified five (5) Aboriginal sites recorded within 100 m of the proposed borehole locations. AHIMS site 45-5-0762 (a culturally modified tree with associated PAD) extends within the 50 m buffer for WTP_BH05. Additionally, GALC-MW35 is located within 100 m of a PAD included on AHIMS (AHIMS site #2856).
- The Project area is identified as being of archaeological sensitivity within the Conservation Management Plan for the Parramatta Park (Parramatta Park Trust, 2020) and the Archaeological Zoning Plan for Parramatta Park (Godden Mackay, 1995). This includes historical archaeological sensitivity associated with the use of the Domain for early agricultural practices, which is mapped across all areas of the proposed works. Archaeological sensitivity for Aboriginal archaeology is mapped in the vicinity of GALC-MW54 which includes The Crescent.
- GALC-MW54 and WTP_BH05 are located within key viewsheds associated with the Old Government House and The Domain. Additionally, these locations are within the vicinity of several significant built heritage elements of the Park, including Old Government House, the former Governors Bathhouse, the Boer War Memorial.

7.0 Impact Assessment

7.1 Aboriginal Heritage

The following provides a summary of the key questions asked as part of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010:10). Should the answer to Question 4 be 'yes', further investigation and impact assessment would be required.

1.Will the activity disturb the ground surface or any culturally modified trees?

Yes, the proposed geotechnical testing locations will include the localised disturbance of extant ground surfaces and extend to bedrock. No impacts are proposed and/or expected to any culturally modified trees located in the vicinity of the proposed borehole locations.

Proceed to Question 2

2a. Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?

The AHIMS database holds records of known Aboriginal sites located within 200 m of the Project area. Searches of the AHIMS database and reference to the relevant site cards confirmed that there are 24 recorded Aboriginal sites, including five (5) which are located within <100 m of the Project area. None of the existing Aboriginal sites noted above lie within the current Project area.

Proceed to Question 2b

2b. Are there any other sources of information of which a person is already aware?

Umwelt has reviewed all available literature and pertinent sources of information pertaining to the known Aboriginal resource of the Project area and surrounds. Parramatta Park, and the wider Parramatta area, has been subject to extensive archaeological investigation. Historical records for the Project area indicate that although the Project area was utilised for the Governors House and domain from 1788, the area remained largely undeveloped. Initial colonial agricultural land uses gave way to public recreation, which has prevented significant impacts from urbanisation occurring in the Project area as can be seen elsewhere in the Parramatta region. Extensive vegetation clearance associated within the agricultural use of the Project area would have resulted in areas of significant modification to the natural soil profiles within the Project area. However, the presence of Aboriginal sites located within Parramatta Park indicates that although some surface impacts to natural soils have occurred, there is still potential for artefact-bearing natural soils to remain within landscape. This has been indicated through archaeological investigations in the vicinity of the Project area. In particular, where natural soil profiles containing Aboriginal objects were encountered in the Gardens Precinct of Parramatta Park (GML Heritage Pty Ltd, 2016).

Proceed to Question 2c

2c. Are there any landscape features that are likely to indicate presence of Aboriginal objects?

As identified above, the Project area is located within 200 m of the Parramatta River and the Domain Creek. Both watercourses would have provided valuable resources for Aboriginal peoples occupying the area. Parts of the Project area are also located on the ridgeline of the Crescent, overlooking the Parramatta River and above/outside of the flood zone of the nearby river and creek.

3. Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and/or can the carrying out of the activity at the relevant landscape features be avoided?

No harm would occur to any Aboriginal objects listed on AHIMS from the proposed boreholes. The boreholes are generally located in areas with some potential to contain Aboriginal objects, however the likelihood on encountering an Aboriginal object within the footprint of the proposed works (approximately 250 mm diameter per each borehole) is low.

However, it is not possible to relocate the proposed boreholes to areas where there is nil potential to harm Aboriginal objects as the proposed geotechnical testing locations are designed to gather key geotechnical data and monitoring wells for tunnelling associated with the SMW alignment. The location of these boreholes is required to be above the alignment of the tunnels and cannot be moved outside of areas with the potential to contain Aboriginal objects. Additionally, the data cannot be gathered in a non-ground disturbing manner which would prevent the potential for harm to occur to recorded or unknown Aboriginal objects.

Proceed to Question 4

4. Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

Yes, the desktop assessment identified that there is potential for Aboriginal objects to be located in the proposed boreholes. Existing archaeological evidence confirms the presence of Aboriginal sites located within the Parramatta Park environs, including five (5) Aboriginal sites located within 100 m of the current Project area. Other environmental context indicators suggest the likelihood of Aboriginal objects being located in the Project area include the proximity to Parramatta River and the Domain Creek and the resources offered by the Cumberland Plain woodlands.

Historical development of the Project area commenced with the clearing of native vegetation and establishment of The Governors domain and associated agricultural land use prior to the transition to recreation with the establishment of Parramatta Park for the public. This land use would have resulted in impacts to the natural soils; however impacts would have been shallow and not resulted in the total removal of all natural soils with the potential to retain Aboriginal objects. Visual inspection undertaken as part of this assessment identified that generally, the Project area had been subject to limited prior disturbances. The locations of GALC-MW35, WTP_BH05 and GALC-MW34 are situated within the vicinity of several known Aboriginal sites and have similar environmental context to indicate further Aboriginal objects could exist within the footprint of the boreholes.

The southwestern section of the Project area, where GLAC-BH92 and GALC-MW36 are proposed, is likely to have been subject to higher levels of disturbance when compared to other areas of the Project area. The installation of underground services, development and maintenance of the former golf course, realignment of the footpaths and other public domain upgrades are likely to have resulted in more substantial impacts following the cessation of agricultural use in the area, however it is unlikely to have resulted in the total removal of all natural soils with the potential to contain Aboriginal objects.

7.2 Historical (Non-Aboriginal) Heritage

7.2.1 Impact Assessment Methodology

In order to prepare a comparative review of the impact assessment for the proposed geotechnical works against the approved impacts of the Project, this assessment of impacts has been undertaken using the methodology set out in the *Sydney Metro West Concept and Stage 1 (major civil construction between Westmead and The Bays) Environmental Impact Statement (EIS) Technical Paper 3 (non-Aboriginal Heritage)* (Artefact, 2020). This methodology was prepared with reference to the *NSW Heritage Manual* (NSW Heritage Office 2002). Impact to heritage assessed for both impact type, and the associated magnitude or severity of impacts. The types of impact as identified in the EIS Technical Paper 3 are outlined in **Table 7.1**, and the ranking of magnitude used is defined in **Table 7.2**.

Table 7.1 Terminology for Assessing Type of Heritage Impact

Type	Definition
Direct Impact	Impact would result in the demolition or alteration of fabric of heritage significance or significant archaeological remains.
Indirect Impact	Impact would result in changes to the setting or curtilage of heritage items or places, historical streetscapes and landscapes, visual amenity or views.
Potential Indirect Impact	Impacts would result from vibration, subsidence, architectural noise treatment and demolition of adjoining structures.

© information within Table 7.1 sourced from Artefact Heritage Pty Ltd, 2020.

Table 7.2 Terminology for Assessing Magnitude of Heritage Impact

Magnitude	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historical building elements, key historic landscape features, or significant archaeological material, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	This would include actions involving the modification of a heritage item, including altering the settlement of a heritage item or landscape, partially removing archaeological resources or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological resources or the setting of a historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

© information within Table 7.2 sourced from Artefact Heritage Pty Ltd, 2020.

7.2.2 Assessment of Impacts

The impacts of the proposed boreholes and monitoring wells on the historical heritage of Parramatta Park are outlined in **Table 7.3**. This includes discussion of impacts on significant elements and viewsheds within the Park as well as potential impacts to areas identified as having historical archaeological potential.

Table 7.3 Assessment of Non-Aboriginal Heritage Impacts

Scope ID	Built Heritage Impacts	Impacts to Historical Archaeology
GALC-MW35	This monitoring well is proposed within the Domain Precinct of Parramatta Park, approximately 52 m from the southern wall of the Old Government House, and adjacent to the alignment of Philips Walk, one of the significant historical access routes within the park. The monitoring well and associated installation works are limited to the open grassed area in front of Old Government House and will not require the interaction or impact to any significant fabric of this historical heritage element within Parramatta Park. Once installed, the monitoring well will be predominantly below ground surface, with only the access cap visible, and will be accessed periodically throughout the life of the Project. This will be set at ground level, almost flush with the surrounding grass surface. The monitoring well, although a permanent introduction to the cultural landscape of Parramatta Park, will not be noticeable unless standing immediately on or adjacent to its location, and as its visible component will sit at ground level, it will not change or impact on the views to Old Government House from the South, nor on the significant view sheds available across The Domain precinct. No direct or indirect impacts would result from the chosen location for GALC-MW35.	The location of this monitoring well was identified in the CMP (2020) as having archaeological sensitivity associated with the early colonial botanical and astronomical research and early colonial and vice-regal structures associated with the development and historical uses of Old Government House and its immediate setting. The installation of GALC-MW35 would be limited to the footprint of the borehole and its immediate surrounds. This would result in localised ground disturbance (<1 m^2) within the area of archaeological potential, to an approximate depth of 40 m. Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological resource within The Domain precinct of the Park. The works would therefore result in a minor heritage impact.
WTP_BH05	This borehole is proposed the junction of three (3) precincts within Parramatta Park, including The Domain, The Crescent and The Paddocks. It is located approximately 40 m west of the Boer War Memorial and 70 m northwest of the former Governors Bathhouse, in a small triangular section of open garden between Railway Parade and two (2) pedestrian access paths.	As outlined in the CMP (2020), this borehole is located in an area of identified historical archaeological potential for remains associated with the development of agriculture in Australia. No structural remains associated with former buildings are indicated to be present in this location, and archaeological remains would be limited to remnants of the agricultural landscape.

Scope ID	Built Heritage Impacts	Impacts to Historical Archaeology
	The location of the borehole is separated from the nearby significant elements of the Park by open grassed areas and the pedestrian access path. The borehole would not require changes to or intervention with any significant elements within the Park. Once the works are complete, the location of the borehole will be backfilled and reinstated with topsoil and grass. The works will not result in any changes to the setting and character of the Park, nor will it introduce any new items into the park landscape. No or indirect impacts would result from the WTP_BH05.	The proposed diameter of the borehole is 125 mm and the associated site establishment works and drilling would result in ground disturbance of <1 m^2, to a depth of 40 m. The resulting ground disturbance could result in the truncation or partial removal of a localised section of any historical archaeological resource that is located within the footprint of the proposed borehole, and not require the total removal or significant impact to the area of archaeological potential within Parramatta Park. The works would therefore result in a minor heritage impact.
GALC-MW34	This borehole and subsequent monitoring well is located in The Paddocks precinct of Parramatta Park. The works are located a significant distance from the significant historical elements of the Park, such as Old Government House and the Dairy buildings. The drilling of the borehole and installation of the monitoring well cover will not require any changes to or intervention with significant elements with Parramatta Park. Upon completion of the works, the monitoring well will be primarily below ground level, with the cover sitting flush with the existing ground surface. This will largely be unnoticeable within the landscape, unless standing directly on or immediately adjacent to the monitoring well. No changes to the setting or characteristics of The Paddocks Precinct, or the wider Parramatta Park cultural landscape would result from the proposed works. No direct or indirect impacts would result from the installation of GLAC-MW34.	This borehole and monitoring well are located in an area of archaeological potential as identified in the CMP (2020). This archaeological potential is associated with the early development of agriculture in Australia and historical research has indicated than no significant structural remains were recorded in the vicinity of this proposed borehole/monitoring well. The installation of GALC-MW34 would be limited to the footprint of the borehole and its immediate surrounds. This would result in localised ground disturbance (<1 m^2) within the area of archaeological potential, to an approximate depth of 35 m. Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological resource within The Paddocks precinct of the Park. The works would therefore result in a minor heritage impact.
GALC-MW36 GALC-BH92	The borehole and monitoring well GALC-MW36 and GALC-BH92 are located on the south side of the railway that transects Parramatta Park, in the Mays Hill Precinct, and are separated visually and physically from the significant historical elements of the Park such as the Old Government House, the Crescent and the Dairy.	The Mays Hill precinct of Parramatta Park was identified in the CMP (2020) as having archaeological potential. This is associated with the archaeological remains of the early agriculture in Australia. The installation of the borehole and monitoring well proposed in the northwest corner of Mays Hill precinct. would be limited to the footprint of the borehole and monitoring well, and its immediate surrounds. This would result in localised ground disturbance within the area of archaeological potential, to an

Scope ID	Built Heritage Impacts	Impacts to Historical Archaeology
	The proposed works will not require any impacts or alterations to significant fabric within the park. Borehole GALC-BH92 will be backfilled and re-seeded with grass upon completion and will not result in any changes to the setting or characteristic of the Mays Hill precinct or the wider Parramatta Park cultural landscape. The monitoring well will primarily be located below ground level, with the cover installed flush with the ground surface. This will largely be unnoticeable within the landscape, unless standing directly on or immediately adjacent to the monitoring well. No direct or indirect impacts would result from the installation of GALC-MW36 and GALC-BH92.	approximate depth of up to 40 m (up to 26 m depth is proposed for the monitoring well). Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological resource within The Mays Hill precinct of the Park. The works would therefore result in a minor heritage impact.

7.2.3 Material Threshold Policy

As outlined in **Section 2.2.2.1**, the materials threshold policy is applied on the SMW WTP in accordance with MCoA D13, as well as the best practice approach to managing impacts to items of State heritage significance. This policy seeks to understand whether the degree of impact of a proposed action or change to a State heritage item would materially affect the heritage significance of the place, irrespective of the degree of change proposed (Heritage NSW, Department of Premier and Cabinet, 2020).

The boreholes and monitoring wells proposed within Parramatta Park and therefore within the curtilage of the State heritage listing for Parramatta Park and Old Government House are placed generally within discreet open grassed spaces and will not result in the introduction of new structural elements above ground level. The installation of these boreholes would also not require the removal of, or interaction with any significant fabric of Parramatta Park.

The actions required to install the five (5) boreholes would have the potential for minor but localised impacts to the potential historical and Aboriginal archaeological remains that have been identified within the Park. These impacts, when considered in the context of the broader heritage significance of Parramatta Park, would be of little to no impact on the overall heritage values and would have no material effect on the heritage item. Parramatta Park would continue to meet the threshold for State significance under the NSW State Heritage Criteria.

7.3 Summary of Impacts

7.3.1 Approved Project Impacts

As identified in **Section 1.2**, the Project was granted SSI approval under SSI-1008. This included the approval of the potential impacts to heritage as identified within the EIS, including the accompanying Aboriginal and non-Aboriginal technical papers and subsequent modification reports. The approved project impacts for the WTP included in the EIS were:

- Construction footprint of the station box at Westmead, Parramatta and Sydney Olympic Park.
- Construction footprint of Clyde Maintenance and Services Facilities.
- Construction footprint of the Rosehill Dive Site (connection to the CMSF).
- Power supply upgrade routes.
- The EIS did not include any surface works within the boundaries of Parramatta Park and associated heritage listings (including the World heritage buffer zone and National heritage curtilage) and overall were not assessed as having any potential direct impacts on the heritage values of Parramatta Park, nor result in any harm to Aboriginal objects. The tunnel alignment runs below the southern section of Parramatta Park however no indirect impacts associated with tunnelling and operation of the tunnel were identified within the EIS and associated Technical Paper 3 (Artefact 2020).
- The closest components of the Project to the proposed boreholes include the Westmead Station construction site and the Parramatta Station construction site, both of which are less than 700 m from the Project area. The impacts of these two (2) sites were included in the EIS and Technical Paper 4, and can be used to understand the relative heritage impacts of the Project in a local context.
- Westmead Metro Station construction site is located approximately 190 m west from the closest proposed borehole. This was assessed in the EIS as having a neutral direct and minor indirect impact on the heritage items in the vicinity of the site. No potential to harm Aboriginal objects was identified for the proposed works at Westmead Metro Station construction site.
- The Parramatta Station construction site (located 600 m east of the Project area) was assessed as having varied heritage impacts on the listed items and archaeological remains present at the site. Impacts to listed heritage items ranged from minor to neutral impacts, however, impacts to the archaeological resource at the site was assessed as being major. An Aboriginal site (AHIMS 45-6-3582) is also located within the footprint of the Parramatta Metro Station construction site. The EIS and Technical Paper 4 Aboriginal Cultural Heritage Assessment (Artefact 2020) prepared for the project identified that the proposed works would result in significant impacts to this PAD, and harm was not able to be avoided due to the extent of ground disturbance required for the completion of the construction activities at the Parramatta Metro Station construction site.

7.3.2 Consistency Assessment

As identified above, the proposed geotechnical testing locations within Parramatta Park have not previously been assessed as part of the approved Project impacts. The proposed borehole locations are located within <100 m of five (5) Aboriginal sites recorded on AHIMS, and (as identified in **Section 7.1**) are located in areas with the potential to contain previously unrecorded Aboriginal objects. However, based on a review of the environmental context and previous disturbances in the area (as identified in **Section 7.1**) the likelihood of encountering Aboriginal objects is overall considered to be low.

A review of the archaeological context of the Project area and environs suggest that the types of archaeological remains likely to be in the footprint of the proposed boreholes would be of an ephemeral nature only and as such, any minor disturbances resulting from the proposed geotechnical works would constitute little to no overall impact to the heritage values of Parramatta Park.

The installation of three (3) monitoring wells will introduce new elements to the Parramatta Park, however the scale and nature of the works would not result in any changes to the character or setting of Parramatta Park in the proposed locations, nor would they result in any impacts on the significant views of Old Government House and other key landmarks within Parramatta Park.

Additionally, the proposed works would not result in any impact to the overall heritage significance of Parramatta Park, Old Government House and the Domain at a World, National or State level.

7.3.3 Conclusion

The approved Project impacts, as set out within the EIS and associated technical papers and subsequent modifications, were limited to the assessment of impacts within the construction sites and immediate vicinity of the SMW WTP Station sites and Clyde Stabling and Maintenance Facility site (Artefact, April 2020). No direct or indirect impacts were assessed for the Project on the heritage significance of Parramatta Park and Old Government House.

Although the works within the curtilage of Parramatta Park were not assessed within the EIS or associated technical papers (Artefact 2020), the works are consistent with Condition D13 of the MCOA for the Project, as the proposed geotechnical investigations will not 'destroy, modify or otherwise affect any Heritage item' not included in the Project approval.

As noted in the consolidated consent for SSI-10038 the term 'affect' in Condition D13 means any impact above "little to no impact" as defined in the Material Threshold Policy (Heritage NSW, 2020). The proposed geotechnical investigations have been assessed with respect to this requirement and will have "little to no impact" and thus comply with Condition D13.

8.0 Management Recommendations

In light of the above key findings presented in **Section 6.0** and impact assessment presented in **Section 7.0**, this Aboriginal Heritage and Historical (non-Aboriginal) Heritage Impact Assessment provides the following management recommendations:

Recommendation 1. Non-Destructive Digging (NDD) for the purposes of locating underground utilities should be undertaken with a suitably qualified archaeologist present to ensure the works are completed appropriately, and to ensure no unidentified Aboriginal objects or historical archaeological remains are impacted by the work, should they unexpectedly be located within the borehole footprint.

Recommendation 2. If, in the unlikely event that Aboriginal objects or historical relics is located during the works, all works in the area must cease immediately and the Sydney Metro Unexpected Heritage Finds Procedure (SM-18-00105232) must be implemented.

Recommendation 3. All contractors and GLC personnel undertaking the proposed geotechnical works within Parramatta Park should be made aware of the heritage values of the Parramatta Park, and the requirements of the Project approvals and HMP to prevent adverse impacts or damage to any heritage item or significant elements within Parramatta Park.

Recommendation 4. All vehicles and plant should be parked on sealed surfaces to prevent impacts to the ground surface within the vicinity of the proposed works. Any equipment that is required to be driven or operated on grassed areas should only be manoeuvred on track matts in dry conditions to manage any ground disturbance associated with these movements.

Recommendation 5. Any changes to the locations and methodology for any boreholes or monitoring wells may require further assessment. Should any changes to the scope of works outlined in this report be identified, no works should be undertaken prior to review of the locations by the GLC environmental managers and heritage specialist.

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9.0 References

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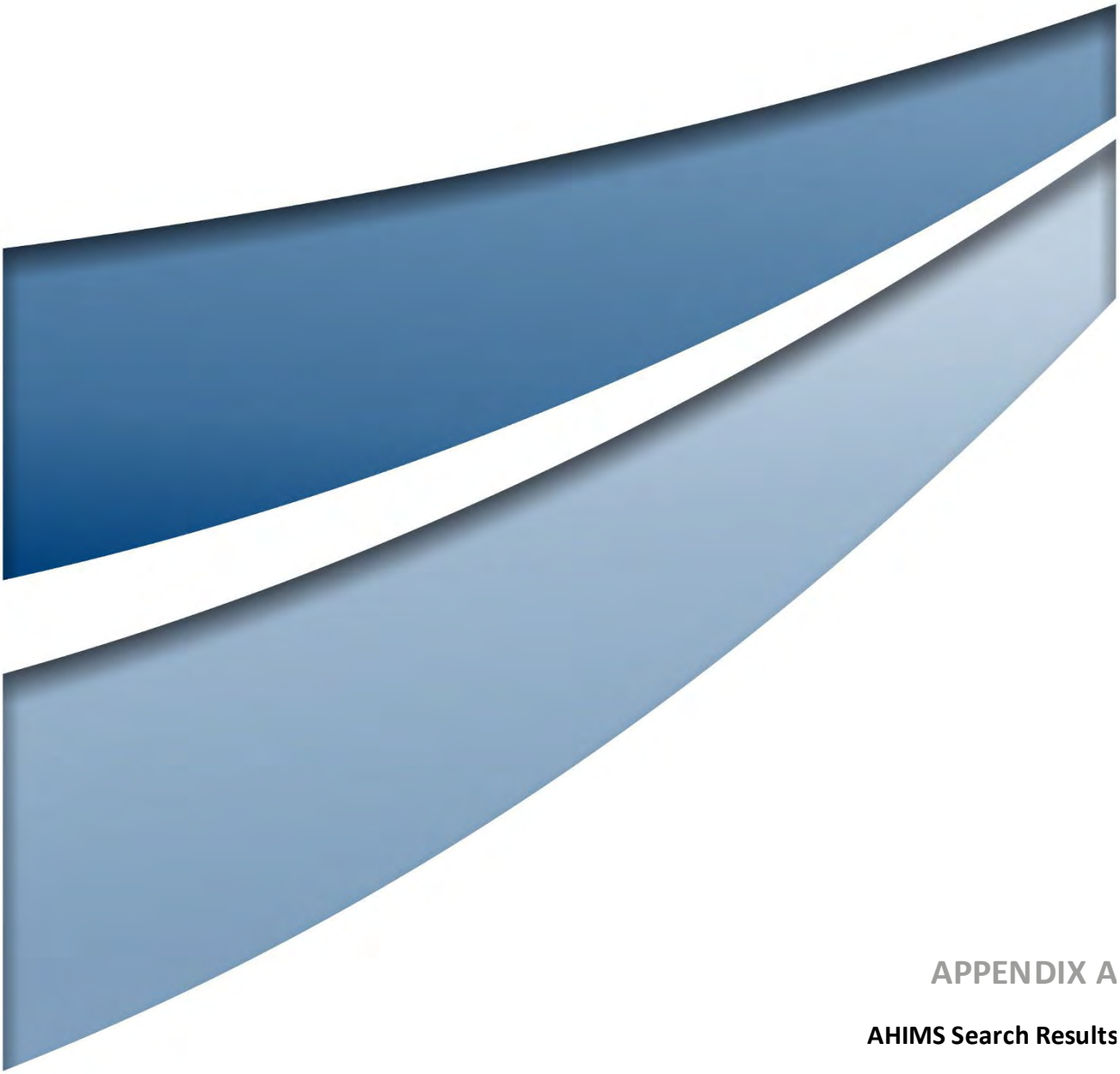

APPENDIX A

AHIMS Search Results

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-5-2465	Parramatta Regional Park (IF3)	GDA	56	314524	6256879	Open site	Partially Destroyed	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	Doctor.Jillian Comber,J Steel					**Permits**	3822	
45-5-2463	Parramatta Regional Park (IF1)	GDA	56	314462	6257627	Open site	Valid	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	J Steel					**Permits**	3994	
45-5-2464	Parramatta Regional Park (IF2)	GDA	56	314400	6257619	Open site	Valid	Artefact : -	Isolated Find	102196
	Contact	**Recorders**	J Steel					**Permits**		
45-6-1523	George St Parramatta;Family Law Courts;	AGD	56	314950	6256450	Open site	Valid	Artefact : -	Open Camp Site	1809,102196,103782
	Contact	**Recorders**	Val Attenbrow,Doctor.Edward Higginbotham					**Permits**		
45-5-1065	Parra Park 3;PP 3;	AGD	56	314620	6257620	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2554	Elizabeth Farmhouse	AGD	56	316420	6255700	Open site	Valid	Artefact : -	Open Camp Site	102196,103782
	Contact	**Recorders**	Michael Guider					**Permits**	2928	
45-6-2559	Sydney Turf Club Carpark;STC Carpark;	AGD	56	316900	6256020	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2570	Kissing Point Rd	AGD	56	318820	6258140	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2578	Collett Park;	AGD	56	316680	6257140	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-5-1110	Redbank;Northmead;	AGD	56	314020	6258060	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-5-0864	Governors Bathhouse;	AGD	56	314340	6256750	Open site	Partially Destroyed	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**	3822	
45-5-0277	Cumberland Oval;Parramatta;	AGD	56	314588	6257260	Open site	Destroyed	Modified Tree (Carved or Scarred) : -	Scarred Tree	223,260,1018,102142,102196
	Contact	**Recorders**	Cook					**Permits**		
45-5-0762	Parramatta Park	AGD	56	314320	6256950	Open site	Partially Destroyed	Artefact : -, Modified Tree (Carved or Scarred) : -	Open Camp Site,Scarred Tree	102142,102196
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	
45-6-2627	HP-1	AGD	56	315850	6255210	Open site	Valid	Artefact : -		102196
	Contact	**Recorders**	Mick Leon					**Permits**		

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-2648	Charles/George 1	GDA	56	315690	6256470	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99538,102196
	Contact	**Recorders**	Doctor.Jo McDonald,EMM Consulting - St Leonards - Individual users,Curio Projects					**Permits**	1433,1682,2176,2240,2353,3049,3509,4662	
45-5-2856	Parramatta Park Macquarie Entrance PAD	AGD	56	314500	6256550	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		98738,103133
	Contact	**Recorders**	Dominic Steele Archaeological Consulting					**Permits**	1647,3822	
45-6-2678	SSP1 (formerly Smith Street PAD)	AGD	56	315330	6256150	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		99518,102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1848,2561	
45-6-2668	Argyle St	AGD	56	315200	6256060	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1764,2155	
45-6-2669	Kendall Street, Harris Park	AGD	56	315525	6256150	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Jim Wheeler					**Permits**	1767	
45-6-2673	RTA-G1	GDA	56	315842	6256510	Open site	Valid	Artefact : -		100552,102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1841,2176,3050,3509	
45-6-2679	Parramatta Children's Court	AGD	56	314900	6256600	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**	1850,1973,2117,3847	
45-6-2738	James Ruse Reserve Open Camp 1	AGD	56	316000	6256000	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Jim Wheeler					**Permits**	2018,2187	
45-6-2686	Civic Place PAD	GDA	56	315130	6256450	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99666,99791,103115,103782
	Contact	**Recorders**	Doctor.Jo McDonald,Niche Environment and Heritage,Niche Environment and Heri					**Permits**	1960,3749,3890,3897,3983,3988,4044,414	
45-6-2751	Marsden St Carpark	AGD	56	314900	6256350	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**	2243	
45-6-2739	PADUNknown	AGD	56	314950	6256700	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Haglund and Associates					Permits		
45-6-2746	Old Hospital Site Parramatta Health Services Precinct	AGD	56	314950	6256650	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		99798,100551,100558,102196,103782
	Contact	Recorders	Ms.Laila Haglund					Permits	2160,2507	
45-6-2741	Parramatta Transport Interchange PAD	AGD	56	315450	6256250	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99438,99497,102196,103782
	Contact	Recorders	Doctor.Susan (left ahms) Mcintyre-Tamwoy					Permits	2121,4767	
45-5-3186	Marsden Street	GDA	56	314800	6256315	Open site	Valid	Artefact : 4		102196,103782
	Contact T Russell	Recorders	Doctor.Edward Higginbotham					Permits		
45-6-2756	Parramatta Rehabilitation Centre (formerly O'Connell St PAD)	GDA	56	314950	6256850	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		102196,103782
	Contact	Recorders	Ms.Laila Haglund,Doctor.Alan Williams,EMM Consulting - St Leonards - Individual u					Permits	2317,2414,2511,4797	
45-6-2795	150 Marsden Street Parramatta PAD	AGD	56	314955	6256480	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		102196,103782
	Contact T Russell	Recorders	Austral Archaeology - Wollongong					Permits	2404	
45-6-2863	Cumberland Press Site	GDA	56	315913	6256448	Open site	Valid	Artefact : 89		103782
	Contact	Recorders	Ms.Laila Haglund,Ms.Tory Stening					Permits	2865,3307,3509,3816	
45-6-2893	95-101 George St (GSP AD)	GDA	56	315720	6256570	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		101078,103782
	Contact	Recorders	Megan Mebberson					Permits	3509	
45-6-2933	Belmore Park	GDA	56	315500	6258293	Open site	Valid	Artefact : -		
	Contact	Recorders	Michael Guider,Kelleher Nightingale Consulting Pty Ltd,Miss.Madeline Harding					Permits		
45-5-3630	Macquarie St PAD	AGD	56	314800	6256500	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		103782
	Contact	Recorders	Comber Consultants Pty Limited,Comber Consultants Pty Limited					Permits	3107,3302	
45-6-2950	Macquarie St PAD 2	GDA	56	315835	6256410	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		102144,103782
	Contact	Recorders	Doctor.Jillian Comber,Comber Consultants Pty Limited					Permits	3238,3366	
45-6-2976	George St PAD 1	GDA	56	315650	6256690	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509,4766,4767	

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-2977	Macquarie St PAD 3	GDA	56	315090	6256650	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509,4767	
45-5-4097	O'Connell St PAD1	GDA	56	314900	6256695	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509	
45-6-2978	41 Hunter Street PAD	GDA	56	315030	6256450	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Mr.Alexander Beben					Permits	3419	
45-6-3108	42 Bridge Street Rydalmere PAD	GDA	56	317670	6256778	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	GML Heritage Pty Ltd - Surry Hills,Ms.Sally MacLennan					Permits		
45-6-3102	Phillip Street PAD 1	GDA	56	315581	6256801	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Mr.Dominic Steele					Permits	3755	
45-6-2988	7-9 Victoria Road Parramatta	GDA	56	315502	6257233	Open site	Valid	Artefact : 9		
Contact		Recorders	GML Heritage Pty Ltd - Surry Hills,Ms.Anita Yousif					Permits	3488	
45-6-3068	GS PAD 1 184-188 George Street	GDA	56	315899	6256375	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		103962
Contact		Recorders	Mr.Dominic Steele					Permits	3584	
45-6-3065	PHILLIP ST PAD 1	GDA	56	315500	6256675	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Mr.Dominic Steele					Permits		
45-6-3124	330 Church St Artefact Scatter	GDA	56	315330	6256965	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Doctor.Julie Dibden					Permits		
45-6-3151	UWS Rydalmere OS 1	GDA	56	317400	6257004	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Benjamin Streat					Permits	3800	
45-6-3118	Clay Cliff Creek Levee	GDA	56	315801	6256294	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		102992,102997,102998
Contact		Recorders	Ms.Fenella Atkinson					Permits	3788	

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3134	Lennox Bridge Car Park PAD	GDA	56	315209	6256970	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Felicity Barry					**Permits**	3797,4094,4537,4767	
45-6-3131	River Road West	GDA	56	316650	6256450	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -, Artefact : -		102338
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson,Miss.Cora					**Permits**	3734,4657,4825	
45-5-4630	Parramatta Leagues Club PAD	GDA	56	314974	6257483	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		103589
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Doctor.Tim Owen					**Permits**	3958	
45-5-4530	Parramatta RSL PAD	GDA	56	314810	6256690	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -, Hearth : -		104179
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim O					**Permits**	3819,3853,3935,4364	
45-6-3159	Catholic Diocese Parramatta PAD	GDA	56	315120	6257259	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		104276
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Miss.Diana Cowie,Mrs.Laressa					**Permits**	4300	
45-5-4533	Paddocks Playground Parra Park	GDA	56	314323	6257378	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	3822	
45-5-4534	Parramatta Park - Location C	GDA	56	314568	6257473	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Annie Bickford					**Permits**		
45-5-4535	Parramatta Park - Location E	GDA	56	314539	6256846	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4536	Parramatta Park - Location G	GDA	56	314504	6256700	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4537	Parramatta Park - Location H	GDA	56	314199	6257357	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	
45-5-4538	Parramatta Park - Location J	GDA	56	314351	6257676	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4539	Parramatta Park - Location K	GDA	56	314460	6257823	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4540	Parramatta Park - Location I	GDA	56	314260	6257448	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-5-4542	Parramatta Park - Location L	GDA	56	314542	6257709	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4543	Parramatta Park - Location N	GDA	56	314693	6257737	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4544	Parramatta Park - Location O	GDA	56	314725	6257680	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4545	Parramatta Park - Location S	GDA	56	314170	6256851	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Dominic Steele					**Permits**		
45-5-4546	Parramatta Park - Location D	GDA	56	314555	6256864	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4547	Parramatta Park - Location F	GDA	56	314304	6257230	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4541	Parramatta Park - Location M	GDA	56	314608	6257586	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-6-3158	Robin Thomas Reserve	GDA	56	316100	6256300	Open site	Partially Destroyed	Aboriginal Resource and Gathering : -, Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent H					**Permits**	4439	
45-6-3157	Harris St Footpath	GDA	56	316013	6256461	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	4439,4900	
45-6-3193	Riverbank Square PAD	GDA	56	315405	6256895	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**		
45-6-3195	Cumberland Hospital East	GDA	56	315022	6258090	Open site	Valid	Potential Archaeological Deposit (PAD) : -		103863
	Contact	**Recorders**	Ms.Jillian Comber					**Permits**	3932,4900	
45-6-3180	21 Hassall Street	GDA	56	315761	6256247	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103758
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**	3906,3975	
45-5-4895	Old Kings Oval Artefact Scatter 1	GDA	56	314665	6257231	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd - Sydney,Artefact - Cultural Heritage Management - Pyrm					**Permits**	4307,4461	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3232	Test recording	GDA	56	315051	6257106	Open site	Deleted	Artefact : -		
	Contact	**Recorders**	DPIE - Armidale,Mr.Stewart Watters					**Permits**		
45-6-3312	PLR AFT 1	GDA	56	316105	6256465	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3313	PLR AFT 2	GDA	56	316305	6256340	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3222	Old Kings School AS1	GDA	56	315026	6257139	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Ngaire Richards					**Permits**		
45-6-3214	Wigram & Hassall St AS	GDA	56	315825	6256231	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Mr.Alistair Hobbs					**Permits**	4043	
45-6-3503	32 Smith Street	GDA	56	315536	6256745	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103963,103964,103965
	Contact	**Recorders**	AMAC Group P/L,Mr.Benjamin Streat					**Permits**	4268,4347	
45-6-3360	Parramatta Riverside PAD 1	GDA	56	315172	6256924	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Sydney,Biosis Pty Ltd - Wollongong,Mr.James Cole,Mrs.Samantha K					**Permits**	4250,4379	
45-6-3625	Granville MPC PAD	GDA	56	316175	6254420	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		104230
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson					**Permits**	4352	
45-6-3692	VOC IF1	GDA	56	315044	6257297	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Ms.Jennifer Norfolk					**Permits**	4900	
45-6-3630	Hassall St PAD	GDA	56	315587	6256244	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4412,4527	
45-5-4942	Parramatta RSL Artefact Scatter 1 (PRSL AS-01)	GDA	56	314839	6256683	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Artefact - Cultural Heritage Ma					**Permits**	4235,4949	
45-6-3679	Stage One PAD	GDA	56	315454	6256795	Open site	Not a Site	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Ms.Clare Anders					**Permits**	4522	

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3582	Macquarie Street PAD	GDA	56	315306	6256602	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Alandra Tasire,Comber Consultants Pty Limited,Artefact - Cultural Heritage M					**Permits**		
45-5-5126	Cumberland West	GDA	56	314493	6257901	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4363,4468	
45-6-3495	116 Macquarie St Parramatta	GDA	56	315700	6256475	Open site	Valid	Potential Archaeological Deposit (PAD) : 1, Artefact : -		103782
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Alandra Tasir					**Permits**	4607,4651	
45-5-5010	Parramatta Park PAD_1	GDA	56	314400	6256580	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Mr.Samuel Rich					**Permits**	4256,4698,4889	
45-5-5251	Western Sydney Stadium	GDA	56	314884	6257269	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Comber Consultants Pty Limited					**Permits**		
45-6-3767	85-97 Macquarie St	GDA	56	315235	6256513	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Tory Stening					**Permits**	4627,4681	
45-6-3702	Smith St PAD1	GDA	56	315480	6256713	Open site	Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Jillian Combe					**Permits**	4513,4756	
45-6-3764	Belmore Park ISO 1	GDA	56	315593	6258267	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Ms.Jennifer Norfolk					**Permits**		
45-6-3837	Baludarri Drive PAD	GDA	56	316635	6256597	Open site	Not a Site	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent Heritage Pty Ltd - Pyrm					**Permits**	4657	
45-6-3801	APHS Stone and Glass Artefacts	GDA	56	315650	6256471	Open site	Partially Destroyed	Artefact : -, Hearth : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim O					**Permits**	4808	

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3827	Clyde PAD 01	GDA	56	317121	6254846	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Artefact - Cultural Heritage Ma					**Permits**		
45-6-3818	St Johns Cathedral Background Artefact Scatter	GDA	56	315165	6256458	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Alan Williams,EMM Consulting - St Leonards - Individual users					**Permits**	4702	
45-5-5472	PLR CHE Area	GDA	56	314724	6258051	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-3894	PLR Church St PAD and Artefacts	GDA	56	315241	6256871	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3895	PLR Macquarie St PAD	GDA	56	315787	6256398	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-3896	PLR George St PAD	GDA	56	316497	6256288	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3897	PLR RTR Artefacts and PAD	GDA	56	316017	6256441	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-5-5473	PLR AT14	GDA	56	314592	6258005	Open site	Valid	Artefact : -, Hearth : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-4048	Phillip St East PAD	GDA	56	315691	6256742	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4981	
45-6-4053	87-91 George St PAD	GDA	56	315633	6256560	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Urbis Pty Ltd - Angel Place L8 123 Pitt Street,Mr.Owen Barrett					**Permits**		

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-4015	Church St PAD-1	GDA	56	315118	6256622	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats,Mrs.S					**Permits**	4960	
45-6-3992	PPS PAD 1	GDA	56	315168	6256871	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4906	
45-6-4063	The Albion Hotel	GDA	56	315977	6256462	Open site	Valid	Potential Archaeological Deposit (PAD) : -		105061
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Agata Calabrese					**Permits**		

**** Site Status**

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

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umwelt
Environmental & Social
Consultants

Umwelt (Australia) Pty Limited
T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

Appendix D – Parramatta Streetscapes Heritage Impact Assessment

umwelt
Environmental & Social Consultants

GAMUDA Australia

SYDNEY METRO WEST WESTERN TUNNELLING PACKAGE

Aboriginal and non-Aboriginal Heritage Impact Assessment – Parramatta Streetscape Boreholes and Monitoring Wells

DRAFT

January 2023

SYDNEY METRO WEST WESTERN TUNNELLING PACKAGE

Aboriginal and non-Aboriginal Heritage Impact Assessment – Parramatta Streetscape Boreholes and Monitoring Wells

DRAFT

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Gamuda Australia Lang O'Rourke Consortium

Project Director: Nathan Baker
Project Manager: Thomas Buchan
Technical Director: Tim Adams
Technical Manager: Melissa Moritz

Report No. 22052/R19
Date: January 2023

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
01	Luke Wolfe	5 January 2023	Nathan Baker	9 January 2023

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Appendices

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was engaged by Gamuda Australia Lang O'Rourke Consortium (GLC) to undertake a combined Aboriginal and Historical (non-Aboriginal) Heritage Impact Assessment for the proposed geotechnical borehole investigations for the Sydney Metro West Western Tunnelling Package (hereafter 'the Project') and to inform the Consistency Assessment being prepared for the Detailed Site Investigations (DSI) required for Phase F — Western Tunnelling Works.

This Aboriginal and Historical (non-Aboriginal) Heritage Impact Assessment report documents the results of Umwelt's assessment and has been compiled with general reference to the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW 2010* (Department of Environment, Climate Change and Water NSW [former], 2010). This code was developed to assist proponents in exercising due diligence when carrying out activities that may result in harm to Aboriginal objects. Where historical (non-Aboriginal) heritage matters are assessed in this report, Umwelt have referred to *Statements of Heritage Impact* (Heritage Office and Department of Urban Affairs and Planning [former], 1996)

1.1 The Proponent

The proponent for this assessment is **Gamuda Australia Lang O'Rourke Consortium** (GLC) (ABN: 27 632 738 768), a joint venture tasked with delivering the Western Tunnelling Package (WTP) component of the Sydney Metro West (SMW) project on behalf of the New South Wales Government.

1.2 The Project

GLC propose to undertake geotechnical investigations above the tunnel alignment of the western portion of the Sydney Metro West – Westmead to the Bays to understand groundwater conditions and inform the design for the tunnel. The Project will comprise the advancement of 43 boreholes across strategic locations between Westmead and Sydney Olympic Park. A selected series of the boreholes will be converted into temporary monitoring wells for the purposes of monitoring groundwater fluctuations.

A preceding preliminary heritage and ecological constraints assessment undertaken by Umwelt in 2022 was used to categorise the 43 boreholes sites into low, moderate and high risk sites, which was then used to inform the Consistency Assessment/s for the geotechnical testing locations between Westmead and Sydney Olympic Park for the Detailed Site Investigation/s (DSI). This preliminary assessment identified four of the 43 locations within the Parramatta Central Business District (CBD) environs as representing a 'high' risk to historical and/or Aboriginal cultural heritage values based on the initial desktop review of environmental and heritage/archaeological constraints.

It is noted that the majority of the proposed geotechnical testing locations are located outside the approved SMW surface construction site boundaries (but in the vicinity of the tunnelling alignment). A targeted assessment of the 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 the geotechnical investigation locations are subject to the assessment undertaken in Umwelt's Consistency Assessment (2022). The Consistency Assessment examined the proposed geotechnical testing locations between Parramatta and Sydney Olympic Park for the DSI required for Phase F — Western Tunnelling Works. Further examination identified four (4) proposed geotechnical testing locations within the public domain in the

Parramatta local government area (LGA) which represented a potential 'high risk' to historical and/or Aboriginal cultural heritage values based on an initial desktop review of environmental and heritage/archaeological constraints. Subsequent revision of the proposed locations facilitated the relocation of the proposed borehole 'GALC-BH97' inside the approved Parramatta Metro Station construction site boundary. As such, this location no longer required consideration as part of the Consistency Assessment, resulting in three (3) proposed geotechnical locations requiring assessment.

1.2.1 Summary of Works

The geotechnical testing locations will be advanced using a rubber track-mounted drill rig equipped with 125 mm diameter drill rods. Works will also utilise a small excavator (approximately 5 tonnes) to transfer drilling spoil into a dump truck for transportation off-site. Once drilling activities have been completed to the required depth (refer **Table 1.1**), the monitoring well materials will be installed and grout would be used to fill boreholes to below ground level. The area will then be reinstated with backfill and topsoil and topped with grass seed to reinstate the grassed areas. Where any geotechnical testing locations are located on existing hardstand, reinstatement will comprise either asphalt or concrete, to align with the pre-existing surface/s.

In order to minimise impacts of vehicle movements on non-paved surfaces, GLC will use sealed areas to travel wherever possible to minimise ground disturbance. Where works are located on non-paved surfaces, track mats will be placed to prevent ground disturbance from machinery. No works will be undertaken during rain events or when the ground surface is wet enough that works cannot be completed without impacting the surrounding ground surface.

Table 1.1 Maximum Depth of Proposed Geotechnical Testing Locations

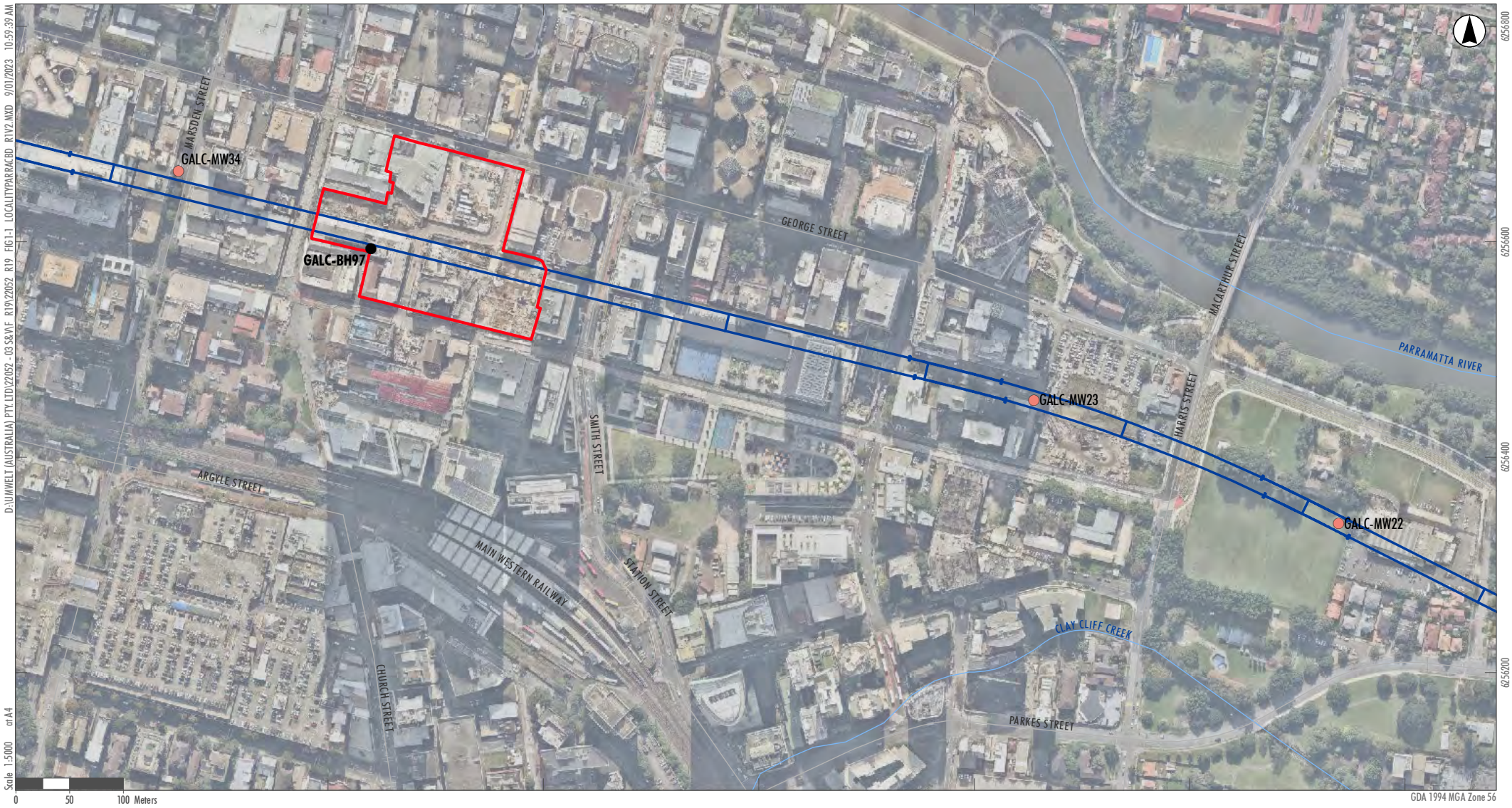
Borehole Scope ID	Drilling Depth (m)	Drilling Diameter (mm)	Vertical/Incline
GALC-MW22	37	125	Vertical
GALC-MW23	40	125	Vertical
GALC-MW34	30	125	Vertical

1.3 The Project Area

The Project Area for this assessment, shown in **Figure1.1**, comprises the immediate footprints of three (3) geotechnical testing locations (boreholes) located within the Parramatta CBD and immediate environs (hereafter the 'Project Area'). The proposed geotechnical testing locations assessed in this report are summarised below in **Table 1.2**.

Table 1.2 Proposed Investigation Locations

Scope ID	Investigation Type	Locality	Address	Easting	Northing
GALC-MW22	Borehole with monitoring well	Parramatta CBD	Robin Thomas Reserve	315062	6256667
GALC-MW23	Borehole with monitoring well	Parramatta CBD	19 Union St	316139	6256340
GALC-MW34	Borehole with monitoring well	Parramatta CBD	146 Marsden St	315843	6256462



Legend

- Approved Surface Construction Boundary
- Boreholes with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA
- Drainage Line
- Tunnel Alignment
- Road

FIGURE 1.1

Boreholes in Parramatta CBD

Image Source: Nearmap (May 2022) Data source: DFSI (2021)

1.4 Authorship

This report was prepared by Elise Jakeman (Umwelt, Archaeologist) and Melissa Moritz (Umwelt, Senior Heritage Consultant). Specialist geomorphology input was provided by Pam Dean Jones (Umwelt, Principal Environmental Consultant). Technical review was undertaken by Luke Wolfe (Umwelt, Principal Archaeologist). Final review of the document was undertaken by Thomas Buchan (Umwelt, Project Manager) and Nathan Baker (Umwelt, Project Director).

1.5 Limitations

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

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This combined Aboriginal and Historical (non-Aboriginal) Heritage Impact Assessment report utilised desktop-based information and resources only.

No consultation with Aboriginal groups, individuals Registered and/or Aboriginal Parties (RAPs) associated with the SMW Project was undertaken for the current assessment.

2.0 Statutory Context

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the statutory protection of all items of National environmental significance, and includes protection to heritage items of Commonwealth, National, and World significance. The EPBC Act and its regulations also set out the processes for undertaking works within (or in the vicinity of) World, National or Commonwealth heritage items, including where approvals under the EPBC Act are required.

The full extent of requirements for environmental approvals are set out in Subdivision A and AA or Part 4 of the Act. The key trigger for requiring approval is whether works – referred to as an 'action' in the Act, will have a significant impact on the item of National environmental significance. If the proposed action is assessed as having, or likely to have, a significant impact, the matter must be referred to the Minister for Environment for approval.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) enables responsibility for heritage (both Aboriginal and non-Aboriginal) to be shared by state and local government agencies. The EP&A Act provides local government with the power to protect items and places of heritage significance in the local area through local environmental plans (LEPs) and development control plans.

The EP&A Act requires consideration be given to environmental impact – including heritage – as part of the land use planning process, and the provisions of the EP&A Act allow for the implementation of LEPs which provide the statutory framework for heritage conservation within a particular LGA.

2.2.2 Heritage Act 1977

The *Heritage Act 1977* (NSW) (Heritage Act) affords automatic statutory protection to 'relics' which form part of archaeological deposits, except where these provisions are suspended by other prevailing legislation. The Heritage Act defines a 'relic' as any deposit, object or material evidence that:

- Relates to the settlement of the area that comprises NSW, not being Aboriginal settlement.
- Is of State or local heritage significance.

Sections 139 to 145 of the Heritage Act prevent the excavation of a relic (on non-State Heritage Register listed (SHR) land), except in accordance with a gazetted exception or an excavation permit issued by the Heritage Council of NSW. Section 139 of the Heritage Act requires that:

- A person must not 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.

- A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.

As all 'relics' are protected under the Heritage Act, an Excavation Permit under Section 140 of the Act needs to be obtained prior to any works that would disturb or destroy them. However, if the proposed works are only minor in nature and will have minimal impact on the heritage significance of the place, they may be excepted from the provisions of Section 139.

The Heritage Council of NSW and delegate offices of Heritage NSW, Community Engagement, Department of Premier and Cabinet (Heritage NSW) are the approval authorities for issuing Excavation Permits and considering exceptions under Sections 139 and 140 of the Heritage Act.

As the Project has been approved as State Significant Infrastructure (SSI) under the EP&A Act (SSI-10038), the requirements for approvals under the Heritage Act are generally not required, however the process and procedures required under the Act are followed as best practice in all designated State Significant projects.

2.2.2.1 Material Threshold Policy

Under the Heritage Act, the Heritage Council of NSW considers the term/s "materially affect/effect" when regarding the public notice and/or the determination of applications under sections s61(1) and s63(3) of the Heritage Act, respectively (Heritage NSW Department of Premier and Cabinet 2020). Under the Heritage Act, a number of these functions may be delegated through 'Instrument of Delegation' which allow certain delegates to grant approvals for changes to SHR listed places. The power of delegation is only granted in relation to applications for approval to undertake activities that will not materially affect the significance of that item as an item of 'environmental heritage'.

As the Project has been approved as SSI under the EP&A Act, approvals under the Heritage Act generally are not required. However, the process and procedures required under the Heritage Act are followed as best practice in all designated State Significant projects.

Condition D13 of the Ministers Conditions of Approval (MCoA) for the Project references the Materials Threshold Policy (Heritage NSW Department of Premier and Cabinet 2020) and required the following consideration:

D13 The proponent must not destroy, modify or otherwise affect any Heritage item not identified in documents referred to in Condition A1. Unexpected heritage finds identified by the CSSI must be managed in accordance with the Unexpected Finds Protocol outlined in Condition D13 to D33 of this schedule [Modified Instrument of Approval]. Consideration of avoidance and redesign to protect state significant unexpected finds must be addressed where this condition applies.

Note: Affect in this condition means any impact above 'little to no impact' as defined in the Material Threshold Policy (Heritage NSW 2020).

The definitions outlined in the Material Threshold Policy have been used to assess the impacts of the Project on the overall heritage significance of the Parramatta streetscapes.

2.2.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act), administered by the Department of Planning and Environment, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act is accompanied by the *National Parks and Wildlife Regulation 2019*. The NPW Act gives the Heritage NSW the responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as:

An ***Aboriginal object*** is any deposit, object or material evidence (that is not a handicraft made for sale) relating to the Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains)

An ***Aboriginal place*** is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a 'strict liability offence' for such harm. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' in the NPW Act include the carrying out of certain 'Low Impact Activities', prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010*, and the demonstration of due diligence.

In general, an Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened. Pursuant to Section 89J of the EP&A Act, AHIPs are not required for projects approved under Division 4.1 of Part 4 of the EP&A Act. This Project has been approved as State Significant Infrastructure under the EP&A Act. The requirements for approvals under the NPW Act are therefore not required and are subsequently managed under a Heritage Management Plan (refer **Section 2.4**).

2.3 Local

The Project Area falls within the LGA of Parramatta, of which the relevant Environmental Planning Instrument (EPI) is the Parramatta LEP 2011.

Part 5.10 of the LEP provides specific provisions for the protection of heritage items and relics in order to:

a. to conserve the environmental heritage,

b. to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,

c. to conserve archaeological sites,

d. to conserve Aboriginal objects and Aboriginal places of heritage significance.

Under the LEP, development consent is required for any of the following:

e. demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

i. a heritage item,

ii. an Aboriginal object,

iii. a building, work, relic or tree within a heritage conservation area,

f. altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in *Schedule 5* in relation to the item,

g. disturbing or excavating an archaeological site while 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,

h. disturbing or excavating an Aboriginal place of heritage significance,

i. erecting a building on land:

i. on which a heritage item is located or that is within a heritage conservation area, or

ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,

j. subdividing land:

i. on which a heritage item is located or that is within a heritage conservation area, or

ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Schedule 5 of the LEP provides a list of heritage items within the LGA. The curtilages of items currently listed on the Parramatta LEP 2011 that fall within the Project Area are listed in **Section 4.3.1**.

2.4 Management Plans

2.4.1 Sydney Metro West Western Tunnelling Package HMP 2022

Th Project is currently managed under the Sydney Metro West – Western Tunnelling Package – Heritage Management Plan (SMWSTWTP-GLO-1NL-HE-PLN-000001) that was prepared and subsequently approved in July 2022 (Umwelt 2021). Intended to provide robust heritage guidance, the HMP provides outlines the policies and strategies to assist GLC to undertake works associated with the Western Tunnelling Package. Section 7.4.2 of the HMP requires that additional assessment and approval is required for any potential impacts to Aboriginal cultural heritage outside of the approved construction activities for the Project. Similarly, Section 7.6.9 required additional assessment and approval of any additional impacts to historical (non-Aboriginal) heritage items. Both measures in the HMP require the approval of the impacts prior to the commencement of any construction activities, this will occur under the Consistency Assessment approvals pathway.

2.4.2 Parramatta Historical Archaeological Landscape Management Study 2000

The Parramatta Historical Archaeological Landscape Management Study (PHALMS) (GML Heritage, 2000) is a non-statutory framework that was adopted by Parramatta City Council and the Heritage Council of NSW

and subsequently integrated into the NSW State Heritage Inventory database to inform urban development in the Parramatta LGA. The PHALMS study area was divided into Archaeological Management Units (AMUs) defined by consideration of the historical development of a particular item / site and the current physical condition. The archaeological resources within each AMU have similar levels of archaeological significance, archaeological research potential and have undergone similar levels of disturbance. Generally, streets are included in PHALMS as either individual AMU's or within the same AMU as the adjacent allotment.

3.0 Aboriginal Heritage

3.1.1 Data Sources

Information regarding the known and potential Aboriginal heritage resources and values of the Project Area was obtained from:

- A review of the landscape context of the Project Area and surrounds, including detailed geomorphology investigations that have been completed to understand the landscape and stratigraphic context of several previous archaeological investigations across the Parramatta central business district. This review draws on a range of published and unpublished reports of investigations and interpretation of the stratigraphy and geomorphology of the central district of Parramatta, to the extent that they are relevant to the archaeological potential of the land.
- A review of existing Aboriginal Heritage Information Management System (AHIMS) data for land within and surrounding the Project Area, obtained from Heritage NSW on 14 November 2022 (AHIMS search # 732154).
- A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal (NNTT) for land within and surrounding the Project Area (14 November 2022).
- A review of the findings of past Aboriginal archaeological investigations within the Project Area and surrounds.

3.1.2 Landscape Context

The nature and distribution of Aboriginal archaeological sites are connected to the environments in which they occur, at both local scale and broader landscape scale. The archaeological evidence is the result of interactions of culture, environment (in terms of resources and values) and the potential for materials to be conserved in situ over time.

Environmental variables such as topography, geology, and the hydrology, local vegetation and faunal communities of the landscape over the period of Aboriginal occupation, are a key consideration in determining how Aboriginal peoples lived and utilised their Country. In practical terms, these variables would have influenced the suitability of campsites, access to drinking water, plant and animal resources, and access to raw materials for the manufacture of stone and organic implements. Environmental variables also affect the likelihood that archaeological materials will be retained *in situ*, buried within the topsoil, or eroded and redeposited elsewhere.

Equally critical is the identification of historical and contemporary land use activities, which contribute to the understanding of site presence/absence and the integrity of archaeological deposits. This is particularly important for developments within urban areas where existing or previous development may have truncated, conflated or removed archaeologically sensitive soils, sediments and landforms.

Information about the hydrology, geomorphology, stratigraphy and soils of the upper estuary of the Parramatta River is available at a range of scales and levels of resolution, with mapping and investigations

conducted with a variety of objectives and access to technical analysis tools. Broad-scale mapping and landscape descriptions include:

- Geological mapping.
- Soil landscape mapping (Chapman et al 1989).
- Initial auger investigations of the 'Paramatta Sand body' (Mitchell 2008).
- Flood risk studies for Toongabbie Creek and Darling Mills Creek.
- Seismic and bore log studies of the bed of Sydney Harbour.
- Reconstructions of early colonial vegetation types e.g., Benson et al 2006 and more recent studies on estuarine substrates and salt marsh distribution around Sydney Harbour.
- Studies undertaken for impact assessment across the Parramatta District (left and right banks of the Parramatta River, close to the tidal limit), which variously refer to the Parramatta Sand Sheet, Parramatta Sand, Parramatta Sand Body and Parramatta Terrace Sand. These all refer to interbedded sand and clay deposits, extending to as much as 13 metres (m) below the modern ground surface.
- Overviews, reviews and analysis of multiple research and assessment projects such as Owen et al 2022 and Williams et al 2021.

These sources of information are reviewed in the following sections. The cumulative evidence can be used to understand both the variability/diversity of resources available to Aboriginal people over the Late Pleistocene and Holocene, and the extent of dynamic reworking of potential occupation surfaces by flooding, erosion and deposition from different sources.

The review covers a wide range of evidence about the hydrology and geomorphology of the Parramatta River in the vicinity of the Project Area but is still a preliminary assessment. The review includes what is known about each relevant component of the landscape context and the implications for archaeological sensitivity and risk**.**

3.1.2.1 Hydrology

The Parramatta CBD is located just downstream of the junction of the two main tributaries of the Parramatta River: Toongabbie Creek and Darling Mills Creek. Domain Creek (right bank) and Brickfield Creek (left bank) are tributaries of the Paramatta River downstream of the junction of Toongabbie Creek and Darling Mills Creek, but upstream of the Charles St Weir. Clay Cliff Creek joins the Parramatta River as a right bank tributary (at James Ruse Drive Bridge), downstream of the Charles St Weir and in the tidal reach of the river. It is almost entirely channelised in the stormwater system.

Darling Mills Creek drains the north-eastern part of the catchment area, including parts of Castle Hill, Northmead, Carlingford and Pennant Hills. Its tributaries are primarily from the east (left bank) and include Hunts Creek, Rifle Range Creek, Blue Gum Creek, Bellbird Creek and Excelsior Creek. Toongabbie Creek has a much larger catchment, extending north-west and west from the CBD and including areas such as Baulkham Hills, Lalor Park, Seven Hills, Blacktown, Girraween, Wentworthville, Pendle Hill, Old Toongabbie, Westmead and Northmead. Freshwater flows in the Parramatta River are dominated by runoff from this catchment, but the steep slopes of the upper Darling Mills catchment would also lead to short term high

flows and exacerbate flash flooding. Sand bedload is likely to be derived from Darling Mills Creek catchment. Suspended sediment load and water quality in the upper Parramatta River are more likely to be most influenced by the geology and geomorphology of the Toongabbie Creek catchment (e.g., Birch 2000 notes that suspended sediment load in Toongabbie Creek is three times that in Darling Mills Creek.

Downstream of the junction of the two tributary systems, The Parramatta River channel is relatively straight (slightly sinuous), except for a meander bend with an amplitude of approximately 400 m, around what is now Parramatta Football Stadium and a cricket ground (the former Government Domain). This meander bend separates the terrace landforms on the left bank (i.e., the landforms on which the Parramatta Stadium is located from those on the right bank. The channel orientation downstream of this meander is approximately 90 degrees to the orientation upstream, flowing generally east-west rather than north-south. It is likely that this change in channel alignment has a structural origin, with the channel constrained by bedrock under the banks.

The tidal limit of the estuary affects access to fresh water and the diversity of biophysical resources that occur across the interface of tidal and freshwater waterways and wetlands. The junction of Toongabbie Creek and Darling Mills Creek is approximately at the natural Late Pleistocene (last Interglacial) tidal limit of the Parramatta River. The Charles St Weir is the current tidal limit of the estuary. The weir prevents tidal ventilation upstream. Early maps of Parramatta (*The Plan of the Township of Parramatta in NSW 1814*) show the tidal influence extending further upstream to what is now Rings Bridge. For instance, Naval Surgeon White (1790) and a painting by GW Evans describe the natural tidal limit as '*here the tide ceased to flow and all further progress for boats was stopped by a flat space of large broad stones over which a freshwater stream ran*.' The Smith St Crossing is approximately 300 m upstream of the Charles St Weir and is well downstream of the early colonial Governors Domain. It is important to note that the tidal limit has migrated upstream and downstream over the last 100,000 years, as sea level has risen (to + 4-5 m AHD in the last Interglacial and +2-3 m in the early to mid-Holocene) and fallen (to -130 m AHD) at the last Glacial Maximum. Over the period of potential Aboriginal occupation of this landscape, the tidal limit may have been as far upstream as the junction of Toongabbie and Darling Mills Creeks, or many kilometres (km) downstream, on the coastal shelf.

As noted above, the Project area is in a landscape that has varied over time from estuarine to freshwater and catchment hinterland. The catchments contributing to flows in the upper Parramatta River are large and the lower reaches of Toongabbie Creek and Darling Mills Creek, as well as the upper Parramatta River and estuary are subject to major flooding events. The Parramatta River Corridor Review (Extent Heritage 2017, for City of Parramatta) notes records of three major flood events in the nineteenth century:

- 1812 flooding of the township and along the river flats west of the Church St Bridge.
- 1864 – resulting in the displacement of stonework in the Marsden St Weir, and flooding properties between the weir and Lennox Bridge. Water is reported to have reached almost to the top of the bridge arch.
- 1889, the flood caused scouring to bedrock along the southern bank of the river between Marsden St Weir and Lenox Bridge. Properties along Church St were flooded and there was extensive bank erosion at the 'Riverside' property, east of Marsden St Weir.
- Multiple large floods have also been recorded during the twentieth century.

Molino Stewart (2016) describe flooding mechanisms in the Parramatta CBD and note three major sources of flooding: the Parramatta River catchment, local overland flow and flooding in the Clay Cliff Creek and Brickfield Creek floodplains. Flows from these three sources would historically have interacted at different parts of the flood rise and fall cycle. Molino Stewart 2016 note that in moderate floods, flooding extends from main roads (O'Connell St, Marsden St, Church and Smith Street, Phillip St, George St, and Macquarie St) and then spreads across the CBD. For events larger than the 1% AEP the river breaks its banks south of the river just upstream of O'Connell St. On the north bank, Wilde Avenue (opposite Smith St) is the first to be inundated.

The channel alignment of Clay Cliff Creek initially follows the boundary between the hillslopes of the Blacktown Soil Landscape and the Parramatta Sand Body/terrace (see below), indicating a younger alluvium than the terrace unit, but then turns ninety degrees and is inset in the terrace deposits before joining the river. Overbank flooding onto the Clay Cliff Creek floodplain follows the path of the creek from Ollie Webb Reserve through the CBD to Robin Thomas Reserve, then across the floodplain, first affecting Lansdowne St, Church St, Parkes St, Wigram St and Hassall St. A 20-year ARI event would flood a wide area of land through the Clay Cliff Creek corridor. In smaller floods, flows from Brickfield Creek enter the Parramatta CBD by crossing Victoria Road, then down Wilde Avenue to the river. In higher floods, combined with a catchment flood in the Parramatta River catchment, flows result in flooding across the area from Victoria Road up to Marsden St (**Figure 3.1**).

- The pattern of flow break out from the river channel will have affected where sand is deposited and also minor topographic features on the floodplain surface.

- From an archaeological perspective, the patterns of flooding indicate the likelihood of ongoing scour and deposition on the floodplain level, leading to burial and/or reworking of discarded occupation evidence. In contrast, the higher terrace level is likely to not have been subject to inundation from the Parramatta River – floodway or ponded water, since the late Pleistocene, when sea level was falling. There is evidence that the terrace surface has been inundated, causing ponding, by runoff from the steeper bedrock hillslopes to the south. Direct run-on from hillslopes and from small tributary creeks that did not convey flows across the terrace to the Parramatta River, is reported to have created flash flooding and stagnant ponds along Church St, Market Place (now the Town Hall) and Macquarie St. The extent to which this flash flooding from local run-on occurred in pre-colonial times is not known, but it would almost certainly have been exacerbated by early land clearing on the slopes around the township.

- It is apparent from early colonial descriptions of local terrain and flood processes that the surface of the upper terrace had been modified by the interaction of colluvial and fluvial processes, which extended through the last Glacial and Holocene periods. These could have included development of alluvial fans from small creeks debouching onto the terrace, incision of channels partly crossing the terrace, scour of channels and hollows, later ponded, and development of channels capturing tributary flows and conveying them to the main River (Clay Cliff Creek appears to be an example).

Modern flooding patterns are likely to have been much modified from the natural patterns, but this description does highlight that levee deposition, patterns of high velocity flows, patterns of poor drainage and standing water, areas of frequent reworking of the floodplain and terrace surface are likely to have created areas of ground surface stability, areas of coarser sediment and finer sediment deposition, relatively flood free areas, and areas where ground surface modification was relatively frequent (either by

fluvial sedimentation, erosion or reshaping). There is no need to invoke aeolian processes to explain significant variability in the grain size of flood plain and terrace materials.

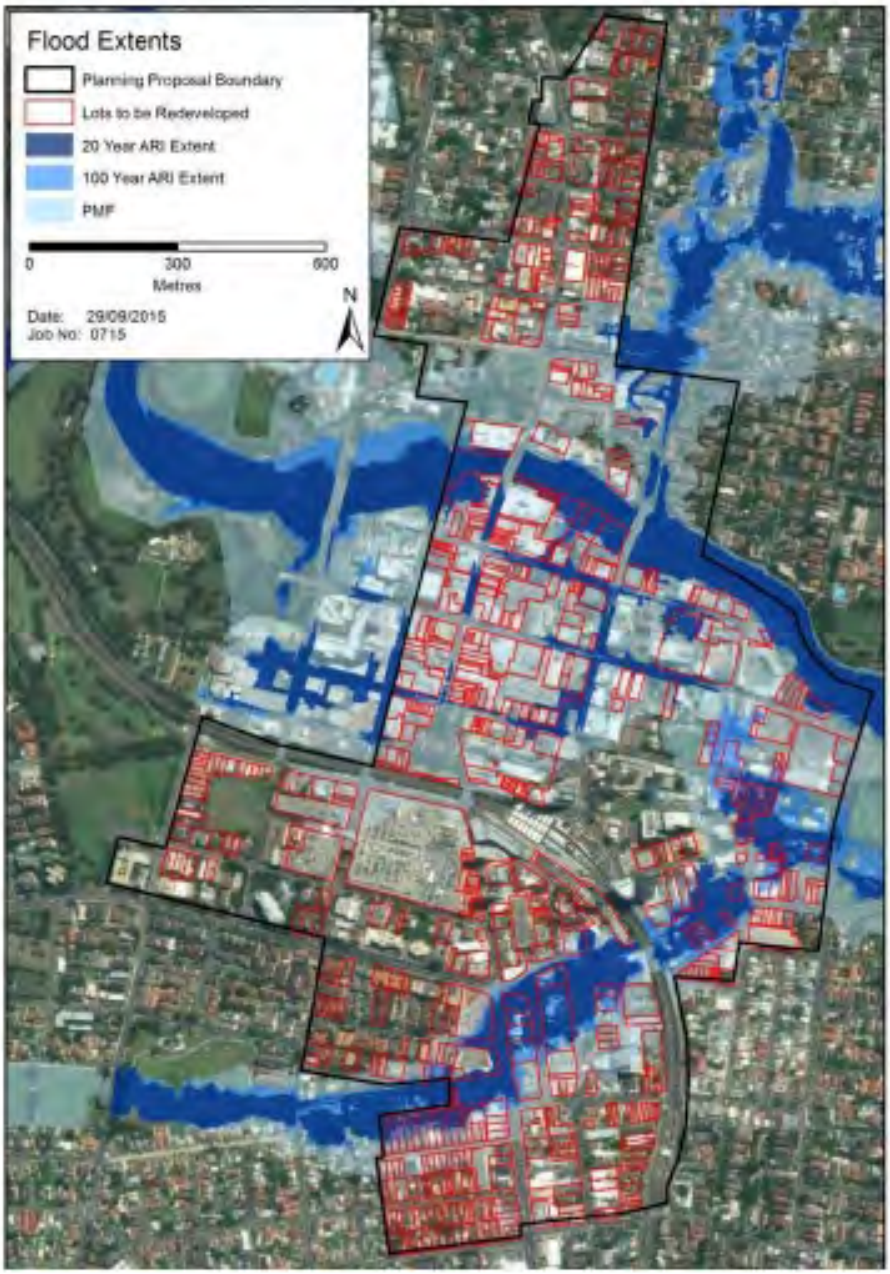


Figure 3.1 Flood Extent of Parramatta River

© City of Parramatta Council, Updated Parramatta Floodplain Risk Management, Draft October 2019

An important feature of the Parramatta River catchment is the early influence of European land clearing on its soils and erosion and sedimentation processes. There is potential for these processes to have scoured creek bank sites in the catchment, buried floodplain sites in the lower catchment/upper tidal reaches with excess sediment transport during floods, and changed sedimentation rates (and productive habitats for cultural resources) in the upper reaches of the estuary.

Cardno 2008 (Parramatta River Estuary Processes Study) note that there are several references to a rapid increase in sedimentation along the Parramatta River, even in the early years of European settlement.

Cardno reference a report by McLoughlin 2000 which refers to a Sydney Morning Herald report in 1861 about 'the blockage ('again') of access to the Parramatta River above Homebush Bay, due the deposition of a large quantity of sediment by floodwaters. Water depths in the upper estuary are currently at least 4 m , following widespread and ongoing dredging to enable navigation. While the dredging appears to have removed large quantities of sediment from the bed of the estuary (which may have included Holocene and recent estuarine muds and associated saltmarsh and mangrove communities in the Parramatta area), there is no evidence in the published literature of major changes to the course of the river in the upper estuary. This means that the relative proximity of archaeological evidence to the bank of the Parramatta River is likely to have remained largely unchanged during the Holocene.

Broadly, the morphology of the alluvial forms at Parramatta comprises estuarine (intertidal) mud flats, the modern (Late Holocene to contemporary) floodplain and two levels of terrace. Mitchell 2008 refers to a levee along the river side of the floodplain and lower terrace. The surface of the lower terrace is 4 to 6 m AHD. Descriptions from the early period of European settlement at Parramatta refer to natural waterholes along the tributary creeks such as Clay Cliff Creek and Brickfield Creek, suggesting they had a pool and riffle form, set into older alluvium. There are also several references to wetlands or ponds on the floodplain and potentially on the higher terraces. This is consistent with freshwater and estuarine backswamps that are common on the estuarine floodplains of many coastal river systems in NSW, especially where there is a natural levee on the river margin of the floodplain.

Small tributaries dissect older alluvial landforms/deposits at the freshwater/estuarine interface. The creeks and associated small alluvial deposits are inset into the terrace and floodplain deposits that underlie central Parramatta. The extent of the terrace landforms has been mapped schematically and is included in Williams *et al* 2021.

3.1.2.2 Geology

The geology of the Sydney Basin has been described by Herbert and Helby (1980), Herbert (1983), and Roy (1983), and the basic geological structure has been reviewed by multiple authors to develop the context of the Parramatta landscape. The Triassic Wianamatta Group underlies the Cumberland Plain component of the Sydney Basin and is represented in the catchments of Toongabbie Creek and Darling Mills Creek by the Ashfield Shale. Further west, the Bringelly Shale extends to Windsor, Penrith, Wallacia and Camden along the Nepean River. The eastern part of the Sydney Harbour catchment (i.e., the open bay component of the estuary) has tributaries whose catchments are underlain by the Hawkesbury Sandstone, a massive quartz sandstone unit. The Hawkesbury Sandstone also forms the upper catchment and northern catchment boundary (ridgeline) for Darling Mills Creek.

The Ashfield Shale comprises (Herbert 1980) 'a lower sequence of dark grey to black, sideritic claystone-siltstone which grades upwards into a fine sandstone-siltstone laminate'. Some units a slightly carbonaceous. The upper members of the Ashfield Shale have an increasing sand content and display some depositional features such as current ripples and animal burrows.

There is no conglomerate (and very little gravelly sandstone) in the Parramatta River catchment, so residual gravels are unlikely (other than platy, weathered shale and ironstone fragments) and there are few rock types likely to provide good sources of raw materials for flaked artefacts, or for edge ground implements. There are unlikely to be *in situ* grinding surfaces in the lower catchment and adjacent to Paramatta CBD. Several authors (e.g., Williams et al 2021, McDonald 2008, White 2017) have noted that the nearest sources for many stone raw materials would have been in the Hawkesbury Nepean catchment (40km west

of Parramatta) or for silcrete, from outcrops across north-western Sydney, approximately 20km from Parramatta.

Key implications of this catchment geology are that soils (both in situ and developed on floodplain alluvium) will be dominated by clay textures, sediment load in the creek system will be primarily clay, silt and fine sand, much of it transported as suspended sediment, with potential to be carried downstream into the estuarine reaches of the Parramatta River/Sydney Harbour.

3.1.2.3 Soil types

Soil Landscapes and associated soil profile descriptions (Chapman et al 1989) have been reviewed by Player 2018 (in Comber 2020). Two soil landscape types cover the upper estuary of Parramatta River:

- The Blacktown Soil Landscape, developed on the Ashfield Shale, described as comprising gently undulating rises on Wianamatta Group Shales. Shallow to moderately deep (<100 cm) hard setting mottled texture contrast soils, red and brown podzolic soils on crests, grading to yellow podzolic soils on lower slopes and in drainage lines.

- Birrong Soil Landscape, described as comprising fluvial and estuarine deposits adjacent to the Parramatta River. This is described as 'Level to gently undulating alluvial floodplain draining Wianamatta Group shales. Deep (>2.5 m) yellow podsolic soil and yellow solodic soils on older alluvial terraces. Deep (>2.5 m) solodic soils and yellow solonetzic soils on the current floodplain'.

- This soil landscape extends upstream along both the tributaries of the Parramatta River (Toongabbie Creek and Darling Mills Creek). It is not confined to the floodplain, but includes older terrace sequences, including the alluvial terrace sequence at Parramatta. At Parramatta, two terrace levels are distinguished, above a modern floodplain.

Multiple archaeological excavations in central Parramatta have provided small windows into the geomorphology of the alluvial landforms that underlie the city, including the current project area. Initial mapping of the extent of the alluvial units (of which the deposit known as the Parramatta Sand Body is one part) as archaeological context was prepared by Mitchell in 2011. McPhail 2017 and Player 2018 (in Comber 2020) provide robust reviews of the stratigraphic context of central Parramatta, from their work at the Parramatta Square development (bounded by Smith, Darcy, Church and Macquarie streets). This includes sediments, soils and palynological information. Williams *et al* 2021 provide a series of dates for stratigraphic units within the terrace sequence at Parramatta, in their review of the implications of archaeological evidence for occupation patterns across the late Pleistocene to Holocene transition.

Williams *et al* provide dimensions and characteristics of the sand body:

- Approximately 69 ha in size (on the right bank), although it is apparent that similar terrace deposits exist on the left bank

- Approximately 2.5 km of frontage to the Parramatta River, traversing the tidal to freshwater transition

- Extends up to 300 m from the bank and 4 – 7 m above water level

- Dominated by medium to coarse sand close to the Parramatta River (250-1000 µm), likely to include levee deposits

- Increasing fine clay and 'silts' further away, which they state suggests a role for aeolian processes, with sorting with distance from the river. However, overbank flooding and settlement of suspended sediment across the floodplain and in backswamps would also produce a similar grain size distribution and appears more likely.

- Terrace deposits are at least 3m thick, overlying the shale bedrock. Note that bedrock outcrops at the tidal limit and nearby, in the bed of the river.

- Williams et al also note that the 'sand' component of the terrace is 1 to 1.3m thick, overlying older, indurated heavy clay (alluvial, not in situ weathered bedrock), which they say occurs in other alluvial contexts across the Cumberland Plain (e.g., Londonderry Clay)

- Williams et al also refer to a levee bank along the alluvial deposits associated with Clay Cliff Creek. It is noted that if Clay Cliff Creek is incised into the terrace strata, it would likely intersect the heavy indurated clay units, and they would form its banks.

The older dates for the base of the terrace are around 50,000 years. Many of the dates (all from archaeological excavations) are in the 16,000-24,000 years range, with another cluster in the 10,000 to 14,000 years age range. The youngest dates are as recent as 4,000 to 6000 years. Williams *et al* 2022 suggest that the dates indicate that the alluvial deposit had mostly stopped forming by approximately 5000 years ago. They interpret the few later dates as 'Holocene aeolian reworking', but Holocene colluvial/flash flooding reworking is an alternative explanation. An older, higher terrace occupies part of the overall area of the Parramatta alluvial sequence. It is generically referred to as 'Late Pleistocene or Tertiary' alluvial clay and sand, but there is no real clarity about its age. The sequence of OSL dates from the Parramatta Sand Terrace can be aligned with late Pleistocene and Holocene climate and sea level information to provide a link between the environmental context and the occupation evidence.

3.1.2.4 Vegetation

Early historical accounts (e.g., *sensu* Kass et al 1996 and Benson and Howell 1990) refer to the vegetation on the floodplain and low terrace at Parramatta being dominated by very large, well-spaced trees (likely grey box and forest red gum) with a grassy understory. Other vegetation likely to be present (Benson and Howell 1990) included:

- Mangrove along the tidal riverbanks, probably not as dense as today. Saltmarsh may also have been present where more extensive tidal flats had developed

- Saltwater tolerant swamp oak (*Casuarina glauca*) and the black she oak (*Allocasuarina littoralis*) or river oak (*Casuarina cunninghamiania*) may have formed the riparian corridor at and just upstream of the tidal limit and in poorly drained areas. McPhail (2017, in Comber) notes that pollen of these species is common in samples from the terrace and floodplain deposits at Parramatta, but that these species are not mentioned in the early colonial records.

- Common reed (*Phragmites australis*) and paperbark (*Melaleuca* sp.) along freshwater reaches. These species are also common in and around poorly drained parts of the floodplain, including freshwater backswamps. MacPhail 2017 also notes a high abundance of rainbow fern spores in palynological samples, consistent with poorly drained, swampy areas of the floodplain and terrace sequence.

3.1.3 Landscape Context Summary

A summary of the implications for the archaeological record of the landscape context is provided in **Table 3.1**. This information provides a preliminary indication of the potential distribution and stratigraphic integrity of archaeological materials at Parramatta. These indications are primarily hypotheses at this stage, as despite extensive and detailed archaeological investigations and a number of geomorphic and soil studies, attempts to integrate complex strands of evidence have been limited. While the floodplain and terrace sequence at Parramatta provided appropriate substrates for occupation and access to diverse and valuable resources, the available information suggests that the archaeological evidence of Aboriginal occupation activities from late Pleistocene to late Holocene is not evenly distributed and there may be significant differences in the scope, scale and preservation of archaeological evidence over short distances.

Table 3.1 Summary of key features of the landscape context of the Project area

Environmental Variable	Key Observations
Topography	The Parramatta Sand Body (also known by several other similar names) is downstream of the confluence of the two major tributary creeks of the Parramatta River – Toongabbie Creek and Darling Mills Creek. The natural tidal limit of the river is less than 1 km downstream of the confluence (at a rock riffle in the river-bed). The contemporary tidal limit is set by Charles St Weir. The alluvial landforms extend approximately 2.5 km along the south bank of the Parramatta River, extend up to 300 m from the bank, and have elevations of 4 – 7 m above sea level.
Hydrology	The floodplain of the Parramatta River and the level referred to as terrace are known to be flood prone with major catchment floods occurring at least three times during the nineteenth century and more during the twentieth century. The terrace surfaces are also subject to local 'flash flooding' with run-on from adjacent hillslopes and local catchments ponding on the poorly drained parts of the terrace surface.
Geomorphology and Soils	The alluvial landforms at Paramatta comprise a long term but complex sequence of substrates which define the potential for occupation and the preservation of occupation evidence through the late Pleistocene and Holocene. The alluvial deposits overlie shale bedrock and comprise sediments derived from shales and fine sandstones in two major sub catchments. The alluvial deposits appear to span the period approximately 50,000 to recent, but there are also some areas of older, higher alluvial material (Pleistocene or Tertiary age have been hypothesized). The older, higher surfaces would have been available for occupation throughout the late Pleistocene and Holocene. The archaeological record of interest is associated with two terrace levels, including a low sandy levee, and a modern floodplain, located adjacent to the late Holocene tidal limit of the system. All three bore holes are located within this terrain/stratigraphic unit. It is apparent that some reworking and incision of the terrace deposits has occurred, interacting with overbank deposition from the Parramatta River. For instance, high volume run-on from the adjacent bedrock slopes and local catchments is likely to have created alluvial fans on the terrace surface and likely also scoured/increased the size of back swamps, but may also have led to short, incised channels and younger valley fills, inset into the terrace alluvium. Archaeological excavations reveal small and discontinuous windows into this complex geomorphic history. It is likely that the alluvial deposits on the southern (right hand) bank of the Parramatta River are not the only units of this type. A similar sequence is likely to occur on the left bank (e.g., under the Parramatta Stadium) and complementary floodplain and terrace units would have occurred in the lower reaches of Toongabbie Creek and Darling Mills Creek.

Environmental Variable	Key Observations
	The complexity of the geomorphic materials and relationships means that it is likely there are also complex archaeological deposits in which reworking would have occurred through natural floodplain processes and bioturbation, prior to the major disturbance in colonial and post-colonial times. Some archaeological materials are likely to have been removed by post depositional surface processes and some parts of the terrace system would not have provided high value as a campsite (leaving occupation evidence) at any time – although these areas may have provided useful resources.
Flora and Fauna	The early colonial records suggest open forest with a grassy understory in the early nineteenth century. There is also evidence of riparian communities and poorly drained areas in the palynological record.
Land Disturbance	The colonial records of settlement at Parramatta provide information about rapid land clearing and associated impacts on slope stability and soil erosion. The records also provide evidence of cultivation and the

3.2 Aboriginal Archaeological Context

3.2.1 Aboriginal Heritage Information System (AHIMS)

The Aboriginal Heritage Information System (AHIMS) database, administered by Heritage NSW, contains records of all Aboriginal objects reported to Heritage NSW in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared to have special significance with respect to Aboriginal culture/s. Previously recorded Aboriginal objects and declared Aboriginal Places are defined as 'Aboriginal sites'.

A search of the AHIMS data base on 14 November 2022 for an area approximately 3 x 3 km, centred on the Project Area (i.e., the AHIMS search area) returned 109 site entries. Of these, one (1) site was deleted, eight (8) have been destroyed and four (4) confirmed as 'not a site', leaving 95 Aboriginal sites as valid or partially destroyed. The most common site types are open artefact sites accounting for 55.79% (n = 53) and potential archaeological deposit (PAD) accounting for 49.47% (n = 47). Other site types reported in the AHIMS search included hearths (n= 4), grinding groove (n = 1) and culturally modified trees (n = 2). Summary details of the AHIMS search Results are provided in Table 3.2**.** The location of the sites is shown on Figure 3.2**.** The proposed geotechnical investigations are located in the vicinity (less than 50 m) of six (6) Aboriginal sites. Additionally, GALC-MW22 is located within the boundary of AHIMS #45-6-3158.

Table 3.2 AHIMS Search Results

Site Type	Count (n)	Percentage (%)
Potential archaeological deposit (PAD)	45	49.47%
Open artefact site	53	55.79
Hearth	4	4.21
Culturally modified tree	2	2.11%
Grinding groove	1	1.05%
Aboriginal Resource and Gathering	1	1.05%
Total	**95**	**100%**

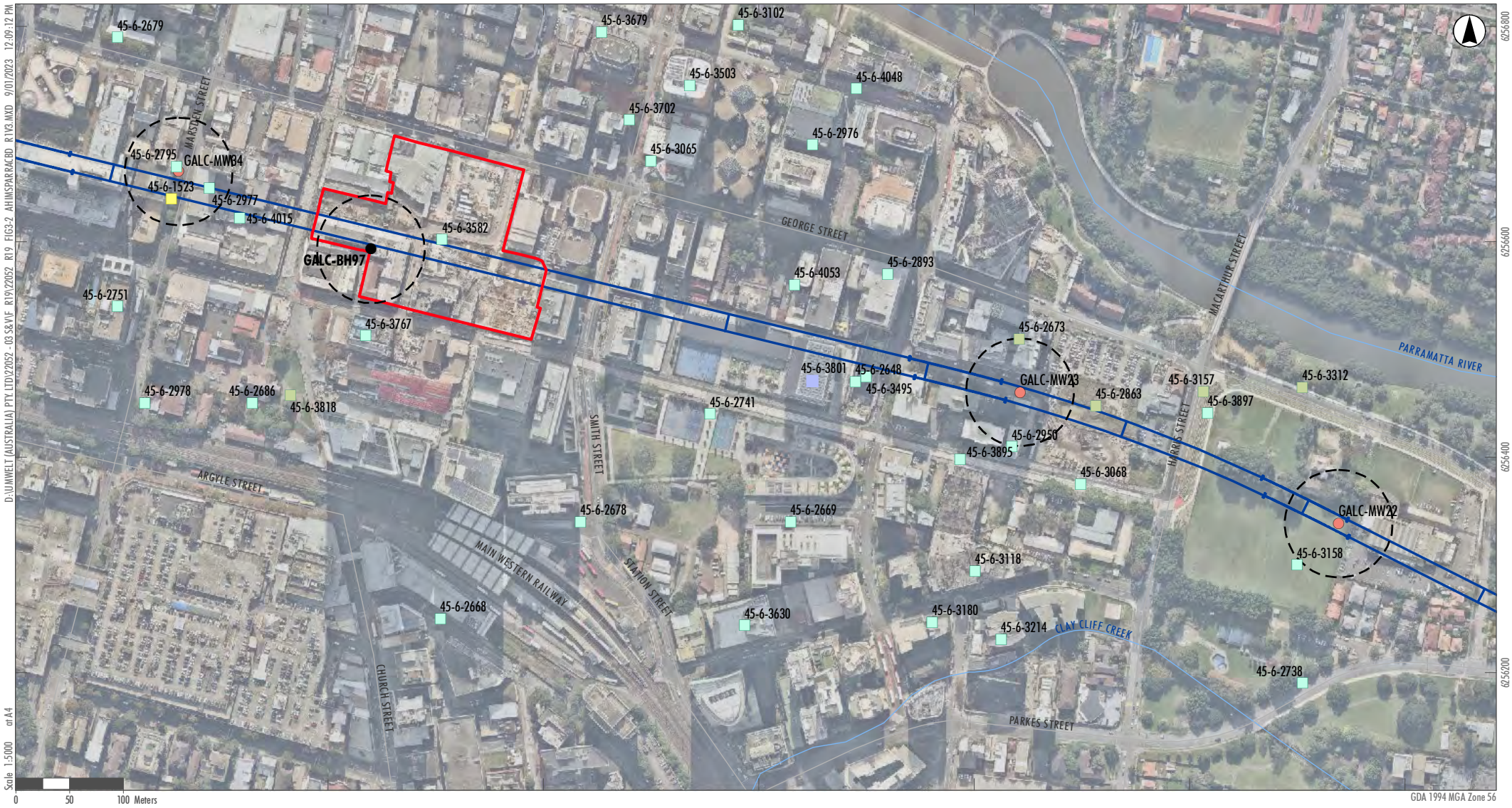
Source: Department of Premier and Cabinet, 14 November 2022 (AHIMS search ID #732154)

Table 3.3 Aboriginal Sites near Project Area

Scope ID	AHIMS ID	Site Name	Description
GALC-MW22	45-6-3158	Robin Thomas reserve	The site has been assessed as being of State significance and is registered on the State Heritage Register. The SHR listing states: *The conservation area has the potential to contain evidence of pre-colonial and early colonial Aboriginal occupation...*" "*...It is possible that the area contains stratified archaeological material which is rare occurrence for open sites*". "Recent excavations at George St Parramatta found similar soil deposits. Given the similarity of soil deposits, the subject site has the potential to contain similar archaeological deposit
GALC-MW23	45-6-2673	RTA-G1	Archaeological salvage excavations were undertaken at this site in 2003 prior to the construction of a high-rise residential development. Results of the excavation (JMCHM 2005a) identified significant archaeological deposits associated with the late Pleistocene through to the mid-Holocene occupation of the site located in the river terrace despots of the Parramatta Sand Body. Results of these excavations indicate that the archaeological remains are likely a continuation of the previously identified open artefact site located 50 m northwest (AHIMS site #45-6-2648). Also located in deep expressions of the Parramatta Sand Body, the archaeological assemblage in AHIMS site #45-6-2672 included a high percentage (82%) of knapping debitage, with areas of high artefact concentration identified against a continuous background scatter of lithic material across the site. The overall results of the excavation established that as range of activities were carried out by Aboriginal people within the site and represented domestic occupation debris accumulated over a long period.
	45-6-2863*	Cumberland Press Site	The Cumberland Press site comprises the majority of the block bound by George Street, Harris Street, Argus Lane and Macquarie Street, with the exception of the Albion Hotel to the east. Preliminary test excavation (JMCHM. 2006) within the site identified the Paramatta Sand Body in parts of the site and confirmed the presence of Aboriginal objects within the PAD. Although historical development of the site, particularly in the 20th century, had disturbed the upper layers of fill, the site retains the potential to contain Aboriginal objects, particularly at depths of up to 1 m.
	45-6-2950	Macquarie St PAD 2	Destroyed
GALC-MW34	45-6-2795	150 Marsden Street Parramatta PAD	An area of archaeological potential recorded based on site's similar context and location compared to the nearby excavations at Parramatta Children's Court and the Civic Place which revealed low density archaeological deposits.

Scope ID	AHIMS ID	Site Name	Description
			Redevelopment of the site likely resulted in impacts to any natural soil profiles however this is likely limited to the footprint of the new building. It is unclear the full extent of the PAD and whether it extends beyond the boundaries of 150 Marsden Street.
	45-6-2977	Macquarie Street PAD 3	Although mapped within 50 m of the borehole location, the description of this AHIMS site is identified as Macquarie Street, between Church and O'Connell Street. The site is described to be located on Parramatta Sand Body (within the mapped extent) and further investigation required to understand the nature of any intact natural soil profiles.
	45-6-1523	George Street Parramatta	This site was recorded in association with the Commonwealth Government Office Block and Law Courts, which although fronting George street, extends back towards Marsden Street. Little information about this site is available on the site card for this site, or in associated archaeological reports.

**AHIMS site 45-6-2863 has been included in this table for completeness but is located >50 m from GALC-MW32*



Legend

- Approved Surface Construction Boundary
- Study Area
- High Risk Boreholes with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA
- Tunnel Alignment
- Road
- Drainage Line

Aboriginal Sites

- Artefact
- Hearth, PAD
- Open Camp Site
- PAD

FIGURE 3.2

Aboriginal Sites in Parramatta CBD

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

3.2.2 Native Title Search

A search of the National Native Title Register (NNTR) and Register of Native Title Claims (RNTC) administered by the National Native Title Tribunal was undertaken for the Parramatta LGA, inclusive of land within and surrounding the Project area. No current Native Title listings or claims were identified within or near the Project area.

3.3 Previous Aboriginal Archaeological Assessments

Aboriginal archaeological investigations have been carried out for impact assessment and compliance purposes across the broader archaeological context area for the Project Area and several have been prepared within and adjacent to the Project area. For contextual purposes, the results of a selection of these investigations, including those undertaken near the Project area, are summarised in **Table 3.4.**

Table 3.4 Previous Aboriginal Archaeological Assessments (Church St and nearby)

Assessment	Description	Distance from Project area
Kelleher Nightingale Consulting Pty Ltd (KNC), for Parramatta Light Rail 2017	Project area includes George St and Church St Parramatta, approaching the CBD through Harris Park, from James Ruse Drive on the southern bank of the river. Provides detailed review of geology, topography, hydrology and ecology, and notes the rich and diverse resources available to Aboriginal people in this locality. The report notes the significant archaeological value of the Parramatta Sand body, but also notes the highly variable potential of the area generally to retain archaeological evidence of Aboriginal occupation, both because of varying factors which could attract occupation activities that would leave archaeological traces, and the varying impacts of hillslope and alluvial processes on the stability of soils and sedimentary deposits. The report also notes the extent of disturbance across the whole southern side of the Parramatta River. KNC reviews several previous archaeological reports from along or near the light rail corridor. It is apparent from these that archaeological evidence is widespread across the alluvial terraces and associated landscapes along the Parramatta River, with evidence of occupation having been recorded over several decades. The evidence is a complex mix of scarred trees, open campsites (with both flaked and edge ground implements and both deeper and shallow deposits), grind stones, chopping tools, gathering areas, some midden material (Anadara), and even one 'decorative item' – a perforated shark tooth. Substantial areas are identified as PAD, where subsurface archaeology is predicted to be present in a stratified context. There is evidence of former swampy areas on the terraces at Parramatta and evidence that Aboriginal people accessed wetland resources. However, although there is a very high density of archaeological material in some areas, there also appear to be significant parts of the sand sheet surface where artefacts are absent or in very low densities. This variation does not appear to be related only to disturbance.	Approximately 50 m from GALC-MW22
Dominic Steele Consulting Archaeology 2017 Aboriginal Archaeological Test & Salvage Excavation Report – 184-188 George Street, Parramatta, NSW	An Aboriginal Archaeological Test and Salvage Excavation Report was prepared for Aboriginal site #45-6-3068 located in Parramatta, NSW. The assessment included background research and test excavations within the study area, which is located in the Parramatta Sand Body. Eight trenches were hand excavated within the study area and one L-shaped trench was machine excavated. These test excavations were completed in accordance with Section 90 of the NPW Act and Section 140 of the Heritage Act. The test excavations completed under Section 90 of the NPW Act recovered an assemblage of 114 Aboriginal objects made primarily from silicified tuff and silcrete. Test excavations completed under Section 140 of the Heritage Act identified archaeological deposits and built elements along a former freshwater lagoon, which comprised the remains of houses and structures dating back to the 1800s.	80 m north of GALC-MW-23

Assessment	Description	Distance from Project area
AHMS, for Meriton Apartments, 330 Church St Parramatta. 2011	Church St crosse the Parramatta River and could provide a transect across the terrace and floodplain. High Aboriginal archaeological potential attributed to the project area because of its location on the Parramatta Sand sheet (late Pleistocene) and more recent Holocene floodplain deposits. This report provides a detailed description of the early colonial land subdivision process – where floodplain and terrace land were divided into allotments from 1788 approx. The report includes an image of a painting by Lewin in 1809 showing the (then) Smith St bridge, and a steep rise away from the river on the south side, as well as rock or shoaling in the bed of the channel just downstream of the bridge. In terms of geomorphic context for Aboriginal occupation, the report shows the indicative boundary between late Pleistocene and Holocene landforms, which is linked to the top of the steep slope adjacent to the river (noted above). Most of the project area is on the Pleistocene area. The report notes the broader regional context, with dated occupation evidence in the Hawkesbury Nepean extending to the late Pleistocene. The report references several studies (including Attenbrow at Mangrove Creek) which together point to limited occupation activity prior to about 4000 years BP, with a rapid expansion of the area occupied by 3000 BP and further intensification after 2000 years BP, with new technologies and higher mobility across the landscape. As for the KNC report, AHMS describe the distribution of artefacts identified in the terrace deposits, from previous studies. The report reiterates the large number of artefacts recovered and the strong vertical differentiation with clear pre and post Bondaian assemblages, differences in raw materials, and much higher numbers of artefacts in the late Holocene, upper part of the deposit. Some previous excavation sites which returned abundant artefacts are within the modern flood zone (or potentially levee), suggesting that for these open campsites, proximity to the river was more important than the occasional risk of inundation.	>300 m north from GALC-MW34

Assessment	Description	Distance from Project area
AHMS 2014. Archaeological report for Meriton Apartments, 330 Church St Parramatta	Provides the results of additional excavation and testing conducted at 330 Church St, including dating, palynology and soil studies. A total of 43 artefacts were recovered from 18m2 of excavation, with an average artefact density of 2.4/m^2. However, no artefacts were recovered from 9 of 18 pits, and one pit had doble the average density. Artefacts do not appear to be associated with any former topsoil and are not present in active alluvial layers (upward fining flood sequences). Some artefacts appear to have been 'water rolled'. The report suggests that the sandy soils (coarse sand with particle size greater than 250 µm, but some finer lenses) indicate ongoing alluvial processes, including flooding, scouring and sheet wash, but there are higher organic content layers within the overall profile. The active surface processes have affected site content and preservation. The report also hypothesizes aeolian reworking, but with limited evidence. The maximum age of the alluvial deposit is estimated from one OSL date, of approx. 20,000 years	>300 m north from GALC-MW34
AHMS 2016 Aboriginal Cultural Heritage Assessment Report – 113–117A Wigram Street, Harris Park & 23–29 Hassall Street, Parramatta	An Aboriginal Cultural Heritage Assessment Report was prepared to assess the potential impacts to Aboriginal heritage items for a proposed development in Harris Park and Parramatta, NSW. The assessment included background research and test excavations within the study area. Test excavations included 12, 1 m^2 test pits in a 5 m–10 m grid across the site. The excavated materials were sieved through 5 mm mesh, and all Aboriginal objects and possible Aboriginal objects were retained for analysis. The excavations found an alluvial sand unit in the western portion of the Project area, in which 93 Aboriginal objects were uncovered. The majority of Aboriginal objects were uncovered from one test pit location at a depth of 30–40 cm, which was considered to represent a discrete occupation event. Due to the truncation and disturbance of the alluvial sand deposit within the study site (due to historical land use activities), the site was ultimately considered of low scientific significance, since the mixed and shallow nature of the deposit limits the potential for further research outcomes	215 m south of GALC-MW23
AHMS 2018 Aboriginal archaeological salvage excavation report – O'Connell St Public School, Parramatta	An Aboriginal Archaeological Salvage Excavation Report was prepared describe the results of an Aboriginal archaeological salvage excavation undertaken at a school in Parramatta, NSW. The assessment included salvage excavations within the Project area. This included mechanical excavation of the uppermost historic fill layers (at a 40 cm – 70 cm depth) and excavation of a 25 m^2 salvage area. 25 test pits were excavated, which were 1 m^2 squares excavated by hand in 5cm spits. Sediments were wet-sieved through a 3 mm mesh and all Aboriginal objects and other archaeological material were labelled and bagged for subsequent analysis. The salvage excavation found that the Project area contained a low density of artefacts and represented a discrete knapping event. The cultural assemblage identified in the Project area were restricted to a narrow 40 cm band between 7.85 and 7.55m AHD. Despite finding a high concentration of artefacts from the initial testing phase, the subsequent salvage excavation found the assemblage to be relatively sparse beyond this.	>300 m west of GALC-MW34

Assessment	Description	Distance from Project area
AHMS and Streat Archaeological Services 2018 Aboriginal Archaeological Assessment – 93-95 Phillip Street & 32 Smith Street Parramatta NSW	An Aboriginal Cultural Heritage Assessment and Aboriginal Archaeological Assessment was prepared to identify Aboriginal heritage items within a proposed development in Parramatta, NSW. The assessment included background research and test excavations within the study area. Test excavations were undertaken in 17 one (1) m^2 trenches, 14 of which were excavated to a depth of at least 2 spits (200 mm). 13 artefacts were uncovered, which have been quantified and undergone preliminary artefact analysis. These artefacts do not appear to represent intact occupation deposits, but instead appear to reflect considerable amounts of archaeological material moving through the bio-mantle. The assemblage is considered to be of low archaeological significance whilst still possessing higher cultural significance based on their intrinsic value within the Aboriginal community.	>300 m west of GALC-MW34
CG1 (Casey and Lowe 2003, JMDCHM 2005)	- 460 m2 excavation, comprising manual and mechanical methods - 6763 stone artefacts (averaging 32/m2) - Diagnostic pieces and 'heat retainers' from living floors - Estimated that 20-30 cm of the natural soil profile had been truncated - Artefacts were concentrated in the upper 40 cm of the remaining profile, separated into two phases: • Upper assemblage (less than 20 cm), with diverse tool types – backed artefacts, edge ground hatchets, hammerstones, anvils, grindstone fragments and cobble chopping tools. Indicatively 3000 years or less. • Lower assemblage (20-80 cm, but mostly in the upper part of this sedimentary unit), considered to be of terminal Pleistocene age (indicative 10-20 ka)	Approximately 50 m from GALC-MW-23

Assessment	Description	Distance from Project area
RTAG1 (JMDCHM 2003, 2005)	- 122m2 salvage excavation, 50m south east of CG1 - 4775 stone artefacts recovered, with average density of 39.1/m2 - Two phase stratigraphic distribution: • Upper unit, at depth 0-40 cm, 75% of the total assemblage, with mostly silcrete material and a range of formal tool types – backed blades, heat treatment, edge ground axes. C14 dates of 3,500 to 9,200 years • Lower unit, approximately 25% of the assemblage, at 40-60 cm below the surface, indurated mudstone/tuff/chert and reflecting a 'more expedient' technology. Lowest date from this unit (c14) approximately 34,000 years	Approximately 50 m from GALC-MW-23
21 Hassall St (AHMS 2016)	Interpreted as a levee on Clay Cliff Creek, which may not be connected to the broader alluvial terrace deposit. Approximately 15 cm of 'overburden', overlying approximately 80cm of alluvial terrace. Soil profile includes 20 cm of dark greyish brown sandy loam with colonial debris (A1), over 20-10 cm friable yellowish brown clayey sand (single grain), with occasional ironstone/manganese fragments) (B2 horizon), and 50-80 cm friable compact reddish yellow sandy clay with frequent ironstone/manganese 9b/C transition) with the underlying heavy (Tertiary). OSL dating of the alluvial materials suggests accumulation approximately 15,000 to 4,000 years ago 1730 artefacts recovered from investigations with average spatial densities of 52.2/m^2 (24-101/m^2), and a further 1026 from salvage. The authors suggest a total assemblage of up to 17,000 artefacts. A late Holocene assemblage overlaps an older early Holocene assemblage, with some vertical mixing. Lower assemblage comprises 'expedient' flakes, cores and tools of indurated mudstone/tuff/chert – which the authors suggest indicates a connection to the Hawkesbury, where these raw materials are known to be available. Many broken flakes and heat shattering – interpreted as campfire/cooking site. Upper assemblage – has some attributes similar to the older phase, but with abundant silcrete. Also many broken flakes and heat shattering. Higher density of stone materials in the upper assemblage, interpreted as indicating a 'doubling of activities'.	Approximately 225 m south of GALC-MW23

Assessment	Description	Distance from Project area
Williams *et al* 2022 Was Aboriginal population recovery delayed after the last Glacial Maximum? A synthesis of a terminal Glacial deposit from Sydney Basin, NSW. Journal of Archaeological Science: Reports 20, 103225.	Williams *et al* 2022 provide a review of recent detailed excavations in Parramatta (e.g. at 21 Hassall St (Site #45-6-3180), CG1 (Site #45-6-2648) and RTA-G1 (Site #45-6-2673)). These excavations have revealed rich but variable archaeological layers of approximately 1 metre thickness, truncated at the upper level by historical development. Williams *et al* report important features of these investigations, which are summarised in **Table 4.4**. Williams et al conclude from a series of excavations in the vicinity of CG1 and RTA-G1, that: - There is a less intensive end-Pleistocene occupation period, transitioning to a more intensive mid to late Holocene occupation pattern - Sites displaying the full sequence are rare and many of the excavations have revealed truncation and disturbance of the terrace surfaces (especially the upper terrace); and areas of shallow and archaeologically near sterile or sterile sediment. - Foci of occupation (25-35m2 in size) interspersed amongst a wider background scatter of stone artefacts, with a spatial density of less than 10/m2 - The indurated mudstone/tuff/chert materials that dominate the older parts of the assemblage are considered to be sourced from the Hawkesbury Nepean catchment, although the possibility of other sources downstream in what is now Sydney Harbour is not excluded. - Late Pleistocene occupation favoured major rivers such as the Hawkesbury Nepean, with significant activity not occurring in small catchments (such as Parramatta River) at the height of the last Glacial, but increasing from about 14,000 years ago as sea level rose and removed access to more coastal resources. In the early part of the post Glacial transition, Williams et al suggest that occupation at Parramatta continued to focus on established 'key loci' in the landscape, and that use of the Cumberland Plain generally expanded and intensified significantly in the late Holocene.	n/a

Owen *et al* 2022 *Parramatta, NSW: a deep time Aboriginal cultural landscape*. Journal of the Australian Association of Consulting Archaeologists Vol. 9	Owen *et al* review the results of archaeological investigations across the Cumberland Plain, and the results of the analysis support the desktop review of the influence of landscape context on archaeological materials and distribution. Key points made by Owen et al, also drawing on White 2017, include: - The majority of Aboriginal worked stone across the Cumberland Plain utilises three local materials – indurated, silicified mudstone/tuff; silcrete and quartz. Other non-local stone types are represented in low numbers. At Parramatta, these include (in early deposits), manuports of ferruginous shale and sandstone. - Four distinct phases of Aboriginal occupation are identified in the Sydney region and are observed in the known sequence at Parramatta: o Phase 1 - Pre Bondaian, more than 7,000 years BP. Indurated mudstone/tuff is the dominant material. Archaeologists believe this was sourced from the Nepean River gravels (Doelman 2015). The artefacts are unifacial flaking of cores, with no evidence of conservation of raw materials. Authors conclude that the raw material was readily available at this time. Ground stone is absent and backed artefacts rare. o At Parramatta, White's 2017 research (with mapping presented in Owen et al 2022) indicated that these sites are clustered at the eastern end of the CBD, extending away from the river, up the slopes of Macquarie St and onto the alluvial soils of Clay Cliff Creek. Drill hole GALC-MW22 is at the eastern margin of this locality. Contextually, it is important to note that 7000 years BP is the very end of a freshwater landscape at Parramatta, with sea level returning to its pre last Glacial level from that time, and the tidal limit migrating upstream past Clay Cliff Creek, potentially to above the natural rock riffle, and as far as the junction of Toongabbie and Darling Mills Creeks. Prior to 7000 BP, there was around 10,000 years of a freshwater landscape, perhaps one with relatively low flows at the Glacial maximum, but increasing freshwater flows as warming occurred. o Phase 2A – Bondaian, from 7000 to 1500BP. During this period, use of indurated mudstone/tuff decreased, and silcrete artefacts became more common. Smaller artefacts, heat treatment and backed artefacts are interpreted as indicating that access to the abundant stone resources of the Nepean was constrained and people used locally available materials, which were relatively scarce. o Phase 2A evidence is present at most of the Phase 1 locations, but also extend to cover an area of approximately 1km length, generally parallel to the river, on elevated landforms	n/a

Assessment	Description	Distance from Project area
	associated with the wetland/alluvial landscape described for the Holocene floodplain and terrace. o Borehole GALC-MW23 is in the eastern part of the CBD, in an area where pre 7000BP and post 7000BP archaeological materials have been recorded. o This would have been a period of significant environmental change at the saltwater to freshwater interface. Estuarine habitats established, migrated and adapted to changes to flow, and sedimentation rates across the tidal limit. o Phase 2B – Late Bondaian, from 1500BP to contact. Favoured raw materials shifted again, with more quartz (with bipolar flaking techniques, to make flakes from very small cores); and ground edged artefacts became more common. Fewer phase 2B sites have been identified. They are reported to be on higher ground (at more than 9m AHD). Owen et al suggest this reflects a 'withdrawal' from the broader alluvial occupation strategy of Phase 2A. o Sites near Harris St, located between Clay Cliff Creek and the Parramatta River, include materials from throughout Stages 2A and 2B. Phase 3 sites also include properties either side of O'Connell St (which also include Phase 2A and Phase 1 material) and upstream of Paramatta Park. o Borehole GALC-MW34 is adjacent to Marsden Road, and lies east of sites known to contain materials from Phase 1, 2A and 3. o Owen et al 2022 and Williams et al 2021 both argue for increased intensification of occupation in the late Holocene period, with evidence of higher populations, more activity locations, use of more marginal areas, more complex systems of food procurement and resource use, increased use of non-stone materials for economic purposes, and more restricted clan occupation spaces. The archaeological evidence at Parramatta does not show more sites – in fact it shows fewer from this period. However, Owen *et al* attribute the reduced number of sites with Phase 2B stone materials as evidence of both hydrological disturbance (flash floods and overbank flooding) and reduced archaeological visibility of occupation tools, with the increase in the use of wood and plant materials. o Phase 4 is post European. Contact occupation sites are similar in distribution to Phase 2B.	

3.4 Key Observations

Key observations to be drawn from a review of both the environmental and Aboriginal archaeological context of the Project area and environs are as follows:

- The alluvial landforms (floodplain and terrace) at Parramatta (also known as the Parramatta Sand Body) contain archaeological evidence spanning pre last Glacial, through the last Glacial and through the Holocene to contact times. This means that occupation was at different times based around a fresh-water landscape and an upper tidal zone landscape.

- There is spatial patterning of stone occupation evidence from different periods. Sites containing older occupation evidence (i.e., predating the final stages of Holocene sea level rise) tend to be located towards the eastern end of the Parramatta alluvial landforms, but may occur on any of the older terrace deposits. Holocene sites are spread along the alluvial land parallel to the river. Pre Holocene and Holocene sites also occur within the floodplain/levee area along Clay Cliff Creek. Of the sites discussed by Owen et al 2022, five are reported to include evidence from the three pre-colonial phases of occupation. One of these (APHS quadrant 3+4) is located outside the alluvial landscape, on the Blacktown soil landscape. Three are located on the Parramatta sand body (terrace) and one is described as being on 'alluvium' (APHS Quadrant 1).

- The distribution of archaeological evidence is influenced by a combination of available resources; cultural choices about which resources to use and where; and post discard processes. In the Parramatta context, these disturbance processes have included flash flooding and overbank flooding, likely continuing throughout the Holocene. There is some climate evidence of increasing storm intensity in the late Holocene, which would tend to increase the risk of surface reworking – by both scour and deposition.

- Archaeological materials have been recovered from multiple sites throughout the Parramatta alluvial deposits. The geomorphology of these landforms indicates that there is likely to be a high-resolution patchy distribution of archaeological materials. However, it is not possible with available data to specify with a high level of resolution which locations will have fewer sites and fewer artefacts, or more sites and more artefacts.

- Williams et al 2022 report that foci of occupation (25-35 m2 in size) are interspersed amongst a wider background scatter of stone artefacts, with a spatial density of less than 10 m2

- It must therefore be assumed that it is probable that archaeological materials could be identified subsurface in any part of the terrace sequence, other than in known river/creek channels and in known long term wetlands. The significance of any archaeological deposits will be related to the diversity and age of occupation evidence. Land around the margins of floodplain wetlands may have been a seasonal focus of occupation of cultural value, but with limited archaeological evidence (if late Holocene wetland use was achieved with wooden implements).

- GALC-MW22 is located within the sensitive archaeological landscape of Robin Thomas Reserve, which is a conservation area for the Parramatta Sand Body. It is also an area of known Aboriginal archaeology, with test excavation undertaken within the wider reserve uncovering Aboriginal objects within deep expressions of the Parramatta Sand Body.

- GALC-MW23 and GALC-MW34 are located within 50 m of Aboriginal sites (AHIMS ID# 45-6-3158, 45-6-2673 and 45-6-2863), however the full extent of these Aboriginal site is not mapped within the available information.

4.0 Historical Heritage

4.1 Data Sources

Information regarding the known and potential historic (non-Aboriginal) heritage resource of the Project Area was obtained from:

- Desktop searches of relevant heritage registers,
- Visual inspection by Melissa Moritz, Umwelt Senior Archaeologist, in order to assess the existing condition of the Project Area and environs.

4.2 Historical Context

4.2.1 Contact with Europeans

The Aboriginal population in the Parramatta district continued after European occupation in the late eighteenth century. However, traditional life was broken through the course of the early nineteenth century. The impact of smallpox and influenza decimated the Aboriginal population, with several epidemics killing large numbers of people. European occupation of traditional lands deprived Aboriginal groups of sources of food and access to camping and ceremonial sites. This forced individuals to either relocate into the potentially hostile lands of neighbouring Aboriginal groups, to partially integrate into colonial society as fringe dwellers or to resist. Resistance by Aboriginal groups was often met with retaliatory action by white settlers and the colonial administration. A combination of these factors led to the demise of traditional lifestyles and a decrease in the Aboriginal population, particularly in and around the early centres of colonial settlement in Sydney and Parramatta (Attenbrow, 2010).

The Aboriginal presence in the Parramatta district continued after European settlement in the late eighteenth century. Ballodery was one of a number of Aboriginal people who, by June 1791, had established a commercial trade as fishermen with the settlement. This trade was officially encouraged but ceased abruptly when a group of convicts destroyed his canoe. Ballodery featured prominently in the early post-contact history of Parramatta. He was the son of a Parramatta man known as Maugoran. Ballodery lived for a period at Government House with Phillip when the Governor was attempting to establish relations with and *'bring in'* the Sydney Aboriginal population between 1790-1791 (Hunter 1793).

Many of the traditional groups broke up and scattered or re-aligned themselves by the time that colonial diarists, missionaries and early visitors to the area made detailed records of the Aboriginal peoples. The various groups referred to by colonists in the nineteenth century were the result of major post-contact social re-organisation. The displacement and dislocation from traditional lands that occurred soon after European settlement meant that remnant Aboriginal groups were forced to combine '*to provide mutual protection and to maintain viable social and economic units'* (Kohen 1986; Attenbrow 2010). Some researchers have argued that, by as early as the 1820s, the pre-contact population no longer existed as identifiable groups (Attenbrow 2010). Aboriginal peoples who stayed in the area in the early to mid-1800s tended to live on the fringes of white society and became increasingly dependent on welfare. Government allocations of blankets and slop clothing and the bartering of fish and game for sugar, flour and alcohol

reflect the changes that occurred in Aboriginal culture and lifestyle. These changes were replicated throughout greater Sydney and likely occurred in the Parramatta district.

The 1828 Census recorded the *'Parramatta Tribe'* as comprising 49 people. Blanket returns for the Parramatta District dating to the 1830s and 1840s, however, make no mention of a distinct 'Parramatta Tribe' but do record groups from Duck River, Prospect, Eastern Creek and Kissing Point visiting Parramatta to collect blankets (Colonial Secretaries Correspondence - Special Bundles [Aborigines] Reel 3076, SR NSW). The available historical records are largely silent regarding the presence and activities of Aboriginal people at Parramatta by the 1850s. It is likely that many Aboriginal people of the region had by this time moved away or been 'assimilated' into the developing European social, economic and religious fabric.

4.2.2 Parramatta Town Plan

A small settlement named Rose Hill was established by November 1788 in what is now Parramatta Park, to the west of the Parramatta CBD, where land was cleared and planted with crops. In 1790, Governor Arthur Phillip laid out the town that became Parramatta. The Parramatta township referred to the area *'from the foot of Rose Hill and the land for one mile along the creek'* (Parramatta River) (**Figure 4.1**).

A basic grid of streets was established with High Street (now George Street) running between the planned site of Government House and the Landing Place at the eastern end of Parramatta, near Harris Street. Huts were constructed to house the convict workforce and by November 1790, 32 huts had been built with two rooms each (GML Heritage, 2019) (Government Architects Office [Public Works], 2016)). The huts were built of wattle and daub with a thatched roof approximately 12 by 24 feet (3.7 x 7.4 m), a garden allotted to the rear, and capable of housing 10 people (Casey & Lowe, 2014). Plans and paintings from the 1790s and early 1800s show the main streets with rows of timber huts regularly spaced along the street (refer to **Figure 4.2**).

As early as 12 December 1810, Governor Lachlan Macquarie inspected the streets of Parramatta with surveyor James Meehan to plan new streets and alterations to their layout. By May 1811, he had renamed High Street as George Street and realigned neighbouring streets to perfect the grid. Once laid out on a regular plan, greater control over building was also implemented. On 11 May 1811, Macquarie issued a proclamation that:

> *The Towns of Parramatta and Windsor having been lately laid out and arranged into regular Streets, His Excellency hereby orders and directs that no Person shall presume to build any House within those Towns, without previously submitting a Plan of such House and Outhouses, or Offices as he may be disposed to build, to the Magistrate resident in each of those Towns*
>
> (Sydney Gazette, 18 May 1811, p 1 in GML 2019).

Parramatta evolved during the early nineteenth century from a convict settlement to a free town. The township was comprehensively mapped in order to establish the identity of the holders of town lands. Of 390 allotments, only 10 were held by lease at the turn of the nineteenth century. Subsequently, many occupiers were offered leases from the Crown. By 1833 a Commission was established to convert leaseholds to grants based on the presence of a structure on the allotment worth at least 1,000 pounds (Government Architects Office [Public Works] 2016; (GML, 2004)

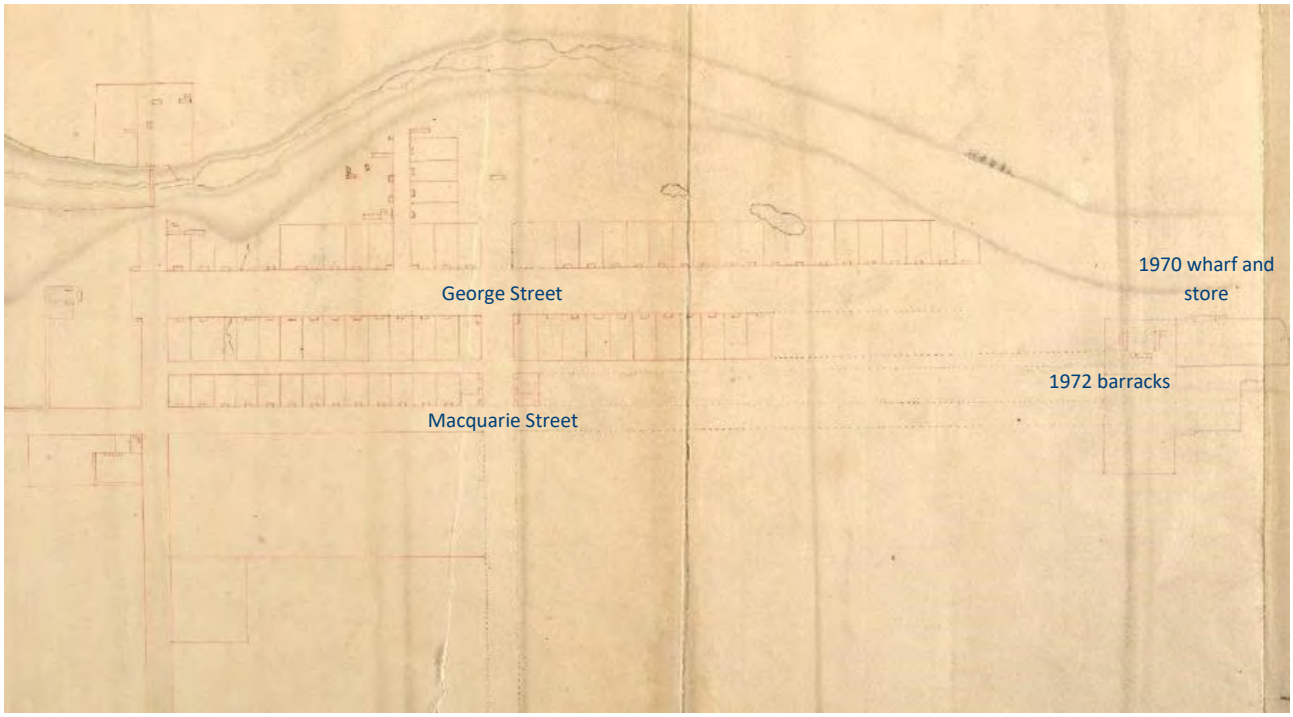


Figure 4.1 1972 plan of Rose Hill, showing George and Macquarie Streets, the 1970 wharf and store, and 1972 barracks.

The National Archives, TNA [UK] CO 700/New South Wales

Figure 4.2 1790 sketch plan of Rose Hill showing the rows of huts along Marsden Street.

State Library of NSW

Figure 4.3 George Street, showing convict huts leading towards Government House (1798).

State Library of Victoria

Figure 4.4 A c.1804 view of George Street, shown from the opposite direction of Figure 4.3.

Caroline Simpson Library & Research Collection

4.2.3 Soldiers District

The 'soldiers district' was located at the eastern extent of George Street, encompassing Harris Street and the current area of Robin Thomas Reserve. Construction of the foundations of the military barracks commenced in November 1790 close to the wharf (**Figure 4.1**). In April 1791, the building of the officers' barracks was listed among the public works being undertaken at Rose Hill. The barracks buildings were arranged in a U-shape with an adjacent area set aside for a garden.

By the early nineteenth century, the barracks had fallen into disrepair and a site was selected for the construction of a new precinct (the current Lancer Barracks) (**Figure 4.5**). By February 1820 the new military barracks for 100 men had been completed (Casey and Lowe 2003). It is likely that the original barracks were demolished shortly after the completion of the new barracks.

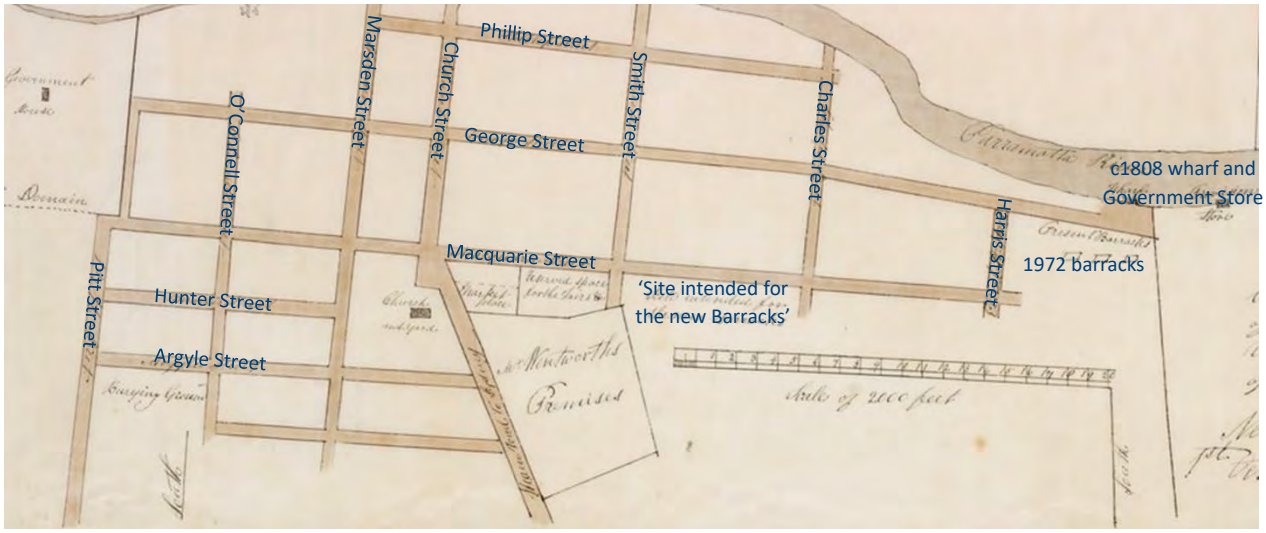


Figure 4.5 1814 plan of Parramatta, showing location intended for the new barracks, Government Store and Queen's Wharf.

State Library of NSW

4.2.4 Continued Development

4.2.4.1 Industrial River Frontage

As larger estates flourished on the outskirts of the township, the accessible river frontage developed as an industrial area. The Parramatta River was a crucial factor in the success of the early township, as it was relied upon for transport and industrial development. The site of the first boat landing area was possibly around the natural stone constriction of the river at the modern sites of Howell's Mill and the Gasworks Bridge. A wharf was constructed by the end of September 1790, a short distance downstream where the deep water provided a natural harbour (Stedinger Associates, 2008). A brick storehouse was constructed in proximity to the early wharf in *circa* 1790.

The initial wharf was later replaced by a stone structure in *circa* 1808 (**Figure 4.5**). A new three-storey stone Government Store was established adjacent to it around the same time. The store was intended to serve as NSW's main granary until an even larger store could be built in Sydney. In 1825 a four-storey Commissariat Store was constructed behind the Government Store; on the other side of what was to become Noller Parade. The Government Store was demolished soon after (Stedinger 2008).

By 1837, the wharf was known as 'Queen's Wharf'. Continued silting of the river, however, meant that eventually it became difficult for ships to reach Queen's Wharf. In 1846, a new wharf was constructed at Redbank, close to the mouth of Duck River. Whilst some smaller boats were initially able to proceed to Queen's Wharf, by the 1880s the majority of the river traffic terminated at Redbank (Stedinger 2008). Other development along the river included a boatshed, Howell's Mill complex, Byrne's Mill complex, the government-run Benevolent Asylum, and the Steam Packet Inn.

4.2.4.2 Growth of the Town

The present-day George, Church, and Macquarie Streets formed some of the earliest street alignments in Parramatta. The first permanent dwellings constructed in the new town — following the convict huts — were concentrated along these principal streets. Church Street developed into an important thoroughfare in the early town; particularly as it was the entry point of the road joining Parramatta to Sydney, with all road traffic between the two settlements travelling along its route. By the 1830s many of the leases along Church and George Streets had been converted to freehold, resulting in the demolition and rebuilding of earlier improvements. Subsequently both streets became formed Parramatta's main commercial centre (GML, 2004).

Major developments along Macquarie Street included the construction of the 1820 military barracks (now Lancer Barracks) and the 1821 convict barracks and lumber yard (now Arthur Phillip High School). In 1836 the lumber yard was closed after major civil infrastructure projects were taken over by the Royal Engineers, and the convict barracks were absorbed by the military. By the 1870s, the barracks had been converted into a hospital and then later as a Benevolent Asylum for destitute men. The barracks continued to operate as an asylum for men until it was demolished in 1935 (GML 2004).

A plan dated to 1804 illustrates the rapid growth and occupation of Parramatta (**Figure 4.5**). The current Smith and Charles Streets were established sometime between 1792 and 1804. By 1814, additional north–south streets (O'Connell, Smith, Charles and Elizabeth [later Harris] Streets) and east–west streets (Phillip, Hunter, and Argyle Streets) had been established (Godden Mackay, 1995) (**Figure 4.6** and **Figure 4.7**). Parramatta continued to rapidly develop and expand over the course of the eighteenth and nineteenth centuries.

Figure 4.6 Detail of 1823 plan of Parramatta

State Archives and Records Authority of NSW

Figure 4.7 Detail of 1844 plan of Parramatta

State Library of NSW

4.3 Desktop Review

4.3.1 Register Searches

The Parramatta landscape is layered with heritage items of varying significance, from local to World heritage significance. Searches of relevant historic heritage registers and lists, both statutory and non-statutory, were undertaken on 27 September 2022 to identify any previously recorded historic heritage items within the Project Area.

A total of 52 heritage items of State significance and 649 heritage items of local significance are currently registered within the City of Parramatta. For clarity, the following assessment will only discuss items located within or adjacent to the 50 m buffer of each geotechnical testing location. Search results are provided in **Table 4.1** and shown in **Figure 4.8**.

Table 4.1 Summary of Registered Heritage Items within the Project Area

Scope ID	Location	Heritage List	Items	Level of Significance
GALC-MW22	Geotechnical testing location	Parramatta LEP 2011	- Robin Thomas Reserve (A2).	Local
	Within 50 m buffer	State Heritage Register	- Ancient Aboriginal and Early Colonial Landscape (SHR 01863).	State
		Parramatta LEP 2011	- Tara (I483).	Local
	Area adjacent	Nil		
GALC-MW23	Geotechnical testing location	Nil		
	Within 50 m buffer	Nil		
	Area adjacent	Nil		
GALC-MW34	Geotechnical testing location	Nil		
	Within 50 m buffer	Parramatta LEP 2011	- Shop and potential archaeological site (I655), - HMV (former Commonwealth Bank) and potential archaeological site (I658), - Woolpack Hotel and potential archaeological site (I702),	Local

Scope ID	Location	Heritage List	Items	Level of Significance
	Area adjacent	Parramatta LEP 2011	- Telstra House (former post office) and potential archaeological site (I657), - Marsdens Building and potential archaeological site (I701).	Local

4.3.2 PHALMS (2000)

The Project Area falls across three (3) AMUs. These are discussed in **Table 4.2** below.

Table 4.2 AMUs applicable to the Project Area

Scope ID	AMU	Discussion	Archaeological Potential	Significance
GALC-MW22	3038	This area has remained largely undeveloped throughout the nineteenth and twentieth centuries. It was, however, in turns part of a pastoral estate and then a garden nursery. This AMU may contain archaeological resources related to agricultural practices or small-scale structural remains. This AMU is also associated with the former Military Barracks and Soldiers' District located at the east end of George Street, on the east and west side of Harris Street including the current Robbin Thomas Reserve	High	Local Military Barracks – State
GALC-MW23	3147	This area was marginal to the early town of Parramatta and may reflect 'fringe dwelling'. This AMU is likely to contain archaeological resources related to domestic activities and post-contact interaction between Europeans and Aboriginal groups.	High	Local
GALC-MW34	3158	This area was part of the early Rose Hill settlement and subsequently the core commercial area of convict and colonial Parramatta. This AMU is likely to contain archaeological resources related to the early development of Parramatta, including structural and other remains associated with convict housing.	Exceptional	State

4.3.3 Previous Historical Assessments

Numerous archaeological reports and associated investigations have been undertaken in Parramatta, providing a substantial body of information relating to the establishment and development of the CBD.

Two proposed geotechnical testing locations (GALC-MW23 and GALC-MW34) are located within / immediately adjacent to the road corridor. Previous archaeological assessments and investigations in road corridors throughout the Parramatta CBD suggest that whilst archaeological remains may survive within these areas, the likelihood that they are intact is low; with the exception of deeper or more robust structures such as drains. The installation of services, upgrades to the roads and footpaths, and — in places — the raising of street levels are likely to have impacted and buried any remains in these locations.

One geotechnical testing location (GALC-BH97) is located within a developed commercial block. An archaeological assessment of this area was undertaken in 2017 (Casey and Lowe 2017). Despite the construction of post-1950s buildings on the site, the assessment concluded that there was moderate to high potential for occupational deposits and structural features to survive across a large proportion of the

block (Casey and Lowe 2017: 80). This is corroborated by the identification of early nineteenth century archaeological deposits beneath late twentieth century structures in various locations along Smith, Macquarie, and George Streets (Casey and Lowe 2017: 67–70).

One geotechnical testing location (GALC-MW22) is located within Robin Thomas Reserve. Several archaeological assessments have been undertaken in the area north of the Reserve, primarily consisting of restricted test pits along the perimeters of Harris and George Streets (Extent 2017: 13–14). One larger test excavation has been undertaken in the proximity to the Reserve (Casey and Lowe 2003). During the archaeological investigations, a largely intact sandstone-capped drain and sandstock brick footings associated with the 1792 barracks were identified (Casey and Lowe 2003: 14–15). As a result, there is high potential for further remains associated with the early development of Parramatta to be present in the area.

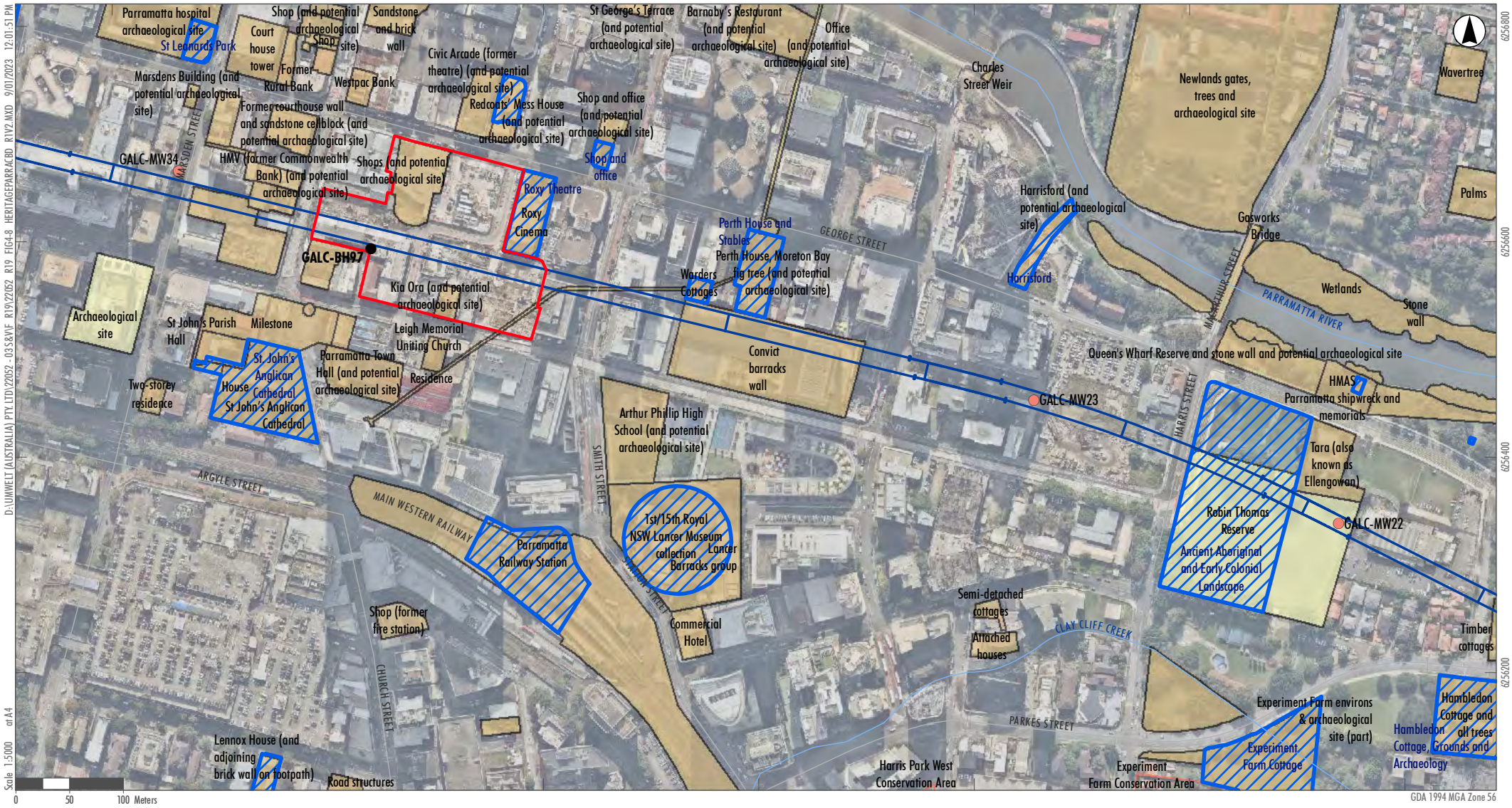
4.4 Key Observations

The three (3) geotechnical testing locations are distributed across the Parramatta CBD in proximity to numerous registered heritage sites and areas of archaeological potential. Key observations drawn from a review of the historical (non-Aboriginal) heritage context of the Project Area and environs are detailed in **Table 4.3**.

Table 4.3 Summary of key observations for each geotechnical testing location

Scope ID	Heritage Listings and AMU	Prior Assessment	Visual Inspection
GALC-MW22	This area has been identified as having high archaeological potential to contain nineteenth century remains of local significance. There is also potential for Aboriginal heritage values to be present (refer to **Section 3.4**). The geotechnical testing location is located within the curtilage of Robin Thomas Reserve (Parramatta LEP A2).	An archaeological test excavation adjacent to the Robin Thomas Reserve (Casey and Lowe 2003) identified several substantial remains associated with the 1792 barracks.	The location of the proposed borehole is within the northeast corner of the playing field at Robin Thomas Reserve. Little disturbances to the area were observable, likely limited to the installation of services and low levels of disturbance associated with the ongoing maintenance and use of the playing fields.
GALC-MW23	This area has been identified as having high archaeological potential to contain nineteenth and twentieth century remains of local significance. There are no registered heritage items within or in close proximity to the 50 m buffer for the geotechnical testing location.	Previous archaeological assessments and investigations in road corridors throughout the Parramatta CBD suggest that whilst archaeological remains may survive within these areas, the likelihood that they are intact is low.	This borehole location is within a highly urbanised area, located within the road corridor. Evidence of previous disturbance through the installation of services as well as upgrades and maintenance of existing road and footpaths. No indications of potential archaeological deposits however there is extensive hardstand covering the area.
GALC-MW34	This area has been identified as having exceptional archaeological potential to contain eighteenth and nineteenth century remains of State significance.	Previous archaeological assessments and investigations in road corridors throughout the Parramatta CBD suggest	This borehole location is in a highly urbanised area in the road corridor on Marsden Street. The west side of the street has been subject to

Scope ID	Heritage Listings and AMU	Prior Assessment	Visual Inspection
	Three registered heritage items are contained within the 50 m buffer for the geotechnical testing location. All are nineteenth century-built heritage items of local significance.	that whilst archaeological remains may survive within these areas, the likelihood that they are intact is low.	recent excavation from telecommunications trenching however this does not extend for the full width of the footpath. No archaeological remains visible due to hardstand covering the area. Extent of previous ground disturbance is unclear.



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Road
- Drainage Line
- Boreholes with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA
- State Heritage Act

Local Heritage

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

Image Source: Nearmap (May 2022) Data source: DFSI (2021)

FIGURE 4.8

Historical Heritage Items in Parramatta Park

5.0 Key Findings

The key findings of this assessment are as follows:

- Proposed geotechnical locations within Robin Thomas Reserve (GALC-MW22) are within the boundaries of AHIMS site #45-6-3158. This is an area of archaeological potential and a Gathering and Resource Site which has also been confirmed to contain intact deep deposits of the Parramatta Sand Body.
- GALC-MW23 is located within 50 m of two valid Aboriginal sites (AHIIMS site #45-6-2863 and #45-6-2673) and the vicinity of several more which have been identified as a continued landscape in the vicinity of Union Street, George Street, Macquarie Street and Angus Lane. It is likely to be located within the Parramatta Sand Body, with confirmed deposits of the alluvial and terrace sands located to the north and east of the proposed borehole location.
- No new Aboriginal sites were identified during the visual inspection component of this assessment. The three locations of the proposed geotechnical locations all have the potential to retain natural soil profiles below the existing hardscape on Marsden Street and Union Street, and below the grass within Robin Thomas Reserve.
- No historic relics or works (including buildings) were observed during the visual inspection component of this assessment, as discussed in **Section 6.0** below.

6.0 Visual Inspection

A visual inspection of the Project Area was undertaken by Melissa Moritz in November 2022. The primary aim of the visual inspection was to identify and record any existing surface evidence of past-Aboriginal activity and/or historic heritage relics within the Project area. The inspection path was tracked in real-time using a held-held Global Positioning System (GPS), with associated transect data recorded (e.g., Ground Surface Visibility (GSV) and Ground Integrity (GI) ratings). The following key observations were made during the visual inspection:

- No Aboriginal objects or historic relics were identified in surface expressions during the visual inspection.
- Stone suitable for flaked and/or ground stone artefact manufacture is, at present, absent from the immediate vicinity of the Project Area.
- Ground visibility within the proposed geotechnical locations was generally low, with thick grass coverage within Robin Thomas Reserve (GALC-MW22) and asphalt and other hardstand in the location of GALC-ML23 and GALC-MW34.
- The location of GALC-MW22, within Robin Thomas Reserve has been subject to lower levels of previous impacts, generally associated with the formation of the playing field and subsequent maintenance and use.
- The locations of GALC-ML23 and GALC-MW34 have been subject to some impacts, though the creation and upgrades of the road and footpaths in the area. However visual inspection cannot confirm the total removal of any historical archaeology or natural soil profiles.

Photo 6.1 Robin Thomas Reserve playing fields. Looking east towards proposed monitoring well location (GALC-MW22)

Source: Umwelt 2022

Photo 6.2 Approximate location of GALC-MW22. Looking east from the northeast corner of the playing field. No structures visible in the area and little ground disturbance noticeable.

Source: Umwelt 2022

Photo 6.3 Approximate location of GALC-MW23. Looking west along Union Street from Angus Lane

Source: Umwelt 2022

Photo 6.4 Approximate location of GALC-MW23. Looking south from Angus Lane. The area is covered in hardstand in the public domain, no visibility of the ground surface.

Source: Umwelt 2022

Photo 6.5 Approximate location of GALC-MW34 looking north along Marsden Street. Area of recent trenching indicated by strip of asphalt within the brick footpath.

Source: Umwelt 2022

Photo 6.6 Approximate location of GALC-MW34 looking south along Marsden Street. Area of recent trenching indicated by strip of asphalt within the brick footpath.

Source: Umwelt 2022

7.0 Impact Assessment

7.1 Aboriginal Heritage

The following provides a summary of the key questions asked as part of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010:10). Should the answer to Question 4 be 'yes', further investigation and impact assessment would be required.

1.Will the activity disturb the ground surface or any culturally modified trees?

Yes, the proposed geotechnical testing locations will include the localised disturbance of extant ground surfaces and extend to bedrock. No impacts are proposed and/or expected to any culturally modified trees located in the vicinity of the proposed borehole locations.

Proceed to Question 2

2a. Are there any relevant confirmed site records or other associated landscape feature information on AHIMS?

The AHIMS database holds records of known Aboriginal sites located within 200 m of the Project Area. Searches of the AHIMS database and reference to the relevant site card recordings confirmed that there are six (6) recorded Aboriginal sites within 50 m of the Project Area. Borehole GALC-MW22 is located within the boundary of one of the Aboriginal sites, AHIMS site # 45-6-3158. AHIMS site # 45-6-3158 is located in Robin Thomas Reserve, encompassing the entire reserve and adjacent allotment to the east of the park. It is an Aboriginal resource and gathering site, with known deposits of the Parramatta Sand Body retaining Aboriginal objects.

Proceed to Question 2b

2b. Are there any other sources of information of which a person is already aware?

Umwelt has reviewed all available literature and pertinent sources of information pertaining to the known Aboriginal resource of the Project area and surrounds. The Parramatta region has been subject to extensive archaeological investigation. Historical records for the Project area indicate that the locations of GALC-MW23 and GALC-MW34 was at the centre of historical development for Parramatta following the establishment of British settlement in the area in 1788. The initial colonial agricultural land use gave way to residential and commercial development, formed on the grid town planning largely visible today. Extensive vegetation clearance associated with agricultural and continued urbanisation of the Project area would have resulted modification to the natural soil profiles. However, results of archaeological investigations within Parramatta demonstrate that although some surface impacts to natural soils have occurred, there is still potential for artefact bearing natural soils to remain across the landscape.

GALC-MW22 is located within the grass playing field of Robin Thomas Reserve, which historical documentation indicates was cleared for agricultural use prior to the establishment of the military barracks and soldiers settlement. Archaeological test excavations undertaken as part of the Parramatta Light Rail works (GML 2020) encountered deep, artefact bearing deposits of the Parramatta Sand Body within the

reserve, demonstrating the retention of archaeological resource despite known historical impacts to the site from its use following British settlement of the area.

Proceed to Question 2c

2c. Are there any landscape features that are likely to indicate presence of Aboriginal objects?

Available evidence suggests that there is widespread evidence of Aboriginal occupation across the alluvial landform sequence at Parramatta, including two levels of terrace adjacent to the upper tidal reaches of the Parramatta River, and within the alluvium associated with Clay Cliff Creek. The distribution of objects is clustered, with patches of higher density, and intervening areas of low density/background objects. The proposed geotechnical investigations are also located within 200 m of the Parramatta River and Clay Cliff Creek, both watercourses would have provided valuable resources for Aboriginal people occupying the Area, with Parramatta River also providing key transportation links to the Sydney Harbour.

3. Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and/or can the carrying out of the activity at the relevant landscape features be avoided?

No harm would occur to any Aboriginal objects listed on AHIMS as a result of the proposed geotechnical investigations. The boreholes are generally located in areas with some potential to contain Aboriginal objects, however the likelihood on encountering an Aboriginal object within the footprint of the proposed works (approximately 250 mm diameter per borehole) is low.

However, it is not possible to relocate the proposed boreholes to areas where there is nil potential to harm Aboriginal objects as the proposed geotechnical testing locations are designed to gather key geotechnical data and monitoring wells for tunnelling associated with the SMW alignment. The location of these boreholes is required to be above the alignment of the tunnels and cannot be moved outside of areas with the potential to contain Aboriginal objects. Additionally, the data cannot be gathered in a non-ground disturbing manner which would prevent the potential for harm to occur to recorded or unknown Aboriginal objects.

Proceed to Question 4

4. Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

The desktop assessment indicates that there is potential for Aboriginal objects to be located in the locations of proposed geotechnical investigations, a low density background level, and may be present at diverse depths in the sedimentary profile. Existing archaeological evidence confirms the presence of Aboriginal sites within the vicinity of the Project area, including six (6) Aboriginal sites located within 50 m of the proposed geotechnical investigations. Other environmental context indicators suggest the likelihood of Aboriginal objects being located in the Project area include the proximity to Parramatta River and the Clay Cliff Creek and the resources offered by the Cumberland Plain woodlands.

Historical development of the project area commenced with the clearing of native vegetation prior to the establishment of the Parramatta settlement in 1788 and later development of Military Barracks and Soldiers Settlement within the boundaries of the current Robin Thomas Reserve. This land use would have resulted in impacts to the natural soils; however, impacts would have been shallow and not resulted in the total removal of all natural soils with the potential to retain Aboriginal object

7.2 Historical (Non-Aboriginal) Heritage

7.2.1 Impact Assessment Methodology

In order to prepare a comparative review of the impact assessment for the proposed geotechnical works against the approved impacts of the Project, this assessment of impacts has been undertaken using the methodology set out in the *Sydney Metro West Concept and Stage 1 (major civil construction between Westmead and The Bays) Environmental Impact Statement (EIS) Technical Paper 3 (non-Aboriginal Heritage)* (Artefact 2020) (EIS Technical Paper 3). This methodology was prepared with reference to the *NSW Heritage Manual* (NSW Heritage Office 2002). Impact to heritage assessed for both impact type, and the associated magnitude or severity of impacts. The types of impact as identified in the EIS Technical Paper 3 are outlined in **Table 7.1**, and the ranking of magnitude used is defined in **Table 7.2**.

Table 7.1 Terminology for Assessing Type of Heritage Impact

Type	Definition
Direct Impact	Impact would result in the demolition or alteration of fabric of heritage significance or significant archaeological remains.
Indirect Impact	Impact would result in changes to the setting or curtilage of heritage items or places, historical streetscapes and landscapes, visual amenity or views.
Potential Indirect Impact	Impacts would result from vibration, subsidence, architectural noise treatment and demolition of adjoining structures.

© information within Table 7.1 sourced from Artefact Heritage Pty Ltd, 2020.

Table 7.2 Terminology for Assessing Magnitude of Heritage Impact

Magnitude	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historical building elements, key historic landscape features, or significant archaeological material, thereby resulting in a change of historic character, or altering of a historical resource. These actions cannot be fully mitigated.
Moderate	This would include actions involving the modification of a heritage item, including altering the settlement of a heritage item or landscape, partially removing archaeological resources or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological resources or the setting of a historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

© information within Table 7.2 sourced from Artefact Heritage Pty Ltd, 2020.

7.2.2 Assessment of Impacts

The impacts of the proposed boreholes and monitoring wells on the historical heritage in the vicinity of the proposed geotechnical investigations are outlined in **Table 7.3**. This includes discussion of impacts on listed heritage items as well as potential impacts to historical archaeological remains.

Table 7.3 Assessment of Non-Aboriginal Heritage Impacts

Scope ID	Impacts to Listed Heritage Items	Impacts to Historical Archaeology
GALC-MW22	This monitoring well is proposed within the northeast corner of the playing fields at Robin Thomas Reserve. Although it is located outside of the SHR curtilage for the Reserve, it is in the curtilage of heritage item A2 'Robin Thomas Reserve' included on the Parramatta LEP 2011. This heritage item is listed for its historical significance as part of the Somerset Nursery established in 1870 by Samuel Purchase, including plantings from this remaining within the boundaries of Robin Thomas Reserve. The proposed monitoring well is located in a clear area of the playing field, away from any vegetation, particularly mature trees potentially associated with the Somerset Nursery. The proposed geotechnical investigations would not require impacts to the significant plantings of this heritage item, nor would it result in any permanent changes that adversely impact on the views and open character of the landscape. It would not result in any direct or indirect impacts The proposed GALC-MW22 would have no material impact on the overall heritage significance of 'Robin Thomas Reserve', item A2 on the Parramatta LEP 2011.	As identified in **Section 5.0**, the proposed monitoring well is located in an area of historical archaeological potential associated with the former military barrack and soldiers district previously located within the boundaries of Robin Thomas Reserve. GALC-MW22 is located in an open grassed playfield with little evidence of previous impacts such as buildings, utilities or other ground surface modification works. It is likely that historical archaeological remains associated for early land use may be retained within the vicinity of the monitoring well. The monitoring well would require the ground disturbance within the approximately 250 mm diameter footprint required for its installation and associated non-destructive digging (NDD) service location. This would result in localised removal to any historical archaeological remains within this 250 mm diameter footprint. Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological resource within Robin Thomas Reserve. The works would therefore result in a minor heritage impact, with little to no material impact to the overall heritage significance of the heritage item.
GALC-MW23	This monitoring well is not located in the vicinity of any listed heritage items. The nearest heritage item, the Harrisford (SHR item 00248) is located approximately 100 m north of GALC-MW23. It would not result in any direct or indirect impacts to this heritage item.	The location of this monitoring well is within an AMU identified as having high archaeological potential to contain nineteenth and twentieth century remains of local significance. This is associated with the former structures located to either side of Angus Lane and Union Street. The proposed monitoring well is located in the public domain outside existing allotments. It is likely that any significant archaeological remains are located outside of the public domain. Any historical archaeological remains which extend into the public domain may be located within the 250 mm diameter of the monitoring well and associated NDD service searching. These works would result in irreversible but localised impacts to any historical archaeological remains within the footprint of the proposed works Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological

Scope ID	Impacts to Listed Heritage Items	Impacts to Historical Archaeology
		associated with the nineteenth and twentieth century development of the northeast corner of Parramatta.
GALC-MW34	This monitoring well is not located within the curtilage of a listed heritage item. The nearest heritage item ('House', Item 655 Parramatta LEP 2011) is located approximately 30 m east, on the opposite side of Marsden Street. GALC-MW34 would not require the intervention with any significant fabric associated within the listed heritage items in the vicinity. Once installed, the monitoring well will set flush with the pavement and would not restrict views to the heritage items in the vicinity. GALC-MW34 would not result in any direct or indirect impacts to listed heritage items.	GALC-MW34 is located within an AMU identified as having exceptional archaeological potential to contain eighteenth and nineteenth century remains of State significance. As identified above, these archaeological remains are associated with the allotments to either side of Marsden Street however there is potential, albeit low, for these archaeological remains to extend into the public domain. Any historical archaeological remains which extend into the public domain may be located within the 250 mm diameter of the monitoring well and associated NDD service searching. These works would result in irreversible but localised impacts to any historical archaeological remains within the footprint of the proposed works Ground disturbance at this minor scale could result in truncation or removal of isolated sections of any archaeological deposits than may exist within the footprint of the proposed borehole. However, this impact would not result in extensive impact to or total removal of the potential archaeological remains associated with the development of Marsden Street in Parramatta.

7.2.3 Material Threshold Policy

As outlined in **Section 2.2.2.1,** the Materials Threshold Policy is applied on the SMW WTP in accordance with MCoA D13, as well as the best practice approach to managing impacts to items of State heritage significance. This policy seeks to understand whether the degree of impact of a proposed action or change to a State heritage item would materially affect the heritage significance of the place, irrespective of the degree of change proposed (Heritage NSW Department of Premier and Cabinet 2020).

The monitoring wells identified in this assessment are not located within the curtilage of any State heritage items. One of the three monitoring well (GALC-MW22) is located within the curtilage of a heritage item, being Robin Thomas Reserve. The borehole is located within an open grass section of the reserve and will not result in the introduction of new structural elements nor the removal of significant trees within Robin Thomas Reserve.

GALC-MW22 would have the potential for minor but localised impacts to the potential historical and Aboriginal archaeological remains that have been identified within Robin Thomas Reserve. These impacts, when considered in the context of the broader heritage significance of the Parramatta streetscapes, would be of little to no impact on the overall heritage values and would have no material effect on the heritage item.

7.3 Summary of Impacts

7.3.1 Approved Project Impacts

The Project was granted SSI approval under SSI-10038, which included the approval of the potential impacts to heritage as identified within the EIS, including the accompanying Aboriginal and non-Aboriginal technical papers and subsequent modification reports. The approved project impacts for the WTP included in the EIS were:

- Construction footprint of the station box at Westmead, Parramatta and Sydney Olympic Park.
- Construction footprint of Clyde Maintenance and Services Facilities.
- Construction footprint of the Rosehill Dive Site (connection to the CMSF).
- Power supply upgrade routes.

The EIS did not include any surface works within Robin Thomas Reserve or the Parramatta streetscape outside of the Parramatta Metro Station construction site and overall were not assessed as having any potential direct impacts on the heritage values of Robin Thomas Reserve, nor result in any harm to Aboriginal objects. The tunnel alignment runs below the locations of the proposed geotechnical investigations however no indirect impacts associated with tunnelling and operation of the tunnel were identified within the EIS and associated Technical Paper 3 (Artefact 2020).

7.3.2 Consistency Assessment

As identified above, the proposed geotechnical testing location within Robin Thomas Reserve have not previously been assessed as part of the approved Project impacts. The proposed monitoring locations are located within <50 m of six (6) Aboriginal sites recorded on AHIMS, with GALC-MW22 located within the boundaries of Aboriginal site #45-6-3158, and (as identified in **Section 3.2.1**) are located in areas with the potential to contain previously unrecorded Aboriginal objects. However, based on a review of the environmental context and previous disturbances in the area (as identified in **Section 7.1**) the likelihood of encountering Aboriginal objects is overall considered to be low.

A review of the archaeological context of the Project Area and environs suggest that the types of historical archaeological remains likely to be in the footprint of the proposed boreholes would be of an ephemeral nature only and as such, any minor disturbances resulting from the proposed geotechnical works would result in little to no impact to the heritage values of Robin Thomas Reserve, and would not remove the total archaeological resource remaining within the Parramatta streetscape.

The installation of three (3) monitoring wells will introduce new elements to the Parramatta streetscapes, however the scale and nature of the works would not result in any changes to the character or setting of the Parramatta streetscapes in the proposed locations, nor would they result in any impacts on the heritage significance of Robin Thomas Reserve, and other key landmarks of the Parramatta streetscapes.

7.3.3 Conclusion

The approved Project impacts, as set out within the EIS and associated technical papers and subsequent modifications, were limited to the assessment of impacts within the construction sites and immediate vicinity of the SMW WTP Metro Station sites and Clyde Stabling and Maintenance Facility site (Artefact 2020). No direct or indirect impacts were assessed for the Project on the heritage significance of Robin Thomas Reserve.

Although the works within the curtilage of local heritage item 'Robin Thomas Reserve' were not assessed within the EIS or associated technical papers (Artefact 2020), the works are consistent with Condition D13 of the MCoA for the Project, as the proposed geotechnical investigations will not 'destroy, modify or otherwise affect any Heritage item' not included in the Project approval.

As noted in the consolidated consent for SSI-10038 the term 'affect' in Condition D13 means any impact above "little to no impact" as defined in the Material Threshold Policy (Heritage NSW 2020). The proposed geotechnical investigations have been assessed with respect to this requirement and will have "little to no impact" and thus comply with Condition D13.

8.0 Management Recommendations

In light of the above key findings and impact assessment presented in **Section 8.0** this Aboriginal Heritage and Historical (non-Aboriginal) Heritage Impact Assessment provides the following management recommendations:

Recommendation 1. Non-Destructive Digging (NDD) for the purposes of locating underground utilities should be undertaken with a suitably qualified archaeologist present to ensure the works are completed appropriately, and to ensure no unidentified Aboriginal objects or historical archaeological remains are impacted by the work, should they unexpectedly be located within the borehole footprint.

Recommendation 2. If, in the unlikely event that Aboriginal objects or historical relics is located during the works, all works in the area must cease immediately and the ***Sydney Metro Unexpected Heritage Finds Procedure*** (SM-18-00105232) must be implemented.

Recommendation 3. All contractors and GLC personnel undertaking the proposed geotechnical works within this assessment must be made aware of the heritage values of the Robin Thomas Reserve and the requirements of the Project approvals and HMP to prevent adverse impacts or damage to any heritage item or significant elements within Parramatta Park.

Recommendation 4. All vehicles and plant must be parked on sealed surfaces to prevent impacts to the ground surface within the vicinity of the proposed works. Any equipment that is required to be driven or operated on grassed areas should only be manoeuvred on track mats in dry conditions to manage any ground disturbance associated with these movements.

Recommendation 5. Any changes to the locations and methodology for any boreholes or monitoring wells may require further assessment. Should any changes to the scope of works outlined in this report be identified, no works should be undertaken prior to review of the locations by the GLC environmental manager/s and/or heritage specialist.

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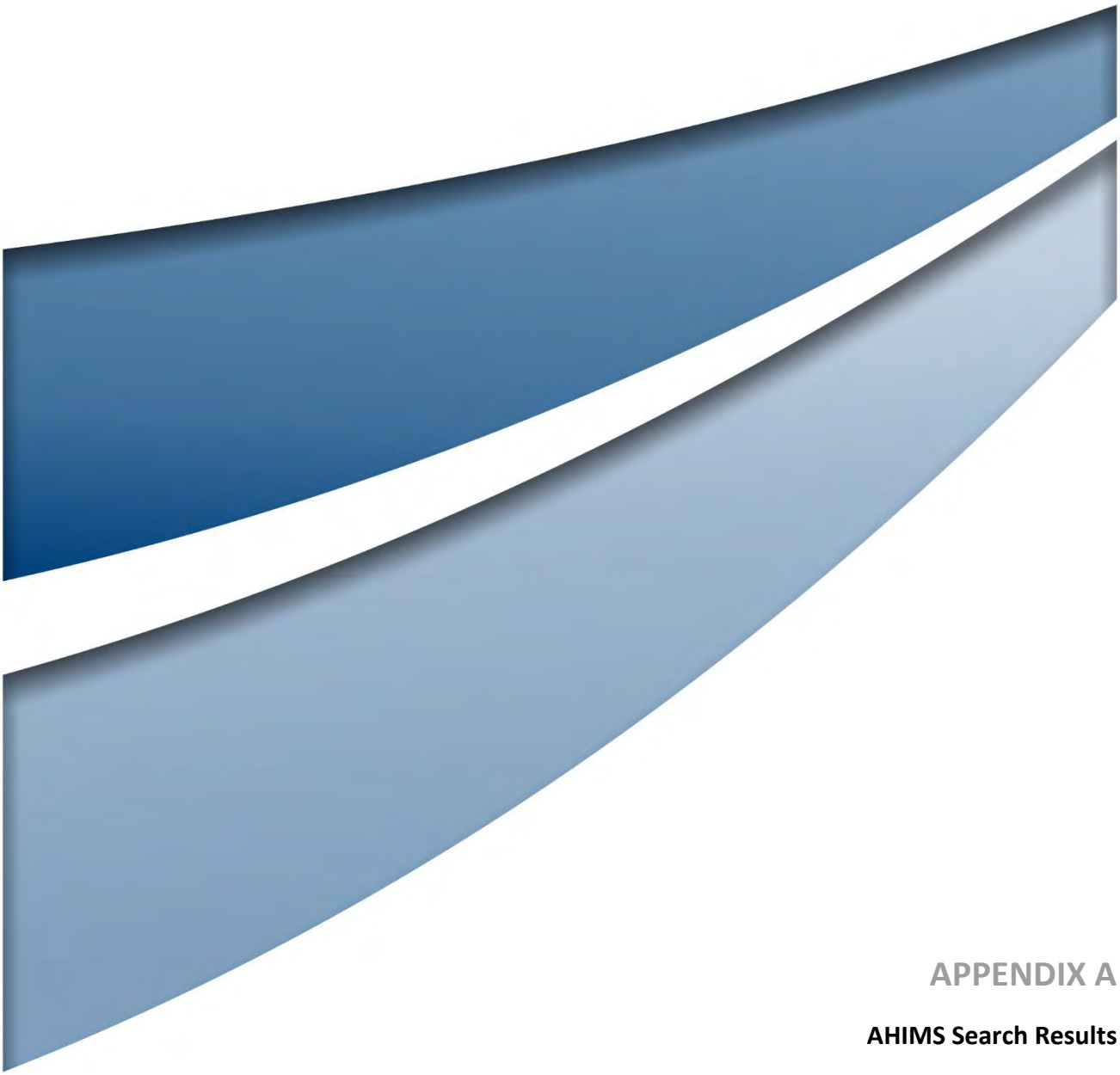

APPENDIX A

AHIMS Search Results

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-5-2465	Parramatta Regional Park (IF3)	GDA	56	314524	6256879	Open site	Partially Destroyed	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	Doctor.Jillian Comber,J Steel					**Permits**	3822	
45-5-2463	Parramatta Regional Park (IF1)	GDA	56	314462	6257627	Open site	Valid	Artefact : -	Isolated Find	102142,102196
	Contact	**Recorders**	J Steel					**Permits**	3994	
45-5-2464	Parramatta Regional Park (IF2)	GDA	56	314400	6257619	Open site	Valid	Artefact : -	Isolated Find	102196
	Contact	**Recorders**	J Steel					**Permits**		
45-6-1523	George St Parramatta;Family Law Courts;	AGD	56	314950	6256450	Open site	Valid	Artefact : -	Open Camp Site	1809,102196,103782
	Contact	**Recorders**	Val Attenbrow,Doctor.Edward Higginbotham					**Permits**		
45-5-1065	Parra Park 3;PP 3;	AGD	56	314620	6257620	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2554	Elizabeth Farmhouse	AGD	56	316420	6255700	Open site	Valid	Artefact : -	Open Camp Site	102196,103782
	Contact	**Recorders**	Michael Guider					**Permits**	2928	
45-6-2559	Sydney Turf Club Carpark;STC Carpark;	AGD	56	316900	6256020	Open site	Valid	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2570	Kissing Point Rd	AGD	56	318820	6258140	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-6-2578	Collett Park;	AGD	56	316680	6257140	Open site	Valid	Artefact : -	Open Camp Site	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-5-1110	Redbank;Northmead;	AGD	56	314020	6258060	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	102196
	Contact	**Recorders**	Michael Guider					**Permits**		
45-5-0864	Governors Bathhouse;	AGD	56	314340	6256750	Open site	Partially Destroyed	Artefact : -	Open Camp Site	102142,102196
	Contact	**Recorders**	Michael Guider					**Permits**	3822	
45-5-0277	Cumberland Oval;Parramatta;	AGD	56	314588	6257260	Open site	Destroyed	Modified Tree (Carved or Scarred) : -	Scarred Tree	223,260,1018,102142,102196
	Contact	**Recorders**	Cook					**Permits**		
45-5-0762	Parramatta Park	AGD	56	314320	6256950	Open site	Partially Destroyed	Artefact : -, Modified Tree (Carved or Scarred) : -	Open Camp Site,Scarred Tree	102142,102196
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	
45-6-2627	HP-1	AGD	56	315850	6255210	Open site	Valid	Artefact : -		102196
	Contact	**Recorders**	Mick Leon					**Permits**		

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-2648	Charles/George 1	GDA	56	315690	6256470	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99538,102196
	Contact	**Recorders**	Doctor.Jo McDonald,EMM Consulting - St Leonards - Individual users,Curio Projects					**Permits**	1433,1682,2176,2240,2353,3049,3509,4662	
45-5-2856	Parramatta Park Macquarie Entrance PAD	AGD	56	314500	6256550	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		98738,103133
	Contact	**Recorders**	Dominic Steele Archaeological Consulting					**Permits**	1647,3822	
45-6-2678	SSP1 (formerly Smith Street PAD)	AGD	56	315330	6256150	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		99518,102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1848,2561	
45-6-2668	Argyle St	AGD	56	315200	6256060	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1764,2155	
45-6-2669	Kendall Street, Harris Park	AGD	56	315525	6256150	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Jim Wheeler					**Permits**	1767	
45-6-2673	RTA-G1	GDA	56	315842	6256510	Open site	Valid	Artefact : -		100552,102196,103782
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	1841,2176,3050,3509	
45-6-2679	Parramatta Children's Court	AGD	56	314900	6256600	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**	1850,1973,2117,3847	
45-6-2738	James Ruse Reserve Open Camp 1	AGD	56	316000	6256000	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Jim Wheeler					**Permits**	2018,2187	
45-6-2686	Civic Place PAD	GDA	56	315130	6256450	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		99666,99791,103115,103782
	Contact	**Recorders**	Doctor.Jo McDonald,Niche Environment and Heritage,Niche Environment and Heri					**Permits**	1960,3749,3890,3897,3983,3988,4044,414	
45-6-2751	Marsden St Carpark	AGD	56	314900	6256350	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		102196,103782
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**	2243	
45-6-2739	PADUNknown	AGD	56	314950	6256700	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102196,103782

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Haglund and Associates					Permits		
45-6-2746	Old Hospital Site Parramatta Health Services Precinct	AGD	56	314950	6256650	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		99798,100551,100558,102196,103782
	Contact	Recorders	Ms.Laila Haglund					Permits	2160,2507	
45-6-2741	Parramatta Transport Interchange PAD	AGD	56	315450	6256250	Open site	Valid	Potential Archaeological Deposit (PAD) : -		99438,99497,102196,103782
	Contact	Recorders	Doctor.Susan (left ahms) Mcintyre-Tamwoy					Permits	2121,4767	
45-5-3186	Marsden Street	GDA	56	314800	6256315	Open site	Valid	Artefact : 4		102196,103782
	Contact T Russell	Recorders	Doctor.Edward Higginbotham					Permits		
45-6-2756	Parramatta Rehabilitation Centre (formerly O'Connell St PAD)	GDA	56	314950	6256850	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		102196,103782
	Contact	Recorders	Ms.Laila Haglund,Doctor.Alan Williams,EMM Consulting - St Leonards - Individual u					Permits	2317,2414,2511,4797	
45-6-2795	150 Marsden Street Parramatta PAD	AGD	56	314955	6256480	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		102196,103782
	Contact T Russell	Recorders	Austral Archaeology - Wollongong					Permits	2404	
45-6-2863	Cumberland Press Site	GDA	56	315913	6256448	Open site	Valid	Artefact : 89		103782
	Contact	Recorders	Ms.Laila Haglund,Ms.Tory Stening					Permits	2865,3307,3509,3816	
45-6-2893	95-101 George St (GSP AD)	GDA	56	315720	6256570	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		101078,103782
	Contact	Recorders	Megan Mebberson					Permits	3509	
45-6-2933	Belmore Park	GDA	56	315500	6258293	Open site	Valid	Artefact : -		
	Contact	Recorders	Michael Guider,Kelleher Nightingale Consulting Pty Ltd,Miss.Madeline Harding					Permits		
45-5-3630	Macquarie St PAD	AGD	56	314800	6256500	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		103782
	Contact	Recorders	Comber Consultants Pty Limited,Comber Consultants Pty Limited					Permits	3107,3302	
45-6-2950	Macquarie St PAD 2	GDA	56	315835	6256410	Open site	Destroyed	Potential Archaeological Deposit (PAD) : -		102144,103782
	Contact	Recorders	Doctor.Jillian Comber,Comber Consultants Pty Limited					Permits	3238,3366	
45-6-2976	George St PAD 1	GDA	56	315650	6256690	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509,4766,4767	

Report generated by AHIMS Web Service on 14/11/2022 for Melissa Moritz for the following area at Lat, Long From : -33.8346, 150.9836 - Lat, Long To : -33.7989, 151.0454. Number of Aboriginal sites and Aboriginal objects found is 108

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 22052 HRBH

Client Service ID : 732154

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-2977	Macquarie St PAD 3	GDA	56	315090	6256650	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509,4767	
45-5-4097	O'Connell St PAD1	GDA	56	314900	6256695	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Comber Consultants Pty Limited,Mr.David Nutley					Permits	3509	
45-6-2978	41 Hunter Street PAD	GDA	56	315030	6256450	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Mr.Alexander Beben					Permits	3419	
45-6-3108	42 Bridge Street Rydalmere PAD	GDA	56	317670	6256778	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	GML Heritage Pty Ltd - Surry Hills,Ms.Sally MacLennan					Permits		
45-6-3102	Phillip Street PAD 1	GDA	56	315581	6256801	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Mr.Dominic Steele					Permits	3755	
45-6-2988	7-9 Victoria Road Parramatta	GDA	56	315502	6257233	Open site	Valid	Artefact : 9		
Contact		Recorders	GML Heritage Pty Ltd - Surry Hills,Ms.Anita Yousif					Permits	3488	
45-6-3068	GS PAD 1 184-188 George Street	GDA	56	315899	6256375	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		103962
Contact		Recorders	Mr.Dominic Steele					Permits	3584	
45-6-3065	PHILLIP ST PAD 1	GDA	56	315500	6256675	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
Contact		Recorders	Mr.Dominic Steele					Permits		
45-6-3124	330 Church St Artefact Scatter	GDA	56	315330	6256965	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Doctor.Julie Dibden					Permits		
45-6-3151	UWS Rydalmere OS 1	GDA	56	317400	6257004	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Benjamin Streat					Permits	3800	
45-6-3118	Clay Cliff Creek Levee	GDA	56	315801	6256294	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		102992,102997,102998
Contact		Recorders	Ms.Fenella Atkinson					Permits	3788	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3134	Lennox Bridge Car Park PAD	GDA	56	315209	6256970	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Felicity Barry					**Permits**	3797,4094,4537,4767	
45-6-3131	River Road West	GDA	56	316650	6256450	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : -, Artefact : -		102338
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson,Miss.Cora					**Permits**	3734,4657,4825	
45-5-4630	Parramatta Leagues Club PAD	GDA	56	314974	6257483	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		103589
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Doctor.Tim Owen					**Permits**	3958	
45-5-4530	Parramatta RSL PAD	GDA	56	314810	6256690	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -, Hearth : -		104179
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim O					**Permits**	3819,3853,3935,4364	
45-6-3159	Catholic Diocese Parramatta PAD	GDA	56	315120	6257259	Open site	Partially Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : -		104276
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Miss.Diana Cowie,Mrs.Laressa					**Permits**	4300	
45-5-4533	Paddocks Playground Parra Park	GDA	56	314323	6257378	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	3822	
45-5-4534	Parramatta Park - Location C	GDA	56	314568	6257473	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Annie Bickford					**Permits**		
45-5-4535	Parramatta Park - Location E	GDA	56	314539	6256846	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4536	Parramatta Park - Location G	GDA	56	314504	6256700	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4537	Parramatta Park - Location H	GDA	56	314199	6257357	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	
45-5-4538	Parramatta Park - Location J	GDA	56	314351	6257676	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4539	Parramatta Park - Location K	GDA	56	314460	6257823	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4540	Parramatta Park - Location I	GDA	56	314260	6257448	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3822	

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45-5-4542	Parramatta Park - Location L	GDA	56	314542	6257709	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4543	Parramatta Park - Location N	GDA	56	314693	6257737	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4544	Parramatta Park - Location O	GDA	56	314725	6257680	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4545	Parramatta Park - Location S	GDA	56	314170	6256851	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Dominic Steele					**Permits**		
45-5-4546	Parramatta Park - Location D	GDA	56	314555	6256864	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-5-4547	Parramatta Park - Location F	GDA	56	314304	6257230	Open site	Partially Destroyed	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**	3994	
45-5-4541	Parramatta Park - Location M	GDA	56	314608	6257586	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Val Attenbrow					**Permits**		
45-6-3158	Robin Thomas Reserve	GDA	56	316100	6256300	Open site	Partially Destroyed	Aboriginal Resource and Gathering : -, Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent H					**Permits**	4439	
45-6-3157	Harris St Footpath	GDA	56	316013	6256461	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Ms.Tory Stening					**Permits**	4439,4900	
45-6-3193	Riverbank Square PAD	GDA	56	315405	6256895	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**		
45-6-3195	Cumberland Hospital East	GDA	56	315022	6258090	Open site	Valid	Potential Archaeological Deposit (PAD) : -		103863
	Contact	**Recorders**	Ms.Jillian Comber					**Permits**	3932,4900	
45-6-3180	21 Hassall Street	GDA	56	315761	6256247	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103758
	Contact	**Recorders**	Ms.Ngaire Richards					**Permits**	3906,3975	
45-5-4895	Old Kings Oval Artefact Scatter 1	GDA	56	314665	6257231	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd - Sydney,Artefact - Cultural Heritage Management - Pyrm					**Permits**	4307,4461	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3232	Test recording	GDA	56	315051	6257106	Open site	Deleted	Artefact : -		
	Contact	**Recorders**	DPIE - Armidale,Mr.Stewart Watters					**Permits**		
45-6-3312	PLR AFT 1	GDA	56	316105	6256465	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3313	PLR AFT 2	GDA	56	316305	6256340	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd,Ms.Cristany Milicich					**Permits**		
45-6-3222	Old Kings School AS1	GDA	56	315026	6257139	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Ngaire Richards					**Permits**		
45-6-3214	Wigram & Hassall St AS	GDA	56	315825	6256231	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Mr.Alistair Hobbs					**Permits**	4043	
45-6-3503	32 Smith Street	GDA	56	315536	6256745	Open site	Partially Destroyed	Potential Archaeological Deposit (PAD) : 1		103963,103964,103965
	Contact	**Recorders**	AMAC Group P/L,Mr.Benjamin Streat					**Permits**	4268,4347	
45-6-3360	Parramatta Riverside PAD 1	GDA	56	315172	6256924	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Biosis Pty Ltd - Sydney,Biosis Pty Ltd - Wollongong,Mr.James Cole,Mrs.Samantha K					**Permits**	4250,4379	
45-6-3625	Granville MPC PAD	GDA	56	316175	6254420	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		104230
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Ms.Fenella Atkinson					**Permits**	4352	
45-6-3692	VOC IF1	GDA	56	315044	6257297	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Ms.Jennifer Norfolk					**Permits**	4900	
45-6-3630	Hassall St PAD	GDA	56	315587	6256244	Open site	Destroyed	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4412,4527	
45-5-4942	Parramatta RSL Artefact Scatter 1 (PRSL AS-01)	GDA	56	314839	6256683	Open site	Destroyed	Artefact : -, Hearth : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Artefact - Cultural Heritage Ma					**Permits**	4235,4949	
45-6-3679	Stage One PAD	GDA	56	315454	6256795	Open site	Not a Site	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Ms.Clare Anders					**Permits**	4522	

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
45-6-3582	Macquarie Street PAD	GDA	56	315306	6256602	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Miss.Alandra Tasire,Comber Consultants Pty Limited,Artefact - Cultural Heritage M					**Permits**		
45-5-5126	Cumberland West	GDA	56	314493	6257901	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Jillian Comber					**Permits**	4363,4468	
45-6-3495	116 Macquarie St Parramatta	GDA	56	315700	6256475	Open site	Valid	Potential Archaeological Deposit (PAD) : 1, Artefact : -		103782
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Alandra Tasir					**Permits**	4607,4651	
45-5-5010	Parramatta Park PAD_1	GDA	56	314400	6256580	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	Niche Environment and Heritage,Niche Environment and Heritage,Mr.Samuel Rich					**Permits**	4256,4698,4889	
45-5-5251	Western Sydney Stadium	GDA	56	314884	6257269	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Jillian Comber,Comber Consultants Pty Limited					**Permits**		
45-6-3767	85-97 Macquarie St	GDA	56	315235	6256513	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Tory Stening					**Permits**	4627,4681	
45-6-3702	Smith St PAD1	GDA	56	315480	6256713	Open site	Destroyed	Artefact : -, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Comber Consultants Pty Limited,Comber Consultants Pty Limited,Ms.Jillian Combe					**Permits**	4513,4756	
45-6-3764	Belmore Park ISO 1	GDA	56	315593	6258267	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Artefact - Cultural Heritage Management - Pyrmont,Ms.Jennifer Norfolk					**Permits**		
45-6-3837	Baludarri Drive PAD	GDA	56	316635	6256597	Open site	Not a Site	Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Extent Heritage Pty Ltd - Pyrmont - Individual users,Extent Heritage Pty Ltd - Pyrm					**Permits**	4657	
45-6-3801	APHS Stone and Glass Artefacts	GDA	56	315650	6256471	Open site	Partially Destroyed	Artefact : -, Hearth : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,GML Heritage Pty Ltd - Surry Hills,Doctor.Tim O					**Permits**	4808	

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45-6-3827	Clyde PAD 01	GDA	56	317121	6254846	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen,Artefact - Cultural Heritage Ma					**Permits**		
45-6-3818	St Johns Cathedral Background Artefact Scatter	GDA	56	315165	6256458	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Doctor.Alan Williams,EMM Consulting - St Leonards - Individual users					**Permits**	4702	
45-5-5472	PLR CHE Area	GDA	56	314724	6258051	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-3894	PLR Church St PAD and Artefacts	GDA	56	315241	6256871	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3895	PLR Macquarie St PAD	GDA	56	315787	6256398	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-3896	PLR George St PAD	GDA	56	316497	6256288	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4900	
45-6-3897	PLR RTR Artefacts and PAD	GDA	56	316017	6256441	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-5-5473	PLR AT14	GDA	56	314592	6258005	Open site	Valid	Artefact : -, Hearth : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**		
45-6-4048	Phillip St East PAD	GDA	56	315691	6256742	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	GML Heritage Pty Ltd - Surry Hills,Doctor.Tim Owen					**Permits**	4981	
45-6-4053	87-91 George St PAD	GDA	56	315633	6256560	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Urbis Pty Ltd - Angel Place L8 123 Pitt Street,Mr.Owen Barrett					**Permits**		

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45-6-4015	Church St PAD-1	GDA	56	315118	6256622	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats,Mrs.S					**Permits**	4960	
45-6-3992	PPS PAD 1	GDA	56	315168	6256871	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats					**Permits**	4906	
45-6-4063	The Albion Hotel	GDA	56	315977	6256462	Open site	Valid	Potential Archaeological Deposit (PAD) : -		105061
	Contact	**Recorders**	Comber Consultants Pty Limited,Ms.Agata Calabrese					**Permits**		

**** Site Status**

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

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umwelt
Environmental & Social
Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au

Appendix E – Construction Noise and Vibration Impact Assessment (CNVIA)

Memorandum

To:	Candice Somerville	**At:**	GLC
From:	M. Bruck / S. Luzuriaga	**At:**	SLR Consulting Australia Pty Ltd
Date:	17 November 2022	**Ref:**	610.30644-M07c-High Risk Sites-v1.0-20221117.docx
Subject:	Sydney Metro West WTP NVIA Geotechnical Investigations (High Risk)		

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 and vibration impacts associated with Geotechnical Investigations along the project alignment during approved hours and out-of-hours (OOH) assessment periods.

All work on or adjacent to roads would be carried out in accordance with a relevant Traffic Control Plan (TCP) and/or Road Occupancy Licence (ROL) to facilitate safe work near live traffic. Where an ROL cannot be obtained for the approved project hours and/or proposed works cannot be undertaken safely during these hours, some works will be required to be undertaken outside of approved project hours (ie Out of Hours Work, OOHW).

2 Overview of Proposed Work

Table 1 presents an overview of key information relevant to this NVIA. **Table 2** presents the Construction Scenarios and Equipment. 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 the project team, and subsequent updates. 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 work

Item	Description		
CNIA Reference	M07c		
Works Type	Geotechnical Investigations (High Risk)		
Location	Westmead to Sydney Olympic Park		
Assessment Periods (refer CNVMP)	**Approved Project Hours (AH)**	**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'.		
Noise Modelling	ISO 9613:2 algorithm in SoundPLAN v8.2		
Results Presentation	Free field – no façade reflections		

Table 2 Construction Scenarios and Equipment

			Total Lw (dBA)	Excavator 3-6T + hydraulic Hammer[3]	Plate Compactor	Lighting Tower	Saw – Concrete[3]	Tipper Truck	Truck - Vacuum (NDD)	Water Cart	Tracked Hydraulic Drilling Rig	Hand tools (electric)	Light Vehicle (accelerating)[2]	Tracked Excavator 10t
Sound Power Level (Lw)[1]				115	104	80	118	103	109	107	114	102	96	100
Estimated utilisation per period (%)				30%	30%	100%	30%	25%	30%	10%	100%	50%	25%	50%
ID	**Construction Scenario**	**Assessment Period**												
W.001	Non-Destructive Digger (NDD)	AH (Day) / OOHW2 (Night)	**120**	1		1	1	1	1	1		1		1
W.002	Drilling Operations	AH (Day) / OOHW2 (Night)	**114**			1				1	1	1	4	
W.003	Reinstatement	AH (Day) / OOHW2 (Night)	**105**		1	1		1		1		1		1

Note 1: Individual Sound Power Levels (Lw) for key activities have been adopted from the DEFRA Noise Database, AS2436, TfNSW *Construction Noise and Vibration Strategy* and Sydney Metro *Construction Noise and Vibration Standard.*

Note 2: Taken from *Road Traffic Noise Prediction Model "ASJ RTN-Model 2013" Proposed by the Acoustical Society of Japan – Part 2: Study on Sound Emission of Road Vehicles*, OKADA et al, Internoise 2014, and accounts for vehicles accelerating.

Note 3: The ICNG requires 'annoying' activities (eg saw operations) to have a 5 dB 'penalty' applied to the source sound power level.

A total of 30 borehole (BH) /monitoring well (MW) locations have been assessed as part of this geotechnical investigation scope of work. Following the heritage and ecological constraints review, these locations were divided into three categories:

- Low environmental risk: *BH03, BH13, BH90, BH91, MW01, MW06, MW37, MW40*
- Moderate environmental risk: *BH01, BH02, BH31, BH32, BH33, BH34, BH35, BH36, MW19, MW20, MW21, MW24, MW25, MW26*
- High environmental risk: *BH05, BH92, MW22, MW23, MW34, MW35, MW36, MW54*

This assessment addresses the **high environmental risk locations only**.

3 Assessment Criteria

3.1 Noise Management Levels

The noise management levels (NMLs) for residential (**Table 3**) and other sensitive receivers (**Table 4**) have been adopted from the Construction Noise and Vibration Management Plan (CNVMP). Project-specific NMLs for residential receivers were determined for each Noise Catchment Area (NCA). During out-of-hours work (OOHW) the residential NML is determined as 5 dB above the Rating Background Noise level (RBL) (ie RBL + 5dB).

NMLs for other sensitive receivers have been adopted from the Interim Construction Noise Guideline (ICNG), Sydney Metro - Construction Noise and Vibration Standard (CNVS), *AS2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors*, and previous assessments undertaken for the Sydney Metro West Project (eg EIS and modification reports).

Table 3 Project Residential NMLs

NCA	Receiver Type	Representative Logger Location	Noise Management Level ($L_{Aeq(15minute)}$ – dBA)				Sleep Disturbance Screening Level (52 dBA or RBL +15 dB whichever is higher) (L_{Amax} dBA)
			Approved Construction Hours (RBL+10dB)	Out of Hours (RBL+5dB)			
			Day	Day[1]	Evening	Night	Night
NCA01	Residential	B.02	58	53	51	46	56
NCA02	Residential	B.01	59	54	52	42	52
NCA03	Residential	B.03	68	63	58	48	58
NCA04	Residential	B.04	61	56	53	46	56
NCA05	Residential	B.05	60	55	54	50	60
NCA06	Residential	B.06	62	57	56	49	59
NCA07	Residential	B.07	56	51	49	46	56
NCA08	Residential	B.08	58	53	53	51	61
NCA09	Residential	B.09	58	53	51	46	56

Note 1: Daytime out of hours is 7 am to 8 am on Saturday, and 8 am to 6 pm on Sunday and public holidays

Table 4 NMLs for 'Other Sensitive' Receivers

Land Use	Assessment Period	Noise Management Level $L_{Aeq(15minute)}$ (dBA)	
		Internal	External
ICNG 'Other Sensitive' Receivers			
Classrooms at schools and other educational institutions	When in use	45	55[1]
Hospital wards and operating theatres	When in use	45	65[2]
Places of worship	When in use	45	55[1]
Active recreation areas (characterised by sporting activities and activities which generate noise)	When in use	-	65
Passive recreation areas (characterised by contemplative activities that generate little noise)	When in use	-	60
Commercial	When in use	-	70
Industrial	When in use	-	75

Land Use	Assessment Period	Noise Management Level $L_{Aeq(15minute)}$ (dBA)	
		Internal	External
Non-ICNG 'Other Sensitive' Receivers			
Hotel[3]	Day / Evening	50	70[2]
	Night-time	40	60[2]
Café / Bar / Restaurant[3]	When in use	50	70[2]
Child Care Centres – Sleeping areas[4]	When in use	40	50[1]
Public Building	When in use	50	60[1]
Recording Studio	When in use	25	45[2]
Theatre/Auditorium	When in use	30	50[2]
Rosehill Gardens Racecourse Stables[5]	When in use	-	60

Note 1: It is assumed that these receivers have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level.

Note 2: It is assumed that these receivers have fixed windows which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

Note 3: Adopted from AS2107.

Note 4: Adopted from *Association of Australian Acoustical Consultants Guideline for Child Care Centre Acoustic Assessment*.

Note 5: Adopted from the ICNG – passive recreation.

3.2 Vibration Guidelines

The effects of vibration from construction work can be divided into three categories:

- Those in which the occupants of buildings are disturbed (**human comfort**). People can sometimes perceive vibration impacts when vibration generating construction work is located close to occupied buildings. Vibration from construction work tends to be intermittent in nature and the *Assessing Vibration: a technical guideline* (AVTG) (DEC, 2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV).
- Those where the integrity of the building may be compromised (**structural/cosmetic damage**). If vibration from construction work is sufficiently high, it can cause cosmetic damage to elements of affected buildings. Industry standard cosmetic damage vibration limits are specified in British Standard BS 7385 *Part 2-1993 Evaluation and measurement for vibration in buildings Part 2, BSI, 1993* and German Standard DIN 4150 *Part 3-2016 Structural vibration – Effects of vibration on structures, Deutsches Institute fur Normung, 1999*.
- Those where building contents may be affected (**building contents**). People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents. Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes or medical imaging equipment, are in buildings near to construction work, refer Sydney Metro *Construction Noise and Vibration Standard*.

Based on the equipment and activities identified for the geotechnical investigation work vibration impacts are not expected for human comfort, structural/cosmetic damage or building contents. Given the limited potential for any vibration impacts to occur, no further assessment of construction vibration is considered necessary.

4 Assessment Findings

Noise modelling was conducted in accordance with the method outlined in the DNVIS. A summary of the number of buildings where NML exceedances were predicted for the various work scenarios is shown in **Table 6** to **Table 7**. Maps of the predicted (worst-case) noise impacts are presented in **Appendix A** (Approved Hours) **Appendix B** (OOHW). As the timing of all work locations has not yet been confirmed, noise impacts are presented 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.

The assessment shows the predicted impacts based on the exceedance of the management levels, as per the categories in **Table 5**.

Table 5 Exceedance Bands and Impact Colouring

Exceedance of Management Level	Impact Colouring
No exceedance	
1 to 10 dB	
11 dB to 20 dB	
21 dB to 30 dB	
>30 dB	

The noise impact maps in **Appendix A** and **Appendix B** present the worst-case predicted noise impacts (ie when work is occurring closest to each receiver). It is noted that there may be up to three crews working simultaneously during the geotechnical investigations.

Recommendations are provided in **Section 5** to avoid cumulative impacts.

The assessment is generally considered conservative as the calculations assume several items of construction equipment are in use at the same time within individual scenarios. In reality, there would frequently be periods when construction noise levels are much lower than the worst-case levels predicted as well as times when no equipment is in use and no noise impacts occur.

Table 6 Construction Noise Assessment – High Risk Work Locations – Approved Hours

Work ID	Assessment Period	Exceedance Category Above NML	Number of Receivers with NML Exceedance									
			Residential Receivers									Other Sensitive Receivers
			NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09	All NCAs
W.001	Approved Hours (AH)	1-10 dB	27	22	4	6	-	-	-	-	-	37
		11-20 dB	1	1	2	-	-	-	-	-	-	14
		20-30 dB	-	-	1	-	-	-	-	-	-	3
		>30 dB	-	1	-	-	-	-	-	-	-	-
		HNA[1]	-	**1**	**4**	-	-	-	-	-	-	-
W.002	Approved Hours (AH)	1-10 dB	5	2	3	-	-	-	-	-	-	27
		11-20 dB	-	-	1	-	-	-	-	-	-	8
		20-30 dB	-	1	-	-	-	-	-	-	-	-
		>30 dB	-	-	-	-	-	-	-	-	-	-
		HNA[1]	-	**1**	**2**	-	-	-	-	-	-	-
W.003	Approved Hours (AH)	1-10 dB	-	-	-	-	-	-	-	-	-	6
		11-20 dB		1	-	-	-	-	-	-	-	2
		20-30 dB	-	-	-	-	-	-	-	-	-	-
		>30 dB	-	-	-	-	-	-	-	-	-	-
		HNA[1]	-	**1**	-	-	-	-	-	-	-	-

Note 1: Highly noise affected, based on ICNG definition (i.e. predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater).

Table 7 Construction Noise Assessment – High Risk Work Locations - OOHW

Work ID	Assessment Period	Exceedance Category Above NML	Number of Receivers with NML Exceedance									
			Residential Receivers									Other Sensitive Receivers
			NCA01	NCA02	NCA03	NCA04	NCA05	NCA06	NCA07	NCA08	NCA09	All NCAs
W.001	OOHW2 (Night)	1-10 dB	153	461	79	63	4	-	-	-	-	38
		11-20 dB	36	92	14	14	-	-	-	-	-	15
		20-30 dB	2	11	4	-	-	-	-	-	-	3
		>30 dB	-	1	3	-	-	-	-	-	-	-
		SD[1]	**77**	**229**	**33**	**29**	-	-	-	-	-	-
W.002	OOHW2 (Night)	1-10 dB	68	197	26	26	-	-	-	-	-	29
		11-20 dB	9	30	3	3	-	-	-	-	-	8
		20-30 dB	-	1	3	-	-	-	-	-	-	-
		>30 dB	-	1	1	-	-	-	-	-	-	-
		SD[1]	**28**	**66**	**16**	**11**	-	-		-	-	-
W.003	OOHW2 (Night)	1-10 dB	11	38	3	6	-	-	-	-	-	6
		11-20 dB	-	1	3	-	-	-	-	-	-	2
		20-30 dB	-	-	1	-	-	-	-	-	-	-
		>30 dB	-	1	-	-	-	-	-	-	-	-
		SD[1]	**2**	**7**	**7**	-	-	-	-	-	-	-

Note 1: Sleep Disturbance Screening Level – (L_{Amax})

5 Conclusion and Recommendations

Noise emissions from the project have been predicted at the surrounding receivers. Worst-case noise levels are expected to exceed the noise management level (NML) by up to '20-30 dB' at the closest 'other sensitive' receivers and by up to '> 30 dB' at the closest residential receiver during OOHW2 (Night). Impacts are predicted to be lower during the approved project hours, where receivers are less sensitive to construction noise.

A number of mitigation and management measures have been recommended below. Where feasible and reasonable these should be applied to the project to control and minimise the impacts during construction as far as practicable.

Consider the following recommendations (where feasible and reasonable) during commencement of each work scenario:

- Implement mitigation measures identified within the CNVMP and DNVIS
- Implement additional mitigation measures identified within the CNVMP and DNVIS
- Ensure the minimum sized equipment necessary to complete the work are used
- Implement portable noise barriers around noise intensive activities (ie drill rig, concrete saw and hydraulic hammer)
- Where multiple crews work simultaneously during the geotechnical investigations. Crews should avoid working within 500 m of each other to avoid cumulative impacts.
- Provide respite periods for noise intensive activities
- Shut down plant and machinery, including vehicles when not in operation
- Undertake noise monitoring during works to confirm noise predictions. Monitoring locations should be targeted to most affected receivers (**Appendix A and B**), or representative locations nearby.

Checked/
Authorised by: DL

APPENDIX A – NOISE IMPACT MAPS (APPROVED HOURS)

Figure A1 W.001: Non-Destructive Digger (NDD) - AH

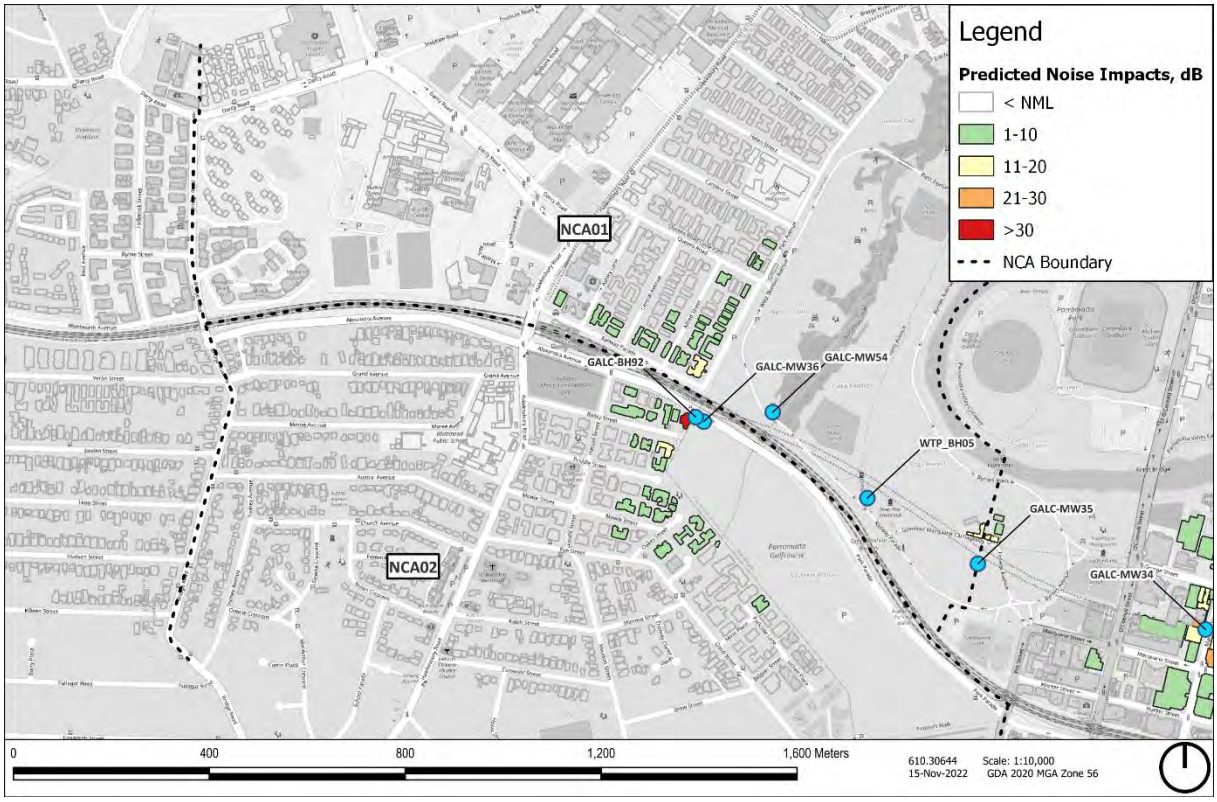


Figure A2 W.001: Non-Destructive Digger (NDD) - AH

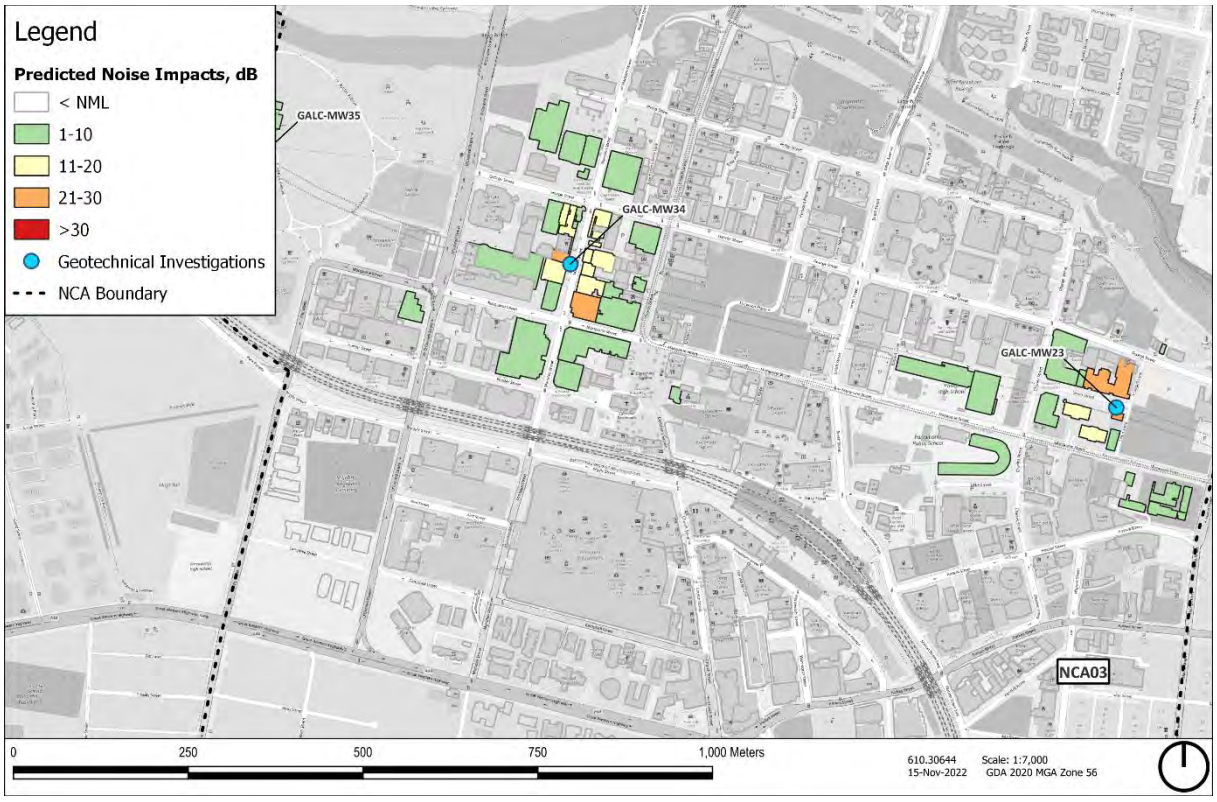


Figure A3 W.001: Non-Destructive Digger (NDD) - AH

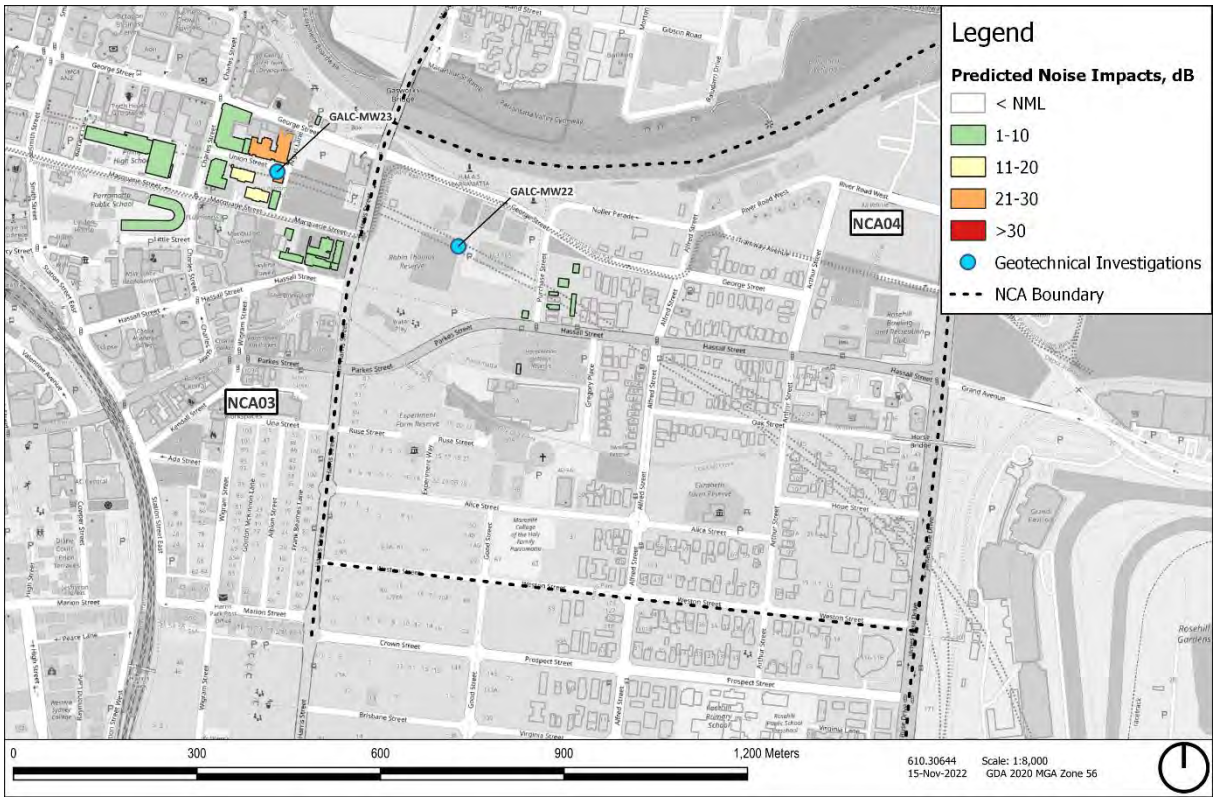


Figure A4 W.002: Drilling Operations - AH

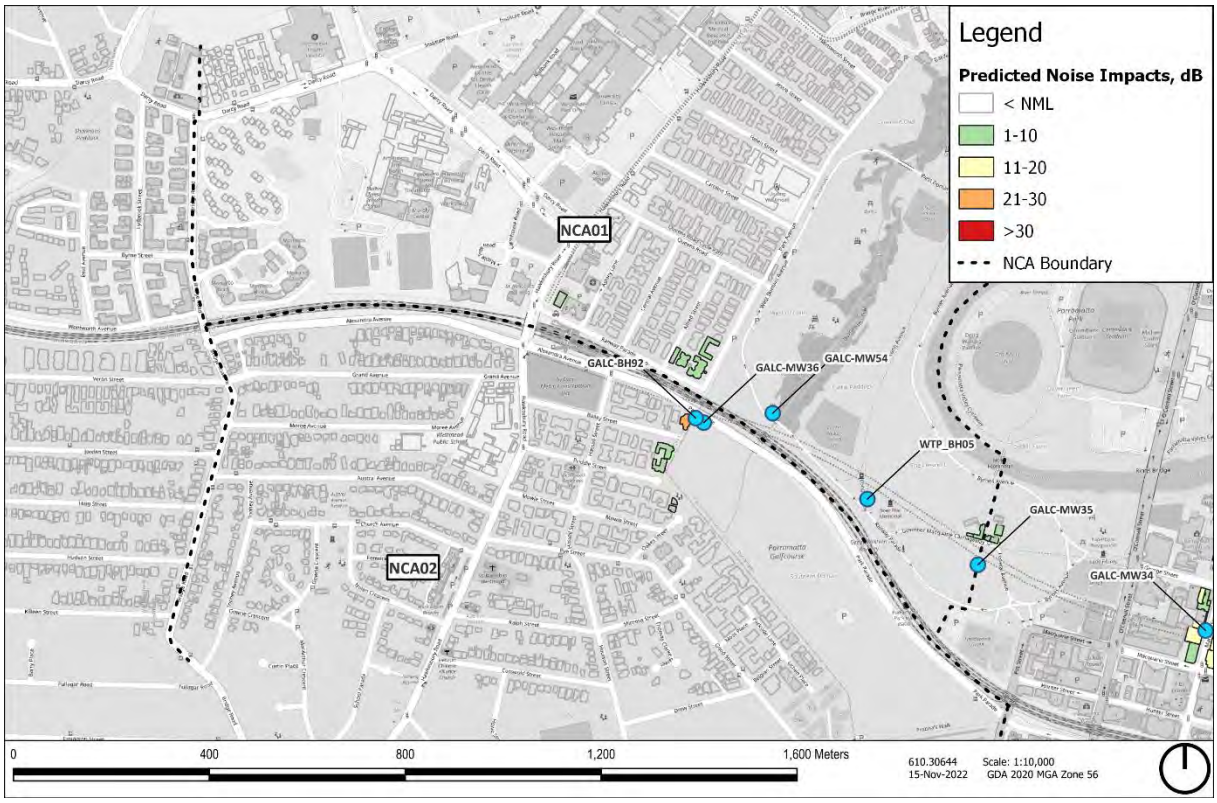


Figure A5 W.002: Drilling Operations - AH

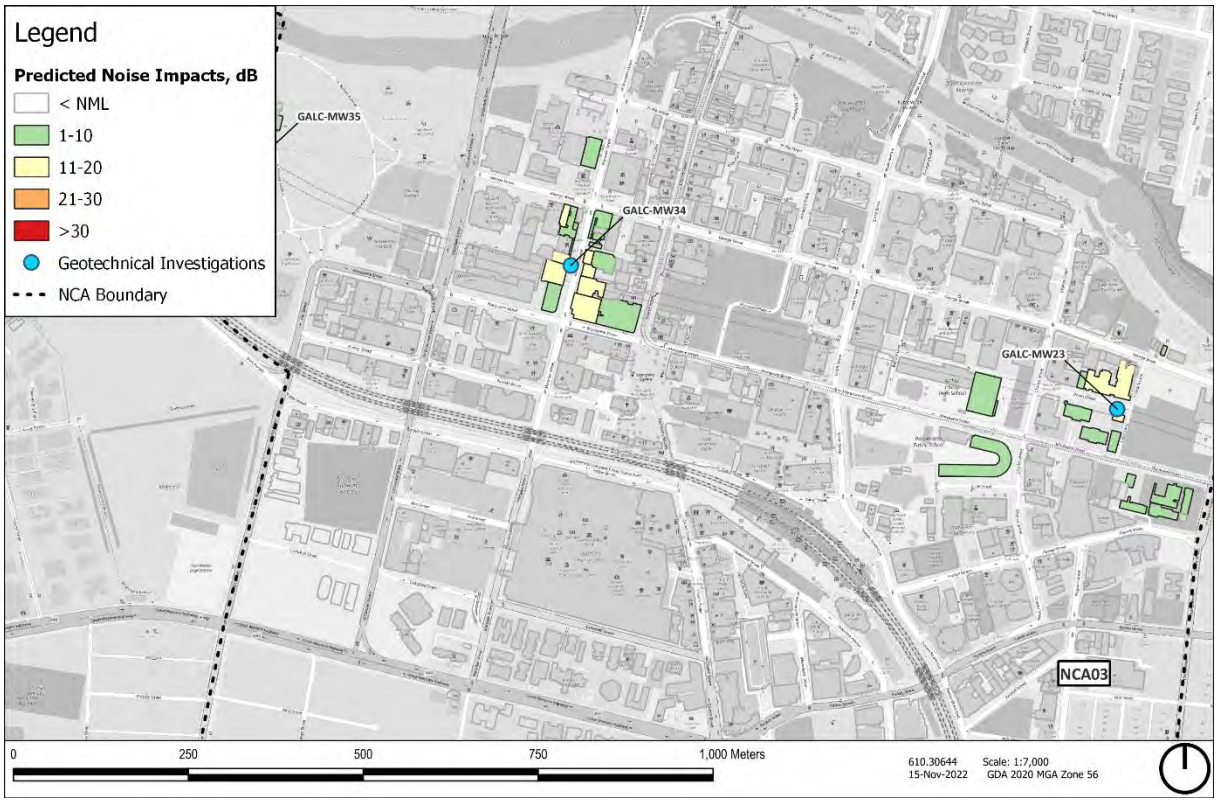


Figure A6 W.002: Drilling Operations - AH

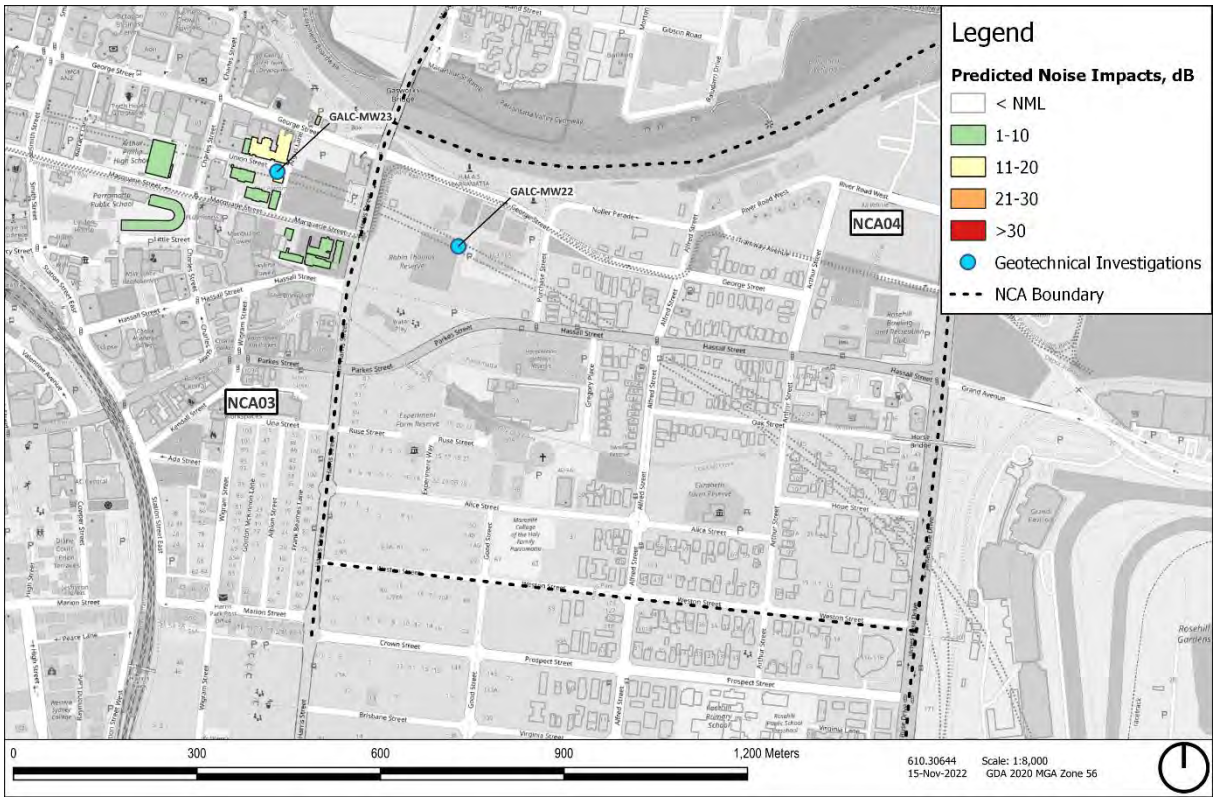


Figure A7 W.003: Reinstatement - AH

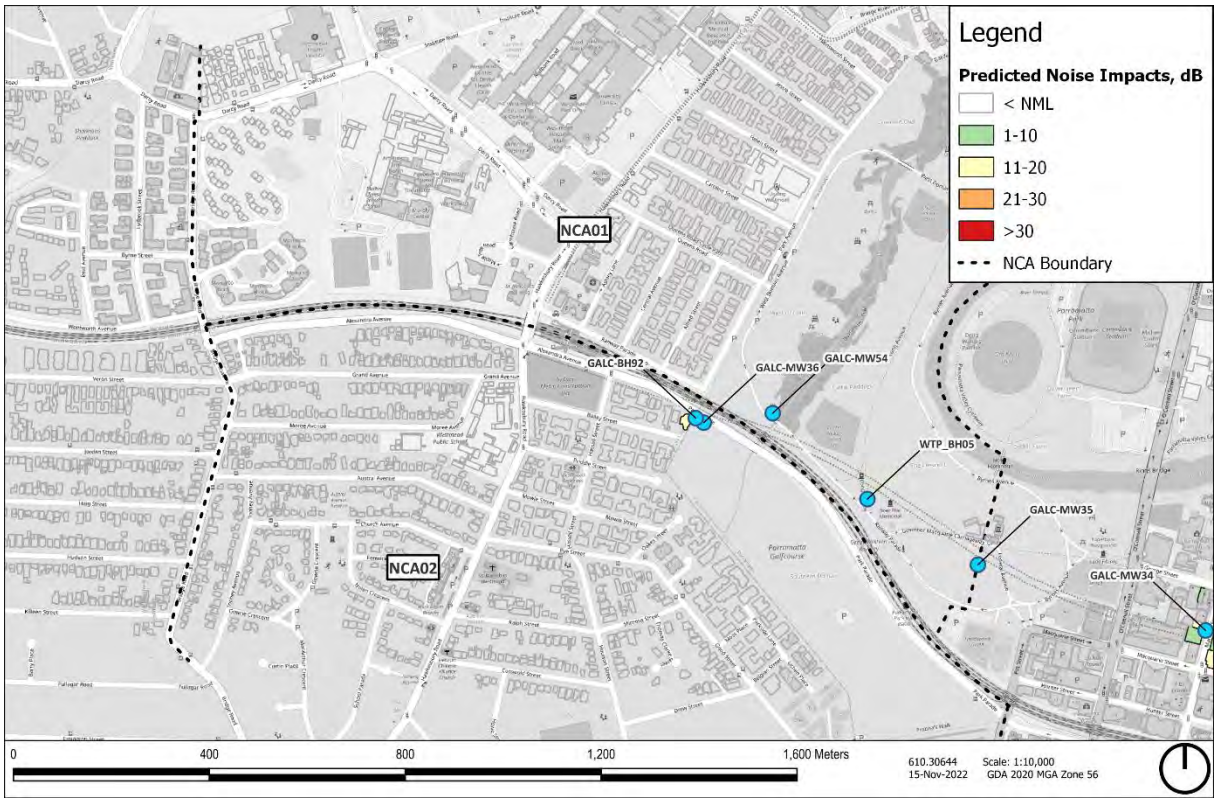


Figure A8 W.003: Reinstatement - AH

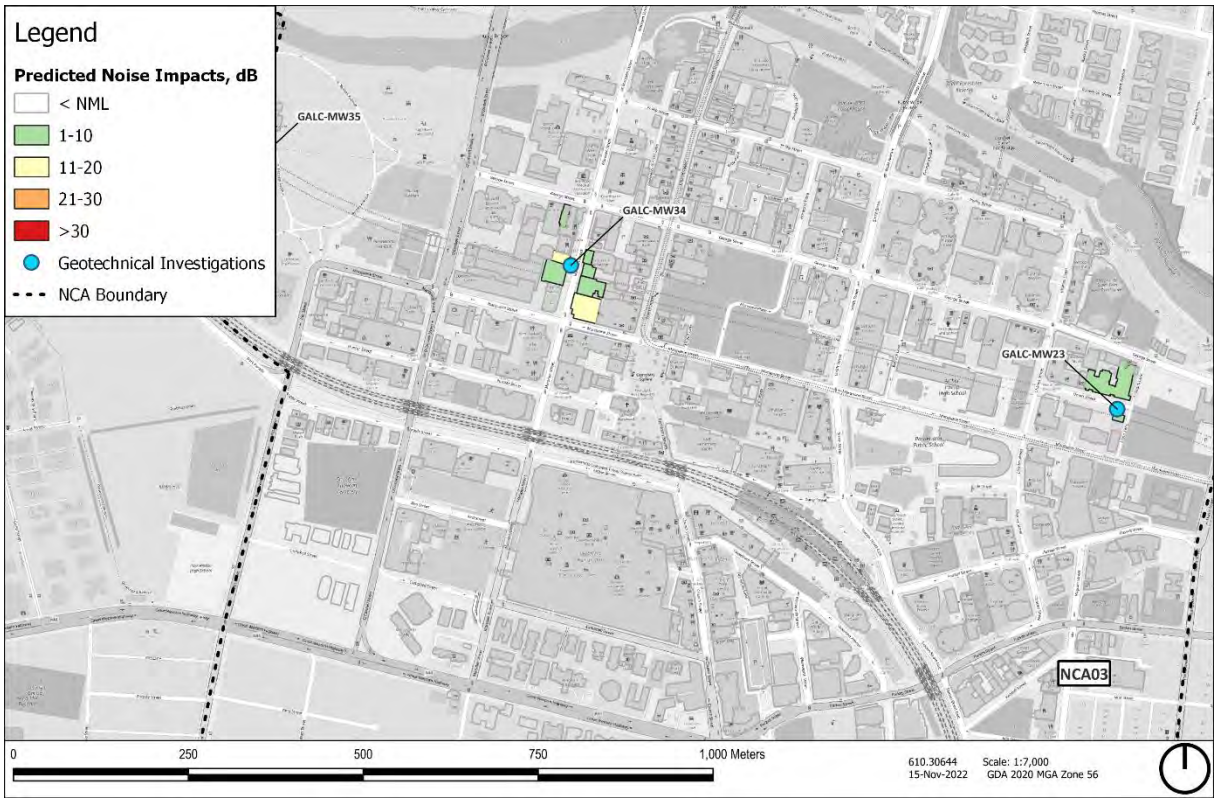
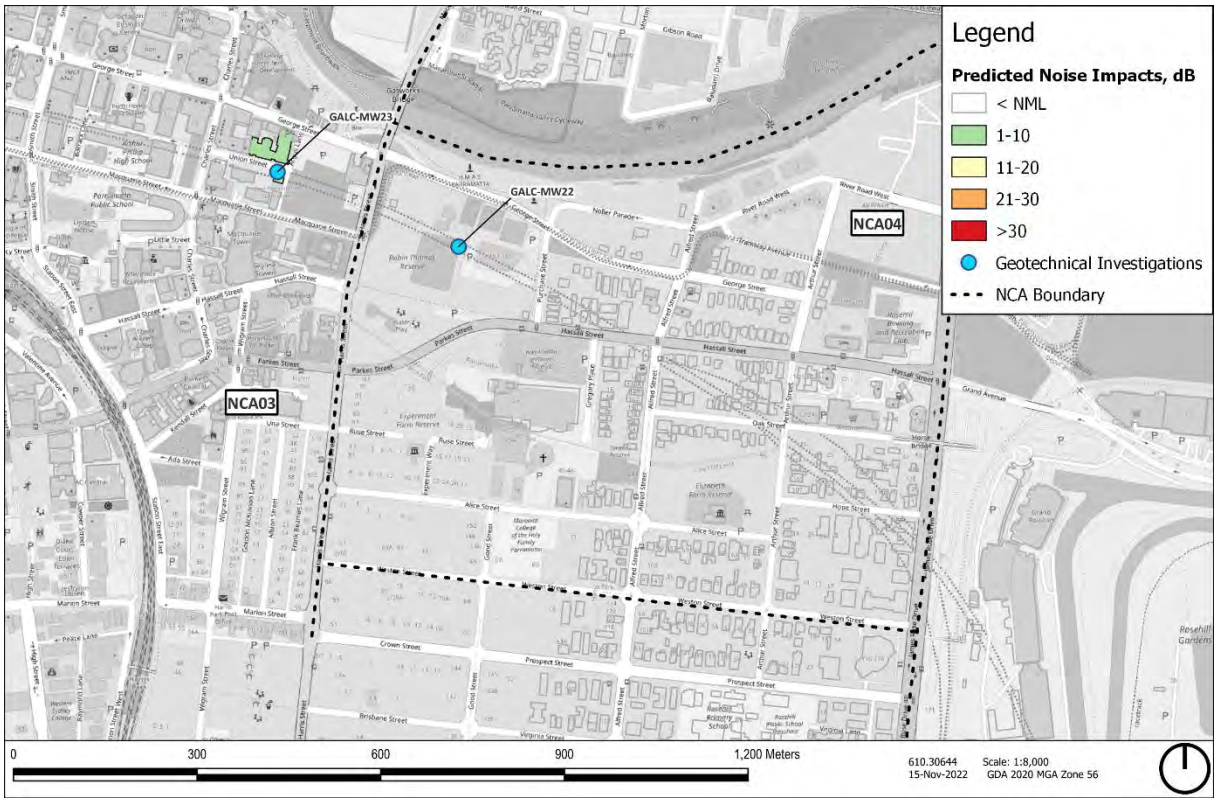


Figure A9 W.003: Reinstatement - AH



APPENDIX B – NOISE IMPACT MAPS (OOHW2)

Figure B1 W.001: Non-Destructive Digger (NDD) - OOHW2

Figure B2 W.001: Non-Destructive Digger (NDD) - OOHW2

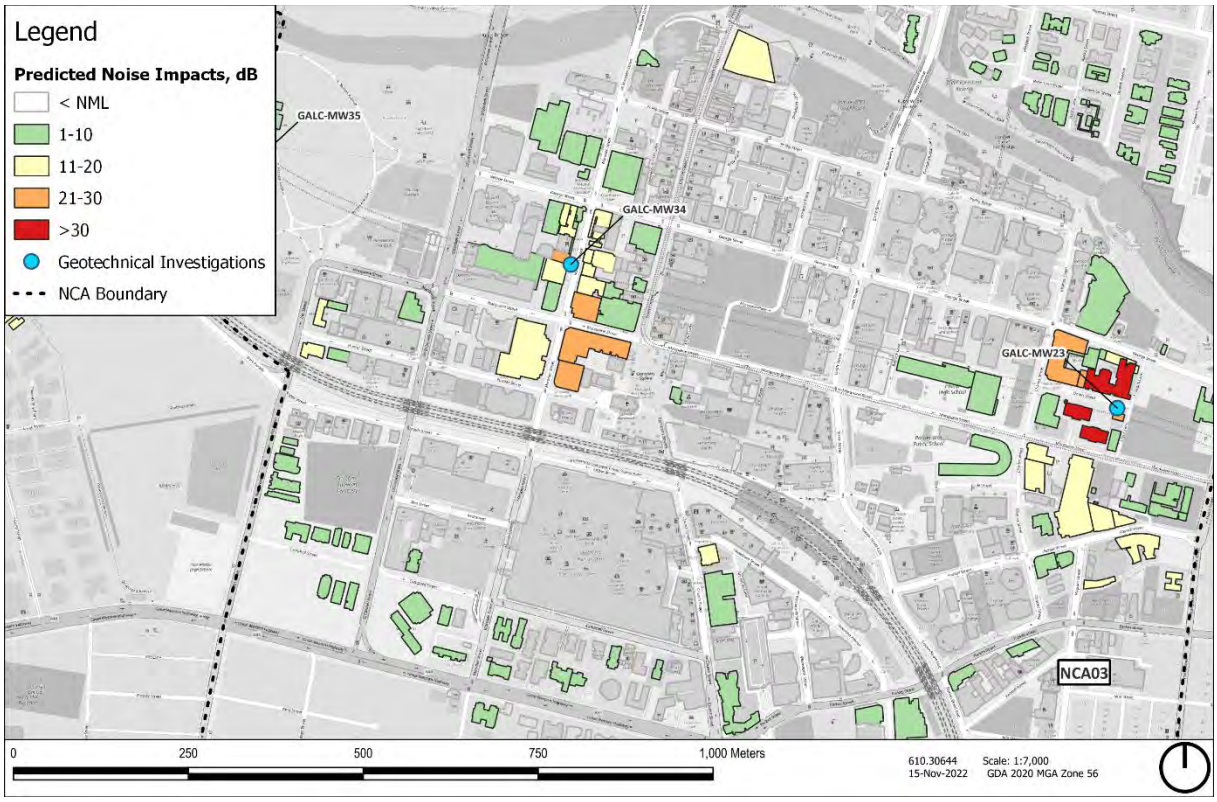


Figure B3 W.001: Non-Destructive Digger (NDD) - OOHW2

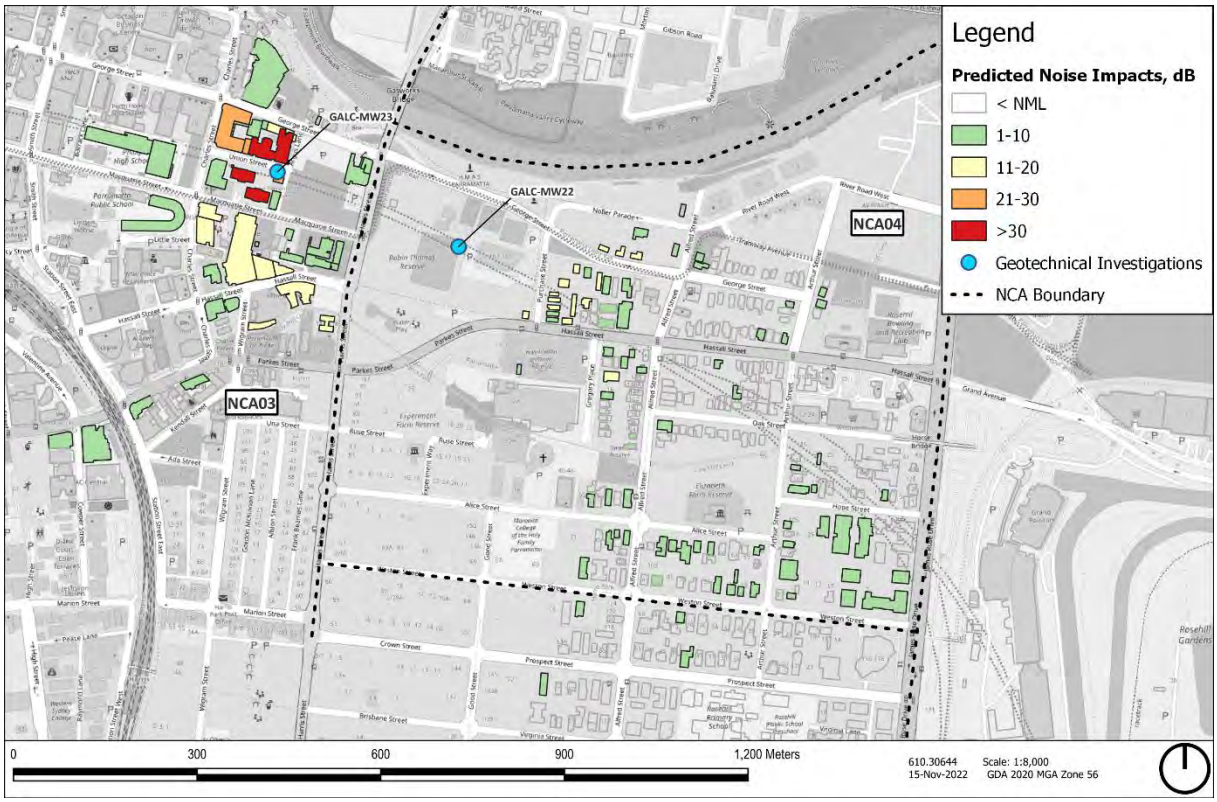


Figure B4 W.002: Drilling Operations - OOHW2

Figure B5 W.002: Drilling Operations - OOHW2

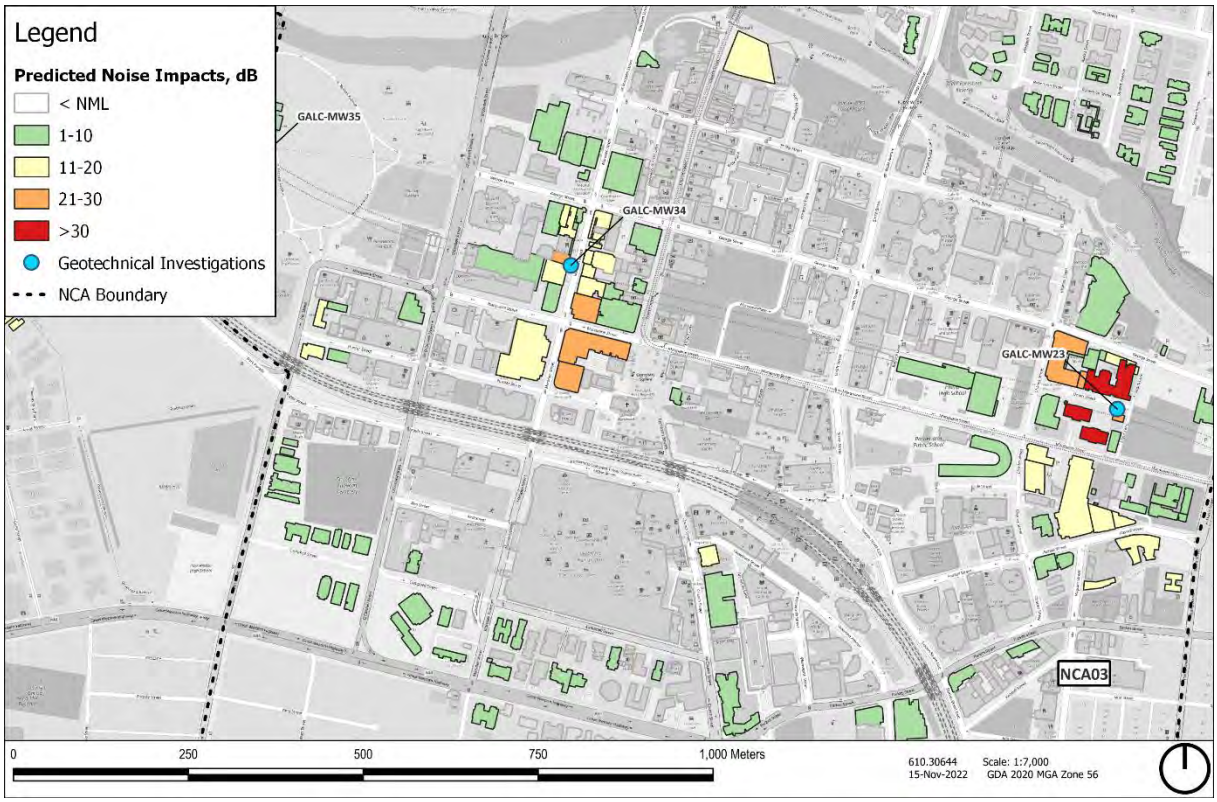


Figure B6 W.002: Drilling Operations - OOHW2

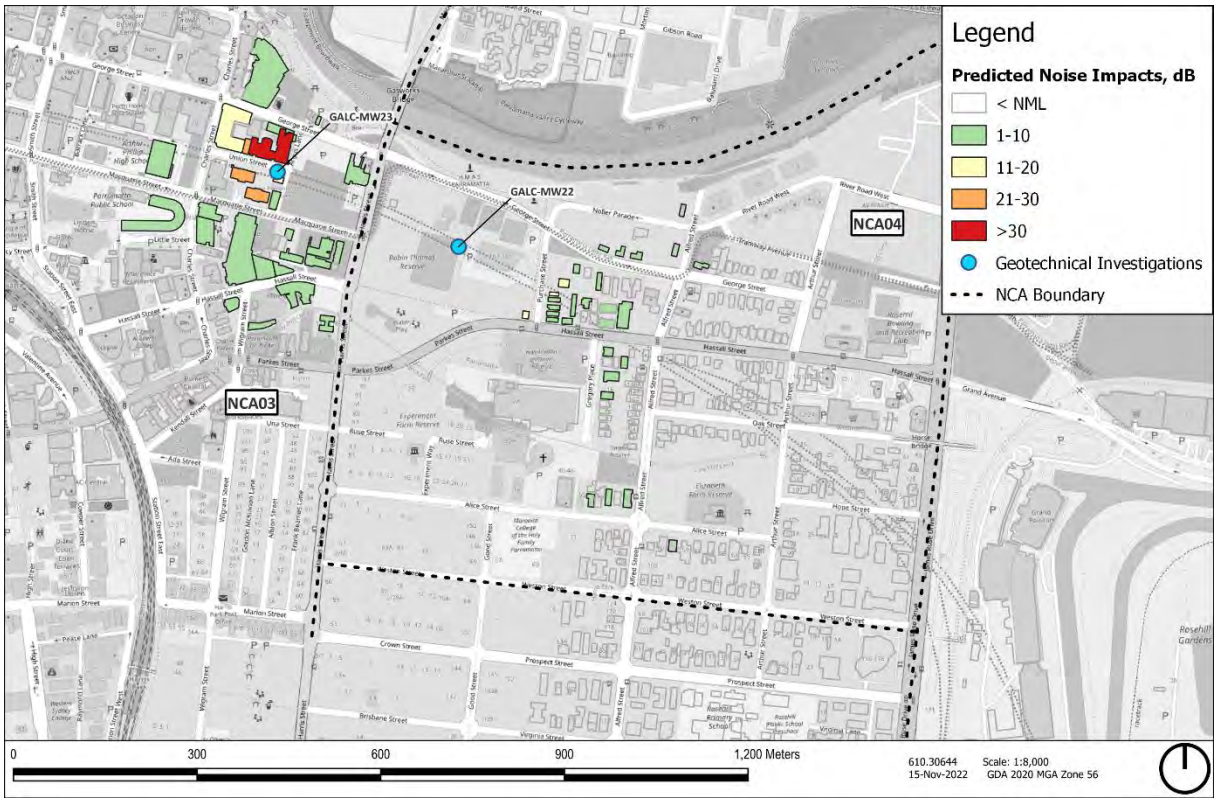


Figure B7 W.003: Reinstatement - OOHW2

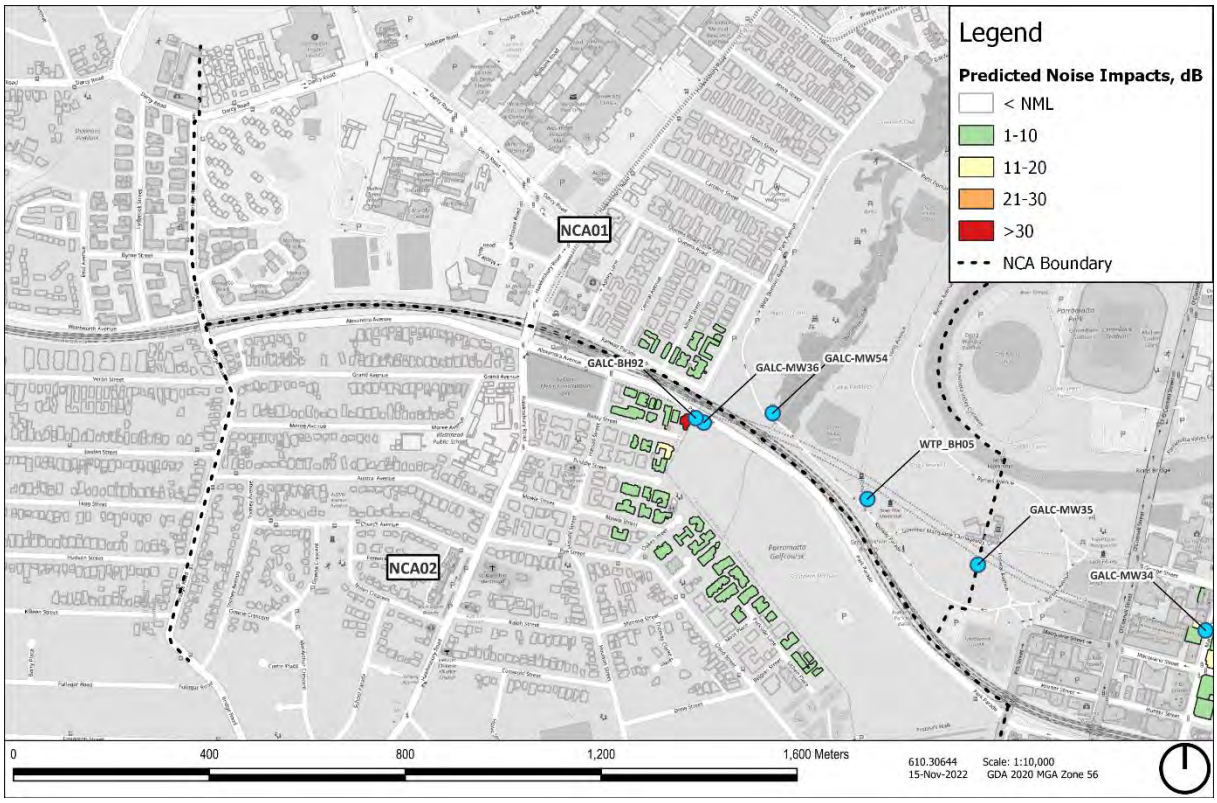


Figure B8 W.003: Reinstatement - OOHW2

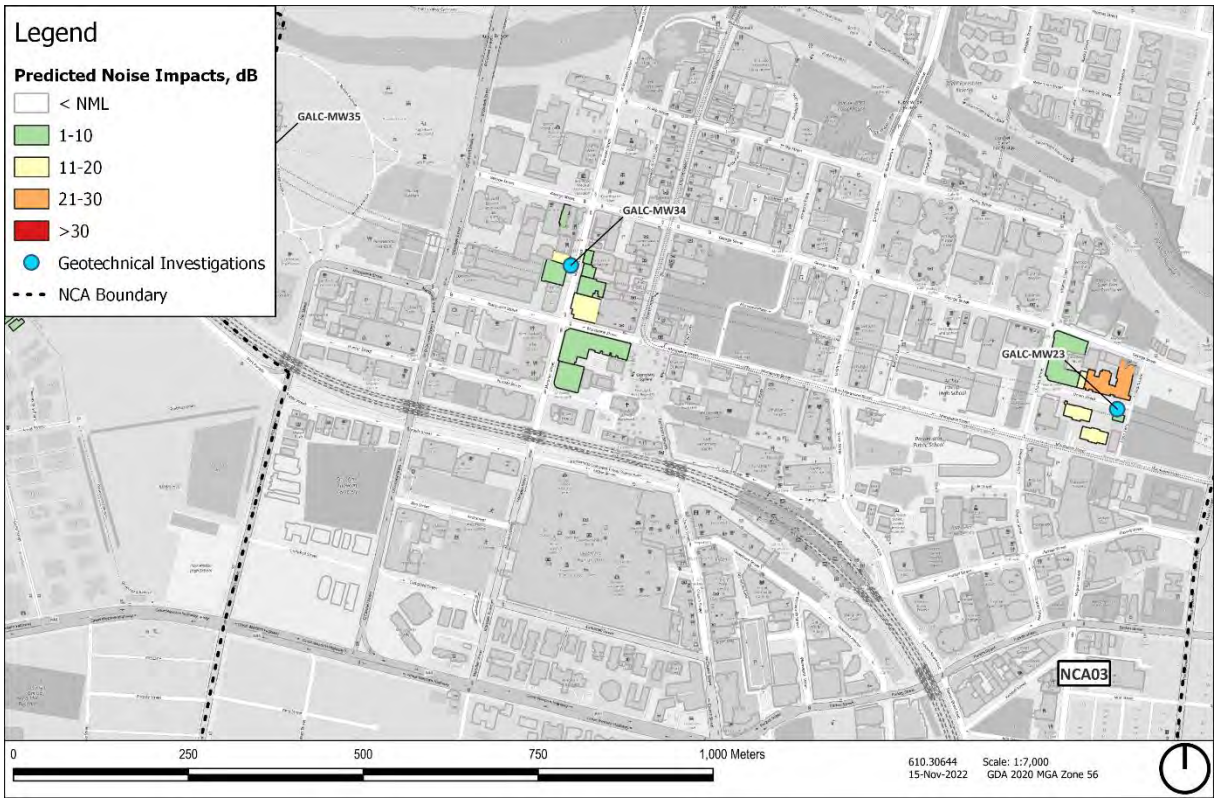
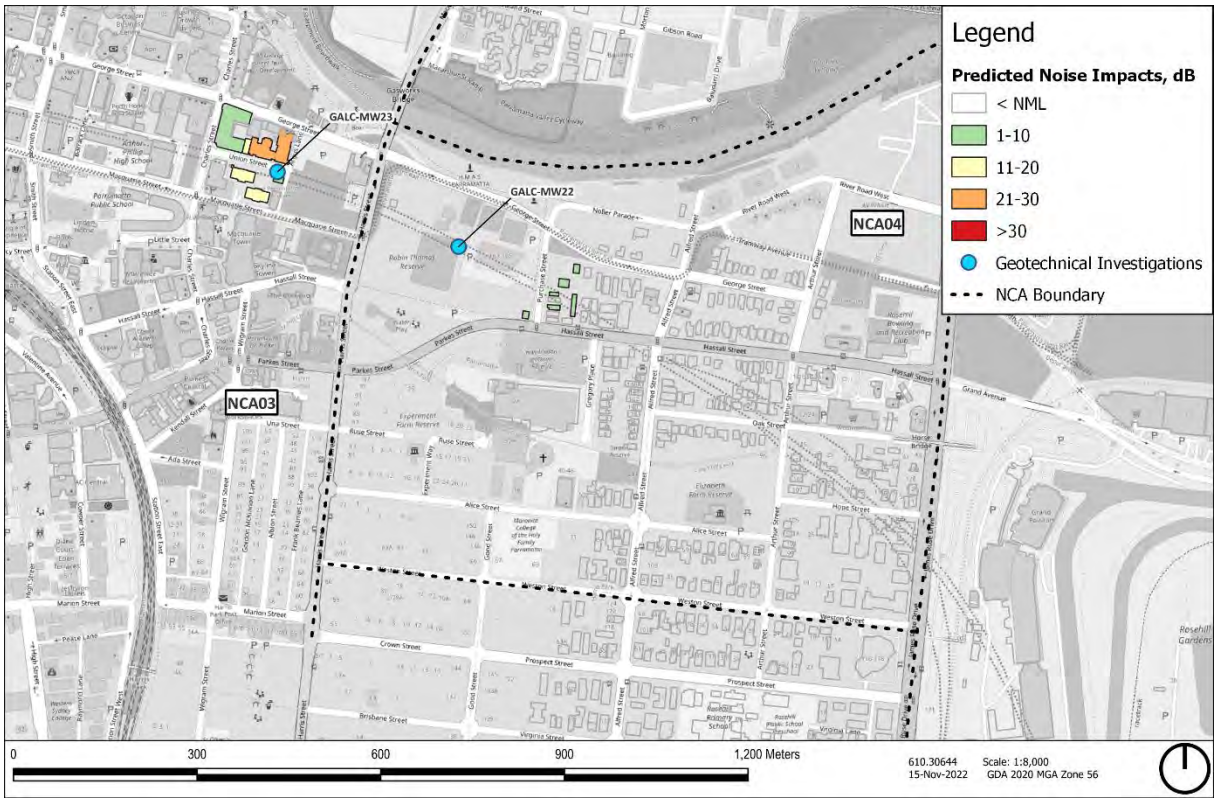
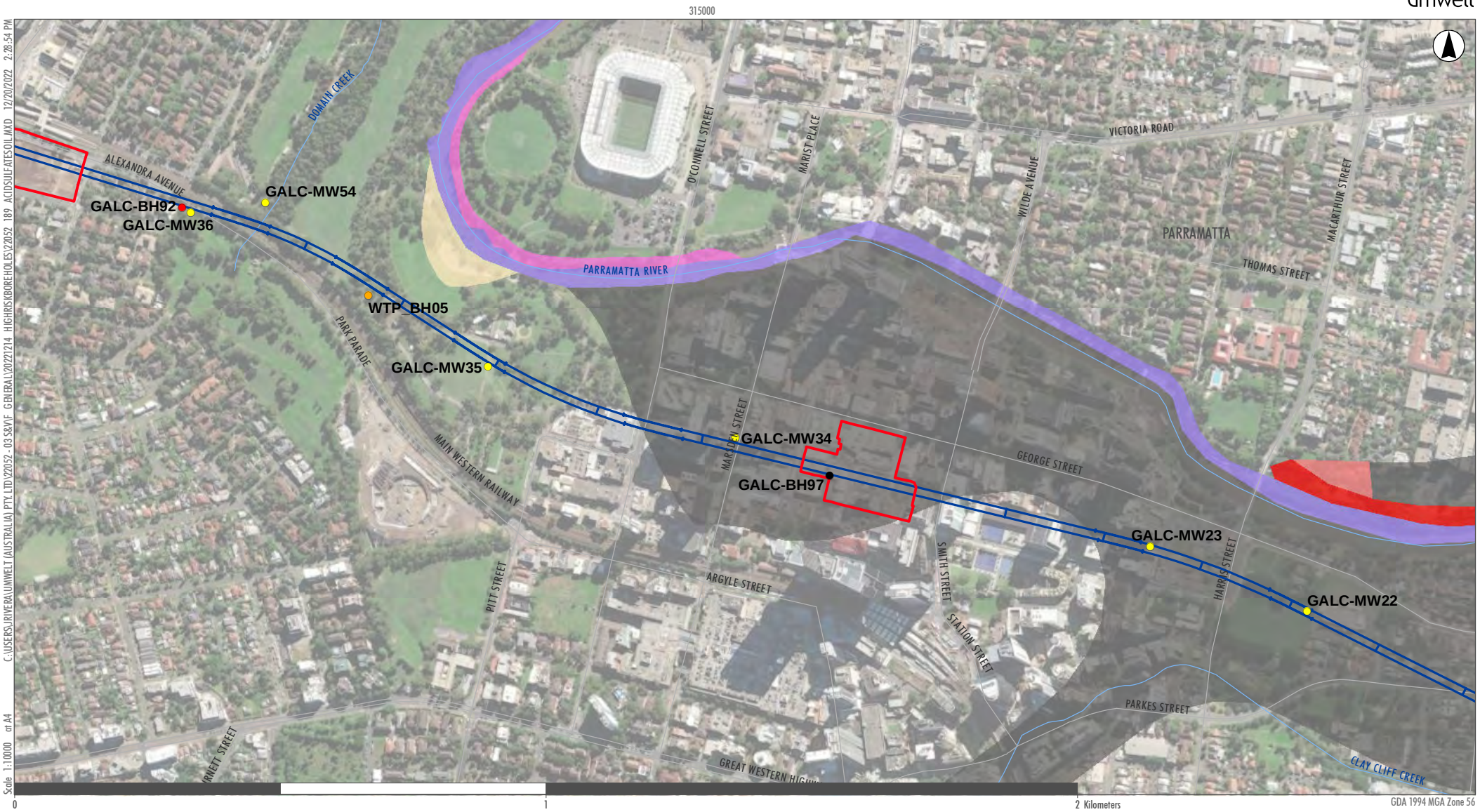


Figure B9 W.003: Reinstatement - OOHW2



Appendix F – Acid Sulfate Soil Risk Map



Legend

- Approved Surface Construction Boundary
- Tunnel Alignment
- Road
- Drainage Line
- High Risk Borehole
- High Risk Borehole (proposed by SM)
- High Risk Borehole with Monitoring Wells
- High Risk Boreholes/Monitoring Wells removed from the CA

Acid Sulfate Soil Risk

- High Risk 0-1m
- High Risk 1-2m
- High Risk 2-4m
- High Risk Sediments
- Low Risk above 4m
- Disturbed Terrain

APPENDIX F

Acid Sulfate Soil Risk

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

Appendix G – High Risk Borehole/Monitoring Wells - Biodiversity Briefing Note

Inspired People.
Dedicated Team.
Quality Outcomes.

Briefing Note

To: Candice Somerville

E | candice.somerville@glcwtp.com.au

Cc: Nathan Baker, Thomas Buchan

E | nbaker@umwelt.com.au, tbuchan@umwelt.com.au

From: Rachel Musgrave

Date: 6 December 2022

Purpose

This biodiversity briefing note was prepared for Gamuda Australia Lang O'Rourke Consortium (GLC) to assess the impacts to biodiversity resulting from the proposed geotechnical investigations involving installation of selected boreholes and/or monitoring wells required for the Sydney Metro West – Western Tunnelling Package project (i.e. the Project). This briefing note has been prepared to support a Consistency Assessment seeking approval for the proposed geotechnical investigations outside of the approved Project construction boundaries.

Outcomes/Key Messages

Regional vegetation mapping identified two Plant Community Types (PCTs) within 50 metres (m) of the proposed works, including PCT 3320: Cumberland Shale Plains Woodland, and PCT 4024: Cumberland Blue Box Riverflat Forest. These PCTs conform to Threatened Ecological Communities (TECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), including:

- PCT 3320
    - Cumberland Plain Woodland in the Sydney Basin Bioregion – listed as Critically Endangered under the BC Act
    - Shale Gravel Transition Forest in the Sydney Basin Bioregion – listed as Endangered under the BC Act
    - Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act
- PCT 4024
    - River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – listed as Endangered under the BC Act

Umwelt (Australia) Pty Limited

ABN 18 059 519 041

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – listed as Critically Endangered under the EPBC Act.

A site inspection was undertaken in November 2022 which did not identify any native assemblages at each of the geotechnical investigation sites that conform to the TECs listed above. There are native species adjacent to the proposed sites, which may form part of assemblages consistent with the Cumberland Plain Woodland in the Sydney Basin Bioregion, and the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregion. However, these assemblages are unlikely to meet the condition thresholds for the EPBC Act critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest, or the River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria.

Direct impacts to these PCT are expected to be negligible to nil, as no trimming of native trees or disturbance to the groundcover stratum within the patches of potential TECs are expected or proposed as part of the geotechnical investigations proposed under the Consistency Assessment.

The desktop assessment identified one threatened fauna species, being the Grey-headed Flying Fox, as having a high likelihood of occurrence within the study area, however evidence of this species was not recorded during the site inspection. There are no anticipated impacts to suitable habitat for the Grey-headed Flying Fox, as no trimming or clearing of native tree species is required (or proposed) for the works.

No other significant impacts to biodiversity or threatened species habitat have been identified as likely to occur as a result of the proposed works. As such, no assessment of significance has been prepared to assess the impacts of the proposed works.

In this document

1.0 Background

Umwelt has been engaged by GLC to prepare a biodiversity briefing note to understand potential impacts to biodiversity resulting from the proposed geotechnical investigations associated with the Sydney Metro West - Western Tunnelling Package (the Project). This will form part of the Planning Approval Consistency Assessment for 'High Risk Boreholes and Monitoring Wells Outside Approved Construction Boundary' (referred to as the 'CA' from this point forward). This report includes Umwelt's assessment of impacts and provides recommendations for the geotechnical investigations proposed along the tunnelling alignment between Westmead and Sydney Olympic Park.

The proposed geotechnical investigations are required to collect groundwater data and inform the design for the tunnelling works between Parramatta and Sydney Olympic Park.

1.1 The Proposed Works

44 boreholes and/or monitoring wells were originally proposed for the Project, which are located along (or adjacent to) the Project's underground tunnel alignment between Westmead and Sydney Olympic Park outside of the approved Project construction site boundaries. Of the 44 originally proposed sites, 13 were subsequently removed from the scope of works or relocated to within already approved Project construction site boundaries, and further assessment was no longer required.

A high-level desktop assessment and subsequent site inspection was undertaken in August 2022 to identify 'high constraint sites' for biodiversity impacts (refer to Appendix C of the CA). Four sites were identified within Parramatta Park including borehole (BH) 92, monitoring well (MW) 36, MW54 and BH05, which are the focus of this assessment.

BH92, MW36, MW54 and BH05 (referred to as 'the sites' from this point forward) are located within the City of Parramatta Local Government Area (LGA), approximately 14 kilometres (km) west of the Sydney Central Business District (CBD).

A study area was developed to capture all potential direct and indirect impacts caused by the sites. The study area was developed by buffering the approximate location of the proposed sites by 50 m in all directions. The location of the sites and study area are shown in **Figure 1.1**.

1.1.1 Methodology

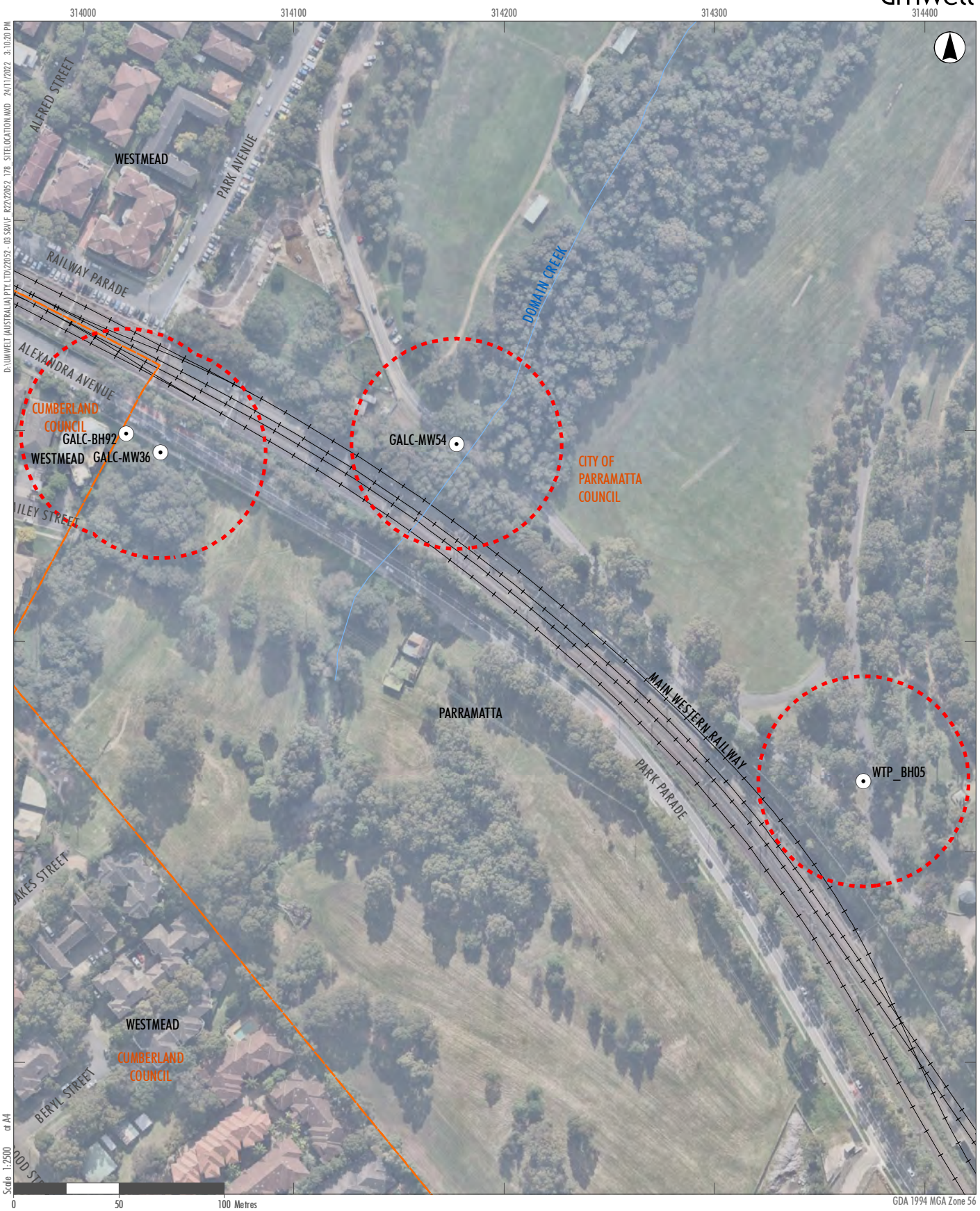
The proposed geotechnical investigations involve the drilling of boreholes at all sites, and the installation of permanent monitoring wells at MW36 and MW45 above the underground tunnel alignment to understand groundwater conditions and soil profile to inform the Project design. The proposed methodology for the geotechnical investigations is discussed below (referred to as 'the proposed works' from this point forward):

- Undertake pre-condition surveys
- Undertake site setup including traffic control, temporary site fencing, heritage buffers, shade cloths, erosion/sediment controls and noise blankets
- Undertake onsite service location, service clearance and proving activities (to determine service location, depth, and type) using an accredited service locator and non-destructive digging method (if required)
- Transport drill rig to each site via a float truck and drill boreholes using a truck or tractor mounted augur drill rig

- Drilling operation – drilling of boreholes and installation of groundwater monitoring wells where required
- Management of surplus soil from drilling operation as per the approved Soil and Water Management Plan (SWMP) and Waste Management Plan (WMP)
- Management of any excess water from each site using a vacuum truck
- Reinstate each borehole/monitoring well site, including:
    - Demobilisation of drill rig and other plant and equipment from the site including removal of any waste related to the drilling activities
    - Backfill drilled hole with grout to just under surface level
    - Reinstate surface area around drill location
    - Clean site and undertake post-construction dilapidation survey
    - Remove traffic controls and environmental controls
- Undertake fortnightly manual dripping and groundwater sampling (only required for monitoring well sites)
- Decommissioning of the monitoring well(s) post completion of the Sydney Metro West project, including backfilling of the drilled hole and reinstatement of surface area consistent with each sites surroundings

Each drilling site will be in operation for a duration of approximately two weeks, inclusive of pre-works, drilling and reinstatement phases. For proposed monitoring well sites, the monitoring well will stay in place for the duration of the project (monitoring well flush to ground). The monitoring well will be decommission as required once redundant.

No removal of native canopy species is required. However, there may be some trimming of overhanging branches from surrounding trees where necessary, and limited disturbance to the groundcover stratum during the course of the proposed works.



Legend

- High Risk Boreholes for Ecological Constraints
- Study Area (50m Buffer)
- Local Government Area
- Railway Line
- Drainage Line

FIGURE 1.1

Site Location

Image Source: Nearmap (August 2022) Data source: DFSI (2021)

2.0 Assessment Methodology

2.1 Desktop Assessment

A review of relevant public databases and literature was undertaken in November 2022 to identify threatened and migratory species, endangered populations, TECs and their habitats that have previously been recorded within the locality (a 10 km radius around the study area). Threatened species, migratory species, endangered populations and TECs (listed under the NSW BC Act, NSW *Fisheries Management Act 1994* (FM Act) and the EPBC Act) that have the potential to occur within the locality were also considered based on the type of habitat present and the NSW bioregion within which the study area occurs.

Databases and literature reviewed as part of this assessment include:

- A search of the Department of Planning and Environment (DPE) BioNet Atlas based on a 10 km radius around the sites
- A search of the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) based on a 10 km radius around the sites
- A search of the BioNet Threatened Biodiversity Data Collection (TBDC)
- A search of the Biodiversity Values Map Threshold Tool (BVMTT)
- A search of the NSW eSPADE spatial viewer
- A search of the National Flying-fox monitoring viewer accessed by the DCCEEW Interactive Flying-fox Web Viewer
- A search of the NSW Spatial Services Historical Imagery Viewer Portal.

2.2 Vegetation Mapping

The following sets of regional vegetation mapping were reviewed to inform the assessment of the vegetation communities present within the study area:

- The NSW State Vegetation Type Map (SVTM), 2022 (DPE, 2022)
- Native Vegetation of the Sydney Metropolitan Area - Version 3.1, 2016. VIS_ID 4489 (OEH, 2016).

Additionally, a Biodiversity Development Assessment Report (BDAR) (Jacobs, 2020) was prepared to support the Sydney Metro West – Concept and Stage 1 Environmental Impact Statement (EIS) for the project. The findings from the BDAR were also considered for the assessment of the vegetation communities.

2.3 Site Visit

A site visit was conducted on 16 November 2022. An Umwelt ecologist inspected the sites to record observations of any threatened and/or migratory species, endangered populations, TECs and any other ecological features that have the potential to be impacted. All investigations were limited to the extent of the study area**.**

Rapid data assessments to record the flora species occurring in the areas of the site were conducted at points using random meanders as described by Cropper (1993). Five rapid data assessments were undertaken to capture the structural variation in vegetation communities, the variation in species diversity across the study area and to define changes in abiotic conditions (i.e. the occurrence of creek lines and past disturbances). The rapid data assessments recorded the dominant species present, the frequency of their occurrence (i.e. common, uncommon, or rare) and their status as either threatened, native or non-native to the Sydney Basin Bioregion.

The presence of fauna habitat within the study area was also assessed. Specific attention was paid to the potential occurrence of hollow bearing trees, course woody debris, semi-permanent waterbodies and structures with the potential to support bat roosts.

2.4 Limitations and Assumptions

Field surveys were conducted over one day in November 2022. In addition to the surveys undertaken, the full spectrum of flora and fauna species and ecological processes likely to occur at each site was considered by identifying potential habitats for such species and assessing the potential for these species to occur on the site based on previous records, the type and condition of habitats present, the land use of the site and its landscape context.

As stated by the DEC (2004a):

> '*The absence of a species from survey data does not necessarily mean it does not inhabit the survey area. It may simply mean that the species was not detected at that time with the survey method adopted and the prevailing seasonal or climatic conditions.'*

Accordingly, the relative brevity of the survey and its timing mean that the full spectrum of flora and fauna species, as well as ecological processes, likely to occur on the subject site may not be fully quantified or described in this report.

During the preparation of this document and field survey undertaken for the proposed works, the following assumptions were made:

- The locations of each site are accurately shown on maps and datasets provided by GLC
- The most direct routes will be chosen to access the sites to limit impacts to native vegetation
- No ground disturbance will occur within 3 m of any centre point for surrounding trees. As such, any tree with up to 80 cm diameter at breast height (DBH) would not have any of its structural root zone (SRZ) impacted as per AS 4970-2009.

3.0 Results

3.1 Vegetation Communities

3.1.1 Review of Regional Mapping

The vegetation within the study area is mapped as containing several PCTs according to the regional vegetation mapping methodologies considered for this assessment, including PCT 4024: Cumberland Blue Box Riverflat Forest and PCT 3320: Cumberland Shale Plains Woodland. Refer to **Table 3.1** for more detail on these PCTs.

Table 3.1 Mapped PCTs within the Study Area

PCT Name	Associated Borehole Sites	Regional Vegetation Mapping
PCT 4024: Cumberland Blue Box Riverflat Forest *Note: This PCT replaced the decommissioned PCT 835: Cumberland Riverflat Forest*	MW54	VIS 4489 (OEH, 2016), BDAR (Jacobs, 2020), SVTM (DPE, 2022)
PCT 3320: Cumberland Shale Plains Woodland *Note: This PCT replaced the decommissioned PCT 849: Cumberland Shale Plains Woodland*	BH92, MW36, BH05	VIS 4489 (OEH, 2016), BDAR (Jacobs, 2020), SVTM (DPE, 2022)

PCT 4024 is mapped along the riparian edges of Domain Creek and Parramatta River, including an area approximately 5 m north of MW54. Refer to **Figure 3.1** for the location of this PCT. PCT 4024 is associated with the following TECs:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – listed as Endangered under the BC Act
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – listed as Critically Endangered under the EPBC Act

PCT 3320 is mapped in scattered patches throughout Parramatta Park, including within the location of MW36, to the immediate east of BH92 and 48 m north-east of BH05. Refer to **Figure 3.1** for the location of this PCT. PCT 3320 is associated with the following TECs:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – listed as Critically Endangered under the BC Act
- Shale Gravel Transition Forest in the Sydney Basin Bioregion – listed as Endangered under the BC Act
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act

Legend

- High Risk Boreholes for Ecological Constraints
- Study Area (50m Buffer)
- Railway Line
- Drainage

Native Vegetation of the Sydney Metropolitan Area (VIS 4489)

- PCT 835, Cumberland Riverflat Forest
- PCT 849, Cumberland Shale Plains Woodland

Jacobs Biodiversity Development Assessment Report

- PCT 835, Cumberland Riverflat Forest
- PCT 849, Cumberland Shale Plains Woodland

NSW State Vegetation Type Map

- PCT 3320, Cumberland Shale Plains Woodland
- PCT 4024, Cumberland Blue Box Riverflat Forest

FIGURE 3.1

Mapped Native Vegetation Communities

Image Source: Nearmap (August 2022) Data source: DFSI (2021), State Government of NSW and Department of Planning and Environment (2016)

3.1.2 Soil Landscape

The *Soil Landscapes of the Penrith 1:100,000 Sheet* (Bannerman and Hazelton, 2011) mapped the study area as 'Blacktown' soil landscape. This soil landscape is characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale. It is typically found on the Cumberland Lowlands between the Georges and Parramatta Rivers in the south-west. The vegetation commonly found in this soil landscape include cleared tall open-forest (wet sclerophyll forest) and open-woodland (dry sclerophyll forest).

3.1.3 Biodiversity Values Map

Parramatta River has been mapped as 'protected riparian land' under the Biodiversity Values Map and Threshold Tool. Additionally, patches of native vegetation identified as PCT 3320 have been mapped as 'threatened species or communities with potential for serious and irreversible impacts'. This includes the portions of PCT 3320 within the location for MW36 and in proximity to BH92 and BH05, as shown in **Figure 3.2.**

Legend

- High Risk Boreholes for Ecological
- Study Area (50m Buffer)
- Railway
- Drainage

Biodiversity Values

- Threatened species or communities with potential for serious and irreversible impacts

FIGURE 3.2

Biodiversity Values Map

Image Source: Nearmap (August 2022) Data source: DFSI (2021), © State Government of NSW and Department of Planning and Environment 2018

3.1.4 Historical Aerial Imagery

A review of the NSW Spatial Services Historical Imagery Viewer was undertaken to understand the history of the sites and surrounding native vegetation communities. The landscape around the sites was generally cleared agricultural land since at least the 1930s, with the local roads within Parramatta Park lined with trees. There was a patch of native vegetation consistent with the patch of PCT 3320 within the study area for BH92 and MW36. By 1960, the majority of trees lining the local roads were cleared in the Domain Park area and retained elsewhere in Parramatta Park. By 1985, native tree species were planted along Domain Creek, which became more densely populated by 2001. Refer to **Figure 3.3** to **Figure 3.6** for the changes in landscape since the 1930s.

Figure 3.3 Aerial Imagery from 1930

Figure 3.4 Aerial Imagery from 1960

Figure 3.5 Aerial Imagery from 1985

Figure 3.6 Aerial Imagery from 2001

3.1.5 Site Visit

The site visit identified that the majority of vegetation within the study area comprises of exotic grasslands with exotic species, with some *Eucalyptus* species nearby (refer to **Table 3.2**). Mid-storey species are generally absent within the study area.

Table 3.2 Site Visit Observations

Site	Site Visit Observations
BH92	Predominately exotic grassland with exotic species, including: • *Bromus catharticus* • *Lepidium* sp • *Modiola caroliniana.* Local *Eucalyptus moluccana* present nearby.
MW36	Predominately exotic grassland with exotic species, including: • *Bromus catharticus* • *Bidens pilosa* • *Modiola caroliniana* • *Ehrharta erecta.* Local *Eucalyptus moluccana* present nearby.
MW54	Predominately exotic grassland with exotic species, including: • *Cenchrus clandestinus* (Kikuyu) with local natives *Casuarina glauca* and *Eucalyptus robusta* is present nearby. It was noted that bollards may impede access from road, and it was assumed that the location of the site will avoid dense grove of Casuarinas between each side of the road and rail line.
BH05	Comprises a mix of native and exotic grassland in low condition. Native grasses include: • Couch (*Cynodon dactylon*) • *Microlaena stipoides.* The site is located within approximately 5 m of a *Eucalyptus tereticornis*. It is assumed that proposed works will avoid unmown areas of grasses and shrubs on east of the adjacent road (between the road and sandstone memorial).

As discussed in **Section 3.1.4**, the study area was predominately cleared since at least the 1930s before undergoing landscaping works and native tree plantings in the early 2000s. Although the majority of vegetation within the study area was likely planted as part of revegetation works, the species composition of the community is consistent with a natural PCT (that is PCT 3320). As such, the vegetation is functioning as a native ecosystem despite having been planted.

3.2 Threatened Species

3.2.1 Threatened Flora

The desktop assessment used a 10 km radius around the sites to identify threatened flora species with the potential to occur in the study area. The assessment identified the study area as providing potential habitat for 56 threatened flora species and four endangered flora populations. Of these, seven species were identified as having a moderate or higher likelihood of occurring within the study area based on known habitat preference and distribution as identified in **Table 3.4.** The potential habitat for these species and population was assessed as part of the site visit.

Table 3.3 Threatened flora with a moderate or higher likelihood of occurring within the study area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
Downy Wattle	*Cryptostylis hunteriana*	V	V	Moderate
Leafless Tongue-orchid	*Dillwynia tenuifolia*	V	V	Moderate
Dillwynia tenuifolia	*Epacris purpurascens* var. *purpurascens*	V	-	Moderate
Epacris purpurascens var. purpurascens	*Pimelea spicata*	V	-	Moderate
Spiked Rice-flower	*Rhizanthella slateri*	E	E	Moderate
Eastern Underground Orchid	*Syzygium paniculatum*	V	E	Moderate
Magenta Lilly Pilly	*Cryptostylis hunteriana*	E	V	Moderate

V = Vulnerable
E = Endangered
EP = Endangered Population
CE = Critically Endangered

3.2.2 Threatened Fauna

The desktop assessment used a 10 km radius around the sites to identify threatened fauna species with the potential to occur in the study area. The assessment identified the study area as providing potential habitat for 78 threatened fauna species and two threatened fauna populations. Of these, 40 were identified as having a moderate or higher likelihood of occurring within the study area based on known habitat preference and distribution, as identified in **Table 3.5.**

None of the listed species were incidentally recorded during the site investigation. The vegetation within the study area provides little by the way of breeding habitat for threatened fauna species with no hollow bearing trees, culverts, freshwater waterbodies, or decorticating bark present.

Table 3.4 Threatened fauna with a moderate or higher likelihood of occurring within the study area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
Aves				
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Moderate
Australasian Bittern	*Botaurus poiciloptilus*	E	E	Moderate
Bush Stone-curlew	*Burhinus grallarius*	E	-	Moderate
Red Knot	*Calidris canutus*	-	E	Moderate
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Moderate
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Moderate
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	V	Moderate
Spotted Harrier	*Circus assimilis*	V	-	Moderate
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-	Moderate
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Moderate

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
White-fronted Chat	*Epthianura albifrons*	V	-	Moderate
Grey Falcon	*Falco hypoleucos*	E	V	Moderate
Little Lorikeet	*Glossopsitta pusilla*	V	-	Moderate
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	Migratory	Moderate
Little Eagle	*Hieraaetus morphnoides*	V	-	Moderate
White-throated Needletail	*Hirundapus caudacutus*	-	V	Moderate
Black Bittern	*Ixobrychus flavicollis*	V	-	Moderate
Swift Parrot	*Lathamus discolor*	E	CE	Moderate
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	-	V	Moderate
Turquoise Parrot	*Neophema pulchella*	V	-	Moderate
Barking Owl	*Ninox connivens*	V	-	Moderate
Powerful Owl	*Ninox strenua*	V	-	Moderate
Eastern Osprey	*Pandion cristatus*	V	-	Moderate
Scarlet Robin	*Petroica boodang*	V	-	Moderate
Flame Robin	*Petroica phoenicea*	V	-	Moderate
Australian Painted Snipe	*Rostratula australis*	E	E	Moderate
Little Tern	*Sternula albifrons*	E	-	Moderate
Eastern Grass Owl	*Tyto longimembris*	V	-	Moderate
Masked Owl	*Tyto novaehollandiae*	V	-	Moderate
Mammals				
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Moderate
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Moderate
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Moderate
Little Bent-winged Bat	*Miniopterus australis*	V	-	Moderate
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Moderate
Southern Myotis	*Myotis macropus*	V	-	Moderate
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Moderate
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Moderate
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Moderate
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Moderate
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Moderate
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Moderate
Little Bent-winged Bat	*Miniopterus australis*	V	-	Moderate
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Moderate
Southern Myotis	*Myotis macropus*	V	-	Moderate
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	High

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of occurrence
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Moderate
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Moderate
Gastropods				
Cumberland Plain Land Snail	*Meridolum corneovirens*	E	-	Moderate
Dural Land Snail	*Pommerhelix duralensis*	E	E	Moderate

V = Vulnerable
E = Endangered
EP = Endangered Population
CE = Critically Endangered
CD = Conservation Dependent

3.2.3 Grey-headed Flying Fox Camps

Two Grey-headed Flying Fox camps were identified within 10 km, including:

- Parramatta Park 1 (ID: 134) – located approximately 400 m north-west of BH05
- Clyde (ID: 234) – located approximately 3.7 km south-east of BH05

The sites contains potential foraging habitat for the Grey-headed Flying Fox colonies roosting at these nearby camps, due to the presence of flowering *Eucalyptus* species.

3.2.4 Tree Hollows and Log Habitat

No tree hollows or log habitat were recorded within the study area during the site visit. No tree hollows or log habitat are expected to be disturbed as part of the proposed works.

3.2.5 Migratory Species

The desktop assessment used a 10 km radius around the sites to identify migratory fauna species with the potential to occur in the study area. The study area may provide habitat for the migratory bird species detailed in **Table 3.6**. These species may forage and move through the vegetation within the study area – as well as the airspace above it – as they migrate up and down the coast.

Table 3.5 Migratory species with a moderate or higher likelihood of occurring within the study area

Common Name	Scientific Name	BC Act	EPBC Act	Likelihood of Occurrence
Sharp-tailed Sandpiper	*Calidris acuminata*	-	Migratory	Moderate
Red Knot, Knot	*Calidris canutus*	-	Migratory	Moderate
Curlew Sandpiper	*Calidris ferruginea*	-	Migratory	Moderate
Pectoral Sandpiper	*Calidris melanotos*	-	Migratory	Moderate
Red-necked Stint	*Calidris ruficollis*	-	Migratory	Moderate
White-throated Needletail	*Hirundapus caudacutus*	-	Migratory	Moderate
Pacific Golden Plover	*Pluvialis fulva*	-	Migratory	Moderate
Little Tern	*Sternula albifrons*	-	Migratory	Moderate
Spectacled Monarch	*Symposiachrus trivirgatus*	-	Migratory	Moderate
Marsh Sandpiper, Little Greenshank	*Tringa stagnatilis*	-	Migratory	Moderate

4.0 Potential Impacts

4.1 Direct Impacts

4.1.1 Vegetation Removal/Trimming

No tree removal is required as part of the proposed works, including trimming or disturbance to native tree species that conforms to PCT 3320 or PCT 4024. There will also be no disturbance to the ground strata for these PCTs, including soil stored seedbank, through direct drilling and ancillary works such as temporary laydowns. As such, there will be no impact to PCT 3320 or PCT 4024 through vegetation removal or trimming works.

4.1.2 Estimated Loss of Native Canopy

No trees will be removed, as such there will be no loss to native canopy.

4.2 Ground Disturbances

The proposed works will require geotechnical borehole excavations of soil and rock to an approximate depth of 45 m. BH92 is located within an area mapped as PCT 3320, as discussed in **Section 3.1.5**, which is characterised by the composition of native vegetation, understorey and ground stratum. However, the site inspection confirmed that the site itself is located within a cleared grassland area. Where feasible, the boreholes and associated works would be micro-sited within disturbed land, which includes cleared grassland. It is unlikely that the ground stratum for PCT 3320 or PCT 4024 will be disturbed during the proposed works, as drilling works and movement of vehicles on unpaved surfaces will occur in cleared grassland comprising of predominately exotic species.

4.3 Threatened Species

The desktop assessment identified one threatened fauna species, being the Grey-headed Flying Fox, as having a high likelihood of occurrence within the study area, however evidence of this species was not recorded during the site inspection. As this species is highly mobile, it is unlikely that the proposed works will injure any individuals during drilling activities or establishment of laydown areas.

4.4 Habitat Disturbances

The Grey-headed Flying Fox is a highly mobile species that utilises a range of vegetation communities for foraging and roosting, including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. They can travel up to 50 km from their roosting camp to forage. There is unlikely to be any impacts to suitable habitat for the Grey-headed Flying Fox, as no trimming or clearing of native vegetation is required.

4.5 Indirect Impacts

The proposed works have the potential to indirectly impact the biodiversity occurring within the study area. These indirect impacts and a description of how they may impact the biodiversity present in the study area are outlined in **Table 4.1**.

Table 4.1 Indirect impacts to biodiversity

Indirect impact	Explanation	Affected biodiversity
Erosion	Ground disturbing works may lead to erosion in adjacent areas. This may come as a result from borehole drilling works.	All vegetation communities within the study area.
Spread of weeds and exotic species	The movement of machinery and people have the potential to spread weeds to and from the site.	All vegetation communities within the study area.
Spread of pathogens and disease	Soil borne pathogens with the potential to infect plants e.g., *Phytophthora cinnamomi*, may be mobilised by the proposed works.	All vegetation communities within the study area. Potentially vegetation occurring outside of the study area.
Noise and vibration	The proposed works would temporarily alter the noise environment within the study area.	The flying patterns and foraging/hunting behaviour of the and microbats may be altered if construction activities are to occur at night.
Changes to the light environment	The proposed works will be undertaken during the day. If any works are required to occur at night, there is potential to alter the light environment within the study area.	The flying patterns and foraging/hunting behaviour of the grey-headed flying-Fox, nocturnal birds, and microbats may be altered if construction activities are to occur at night

4.6 Habitat Connectivity

The proposed works are not expected to introduce any new barriers to habitat connectivity or wildlife movement across the available habitat in areas around Parramatta.

5.0 Mitigation Measures

Mitigation measures and safeguards to avoid and minimise the impacts of the proposed works on the biodiversity values identified in the study area are detailed in **Table 5.1**.

Table 5.1 Mitigation measures

Impact	Mitigation	Timing
Impacts to vegetation and threatened species	A no-go zone should be placed around canopy drip line of native tree species within the study area for each site to avoid unintended disturbance during proposed works. A toolbox talk should be undertaken with all site personnel that includes information on the potential presence of PCT 4024 and PCT 3320, as well as the Grey-headed Flying Fox. The approved Sydney Metro West – Western Tunnelling Package – Flora and Fauna Management Plan (SMWSTWTP-GLO-1NL-NL000-EO-PLN-000001) should be implemented as applicable to the scope of works, including the procedures to follow when there is an unexpected find.	Prior to and during proposed works
Spread of pathogens and disease	Hygiene controls for all vehicles, equipment and people working in the study area.	During proposed works
	Machinery will be washed following best practice hygiene protocols prior to being brought to site to prevent the spread of weeds, seeds, pathogens and fungi.	Prior to proposed works
Spread of weeds and exotic species	Hygiene controls for all vehicles, equipment and people working in the study area.	During proposed works
	All weed material removed will be disposed of in a suitable waste facility and not mulched at each site, to avoid the reintroduction and further spread of weeds in the area.	During proposed works
	Machinery will be washed following best practice hygiene protocols prior to being brought to each site, to prevent the spread of weeds, seeds, pathogens and fungi.	Prior to proposed works
Edge effects	Establishment of no-go zones.	During proposed works
Erosion	Establishment of appropriate erosion and sediment controls.	During proposed works

6.0 Conclusion

This biodiversity briefing note assesses the potential impacts to biodiversity resulting from the geotechnical borehole works for the Project. The proposed works as detailed in **Section 1.1** include ground disturbing works for borehole drilling and monitoring well installation activities. No trimming or clearing of native tree species is required. A site visit was conducted on the 16 November 2022 to assess the biodiversity values present at each site and to determine the occurrence of any threatened biodiversity that may be impacted by the proposed works.

Regional vegetation mapping identified two PCTs within the study area for the proposed works, including PCT 3320: Cumberland Shale Plains Woodland and PCT 4024: Cumberland Blue Box Riverflat Forest. These PCTs conform to TECs listed under the BC Act and EPBC Act. No impacts to these PCTs are anticipated, as no trimming or clearing of native tree species is required. Additionally, there will be no ground disturbing works to ground strata characteristic to either PCT. Indirect impacts in the context of the PCT 4024 and PCT 3320 under assessment are not considered significant and will be further minimised with the implementation of the mitigation documented in **Section 5.0** of this briefing note.

One threatened fauna species was identified as having a high likelihood of occurrence within the study area, being the Grey-headed Flying Fox, however evidence of this species was not recorded during the site inspection. There are no anticipated impacts to suitable habitat for the Grey-headed Flying Fox, as no trimming or clearing of native tree species is required for the proposed works.

No other significant impacts to biodiversity or threatened species habitat have been identified as likely to occur as a result of the proposed works. As such, no assessment of significance has been prepared to assess the impacts of the proposed works.

7.0 References

Bannerman S.M. and Hazelton P.A. (2011). Soil Landscapes of the Penrith 1:100,000 Sheet

Cropper, S. C. (1993). Management of endangered plants Department of Agriculture, Water and the Environment , CSIRO, East Melbourne

Jacobs (2020). Westmead to The Bays and Sydney CBD - Environmental Impact Statement Concept and Stage 1 - Technical Paper 10 Biodiversity development assessment report

Attachment A - Likelihood of Occurrence Table

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area, or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded. Do not include this species in the final letter.
None	Suitable habitat is absent from the study area. Do not include this species in the final letter.

Habitat Assessment Table – Threatened Flora

**Marine and pelagic species, and shorebird species have been assessed as having a nil likelihood of occurrence and are not included in this table.*

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Bynoe's Wattle	*Acacia bynoeana*	Endangered	Vulnerable	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Kanangra Wattle	*Acacia clunies-rossiae*	Vulnerable	-	Kanangra Wattle grows in the Kowmung and Coxs River areas entirely within Kanangra-Boyd and Blue Mountains National Parks. Grows in dry sclerophyll forest on skeletal soils on rocky slopes, or on alluvium along creeks.	BioNet	Low. Study area does not possess preferred vegetation associations.
Downy Wattle	*Acacia pubescens*	Vulnerable	Vulnerable	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area. Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	BioNet, PMST	Moderate. Study area possesses preferred edaphics and vegetation associations. Abundance of species records within 10 km of study area.
Sunshine Wattle (Sydney region)	*Acacia terminalis subsp. terminalis MS*	Endangered	Endangered	Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay. Coastal scrub and dry sclerophyll woodland on sandy soils.	PMST	Low. Study area does not possess preferred edaphics and vegetation associations.
Allocasuarina glareicola	*Allocasuarina glareicola*	Endangered	Endangered	Primarily restricted to the Richmond (NW Cumberland Plain) district. Grows in Castlereagh woodland on lateritic soil.	PMST	Low. Study area does not possess preferred edaphics and vegetation associations.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Nielsen Park She-oak	*Allocasuarina portuensis*	Endangered	Endangered	The original known habitat of the Neilsen Park She-oak is at Nielsen Park, in Woollahra local government area. There are no plants left at the original site where it was discovered. However, propagation material has been planted successfully at a number of locations at Nielsen Park and other locations in the local area, e.g. Gap Bluff, Hermit Point and Vaucluse House.	PMST	Low. Outside known habitat areas and propagation locations.
Asterolasia elegans	*Asterolasia elegans*	Endangered	Endangered	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Found on Hawkesbury sandstone in sheltered forests on mid- to lower slopes and valleys.	PMST	Low. Study area does not possess preferred edaphics and vegetation associations.
Thick-lipped Spider-orchid, Daddy Long-legs	*Caladenia tessellata*	Endangered	Vulnerable	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	PMST	Low. Study area does not possess preferred vegetation associations.
Netted Bottle Brush	*Callistemon linearifolius*	Vulnerable	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Grows in dry sclerophyll forest on the coast and adjacent ranges.	BioNet	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Leafless Tongue-orchid	*Cryptostylis hunteriana*	Vulnerable	Vulnerable	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Does not appear to have well defined habitat preferences and is	PMST	Moderate. Suitable habitat for the species may be present within the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				known from a range of communities, including swamp-heath and woodland.		
White-flowered Wax Plant	*Cynanchum elegans*	Endangered	Endangered	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. The species has been recorded as far west as Merriwa in the upper Hunter River valley. Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp. integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	PMST	Low. Study area does not possess preferred vegetation associations.
Darwinia biflora	*Darwinia biflora*	Vulnerable	Vulnerable	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Deyeuxia appressa	*Deyeuxia appressa*	Endangered	Endangered	Highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Given that *D. appressa* has not been seen in over 60 years, almost nothing is known of the species' habitat and ecology.	PMST	Low. This species has not been seen in the area in 80 years.
Dillwynia tenuifolia	*Dillwynia tenuifolia*	Vulnerable	-	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and	BioNet	Moderate. Study area may possess preferred edaphics and vegetation associations.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				Shale Gravel Transition Forest on tertiary alluvium or laterised clays.		
Dillwynia tenuifolia Sieber ex D.C. in the Baulkham Hills local government area	*Dillwynia tenuifolia*	Endangered Population	-	The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	BioNet	Low. Study area is outside the specified population range.
Epacris purpurascens var. purpurascens	*Epacris purpurascens var. purpurascens*	Vulnerable	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	BioNet	Moderate. Study area may possess preferred edaphics and vegetation associations. Abundance of records within 10 km.
Camfield's Stringybark	*Eucalyptus camfieldii*	Vulnerable	Vulnerable	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Found in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	PMST	Low. Study area does not possess preferred edaphics and vegetation associations.
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Vulnerable	Vulnerable	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	BioNet	Low. Study area does not possess the species preferred edaphics and vegetation associations. The study area is outside the species natural distribution of the New England Tablelands. No recently recorded sightings within 10 km.
Wallangarra White Gum	*Eucalyptus scoparia*	Endangered	Vulnerable	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite	BioNet	Low. Study area does not possess the species preferred edaphics and vegetation associations.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				hilltops, slopes and rocky outcrops, typically at high altitudes.		The study area is outside the species natural distribution of the New England Tablelands. No recently recorded sightings within 10 km.
Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid	*Genoplesium baueri*	Endangered	Endangered	The species has been recorded from locations between Ulladulla and Port Stephens. Grows in dry sclerophyll forest and moss gardens over sandstone.	PMST	Low. Study area does not possess preferred vegetation associations.
Narrow-leaf Finger Fern	*Grammitis stenophylla*	Endangered	-	Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	BioNet	Low. Study area does not possess the species preferred edaphics and vegetation associations. No recently recorded sightings within 10 km.
Beadle's Grevillea	*Grevillea beadleana*	Endangered	Endangered	Known from four separate areas, all in north-east NSW: the Torrington area west of Tenterfield, Oxley Wild Rivers National Park, Guy Fawkes River National Park and at Chambigne Nature Reserve south-west of Grafton. Occurs in open eucalypt forest and woodland with a shrubby understorey on granite.	BioNet	Low. Study area does not possess the species preferred edaphics and vegetation associations. No recently recorded sightings within 10 km.
Caley's Grevillea	*Grevillea caleyi*	Critically Endangered	Critically Endangered	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. All sites occur on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community	PMST	Low. Study area is outside the known distribution range.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				of open forest, generally dominated by *Eucalyptus sieberi* and *E. gummifera*.		
Juniper-leaved Grevillea	*Grevillea juniperina subsp. juniperina*	Vulnerable	-	Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.	BioNet	Low. Outside the natural distribution in the Western Sydney area. One recently recorded sighting within 10 km.
Grevillea shiressii	*Grevillea shiressii*	Vulnerable	Vulnerable	Known from two populations near Gosford, on tributaries of the lower Hawkesbury River north of Sydney (Mooney Mooney Creek and Mullet Creek). Both populations occur within the Gosford Local Government Area. There is also a naturalised population at Newcastle. Grows along creek banks in wet sclerophyll forest with a moist understorey in alluvial sandy or loamy soils.	PMST	Low. Study area is outside the known distribution range. Study area does not possess the preferred habitat.
Hal	*Haloragodendron lucasii*	Endangered	Endangered	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest.	PMST	Low. Study area is outside the known distribution range.
Julian's Hibbertia	*Hibbertia spanantha*	Critically Endangered	Critically Endangered	Endemic to NSW where it is restricted to four known locations. Grows in forest with canopy species including *Eucalyptus pilularis*, *E. resinifera*, *Corymbia gummifera* and *Angophora costata*.	BioNet	Low. Study area does not possess the species preferred habitat.
Hibbertia superans	*Hibbertia superans*	Endangered	-	Occurs from Baulkham Hills to South Maroota in the northern outskirts of Sydney, in both open	BioNet	Low. Study area does not possess the species

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				woodland and heathland, and appears to prefer open disturbed areas, such as tracksides.		preferred edaphics and vegetation associations.
Kunzea rupestris	*Kunzea rupestris*	Vulnerable	Vulnerable	Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW. Currently known to exist in 20 populations, 6 of which are reserved. Grows in shallow depressions on large flat sandstone rock outcrops.	PMST	Low. Study area does not possess the preferred habitat.
Lasiopetalum joyceae	*Lasiopetalum joyceae*	Vulnerable	Vulnerable	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved. Grows in heath on sandstone.	PMST	Low. Study area is outside the known distribution range. Study area does not possess the preferred habitat.
Deane's Tea-tree	*Leptospermum deanei*	Vulnerable	Vulnerable	Occurs in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs. Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone.	PMST	Low. Study area is outside the known distribution range. Study area does not possess the preferred habitat.
Macadamia Nut	*Macadamia integrifolia*	-	Vulnerable	Not known to occur naturally in the wild in NSW.	BioNet	Low. Not anticipated to occur in the wild.
Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	*Marsdenia viridiflora subsp. viridiflora*	Endangered Population	-	Grows in vine thickets and open shale woodland.	BioNet	Low. Study area is outside the specified population range.
Biconvex Paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in	PMST	Low. Study area is outside the known habitat - the

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.		species is known from two populations in the Central Coast and Nowra.
Deane's Paperbark	*Melaleuca deanei*	Vulnerable	Vulnerable	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Angus's Onion Orchid	*Microtis angusii*	Endangered	Endangered	Currently known from only one site at Ingleside, north of Sydney. A collection previously thought to be this species was made from Sunny Corner 100 km west of Sydney, but has since been confirmed as being genetically distinct and may possibly be a subspecies. It is not easy to define the preferred natural habitat of this orchid as the Ingleside location is highly disturbed. The dominant species occurring on the site are introduced weeds *Hyparrhenia hirta* (Coolatai grass) and *Acacia saligna*.	PMST	Low. Study area is outside the known distribution range.
Knotweed, Tall Knotweed	*Persicaria elatior*	Vulnerable	Vulnerable	Tall Knotweed has been recorded in south-eastern NSW, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. This species normally grows in damp places, especially beside streams and lakes.	PMST	Low. Study area does not possess the preferred habitat.
Hairy Geebung	*Persoonia hirsuta*	Endangered	Endangered	*Persoonia hirsuta* has a scattered distribution around Sydney. Found in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. One recently recorded sighting within 10 km.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Persoonia mollis subsp. maxima	*Persoonia mollis subsp. maxima*	Endangered	Endangered	Highly restricted, known from the Hornsby Heights-Mt Colah area north of Sydney in the Sydney Basin Bioregion. Occurs in three populations (described on a catchment basis) located over an approximate north-south range of 5.75 km and east-west distance of 7.5 km. Additional locations may exist outside the current distribution. Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences.	PMST	Low. Study area is outside the known distribution range. Study area does not possess the preferred habitat.
Nodding Geebung	*Persoonia nutans*	Endangered	Endangered	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests.	BioNet	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Pimelea curviflora var. curviflora	*Pimelea curviflora var. curviflora*	Vulnerable	Vulnerable	Confined to the coastal area of the Sydney and Illawarra regions. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. No recently recorded sightings within 10 km.
Spiked Rice-flower	*Pimelea spicata*	Endangered	Endangered	Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain and the Illawarra. In both the Cumberland Plain and Illawarra	BioNet, PMST	Moderate. Suitable habitat may be present within the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				environments this species is found on well-structured clay soils.		
Brown Pomaderris	*Pomaderris brunnea*	Endangered	Vulnerable	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	BioNet	Low. The study area is outside the restricted habitat locations for the species.
P**omaderris **prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	*Pomaderris prunifolia*	Endangered Population	-	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. It is known to occur along a road reserve near a creek, among grass species on sandstone, as well as in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	BioNet	Low. Study area is outside the specified population range.
Villous Mintbush	*Prostanthera densa*	Vulnerable	Vulnerable	The Sydney and Royal National Park populations were thought possibly extinct, but the species is now known to occur at Bass and Flinders Point in Cronulla. *Prostanthera densa* generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	PMST	Low. Study area does not possess preferred edaphics and vegetation associations.
Somersby Mintbush	*Prostanthera junonis*	Endangered	Endangered	Has a north-south range of approximately 19 km on the Somersby Plateau in the Gosford and Wyong local government areas. The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites.	PMST	Low. Study area is outside the known distribution range.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Seaforth Mintbush	*Prostanthera marifolia*	Critically Endangered	Critically Endangered	*Prostanthera marifolia* is currently only known from the northern Sydney suburb of Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community.	PMST	Low. Study area is outside the known distribution range.
Sydney Plains Greenhood	*Pterostylis saxicola*	Endangered	Endangered	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	BioNet	Low. Study area does not possess the species preferred edaphics and vegetation associations.
Pultenaea parviflora	*Pultenaea parviflora*	Endangered	Vulnerable	Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	BioNet	Low. Study area does not possess the species preferred vegetation associations. One recently recorded sighting within 10 km.
Matted Bush-pea	*Pultenaea pedunculata*	Endangered	-	In NSW, the Matted Bush-pea is represented by just three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs.	BioNet	Low. The study area is outside the restricted habitat locations for the species.
Eastern Underground Orchid	*Rhizanthella slateri*	Vulnerable	Endangered	Occurs from south-east Queensland to south-east NSW. Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	PMST	Moderate. Suitable habitat for the species may be present within the study area, due to the limited understanding of the species' preferred habitat.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Scrub Turpentine	*Rhodamnia rubescens*	Critically Endangered	Critically Endangered	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	BioNet, PMST	Low. Study area does not possess the species preferred vegetation associations. One recently recorded sighting within 10 km.
Native Guava	*Rhodomyrtus psidioides*	Critically Endangered	Critically Endangered	Occurs from Broken Bay, approximately 90 km north of Sydney, New South Wales, to Maryborough in Queensland. Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	PMST	Low. Study area is outside the known distribution range. Study area does not possess the preferred habitat.
Magenta Lilly Pilly	*Syzygium paniculatum*	Endangered	Vulnerable	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	BioNet, PMST	Moderate. Suitable habitat for the species may be present within the study area. One recently recorded sighting within 2 km.
Tetratheca glandulosa	*Tetratheca glandulosa*	Vulnerable	-	Restricted to the following Local Government Areas: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge.	BioNet	Low. The study area is outside the restricted habitat locations for the species.
Austral Toadflax, Toadflax	*Thesium australe*	Vulnerable	Vulnerable	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	PMST	Low. Study area is not along a coastline or within the tablelands.
Creek Triplarina	*Triplarina imbricata*	Endangered	Endangered	The species was previously recorded in Parramatta, near Sydney, however, the species	BioNet	Low. Study area does not possess the species

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				is no longer thought to occur in this area. Occurs along watercourses in low open forest with Water Gum (*Tristaniopsis laurina*) or in montane bogs, often with *Baekea amissa*.		preferred vegetation associations. No recently recorded sightings within 10 km.
Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	*Wahlenbergia multicaulis*	Endangered Population	-	Found across the Hornsby LGA and Western Sydney in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open.	BioNet	Low. Study area is outside the specified population range.
Narrow-leafed Wilsonia	*Wilsonia backhousei*	Vulnerable	-	In NSW, Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney. This is a species of the margins of salt marshes and lakes.	BioNet	Low. The study area is outside the restricted habitat locations for the species.
Zannichellia palustris	*Zannichellia palustris*	Endangered	-	In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water.	BioNet	Low. The study area is outside the restricted habitat locations for the species.

Habitat Assessment Table – Threatened Fauna

**Marine and pelagic species, and shorebird species have been assessed as having a nil likelihood of occurrence and are not included in this table.*

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Amphibians						
Green and Golden Bell Frog	*Litoria aurea*	Endangered	Vulnerable	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.*) or spikerushes (*Eleocharis spp*.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.	BioNet, PMST	Low. The study area does not contain the preferred vegetation or permanent waterbodies. No recorded sightings within 2 km.
Red Crowned-toadlet	*Pseudophryne australis*	Vulnerable	-	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	BioNet	Low. The study area does not contain the preferred sandstone soil composition for this species.
Giant Burrowing Frog	*Heleioporus australiacus*	Vulnerable	Vulnerable	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath,	PMST	Low. The study area is located within a predominately clay loam soil landscape.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.		
Stuttering Frog, Southern Barred Frog (in Victoria)	*Mixophyes balbus*	Endangered	Vulnerable	Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	PMST	Low. The study area does not contain the moist micro-habitat required for this species.
Aves						
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Critically Endangered	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. In NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. Also found in drier coastal woodlands and forests. Inhabits dry open forest and woodland, particularly Box-Ironbark woodland and riparian forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany.	BioNet, PMST	Low. The species may occasionally utilise the study area when foraging nearby, however this species has only been recently sighted once within 10km and the study area does not contain high-quality habitat.
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Vulnerable	-	The Dusky Woodswallow has a large but sparse distribution covering much of southern Australia. It primarily inhabits dry and open eucalypts forests and woodlands but has on occasion been observed in the bordering agricultural land.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Endangered	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha spp.*) and spikerushes (*Eleocharis spp.*)	BioNet, PMST	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 2 km of the study area.
Bush Stone-curlew	*Burhinus grallarius*	Endangered	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Red Knot	*Calidris canutus*	-	Endangered	In NSW, this species is recorded in small numbers along some of the major river estuaries and sheltered embayments of the coastline, in particular the Hunter River estuary. The Red Knot mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps.	BioNet, PMST	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Curlew Sandpiper	*Calidris ferruginea*	Endangered	Critically Endangered	The Curlew Sandpiper occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps,	BioNet, PMST	Moderate. The species may occasionally utilise the study area. There is an abundance of recent sightings for this species within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				lakes and lagoons on the coast and sometimes inland.		
Great Knot	*Calidris tenuirostris*	Vulnerable	Critically Endangered	In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	BioNet, PMST	Low. This species may infrequently utilise the study area. Only one recent sighting within 10 km.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable	Endangered	Occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests in winter. In summer this species prefers open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry coastal forests.	BioNet, PMST	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	*Callocephalon fimbriatum*	Endangered Population	-	This endangered population is found in the Ku-ring-gai and Hornsby local government areas. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. Occurs within a variety of forest and woodland types. Usually frequents forested areas with old growth attributes required for nesting and roosting purposes.	BioNet	Low. Study area is outside the specified population range.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable	Vulnerable	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands	BioNet, PMST	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 2 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods.		
Greater Sand-plover	*Charadrius leschenaultii*	Vulnerable	Vulnerable	In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	BioNet, PMST	Low. This species may infrequently utilise the study area. No recent sightings within 10 km.
Lesser Sand Plover, Mongolian Plover	*Charadrius mongolus*	Vulnerable	Endangered	In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. This species is found in almost entirely coastal habitats in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Speckled Warbler	*Chthonicola sagittata*	Vulnerable	-	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock	BioNet	Low. This species may infrequently utilise the study area. Two recent sightings within 10 km.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.		
Spotted Harrier	*Circus assimilis*	Vulnerable	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Vulnerable	-	The eastern subspecies lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with drier open woodlands such as the Snowy River Valley, Cumberland Plains, Hunter Valley and parts of the Richmond and Clarence Valleys. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis)	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Varied Sittella	*Daphoenositta chrysoptera*	Vulnerable	-	Inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Eastern Bristlebird	*Dasyornis brachypterus*	Endangered	Endangered	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
White-fronted Chat	*Epthianura albifrons*	Vulnerable	-	In NSW, the species occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	BioNet	Moderate. The species may occasionally utilise the study area. There is an abundance of sightings within 10 km of the study area.
White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	*Epthianura albifrons*	Endangered Population	-	Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay. These sub-populations are separated from each other by 25 km of urbanised land, across which the Chats are unlikely to fly. The nearest extant populations outside Sydney Metropolitan CMA are at Ash Island north of Newcastle and Lake Illawarra, south of Wollongong. Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals.	BioNet	Low. Study area is outside the specified population range.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Red Goshawk	*Erythrotriorchis radiatus*	Critically Endangered	Vulnerable	The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Grey Falcon	*Falco hypoleucos*	Endangered	Vulnerable	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	PMST	Moderate. The species may occasionally utilise the study area when foraging nearby. No records of this species within 10km.
Black Falcon	*Falco subniger*	Vulnerable	-	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions.	BioNet	Low. This species may infrequently utilise the study area. One recent sighting within 10 km.
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable	-	Mostly occur in dry, open eucalypt forests and woodlands. Have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance about three cm) of Eucalyptus spp. between 2-15 m above the ground.	BioNet	Moderate. The species may occasionally utilise the study area. There is an abundance of sightings within 10 km of the study area.
Painted Honeyeater	*Grantiella picta*	Vulnerable	Vulnerable	The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall (*Acacia pendula*),	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.		
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Vulnerable	Migratory	Habitat includes coastlines, estuaries, large rivers and lakes. It has occasionally been recorded over adjacent habitats. This species builds a large stick nest in a tall tree and very rarely on artificial structures.	BioNet, PMST	Moderate. The species may occasionally utilise the study area. There is an abundance of sightings within 10 km of the study area.
Little Eagle	*Hieraaetus morphnoides*	Vulnerable	-	Occupies habitats rich in prey, such as birds, reptiles and mammals, within open eucalypt forest, woodland or open woodland. Requires tall living trees for building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
White-throated Needletail	*Hirundapus caudacutus*	-	Vulnerable	Migratory and usually seen in eastern Australia from October to April. The White-throated Needletail is almost exclusively aerial, occurring over most types of habitat, yet are probably recorded most often above wooded areas, including open forest and rainforest.	BioNet, PMST	Moderate. The species may occasionally utilise the study area. There is an abundance of sightings within 10 km of the study area.
Black Bittern	*Ixobrychus flavicollis*	Vulnerable	-	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	BioNet	Moderate. The species may occasionally utilise the study area. This species has been recently sighted within 10 km of the study area.
Swift Parrot	*Lathamus discolor*	Endangered	Critically Endangered	In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely	BioNet, PMST	Moderate. The species may occasionally utilise the study area. This species has been recently

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				or where there are abundant lerp (from sap-sucking bugs) infestations.		sighted within 10 km of the study area.
Broad-billed Sandpiper	*Limicola falcinellus*	Vulnerable	-	In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. Favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	BioNet	Low. This species may infrequently utilise the study area. One recent sighting within 10 km.
Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	-	Vulnerable	The species is most frequently recorded along major coastal river estuaries and sheltered embayments, particularly the Tweed, Richmond, Clarence, Macleay, Hastings, Hunter and Shoalhaven River estuaries, Port Stephens and Botany Bay. It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms.	PMST	Moderate. The species may occasionally utilise the study area when foraging nearby. No records of this species within 10 km.
Black-tailed Godwit	*Limosa limosa*	Vulnerable	-	In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water	BioNet	Low. This species may infrequently utilise the study area. One recent sighting within 10 km.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				less than 10 cm deep, around muddy lakes and swamps.		
Square-tailed Kite	*Lophoictinia isura*	Vulnerable	-	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	BioNet	Low. This species may infrequently utilise the study area. Two recent sightings within 10 km.
Turquoise Parrot	*Neophema pulchella*	Vulnerable	-	Occupies mostly on upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Barking Owl	*Ninox connivens*	Vulnerable	-	Inhabits woodland and open forest, including fragmented remnants and agricultural land. It is flexible in its habitat use, and hunting can extend in to closed forests. Roosts in shaded portions of tree canopies in species such as *Acacia spp.* and *Casuarina spp.*	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Powerful Owl	*Ninox strenua*	Vulnerable	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Nest in large tree hollows, at least 0.5 metres deep, in large eucalypts, with DBH of 80-240 centimetres) that are at least 150 years old.	BioNet	Moderate. The species may occasionally utilise the study area. There is an abundance of sightings within 10 km of the study area.
Eastern Curlew, Far Eastern Curlew	*Numenius madagascariensis*	-	Critically Endangered	In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. The species is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Fairy Prion (southern)	*Pachyptila turtur subantarctica*	-	Vulnerable	The fairy prion (southern) breeds on Macquarie Island and a number of other subantarctic islands outside of Australia. There are 80 to 250 breeding pairs in Australia and a global population of 80 000. In Australia, breeding is recorded on two rock stacks off Macquarie Island and on the nearby Bishop and Clerk Island.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Eastern Osprey	*Pandion cristatus*	Vulnerable	-	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Scarlet Robin	*Petroica boodang*	Vulnerable	-	In NSW, this species occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Flame Robin	*Petroica phoenicea*	Vulnerable	-	The Flame Robin is endemic to south eastern Australia, and ranges from near the Queensland border to south east South Australia and also in Tasmania. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Pink Robin	*Petroica rodinogaster*	Vulnerable	-	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	BioNet	Low. The study area does not contain suitable habitat. This species may infrequently utilise the study area. No recent sightings within 10 km.
Superb Parrot	*Polytelis swainsonii*	Vulnerable	Vulnerable	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	BioNet	Low. The study area does not contain suitable habitat. This species may infrequently utilise the study area. No recent sightings within 10 km.
Superb Fruit-Dove	*Ptilinopus superbus*	Vulnerable	-	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt	BioNet	Low. The study area does not contain suitable habitat. This species may infrequently utilise the study area. No recent sightings within 10 km.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				or acacia woodland where there are fruit-bearing trees.		
Pilotbird	*Pycnoptilus floccosus*	-	Vulnerable	Pilotbirds are endemic to south-east Australia. Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth – typically in wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth or dry sclerophyll forests and woodlands occupying dry slopes and ridges.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Australian Painted Snipe	*Rostratula australis*	Endangered	Endangered	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. Nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	BioNet, PMST	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Little Tern	*Sternula albifrons*	Endangered	-	The Little Tern is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records).	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Australian Fairy Tern	*Sternula nereis nereis*	-	Vulnerable	The Fairy Tern nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The species has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline.	PMST	Low. The study area does not provide suitable habitat for this species. No records of this species within 10 km.
Freckled Duck	*Stictonetta naevosa*	Vulnerable	-	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. Prefer	BioNet	Low. Study area does not possess the preferred habitat.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.		
Eastern Grass Owl	*Tyto longimembris*	Vulnerable	-	Eastern Grass Owls have been recorded occasionally in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east. Found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 10 km of the study area.
Masked Owl	*Tyto novaehollandiae*	Vulnerable	-	Lives in dry eucalypt forests and woodlands up to 1110 metres above sea level. Predominantly hunts in forests but has been observed foraging along roadsides and along forest margins. Roosts in eucalypt forested gullies, utilising large tree hollows and or even caves.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently sighted within 2 km of the study area.
Sooty Owl	*Tyto tenebricosa*	Vulnerable	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	BioNet	Low. The study area does not provide suitable habitat for this species.
Terek Sandpiper	*Xenus cinereus*	Vulnerable	-	The two main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary. Favours mudbanks and sandbanks located near mangroves, but may also be observed on rocky pools and reefs,	BioNet	Low. The study area does not provide suitable habitat for this species.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				and occasionally up to 10 km inland around brackish pools.		
Gastropoda						
Cumberland Plain Land Snail	*Meridolum corneovirens*	Endangered	-	Primarily occurs in Cumberland Plain Woodland – a grassy, open woodland with stands of denser vegetation.	BioNet	Moderate. The species may occasionally utilise the study area. There has been an abundance of recent sightings of this species within 10 km of the study area.
Dural Land Snail	*Pommerhelix duralensis*	Endangered	Endangered	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.	BioNet, PMST	Moderate. The species may occasionally utilise the study area. There has been an abundance of recent sightings of this species within 10 km of the study area.
Maroubra Woodland Snail, Maroubra Land Snail	*Meridolum maryae*	Endangered	Endangered	This species is confined to a narrow band of habitat along the coast from the north-eastern corner of the Royal National Park to Palm Beach in Sydney. Records of the species are generally within 1 km of the ocean but occur up to 5 km inland. The species is found in the leaf litter of coastal vegetation communities, most commonly in heathland on foredunes also from areas of podsolised dunes/sand plains that support taller heath communities including Eastern Suburbs Banksia Scrub.	PMST	Low. The study area is outside the known habitat locations for the species.
Mammals						
Eastern Pygmy-possum	*Cercartetus nanus*	Vulnerable	-	In NSW, the species extends from the coast inland as far as the Pilliga, Dubbo, Parkes and	BioNet	Low. The study area does not contain the resources required for

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.		this species. No recent records within 10 km.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable	Roosts in disused mine shafts, caves, overhangs and disused Fairy Martin nests for shelter and to raise young. Also potentially roost in tree hollows. Occurs in low to mid-elevation dry open forest and woodlands, preferably with extensive cliffs, caves or gullies. Largely restricted to the interface of sandstone escarpment for roost habitat and relatively fertile valleys for foraging habitat.	BioNet, PMST	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 10 km of the study area.
Spotted-tailed Quoll	*Dasyurus maculatus*	Vulnerable	Endangered	Utilises a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	BioNet, PMST	Low. The study area does not contain suitable habitat for this species.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable	-	Occurs in the south-east coast and ranges of Australia. This bat prefers moist habitat that supports trees taller than 20 meters. It will roost in eucalypt hollows but on occasion has been found in buildings and under loose bark still partially attached to trees. It will hunt flying insects just above or below the tree canopy.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 2 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	Vulnerable	-	Habitat preferences include dry eucalypt forest and coastal woodlands but also include the riparian zones of rainforests and wet sclerophyll forests. Forages above forest canopy or forest edge. Usually roosts in tree hollows but roosts have been found in buildings.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 10 km of the study area.
Little Bent-winged Bat	*Miniopterus australis*	Vulnerable	-	Found along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Preferred habitat includes moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 10 km of the study area.
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	Vulnerable	-	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. They form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. This species tends to hunt in forested areas.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 2 km of the study area.
Southern Myotis	*Myotis macropus*	Vulnerable	-	This species generally roost in groups of 10-15 close to water in caves, mine shafts, hollow bearing trees, storm water channels, buildings, under bridges and in dense foliage. They forage over streams and pools catching insects and small fish.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 2 km of the study area.
Greater Glider	*Petauroides volans*	-	Endangered	The greater glider (southern and central) occurs in eastern Australia, where it has a broad distribution from around Proserpine in Queensland, south through NSW and the ACT,	BioNet, PMST	Low. The study area does not contain suitable habitat for this species. There is one recent sighting

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				to Wombat State Forest in central Victoria. The species is predominantly solitary and largely restricted to eucalypt forests and woodlands of eastern Australia.		for this species within 10 km of the study area.
Koala	*Phascolarctos cinereus*	Endangered	Endangered	Inhabits a range of eucalypt forest and woodland communities. Adequate floristic diversity, availability of feed trees (primarily *Eucalyptus tereticornis* and *E. viminalis*) and presence of mature trees very important. Preferred food tree species vary with locality and there are quite distinct regional preferences. They are able to persist in fragmented habitats, and even survive in isolated trees across a predominantly agricultural landscape.	BioNet, PMST	Low. The study area does not provide suitable habitat for this species.
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 km to forage, on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	BioNet, PMST	High. The species may utilise the study area when foraging nearby. This species has been recently recorded within 2 km of the study area. There is a roost camp 400 m from the study area.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Vulnerable	-	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 2 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Vulnerable	-	Occurs in a variety of habitats including rainforest, dry and wet sclerophyll forest and eucalypt woodland. Large hollow bearing trees required for roosting.	BioNet	Moderate. The species may occasionally utilise the study area when foraging nearby. This species has been recently recorded within 10 km of the study area.
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)	*Isoodon obesulus obesulus*	Endangered	Endangered	This species is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.
Parma Wallaby	*Notamacropus parma*	Vulnerable	Vulnerable	The species once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to south of the Bruxner Highway between Tenterfield and Casino. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.
Yellow-bellied Glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.		
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Endangered	Vulnerable	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.
Long-nosed Potoroo (northern)	*Potorous tridactylus tridactylus*	Vulnerable	Vulnerable	In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.
New Holland Mouse, Pookila	*Pseudomys novaehollandiae*	-	Vulnerable	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent sightings for this species within 10 km of the study area.
Reptiles						
Broad-headed Snake	*Hoplocephalus bungaroides*	Endangered	Vulnerable	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven	PMST	Low. The study area does not contain suitable habitat for this species. There are no recent

Common Name	Scientific Name	BC Act	EPBC Act	Habitat Preference	Source	Likelihood of occurrence
				groups, within the coast and ranges in an area within approximately 250 km of Sydney. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring.		sightings for this species within 10 km of the study area.

Attachment B – Species Identified During Rapid Flora Surveys

Species name	Common Name	Status (native, non-native)
Canopy Species		
Casuarina glauca	Swamp Oak	Native
Eucalyptus moluccana	Grey Box	Native
Eucalyptus robusta	Swamp Mahogany	Native
Eucalyptus tereticornis	Forest Red Gum	Native
Ground Cover Species		
Bromus catharticus	Prairie Grass	Non-native
Lepidium sp.	-	Non-native
Modiola caroliniana	Red-flowered Mallow	Non-native
Bidens pilosa	Cobbler's Pegs	Non-native
Ehrharta erecta	Panic Veldtgrass	Non-native
Cynodon dactylon	Bermuda Grass	Native
Microlaena stipoides	Burra Weeping Grass	Native