

Technical Paper 5

Aboriginal heritage

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Glossary and terms and abbreviations

Term	Definition
AAR	Aboriginal Archaeological Report
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions associated with past and present day Aboriginal communities
Aboriginal object	Any deposit, object or material evidence (not being a handicraft made for sale), including Aboriginal remains, relating to the Aboriginal habitation of NSW
Aboriginal place	Any place declared to be an Aboriginal place under Section 94 of the <i>National Parks and Wildlife Act 1974</i> (NSW)
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHMP	Aboriginal Cultural Heritage Management Plan
AEPR	Airports (Environment Protection) Regulations 1997
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System - a register of New South Wales (NSW) Aboriginal heritage information maintained by Environment, Energy and Science (EES), which is a group within the NSW Department of Planning, Industry and Environment
AHIP	Aboriginal Heritage Impact Permit
ASIR	Aboriginal Site Impact Recording
ATSIHP Act	<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i>
BNI	Blacktown Native Institution
BP	Before Present is a term used by archaeologists and geologists referring to dates obtained by radiocarbon dating. The “present” in this case is not the present day, which is constantly changing and therefore is unable to be used as a consistent point from which to measure. Instead the year 1950 was chosen to be used as the “present” for this term
CBD	Central Business District
CEMF	Construction Environmental Management Framework
CEMP	Construction Environmental Management Plan
CHL	Commonwealth Heritage List
CMA	Catchment Management Authorities
CMP	Conservation Management Plan
construction footprint	The total extent of land required for the construction of the project, including ancillary facilities, services and land temporarily required for construction (incorporating construction elements such as compounds, access tracks and worksites)
CSSI	Critical State Significant Infrastructure
DEOH	Defence Establishment Orchard Hills
DPC	Department of Premier and Cabinet

Term	Definition
DPIE	NSW Department of Planning, Industry and Environment. As of 1 July 2020 management of Aboriginal Cultural Heritage in NSW moved from DPIE to Heritage NSW in the Department of Premier and Cabinet (DPC)
earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock
EES	Environment, Energy and Science, which is a division within the NSW Department of Planning, Industry and Environment (DPIE). As of 1 July 2020 management of Aboriginal Cultural Heritage in NSW moved from DPIE to Heritage NSW in the Department of Premier and Cabinet (DPC)
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPI	Environmental Planning Instruments
erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle
floodplain	An area of land which is inundated by floods up to and including the probable maximum flood event (i.e. flood prone land)
GPS	Global Positioning System
GSV	Ground Surface Visibility
heritage item	Any place, building or object listed on a statutory heritage register
HHMP	Historical Heritage Management Plans
HMP	Heritage Management Plan
ILUA	Indigenous Land Use Agreements
impact	Influence or effect exerted by the project or other activity on the natural, built and community environment
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
NHL	National Heritage List
NNTT	National Native Title Tribunal
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NTA	<i>Native Title Act 1993</i>
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
paleochannel	Ancient river systems eroded deeply into the landscape and infilled with saturated alluvial sediments
RAP	Registered Aboriginal Party
RNE	Register of the National Estate

Term	Definition
road reserve	A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
SEARs	Secretary's Environmental Assessment Requirements
SEPP SRD	<i>State Environmental Planning Policy (State and Regional Development) 2011</i>
SSI	State Significant Infrastructure
Sydney Metro - Western Sydney Airport (the project)	The Sydney Metro - Western Sydney Airport between St Marys and Western Sydney Aerotropolis comprises a new north-south metro railway around 23 kilometres in length, creating passenger rail access to Western Sydney Airport, the Aerotropolis and a connection with the T1 Western Line
Western Sydney Aerotropolis	This includes the land surrounding Western Sydney International (including Bringelly, Luddenham, Kemps Creek, Badgerys Creek and Rossmore) where commercial and residential property development is proposed, supported by key infrastructure. This will include commercial and industrial precincts, and agricultural land, as well as transport corridors
Western Sydney Airport	The Australian government-owned organisation responsible for delivering and operating Western Sydney International

Executive Summary

The *Greater Sydney Region Plan* (Greater Sydney Commission, 2018a) sets the vision and strategy for Greater Sydney to become a global metropolis of three unique and connected cities; the Eastern Harbour City, the Central River City and the Western Parkland City. The Western Parkland City incorporates the future Western Sydney International (Nancy-Bird Walton) Airport (hereafter referred to as Western Sydney International) and Western Sydney Aerotropolis (hereafter referred to as the Aerotropolis).

Sydney Metro – Western Sydney Airport (the project) is identified in the *Greater Sydney Region Plan* as a key element to delivering an integrated transport system for the Western Parkland City. The project would be located within the Penrith and Liverpool Local Government Areas (LGAs) and would involve the construction and operation of a new metro railway line around 23 kilometres in length between the T1 Western Line at St Marys in the north and the Aerotropolis in the south. This would include a section of the alignment which passes through and provides access to Western Sydney International.

The project is characterised into components that are located outside Western Sydney International (off-airport) and components that are located within Western Sydney International (on-airport), to align with their different planning approval pathways required under State and Commonwealth legislation.

An Aboriginal cultural heritage assessment for the project is provided in this technical paper. The assessment was prepared in accordance with relevant statutory guidelines including the Heritage documents *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) and *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a).

The study area for the project (Figure 1-2) was defined as a 58 kilometre by nine kilometre area, which was the subject of an Aboriginal Heritage Information Management System (AHIMS) search to gain regional site distribution data. The primary focus in relation to assessing likely direct impacts was on the construction footprint within the study area; which covers the total extent of land required for the construction of the project, including ancillary facilities and services and land temporarily required for construction (incorporating construction elements such as compounds, access tracks and construction footprint). The extent of the construction footprint is shown on Figure 1-2. A buffer of 200 m surrounding the construction footprint has also been considered in relation to impacts, as there is a regular 200 m error for centroid coordinates in the AHIMS register due to legacy data issues with changing datum use over time. Areas proposed for power line routes and surface areas above subsurface tunnels were also considered (with special consideration given to the risk of impacts from ground movement or vibration).

Consultation was undertaken for the project as per the requirements of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). Following newspaper advertisements and letters requesting registration, a total of 68 Registered Aboriginal Parties (RAPs) registered for consultation on this project. Consultation was undertaken via letter, email and phone with all RAPs, providing an opportunity for information to be shared on the cultural heritage values of the region being intersected by the project.

Searches of the AHIMS database for the study area resulted in the identification of a total of 360 Aboriginal sites. Of these, a total of 10 sites were found to have centroids registered within the bounds of the construction footprint (eight on-airport and two off-airport). Of the two located in the off-airport area, one was identified as having been destroyed under the conditions of an Aboriginal Heritage Impact Permit (AHIP). The other was a valid artefact scatter site 45-5-2640 located in the Aerotropolis Core construction footprint.

Inspections of accessible sections of the construction footprint were undertaken over non-consecutive days in February, March, April and June 2020 (Thursday 27 February, Wednesday 4 March, Tuesday 28 April 2020 and Friday 12 June 2020). At this stage of the project, access was only available for limited sections of the construction footprint, due to private property access and COVID-19 constraints. In all instances, inspections were conducted by a combined field team of one archaeologist and a representative from the relevant Local Aboriginal Land Council (LALC). Representatives were from

Gandangara LALC and Deerubbin LALC. Inspections of accessible sections of the construction footprint were undertaken over four days on Thursday 27 February, Wednesday 4 March, Tuesday 28 April 2020 and Friday 12 June 2020.

During the inspections, two new sites, consisting of one isolated artefact and one artefact scatter, were identified, with artefacts left in situ at the location. These sites were recorded as WSI-IA1-20 and WSI-AS1-20 respectively. Both sites were located outside the bounds of the construction footprint. The location for artefact scatter site 45-5-2640 was inspected but no surface expression of artefacts was identified, most likely due to high levels of vegetation obscuring the ground during the inspection.

Feedback from the RAP representatives during the inspections indicated that the waterways that traverse the construction footprint, and the project alignment, have cultural significance as pathways and focal resource areas for Aboriginal people in the past. Known sites are culturally significant on the grounds that they are a tangible link to ancestors and a physical presence in the landscape denoting the long-term Aboriginal use and occupation of this area. These values may be preserved in a number of ways, through the avoidance and protection of sites as the primary response, or through mitigation measures such as surface collection and salvage where impacts cannot be avoided, with site specific mitigation measures to be developed with RAPs.

Observations of current landforms and visible levels of past disturbance within the study area have indicated that there is archaeological potential associated with the creeks within and/or adjacent to the construction footprint, including Blaxland Creek, Cosgroves Creek and Badgerys Creek as well as their tributaries. Ground surface visibility was found to be low across much of the investigated areas due to vegetation cover. Areas of archaeological potential were determined based on the presence of surface sites, consultation with RAPs and identification of sensitive landforms (largely focussed on areas of low disturbance in close proximity to water sources).

It is concluded that there are known Aboriginal sites, areas of cultural value and areas of archaeological potential intersecting with the construction footprint. Based on these findings, further investigations will be undertaken, including further consultation, survey and test excavation. These investigations will be carried out so the outcomes can be used to inform the project approval and need to be undertaken prior to construction commencing. Where it is not possible to avoid impacts either to archaeological or cultural sites or features (or both), mitigation measures will be developed for the project in consultation with RAPs.

The CEMPs for the on-airport rail works would be consistent with the Western Sydney International CEMPs and Survey and Salvage Plan. This would include methodologies for collection and salvage, protocols for unexpected finds and the long-term storage of any salvaged or collected Aboriginal cultural material.

1.0 Introduction

1.1 Project context and overview

The Greater Sydney Region Plan (Greater Sydney Commission, 2018a) sets the vision and strategy for Greater Sydney to become a global metropolis of three unique and connected cities; the Eastern Harbour City, the Central River City and the Western Parkland City. The Western Parkland City incorporates the future Western Sydney International (Nancy-Bird Walton) Airport (hereafter referred to as Western Sydney International) and Western Sydney Aerotropolis (hereafter referred to as the Aerotropolis).

Sydney Metro – Western Sydney Airport (the project) (see Figure 1-1) is identified in the Greater Sydney Region Plan as a key element to delivering an integrated transport system for the Western Parkland City. The project would be located within the Penrith and Liverpool Local Government Areas (LGAs) and would involve the construction and operation of a new metro railway line around 23 kilometres in length between the T1 Western Line at St Marys in the north and the Aerotropolis in the south. This would include a section of the alignment which passes through and provides access to Western Sydney International.

The project is characterised into components that are located outside Western Sydney International (off-airport) and components that are located within Western Sydney International (on-airport), to align with their different planning approval pathways required under State and Commonwealth legislation.

1.2 Key project features

Key operational features of the project are shown on Figure 1-1 and would include:

- around 4.3 kilometres of twin rail tunnels (generally located side by side) between St Marys (the northern extent of the project) and Orchard Hills
- a cut-and-cover tunnel around 350 metres long (including tunnel portal), transitioning to an in-cutting rail alignment south of the M4 Western Motorway at Orchard Hills
- around 10 kilometres of rail alignment between Orchard Hills and Western Sydney International, consisting of a combination of viaduct and surface rail alignment
- around two kilometres of surface rail alignment within Western Sydney International
- around 3.3 kilometres of twin rail tunnels (including tunnel portal) within Western Sydney International
- around three kilometres of twin rail tunnels between Western Sydney International and the Aerotropolis Core
- six new metro stations:
 - four off-airport stations:
 - St Marys (providing interchange with the T1 Western Line)
 - Orchard Hills
 - Luddenham Road
 - Aerotropolis Core
 - two on-airport stations:
 - Airport Business Park
 - Airport Terminal
- grade separation of the track alignment at key locations including:
 - where the alignment interfaces with existing infrastructure such as the Great Western Highway, M4 Western Motorway, Lansdowne Road, Patons Lane, the Warragamba to

Prospect Water Supply Pipelines, Luddenham Road, the future M12 Motorway, Elizabeth Drive, Derwent Road and Badgerys Creek Road

- crossings of Blaxland Creek, Cosgroves Creek, Badgerys Creek and other small waterways to provide flood immunity for the project
- modifications to the existing Sydney Trains station and suburban rail network at St Marys (where required) to support interchange and customer transfer between the new metro station and the T1 Western Line
- a stabling and maintenance facility and operational control centre located to the south of Blaxland Creek and east of the proposed metro track
- new pedestrian, cycle, park-and-ride and kiss-and-ride facilities, public transport interchange infrastructure, road infrastructure and landscaping as part of the station precincts.

The project would also include:

- turnback track arrangements (turnbacks) at St Marys and Aerotropolis Core to allow trains to turn back and run in the opposite direction
- additional track stubs to the east of St Marys Station and south of the Aerotropolis Core Station to allow for potential future extension of the line to the north and south respectively without impacting future metro operations
- an integrated tunnel ventilation system including services facilities at Claremont Meadows and at Bringelly
- all operational systems and infrastructure such as crossovers, rail sidings, signalling, communications, overhead wiring, power supply, lighting, fencing, security and access tracks/paths
- retaining walls at required locations along the alignment
- environmental protection measures such as noise barriers (if required), on-site water detention, water quality treatment basins and other drainage works.

1.2.1 Off-airport project components

The off-airport components of the project would include the track alignment and associated operational systems and infrastructure north and south of Western Sydney International, four metro stations, the stabling and maintenance facility, two service facilities and a tunnel portal.

1.2.2 On-airport project components

The on-airport components of the project would include the track alignment and associated operational systems and infrastructure within Western Sydney International, two metro stations and a tunnel portal.

The key project features and the design development process are described in more detail in Chapter 7 (project description – operation) of the Environmental Impact Statement.

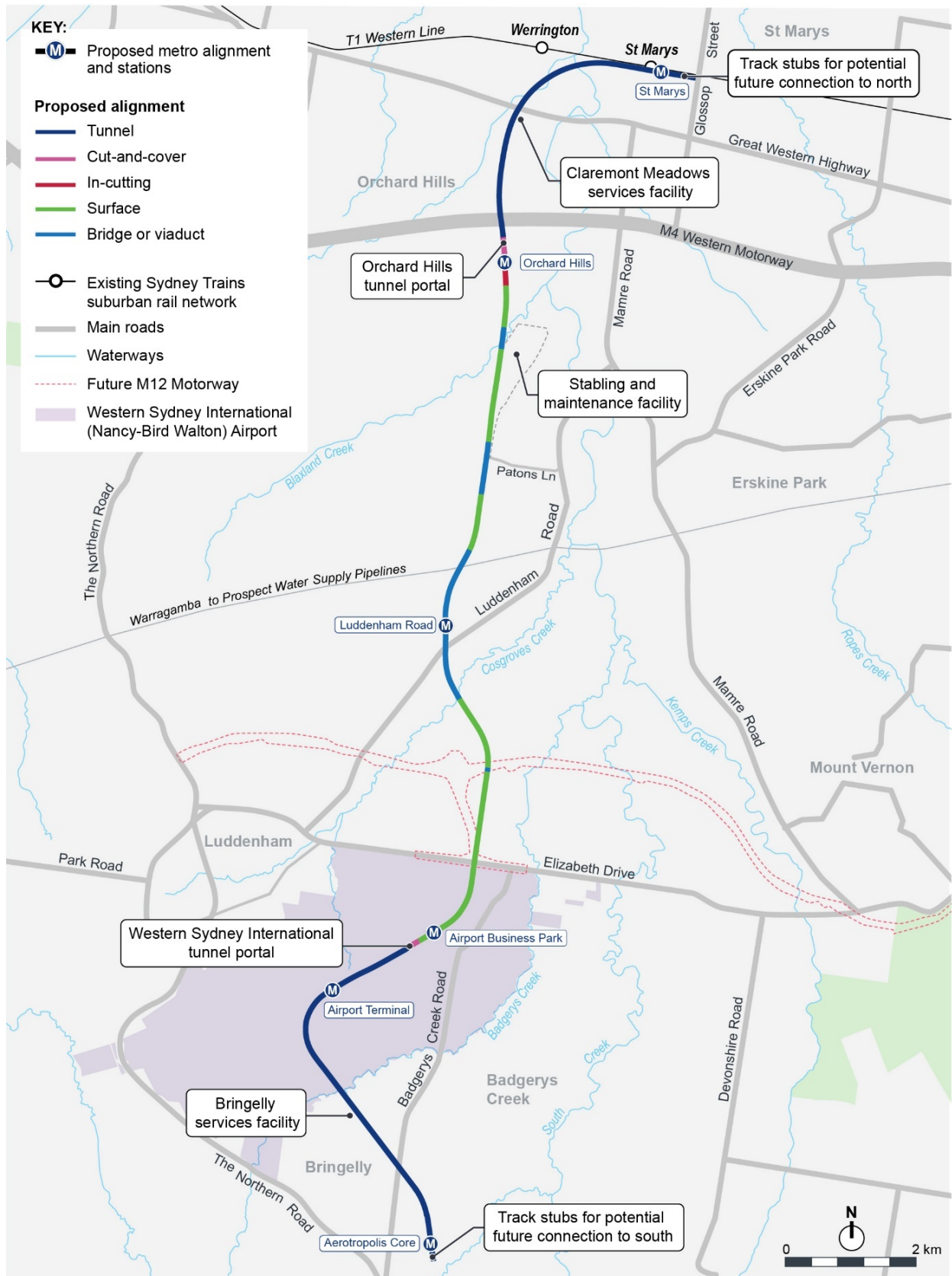


Figure 1-1 Project alignment and key features

1.3 Project construction

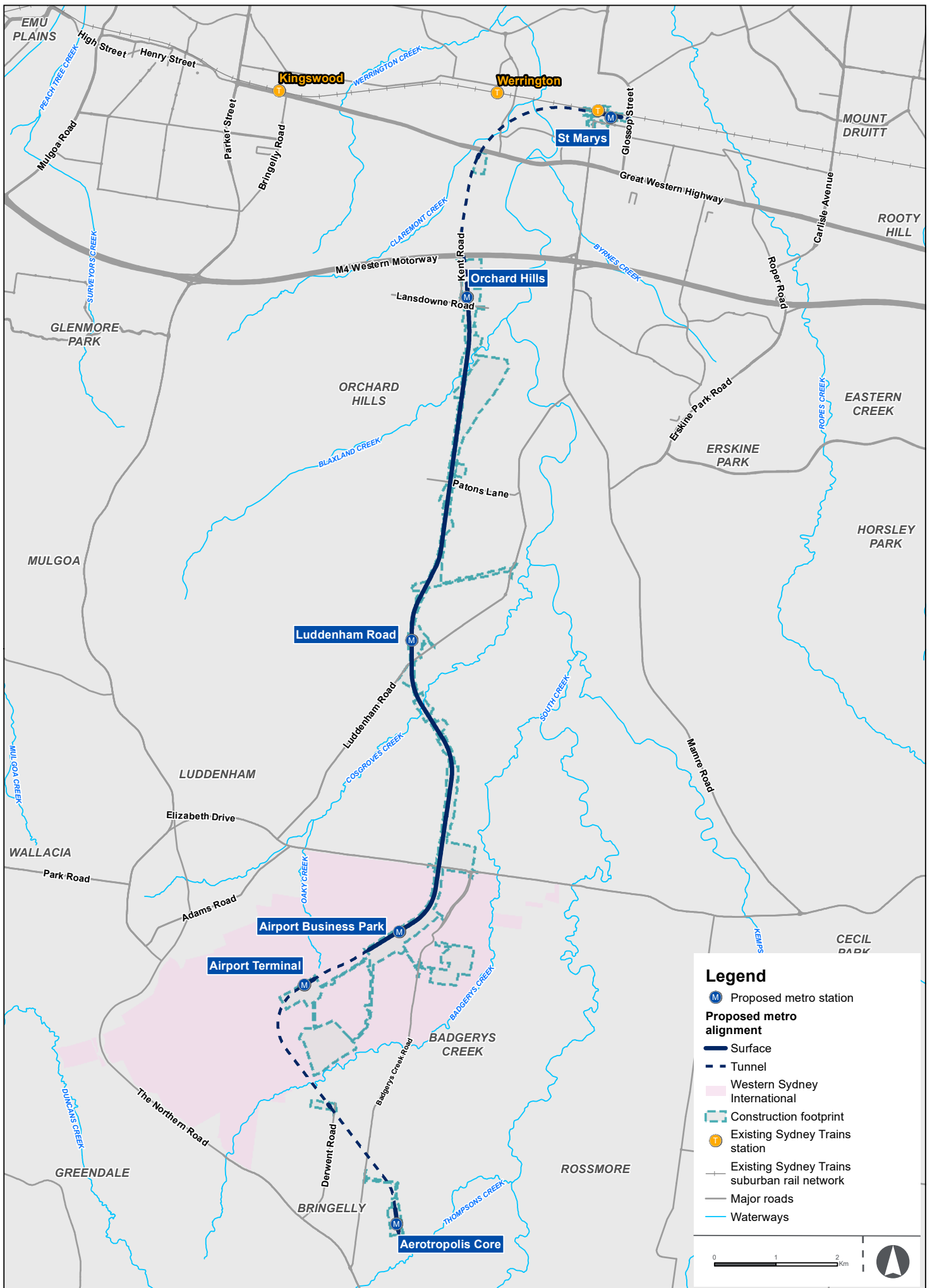
Construction of the project would involve:

- enabling works
- main construction works, including:
 - tunnelling and associated works
 - corridor and associated works
 - stations and associated works
 - ancillary facilities and associated works
 - construction of ancillary infrastructure including the stabling and maintenance facility
- rail systems fitout
- finishing works and testing and commissioning.

These activities are described in more detail in Chapter 8 (project description – construction) of the Environmental Impact Statement.

The construction footprint for the project is shown on Figure 1-2.

Main construction works for the project are expected to commence in 2021, subject to planning approval, and take around five years to complete. An overview of the construction program is provided in Chapter 8 (project description – construction) of the Environmental Impact Statement.



Construction footprint overview

Figure 1-2

1.4 Purpose of this technical paper

1.4.1 Assessment objectives

The purpose of this assessment is to identify known and potential Aboriginal heritage constraints within the study area and provide appropriate management advice. The overarching objectives of this Aboriginal Cultural Heritage Assessment Report (ACHAR) are as follows:

- to identify the Aboriginal cultural heritage values of the construction footprint by way of background research, archaeological field investigation and consultation with RAPs
- to assess the potential impact of the project on the identified Aboriginal cultural heritage values
- to provide an appropriate management strategy to avoid or minimise potential harm to any identified Aboriginal cultural heritage values.

1.4.2 Secretary's environmental assessment requirements

The Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Industry and Environment (DPIE) relating to Aboriginal heritage and where these requirements are addressed in this technical paper, are outlined respectively in Table 1-1. As of 1 July 2020 management of Aboriginal Cultural Heritage in NSW moved from DPIE to Heritage NSW in the Department of Premier and Cabinet (DPC).

The purpose of the SEARs in relation to Aboriginal heritage is to provide specific requirements by which the design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the cultural and environmental heritage and Aboriginal objects and places. It also provides recommendations so that, to the greatest extent possible, the long-term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places is achieved.

Table 1-1 Secretary's Environmental Assessment Requirements

SEARs requirement	Where addressed in this document
<p>Identify direct and/or indirect impacts (including cumulative impacts) to the heritage significance of:</p> <ul style="list-style-type: none"> (a) Aboriginal places, objects and cultural heritage values, as defined under the <i>National Parks and Wildlife Act 1974</i> and in accordance with the principles and methods of assessment identified in the current guidelines; (b) environmental heritage, as defined under the <i>Heritage Act 1977</i>; and (c) items listed on the State, National and World Heritage lists; (d) heritage items and conservation areas identified in environmental planning instruments applicable to the project area; (e) heritage items in Section 170 Heritage and Conservation Register; (f) potential heritage items and archaeological potential. <p>Where impacts to State or locally significant heritage items or historical archaeology are identified, the assessment must include:</p> <ul style="list-style-type: none"> (g) relevant commitments made in Section 8.5.3 of the Scoping Report; (h) consistency of the project against conservation policies of any relevant conservation management plan; (i) identification of archaeological potential and significance; and (j) be undertaken by a suitably qualified heritage consultant(s) and/or historical archaeologist (note: where archaeological 	<p>This technical paper provides details on known Aboriginal sites and areas of archaeological sensitivity to be avoided and/or mitigated. Findings of known sites are summarised in Section 5.4 and mitigation provided in Chapter 10.0.</p> <p>Historic heritage has been assessed in Technical paper 4 – Non-Aboriginal heritage</p>

SEARs requirement	Where addressed in this document
<p>excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria);</p> <p>(k) consideration of alternatives and options to avoid or minimise heritage impacts. The assessment must contain sufficient detail to enable an understanding of why the preferred alternative to and option(s) are recommended.</p> <p>Where impacts to Aboriginal places, objects and cultural heritage values are identified, the assessment must include the preparation of an Aboriginal Cultural Heritage Assessment Report (ACHAR) and relevant commitments in Section 8.6.3 of the Scoping Report.</p> <p>Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> (DECCW 2010).</p> <p>Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.</p>	<p>This report is the required ACHAR.</p> <p>Archaeological investigations were led by suitably qualified archaeologist Dr Darran Jordan, in accordance with the Code of Practice (see Section 1.6).</p> <p>Consultation is documented in Chapter 4.0.</p>

The Commonwealth Minister for the Environment has advised that the on-airport components of the project would be assessed based on the provision of preliminary documentation. Further information was requested to guide the assessment of the on-airport components of the project. This information is included in this report as well as in Appendix J of the Environmental Impact Statement.

1.4.3 Assessment guidelines

This assessment has been undertaken in accordance with and with reference to the following current Heritage NSW guideline documents:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011)
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b)
- NSW Skeletal Remains: Guidelines for Management of Human Remains (Heritage Office, 1998)
- Aboriginal site recording form
- Aboriginal site impact recording form
- Aboriginal Heritage Information Management System site registration form
- Care agreement application form
- Designing with Country (Government Architect New South Wales, 2020).

1.4.4 Structure of report

This report is structured under the following headings:

- 1.0 Introduction – provides an overview and background context on the project
- 2.0 Legislative and policy context – lists the heritage specific legislation that is of relevance to the assessment
- 3.0 Methodology – discusses the methodology adopted for this heritage assessment
- 4.0 Aboriginal community consultation – outlines the consultation undertaken to date with RAPs

- 5.0 Existing environment – provides a summary of the environment of the project based on background research
- 6.0 Archaeological field inspection – presents the findings of the limited targeted archaeological field inspections undertaken to date
- 7.0 Cultural heritage values and statement of significance – outlines the identified values and heritage significance of sites identified within the study area
- 8.0 Assessment of impacts – lists the areas of archaeological potential, and the potential impacts of the project on Aboriginal heritage
- 9.0 Cumulative impact assessment – outlines the cumulative impacts of the project with other projects on Aboriginal heritage
- 10.0 Management and mitigation measures – provides an overview of the management and mitigation approach for the project, outlines the performance outcomes for the project, and provides measures to manage existing sites and areas of potential, as well as mitigation measures for when site destruction cannot be avoided
- 11.0 References – provides a full list of the references used to inform this technical paper.

1.5 Study area and construction footprint

The size of the study area was defined by the AHIMS searches undertaken for this assessment. The three combined searches covered an approximate area of 58 kilometres by nine kilometres, centred on the construction footprint. References to the study area refer to this area covered by the AHIMS searches, which includes the construction footprint as well as the permanent power supply alignment that is proposed between the southern end of the stabling and maintenance facility construction area and an existing Endeavour Energy substation at Erskine Park (the Mamre Zone Substation) and the temporary power supply alignments that are proposed from Claremont Meadows and Kemps Creek.

While the primary impacts of this project would be direct impacts to known sites and areas of archaeological sensitivity within the bounds of the construction footprint, the larger study area provides context for those sites and areas in the surrounding region. It also allows for considerations of the project within a broader landscape. The risk for accidental and indirect impacts to sites outside the bounds of, but in close proximity to, the construction footprint have been considered as part of this assessment for sites within 200 metre of the construction footprint. The reason for a 200 metre buffer is that the most common form of coordinate inaccuracy in the AHIMS register is due to the incorrect datum being applied to a site coordinate, which results in a variance of approximately 200 metres. Including a buffer of this size will capture any sites with such coordinate errors, as well as sites whose registered centroids are outside the construction footprint, but are large enough to extend across the boundary. The potential for indirect impacts to occur, such as visual and related to vibration/settlement, have also been considered. The primary risk with regard to indirect impacts is that any subsidence in areas above tunnelling activity could impact upon either known sites or areas of archaeological sensitivity.

The construction footprint is defined by the boundary shown on Figure 1-2.

The construction footprint crosses through multiple land holdings within the Penrith and Liverpool Local Government Areas (LGAs), including existing road reserves and various parcels of private land. It also passes through three areas of Commonwealth land, being Defence Establishment Orchard Hills (DEOH), the Royal Australian Air Force Telecommunications Unit at Bringelly and Western Sydney International.

For ease of reference in this assessment, the off-airport area has been divided up into the following construction areas:

- St Marys
- Claremont Meadows services facility
- Orchard Hills
- Stabling and maintenance facility

- Off-airport construction corridor
- Luddenham Road
- Bringelly services facility
- Aerotropolis core.

For ease of reference in this assessment, the on-airport area has been divided up into the following construction areas:

On-airport (within the Stage 1 construction impact zone)

- On-airport construction corridor
- Airport Business Park
- Western Sydney International tunnel portal
- Airport terminal
- Airport construction support site.

On-airport (outside the Stage 1 construction impact zone)

- Airport construction support site.

1.6 Project team

The primary author of this report is Dr Darran Jordan (Principal Archaeologist), who has a PhD in archaeology from the University of Sydney and has been working as a heritage specialist for over 14 years. Report inputs and fieldwork activity were also undertaken by Dr Andrew McLaren (Principal Archaeologist), who has a doctorate in archaeology from Cambridge University and has been working as a heritage specialist for over 11 years, and Julia Atkinson (Graduate Archaeologist) who has a degree in Museum Studies from Macquarie University and has worked as a heritage specialist for over two years. The report was reviewed by Dr Andrew McLaren.

2.0 Legislative and policy context

This section describes the legislative and policy context specific to this assessment. The wider legislative and policy context for the project is provided in Chapter 4 (Planning and assessment process) of the Environmental Impact Statement.

2.1 Off-airport legislative and policy context

2.1.1 Commonwealth legislation and policy

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) took effect on 16 July 2000. Under Part 9 of the EPBC Act, any action that is likely to have a significant impact on a matter of national environmental significance may only progress with approval of the Commonwealth Minister for the Environment. An action is defined as a project, development, undertaking, activity, series of activities, or alteration. An action will also require approval if:

- It is undertaken on Commonwealth land and will have or is likely to have a significant impact
- It is undertaken outside Commonwealth land and will have or is likely to have a significant impact on the environment on Commonwealth land
- It is undertaken by the Commonwealth and will have or is likely to have a significant impact.

The EPBC Act defines 'environment' as incorporating both natural and cultural environments and therefore includes Aboriginal heritage items. Under the EPBC Act, protected heritage items are listed on the National Heritage List (NHL) (items of significance to the nation) or the Commonwealth Heritage List (CHL) (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE). Statutory references to the RNE in the EPBC Act were removed on 19 February 2012. However, the RNE remains an archive of over 13,000 heritage places throughout Australia.

The EPBC Act requires that listed items on the CHL be managed by a specific Heritage Management Plan (HMP). Parts of the off-airport construction footprint cross through Commonwealth land, including DEOH, and the Royal Australian Air Force Telecommunications Unit, Bringelly. DEOH is managed through the *Defence Establishment Orchard Hills Heritage Management Plan* (HMP) (GML Heritage Pty Ltd, 2013). The Royal Australian Air Force Telecommunications Unit, Bringelly is managed by a Conservation Management Plan (CMP) (Godden Mackay Logan Pty Ltd, 1995).

On 14 July 2020 it was decided that the proposed action is a controlled action and the project will require assessment and approval under the EPBC Act before it can proceed. This decision was made under section 75 and section 87 of the EPBC Act.

The relevant EPBC Act consultation guidelines Ask First (Australian Heritage Commission, 2002) and Engage Early (Australian Government (Department of the Environment), 2016) have both been referred to and utilised during consultation for this assessment. The consultation process undertaken to date is summarised in Chapter 4.0.

Orchard Hills Defence Area, NSW: Heritage Management Plan

A portion of the construction footprint falls within the bounds of DEOH, being Commonwealth land. The *Defence Establishment Orchard Hills HMP* (GML Heritage Pty Ltd, 2013) sets out procedures to follow to ensure that ongoing operational, maintenance and development activities at DEOH proceed in compliance with the EPBC Act, with a responsibility to conserve and manage the identified Commonwealth heritage values of the site. The HMP:

“identifies and assesses the natural, Indigenous and historic Commonwealth Heritage values of the place as a whole;

“updates previous heritage management plans for DEOH, by including results of a new survey of Indigenous heritage and natural heritage values, a revision of previously identified historic heritage values, including historical archaeology;

“provides a revised Summary Statement of Significance for the DEOH that incorporates natural, Indigenous and historic heritage values;

“identifies the attributes and components of DEOH that are intrinsic to its Commonwealth Heritage values;

“provides a ranking of heritage significance and assesses the heritage sites in regard to their sensitivity or ‘tolerance for change’ to help guide future management of the DEOH;

“provides an assessment of the constraints, risks and opportunities arising from the heritage values;

“explains the heritage management objectives and guidelines for the conservation and monitoring of the Commonwealth Heritage values at DEOH; and

“provides an Interpretation Strategy to support the transmittal of the Commonwealth Heritage values of DEOH” (GML Heritage Pty Ltd, 2013).

The DEOH is subject to the provisions of the EPBC Act, which require that places with Commonwealth Heritage values be managed according to the policies of a management plan prepared specifically for that place. These requirements are set out in Schedule 7A of the *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations) and are met by the HMP.

Conservation Management Plan for Bringelly Radio Receiving Station Complex, Telstra Corporation, Mobile Satellite and Radio Services, Badgerys Creek Road, Bringelly NSW

A portion of the construction footprint falls within the bounds of the former Royal Australian Air Force Telecommunications Unit at Bringelly, being Commonwealth land. The Royal Australian Air Force Telecommunications Unit at Bringelly is managed by a CMP authored by GML in 1995. The CMP covers management of historical values associated with the post-WWII Bringelly Radio Receiving Station Complex and associated staff housing and water tank structures (Godden Mackay Logan Pty Ltd, 1995). These are discussed in detail in Technical paper 4 – Non-Aboriginal heritage, which notes that the water tank and receiving station were both demolished in 2008, the staff housing was demolished between 1996 and 2002, with the semi-circular driveway that the staff housing was concentrated around still present with remnant drainage culverts.

Aboriginal heritage is not specifically covered by this CMP, which focusses on the historical heritage components of the complex.

As it is on Commonwealth land, the former Royal Australian Air Force Telecommunications Unit at Bringelly is subject to the provisions of the EPBC Act, which requires that places with Commonwealth Heritage values be managed by the policies of a management plan prepared specifically for that place. These requirements are set out in Schedule 7A of the EPBC Regulations and are met by the CMP. The relevant EPBC Act consultation guidelines Ask First (Australian Heritage Commission, 2002) and Engage Early (Australian Government (Department of the Environment), 2016) have both been referred to and utilised during consultation for this assessment. The consultation process undertaken to date is summarised in Chapter 4.0.

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (the ATSIHP Act) provides for the preservation and protection of places, areas and objects of particular significance to Aboriginal Australians. The stated purpose of the ATSIHP Act is the *“preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition”* (Part I, Section 4).

Under the Act, ‘Aboriginal tradition’ is defined as *“the body of traditions, observances, customs and beliefs of Aboriginals generally or of a particular community or group of Aboriginals, and includes any such traditions, observances, customs or beliefs relating to particular persons, areas, objects or relationships”* (Part I, Section 3). A ‘significant Aboriginal area’ is an area of land or water in Australia that is of *“particular significance to Aboriginals in accordance with Aboriginal tradition”* (Part I, Section 3). A ‘significant Aboriginal object’, on the other hand, refers to an object (including Aboriginal remains) of like significance.

For the purposes of the ATSIHP Act, an area or object is considered to have been injured or desecrated if:

- a. In the case of an area:
 - i. it is used or treated in a manner inconsistent with Aboriginal tradition
 - ii. the use or significance of the area in accordance with Aboriginal tradition is adversely affected
 - iii. passage through, or over, or entry upon, the area by any person occurs in a manner inconsistent with Aboriginal tradition
- b. in the case of an object:
 - i. it is used or treated in a manner inconsistent with Aboriginal tradition.

The ATSIHP Act can override State and Territory laws in situations where a State or Territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an area or object. However, the Minister can only make a decision after receiving a legally valid application under the ATSIHP Act and, in the case of long-term protection, after considering a report on the matter. Before making a declaration to protect an area or object in a State or Territory, the Commonwealth Minister must consult the appropriate minister of that State or Territory (Part 2, Section 13).

Native Title Act 1993

The *Native Title Act 1993* (NTA) provides for the recognition and protection of native title for Aboriginal peoples and Torres Strait Islanders. The NTA recognises native title for land over which native title has not been extinguished and where persons able to establish native title are able to prove continuous use, occupation or other classes of behaviour and actions consistent with a traditional cultural possession of those lands. It also makes provision for Indigenous Land Use Agreements (ILUA) to be formed as well as a framework for notification of Native Title Stakeholders for certain future acts on land where Native Title has not been extinguished.

Searches of the *National Native Title Register*, *Register of Native Title Claims* and *Register of Indigenous Land Use Agreements* were undertaken in May 2020 for the Penrith and Liverpool LGAs. These searches returned no relevant native title claims, determinations or land use agreements.

2.1.2 State legislation and policy

National Parks and Wildlife Act 1974

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

- an *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to 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.

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. Consultation with Aboriginal communities is required when an application for an AHIP is considered and is an integral part of the process. AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons. Section 89A of the NPW Act requires notification of the location of Aboriginal sites within a reasonable time, with penalties for non-notification.

A Critical State Significant Infrastructure (CSSI) declaration had been sought for the project. Investigation works such as field survey, test excavation works and preparation of an Aboriginal Archaeological Report (AAR), may be undertaken prior to determination of the CSSI application. However, in such instances, these works must be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*. Approved CSSI projects are exempt from the need to obtain an AHIP under Section 90 of the NPW Act. Instead, Aboriginal heritage associated with the project can be managed in accordance with an Aboriginal Cultural Heritage Management Plan (ACHMP) which is normally required as a condition of approval. The proposed approach for the project is shown in the process flowchart on Figure 3-1. ACHMPs are intended to capture management actions including conservation, protection and mitigation, and to authorise harm where appropriate. If any impacts are proposed to Aboriginal sites prior to the CSSI application and approval of an ACHMP, those impacts can only occur under an AHIP. Therefore, avoidance and protection are required or an AHIP must be granted prior to any impacts occurring to a registered AHIMS site until the CSSI application is approved. If needed, permission should be sought from AHIP holders for existing areas covered by previously granted AHIPs.

Environmental Planning and Assessment Act 1979

Division 5.2, Section 5.12 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) stipulates that a development may be declared State Significant Infrastructure (SSI) if it is declared to be such by a State environmental planning policy such as *State Environmental Planning Policy (State and Regional Development) 2011* (SEPP SRD).

Under Clause 14(1) of SEPP SRD, a development is declared to be State Significant Infrastructure if:

- a. the development on the land concerned is, by the operation of a State environmental planning policy, permissible without development consent under Part 4 of the Act
- b. the development is specified in Schedule 3 of the SEPP SRD.

Pursuant to Division 5.2, Subdivision 4, Section 5.23(1)(d) of the EP&A Act, AHIPs are not required for a SSI authorised by a development consent. Similarly, under Section 5.23(1)(c) an approval under Part 4 or an excavation permit under Section 139 of the *Heritage Act 1977* are not required. Section 5.23(2) also states that Division 8 of Part 6 of the *Heritage Act* cannot be invoked to prevent or interfere with an authorised SSI.

Impacts to Aboriginal and historical heritage values associated with approved SSI projects are typically managed under ACHMPs and Historical Heritage Management Plans (HHMPs) respectively. Such management plans are statutorily binding once approved.

The EP&A Act also allows for the preparation of planning instruments to direct development within NSW. This includes Local Environmental Plans (LEP), which are administered by local government, and principally determine land use and the process for development applications. LEPs usually include clauses requiring that heritage be considered during development applications and a schedule of identified heritage items be provided.

Any works undertaken prior to CSSI declaration for this project need to be undertaken under the NPW Act with reference to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*.

Penrith Local Environmental Plan (LEP) 2010 and Liverpool LEP 2008

The project is located within the Penrith LGA and Liverpool LGA. The relevant Environmental Planning Instruments (EPIs) are the Penrith LEP 2010 and the Liverpool LEP 2008. Part 5.10 of each of these LEPs provides specific provisions for the protection of heritage items and relics within the relevant LGA.

Schedule 5 of these LEPs provides a list of heritage items within the relevant LGA. No Aboriginal sites are listed within the study area on Schedule 5 of the LEPs. It should be noted that approved CSSI and SSI projects are exempt from the provisions of LEPs.

2.2 On-airport legislative and policy context

2.2.1 Commonwealth legislation and policy

Airports Act 1996

The *Airports Act 1996* (Airports Act) sets out the framework for the regulation and management of activities within the bounds of the airport site that have the potential to cause environmental harm (including harm to heritage). The Airports Act and regulations covers offences related to environmental harm, environmental management standards, monitoring and the requirement to respond to incidents such as unexpected finds. The Airports Act contains a planning framework under which each airport is required to prepare a master plan for approval by the Commonwealth Infrastructure Minister. For Western Sydney International, a transitional planning instrument, the Airport Plan for Western Sydney (the Airport Plan) has been determined under the Airports Act to guide development on the site. A variation to the Airport Plan will be sought for this project.

The Airport Plan includes conditions for the preparation and approval of a Construction Plan and a number of Construction Environmental Management Plans (CEMPs) prior to commencement of main construction works. Initial versions of those plans have been prepared and approved and main construction work on the airport commenced in September 2018. Specific measures to prevent, control or reduce the environmental impact associated with the airport, including impacts on Aboriginal heritage values, are included within these CEMPs.

Airports (Environment Protection) Regulations 1997

The *Airports (Environment Protection) Regulations 1997* (AEPRs) regulations cover an airport's responsibility to take all reasonable and practicable steps to ensure sites of Indigenous significance located within the bounds of the airport site are not harmed. They also state that the airport has a duty to give notice of unexpected Aboriginal heritage finds.

Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan

A portion of the construction footprint falls within the bounds of Western Sydney International, which is currently being developed. The Aboriginal cultural heritage values of Western Sydney International Airport are managed by a CEMP. The CEMP, authored by Western Sydney Airport in 2019, was produced to "satisfy the requirements of the Aboriginal Cultural Heritage CEMP set out in the Conditions for the Stage 1 Development of Western Sydney International Airport detailed in Section 3.10.2 of the Airport Plan determined in December 2016 (the Airport Plan). Specifically, Section 3.10.2 Condition 11 (1) of the Airport Plan requires that an Aboriginal Cultural Heritage CEMP be approved under the Airport Plan prior to the commencement of Main Construction Works" (Western Sydney Airport, 2019).

The Aboriginal Cultural Heritage CEMP states that a possible culturally modified tree (45-5-2630 - B40) and a grinding groove site (45-5-5057 - B120) will both be conserved within an Environmental Conservation Zone and note that both have already been fenced for their protection. Both of these sites are outside the bounds of the construction footprint of the project. Surface and subsurface salvage was also proposed in the CEMP for surface artefact sites. Sites located within the portion of the construction footprint that intersects with the Western Sydney International Stage 1 construction impact zone consist of 45-5-2665 (B88 - artefact scatter), 45-5-5068 (B131 - isolated artefact), 45-5-5089 (B163 - artefact scatter) and 45-5-5100 (B147 - artefact scatter). Sites located within the portion

of the construction footprint that intersects with the Western Sydney International on-airport, outside of Stage 1 construction impact zone consist of 45-5-2637 and 45-5-5078.

The existing Aboriginal Cultural Heritage CEMP for Western Sydney International contains protocols for the removal and protection of all known sites within Western Sydney International. Sydney Metro would prepare CEMPs for the on-airport rail works, consistent with the existing CEMPs for Western Sydney International, for approval by the Commonwealth. This would include the related methodologies for collection and salvage of sites that remain within the construction footprint where required, unexpected finds, as well as outlining nominated sites for protection. The CEMPs would also align with the Survey and Salvage Plan for Western Sydney International.

Should any unexpected Aboriginal archaeological finds occur during construction, as per section 8.3 of the Western Sydney International Aboriginal Cultural Heritage CEMP, Sydney Metro must stop work in the immediate area, and the Western Sydney International Environment Manager be notified, as well as the Airport Environment Officer and Infrastructure Department. The procedures outlined in the Western Sydney International CEMP following notification must then be followed as appropriate to the nature of the find. This required would be included in the CEMPs for the on-airport rail works.

3.0 Methodology

3.1 Overview

This assessment has been undertaken in accordance with the Heritage NSW documents *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b). As such, key requirements are:

- to conduct a search of the AHIMS database
- to review the landscape context of the project, with specific consideration to its implications for past Aboriginal land use (and by extension, its Aboriginal archaeological record)
- to review relevant archaeological and ethnohistoric information for the study area and its environs
- to prepare a predictive model for the Aboriginal archaeological record of the study area
- to undertake an archaeological field investigation
- to identify, notify and register Aboriginal people who hold cultural knowledge relevant to determining the cultural significance of Aboriginal objects and/or places in the construction footprint and surrounding area
- to provide RAPs with information about the scope of the project and Aboriginal heritage assessment process
- to facilitate a process whereby RAPs can:
 - contribute culturally appropriate information to the assessment methodology
 - provide information that will enable the cultural significance of Aboriginal objects and/or places within the construction footprint to be determined
 - have input into the development of cultural heritage management options
- to prepare and finalise an ACHAR with input from RAPs.

Figure 3-1 provides a flowchart showing the Aboriginal archaeological process and how it relates to the Environmental Impact Statement process. Further detail on the methodologies for each of the components are included in this section.

In addition to the Aboriginal archaeological process there will be additional works and consultation with RAPs and other Aboriginal stakeholders for the cultural design principles and interpretation aspects of the project. These activities will be undertaken concurrently to feed into the design development process and will be informed by the outcomes of the Aboriginal archaeological process. The cultural design principles and interpretation activities may include:

- line-wide and station heritage interpretation
- Aboriginal participation in designed elements including stations, landscape and public spaces
- Aboriginal participation in Focus Group and other participatory processes
- Aboriginal participation in Sydney Metro Public Art process.

Outcomes may include the design of station elements including Aboriginal heritage interpretation aspects, which are to be arrived at in consultation with Aboriginal knowledge holders and other Aboriginal stakeholders.

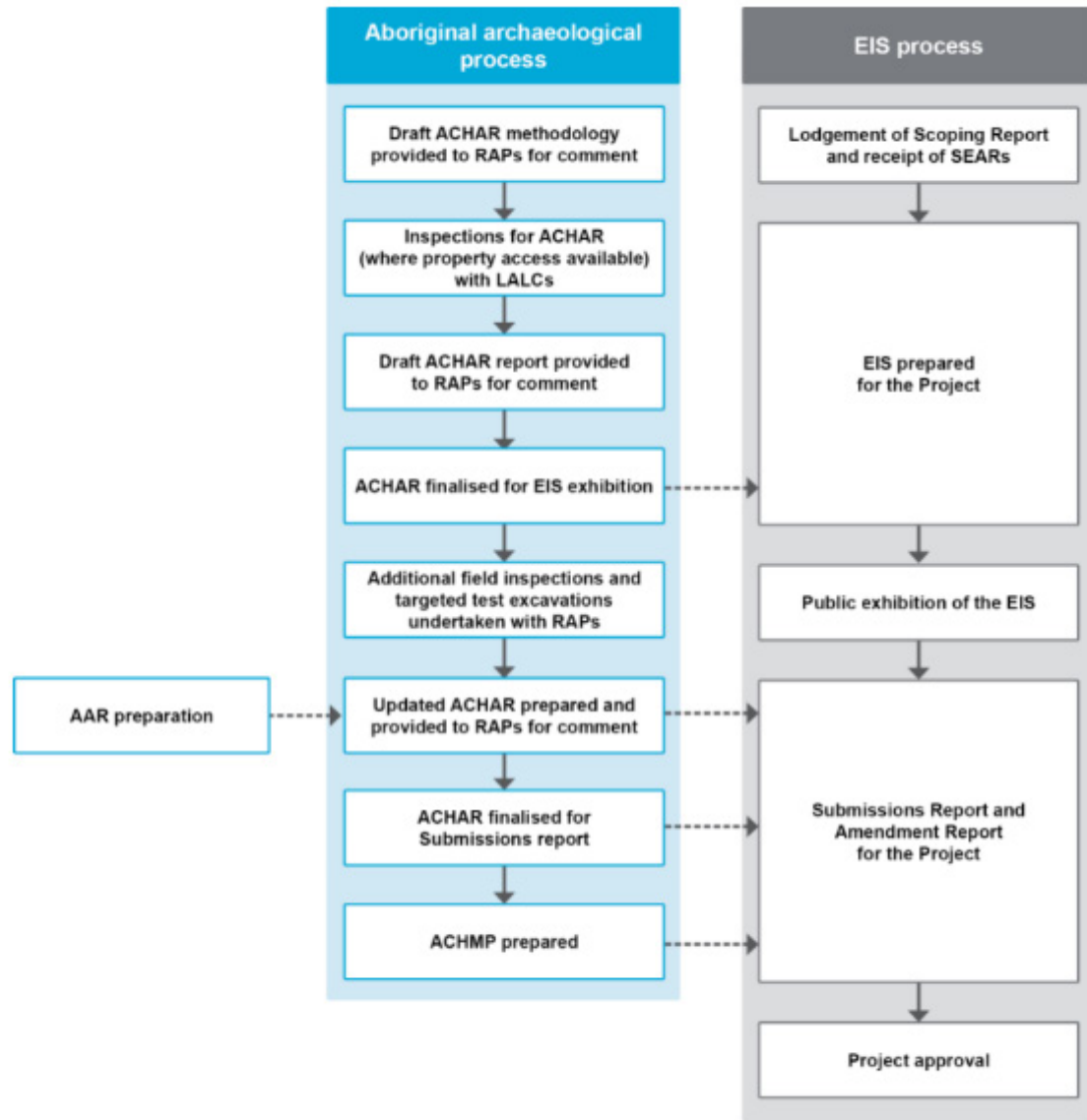


Figure 3-1 Aboriginal archaeological assessment, reporting and management process flowchart

3.2 Aboriginal Cultural Heritage Assessment Report

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* states:

“An Aboriginal cultural heritage assessment report is a written report detailing the results of the assessment and recommendations for actions to be taken before, during and after an activity to manage and protect Aboriginal objects and declared Aboriginal places identified by the investigation and assessment...”

“An Aboriginal cultural heritage assessment report must contain:

- a description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed activity
- a description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the

proposed activity and the significance of these values for the Aboriginal people who have a cultural association with the land

- how the requirements for consultation with Aboriginal people have been met (as specified in clause 80C of the NPW Regulation)
- the views of those Aboriginal people regarding the likely impact of the proposed activity on their cultural heritage (if any submissions have been received as a part of the consultation requirements, the report must include a copy of each submission and your response)
- actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified
- any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places and
- any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm” (NSW Office of Environment & Heritage, 2011:iii & 15).

This technical report includes all of these requirements.

3.3 Background research

The following tasks were undertaken for the background research component of the assessment:

- searches of the AHIMS database
- a review of associated site cards and reports to clarify site contents, extents and statuses
- a review of the landscape context of the study area, with a particular emphasis on its implications for the nature and distribution of Aboriginal archaeological materials
- a review of relevant archaeological and ethnohistoric information for the study area and environs
- preparation of a predictive model for the Aboriginal archaeological record of the study area.

3.4 Archaeological field inspection

3.4.1 Aims and objectives

The overarching aims of the archaeological field investigation were to identify and record any existing surface evidence of past Aboriginal occupation within the construction footprint. As part of the process the following were key considerations:

- to ground truth all AHIMS registered Aboriginal sites within and immediately adjacent to the construction footprint
- to sample all accessible landform elements within the construction footprint
- to identify areas that, irrespective of the presence or absence of surface artefacts, are likely to contain artefact bearing subsurface deposits (i.e., areas of Potential Archaeological Deposit (PAD))
- to provide data that will assist with the development of an appropriate management strategy for the known and potential Aboriginal archaeological values of the study area. This data will include comparing maximum settlement estimates (as presented in the Environmental Impact Statement (Chapter 15)) in relation to recorded sites identified in surface contexts above the tunnelling alignment, as well as areas of archaeological potential along its extent, to guide the archaeological program in relation to impact risks from vibration and subsidence.

3.4.2 Archaeological field inspection strategy

Consideration was given to the following factors when developing the archaeological field inspection strategy:

- property access and COVID-19 restrictions, with numerous land parcels unavailable for access
- the presence of areas of severely disturbed terrain within the study area, all of which were assessed pre-inspection as having negligible potential for the presence of Aboriginal archaeological materials
- generally poor ground surface visibility conditions due to vegetation cover
- a desire to sample all accessible landform elements within the construction footprint.

Ultimately, in consideration of the above, it was decided that all accessible and non-severely disturbed portions of the construction footprint would be comprehensively sampled, with a particular focus on areas of enhanced archaeological visibility.

3.4.3 Field team and methods

The archaeological field inspection was undertaken over non-consecutive days, on Thursday 27 February, Wednesday 4 March, Tuesday 28 April and Friday 12 June 2020. The field team for the inspections consisted of archaeologists Dr Darran Jordan and Dr Andrew McLaren and RAP representatives Darren Duncan (Gandangara Local Aboriginal Land Council (LALC)) and Steve Randall (Deerubbin LALC).

Access was only available to some sections of the construction footprint at this stage of the project.

The strategy of the inspections was to space participants at regular intervals across the construction footprint and to walk transects across the area. All field inspections were conducted on foot. As per the field inspection strategy, all accessible and non-severely disturbed portions of the construction footprint were sampled, with particular attention paid to ground surfaces with higher visibility. All mature trees encountered during the inspection were inspected for cultural scarring. Outcropping sandstone bedrock exposures, where intercepted, were inspected for grinding grooves. The location of each transect completed during the inspection, including start and end points, was recorded using a handheld differential GPS unit, with associated transect data (e.g. levels of visibility and exposure) entered directly into the same unit upon the completion of each transect.

When any Aboriginal archaeological sites were identified they were recorded to the standard required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*. All sites were comprehensively photographed following artefact recording.

3.5 Social/cultural values assessment for the ACHAR

Aboriginal community consultation for the assessment was undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a). RAP representatives are in the best position to provide information on the Aboriginal social/cultural heritage values of the study area. During the assessment process, consultation with RAPs regarding the cultural heritage values of the study area was carried out. This included:

- a request for any comments regarding the Aboriginal cultural heritage values of the study area
- discussion of cultural heritage values during fieldwork
- provision of a draft ACHAR to all RAPs for their review and comment.

The following sections provide detail on further work that will be undertaken, if required, following the recommendations of the ACHAR. Further explanation on how cultural heritage values have been considered are included in Section 3.10.

3.6 Direct and indirect impact assessment for the ACHAR

This assessment considers both direct impacts and indirect impacts. Direct impacts are defined as impacts that would have a physical impact on the site, resulting in damage, which could be either partial or total destruction. Direct impacts have been considered both in relation to known and potential Aboriginal archaeological sites and features.

Indirect impacts are those that do not directly impact on the physical site itself but do have an impact on its cultural heritage significance. Indirect impacts for this assessment are likely to be caused by factors such as subsidence and vibration as a result of tunnelling. Surface areas above where tunnelling would occur have been subject to a separate assessment on the likelihood of subsidence occurring and known sites have been mapped in relation to these areas. Potential indirect impacts have also been considered for sites within a 200 metre buffer area outside the construction footprint.

3.7 Post-ACHAR - survey and targeted test excavation

Further work will be required following the submission of this ACHAR. Due to access limitations some of the construction footprint as well as above ground areas over tunnels and temporary/permanent power supply routes have not yet been subject to field investigations. An archaeological survey would be undertaken of these areas, targeting areas of high sensitivity proposed for direct impacts or at risk from indirect impacts. Survey would be undertaken by a combined field team of archaeologists and an appropriate number of RAP field representatives.

A program of archaeological test excavation will be required to determine the presence or absence of subsurface archaeological deposits in areas of archaeological sensitivity at risk of direct impacts. If test excavation is required, it would be undertaken by a combined field team of archaeologists and an appropriate number of rostered RAP field representatives.

Archaeological subsurface investigations for the project will be undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects*. Where subsurface investigations are required, test pits will be excavated to culturally sterile horizons. Excavated sediment will be either wet or dry-sieved (depending on conditions) through either 3 millimetres or 5 millimetres wire-mesh sieves. Any Aboriginal objects recovered during sieving will be collected and recorded by square and spit. Representative profiles in each excavation unit will be drawn and photographed. Test pit stratigraphy will be recorded on pro forma test pit recording sheets using standard sedimentological terms and criteria (after McDonald & Isbell, 2009). All test pits will be backfilled after excavation, with wet sieved test pits to be filled with clean-fill and the wet-sieved spoil to be contained by sediment fencing and/or bunds.

All flaked stone artefacts recovered during subsurface test investigations will be subject to macroscopic attribute analysis in an off-site location, with the number of attributes recorded per specimen differing by technological type. It is proposed that the management of any artefact assemblage collected during the archaeological program be decided upon in consultation with and be endorsed by the RAPs. If the stone artefacts recovered during test excavation are reburied within the study area in a non-impact area, that reburial will be undertaken in accordance with Requirement 26 of the *Code of Practice*. Other options for artefact management may include a designated Keeping Place or inclusion in an interpretative display or displays.

3.8 Aboriginal Archaeological Report

As per the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) an Aboriginal Archaeological Report (AAR) will be produced to report the findings of the fieldwork program upon its completion. The AAR is to include the archaeological findings of the survey and test excavation.

3.9 Updated ACHAR

An updated ACHAR will be produced for the project following the completion of the additional fieldwork. The updated ACHAR will include the cultural heritage findings of the survey, test excavation and RAP consultation. These additional works will be required due to the limited property access at the time of the preparation of this ACHAR.

The updated ACHAR will assess the importance of Aboriginal cultural heritage values within the study area. In addition, the report will assess the potential impact of the project on identified Aboriginal cultural heritage values and provide appropriate mitigation and management strategies to avoid or minimise potential harm to such values. The report will be prepared in accordance with the following statutory guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).

As with the ACHAR for the Environmental Impact Statement, the updated ACHAR will be provided to RAPs for comment and feedback prior to its finalisation for the Submissions Report. Should salvage be required it will be noted in the updated ACHAR and outlined in the ACHMP.

3.10 Social/cultural values assessment for the updated ACHAR

Ongoing Aboriginal community consultation for the assessment will be undertaken in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a). This will continue through the period of additional work, with all RAPs to be provided with a copy of the drafts of the AAR and updated ACHAR for review and comment prior to their finalisation. Any comments made within the submission period prior to finalisation of the report will be incorporated.

For the purposes of the assessments undertaken for this project, Aboriginal cultural values have been defined as values of significance to Aboriginal people resulting from traditions, observances, lore, customs, beliefs and history. These values, which can comprise physical (tangible) or non-physical (intangible) elements, are evidence of the legacy of Aboriginal people stretching from the ancestors of the past right through to present day.

Cultural values may be attached to physical makers in the landscape, such as objects used for practical purpose or ceremony, such as stone tools, art sites, ceremonial areas or burial grounds. As Aboriginal history stretches through to the present day these values can also be attached to historical or even contemporary structures, such as mission buildings, houses, community areas and cemeteries. All of these varied elements combine to form part of the broader cultural landscape (Department of Environment, 2010).

Aboriginal cultural values are critical to the connection and sense of belonging that Aboriginal people have with the landscape and each other. These values are not only confined to physical sites but also include memories, stories, ceremonies, language, 'ways of doing things', passing on knowledge and looking after cultural traditions and places. It is in this way that Aboriginal cultural values provide continuity and context, forging a tangible link between the past and the present. Community and individual identity, connection and a sense of belonging to Country are all essential parts of Aboriginal cultural values. For this reason, features should not be assessed in isolation but rather understanding should be sought into how they contribute to the wider landscape, seeking an understanding of connections holistically (Department of Environment, 2010).

An Aboriginal cultural landscape is generally defined in heritage documentation as: "a place or area valued by an Aboriginal group (or groups) as a result of their long and complex relationship with that land. It can embody their traditional knowledge of spirits, places, land uses, and ecology. Material remains of the association may be prominent, but will often be minimal or absent" (Bugghey, 1999). The purpose of consultation on this project is to seek an understanding of the connectivity between all parts of a linked cultural landscape through consultation with Aboriginal people. The point of this is to contextualise the present landscape as the product of long-term and complex relationships between people and the environment (DECCW 2010). Sydney Metro's approach will also be informed by the Designing with Country discussion paper, which proposes a set of cultural design principles to develop a stronger presence for Aboriginal culture in the NSW planning system. This requires the development of a broader cultural design framework to support better strategic planning and place-making, recognising that "for tens of thousands of years" Aboriginal people "have managed, cultivated and cared for the landscape where our towns and cities were established and continue to grow" (Government Architect New South Wales, 2020).

Through this process there will be opportunities for collaborative approaches and to incorporate information about the cultural and community values into the design and interpretation of the design of the project. RAP identified areas of cultural importance in the landscape, such as creeks and landforms, may be managed as cultural values that are separate from the archaeological values of discrete sites scattered throughout the landscape (i.e., cultural values are not necessarily tied to discrete pockets of Aboriginal artefacts and instead represent formed attachments to larger landscape features). Contemporary community values and attachments which form part of the cultural values of the place will therefore be sought and recorded through the consultation process and used to inform the project as it develops.

Whereas scientific significance is determined by a hierarchy of values, cultural significance resists definition in this way. Assessing the cultural significance of a place or object requires defining the reason why a place is culturally important, but cultural values are often intentionally excluded from a sliding scale to characterise sites. One common response to requests to define cultural significance is to state that all Aboriginal sites have high cultural significance, as each artefact, place or structure, from a single flake to a stone arrangement to a mission building, provides a tangible link to the ancestors of the past, just as it connects the community of the present. The process of understanding which places are culturally significant and why, can therefore be an emotional experience. The importance of RAPs sharing the reasons for a place's importance where this is culturally appropriate so that values can be appropriately managed and protected, so that changes in the landscape as a part of the project do not damage, diminish or remove the reasons for a place's cultural importance.

Only Aboriginal people are able to define, describe and determine cultural values. The purpose of the ongoing consultation throughout this project is to capture any relevant cultural information that can be shared. Some types of information that will continue to be sought through consultation as the project progresses are:

- knowledge of the plants and animals that have contributed to the continuing existence of Aboriginal peoples in the region over many thousands of years, and how they are valued in today's community
- known sites within the landscape and how these material remains connect to people and other places in the landscape through tradition and story
- following reference to historical records with observations on Aboriginal people, lifestyles, wars, massacres, social and cultural events, population census, social interactions and language, to seek a complementary understanding of these through the shared memories of the contemporary Aboriginal community
- shared stories of how traditional cultural practise and values are experienced by the contemporary Aboriginal community.

As noted in OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a), some information obtained from RAPs may be sensitive or have restricted public access. Sydney Metro, in consultation with relevant RAPs, will develop appropriate protocols for sensitive or restricted information (as required).

4.0 Aboriginal community consultation

4.1 Stage 1 notification and registration

4.1.1 Consultation with regulatory agencies

Letters and emails were sent on 15 May 2019 to the following agencies requesting contact details for groups relevant to the intended study: Office of Environment and Heritage (OEH) (now Heritage NSW in the DPC), Deerubbin LALC, Gandangara LALC, Tharawal LALC, Office of the Registrar, Native Title Services Corporation Limited (NTSCorp Ltd), Penrith City Council, Liverpool City Council, Camden Council and Greater Sydney Local Land Services (formerly Catchment Management Authorities (CMA)).

The names that were provided by these agencies were then invited to register their interest in the project. The consultation log is included in Appendix A and the agency responses are included in Appendix B.

Searches were also undertaken of the National Native Title Tribunal (NNTT) register through the NNTT website on 26 September 2019 for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements. Searches were made of the LGAs for Penrith City Council and Liverpool City Council.

One claim was present in the Liverpool City Council search for the South Coast People, but it was located approximately 20 kilometres to the southeast of the construction footprint. A search of the National Native Title Register for the same three LGAs had no results. A search of Applications and Determinations identified one dismissed application and two discontinued applications in the Penrith City Council area.

The aforementioned claim for the South Coast People was an active application in the Liverpool City Council area, along with two dismissed, three discontinued and two rejected applications. Based on the data available on the NNTT registers, there are no active registrations, claims or applications intersecting with either the construction footprint or the wider study area.

As is discussed in further detail in Chapter 9.0, there are other projects currently being planned and / or delivered in the same region as this project. Each of these other projects is also currently undergoing community consultation with RAPs. Where documents are available a literature review has been undertaken of currently available reports from across the region, as well as site cards for relevant previously recorded sites, to identify any previously recorded cultural values. To manage the risk of inconsistency or of cultural features being reported by RAPs to one project but not another, the literature review and consultation will continue. RAP engagement for this project will also be undertaken with an awareness that participants may be involved in multiple projects. Questions of cultural values will request regional understandings of landscape features, sites and places to contextualise the cultural values relating to the construction footprint with those identified and potentially impacted by other projects across the region (see also Chapter 9.0).

4.1.2 Public notification

The Aboriginal Stakeholder Consultation newspaper advertisement was published in the Liverpool Leader on 22 May 2019, the Penrith Press on 23 May 2019 and the Western Weekender on 17 May 2019.

The advertisement gave a brief summary of the project and described the construction footprint, requesting that interested Aboriginal persons or organisations should register their interest. The advertisements are included in Appendix C.

4.1.3 Invitations for expressions of interest

A letter inviting registration was sent, either by email or post, to all potential registrants (as identified by agency responses) on 30 August 2019.

Correspondence relating to RAP consultation is included in full in Appendices D to H.

4.1.4 Notification of Registered Aboriginal Parties

RAP registration on the project was kept open for a prolonged period to ensure a comprehensive response and the best possible resource for gathering information on the cultural values of the study area. Notification of the names of RAPs that registered for the project along with a copy of the notification were sent to Deerubbin LALC, Gandangara LALC and EES (formerly OEH) on 21 May 2020. As per the request of two of the registrants details were not included in these notifications.

4.2 Stage 2 presentation of information about the project

Initial information about the project was provided to the RAPs by email and letter on 17 September 2019. Further to that initial presentation, discussion has been held by phone and email with RAPs as part of the ongoing consultation for the project. Project information conveyed during ongoing consultation included reference to the changing construction footprint as designs were refined and the delays and limitations for undertaking field investigations due to land access permissions and the restrictions of the COVID-19 pandemic, which occurred during this assessment.

4.3 Stage 3 gathering information about cultural significance

4.3.1 Registration of interest

A total of 68 registrations were received for consultation on the project. These were received verbally by phone, by email and by letter.

4.3.2 Draft assessment methodology

The draft methodology for survey and test excavation was provided to the RAPs for comment by email and letter on 17 September 2019. Responses received from RAPs predominantly agreed with the proposed methodology without changes. The representative from Cubbitch Barta responded by letter and agreed to the approach of survey and test excavation but stated: "I do not agree that any test excavations that will be required for this project be dry sieved. All material should be wet sieved only, with a minimum of 3 millimetre sieve". The methodology was consequently updated so that wet sieving through a 3 millimetre mesh would be utilised when possible and appropriate during the testing program.

One registrant stated he did not agree with the predictive model of highest density artefact scatters being located predominantly in close proximity to water courses, stating: "coastal streams have very shallow sloping banks that extend well beyond the 25-30 metres range and have fast flowing streams at times," stating that in relation to a survey he had participated in the Mungerie Park area: "I personally identified three areas that resulted in thousands of artefacts... these sites were more than 300 metres from Caddies Creek".

Other comments received raised the issue that some RAPs did not agree with other RAPs being involved in the project, stating that acceptance and support would not be given for individuals or organisations not recognised as from Country. These are indicative of larger issues relating to groups and individuals within the wider Aboriginal community. The project team remain sensitive to these concerns and have responded appropriately during the consultation process. As per the legislative requirements, all 68 RAPs registered for the project will be consulted in an ongoing capacity throughout the design and construction the project. Other groups including relevant stakeholders and Aboriginal knowledge holders may also be consulted as part of the larger project to undertake collaborative approaches and to incorporate information about the cultural and community values into the design and interpretation of the design of the project.

4.3.3 Archaeological field investigations

The methodology that was provided to the RAPs for comment by email and letter on 17 September 2019 outlined archaeological field investigations proposed to be undertaken to ground-truth previously recorded sites and areas of archaeological and cultural potential within the study area. Investigations were accordingly carried out on the land where access was available at this stage of the project, with representatives participating from Deerubbin LALC and Gandangara LALC. The methodology states that, if recommended in this ACHAR, RAPs will be asked to participate in future survey, targeting high sensitivity areas proposed for impacts, and a program of archaeological test excavation of areas of

high archaeological sensitivity proposed for impacts. The outcome of those future works would be detailed in an AAR and an updated ACHAR.

4.4 Stage 4 RAP review of draft ACHAR

The draft ACHAR was provided to RAPs for comment on 24 July 2020. Comments on cultural heritage values received during the feedback process for the draft ACHAR included the following:

- The entire area would have once been occupied and inhabited by Aboriginal people in the past, and is still culturally significant to the Aboriginal community of today.
- In the past Aboriginal people in this area walked the land, participated in ceremonies and dance, had camp sites and used fire for cooking in the hot coals, undertook burials in soft ground, marked trees to indicate culturally significant areas, fished in waterways and used them as a source of drinking water. The waterways that traverse the construction footprint (Blaxland Creek, Cosgroves Creek and Badgerys Creek and their tributaries) hold cultural significance, used in the past for their abundant natural resources and as natural landform boundary markers.
- There are some cultural sites as yet unregistered on AHIMS known by the Aboriginal community to occur in the area surrounding the construction footprint. Those identified during consultation include a Canoe Tree located next to the M4 on the bank of South Creek, estimated to be 1 km east of the Orchard Hills construction site, a possible burial site located at the junction of Blaxland Creek and South Creek, estimated to be 530 m to the east of the Orchard Hills construction site, and a culturally modified tree located at the intersection of South Creek and Luddenham Road, estimated to be located 270 m to the east of the Warragamba Pipeline section of the Off-airport construction corridor. No known cultural sites as yet unregistered on AHIMS have been identified within the construction footprint during consultation or survey.
- The potential cumulative impacts of this project are seen by the Aboriginal community to add further to the overall impacts caused by an increasing amount development in the region, including the Aerotropolis and other development projects in this area. The accumulation of these developments is seen by RAPs to be removing/destroying the remnant Aboriginal sites and associated cultural values across the larger area.
- Further investigations (survey and test excavation) are supported as necessary to occur prior to impacts from the project. RAP feedback supports the draft ACHAR, its recommendations for further investigation and the proposed methodology to undertake survey and testing.

The full register of all comments received during the feedback period for the draft ACHAR is included in Appendix A with a summation of the individual comments provided from all 68 RAPs for the project.

5.0 Existing environment

The following section details the existing environment of the study area, which has relevance to both the spread and survival of Aboriginal archaeological materials across the wider area. The purpose of this section is to detail the broad landscape trends of relevance to the entire study area. Specific, detailed discussion of the on-airport and off-airport areas, as well as the construction areas making up each of those parts of the construction footprint, is included in the details on local context in Section 5.4.

5.1 Landscape context

The nature and distribution of Aboriginal archaeological sites is closely linked to the environments in which they occur. Environmental variables such as topography, geology, hydrology and vegetation will have played a critical role in influencing how Aboriginal people moved within and utilised their respective Country. Amongst other things, these variables affected the availability of suitable campsites, drinking water, plant and animal resources and raw materials for the production of stone and organic implements. Accordingly, any attempt to predict or interpret the character and distribution of Aboriginal sites in a given landscape must take such environmental factors into account. At the same time, an assessment of historic land use activities and geomorphic processes, both contemporary and historic, allows predictions to be made concerning the survival, visibility and integrity of any existing Aboriginal archaeological materials.

5.1.1 Physical setting

The project is located approximately 40 kilometres west of the Sydney Central Business District (CBD), between the suburbs of St Marys and Bringelly and within the Penrith and Liverpool LGAs. The project comprises a predominately linear stretch of land, aligned roughly north to south, approximately 23 kilometres in length. The total construction footprint (approximately 411 hectares (ha)), encompasses a small complex at the existing St Marys Station and a larger, mostly continuous portion located between the Great Western Highway and the intersection of Badgerys Creek Road with The Northern Road, just south of Western Sydney International.

Most of the study area is flat to gently undulating land, with floodplains, gentle slopes and rises. A large portion of the area has been cleared for past pastoral activities and is dominated by pasture grasslands. Portions of the study area (particularly at its northern extent) have been more heavily developed for residential and commercial purposes. Roadways run through the study area, connecting the various parts of the landscape. Extant connections of the deeper past are present in the form of waterways that cross the study area in multiple places. Although the waterways are indicative of the landscape of the past it is important to note that due to meandering, over time the routes may have changed with the present alignments not necessarily reflecting one consistent route throughout the history of this area. Similarly, increased erosion caused by clearing and development is likely to have channelised the waterways, which may have been shallower and broader or consisted of chains of ponds in the past.

5.1.2 Topography

The topography of the construction footprint is typical of Bannerman and Hazelton's (1990) Cumberland Lowlands physiographic region and can be broadly characterised as flat to undulating, with floodplains, ridges and flat topped terraces dissected by the drainage depressions of larger watercourses and their tributaries. Landforms within the construction footprint are dominated by undulating slopes and crests, with higher and steeper terrain rising gradually in the south. Elevations within the construction footprint average at approximately 57 metres Australian Height Datum (AHD) but range from low-lying alluvial flats of 26 metres AHD surrounding the Badgerys Creek and Blaxland Creek stream channels, to moderately inclined mid and upper slopes further from larger watercourses. The highest point within the construction footprint consists of a crest in the far southwest, with an elevation of 94 metres AHD.

5.1.3 Hydrology

The project is located within the South Creek catchment – defined by a network of tributaries that originate in the higher terrain south of Catherine Field and combine into larger and more permanent waterways as they drain north towards Windsor. South Creek is a dominant feature of the catchment

and is located as a perennial fourth order stream between 200 metres and two kilometres east of the project for the majority of the alignment. Tributaries of South Creek cross through the project at multiple points. These include various ephemeral streams throughout the construction footprint such as Cosgroves Creek and the higher order perennial streams of Badgerys Creek in the south and Blaxland Creek in the north, at a point just southwest of its confluence with South Creek.

Historic land use practices such as damming, vegetation clearance and flood-mitigating construction across the construction footprint have affected natural stream flows. As such, modern stream alignments may not fully represent the locations and extents of waterways that existed during periods of Aboriginal occupation. However, the Quaternary surface geology underlying the major streams and floodplains within the construction footprint suggests South Creek and its larger tributaries have not substantially deviated from their current alignments since at least the Pleistocene era.

The implications of this hydrology are that sections of the construction footprint would have contained sufficient freshwater to support the year-round and/or repeated activities of past Aboriginal groups, while other portions further from reliable streams may have only been utilised infrequently, or opportunistically. As such, there is potential for higher densities of archaeological material associated with the sections of the construction footprint in close proximity to South Creek, Badgerys Creek and Blaxland Creek. As noted above, one registrant noted that in his experience Aboriginal sites are not necessarily tied to waterways and can occur in any landform. For this reason, sensitivity has been assessed across multiple landforms for the study area, taking into consideration not only proximity to water, but also the presence of other previously recorded sites, past disturbance and any other cultural features shared during consultation.

5.1.4 Surface geology

Reference to the 1:100,000 Geological Series Sheet for Penrith (9030) (Clark & Jones, 1991) indicates that the surface geology of the construction footprint comprises a mixture of Middle Triassic Bringelly Shale (Rwb) and Quaternary Alluvium (Qal), with a small section of Tertiary St Marys Formation (Ts) located to the far north.

Bringelly Shale is strongly associated with the presence of undulating hills in the region and mantles most of the construction footprint, closely corresponding with the observed topography. Bringelly Shale, deposited in a swampy alluvial plain, is the uppermost formation of the Wianamatta Group and consists of shale, carbonaceous claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff (Clark & Jones, 1991).

Quaternary Alluvium (Qal), characterised by quartz and lithic “fluvial” sand, silt and clay, extends in roughly southwest to northeast running bands across sections of the construction footprint that cross major streams (Clark & Jones, 1991). Quaternary Alluvium is closely associated with perennial waterways and floodplains within the region of the project and is of potential Aboriginal archaeological significance as a primary source of raw stone materials. Exposed silcrete boulders have been observed along the eastern bank of South Creek in the vicinity of the construction footprint to the north of Elizabeth Drive (AAJV, 2019:109).

St Marys Formation (Ts) extends into the far eastern side of the existing St Marys Station portion of the construction footprint and is characterised by laterised sand and clay with ferricrete bands containing silcrete, sandstone and shale boulders (Clark & Jones, 1991). This formation has been investigated at the nearby Plumpton Ridge (approximately seven kilometres northeast of the construction footprint) and found to contain quarry sites, with extensive evidence of silcrete extraction and preparation (Kelleher Nightingale Consulting Pty Ltd, 2009; National Heritage Studies Pty Ltd, 1990).

5.1.5 Soil and geomorphology

Soils within the construction footprint have been mapped by Bannerman and Hazelton (2011) as belonging to two distinct soil landscapes: Residual Blacktown (REbt) and Alluvial South Creek (ALsc) (Bannerman & Hazelton, 2011).

Blacktown soils are associated with the slopes and underlying Bringelly Shale and occur across most of the construction footprint. They have been characterised by Bannerman and Hazelton (2011) as shallow to moderately deep, hardsetting mottled texture contrast soils, with red and brown podzolic soils on crests, which grade into yellow podzolic soils on lower slopes and in drainage lines. Blacktown

subsoils are moderately to highly erodible where organic matter is low; however, topsoils vary between low and moderately erodible, as fine sand and silt contents are balanced by the presence of moderate levels of dense organic matter. Consequently, the majority of the construction footprint has moderate potential for containing archaeological material; however, in situ material is unlikely due to erosion.

South Creek soils follow the underlying Quaternary geology across the floodplains and flats of the construction footprint. They have been characterised by Bannerman and Hazelton (2011) as deeply layered sediments over bedrock or relict soils. Where soil deposition has occurred, structured clays or loams are immediately adjacent to drainage lines, with red and yellow podzolic soils on terraces, in addition to small areas of structured grey clays, leached clay and yellow solodic soils. The soils are subject to seasonal waterlogging and have permanently high water tables. The dynamic nature of the soil landscape can encourage both high levels of erosion and deposition. As such, artefacts may be buried at depth, or removed from their original contexts. The acidity of both soil types is of potential import archaeologically, as organic materials are vulnerable to decomposition in soils of high pH (Matthiesen, 2004). If skeletal remains or shells were present at the site in the past, it is unlikely that they would survive in the archaeological record today.

As in other parts of the Cumberland Plain, existing archaeological, environmental and historic reference materials suggest that a range of geomorphic processes are likely to have affected the Aboriginal archaeological record of the site. Potentially significant phenomena from an archaeological perspective include bioturbation, erosion and alluvial/colluvial aggradation. Possible effects of these processes include:

- Increased archaeological site visibility in eroded areas
- Reduced archaeological site visibility in areas of sediment deposition
- Horizontal and vertical translocation of artefacts
- Stratigraphic mixing
- Truncation of archaeological deposits
- Creation of thicker and potentially stratified archaeological deposits in floodplain and slope base contexts.

5.1.6 Flora and fauna

Contemporary flora and fauna have both been assessed separately in the Biodiversity technical paper for the project (as presented in Technical paper 3 (Biodiversity)). The results of that study found that there are currently five plant community types within the study area, being:

- Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- Forest Red Gum - Rough-barked Apple Grassy Woodland on Alluvial Flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum Grassy Woodland on Flats of the Cumberland Plain, Sydney Basin Bioregion
- *Phragmites australis* and *Typha orientalis* Coastal Freshwater Wetlands of the Sydney Basin Bioregion
- Swamp Oak Open Forest on River flats of the Cumberland Plain and Hunter valley.

Four threatened ecological communities were also identified in the study area, being:

- Cumberland Plain Woodland in the Sydney Basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Shale Gravel Transition Forest in the Sydney Basin Bioregion
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

The technical paper also predicted fauna species likely to occur based on vegetation surrogates and landscape features, with a range of amphibians, reptiles, mammals and birds listed as likely to occur within the study area.

It is important to note that while the current flora and fauna species may be indicative of likely past conditions, they are not necessarily representative of the same resources that would have been available to Aboriginal people in this area in the past (not discounting that they may still have cultural significance for contemporary communities as examples of cultural resources). Native vegetation within the construction footprint has been heavily modified as a result of historic land clearance activities, with the majority cleared historically for grazing and/or cropping. With reference to Tozer's (2003) survey of native vegetation across the Cumberland Plain, the available evidence suggests that the construction footprint is likely to once have contained more widespread Shale Plains Woodland vegetation communities, with Alluvial Woodland along waterways and Shale Hills Woodland in the higher terrain to the south.

Shale Plains Woodland is the most widely distributed community on the Cumberland Plain (Tozer, 2003: 36). It is typically dominated by Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*), with Narrow-leafed Ironbark (*E. crebra*), Thin-leafed Stringybark (*E. eugenioides*) and Spotted Gum (*Corymbia maculata*) also occurring, though less frequently. A shrub stratum dominated by Blackthorn (*Bursaria spinosa*) is usually also present. Common ground stratum species for this vegetation community include Kidney Weed (*Dichondra repens*), Threeawn Speargrass (*Aristida vagans*), Weeping Grass (*Microlaena stipoides*), Kangaroo Grass (*Themeda australis*), Brunoniella (*Brunoniella australis*), Tender Tick-trefoil (*Desmodium varians*), Thin Leaf Stink Weed (*Opercularia diphylla*), Blue Bell (*Wahlenbergia gracilis*) and Shorthair Plumegrass (*Dichelachnemicrantha*).

Alluvial Woodland is most often dominated by Cabbage Gum (*E. amplifolia*) and Swamp Oak (*Casuarina glauca*) with Apple Box (*Angophora floribunda*) occurring less frequently (EcoLogical Australia, 2011; Tozer, 2003:32). A shrub stratum is usually evident though is often sparse and dominated by Blackthorn (*Bursaria spinosa*). A dense ground cover of grasses such as Basket-grass (*Opismenus aemulus*), Weeping grass (*Microlaena stipoides*), Bordered Panic (*Entolasia marginata*) and Forest Hedgehog Grass (*Echinopogon ovatus*) is also typical as is the presence of herb species such as Forest Nightshade (*Solanum prinophyllum*), Whiteroot (*Pratia purpurascens*) and Native Wandering Jew (*Commelina cyanea*). Alluvial Plain Woodland is typically associated with minor watercourses draining soils derived from Wianamatta Group shales.

Shale Hills Woodland is similar to Shale Plains Woodland; however, it is predominately found at higher elevations and on steeper slopes in more rugged terrain (Tozer, 2003:35). The community is dominated by Grey Box (*E. moluccana*) and Forest Red Gum (*E. tereticornis*), with fewer instances of Narrow-leafed Ironbark (*E. crebra*). A small tree stratum of Hickory Wattle (*Acacia implexa*) and other *Eucalyptus* species is common. Shrub strata consist of Sweet Bursaria (*Bursaria spinosa*), with rarer instances of Sickie-leafed Wattle (*A. falcata*), Coffee Bush (*Breynia oblongifolia*), Australian Indigo (*Indigofera australis*) and Sticky Hop Bush (*Dodonaea viscosa cuneata*). Ground cover varies, with dense grass and herb cover in areas of open canopy, but sparse groundcover where shrub canopies are closed.

As was noted in the biodiversity technical paper, recorded vegetation communities within the construction footprint and surrounding the project provided suitable habitat for a range of fauna types including amphibians, reptiles, mammals (both terrestrial and arboreal) and birds. Local watercourses supported a diverse range of aquatic fauna (M2A, 2020). Faunal resources that are known or are likely to have been exploited by Aboriginal people occupying the southern extent of the Cumberland Plain, which incorporates the current construction footprint, include freshwater fish, eels, shellfish, molluscs, crustacea, snakes, fruit bats, lizards, bandicoots, possums, gliders, kangaroos, wallabies, birds, insects and grubs (Attenbrow, 2010: 69-76).

5.1.7 Historical land use

An understanding of historic land use and disturbance patterns can indicate the likely survivability and integrity of PADs within a region. The following section contains a brief outline of the historical development within the construction footprint, set within the broader context of the region.

The Hawkesbury-Nepean area was known to Europeans from early in colonial history, when, in 1789, Governor Philip led a party of woodcutters to mark out a line of road between Sydney and Parramatta

(Walker, 1906:43 - 48). With the road open and the soil surrounding the Nepean and its tributaries identified as especially fertile, settlers soon established large rural estates across the region with a focus around major waterways (Thorp, 1986:76). During this time, the landscape was modified by regimes of vegetation clearance prior to its use in agricultural and pastoral activities (Thorp, 1986:104).

From 1812, Governor Macquarie granted large tracts of land to notable figures within the colony. Robert Dixon's 1837 Map of the Colony of NSW (see Figure 5-1) shows the extent of major land holdings within the region by this time, with large portions of land designated along the Nepean River to the southeast of the construction footprint. While the nature of land holdings within the construction footprint at this time is unclear, the far northern portions appear to have been taken up by the estates of Governor King and Colonel O'Connell. These holdings, fronting the fertile South Creek and located close to the main road between Emu Plains and Parramatta, would have been ideal farming positions.



Figure 5-1 Excerpt from Dixon's Map of the Colony of NSW, 1837 (source: SLNSW/IE3742276). Approximate location of the project shown in red. Labels indicating holdings of Governor King and Colonel O'Connell are shown to the north of the project

Additional land was subsequently granted to independent farmers, and early parish maps demonstrate that the construction footprint was divided into multiple holdings by the mid-1800s, with portions varying from small, 20-acre properties, to large, thousand-acre estates. With the introduction of the *Robertson Land Acts* in 1861 and the rail line from Sydney to Penrith officially opened on 7 July 1862, greater numbers of settlers established small farms in the region and additional roads were constructed to accommodate the traffic (Cultural Resources Management, 2019; Walker, 1906:47).

The 1894 Map of the County of Cumberland illustrates the portion numbers and placement of the holdings located within the construction footprint and includes the names of the larger estates, many of which can be identified as farms (see Figure 5-2 to Figure 5-4). The majority of agriculture industries were confined to fruit growing and farming, especially dairying, which was well suited to the landscape (Walker, 1906:48). As such, the construction footprint would have been subject to land disturbance associated with farming activities, with key impacts including native vegetation clearance, grazing, construction of vehicle tracks and roads, altered waterways, and erosion – particularly along creek lines.

More intensive development was soon observed surrounding growing settlements, such as St Marys and Luddenham. As these towns flourished, further subdivisions, roads, public buildings and utilities were established to support their budding communities. A breakdown of the developments seen across the land holdings within the construction footprint is presented in Table 5-1.

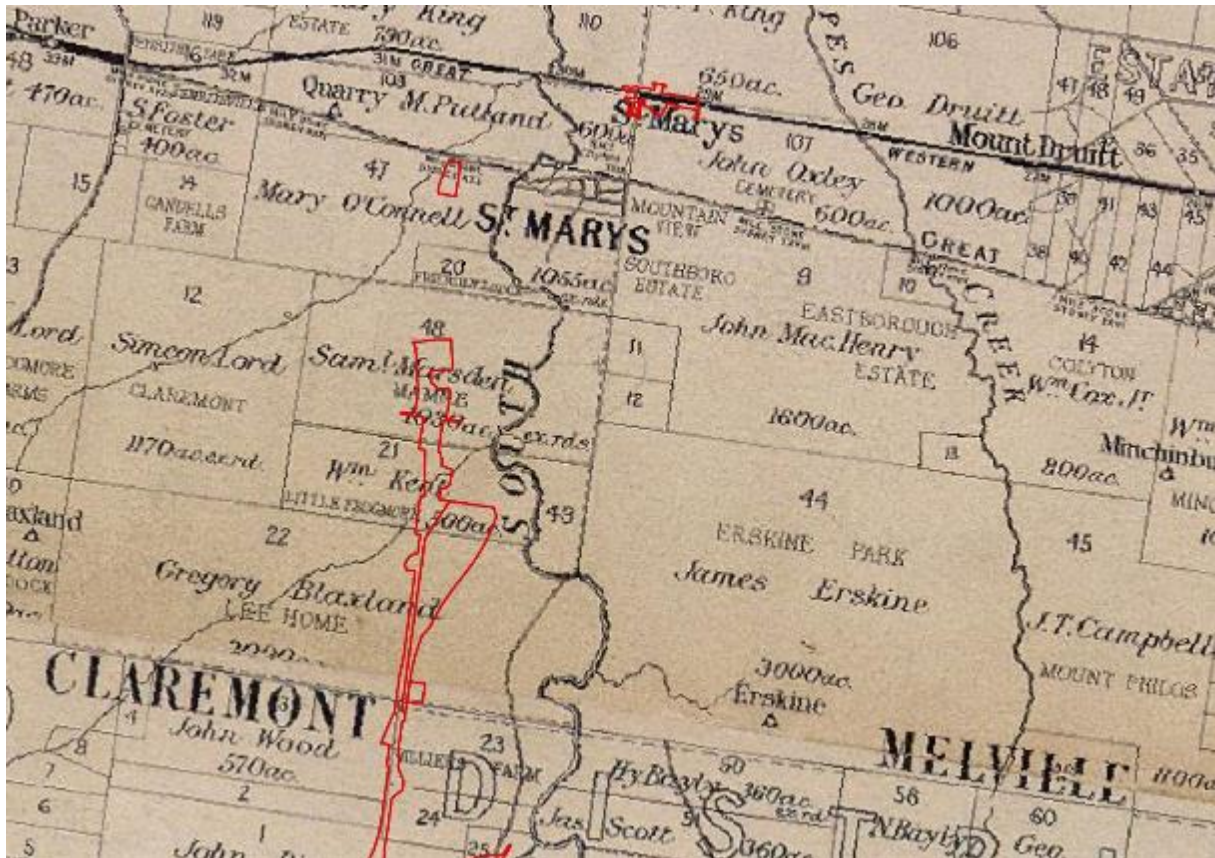


Figure 5-2 Excerpt from Map of the County of Cumberland, NSW 1894 (HLRV/1562201.jp2). Approximate location of the St Marys Station and northern portions of the construction footprint shown in red

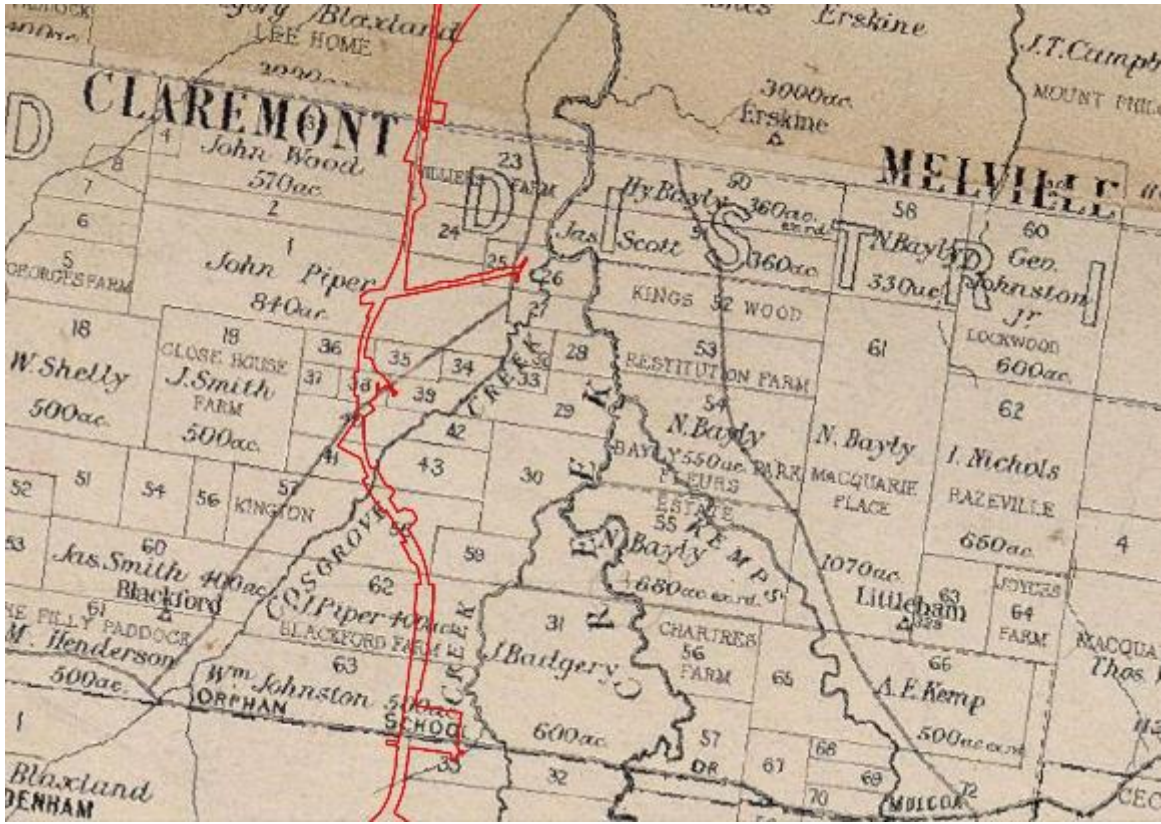


Figure 5-3 Excerpt from Map of the County of Cumberland, NSW 1894 (HLRV/1562201.jp2). Approximate location of the middle portion of the construction footprint shown in red

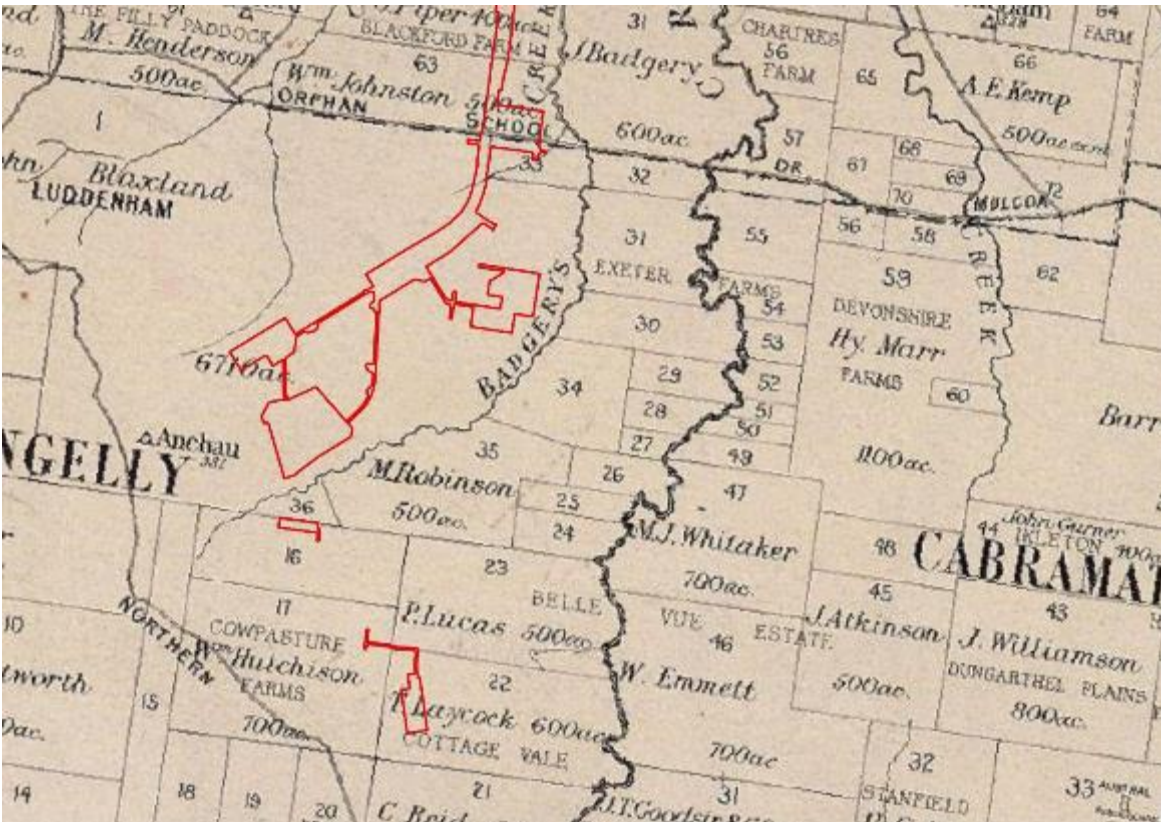


Figure 5-4 Excerpt from Map of the County of Cumberland, NSW 1894 (HLRV/1562201.jp2). Approximate location of the southern portion of the construction footprint shown in red

Table 5-1 Development of land holdings within the construction footprint as depicted in parish maps

Parish	Portion	Initial Land Holder	Acres	Development
Rooty Hill	111	Parker Philip King	650	1835 – Portion surveyed, fronting Ropes Creek N.D. – Labelled ‘Triangle Farm’ 1894 – Further subdivisions to the north, addition of the ‘Great Western Railway’ to the south 1972 – St Marys Railway Station located to south, much more developed with roads and residential/commercial subdivisions
	107	John Oxley (Explorer and surveyor)	600	1835 – Portion surveyed, fronting Ropes Creek and along the ‘Great Western Road’ from Emu Plains to Parramatta N.D. – Labelled ‘Bathurst’ 1894 – Cemetery located to the south, addition of the ‘Great Western Railway’ to the north, town of St Marys shown to the west 1972 – St Marys Railway Station located to west, much more developed with roads and residential/commercial subdivisions
	110; 118	Maria King	280	1835 – Portion surveyed, fronting South Creek N.D. – Labelled ‘Marie Farm’ 1894 – Labelled ‘Parkesville’ and ‘Werrington Estate’, addition of the ‘Great Western Railway’ to the south. 1941 – Acquired for Commonwealth purposes 1952 – Fauna corridor designated along South Creek 1972 – St Marys Railway Station located to east, much more developed with roads and residential/commercial subdivisions
	109	Mary Putland	600	1835 – Portion surveyed, fronting South Creek and along the ‘Great Western Road’ from Emu Plains to Parramatta N.D. – Designated as ‘Town of St Marys’ 1894 – Race course to the east of South Creek, additions of a quarry to the south and the ‘Great Western Railway’ to the north. 1972 – Labelled as ‘Frogmore Farm’ (Claremont Parish), St Marys High School to the north, much more developed with roads and residential/commercial subdivisions
Claremont	47	Mary O’Connell	1055	Mid-1800s – Portion surveyed, fronting South Creek, with South Creek Bridge in the north eastern corner and ‘The Western Road’ along northern boundary N.D. – Labelled as ‘Town of St Marys’, plan with regular, rectangular streets shown along the Western Road (labelled Victoria Road) to the west of South Creek 1894 – Subdivisions and roadways for the Town of St Marys now shown in north eastern corner, much more irregular plan 1916 – Subdivision of the entire property into multiple portions, with roads along

Parish	Portion	Initial Land Holder	Acres	Development
				boundaries, much more development along Victoria Road to east and west. Land labelled 'Coalree' 1972 – Residential subdivision labelled 'The Cedars'
	20	Lieutenant Menzies	100	Mid-1800s – Portion surveyed fronting South Creek, within the portion granted to Mary O'Connell 1894 – Labelled 'Friendly Lodge' 1916 – Land holder shown as Charles AFN Menzies
	18	Samuel Marsden	1030	Mid-1800 – Portion surveyed 1894 – Labelled 'Mamre' 1972 – Western Expressway running through centre, and 'Fauna protection district proclaimed 6 th March 1959'
	21	William Kent	500	Mid-1800 – Portion surveyed 1894 – Labelled 'Little Frogmore' 1916 – Labelled 'Landsdown Place'
	22	Gregory Blaxland	2000	Mid-1800 – Portion surveyed 1894 – Labelled 'Lee Home' 1916 – Line of road through eastern portion 1972 – Easement for Sydney West Substation and Yass-Sydney West Transmission Lines through centre
	23	Gregory Blaxland	280	Mid-1800 – Portion surveyed 1894 – Labelled 'Villiers Farm' 1916 – Line of road through eastern portion 1972 – Easement for Yass-Sydney West Transmission Line through centre
	3	John Wood	570	Mid-1800 – Portion surveyed 1972 – Easement for Sydney West Substation Transmission Line, large portion 'Acquired by Commonwealth 13 Sep 1962'
	2	John Wood	150	Mid-1800 – Portion surveyed 1972 – Easement for Sydney West Substation Transmission Line small portion 'Acquired by Commonwealth 13 Sep 1962'
	24	Henry Bayly	140	Mid-1800 – Portion surveyed 1916 – Line of road through eastern portion
	1	John Piper	840	Mid-1800 – Portion surveyed 1916 – Line of road through eastern portion 1972 – Easement for Yass - Sydney West Substation Transmission Line
	25	Mary Crooke	30	Mid-1800 – Portion surveyed 1916 – Line of road along eastern boundary

Parish	Portion	Initial Land Holder	Acres	Development
	26	William Cosgrove	60	Mid-1800 – Portion surveyed, likely owned land earlier as Cosgroves Creek likely named after the family 1916 – Labelled ‘Cosgrove Farm’, many other holdings in district, line of road though western boundary
	36	James Beckett	60	Mid-1800 – Portion surveyed
	35	Daniel Wellings	50	Mid-1800 – Portion surveyed 1916 – Line of road through eastern portion
	38	William Sherries	70	Mid-1800 – Portion surveyed 1916 – Line of road through eastern portion
	39	Corn Regan	60	Mid-1800 – Portion surveyed 1916 – Land holder Cornelius Regan, line of road through north western corner
	40	Peter Workman	100	Mid-1800 – Portion surveyed 1916 – Line of road through central portion
	41	Andrew Nash	80	Mid-1800 – Portion surveyed 1916 – Line of road through central portion
	43	Philip Hogan	120	Mid-1800 – Portion surveyed
	58	Thomas Nicholls	200	Mid-1800 – Portion surveyed 1916 – Labelled ‘Ham Farm’ 1972 – Southern portion “vested in the commonwealth council for scientific and industrial research 1936”
	59	Samuel Laycock	100	Mid-1800 – Portion surveyed 1972 – Labelled “vested in the commonwealth council for scientific and industrial research 1936”
	62	John Piper	400	Mid-1800 – Portion surveyed 1894 – Labelled ‘Blackford Farm’ 1972 – Labelled “vested in the commonwealth council for scientific and industrial research 1936”
	63	William Johnson	500	Mid-1800 – Portion surveyed 1894 – Road shown south labelled ‘Orphan School or Mulgoa Road’ 1972 – Western portion “vested in the commonwealth council for scientific and industrial research 1936”, Elizabeth Drive to south

Parish	Portion	Initial Land Holder	Acres	Development
Bringelly	1	John Blaxland	6710	Mid-1800 – Portion surveyed, (possibly granted 1813) 1894 – Labelled ‘Luddenham’ N.D. – Subdivision plans for “Luddenham Estate” – Eastern Division, small portion in west resumed for water supply for the Village of Luddenham, line of road ‘Northern Road from Camden to Richmond’ along western boundary 1953 – Multiple streets and regular shaped lots, Badgerys Creek Public School, road to north Elizabeth Drive (previously Orphan School Road and Mulgoa Road). Divisions to the south much larger than along Elizabeth Drive
	39	Hugh Derline	100	Mid-1800 – Portion surveyed within John Blaxland's property
	35	William White	20	Mid-1800 – Portion surveyed N.D. – Portion size changed to 40 acres
	7	John Piper	1500	Mid-1800 – Portion surveyed 1894 – Labelled ‘Bathurst Farm’
	16	Edward Wright	350	Mid-1800 – Portion surveyed N.D. – Changed to Edmund Wright 1953 – Subdivided into regular lots with roads
	17	William Hutchinson	700	Mid-1800 – Portion surveyed N.D. – Labelled ‘Cowpasture Farms’, line of road ‘Northern Road from Camden to Richmond’ through southwest corner and post office to south 1953 – Subdivided into regular farm lots with roads
	23	Penelope Lucas	500	Mid-1800 – Portion surveyed N.D. – Portion boundary redrawn as smaller to the south 1953 – “Acquired for Commonwealth purposes 20.10.49’
	22	Thomas Laycock	600	Mid-1800 – Portion surveyed N.D. – Portion boundary redrawn as larger to the north, labelled ‘Cottage Vale’

5.1.8 Land disturbance

The implications of this land use history includes the disturbance of any pre-existing Aboriginal sites and deposits through both direct and indirect means, resulting in a loss of archaeological integrity. The construction footprint was extensively cleared of vegetation during the early pastoral settlement, with widespread ground disturbance likely associated with the cultivation of crops and smaller areas of impact associated with the construction of residential buildings. However, overall disturbance is minimal in the central and southern portions of the construction footprint in comparison with the existing St Marys Station and northern portions of the construction footprint, which have been subject to higher impact activities through large scale residential, commercial, road and rail development. The

possibility for subsurface archaeological material, below the 'plough zone', therefore remains moderate in the portions of paddock to the south of the M4 Western Motorway (i.e. areas of low to moderate disturbance), but is nil to low in highly disturbed areas, such as within the St Marys area within the broader construction footprint. Levels of disturbance are defined below in Table 5-2.

Table 5-2 Disturbance rating scheme

Rating	Definition
High	Severe disturbance to natural soil profiles including complete-to-near complete topsoil loss through erosion, earthworks, buildings, vehicle tracks and dams.
Moderate	Cleared and/or grazed at some time, with ploughing also attested.
Low	Cleared and/or grazed at some time, but apparently never ploughed.

5.2 Archaeological context

5.2.1 Off-airport archaeological background

Numerous Aboriginal archaeological investigations have been carried out across the off-airport study area over the last four decades. As in other parts of the Cumberland Plain, the majority of these investigations have been limited to survey. However, a number of investigations involving test and/or salvage excavation programs have also been undertaken. For contextual purposes, the results of a selection of these investigations, as relevant to the study area, are summarised in Table 5-3.

Intensive development activities since this time have secured the Cumberland Plain's place as one of the most intensively investigated archaeological regions in Australia, with potentially thousands of Aboriginal archaeological investigations involving survey and/or excavation having now been undertaken (the exact number difficult to calculate due to the limited circulation of many reports). This has led to ongoing cumulative impacts both to select Aboriginal sites and to the wider cultural landscape they are situated within. At the same time, the scientific knowledge gained through these numerous investigations has been significant. Currently much of the scientific knowledge is communicated through technical papers and reports; any opportunity proffered by the project to further the spread of this knowledge would be of benefit to the communities of this area.

These results of previous surface and subsurface investigations show that past Aboriginal occupation and land use in the study area was consistent with that of the Cumberland Plain as a whole. Collectively this does attest to an occupational emphasis on elevated low gradient landforms adjacent to higher order watercourses, as well as an emphasis on the procurement, transport, pre-processing and reduction of silcrete as a primary raw material for artefact manufacture.

Table 5-3 Previous Aboriginal archaeological investigations

Author	Project	Investigation type	Summary of results
Hanrahan, 1981	Proposed Housing Commission Subdivision at South Werrington, near Penrith	Survey	Archaeological survey was undertaken across land proposed for subdivision, incorporating the construction footprint to the north of the (M4) Western Motorway. A single artefact scatter was identified along the banks of Claremont Creek north of Caddens Road.
M. Dallas, 1982	An archaeological survey at Riverstone, Schofields and Quakers Hill, NSW	Survey	Seven artefact scatters and four isolated artefacts were identified during the survey. Identified impacts included erosion and ploughing. Eastern Creek was the main water source in proximity to these sites. Site density ranged from two to 50. Silcrete was the most common raw material, with others including chert, quartz, chalcedony and petrified wood.

Author	Project	Investigation type	Summary of results
			Artefact types included cores and flakes. Two of the sites were noted as having abundant stone resources on the ridges adjacent to them.
Rhoads, J.W.; Dunnett, 1985	Aboriginal Resources Planning Study: City of Penrith	Desktop and Survey	Desktop assessment and survey were undertaken across the region of Penrith for an Aboriginal resources planning study. 11 new and 82 known sites were identified and examined in four analytical study units. The current construction footprint is located within the regions of the Wianamatta Hill Country and South Creek Flood Plains units. Sites in the Wianamatta Hill Country (n=24) were found across all landforms, although correlations were noted with seasonal streams and confluences and gullied rises and stream banks. Raw materials were predominately silcrete and chert, with quartz additionally represented in half of the sites. Artefact densities varied with one artefact located every 2-25 m ² , and suggested activities of manufacture, use and repair. Low ground surface visibility inhibited detailed survey of this area. Sites in the South Creek Flood Plains (n=10) were mainly located on landforms adjacent to permanent waterways. Artefact densities were mostly 1/m ² to 1/5m ² and silcrete and chert were the predominate raw materials. Overall, site ages were poorly indicated by soil horizons.
J. McDonald, 1986	Archaeological reconnaissance of the proposed Schofield regional depot at Plumpton, NSW	Survey and Test Excavation	Surface artefact scatters were identified across the entire area, but density was found to reduce away from the ridgelines (being the source of raw materials). Sites were found to cluster around water courses and low ridges. Four out of five excavated test pits (50 cm by 50 cm) contained artefacts. Silcrete was the most common material.
Dallas, 1988	Preliminary archaeological study of the Luddenham Equestrian Centre, Luddenham Road, Erskine Park, NSW	Survey	An archaeological survey was undertaken for a proposed development located outside the construction footprint to the west of Cosgroves Creek. 12 artefact scatters (LEC 1-12) were identified and an area of PAD was defined.

Author	Project	Investigation type	Summary of results
Dallas & Smith, 1988	Site Investigations at the Luddenham Equestrian Centre, Erskine Park	Test excavation	Following the preliminary study, test excavation was undertaken in areas in proximity to artefact scatters LEC 9 and LEC 12 and also across landforms within similar topographic features to these sites. A total of 13 test trenches were excavated. Within 10 pits 104 stone artefacts and one piece of ochre were recovered. One trench demonstrated modern artefacts suggestive of site disturbance. Silcrete was the dominant raw material (99%), with minor additions of mudstone, quartz and chert. Significant quantities of stone artefacts were limited to at depth subsurface deposits on relatively flat ground.
Dean-Jones, 1991	Proposed clay/shale extraction Lot 3 DP623799 Adams Road, Luddenham	Survey	A single artefact scatter comprising 22 stone artefacts was identified at the edge of the Oaky Creek floodplain.
Brayshaw McDonald Pty Ltd, 1992	Proposed 33kV transmission line between Bringelly and Rossmore, NSW	Survey	A single artefact scatter comprising 11 stone artefacts was identified on a low spur less than 150 m from South Creek.
Brayshaw, 1995	Elizabeth Drive Upgrade Environmental Impact Statement Archaeological Survey for Aboriginal Sites	Survey	Pedestrian surveys were undertaken in an easement along Elizabeth Drive. Surveys noted high levels of disturbance from previous road works in areas that may originally have been archaeologically sensitive. Two open artefact scatters (one disturbed) and six areas of PAD were identified. The artefact scatters contained a total of 13 stone artefacts of varied materials (silcrete, chert, FGS, mudstone and quartzite), with one possible and two definite cores identified. A program of subsurface testing was recommended for the undisturbed site and five of the PADs.
Helen Brayshaw Heritage Consultants, 1996	M4 Upgrade: Archaeological Survey for Aboriginal Sites for Proposal to Upgrade the M4 Motorway from Church Street Parramatta to Coleman Street Marys Hill and Prospect to Emu Plains	Survey	Pedestrian survey undertaken prior to upgrade works on the M4, including an area of the construction footprint where the M4 intersects with Kent Road. 20 open artefact sites comprising isolated artefacts or artefact scatters were identified, including four located within or in proximity to the construction footprint (Locations 11, 12A, 12B and 13). Most sites were located in disturbed contexts.

Author	Project	Investigation type	Summary of results
<p>Steele, 1999</p> <p>Steele, 2001</p> <p>Steele, 2004</p> <p>Steele, 2007</p>	<p>Twin Creeks Estate, Luddenham</p>	<p>Survey (1999); Test excavation (2001); Aboriginal Heritage Conservation Action Plan (2004); Excavation and monitoring (2007)</p>	<p>A program of archaeological assessment was undertaken following previous work undertaken at the Luddenham Equestrian Centre by Dallas in 1988. Surveys identified five previously unrecorded open campsites, an isolated artefact and a possible modified tree, in addition to relocating five of 12 previously recorded artefact scatters in the locality.</p> <p>Preliminary test excavations were undertaken for three of the previously recorded open campsites (AHIMS #45-6-1772, #45-6-1774 and #45-6-1777) which were indicated to contain moderate archaeological potential. Additional excavation was undertaken around a spur identified by the representatives from the Local Aboriginal Land Council (LALC) as potentially sensitive. Angular silcrete gravels and fragments assessed as naturally occurring were present throughout the site. Total worked stone (n=319) consisted of varied proportions of silcrete, tuff and quartz, with small numbers of volcanics, petrified wood and quartzite. The presence of backed artefacts led to the dating of the site to the Middle Bondaian, between 2,800 BP and 1,600 BP.</p> <p>An Aboriginal Heritage Conservation Action Plan (Steele, 2004) was prepared in conjunction with an application for a Section 90 Heritage Impact Permit Consent with Salvage and Collection for the Twin Creeks Estate development. The area was divided into 9 zones; consent with salvage was requested for Zones F and G, while consent with collection was requested for Zones B, C, D, E and H.</p> <p>Archaeological excavation and monitoring (Steele, 2007) were undertaken at the Twin Creeks Estate in accordance with the approved Conservation Action Plan and S90 Consent (#2056). Site LEC 12 (AHIMS #45-6-177) was assessed and stabilised; site LEC 10 (AHIMS #45-6-1779) was excavated for salvage; and site TCE 1 (AHIMS #45-5-2991) was collected following its identification during the period of development monitoring. Excavations for LEC 10 recovered 120 artefacts over 16 test trenches, with 57 complete flakes.</p>

Author	Project	Investigation type	Summary of results
Jo McDonald Cultural Heritage Management Pty Ltd, 2000	Archaeological Survey for Aboriginal Sites: Proposed Light Industrial Subdivision, "Austral Site", Mamre Road, Erskine Park, NSW	Survey	Five artefact scatters and three isolated artefacts were identified. Salvage works were recommended prior to development proceeding.
Jo McDonald Cultural Heritage Management Pty Ltd, 2001	Survey for Aboriginal Sites 1503 Elizabeth Drive, Kemps Creek	Survey	Pedestrian surveys were undertaken for a 25.5 hectares section of Nolans Quarry proposed for redevelopment. One section of PAD was identified on a ridgeline in proximity to Kemps Creek and South Creek, with an associated quartz flake located on the surface. Clearing prior to the survey was suggested to have impacted the surface of the site, potentially having destroyed previous artefacts. Despite this, intact subsurface deposits were considered possible.
URS Australia Pty Ltd, 2001	Gipps Street Landfill Site, Claremont Meadows	Survey	An archaeological survey was undertaken of Gipps Street Lane, located within the construction footprint. No Aboriginal sites were identified. Observations concluded that the site had been subject to high levels of past disturbance.
Appleton, 2002	The Archaeological Investigation of Lot 2, DP 120673 The Site of a Proposed New Clay and Shale Extraction Area - Old Wallgrove Road Horsley Park, West of Sydney NSW	Survey	Two isolated artefacts and an area of PAD were identified during survey at this location.
Environmental Resources Management Australia Pty Ltd, 2003 Environmental Resources Management Australia Pty Ltd, 2006a	Land Solutions Development, Claremont Meadows	Survey; Test excavation and salvage.	Archaeological survey was undertaken for a portion of land located outside the construction footprint, between the M4 and Fowler Street. Nine sites were identified, comprising four artefact scatters, four isolated artefacts and a possible scarred tree. A Section 90 consent to destroy was recommended for disturbed sites in the north of the study area, while testing followed by a Section 90 consent was recommended for site OAD1. Subsequent test excavations and salvage were undertaken for site OAD1 (AHIMS #45-5-3013), which was determined to form part of AHIMS #45-5-2898. Approximately 2,000 artefacts were recovered, with evidence of complex activity zones including knapping floors and potential associations with heat

Author	Project	Investigation type	Summary of results
			shatters and campsites. Site distribution within the area was correlated with the crest at the 30 m contour overlooking South Creek.
Environmental Resources Management Australia Pty Ltd, 2006b	Lots 8, 9, 10 DP27107 and Lot 19 DP239091 Claremont Meadows	Survey	Survey was undertaken for a proposed development located outside the construction footprint, to the north west of Kent Road. Six Aboriginal sites were identified in areas of exposure across the site and subsurface potential was predicted for the flat floodplain.
Jo McDonald Cultural Heritage Management Pty Ltd, 2008b	Austral Land Mamre Rd, Erskine Park: Archaeological Salvage Excavations	Salvage	Salvage excavations were undertaken with 298 m ² excavated and 8,867 artefacts retrieved from subsurface deposits. Artefact density was found to be tied to stream order. Use of silcrete as a raw material diminished as the distance from silcrete sources increased. Backed blades were present as was evidence of bipolar flaking.
Jo McDonald Cultural Heritage Management Pty Ltd, 2008a	Lot 2 DP771697, Claremont Meadows	Survey	Pedestrian survey undertaken for a development area located within the construction footprint to the immediate south of the (A44) Great Western Highway. One isolated find (GS01 consisting of a silcrete flake) was identified in the road corridor of Gipps Street at the edge of an eroding bank associated with a drainage line.
Biosis Research Pty Ltd, 2008	Rosehill Recycled Water Scheme Preliminary Cultural Heritage Assessment	Survey	No sites were identified during survey, although it was noted that one artefact scatter and one PAD were both located in close proximity. An area of sensitivity was demarcated.
Environmental Resources Management Australia Pty Ltd, 2010	Lots 8, 9, 10 DP27107 and Lot 19 DP239091 Claremont Meadows	Test excavation and salvage	Test excavations were undertaken for three sites identified in the 2006 assessment (CMSW3, CMSW4 and CMSW5), while test excavation and salvage were undertaken for site CMSW1. A total of 773 artefacts were recovered and included flaked stone and flaked glass, suggesting site occupation in the contact period.
Archaeological and Heritage Management Solutions Pty Ltd, 2012	Aboriginal Archaeological Survey Report: Werrington Arterial Road (M4 Motorway – Great Western Highway), Claremont Meadows, NSW	Survey	An assessment was undertaken for proposed upgrade works at Gipps Street and Kent Road from the M4 Motorway to the Great Western Highway, near Claremont Meadows. A total of seven Aboriginal sites were identified within the study area, with a further three in close proximity, outside the study area boundary. Five of the sites had been previously recorded; five sites were new recordings. The sites included seven

Author	Project	Investigation type	Summary of results
			isolated artefacts and three artefact scatters (one identified as having an associated area of PAD). Site #45-5-2898 was verified as being outside the study area, as the AHIMS coordinates had erroneously identified it as within. Site avoidance was recommended with an AHIP stated as needed if sites could not be avoided.
Kelleher Nightingale Consulting Pty Ltd, 2012	Werrington Arterial Road M4 Motorway to Great Western Highway Cultural Heritage Assessment Report	Desktop	A report was compiled to support the AHIP application for the proposed upgrades at Kent Road and Gipps Street between the M4 Motorway and the Great Western Highway, as part of the Werrington Arterial Road project near Claremont Meadows. Of the 10 sites identified (seven isolated artefacts and three artefact scatters), seven were to be destroyed, two were to be protected and preserved, and one was to be partially destroyed. An AHIP (C0000636) was subsequently issued for the impact.
Kelleher Nightingale Consulting Pty Ltd, 2013b	Sydney Science Park Development, Luddenham	Survey	Archaeological surveys were undertaken across a 448 hectares parcel of land proposed for rezoning and development. This included a section within the construction footprint to the north of Luddenham Road. Five archaeological sites (including one previously recorded site) and three areas of PAD were identified. An AHIP was recommended for the development.
Kelleher Nightingale Consulting Pty Ltd, 2013a Kelleher Nightingale Consulting Pty Ltd, 2016a	M4 Managed Motorway from Lapstone (Western End) to Strathfield (Eastern End)	Survey and cultural heritage assessment	33 Aboriginal sites were shown to be located within the M4MM corridor, including previously recorded sites (Brayshaw and Haglund 1996) and two new artefact scatters. High levels of disturbance were observed during surveys. AHIP C0002113, AHIMS Permit ID 4001 was subsequently issued for the recommended salvage excavation, community collection and destruction of Aboriginal objects throughout the development.
Biosis Research Pty Ltd, 2016	Mamre West Precinct, Orchard Hills	Survey and test excavation Salvage	Survey recorded a single artefact scatter comprising 11 stone artefacts. Test excavation across four areas of identified sensitivity identified a total of 78 artefacts. Subsequent salvage excavations recovered 43 artefacts from 39 excavation units, with an overall density of 1.1/m ² .

Author	Project	Investigation type	Summary of results
Kelleher Nightingale Consulting Pty Ltd, 2016b	The Northern Road Upgrade Stage 3 Jamison Road, Penrith to Glenmore Parkway	Survey	Pedestrian surveys were undertaken across a four kilometre stretch of land proposed for development. Four artefact scatters and two isolated artefacts were identified, most of these on the crests and slopes of a north-south running ridgeline. Five of the sites showed evidence of high disturbance from infrastructure and erosion, with low archaeological potential. One site (TNR AFT 32) exhibited evidence of in situ material and moderate archaeological potential. The assessment of site TNR ART 32 prompted the adjustment of RMS's concept design to ensure it was avoided. Two sites were assessed as potentially impacted by the proposed works and an AHIP was recommended. AHIP C0002492, AHIMS Permit ID 4078 was subsequently issued for these impacts. Three additional sites were identified as within the boundary of a separate AHIP application (KNC 2016a, AHIP C0002113) that was already in progress at the time of the assessment.
Kelleher Nightingale Consulting Pty Ltd, 2018	Sydney Science Park Development Luddenham, NSW Aboriginal Archaeological Assessment Test Excavation Report	Test Excavation	The study area, located on Luddenham Road, Luddenham, was to be developed as Sydney Science Park, a place to install leading science-based businesses, tertiary institutions, research and development providers. A total of 15 artefacts were recovered from across 24 test pits at RPS LTPAS01. Materials were predominantly silcrete (n=11) whilst artefacts of silicified tuff (n=3) and quartzite (n=1) were also found. Further to this a total of two artefacts were recovered from the five test pits excavated at SSP 1, 29 artefacts were recovered from the 22 test pits excavated at SSP 2, a total of 36 artefacts were recovered from the 15 test pits excavated at SSP 3, 42 artefacts were recovered from the 26 test pits excavated at SSP PAD 1, six artefacts were recovered from the 12 test squares excavated at SSP PAD 2 and 76 artefacts were recovered from the 47 test squares excavated at SSP PAD 3 and 76 artefacts were recovered from the 47 test squares excavated at SSP PAD 3.
Kelleher Nightingale Consulting Pty Ltd, 2018b	Sydney Science Park Development, Luddenham, NSW Cultural Heritage Assessment Report	Desktop	Following test excavations this report was compiled to support an all of area AHIP application.

Author	Project	Investigation type	Summary of results
Streat & Pavinich, 2018	Aboriginal Test Excavation Report Lot 2 Section 4 DP 2954 111-1141 Elizabeth Drive, Cecil Park	Test excavation	30 test trenches were excavated across the study area of a proposed subdivision, located to the east of the construction footprint. Intact soil profiles were present in some areas; however, no Aboriginal archaeological material was identified.
Roads and Maritime Services, 2019	M12 Motorway concept design and Environmental Impact Statement ACHAR	Survey and test excavation	<p>Field surveys and test excavations conducted along the proposed M12 Motorway identified nine stone artefact sites and 17 areas of PAD, all grouped around major creek lines. PADs were subsequently excavated in linear transects extending away from identified creek lines. A total of 1,509 Aboriginal artefacts were recovered from 16 of the 17 PADs, comprising 1,404 flaked artefacts, in addition to hammer stones, stone fragments and an ochre pencil. Across the sites, subsurface extents suggested that subsurface material was extensive across the site and continued into the surrounding landscape.</p> <p>The construction footprint crosses into PAD M12-BWB, defined as an area of creek flats immediately north of Elizabeth Drive and extending at least 520 m along an east-west axis from Badgerys Creek. M12-BWB contained a total of 72 artefacts across 13 test pits. Artefact densities were generally low; however, one pit recorded 24 artefacts. Artefact distributions demonstrated that artefacts were located throughout the soil profile but occurred consistently in topsoils up to 360 m from creek. The site was assessed to be of low-moderate significance, with the exception of high social significance.</p> <p>Overall, 19 sites were to be impacted by the project, including the partial impact (1.7 ha) of BWB. Mitigation measure such as salvage and protective fencing were recommended.</p>
Baker Archaeology Pty Ltd, 2019	University of Sydney lands at Badgerys Creek ACHAR	Survey	Pedestrian field surveys were conducted to assess archaeological sensitivity across parcels of farmland, including the section of the construction footprint to the north of Elizabeth Drive. A total of 29 previously unrecorded sites were identified (UoS 1 – 29), all of which consisted of stone artefact sites ranging from densities of one to 100 artefacts. Two low density artefact sites, (UOS 06 and UOS 27) were located within the current construction footprint. There are

Author	Project	Investigation type	Summary of results
			also zoned areas for conservation value, with the construction footprint passing through areas zoned as low archaeological value, with the exception of the section within the vicinity of Badgerys Creek associated with site BWB, assessed as moderate

Based on the summary provided in the table above, past assessments undertaken across the wider region including the construction footprint have identified the presence of Aboriginal artefacts in both surface and subsurface contexts. Artefact sites have predominantly been identified in proximity to water sources, although other landforms may contain sites if they have not been subject to high levels of past disturbance. Although artefact sites are the most common across the area other site types have been identified in the region, including culturally modified trees. There are both known AHIMS sites and areas of archaeological sensitivity that are likely to contain intact subsurface deposits present within the bounds of the construction footprint. This is discussed further in Section 5.4 and Chapter 6.0.

5.2.2 On-airport archaeological background

Extensive archaeological investigation has been undertaken and is currently ongoing within the bounds of Western Sydney International. Survey and test excavation were undertaken in 2015 and salvage works are currently underway as development works continue. The results of the 2015 investigation (see Table 5-4) identified sites and artefact assemblages consistent with those evident in the wider region (as discussed in the previous section in relation to the off-airport area).

Table 5-4 Previous Aboriginal archaeological investigations

Author	Project	Investigation type	Summary of results
Haglund, 1978	Major airport needs of Sydney study; survey of Aboriginal sites and relics, second Sydney airport site options	Survey	Pedestrian surveys were undertaken over multiple sites selected as potential locations of a second airport, with the aim of identifying Aboriginal archaeological constraints. A number of sites were identified, including three north of Elizabeth Drive (AHIMS sites #45-5-0213, 45-5-0214 and 45-5-0215). No sites were identified within the construction footprint.
Lance & Hughes, 1984	Second Sydney Airport Aboriginal Archaeological Study: Badgerys Creek/Wilton	Survey	Comprehensive survey undertaken over sample areas within Badgerys Creek to assess Aboriginal archaeological sensitivity. Results indicated poor surface visibility adjacent to creeks and on hillslopes due to vegetation growth. One artefact scatter (AHIMS site #45-5-0517) was identified in a ploughed field adjacent to Badgerys Creek.
Navin Officer Heritage Consultants Pty Ltd, 1997	Proposal for Second Sydney Airport at Badgerys Creek or Holsworthy Military Area	Survey	Archaeological surveys were undertaken for alternative airport locations at Badgerys Creek and Holsworthy Military Training Area. 111 Aboriginal sites were recorded across the Badgerys Creek study area, including one previously recorded site (#45-5-0517). These predominately consisted of stone artefact

Author	Project	Investigation type	Summary of results
			sites; however, 8 scarred trees and one area of PAD were also recorded. Sites were generally low density, with the exception of higher densities in valley floor and fluvial corridor landforms. Most sites were assessed to be in disturbed contexts. Badgerys Creek was assessed as a lesser impact due to the presence of highly sensitive rockshelters at the Holsworthy site. Recommendations included a more detailed survey of impacted areas, subsurface testing and salvage.
Artefact Heritage, 2012	The Northern Road Upgrade	Survey	A total of new 32 sites were recorded, including 11 stone artefact sites, two scarred trees and 1 PAD. Sites were located across varied landforms. Four previously recorded sites were assessed as destroyed.
AMBS, 2014	Environmental survey of Commonwealth Land at Badgerys Creek: Aboriginal Heritage	Desktop and survey	<p>A desktop review and archaeological survey were undertaken for Commonwealth owned land at Badgerys Creek. 21 previously recorded sites were inspected to determine their condition. Only seven sites were relocated, consisting of five stone artefact sites and two possible scarred trees.</p> <p>Results concluded that the area contained greater subsurface potential than assessed within the 1997 report (Navin Officer 1997).</p>
Navin Officer Heritage Consultants Pty Ltd, 2015	Western Sydney Airport Aboriginal Cultural Heritage Assessment	Field inspection and test excavation	<p>An archaeological assessment was undertaken for Stage 1 of the proposed 1,700 hectares Western Sydney Airport at Badgerys Creek. Desktop review revealed a total of 51 previously recorded sites within the study area.</p> <p>38 test pit locations were initially proposed for testing; however, only 11 of these were excavated following field inspection of the locations. Each location comprised a total of 10-14 x 5m² test pits.</p> <p>Following field inspections of excavation sites and test excavation, a total of 23 new Aboriginal sites were recorded, comprising of nine surface sites, 13 subsurface sites and one site with both surface and subsurface expressions of artefacts.</p> <p>Due to the nature of impact proposed for the construction of the airport, the sensitivity of the study area for Aboriginal sites, the cumulative impact of</p>

Author	Project	Investigation type	Summary of results
			development across the Cumberland Plain and strong opposition from Aboriginal stakeholders, the preparation of a conservation management plan was recommended.
Department of Infrastructure and Regional Development, 2016	Western Sydney International - Environmental Impact Statement	Survey and Test Excavation	Survey and test excavation were carried out at both the Stage 1 area and areas outside of the Stage 1 area of Western Sydney International in May 2015. In addition to previously recorded sites, a total of 23 new sites were identified, comprising 14 subsurface artefact deposits (identified during test excavation), nine open artefact sites (determined by the surface expression of artefacts) and one grinding groove site. A total of 39 sites (all open artefact sites) were identified within impact areas for the development.
Navin Officer Heritage Consultants Pty Ltd, 2017	Western Sydney Airport - Enabling Activities, Aboriginal Cultural Heritage Management Plan	Desktop	An Aboriginal Cultural Heritage Management Plan (ACHMP) was prepared for Aboriginal archaeological survey and salvage works undertaken prior to the Western Sydney Airport initial enabling works. Upon completion of the ACHMP and subsequent survey and salvage works in 2018, an updated inventory was prepared of all surface and subsurface sites known across the site (n=127).
WSA Co, 2018	Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan	Desktop	An Aboriginal Cultural Heritage CEMP was prepared for further works required at the Western Sydney Airport. The CEMP undertook a risk assessment for potential impacts of the works on Aboriginal cultural heritage and detailed mitigation measures for reducing this impact. The CEMP indicated that the previous inventory of Aboriginal archaeological sites across the site would be updated with additional finds following targeted and selective survey and salvage programs.

5.3 Regional context

A detailed examination of the regional context of Sydney and the Cumberland Plain, with relevant details on occupation chronology and site distribution, is included in Appendix I.

Aboriginal site distribution on the Cumberland Plain has been linked to a variety of environmental factors, with distance to water, stream order, landform and geology (including proximity to known stone sources) variously highlighted as important influences. White and McDonald's (2010) analysis both supports and negates various aspects of the postulated relationships between these factors and Aboriginal site patterning on the Cumberland Plain. Key findings can be summarised as follows:

- Artefact distributions do not, as implied by the models of Kohen (1986) and Smith (1989), form bounded 'sites' but rather 'landscapes'
- Artefact distribution does, as variably expressed by AMBS (2000), Kohen (1986), Jo McDonald CHM (1997b, 2005) and Smith (1989), appear to vary with proximity to water, albeit to different extents based on stream order
- Artefact density does, as suggested by Jo McDonald CHM (1997b, 2005), appear to vary significantly with stream order
- Artefact density does, as suggested by Jo McDonald CHM (1997b, 2005), appear to vary significantly with landform
- Aboriginal archaeological sites on the Cumberland Plain cannot, as proposed by Jo McDonald CHM (2005), be adequately characterized on the basis of surface evidence alone. Most areas, regardless of surface indications, contain subsurface archaeological deposit(s)
- The orientation of open land surfaces appears to have influenced the selection of artefact discard locations in the lower portions of valleys, with generally higher densities on lower slopes facing north and north-east
- Distance from known silcrete sources does not, on present evidence at least, appear to have influenced intensity of artefact discard (cf. Dallas & Witter 1983)
- Trends in artefact density and distribution indicate long-term, large scale patterns. Short term models of settlement organization are insufficient to account for these artefact distributions
- Social and/or symbolic factors may have influenced site selection along with the distributions of economic and other resources.

More recently, AHMS (2015), employing a comparable analytical methodology to White and McDonald (2010), undertook an analysis of lithic artefact distribution across sixteen northwestern Cumberland Plain landscapes subject to dispersed testing and/or targeted open area salvage excavations. The dataset for this analysis, which sought, in common with White and McDonald's (2010) study, to identify patterns in artefact discard¹ comprised 2,988 artefacts from 345 dispersed test pits (1 m²) along multiple pipeline corridors. In common with White and McDonald (2010: 32-33), AHMS found that artefact distribution within their sampled landscapes varied significantly in relation to both stream order and landform, with mean artefact densities highest in third order landscapes (16.7 artefacts/m²) and on terraces (16.9 artefacts/m²). Interestingly, however, the mean artefact density for third order landscapes in AHMS's (2015) dataset (i.e., 16.7 artefacts/m²) was found to exceed that for fourth order landscapes in the RHDA dataset (13.9 artefacts/m²). The mean artefact density for creek flats in AHMS's dataset (7.8 artefacts/m²) was likewise found to exceed its counterpart in the RHDA dataset (3.8 artefacts/m²), suggesting that creek flats in AHMS's sampled landscapes may have been more favoured for occupation than those in the RHDA or, alternatively, that creek flats in the RHDA had been subject to more intensive flood-erosion activity (resulting in a greater loss of artefacts).

In keeping with White and McDonald's (2010:34) results, AHMS found that in second order landscapes, artefact density was highest within 50 metres of water. Distance to water in fourth order landscapes was not assessed by AHMS. However, in a comparable finding to White and McDonald's (2010:34, Table 9) fourth order dataset, AHMS found that in third order landscapes, artefact density was highest between 51 and 100 metres from water. Consideration of first and third order landscapes in combination likewise showed that mean artefact density was highest between 51 and 100 metres of water, suggesting, in combination with the above, that landform elements located at a slightly greater distance to creeks (and particularly larger creeks) were favoured for sustained/repeated occupation². While limited to lower slopes, AHMS's analysis of artefact distribution in relation to slope aspect revealed both similarities and differences with the RHDA dataset, with southeast-facing lower slopes in AHMS's sampled landscapes exhibiting the highest mean artefact density (as opposed to north/northeast-facing slopes in the RHDA dataset), followed by northeast-facing lower slopes. Finally, AHMS's analysis of artefact distribution in relation to distance to known silcrete sources produced an

¹ And, by extension, past Aboriginal land use preferences.

² For the RHDA, White and McDonald (2010:33) attributed a comparable finding to factors such as allowing animals to drink and catching a cool breeze.

entirely different result to White and McDonald's (2010:35, Table 12) analysis of the same relationship, with the latter revealing a pattern of increasing artefact density with increasing distance from known sources. In the AHMS dataset, artefact density was highest within two to three kilometres of known silcrete sources. However, outside of this finding, no clear patterning was evident, suggesting, in line with White and McDonald's (2010) findings, that distance to known silcrete sources likely had little influence over artefact discard rates.

Key observations to be drawn from a review of the existing environment and the existing archaeological models for Cumberland Plain archaeology are as follows:

- The construction footprint contains a range of landforms, varying from alluvial flats and gently inclined slopes, to ridges and flat-topped terraces. The distribution and density of archaeological material associated with past Aboriginal peoples moving through this varied landscape are likely to have been influenced by the suitability of landforms for campsites. Areas considered to have the highest archaeological sensitivity are predominantly undisturbed terraces and flats, especially when elevated and well-drained.
- Prior to European occupation, the permanency of potable water sources is likely to have played an important role influencing the nature and duration of Aboriginal activity in their vicinity. More permanent watercourses (e.g. South Creek, Badgerys Creek and Blaxland Creek) are likely to have attracted more intensive or longer-term occupation activity; while lower order streams may have attracted short term or single activity occupation.
- The availability of raw lithic material (e.g. silcrete boulders observed in South Creek) is also likely to have influenced the nature of activities at the site and may be correlated with higher artefact densities and evidence of tool manufacture.
- Archaeological deposits may have been preserved at depth in alluvial contexts.
- Original native vegetation has been cleared from the construction footprint as a result of European land use practices, including farming and grazing. As old growth trees with the potential for cultural modification have been removed during the past clearance activities, it is unlikely that scarred or carved trees will be present within the construction footprint, with the possible exception of the small sections of riparian corridors.
- The construction footprint has been subject to a range of historic and recent land use impacts including: native vegetation clearance, pastoral activities (e.g. grazing, fencing and dam excavation), the construction of residential and commercial structures, as well as scientific and industrial facilities with their associated subsurface infrastructure services. Key archaeological implications of these activities include the destruction, in areas of grossly modified terrain, of pre-existing sites and deposit(s); the disturbance of pre-existing sites and deposit(s) through both direct and indirect (e.g. erosion) means, resulting in a loss of archaeological integrity, the removal of culturally modified trees and an increase, in areas affected by erosion, of archaeological site visibility.

5.4 Local context

5.4.1 Off-airport local context

AHIMS database

The AHIMS database, administered by Heritage NSW, contains records of all Aboriginal objects reported to the Director General in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

Three searches of the AHIMS database were undertaken on 1 April 2019 (Search IDs 411399, 411404 and 411419). This was undertaken over three search areas as the AHIMS register only provides search results for areas with less than 120 sites contained within them. Each of these searches was updated on 13 March 2020 and again on 6 May 2020. A fourth search was undertaken on 22 May 2020 (Search ID 507243). These searches covered an approximate area of 58 kilometres by nine kilometres, centred on the project, as well as sites in the immediately surrounding region.

A total of 360 sites were identified in these search results, comprising the study area for this assessment. The 360 sites identified in the search results are summarised in Table 5-5. Of these, a total of 10 sites were found to have centroids registered within the bounds of the construction footprint, with eight in the on-airport area and two in the off-airport area. The full search results are included in Appendix J (note: AHIMS sites not presented in exhibition version of this technical paper). The AHIMS sites are shown in relation to the project and the construction footprint on Figure 5-5a to Figure 5-5f (note: AHIMS sites not presented in exhibition version of this technical paper).

As is typical for the Cumberland Plain, artefact scatters and isolated artefact sites with and without other forms of archaeological evidence were the most common site type represented within the AHIMS search area (n=309 combined). Other, comparatively poorly represented types included nine PADs, six culturally modified trees, three art sites and one grinding groove site. It should be noted that a PAD is not a site, rather it is an area of potential awaiting verification of site status following further investigation to determine the presence or absence of subsurface artefact bearing cultural deposits.

There were 30 Destroyed sites listed in the search results as well, referring to sites that have been destroyed under the conditions of a permit, usually issued for development works. The destroyed sites were predominantly located in the northern portion of the construction footprint, generally falling between St Marys and Claremont Creek. They were destroyed under permits 3762, 3752, 4001, 4096 and 4228. They were destroyed as a part of developing a regional depot at Plumpton and M4 Motorway upgrade road works between Church Street, Parramatta and Coleman Street, St Marys, as well as between Prospect and Emu Plains. These works included impacts in the suburbs of Riverstone, Schofields and Quakers Hill. Further details on AHIPs that intersect with the study area are included below.

There were also two registrations listed as Not a Site. The category Not a Site refers to a registration which, on further investigation, has been verified as not being of Aboriginal origin (i.e. verified as not having been created by Aboriginal people).

It should also be noted that the AHIMS search result data contains multiple inaccuracies. It is possible that some of the artefact scatter sites may be isolated artefacts, as information on the number of artefacts located in site areas is not present for all of those identified in the search results. Coordinate inaccuracy for AHIMS data is also known from past assessments to be an issue. The given coordinates only represent a centroid, not the full extent of a site's area. As summarised in Table 5-5, there are 360 registered Aboriginal sites within the total study area.

Table 5-5 AHIMS search results

Site type	Number	%
Artefact Scatter	254	70.6
Isolated Artefact	55	15.3
Destroyed	30	8.3
Potential Archaeological Deposit (PAD)	9	2.5
Modified Tree	6	1.7
Art Site	3	0.8
Not a Site	2	0.56
Grinding Groove	1	0.24
Total	360	100

Of the 360 sites within the larger search area, a total of two sites were found to have centroids registered within the bounds of the off-airport construction footprint, one of which has been destroyed. These sites are summarised in Table 5-6. Information on AHIP permits pertinent to destroyed sites in the off-airport area is included in Chapter 6.0.

Table 5-6 AHIMS sites within the off-airport construction footprint

Site ID	Site Name	Site Type/Status	Within off-airport construction footprint
45-5-2640	B22	Artefact Scatter	Aerotropolis core
45-5-4420	GS3	Destroyed	Claremont Meadows services facility

There are errors and omissions with the AHIMS data, with common centroid discrepancy of up to 200 metre due to datum inaccuracy. Further to this, sites frequently extend to an area larger than the centroid coordinate used to represent them. To account for this and to consider that some sites registered outside the construction footprint according to the centroid coordinate, may in reality extend into its bounds, all sites within a buffer of 200 metres around the construction footprint were considered. The 22 sites within the 200 metre buffer of the off-airport construction footprint are summarised in Table 5-7.

As previously noted in Section 2.0, the three sections of Commonwealth land that the construction footprint crosses are managed by an existing HMP, CMP and CEMP. DEOH is managed through the Orchard Hills Defence Area, NSW HMP. The Royal Australian Air Force Telecommunications Unit, Bringelly is managed by a CMP. Western Sydney International is managed by a CEMP. Where available those documents were searched for any further sites not recorded in the AHIMS database. No further sites were identified intersecting with the study area.

Table 5-7 AHIMS sites within 200 metres of the off-airport construction footprint

Site ID	Site Name	Site Type/Status	Closest off-airport or on-airport construction footprint areas	Distance to construction footprint (m)
45-5-0356	Claremont Creek	Destroyed	Claremont Meadows services facility	170
45-5-2628	B 38	Artefact Scatter	Aerotropolis Core	125
45-5-2641	B 23	Artefact Scatter	Aerotropolis Core	80
45-5-2697	B49	Modified Tree	Bringelly services facility	105
45-5-2702	B10	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	80
45-5-2703	B12	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	40
45-5-2706	B57	Artefact Scatter	Bringelly services facility	55
45-5-2784	B 106	Art Site	Bringelly services facility	10
45-5-2791	B 11	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	25
45-5-3190	Roughwood Park 1	Artefact Scatter	Off-airport construction corridor	2
45-5-3191	Roughwood Park 2	Artefact Scatter	Off-airport construction corridor	50
45-5-3773	Luddenham Road 1	Isolated Artefact	Off-airport construction corridor	20
45-5-3776	Orchard Hills ISO2	Isolated Artefact	Off-airport construction corridor	10
45-5-4390	Luddenham Road 3	Artefact Scatter	Off-airport construction corridor	195

Site ID	Site Name	Site Type/ Status	Closest off-airport or on-airport construction footprint areas	Distance to construction footprint (m)
45-5-4418	GS1	Destroyed	Claremont Meadows services facility	5
45-5-4419	GS2	Destroyed	Claremont Meadows services facility	15
45-5-4424	Kent Road North 13	Destroyed	Orchard Hills	135
45-5-4429	M4 North 1	Destroyed	Orchard Hills	130
45-5-4430	Kent Road South 12A	Destroyed	Orchard Hills	80
45-5-4431	Kent Road South 12B	Destroyed	Orchard Hills	20
45-5-4477	South Creek 4	Destroyed	Orchard Hills	180
45-5-5240	Elizabeth Drive AFT 2	Artefact Scatter	Off-airport construction corridor	95

Previous AHIPs

In land covered by NSW legislation, there are a number of existing AHIPs that have been previously granted to cover works and AHIMS site impacts in those areas. Known AHIPs that the construction footprint for the project crosses into include the following (the permits of which are included in full in Appendix K).

- AHIP C0000637 for upgrades to Kent Road and Gipps Street at Claremont Meadows, granted 5 November 2014. The permit authorised impacts to AHIMS sites 45-4-4418, 45-4-4419, 45-4-4420, 45-4-4423, 45-4-4424, 45-4-4428, 45-4-4430 and 45-4-4431. The entire AHIP area was approved for impacts.
- AHIP C0002113 for M4 Western Motorway upgrades at Parramatta, granted 5 September 2016. The permit authorised impacts to AHIMS sites 45-5-1070, 45-5-1071 and 45-5-1074. The entire AHIP area was approved for impacts following the surface collection and salvage that had been proposed as mitigation measures for the destroyed sites.
- AHIP C0003861 for Sydney Science Park, granted 23 July 2018. The permit authorised impacts to AHIMS sites 45-5-4189, 45-5-4707, 45-5-4709 and 45-5-4922. The entire AHIP area was approved for impacts following the completion of salvage works that had been proposed as a mitigation measure for the destroyed sites.

Surface sites above tunnels

Consideration has also been given to those previously recorded sites identified in surface contexts above the two tunnel alignments, as well as areas of archaeological potential along its extent. Currently artefact scatter site 45-5-4423 (GS5) is the only valid site directly over the tunnel alignment and outside the bounds of the construction footprint (with sites 45-5-4418 (GS1), 45-5-4419 (GS2), 45-5-4420 (GS3) and 45-5-4428 (GS4) all listed as Destroyed). There are areas of archaeological potential along the alignment, but it has been assessed as unlikely that these would be directly impacted by the project, as the tunnelling would be at depth and is unlikely to impact directly or indirectly on either surface sites or deposits. Vibration and subsidence are potential risks however that would require management and/or mitigation (see Section 8.0).

Cultural values

The site card recordings for the previously identified sites within the study area are all focussed on archaeological values, describing site features such as the number of artefacts, tool attributes and raw materials rather than what each individual site, or indeed the totality of identified sites across the wider area, means to the Aboriginal community. The site card for 45-5-0356 is the exception, in that although it does not present cultural values, it does note that the artefact scatter site, associated with

both banks of Claremont Creek, is part of a larger connected landscape of sites. With regard to other sites in the surrounding locality, the site card states that there are: “open sites at Colyton, Emu Plains, Mulgoa and the closest known site is at St Marys (an open site) near Mamre Road and the main railway. A scarred tree is known at Greendale and axe grinding grooves and an art site are at Hawkesbury Lookout”. Recognition of the variety and range of Aboriginal sites across the wider landscape attests to the connected cultural landscape of both past and present. Contemporary Aboriginal people have commented that the artefacts of the past take the form of footprints within the contemporary landscape, verifying the continued presence of Aboriginal people and providing a direct physical link to their ancestors who lived in this landscape in the past.

As per the name of the 2013 paper “*All our sites are of high significance*” *Reflections from recent work in the Hunter Valley – Archaeological and Indigenous perspectives* (Sutton, Huntley, & Anderson, 2013), it is important to note that there is a clear difference in approach to understanding a site’s value from a cultural perspective than there is from a scientific/archaeological perspective. Although the substance of that paper was based on cultural heritage management undertaken in the Hunter Valley, the observations regarding the differences between scientific and cultural perspectives is just as valid in relation to the study area for this project. The paper critically analyses the ACHAR process and the Aboriginal consultation requirements in relation to the definition of ‘values’ and the identification of heritage. The quote that forms the title was taken from feedback given by an Aboriginal representative when asked to define the significance of a site in relation to hierarchical terms of low, moderate or high. The comment clearly draws a distinction between scientific values, which are applied to a hierarchy based on factors such as integrity, rarity and research potential, and cultural values which can instead be about connection, emotion, identity and community. Such connections cannot be characterised as more or less important than each other in relation to specific sites, rather a site either has cultural values or it doesn’t, making all identified sites equal, be it an isolated artefact, art site, set of grinding grooves or stone arrangement. In the context of this project, the previously identified artefact sites within the study area all have cultural value and are part of a larger cultural landscape that demonstrates the long-term presence of Aboriginal people across the region. These markers of the past are direct links to the present through the contemporary Aboriginal community, who have also identified landscape features such as waterways as both connections between the sites, and connections of continuity from the past to the present.

The project intends to integrate Aboriginal cultural values into the infrastructure design, considering both cultural values relating to the past and any contemporary Aboriginal social and economic values that are also relevant. This may include the integration of culturally appropriate project design features, public art, interpretative elements, culturally appropriate use of language and landscaping to include gardens and plantings with traditional resource vegetation. The inclusion and integration of such elements will be informed by knowledge holders. Consultation will continue to be guided by the previously mentioned NSW OEH’s *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*. Other relevant cultural protocols on a local level may include documents like the Liverpool City Council Aboriginal Cultural Protocols (Liverpool City Council, 2016).

Key observations

The presence of surface sites within the study area suggests that further as yet undiscovered sites are likely to be present within this area. Areas of archaeological potential are most likely to occur in proximity to surface sites, or on elevated well drained landforms within 10 metres of a permanent water source. Aboriginal cultural values have been identified as present, attached to known sites and landscape features. Additional survey and test excavation would be required to clearly define surface expression and determine the presence or absence of artefact bearing subsurface deposits, but the available information suggests that further sites are likely to be present within the study area. Archaeological field investigations undertaken for the project to date are outlined in Section 6.0, and areas of archaeological potential are outlined in Section 8.0 to inform the impact assessment of the project.

5.4.2 On-airport local context

AHIMS database

Of the 360 sites within the larger search area, a total of eight sites were found to have centroids registered within the bounds of the on-airport construction footprint within the construction footprint. These sites are summarised in Table 5-8.

Table 5-8 AHIMS sites within the on-airport construction footprint

Site ID	Site Name	Site Type	Within on-airport segment	Stage 1 (Y/N)
45-5-2637	B5	Artefact Scatter	Airport construction support site	N
45-5-2665	B88	Artefact Scatter	On-airport construction corridor	Y
45-5-2687	B71	Artefact Scatter	Airport terminal	Y
45-5-5068	B131	Isolated Artefact	On-airport construction corridor	Y
45-5-5078	B136	Isolated Artefact	Airport construction support site	N
45-5-5089	B163	Artefact Scatter	On-airport construction corridor	Y
45-5-5094	B154	Artefact Scatter	On-airport construction corridor	Y
45-5-5100	B147	Artefact Scatter	Airport construction support site	Y

There are 39 sites within the Western Sydney International Stage 1 construction impact zone that would be managed by the Aboriginal Cultural Heritage CEMP. Those sites were listed as B15, B24, B25, B32, B39, B43, B44, B69, B70, B71, B77, B78, B79, B80, B81, B82, B84, B86, B87, B88, B91, B92, B94, B95, B101, B102, B104, B112, B113, B114, B115, B116, B119, B122, B127, B128, B129, B131 and B134. In addition to these, three of the sites within the construction footprint (B147, B154 and B163) are all cited in the Aboriginal Cultural Heritage CEMP as within the area of early enabling earthworks. The remaining two sites in the construction footprint for the project (B5 and B136) fall just outside (on the northern side) of the Environment Conservation Zone. Listed as both surface and likely subsurface artefact scatter sites in the Aboriginal Cultural Heritage CEMP, they would need to be subject to surface collection and salvage pre-development works in that area as per the Aboriginal Cultural Heritage CEMP. Should site collection and salvage not have been undertaken for any of the on-airport direct impact sites prior to the project commencing in those areas, the conditions of the Western Sydney International Aboriginal Cultural Heritage CEMP and related methodologies for collection and salvage would be followed.

As was previously noted, there are errors and omissions with the AHIMS data, with common centroid discrepancy of up to 200 metres due to datum inaccuracy. Further to this, sites frequently extend to an area larger than the centroid coordinate used to represent them. To account for this and to consider that some sites registered outside the construction footprint according to the centroid coordinate, may in reality extend into its bounds, all sites within a buffer of 200 metres around the construction footprint were considered. These sites within the buffer for the on-airport area are summarised in Table 5-9.

Table 5-9 AHIMS sites within 200 metres of the on-airport construction footprint

Site ID	Site Name	Site Type	Closest off-airport or on-airport construction sites	Distance to construction footprint (m)
45-5-2586	B3	Isolated Artefact	Airport construction support site (on-airport, outside Stage 1)	75
45-5-2623	B 68	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	40
45-5-2630	B 40	Modified Tree	Airport construction support site (on-airport, outside Stage 1)	160
45-5-2632	B 44	Artefact Scatter	On-airport construction corridor (Stage 1)	185
45-5-2658	B67	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	160
45-5-2659	B66	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	10
45-5-2673	B101	Artefact Scatter	Airport construction support site (Stage 1)	185

Site ID	Site Name	Site Type	Closest off-airport or on-airport construction sites	Distance to construction footprint (m)
45-5-2680	B78	Artefact Scatter	Airport terminal (Stage 1)	95
45-5-2681	B77	Artefact Scatter	Airport terminal (Stage 1)	120
45-5-2682	B75	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	55
45-5-2683	B76	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	105
45-5-2690	B59	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	150
45-5-2705	B15	Artefact Scatter	Airport construction support site (Stage 1)	130
45-5-2763	B87	Artefact Scatter	On-airport construction corridor (Stage 1)	120
45-5-2770	B70	Artefact Scatter	Airport construction support site (Stage 1)	180
45-5-2788	B 112	Artefact Scatter	Airport construction support site (Stage 1)	140
45-5-2813	B104	Artefact Scatter	Airport construction support site (Stage 1)	120
45-5-2814	B103	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	80
45-5-5022	B113	Isolated Artefact	Airport construction support site (Stage 1)	140
45-5-5055	B118	Isolated Artefact	Airport construction support site (on-airport, outside Stage 1)	90
45-5-5057	B120	Grinding Groove	Airport construction support site (on-airport, outside Stage 1)	135
45-5-5067	B130	Isolated Artefact	Airport construction support site (on-airport, outside Stage 1)	70
45-5-5082	B159	Artefact Scatter	Airport terminal (Stage 1)	60
45-5-5083	B160	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	120
45-5-5085	B162	Artefact Scatter	Airport construction support site (Stage 1)	155
45-5-5086	B164	Artefact Scatter	On-airport construction corridor (Stage 1)	30
45-5-5087	B165	Artefact Scatter	Off-airport construction corridor	70
45-5-5090	B158	Artefact Scatter	Airport construction support site (on-airport, outside Stage 1)	70
45-5-5096	B152	Artefact Scatter	Off-airport construction corridor	165
45-5-5097	B151	Artefact Scatter	Off-airport construction corridor	40
45-5-5099	B146	Artefact Scatter	Airport construction support site (Stage 1)	10

Site ID	Site Name	Site Type	Closest off-airport or on-airport construction sites	Distance to construction footprint (m)
45-5-5102	B148	Artefact Scatter	Airport construction support site (Stage 1)	125
45-5-5173	B169	Artefact Scatter	On-airport construction corridor (Stage 1)	95
45-5-5175	B167	Artefact Scatter	Airport construction support site (Stage 1)	95

Cultural values

The observations made on cultural values in relation to the off-airport area in the earlier section have the same validity for the on-airport area.

Key observations

The higher number of sites identified within the on-airport area is indicative of the high level of archaeological investigation that has occurred there, rather than that area necessarily having more sites than the off-airport area. Aboriginal cultural values have been identified as present, attached to known sites and landscape features. These sites have been considered further in Section 8.5 of this report, but it has been assumed that the on-airport sites and areas of archaeological potential will be collected, salvaged and removed as part of the Western Sydney International development and will therefore cause no additional impact. Prior to commencing works within the on-airport area Sydney Metro will consult with Western Sydney International to confirm site removal and protection works and to update/vary the Aboriginal Cultural Heritage CEMP to specify the rail specific works (see Section 2.2).

5.5 Ethnographic context

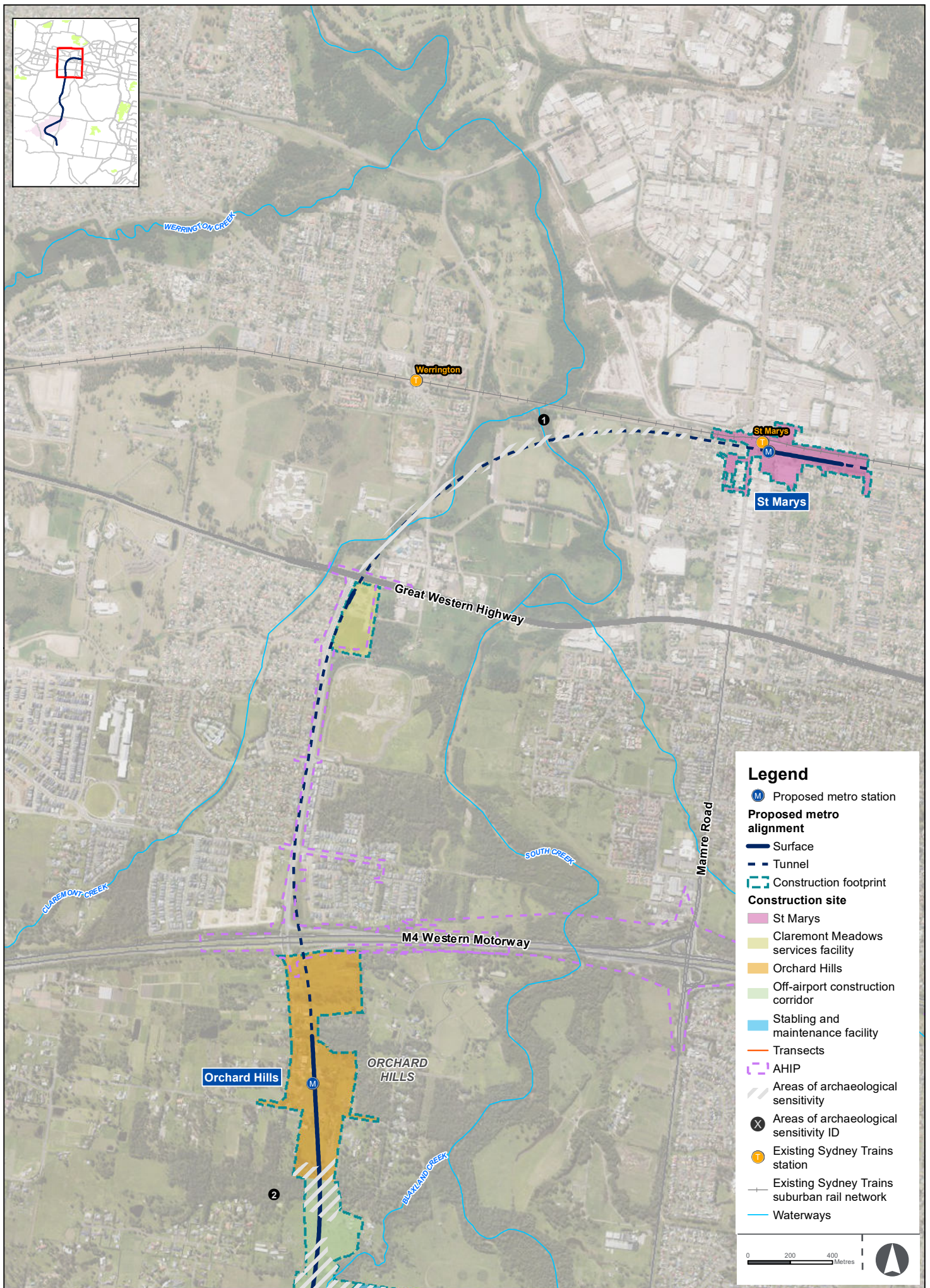
5.5.1 The Darug language and people

The study area is located within the traditional Darug language area (also spelt Dhaŋ-rook, Dharrook, Dhaŋrook, Dharruk and Dharug). Darug is believed to have been spoken from the Hawkesbury River in the north, to Appin in the south, and from the coast west across the Cumberland Plain into the Blue Mountains (Attenbrow, 2002; J. Kohen, 1985, 1988, James Kohen, 1986, 1990). The ethnographic sources from early settlers have been used to develop a picture of what Darug life would have been like prior to the arrival of Europeans. A detailed examination of the available information about the Darug language and people is included in Appendix L.

5.5.2 Post-contact history

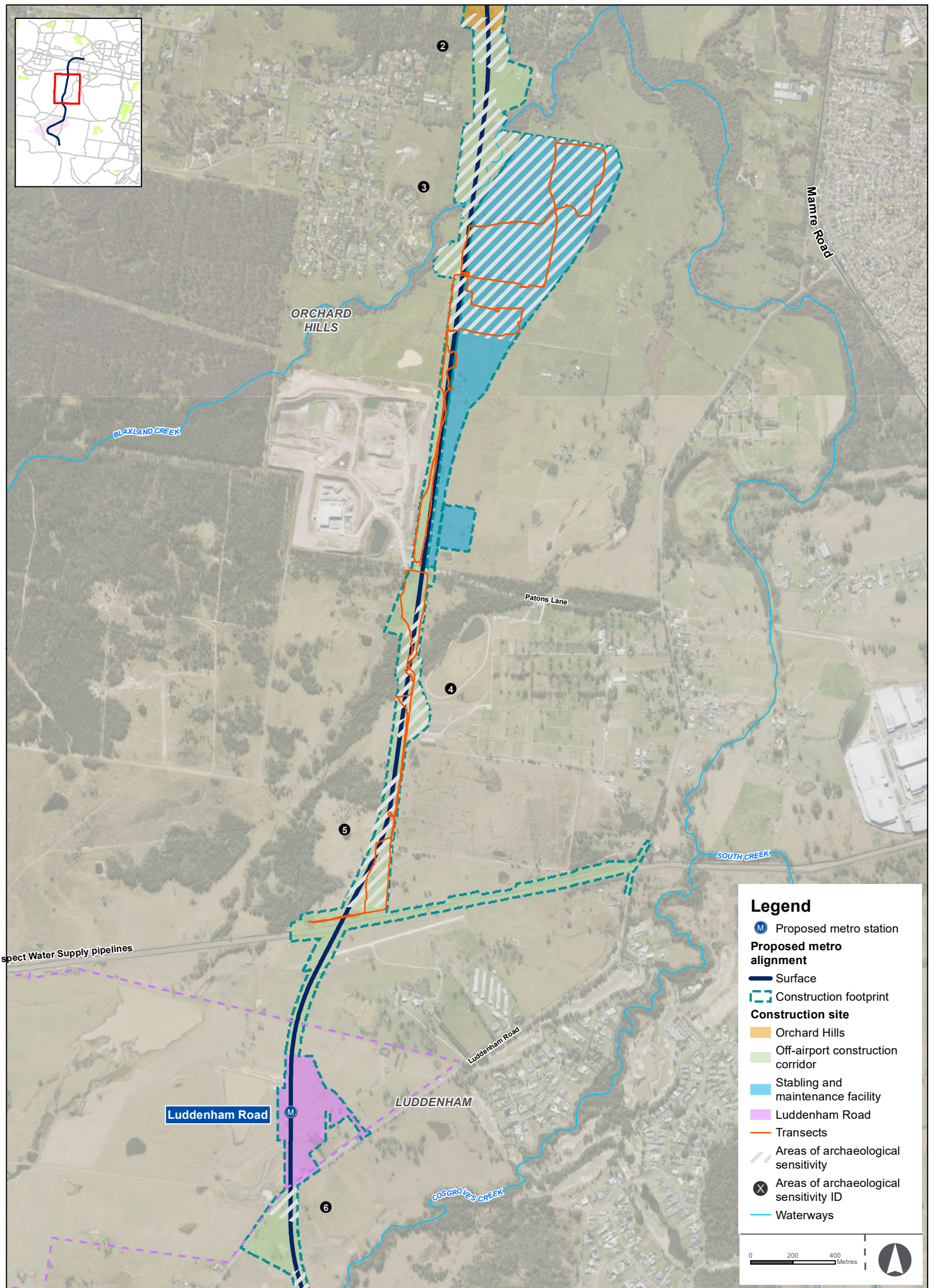
In common with other parts of NSW and Australia more generally, the post-contact history of the Darug-speaking peoples of the Sydney region is primarily one of dispossession, loss, strength and resilience. Populations were drastically reduced due to introduced diseases to which they held no immunity. Frontier violence and being blocked from traditional hunting, gathering and camping grounds also had a dramatic effect on population numbers (Attenbrow 2010:14-15, 21-22). The surviving groups were then subjected to various colonial initiatives aimed at assimilating them into a European way of life, further cutting them off from traditional ways and knowledge.

Active resistance and friendly relations are also attested in available records throughout the post-contact history, with a significant population of Darug people still active within their traditional country to this day. A detailed history of this history is included in Appendix L.



Aboriginal archaeological potential

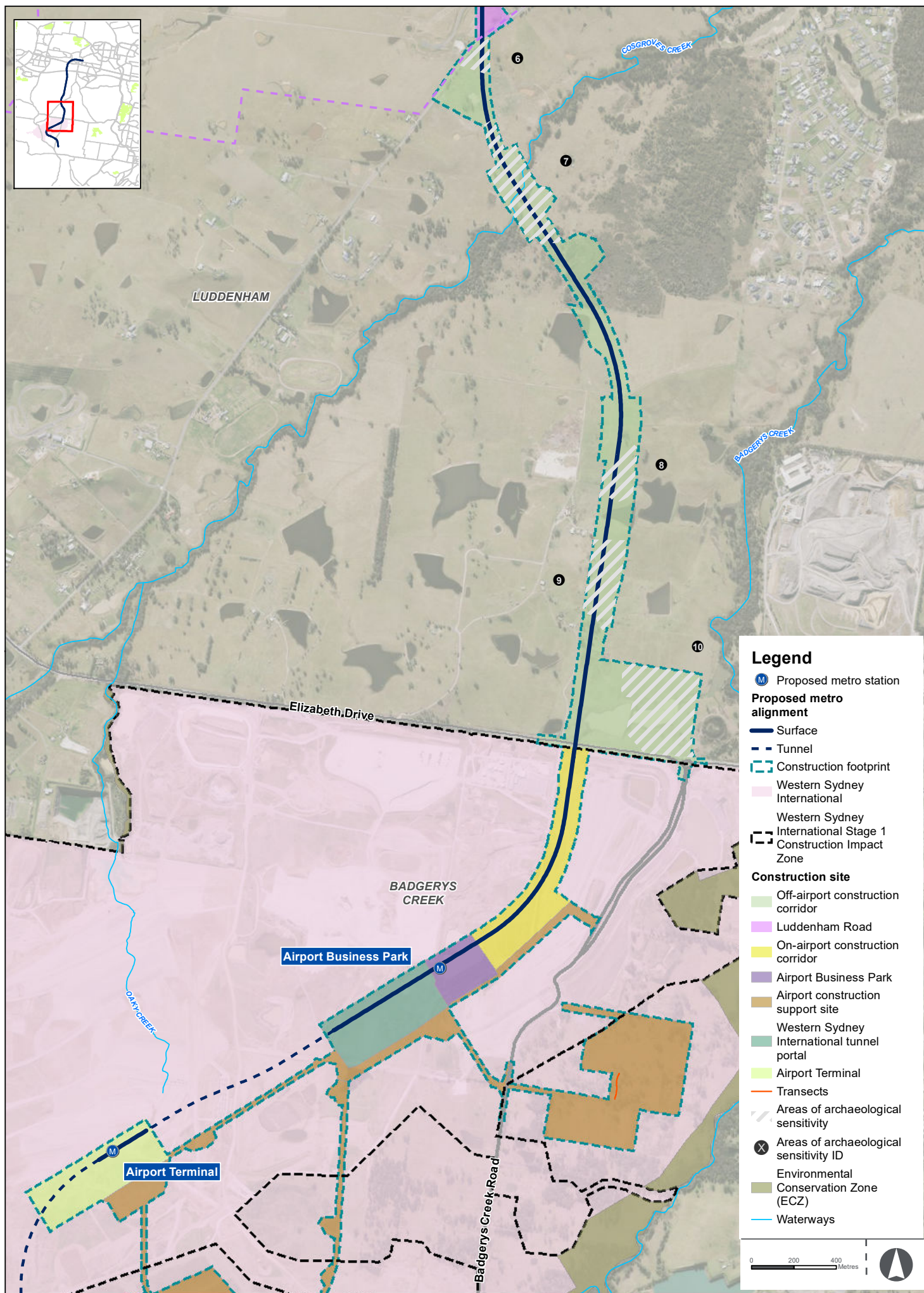
Figure 5-5a

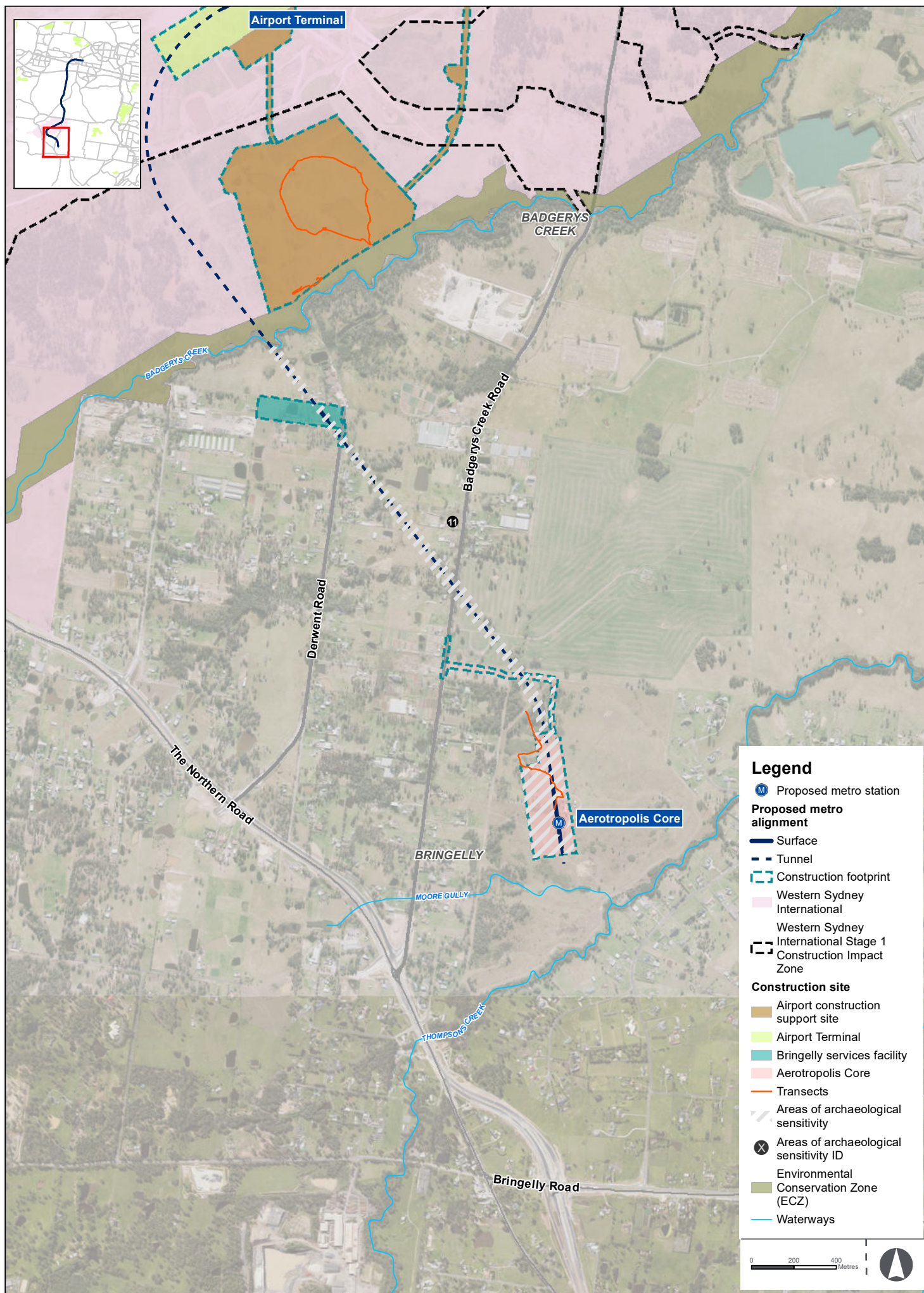


Aboriginal archaeological potential

Figure 5-5b

Indicative only, subject to design development





Aboriginal archaeological potential

Figure 5-5d

Indicative only, subject to design development

6.0 Archaeological field investigations

6.1 Aims and objectives

The aims of the field investigation were to identify and ground-truth previously recorded archaeological sites and to identify and map areas of archaeological and cultural sensitivity. The investigations also provided an opportunity to talk to community members about the cultural values of the landscape and issues of importance to them in the context of the project. Field investigations were undertaken of those land parcels within the construction footprint that could be accessed. These field investigations were undertaken with the participation of RAP representatives. As only limited areas were able to be accessed for field investigations, additional field investigations will be undertaken as part of the updated ACHAR to be prepared later in the project process (see Figure 3-1).

6.2 Field investigation strategy

A full description of the methodology employed for these site inspections has been presented in Chapter 3.0. The transects walked for these field investigations are shown on Figure 5-5e to Figure 5-5f.

6.3 Field team and methods

The field team for the inspections consisted of archaeologists Dr Darran Jordan and Dr Andrew McLaren. RAP representatives consisted of Darren Duncan from Gandangara LALC and Steve Randall from Deerubbin LALC. Inspections of accessible sections of the construction footprint were undertaken over four days on Thursday 27 February, Wednesday 4 March, Tuesday 28 April 2020 and Friday 12 June 2020.

6.4 Investigation results

Off-airport

Limited site investigations were undertaken where land parcel access was available. The transects for each of the investigations are shown on Figure 5-5a to Figure 5-5f.

On Thursday 27 February 2020, an inspection was undertaken of the Aerotropolis Core construction footprint in the off-airport area. The one valid site that was identified in the desktop assessment as being present within the bounds of the construction footprint (artefact scatter site 45-5-2640 (B22)) was targeted for inspection. Although the coordinate was located and the location identified, no surface expression of artefacts was visible at this site during the inspection. It was concluded that this was likely the result of low ground surface visibility due to high levels of grass and weeds currently established at this location. It is likely the site is still valid, with extant artefacts under the grass and/or in subsurface deposits (see Plate 1).

On Wednesday 4 March 2020, three areas were inspected in the off-airport area, the first being to the immediate north of Patons Lane. The second was to the immediate south of the Luddenham Road construction footprint within the off-airport construction corridor. The third was to the immediate north of the Aerotropolis Core construction footprint, outside the bounds of the construction footprint. No previously recorded AHIMS sites were present within the three areas subject to investigation. The centroids for existing sites closest to the transects for these inspections were between 70 metres and 100 metres away. No new sites were identified during the investigations of these areas and no specific areas of archaeological sensitivity were identified at these locations.

On Tuesday 28 April 2020, an inspection was undertaken within the DEOH area. No previously recorded AHIMS sites were present within the area being investigated. The centroid for one site (45-5-3773) was located immediately adjacent to the transect, but it was outside the construction footprint on the opposite side of an impassable fence-line. No new sites were identified during the investigation of this area. It was noted that an unnamed creek that is a tributary of South Creek bisected this investigation area, with areas either side of it appearing to retain intact deposits. These areas have archaeological potential and would require test excavation to be able to discern if any artefact bearing

deposits were present in this area, an approach that was also recommended by attending Deerubbin LALC representative Steve Randall (see Chapter 10.0).

On Friday 12 June 2020, an inspection was undertaken of the stabling and maintenance facility construction footprint. Thick ground vegetation was present across the area obscuring ground surface visibility. No new sites were identified in surface expressions during this inspection. The area was predominantly cleared with little mature vegetation extant in the area. Where trees were present, they were checked for signs of cultural modification, but none were identified. It was noted that much of the north eastern portion of the area was low lying floodplain likely to be water logged at times if inundated. Although the landform was predominantly flat there were some slightly elevated areas which were more likely to have been used for habitation and activity by Aboriginal people in the past. The presence of spring filled dams in the area attests to the availability of resources likely to have been present in the past. Further testing was deemed appropriate to occur in this area to determine the presence or absence of subsurface archaeological deposits.

Feedback from the RAP representatives during the investigations stated that the waterways that crossed the construction footprint have cultural significance as pathways and resource areas for Aboriginal people in the past. The archaeological findings were also that there were likely to be intact deposits associated with either side of the creeks within the construction footprint, including Blaxland Creek, Cosgroves Creek and Badgerys Creek as well as their tributaries. The presence of known sites, areas of potential and waterways linking a connected cultural landscape all attest to the cultural values of the area, elements that may be appropriate to feed into the design and interpretation opportunities for the project. Ground surface visibility was found to be low across much of the inspected areas due to vegetation cover.

On-airport

On Thursday 27 February 2020, an inspection was undertaken on Western Sydney International outside the Stage 1 construction impact zone. The inspection covered areas both within and outside of the project's construction footprint. The on-airport areas investigated were all within the Airport construction support site. The coordinates of 11 previously recorded AHIMS sites located in accessible land parcels were inspected for ground-truthing, but only two of these previously recorded sites were able to be found, being:

- 45-5-5078, this site is listed as an isolated artefact but three surface artefacts were identified during the inspection. This site is within the construction footprint in the Airport construction support site and outside the Western Sydney International Stage 1 construction impact zone.
- 45-5-2699, this site is listed as an artefact scatter, but only a single artefact was able to be identified during the inspection, located on the lower flank of the dam wall. This site is outside the project's construction footprint and outside the Western Sydney International Stage 1 construction impact zone.

In addition to this, two new sites were identified during the inspection, being one isolated artefact and one artefact scatter. These sites were recorded as WSI-IA1-20 and WSI-AS1-20 (see Plate 2 to Plate 7). Both sites were identified outside the project's construction footprint and outside the Western Sydney International Stage 1 construction impact zone.

WSI-AS1-20 consists of a scatter of three artefacts in an area of rabbit/fox burrowing within the Western Sydney International on-airport, outside Stage 1 area. The artefacts, consisting of a complete silicified tuff flake, a proximal silcrete flake and a silicified tuff angular shatter fragment, have been exposed through burrowing. Topographically, the site is located on a gently inclined spur crest approximately 85 metres southwest of an unnamed second order drainage line which feeds into a farm dam around 200 metres to the east. A large ant nest is also present. Surrounding vegetation consists of woodland regrowth.

WSI-IA1-20 comprises a complete silicified tuff flake on the eastern edge of a north-south trending light vehicle track in the Western Sydney International on-airport, outside Stage 1 area. The site is located at the eastern end of a partially vegetated spur crest bordered to the north and south by unnamed first order drainage depressions. The flake measures 26.6 (l) x 34.4 (w) x 14.1 (th) mm, exhibits 1-50% dorsal cortex and has a single conchoidal striking platform. Ground surface visibility on the track itself is good but very poor outside of it due to grass growth.



Plate 1 **45-5-2640 (B22) within the Aerotropolis Core construction footprint during 27 February 2020 inspection**



Plate 2 **WSI-AS1-20**



Plate 3 **WSI-IA1-20**



Plate 4 **WSI-AS1-20 during the inspection**



Plate 5 WSI-IA1-20 during the inspection



Plate 6 Transect during field inspection



Plate 7 Transect during field inspection

7.0 Cultural heritage values and statement of significance

7.1 Overview

The design process has aimed to avoid Aboriginal impacts where possible, with the construction footprint avoiding AHIMS sites wherever possible. The use of subsurface tunnelling for a large proportion of the project would successfully avoid many known sites and minimise the impacts to areas of both Aboriginal cultural significance and archaeological potential.

Off-airport, all but one artefact scatter site (45-5-2640 (B22)) located within the Aerotropolis Core construction footprint, has been avoided. There are further valid sites within the on-airport construction footprint, but as has been noted in Section 2.2, it is assumed all sites approved for removal within Western Sydney International will be removed prior to the project commencing construction in those areas (i.e. for the purposes of assessment it is assumed that this project would not affect any item that has not already been impacted/destroyed by Western Sydney International construction activities).

Due to limited access to private property this assessment has been based on a combination of desktop and limited field investigation. No new sites were identified within the bounds of the construction footprint during the field investigations undertaken thus far (although two new sites, WSI-IA1-20 and WSI-AS1-20, were identified outside the bounds of the construction footprint). RAP consultation has identified that waterways are a culturally significant landform and that sites are important tangible markers in the landscape attesting to the long-term presence of Aboriginal people in this area, the extant material also providing a direct link between contemporary Aboriginal communities and their ancestors. Areas of archaeological sensitivity are present (see Section 8.2) and require further testing and investigation (see Section 10.0). Previously recorded AHIMS sites are the primary focus for identified cultural values.

This section first outlines the principles by which a cultural heritage values assessment is undertaken, then contains details of the identified cultural heritage values of the study area.

7.2 Principles of assessment

Heritage sites hold value for different communities in a variety of different ways. All sites are not equally significant in terms of archaeological/scientific values and thus not equally worthy of conservation and management (Pearson & Sullivan, 1995: 17). One of the primary responsibilities of cultural heritage practitioners, therefore, is to determine which sites are worthy of preservation and management (and why) and, conversely, which are not (and why) (Smith & Burke, 2007: 227). This process is known as *the assessment of cultural significance* and, as highlighted by Pearson and Sullivan (1995: 127), incorporates two interrelated and interdependent components. The first involves identifying, through documentary, physical or oral evidence, the elements that make a heritage site significant, as well as the type(s) of significance it manifests. The second involves determining the degree of value that the site holds for society (i.e. its cultural significance) (Pearson & Sullivan, 1995: 126). As has previously been noted, cultural values are either present or not, and RAPs will not draw a hierarchical distinction between sites and features. All known sites have been identified as having cultural values. Other values associated with the scientific/archaeological components of a site are generally determined through assessment guidelines.

In Australia, the primary guide to the assessment of heritage significance is the *Australian ICOMOS Charter for Places of Cultural Significance* (1999), informally known as *The Burra Charter*, which defines cultural significance as the “aesthetic, historic, scientific, social or spiritual value for past, present or future generations” of a site or place (ICOMOS, 1999: 2). Under the Burra Charter model, the cultural significance of a heritage site or place is assessed in terms of its aesthetic, historic, scientific and social values, none of which are mutually exclusive (see Table 7-1). Establishing cultural significance under the Burra Charter model involves assessing all information relevant to an understanding of the site and its fabric (i.e. its *physical* make-up) (ICOMOS, 1999: 12). The assessment of cultural significance and the preparation of a statement of cultural significance are critical prerequisites to making decisions about the management of any heritage site or place (ICOMOS, 1999: 11).

With respect to Aboriginal sites and places, it is possible to identify two major streams in the overall significance assessment process: the assessment of *scientific value(s)* by archaeologists and the assessment of *social (or cultural) value(s)* by Aboriginal people. Scientific value refers to the importance of a place in terms of its rarity, representativeness and the extent to which it may contribute further information (i.e. its research potential) (OEH 2011: 9). Social or cultural value, meanwhile, refers to the spiritual, traditional, historic and contemporary associations and attachments a place or area has for Aboriginal people and can only be identified through consultation with Aboriginal people (OEH, 2011: 8). Social or cultural value therefore is not limited to specific sites or objects or physical expressions of place.

Table 7-1 Values relevant to determining cultural significance, as defined by The Burra Charter (1999)

Value	Definition
Aesthetic	"Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use" (ICOMOS, 1999: 12).
Historic	"Historic value encompasses the history of aesthetics, science and society...[a] place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may have historic value as the site of an important event" (ICOMOS, 1999: 12).
Scientific	"The scientific or research value of a place will depend on the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information" (ICOMOS, 1999:12).
Social	"Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group" (ICOMOS, 1999: 12).

7.3 Scientific values

The scientific (or archaeological) significance of Aboriginal archaeological sites relates primarily to their potential for providing information about past Aboriginal culture and is commonly assessed on the basis of their research potential, representativeness and rarity. Other criteria, such as aesthetic value and education potential, may also be relevant.

Research potential can be defined as the potential of an archaeological site to address what Bowdler (1981:129) has referred to as "timely and specific research questions". These questions may relate to any number of issues concerning past human lifeways and environments and, as suggested by Bowdler's quote, will inevitably reflect current trends or problems in academic research (Burke & Smith, 2004:249). For their part, Bowdler and Bickford (1984:23-4) suggest that the research potential of an archaeological site can be determined by answering the following series of questions:

1. Can the site contribute knowledge which no other resource can?
2. Can the site contribute knowledge which no other such site can?
3. Is this knowledge relevant to general questions about human history or other substantive subjects?

Several criteria can be used to assess the research potential of an archaeological site. Particularly important in the context of Aboriginal archaeology are the intactness or integrity of the site in question, its complexity and its potential for archaeological deposit (NPWS, 1997: 7). The connectedness of the site to other sites or natural landscape features may also be relevant.

Integrity refers to the extent to which a site has been disturbed by natural and/or anthropogenic phenomena and includes both the state of preservation of particular remains (e.g. animal bones, plant remains) and, where applicable, stratigraphic integrity. Assessments of archaeological integrity are predicated on the notion that undisturbed or minimally disturbed sites are likely to yield higher quality archaeological and/or environmental data than those whose integrity has been significantly compromised by natural and/or anthropogenic phenomena. Establishing levels of preservation or

integrity in the context of a surface survey is difficult. Nonetheless, useful rating schemes are available for 'open' sites (Coutts & Witter, 1977: 34) and scarred trees (Long, 2003).

The *complexity* of a site refers primarily to the nature or character of the artefactual materials or features that constitute it but also includes site structure (e.g. the physical size of the site, spatial patterning in observed cultural materials). In the case of open artefact sites, for example, the principal criteria used to assess complexity are the site's size (i.e. number of artefacts and/or spatial extent), the presence, range and frequency of artefact and raw material types, and the presence of features such as hearths.

Potential for archaeological deposit refers to the potential of a site to contain subsurface archaeological evidence which may, through controlled excavation and analysis, assist in answering questions that are of contemporary archaeological interest. Assessing subsurface potential in the absence of subsurface investigation is difficult. Nonetheless, consideration of a range of factors, including the integrity of the site, the complexity of extant surface evidence, the nature of the local geomorphology (as established through surface observations and documentary research) and the results of previous archaeological excavations in the area, will help inform assessment of this criterion.

Connectedness concerns the relationship between archaeological sites within a given area and may be expressed through a combination of factors such as site location, type and contents. It may, for example, be possible to establish a connection between a stone quarry and hatchet head found nearby. Demonstrating connectedness archaeologically, however, is far from straightforward, especially when dealing with surface evidence alone. Ultimately, this difficulty rests with the need to demonstrate contemporaneity between sites that may have been created hundreds, if not thousands, of years apart. As Shiner (2008: 13) has observed, "much of the surface archaeological record documents the accumulation of materials from multiple behavioural episodes occurring over long periods of discontinuous time". Contemporaneity, then, needs to be demonstrated not assumed.

7.3.1 Rarity and representativeness

Rarity and *representativeness* are related concepts. Rarity refers to the relative uniqueness of a site within its local and regional context. The scientific significance of a site is usually higher if it is unique or rare within either context; conversely, it is usually considered to be of lower scientific significance if it is common in a local or regional context. The concept of representativeness, meanwhile, refers to the question of whether or not a site is "a good example of its type, illustrating clearly the attributes of its significance" (Burke & Smith, 2004: 247). Representativeness is an important criterion as one of the primary goals of cultural heritage management is to preserve for future generations a representative sample of all archaeological site types in their full range of environmental contexts.

In common with rarity, assessments of representativeness within a region are dependent on the state of current knowledge concerning the number and type of archaeological sites present within that region³. This is a critical point, for as suggested by Kuskie (2000) and others (e.g. Bowdler, 1981; Godwin, 2011; Pearson & Sullivan, 1995), the absence across most of Australia of regional-scale quantitative data for Aboriginal sites and places represents a major constraint in assessments of representativeness and rarity. As Bowdler (1981) stressed almost 40 years ago, detailed regional-scale assessments of the Aboriginal archaeological record of Australia are required to address this issue.

7.3.2 Identification process

The investigations undertaken for this assessment have identified one valid AHIMS site within the bounds of the off-airport construction footprint. Site 45-5-2640 (B22) is an artefact scatter located at the Aerotropolis Core construction footprint. It was not able to be relocated during the inspection but is likely to still be extent and obscured by vegetation. Other values across the study area reside in the sites outside the bounds of the construction footprint, the presence of which suggest further as yet unidentified sites are likely to be present within the construction footprint. This is further attested to by the identified areas of archaeological sensitivity associated with relatively undisturbed areas adjacent to waterways.

³ There is, of course, a temporal fluidity to this criterion (i.e., as knowledge of the Aboriginal archaeology of a region increases, assessed levels of representativeness may change, a point of equal relevance to rarity).

7.3.3 Identified scientific values

The artefact assemblage at site 45-5-2640 (B22) is low density and is therefore limited in the research questions it can answer as one discrete location. It is important to note, however, that this site is part of a landscape of linked sites and it is its connection to the wider cultural landscape that allows for a larger suite of research questions to be applied. Research questions are also likely to be answered by testing the identified areas of archaeological potential, which retain a high likelihood to contain previously unidentified sites in subsurface deposits.

7.3.4 Assessment of scientific significance

Site 45-5-2640 has low to moderate scientific significance based on its research value. Research value cannot be verified for areas of PAD because they are a potential resource that has not yet been verified.

7.4 Cultural values

RAP consultation has indicated that all archaeological sites are considered to be of high cultural value to the Aboriginal community as they provide a tangible link to ancestors and are a physical marker in the landscape attesting to the long-term presence of Aboriginal people in this area. Cultural values identified thus far rest in the identified sites, potential sites and landscape features such as waterways. Scientific studies agree that artefact distributions do not, as implied by the models of Kohen (1986) and Smith (1989), form bounded 'sites' but rather 'landscapes'.

Further research and collaboration with the community is required to determine what other cultural values may be attached to the study area including contemporary community values.

7.5 Historic values

No specific historic values have been identified for site 45-5-2640 (B22).

7.6 Aesthetic values

No specific aesthetic values have been identified for site 45-5-2640 (B22). Some aesthetic values may be associated with waterways that cross the landscape, which have been identified as having cultural value due to the association of these being past pathways and resource areas for Aboriginal people. The topography, hydrology and landforms of the study area have been identified during consultation as significant to contemporary Aboriginal communities because they are consistent features that link the wider cultural landscape, a landscape made up of sites and areas that were used by Aboriginal people in the past. Like a palimpsest, these features bleed through from the past into the contemporary landscape as points of continuity that link the contemporary Aboriginal community to the lives and activities of their ancestors. The identified features of the cultural landscape are both links to the past and signs in the present that attest to the ongoing presence of Aboriginal people in this area.

7.7 Consolidated statement of significance

The study area lies within a broader cultural landscape that holds significant traditional and contemporary cultural values for the Aboriginal people of the region. Within this broader cultural landscape there are a range of specific locations and pathways that are known to the contemporary Aboriginal community. Blaxland Creek, South Creek tributary, Cosgroves Creek, Badgerys Creek, Moore Gully, Thompsons Creek and other unnamed waterways were noted during consultation to be past pathways and resource areas for Aboriginal people of the area.

These cultural places are linked to other locations and pathways in the surrounding landscape that hold significance and cultural value for the Aboriginal people of the region. This significance and cultural value of the broader cultural landscape is a result of the intersection of traditional usage, cultural knowledge, historical connection and contemporary cultural understandings. The cultural landscape is linked by Aboriginal sites, which have previously been recorded across the entire study area. The sites act as footprints in the landscape for Aboriginal people, attesting to past uses and linking the ancestors of the past to the present community. One such site is 45-5-2640 (B22), the only currently known Aboriginal site present within the off-airport construction footprint.

All Aboriginal archaeological sites within the study area are of scientific significance, being a finite scientific resource and representing our primary source of evidence regarding past Aboriginal land use within the study area. However, open artefact sites (i.e. isolated artefacts and artefact scatters) in disturbed contexts are generally considered to have low to moderate scientific significance. This site type is the primary occurrence across the study area.

Site 45-5-2640 (B22) consists of a surface scatter of artefacts. It was identified and recorded by Navin Officer Heritage Consultants Pty Ltd in 2000. This Aboriginal archaeological site has associated cultural values and is of importance to the local Aboriginal community, both as a solitary site and in how it connects to the broader landscape of sites across the region. This site has limited scientific/research value on its own, but in combination with areas of potential that may contain artefact bearing deposits, it could provide evidence of the broader tool manufacture and raw material use across the wider landscape through the linked cultural landscape of this region.

8.0 Assessment of potential impacts

8.1 Overview

This section has considered the potential direct and indirect impacts to Aboriginal heritage as a result of the project. Direct and indirect impacts are defined in Section 3.6.

Impacts as a result of the project have considered both known and potential Aboriginal archaeological sites and features. This consideration has also extended to sites with registered centroids located within the 200 metre buffer around the construction footprint. Note that AHIMS locations are not presented in exhibition version of this technical paper.

8.2 Archaeological sensitivity

To inform the desktop predictions, aid in the effectiveness of the field investigations and inform the impact assessment, areas of archaeological sensitivity (i.e. areas considered likely to contain artefact bearing subsurface deposits) were mapped across the construction footprint.

These areas were informed by landform (low gradient areas in close proximity to water courses), previously identified sites (surface expression taken to be an indication of further artefacts below the ground surface where soil deposits were present) and low levels of past disturbance. Where all these attributes connected within the construction footprint it was considered and mapped to be an area of archaeological sensitivity. Some of these areas were further informed by ground-truthing during the field inspections undertaken for this assessment.

Areas of archaeological sensitivity that have not already been inspected will require further investigation, being field investigation of surface expressions at a minimum, or potentially test excavation to determine the presence or absence of subsurface archaeological deposits. The areas of sensitivity are shown in Figure 5-5a to Figure 5-5d and have been used to inform the impact assessment in Section 8.3 and 8.4. Areas that are above the proposed tunnel alignment have been assessed for known sites and areas of archaeological sensitivity (see archaeological sensitivity area 1 on Figure 5-5a and area 11 on Figure 5-5d). Survey of these areas will be required to determine if there are previously unrecorded sites in these areas and if indirect impacts caused by vibration and subsidence are likely to damage sites and/or cultural values. Mitigation measures will be determined following survey so that they can be made specific to sites and values identified within those areas (information not currently known).

8.3 Cultural values

Consultation undertaken to date has identified that cultural values are present within the study area. The currently known examples of this reside predominantly in two features, the previously identified sites which are spread across the area, being interpreted as physical markers attesting to the long-term presence of Aboriginal people in this region and footprints of the ancestors, and the waterways which connect the larger features of the landscape and the sites across it, interpreted as pathways of the past extruding into the present. The project would impact known sites and may impact as yet unidentified sites, damaging the cultural values at these discrete site locations. The project would also cross waterways, having an effect on these physical locations and thus by association the cultural values that are attached to them.

8.4 Potential off-airport impacts

8.4.1 Potential impacts to identified values

Potential direct and indirect impacts as a result of the project are discussed below. Management and mitigations measures as a result of these potential impacts are outlined in Section 10.0.

Potential direct impacts

Potential direct impacts within each construction site are outlined in Table 8-1.

Table 8-1 Potential off-airport direct impacts summary

Construction site	Impacts
St Marys	<ul style="list-style-type: none"> There are no registered AHIMS sites within the curtilage of the St Marys construction site (see Figure 5-5a and Section 5.4). There are no AHIMS sites within 200 metres of the construction site (see Section 5.4 and Figure 5-5a). Based on the high levels of past disturbance in this construction site (including road corridors, rail corridor, the existing St Marys Station, buildings and services), no areas of archaeological sensitivity have been identified within its bounds (see Figure 5-5a). There are no known Aboriginal cultural values specifically associated with this construction site. No potential direct impacts to Aboriginal archaeological sites have been identified in this construction site. No specific cultural values have yet been identified in this construction zone.
Claremont Meadows services facility	<ul style="list-style-type: none"> There was one registered AHIMS site within the bounds of this construction site (artefact scatter site 45-5-4420) (see Figure 5-5a and Section 5.4). This site has however been destroyed under the conditions of AHIP C0000636 and is no longer extant in this construction site. The AHIP covers the entirety of the Claremont Meadows services facility (see Section 5.4.1). There were three AHIMS sites located within 200 metres of this construction site (45-5-0356, 45-5-4418 and 45-5-4419) but all three sites were destroyed under permit conditions (see Section 5.4.1) and are no longer extant at this location (see Section 5.4 and Figure 5-5a). Based on the high levels of past disturbance in this construction site (including road corridors, clearance and development), no areas of archaeological sensitivity have been identified within its bounds (see Figure 5-5a). No direct impacts to Aboriginal archaeology have been identified at this location as the pre-existing archaeology has already been removed. The only currently known cultural values were those associated with the since destroyed AHIMS sites. Although the physical makers in the landscape that were provided by the sites have been removed the site locations may still have cultural value to the Aboriginal community as areas of past Aboriginal activity.
Orchard Hills	<ul style="list-style-type: none"> There are no registered AHIMS sites within the Orchard Hills construction site (see Figure 5-5a and Section 5.4). The northern-most part of this construction site has been subject to impacts under AHIP C0002113 (see Section 5.4.1). There were five artefact scatter sites located within 200 metres of the northern extent of this construction site (45-5-4424, 45-5-4429, 45-5-4430, 45-5-4431 and 45-5-4477) (see Figure 5-5a, b and c and Section 5.4). All five of these sites have been destroyed under permit conditions and they are no longer extant (see Section 5.4). Although there have been past impacts in this area they are not so extensive as to have definitely removed all Aboriginal sites (if present). Based on past impacts, the landform and distance from water channels, archaeological potential has been identified in elevated areas to the south of Landsdowne Road (see archaeological sensitivity area 2 on Figure 5-5a and Figure 5-5b). If intact subsurface deposits are present in this area there is a risk they may be impacted by the project (see Chapter 10.0 for details on management and mitigation). Based on the potential for subsurface deposits to be present, there is the potential for impacts to archaeological heritage within this construction site (see archaeological sensitivity area 2 on Figure 5-5a).

Construction site	Impacts
	<p>and Figure 5-5b). This construction site (particularly areas on sensitivity identified in the area to the south of Lansdowne Road) would need be managed in line with the mitigation measures outlined in Chapter 10.0.</p> <ul style="list-style-type: none"> • Cultural values are associated with the waterways, areas of potential (if sites are identified therein) and the since destroyed AHIMS sites at the northern extent. Although the physical markers in the landscape (provided by the sites) have been removed, the site locations may still have cultural value to the Aboriginal community as areas of past Aboriginal activity.
Stabling and maintenance facility	<ul style="list-style-type: none"> • There are no registered AHIMS sites within the stabling and maintenance facility construction site (see Figure 5-5b and Section 5.4.1). There are two artefact scatters (45-5-3190 and 45-5-3191) and an isolated artefact (45-5-3776) within 200 metres of this construction site, but are separated from the stabling and maintenance facility by the off-airport construction corridor (northern). As such these three sites are discussed in the off-airport construction corridor (northern) section. • Field investigations were undertaken at the southern end of this construction site and no surface artefacts or areas of archaeological potential were identified (see Chapter 6.0). The northern portion of the construction site however is close to the confluence of Blaxland Creek and South Creek and has been identified as having archaeological sensitivity (see Figure 5-5c). Part of the northern area of the stabling and maintenance facility has been ground-truthed during investigations and had high levels of vegetation obscuring ground surface visibility. As a result no new sites were identified but areas of archaeological potential were noted in slightly elevated areas adjacent to water sources and the floodplain. • There are no known Aboriginal cultural values specifically associated with this construction site. If intact subsurface deposits are present in this area there is a risk they may be impacted by the project (see Chapter 10.0). • Based on the potential for subsurface deposits to be present, there is the potential for impacts to archaeological heritage within this construction site (see archaeological sensitivity area 3 on Figure 5-5b). No specific cultural values have yet been identified in this construction zone. This construction footprint would need to be managed in line with the mitigation measures outlined in Chapter 10.0.
Off-airport construction corridor (northern) (between the Orchard Hills and Luddenham Road construction footprint areas as shown on Figure 5-5b)	<ul style="list-style-type: none"> • No surface expressions of artefacts or other site types were identified during the field inspections undertaken to date, but this was primarily due to high levels of vegetation obscuring the ground surface. • Archaeological sensitivity was identified at multiple points along the extent of this construction site (see archaeological sensitivity areas 2, 3, 4 and 5 on Figure 5-5b). This was due to low levels of past disturbance (based on aerial imagery) and multiple water channels crossing through the area, including Blaxland Creek, an unnamed tributary of South Creek and various unnamed tributaries (refer to Figure 5-5b). The banks either side of these water courses are likely to contain artefact bearing deposits (see Section 5.1). • Deerubbin LALC noted that the water channels crossing through this area had cultural significance as part of the larger cultural landscape, connected by water courses which were used in the past as pathways and resource gathering areas (see Sections 4.3.2 and 6.0). • The portion of this area located between the Warragamba to Prospect Water Supply Pipelines and the Luddenham Road construction site has been subject to past impacts under AHIP C0003861 (see Section 5.4.1). The non-AHIP parts of the construction site that have

Construction site	Impacts
	<p>archaeological potential (that have not yet been inspected) will need to be ground-truthed. The results of additional field investigations, including survey, test excavation and consultation, will be reported in the updated ACHAR as per the process flowchart (see Figure 3-1).</p> <ul style="list-style-type: none"> • There are eight artefact scatters (45-5-3190, 45-5-3191, 45-5-5087, 45-5-5096 and 45-5-5097) and two isolated artefacts (45-5-3773 and 45-5-3776) within 200 metres of this construction site. Potential impacts could occur if adequate protection/management measures are not put into place (see Chapter 10.0). • Based on the presence of sites in the surrounding area and the likelihood of subsurface deposits to be present within the construction footprint, there is the potential for impacts to archaeological heritage to occur. • Cultural values are present associated with the waterways, areas of potential (if sites are identified therein) and the known AHIMS sites. This construction site would need to be managed in line with the mitigation measures outlined in Chapter 10.0.
Luddenham Road	<ul style="list-style-type: none"> • There are no registered AHIMS sites within the Luddenham Road construction site (see Section 5.4). There are no known AHIMS sites within 200 metres of this construction site (see Section 5.4). • This construction site has been subject to impacts under AHIP C0003861 (see Section 5.4) which are likely to have removed archaeological values. • There are no currently known Aboriginal cultural values specifically associated with this construction site. • This construction site would need be managed in line with the mitigation measures outlined in Chapter 10.0.
Off-airport construction corridor (southern) (between the Luddenham Road and the 'on-airport corridor' construction site)	<ul style="list-style-type: none"> • There are no registered AHIMS sites within the southern off-airport construction corridor (located between Luddenham Road and the on-airport area) (see Figure 5-5b and Figure 5-5c and Section 5.4). • A small central portion of this construction site was subject to field investigation during this assessment. No surface expressions of artefacts or other sites were identified (see Chapter 6.0). • Deerubbin LALC noted that the water channels crossing through this area had cultural significance as part of the larger cultural landscape, connected by water courses which were used in the past as pathways and resource gathering areas (see Chapter 6.0). • Portions of this construction site have been assessed as having archaeological potential, due to the presence of flats and lower slopes in proximity to Cosgroves Creek and unnamed drainage lines which cross this area (see Section 5.4 and Figure 5-5b and Figure 5-5c). The sections of this construction site with archaeological potential, not yet subject to field inspection, will need to be ground-truthed. • Based on the likelihood of subsurface deposits to be present within the construction footprint, there is the potential for impacts to archaeological heritage to occur (see archaeological sensitivity areas 6, 7, 8, 9 and 10 on Figure 5-5b and Figure 5-5c). • Cultural heritage values are present in landforms such as waterways and would be present in the areas of archaeological potential if they prove to contain sites. This construction site would need be managed in line with the mitigation measures outlined in Chapter 10.0.

Construction site	Impacts
Bringelly services facility	<ul style="list-style-type: none"> • There are no registered AHIMS sites within the curtilage of the Bringelly services facility (see Section 5.4 and Figure 5-5d). • This construction site has not been subject to field investigation but based on desktop data archaeological potential was not identified in this area, due to past disturbances (dam construction and development) (see Section 5.4 and Figure 5-5d). • There are no known Aboriginal cultural values specifically associated with this construction site. • There are three known AHIMS sites within 200 metres of the Bringelly services facility, being modified tree 45-5-2697 (approximately 100 m north of the Bringelly services facility), artefact scatter 45-5-2706 (approximately 50 m north of the Bringelly services facility) and art site 45-5-2784 (approximately 10 m south of the Bringelly services facility). As shown on Figure 5-5d these three sites are not directly above the proposed alignment for the tunnel. Impacts could occur if adequate protection/management measures are not put into place (see Chapter 10.0). • Based on the presence of sites in the surrounding area, there is the potential for impacts to archaeological and cultural values to occur, as the identified sites within 200 metres of the construction zone have both archaeological and cultural values associated with them (see archaeological sensitivity area 11 on Figure 5-5d). This construction footprint would need to be ground-truthed and managed in line with the mitigation measures outlined in Chapter 10.0.
Aerotropolis Core	<ul style="list-style-type: none"> • There is one AHIMS site located within the bounds of the Aerotropolis Core construction site, artefact scatter 45-5-2640 (see Section 5.4 and Figure 5-5d). This area was subject to field investigation during this assessment but no surface artefacts were able to be located due to high levels of vegetation cover obscuring ground surfaces (see Chapter 6.0). There are two artefact scatter sites within 200 metres of the Aerotropolis Core, located to the south of the construction site in proximity to Moore Gully. • Site 45-5-2640 has Aboriginal cultural significance as a tangible link for Aboriginal people to their ancestors and evidence of the long-term presence and activity of Aboriginal people in this region (see Chapter 6.0). • Based on the likelihood of sites and subsurface deposits to be present within the construction footprint, there is the potential for impacts to occur to both archaeological and cultural heritage to occur in relation to sites (see archaeological sensitivity area 11 on Figure 5-5d). This construction footprint would need be managed in line with the mitigation measures outlined in Chapter 10.0.
Permanent power supply route	<ul style="list-style-type: none"> • Construction of the permanent power supply route includes trenching works within road reserves where possible and horizontal directional drilling crossing at South Creek to minimise impacts in this area. • The route crosses close to a number of previously recorded AHIMS sites, including 45-5-3182, 45-5-3184, 45-5-4811, 45-5-4812, 45-5-4813, 45-5-4136, 45-5-4137 and 45-5-4138. Ground-truthing would be required for the route to confirm the proximity of these sites. As part of further design development, the permanent power supply route would seek to avoid and / or minimise potential impacts to these sites. • The banks of South Creek have archaeological sensitivity. Further investigation would be required prior to ground disturbance works at this location to determine both archaeological and cultural heritage values.

Construction site	Impacts
Temporary power supply route (Kemps Creek)	<ul style="list-style-type: none"> Construction of the temporary power supply route includes trenching works. Trenching works would be within road reserves where possible. No previously recorded AHIMS sites were identified along the proposed alignment outside of the construction footprint. Ground-truthing would be required for the route to confirm the proximity of AHIMS sites. The intention is for the route to be redesigned to minimise impact/avoid these sites. The banks either side of South Creek and Badgerys Creek have archaeological sensitivity. Further investigation would be required prior to ground disturbance works at this location to determine both archaeological and cultural heritage values.
Temporary power supply route (Claremont Meadows to Orchard Hills)	<ul style="list-style-type: none"> Trenching works are to be within road reserves where possible. Two destroyed sites were located immediately adjacent to this area and one destroyed site was within its bounds. Although the archaeological values have been removed through site destruction these areas may retain cultural values for the Aboriginal community. One valid artefact scatter site (45-5-4423) is present along the proposed temporary power supply route at its southern end. Ground-truthing would be required for the route to confirm the proximity of AHIMS sites. The intention is for further design development for the route to be informed both by known sites and areas of past disturbance. Further investigation would be required prior to ground disturbance works at this location to determine both archaeological and cultural heritage values.

At this stage of the project, limited access to land parcels has prevented some areas of the construction footprint from being subject to field investigation. Further to this, no test excavation has been undertaken to determine the presence or absence of subsurface archaeological deposits in areas of identified archaeological sensitivity. Further investigation will be required to determine the total cultural and archaeological values within the construction footprint.

Potential indirect impacts

Potential indirect impacts as a result of the project, in the off-airport area, are summarised in Table 8-1. Indirect impacts to Aboriginal heritage can include visual impacts. However, no visual impacts have been identified as aesthetic values were not contributory elements to any of the previously recorded sites. All existing sites within the construction footprint or 200 metres of it (see Section 5.4) were artefact sites. These types of sites have their scientific significance resting primarily with the research value, while cultural values are tied to the artefacts and to the way in which these sites connect across a broader cultural landscape.

As such, indirect impacts associated with the project include risks to cultural heritage by subsidence and vibration as a result of the tunnel alignment. Vibration from tunnelling is unlikely to impact artefact bearing deposits as the depth of the tunnels is such that they would not impact subsurface deposits, being many levels deeper than the maximum archaeological deposits (see Sections 5.0, 5.4 and 6.0). The most likely site types to be impacted are rockshelters, art sites and grinding grooves which can all be negatively affected by cracking and breaking caused by vibration and settlement. To date none of these site types have been identified in surface contexts above the tunnel routes. The location of areas of potential and surface sites above the tunnel routes would be further investigated as part of the updated ACHAR.

Where archaeological potential has been identified, as a mitigation measure the surface area above the tunnel alignment would be ground-truthed where it hasn't been to-date to ensure there are no site types directly above the tunnel that would be damaged by subsidence. If subsidence occurs it could potentially disrupt the archaeological integrity of cultural deposits in this area. That means there is the potential for impacts to cultural heritage to occur. Indirect impacts would need be managed in line with the mitigation measures outlined in Section 10.0. Specific mitigation measures relating to subsidence

need to be considered in relation to specific sites (e.g. rockshelters and grinding grooves are at risk for cracking, whereas surface scatters of artefacts are not likely to be damaged). To identify specific mitigation measures further investigation works will need to be undertaken to survey for sites across the areas of impact (see Figure 5-5d).

8.5 Potential on-airport impacts

8.5.1 Potential impacts to identified values

Potential on-airport direct and indirect impacts as a result of the project are discussed below. Management and mitigations measures as a result of these potential impacts are outlined in Section 10.0.

Potential direct impacts

The direct impacts in the on-airport area that have been identified through this assessment have been summarised in Table 8-2. It should be noted that these impacts are in relation to current known sites and the construction footprint.

The existing Aboriginal Cultural Heritage CEMP for Western Sydney International contain protocols for the removal and protection of all known sites within Western Sydney International. Sydney Metro would prepare a CEMP for the on-airport rail works, consistent with the existing Aboriginal Cultural Heritage CEMP for Western Sydney International, for approval by the Commonwealth. This would include the related methodologies for collection and salvage of sites that remain within the construction footprint where required, unexpected finds, as well as outlining nominated sites for protection. It should be noted that the areas nominated for protection are outside the bounds of the construction footprint for the project. The Sydney Metro CEMP would also align with the Western Sydney International Survey and Salvage Plan.

Table 8-2 On-airport direct impact summary

Construction site	Impacts
On-airport construction corridor	<ul style="list-style-type: none"> There are four artefact scatter sites (45-5-2665, 45-5-5089, 45-5-5094 and 45-5-5100) and one isolated artefact (45-5-5068) located within the on-airport construction corridor in the Stage 1 area (see Sections 5.4 and 6.0 and Figure 5-5c and d). There are four artefact scatter sites located within 200 metres of the on-Airport construction corridor in the Stage 1 area, being 45-5-2632, 45-5-2763, 45-5-5086 and 45-5-5173 (see Sections 5.4, 6.0 and Figure 5-5c and Figure 5-5d). The only known Aboriginal cultural values in this area are associated with the sites. It has been assumed that on-airport sites and areas of archaeological sensitivity will be removed as a part of the Western Sydney International development and will therefore not pose a constraint on this project.
Airport Business Park	<ul style="list-style-type: none"> There are no known Aboriginal cultural values specifically associated with this area. There are no known AHIMS sites within the Airport Business Park in the Stage 1 area or within 200 metres of the construction site (see Sections 5.4 and 6.0 and Figure 5-5c and Figure 5-5d).
Western Sydney International tunnel portal	<ul style="list-style-type: none"> There are no known Aboriginal cultural values specifically associated with this area. There are no known AHIMS sites within the Western Sydney International tunnel portal construction site in the Stage 1 area or within 200 metres of the construction site (see Sections 5.4 and 6.0 and Figure 5-5c and Figure 5-5d).

Construction site	Impacts
Airport Terminal	<ul style="list-style-type: none"> • There is one artefact scatter site (45-5-2687) located within the Airport Terminal construction site in the Stage 1 area (see Sections 5.4 and 6.0 and Figure 5-5c and d). • There are three artefact scatter sites located within 200 metres of the on-Airport construction corridor in the Stage 1 area, being 45-5-5082, 45-5-2680 and 45-5-2681 (see Sections 5.4, 6.0 and Figure 5-5c and Figure 5-5d). • The only known Aboriginal cultural values in this area are associated with the sites. • It has been assumed that the on-airport sites and areas of archaeological potential will be removed as a part of the Western Sydney International development and will therefore not pose a constraint on this project.
Airport construction support site (Stage 1)	<ul style="list-style-type: none"> • There are no known Aboriginal cultural values specifically associated with this area. • There are no known AHIMS sites within the Airport construction support site in the Stage 1 area (see Sections 5.4 and 6.0 and Figure 5-5c and Figure 5-5d). • There are nine artefact scatter sites (45-5-2705, 45-5-2673, 45-5-2770, 45-5-2788, 45-5-2813, 45-5-5085, 45-5-5099, 45-5-5102 and 45-5-5175) and one isolated artefact (45-5-5022) within 200 metres of the Airport construction support site in the Stage 1 area (see Sections 5.4 and 6.0 and Figure 5-5c and d). • It is assumed that the on-airport development works will remove any sites and areas of archaeological sensitivity and will therefore not pose a constraint on this project.
Airport construction support site (on-airport, outside Stage 1)	<ul style="list-style-type: none"> • There is one artefact scatter site (45-5-2637) and one isolated artefact (45-5-5078) located in the airport construction support site, on-airport, outside the Stage 1 area (see Sections 5.4 and 6.0 and Figure 5-5c and d). • There are nine artefact scatters (45-5-2623, 45-5-2658, 45-5-2659, 45-5-2682, 45-5-2683, 45-5-2690, 45-5-2814, 45-5-5083 and 45-5-5090), three isolated artefacts (45-5-2586, 45-5-5055 and 45-5-5067), one modified tree (45-5-2630) and one grinding groove site (45-5-5057) within 200 metres of the airport construction support site, on-airport, outside the Stage 1 area. The modified tree and grinding groove sites have already been protected from impacts and are planned for long term conservation (see Sections 5.4 and 6.0 and Figure 5-5e and f). • The only known Aboriginal cultural values in this area are associated with the sites. <p>As outlined in section 8.5.1, the existing Aboriginal Cultural Heritage CEMP for Western Sydney International contains protocols for the removal and protection of all known sites within Western Sydney International. Sydney Metro would prepare a CEMP for the on-airport rail works, consistent with the existing Aboriginal Cultural Heritage CEMP for Western Sydney International, for approval by the Commonwealth. This would include the related methodologies for collection and salvage of sites that remain within the construction footprint where required, unexpected finds, as well as outlining nominated sites for protection. It should be noted that the areas nominated for protection are outside the bounds of the construction footprint for the Project. The Sydney Metro CEMP would also align with the Western Sydney International Survey and Salvage Plan.</p>

Potential indirect impacts

Since it has been assumed that the on-airport sites and areas of archaeological potential will be removed as a part of the Western Sydney International development and will therefore not pose a constraint on this project, no indirect impacts have been identified as likely for any of the on-airport construction footprint. For sites that are not removed as part of the Western Sydney International development, Sydney Metro would prepare an Aboriginal Cultural Heritage CEMP for the on-airport works in consultation with Western Sydney Airport, for approval by the Commonwealth. The Sydney Metro CEMP would be consistent with the existing Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan (Western Sydney Airport, 2019).

8.6 Summary

Existing data has identified one valid artefact scatter site is located within the off-airport portion of the project (while there are eight within the on-airport area). All other sites in proximity to but outside the construction footprint are proposed to be avoided and protected. As the eight on-airport sites will be removed as a part of Western Sydney International they would not pose a constraint on the project. With regard to known sites, therefore, the project is only increasing the number of impacted sites by one in the off-airport portion of the project, being an artefact scatter, one of many similar sites represented across the wider region (i.e. no rarity value by site type). It is likely that the project would impact upon a number of unidentified sites within its curtilage in both surface and subsurface contexts. All sites have cultural heritage values associated with them.

Based on the available data from the desktop research and field inspections to date, areas of archaeological sensitivity were identified (see Figure 5-5a to Figure 5-5d). The area of sensitivity has been estimated as covering 76 hectares out of the approximate 411 hectares area for the entire construction footprint (measuring 18.5% of the total area). Landscape changes are likely to impact cultural values that have been identified as associated with features such as creeks and waterways. It is important to note, however, that while waterways would be crossed, the waterway itself will still continue as a landscape feature either side of the linear project. This does not mean that there is not visual disruption resulting in potential cumulative cultural impacts relevant to the larger landscape. Further investigation will be required to determine the total cultural and archaeological values within the construction footprint. Cumulative impacts would be further understood as the test excavations are undertaken.

9.0 Cumulative impact assessment

For the purposes of this assessment, cumulative impacts are impacts that, when considered together, have different and/or greater impacts than a single impact on its own. Cumulative impacts result from the successive, incremental and/or combined effects of multiple projects occurring across a shared geographical area. While the project has been assessed in this document in relation to impacts to Aboriginal heritage, so is the surrounding region being impacted by other development projects, including Western Sydney International, Elizabeth Drive road upgrades, M12 Motorway and The Northern Road Upgrade. The Elizabeth Drive project is in its early stages (Transport for NSW, 2020) and due to the lack of availability of further information it is not possible to accurately gauge the cumulative impacts that the Elizabeth Drive road upgrade works may contribute. Consideration of the total impact represented by the other projects is summarised below.

9.1 Western Sydney International

The currently available data has identified a total of 115 Aboriginal sites within the bounds of Western Sydney International, consisting of 88 artefact scatters, 24 isolated artefacts, two modified trees and one grinding groove site. The Western Sydney Airport Aboriginal Cultural Heritage CEMP notes that salvage (including surface collection and archaeological excavation) will occur across the site, but does not specify at which locations. Two of the 115 sites within the Western Sydney International curtilage have been specified as being conserved and protected, being a possible culturally modified tree site (45-5-2630 - B40) and a grinding groove site (45-5-5057 - B120). Areas of sensitivity crossing into its bounds include Oaky Creek and various unnamed drainage lines and tributaries. The south-eastern side of the curtilage is bordered by Badgerys Creek, but sections of this are to be preserved within an Environmental Conservation Zone (Western Sydney Airport, 2019). The project does not propose to impact any sites not previously approved for impact by the airport construction works. Therefore cumulative impacts would not result from the project in combination with the development of Western Sydney International according to the available data.

9.2 Future M12 Motorway

The future M12 Motorway project consists of an area approximately 331 hectares in size, crossing through areas of archaeological sensitivity at South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek. The new motorway is being delivered between the M7 Motorway, Cecil Hills and The Northern Road in Luddenham over a distance of about 16 kilometres. Construction of the project is expected to start in 2022 and be open to traffic before the opening of the Western Sydney International Airport in 2026. The curtilage of known Aboriginal sites likely to be impacted by the proposed works adds up to 48.6 hectares, being 14.7 per cent of the construction footprint. A further 20 hectares have been estimated as containing discontinuous background scatter (Roads and Maritime Services, 2019:93-94). The section of the project that intersects with the future M12 Motorway area (being the off-airport construction corridor to the immediate north of Western Sydney International as shown on Figure 5-5e) does not have any previously identified AHIMS sites within its bounds or landform elements (such as waterways) with associated cultural values crossing through it. Areas of archaeological potential have been identified within this area and further investigation has been proposed. Therefore cumulative impacts would not result from the project in combination with the development of the future M12 Motorway according to the available data.

9.3 The Northern Road upgrade

The Northern Road is proposed for upgrades along a 35-kilometre section between Mersey Road, Bringelly and Glenmore Parkway in Glenmore Park. The Northern Road upgrades are being delivered in stages, with some stages completed and the final stages having started construction in 2019. A total of 28 Aboriginal archaeological sites have been identified as being directly impacted by the proposed upgrade works for The Northern Road. Of the total 28 impacted sites, 20 of them were proposed for salvage (Roads and Maritime Services, 2019:96).

9.4 Cumulative impacts

The available evidence of other projects in the surrounding region is that the finite resource of Aboriginal sites is diminishing rapidly as the impacts of multiple developments have an overall cumulative impact on the Aboriginal cultural record of this area. The currently available data has identified one valid artefact scatter site is located within the off-airport portion of the project and eight within the on-airport area. All other sites in proximity to but outside the construction footprint are proposed to be avoided and protected. It has been assumed that the eight on-airport sites will be removed as a part of Western Sydney International and would therefore not pose a constraint on this project. With regard to known sites, therefore, the project is only increasing the number of impacted sites by one, being an artefact scatter, one of many similar sites represented across the wider region (i.e. no rarity value by site type). In addition to this one known site impact however it is likely that the project would impact upon a number of unidentified sites in both surface and subsurface contexts. Consultation with RAPs to date has identified cultural values associated with waterways, with one representative also stating that the location of sites is not necessarily restricted to water resource areas alone. There is concern that the cumulative effect on cultural values would include landscape changes as well as site impacts. Further consultation during fieldwork is required to determine RAP advice on the potential cumulative impact on places of cultural significance such as creeks and waterways.

10.0 Proposed management and mitigation measures

10.1 Approach to management and mitigation

This chapter describes the environmental management approach for the project for Aboriginal heritage during construction and operation. Further details on the environmental management approach for the project are provided in Chapter 25 of the Environmental Impact Statement (Management and mitigation measures).

A Construction Environmental Management Framework (CEMF) (Appendix F of the Environmental Impact Statement) describes the approach to environmental management, monitoring and reporting during construction. Specifically, it lists the requirements to be addressed by the construction contractor in developing the CEMPs, sub-plans, and other supporting documentation for each specific environmental aspect.

A HMP would be developed for the project as identified by the CEMF.

This chapter includes a compilation of the performance outcomes as well as mitigation measures, including those that would be included in the HMP.

The existing Aboriginal Cultural Heritage CEMP for Western Sydney International contain protocols for the removal and protection of all known sites within Western Sydney International. Sydney Metro would prepare an Aboriginal Cultural Heritage CEMP for the on-airport works in consultation with Western Sydney Airport, for approval by the Commonwealth and the Sydney Metro CEMP would be consistent with the existing Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan (Western Sydney Airport, 2019). This would include the related methodologies for collection and salvage of sites that remain within the construction footprint where required, unexpected finds, as well as outlining nominated sites for protection. The Sydney Metro CEMP would also align with the Western Sydney International Survey and Salvage Plan.

10.2 Performance outcomes

Performance outcomes have been developed consistent with the requirements of the SEARs for the project. The performance outcomes for the project are summarised below in Table 10-1 and identify measurable, performance-based standards for environmental management.

Table 10-1 Performance outcomes for the project in relation to Aboriginal heritage

SEARS desired performance outcome	Project performance outcome	Timing
<p>The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of Aboriginal objects and places</p> <p>The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of Aboriginal objects and places</p>	The heritage significance of Aboriginal objects and places are protected, conserved and/or managed in order to ensure the project does not diminish the story and cultural understanding of Aboriginal people in New South Wales	Construction
	Impacts on areas of archaeological potential and significance are avoided or minimised, where practical	Construction
	The design of the project incorporates Aboriginal heritage interpretation and Aboriginal cultural design principles in consultation with Aboriginal stakeholders.	Operation

10.3 Proposed mitigation measures

The Aboriginal heritage mitigation measures for the project are provided in Table 10-2.

Table 10-2 Mitigation measures

Ref	Mitigation measure	Applicable location (s)
Construction		
AH1	Aboriginal stakeholder consultation would continue to be carried out in accordance with the <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010</i> (NSW Office of Environment and Heritage, 2010). Registered Aboriginal Parties would participate in future site inspections and test excavations. Measures to manage and protect the identified cultural values would be developed collaboratively through this consultation process to inform design development and heritage interpretation	Off-airport
AH2	Survey would be undertaken, with Registered Aboriginal Parties, in the areas of archaeological sensitivity where field investigations have not already been completed or where ground surface visibility limited the effectiveness of past inspections. The surface areas above the tunnel alignment would also be ground-truthed to ensure there are no site types directly above the tunnel that would be damaged by subsidence, with site-specific mitigation measures to be developed where any are found to be present	Off-airport
AH3	Test excavation would be undertaken in ground-truthed areas of confirmed archaeological sensitivity, to determine the presence or absence of subsurface archaeological deposits, where project impacts are anticipated	Off-airport
AH4	Following the test excavation program, an Aboriginal Cultural Heritage Management Plan would be prepared. The Aboriginal Cultural Heritage Management Plan would identify management actions including conservation, protection and mitigation, and would authorise harm where appropriate and provide further detail in relation to salvage excavation program if required	Off-airport
AH5	The temporary repository of any retrieved artefacts would be appropriately secured and under the care of the archaeological consultant If retrieved, further consultation with Registered Aboriginal Parties would be required to determine the preferred long-term care and management of any retrieved Aboriginal artefacts	Off-airport
AH6	Aboriginal Heritage Information Management System site cards would be produced for newly identified sites and submitted to the Aboriginal Heritage Information Management System Registrar as soon as practicable	Off-airport
AH7	Aboriginal Site Impact Recording forms would be submitted to the Aboriginal Heritage Information Management System register for all Aboriginal Heritage Information Management System registered Aboriginal sites that are impacted by the project	Off-airport
AH8	If any suspected human remains or unexpected Aboriginal cultural heritage objects are discovered within the on-airport area, all activity would cease and the unexpected finds protocol and discovery of human remains protocol specified in the	On-airport

Ref	Mitigation measure	Applicable location (s)
Construction		
	Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan would be followed	

11.0 References

- AECOM Australia Pty Ltd. (2015). *Archaeological Salvage of Open Artefact Site MPIP5 (45-5-3726)* (Vol. 5). Unpublished report for Winten (No. 26) Pty Ltd.
- Allen, J., & O'Connell, J. F. (1995). Transitions: Pleistocene to Holocene in Australia and Papua New Guinea. *Antiquity*, 69(265), ix-862.
- AMBS. (2014). *Environmental Survey of Commonwealth Land at Badgerys Creek: Aboriginal Heritage*.
- Appleton, J. (2002). *The Archaeological Investigation of Lot 2, DP 120673 The Site of a Proposed New Clay and Shale Extraction Area - Old Wallgrove Road Horsley Park, West of Sydney NSW*.
- Archaeological & Heritage Management Solutions Pty Ltd. (2013). *Fernadell Precinct, Pitt Town, NSW: Aboriginal Heritage Impact Permit #1129099 Excavation Report*. Unpublished report for Johnson Property Group Pty Ltd.
- Archaeological & Heritage Management Solutions Pty Ltd. (2015). *Water Related Infrastructure for the North West Growth Centre (NWGC) First and Second Release Precincts: Aboriginal Archaeological Excavation Report*. Unpublished report for Lend Lease/Sydney Water.
- Archaeological and Heritage Management Solutions Pty Ltd. (2012). *ABORIGINAL ARCHAEOLOGICAL SURVEY REPORT: WERRINGTON ARTERIAL ROAD (M4 MOTORWAY – GREAT WESTERN HIGHWAY), CLAREMONT MEADOWS, NSW*.
- Artefact Heritage. (2012). *The Northern Road Upgrade from the The Old Northern Road, Narellan, to Mersey Road, Bringelly - Aboriginal Archaeological Survey Report*. Unpublished report for Roads and Maritime Services.
- Attenbrow, V. (2002). *Sydney's Aboriginal Past: investigating the archaeological and historical records*. Sydney: University of New South Wales Press Ltd.
- Attenbrow, V. (2010). *Sydney's Aboriginal Past: Investigating the Archaeological and Historical Records*. Sydney: University of New South Wales Press.
- Attenbrow, V. (2012a). Archaeological Evidence of Aboriginal Life in Sydney. Retrieved from Dictionary of Sydney website:
http://dictionaryofsydney.org/entry/archaeological_evidence_of_aboriginal_life_in_sydney
- Attenbrow, V. (2012b). The Aboriginal Prehistory and Archaeology of Royal National Park and Environs : A Review. *Proceedings of the Linnean Society of New South Wales*, 134, 39–64.
- Attenbrow, V., Graham, I., Kononenko, N., Corkill, T., Byrnes, J., Barron, L., & Grave, P. (2012). Crossing the Great Divide: A Ground-Edge Hatchet-Head from Vaucluse, Sydney. *Archaeology in Oceania*, 47, 47–52.
- Attenbrow, V., Robertson, G., & Hiscock, P. (2009). The Changing Abundance of Backed Artefacts in South-Eastern Australia: A Response to Holocene Climate Change. *Journal of Archaeological Science*, 36, 2765–2770.
- Austral Archaeology Pty Ltd. (2005). *Blacktown Native Institute, Plumpton, NSW: Aboriginal Cultural Salvage Excavation*. Unpublished report for Abigroup Leighton Joint Venture.
- Austral Archaeology Pty Ltd. (2007). *Archaeological Salvage Excavations: 95-101 George Street, Parramatta, NSW*. Unpublished report for Cultural Resources Management on behalf of Leighton Properties.
- Austral Archaeology Pty Ltd. (2011). *Windsor Museum, NSW: Aboriginal Archaeological and Cultural Salvage Excavation AHIP #2119*. Unpublished report for Hawkesbury City Council.
- Australian Government (Department of the Environment). (2016). *Engage Early: Guidance for Proponents on Best Practice Indigenous Engagement for Environmental Assessments under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Retrieved from Commonwealth of Australia website:
<http://www.environment.gov.au/system/files/resources/3201a986-88e8-40f3-8c15-6e659ed04006/files/engage-early-indigenous-engagement-guidelines.pdf>

- Australian Heritage Commission. (2002). *Ask First: a guide to respecting Indigenous heritage places and values*. Retrieved from <http://www.environment.gov.au/heritage/ahc/publications/commission/books/pubs/ask-first.pdf>
- Australian Museum Business Services. (2000). *Mungerie Park Town Centre: Archaeological Salvage Excavations near Kellyville, Cumberland Plain, NSW*.
- Australian Museum Business Services. (2002). *Western Sydney Orbital (WSO) Plumpton Ridge Archaeological Test Excavations*. Sydney: Unpublished report for Roads and Traffic Authority.
- Baker Archaeology Pty Ltd. (2019). *Aboriginal Cultural Heritage Assessment Report University of Sydney lands at Badgerys Creek, NSW DRAFT*.
- Baker, N. (1996). *Archaeological Test Excavations at Plumpton Ridge, Proposed Sydney Orbital Road Route EIS*. Unpublished report for Robynne Mills and Sinclair Knight Pty Ltd.
- Balek, C. L. (2002). Buried Artifacts in Stable Upland Sites and the Role of Bioturbation: A Review. *Geoarchaeology*, 17(1), 41–51.
- Bannerman, S. M., & Hazelton, P. A. (1990). *Soil Landscapes of the Penrith 1:100 000 Sheet*. Sydney: Soil Conservation Service of NSW.
- Bannerman, S. M., & Hazelton, P. A. (2011). *Soil Landscapes of the Penrith 1:100 000 Sheet*. Sydney: Soil Conservation Service of NSW.
- Barham, T. (2005). *A Preliminary Geoarchaeological Assessment of the Archaeological Potential of the Area Mapped as Quaternary Alluvium on the Eastern Margins of Ropes Creek Based on Observations of Geotechnical Test Pits*. Unpublished report for Marys Dallas Consulting Archaeologists.
- Barham, T. (2007). *Eastern Creek Geoarchaeological Model and Strategy Assessment, Interpretation and Strategic Conservation of the Archaeological Resource*. Unpublished report for Hyder Consulting.
- Barns, S., & Mar, P. (2018). *Waves of People*.
- Barrallier, F. (1802). *Journal of the Expedition into the Interior of New South Wales*. Melbourne: Marsh Walsh Publishing.
- Barry, F. (2005). *It's Not Set in Stone: A Landscape Approach to Archaeology in the Cumberland Plain: Investigations from the Western Sydney Orbital (WSO/Westlink M7)*. Sydney University.
- Beaton, J. M. (1985). Evidence for a Coastal Occupation Time-Lag at Princess Charlotte Bay (North Queensland) and Implications for Coastal Colonization and Population Growth Theories for Aboriginal Australia. *Archaeology in Oceania*, 20, 1–20.
- Bickford, A. (1981). *The Archaeological Investigation of the Native Institution, Blacktown, NSW*. Unpublished report for Lyle Marshall & Associates.
- Bickford, A., & Sullivan, S. (1984). Assessing the research significance of historic sites. In S. Sullivan & S. Bowdler (Eds.), *Site survey and significance assessment in Australian Archaeology* (1st ed., pp. 19–26). Canberra: Australian Institute of Aboriginal Affairs.
- Binns, R. A., & McBryde, I. (1972). *A Petrological Analysis of Ground-Edge Artefacts from Northern New South Wales*. Canberra: Australian Institute of Aboriginal Studies.
- Biosis Research Pty Ltd. (2008). *Rosehill Recycled Water Scheme: Aboriginal Archaeological and Cultural Heritage Assessment*. Unpublished report for Jemena Management Pty Ltd.
- Biosis Research Pty Ltd. (2010). *Western Sydney Recycled Water Initiative Replacement Flows Project Aboriginal archaeological testing and salvage results*. Unpublished report for McConnel Dowell.
- Biosis Research Pty Ltd. (2016). *Mamre West Precinct, Orchard Hills: Archaeological Report*.
- Bowdler, S. (1981). Unconsidered Trifles? Cultural Resource Management, Environmental Impact Statements and Archaeological Research in New South Wales. *Australian Archaeology*, 12.
- Bowler, J., Jones, R., Allen, H., & Thorne, A. (1970). Pleistocene Human Remains From Australia: A

Living Site and Human Cremation from Lake Mungo, Western New South Wales. *World Archaeology*, 2, 29–60.

Bradley, W. (1792). *A Voyage to New South Wales. The Journal of Lieutenant William Bradley RN of HMS Sirius 1786-1792*. Unpublished manuscript [Republished 1961 by The Trustees of the Public Library of NSW in assoc. with Ure Smith].

Brayshaw, H. (1995). *Elizabeth Drive Upgrade Environmental Impact Statement Archaeological Survey for Aboriginal Sites*. Unpublished report to the NSW Roads & Traffic Authority.

Brayshaw McDonald Pty Ltd. (1992). *Archaeological Survey of the Proposed 33kV Transmission Line Between Bringelly and Rossmore, NSW*. Unpublished report for EDAW Australia.

Brook, J., & Kohen, J. (1991). *The Parramatta Native Institution and the Black Town: A History*. Sydney: New South Wales University Press.

Brumm, A., & Moore, M. W. (2005). Symbolic Revolutions and the Australian Archaeological Record. *Cambridge Archaeological Journal*, 15(02), 157–175.

Buggey, S. (1999). *An approach to Aboriginal cultural landscapes*. Historic Sites and Monuments Board of Canada, Ottawa.

Burke, H., & Smith, C. (2004). *The Archaeologist's Field Handbook*. Sydney: Allen & Unwin.

Clark, N. R., & Jones, D. C. (1991). *Penrith 1:100,000 Geological Sheet 9030* (1st editio). Sydney: Geological Survey of New South Wales.

Collins, D. (1798). *An Account of the English Colony in New South Wales. Vol. 1.* (B. H. Fletcher, Ed.). London: T. Cadell Jun. & W. Davies [Republished 1975 by AH & AW Reed in assoc. with the Royal Australian Historical Society, Sydney].

Collins, D. (1802). *An Account of the English Colony in New South Wales. Vol. 2.* (J. Collier, Ed.). London: T. Cadell Jun. & W. Davies [Reproduced 1971 by the Libraries Board of South Australia. Australian Facsimile Editions No. 76] Sydney].

Corkill, T. (1999). *Here and There: Links Between Stone Sources and Aboriginal Archaeological Sites in Sydney, Australia*. Unpublished M.Phil thesis, University of Sydney.

Corkill, T. (2005). Sourcing Stone from the Sydney Region: A Hatchet Job. *Australian Archaeology*, 60, 41–50.

Coutts, P. J. F., & Witter, D. C. (1977). Summer Field Programme of the Victoria Archaeological Survey. *Australian Archaeology*, 6.

Cowan, F. L. (1999). Making Sense of Flake Scatters: Lithic technological Strategies and Mobility. *American Antiquity*, 64(4), 593–607.

Craib, J. ., Bonhomme, T., Mangold, G. R., & Williams, S. S. (1999). *Archaeological Salvage Excavations at Site RS1 (45-5-982), Regentville, Western Sydney: Final Report*. Unpublished report for TransGrid.

Dallas, M. (1982). *An Archaeological Survey at Riverstone, Schofields and Quakers Hill, N.S.W.* Unpublished report for Land Commission of NSW.

Dallas, M. (1988). *Preliminary archaeological study of the Luddenham Equestrian Centre, Luddenham Road, Erskine Park, NSW*.

Dallas, M., & Smith, L. (1988). *Appendix C: Site Investigations at the Luddenham Equestrian Centre, Erskine Park, NSW*. Report to the Signature Corporation Australia Limited.

Dallas, M., & Witter, D. C. (1983). *Investigation of an Aboriginal Open Site at Plumpton, NSW*. Unpublished report for Land Commission of NSW.

Dawes, W. (1790a). *Grammatical Forms of the Language of N.S. Wales, in the Neighbourhood of Sydney*. Unpublished manuscript [Original in the Library of the School of Oriental & African Studies, London. Marsden Collection Ms 41645 (a). Microfilm in the ML of the SLNSW].

Dawes, W. (1790b). *Vocabulary of the Language of N.S. Wales, in the Neighbourhood of Sydney*,

Native and English. Unpublished manuscript [Original in the Library of the School of Oriental & African Studies, London. Marsden Collection Ms 41645 (b). Microfilm in the ML of the SLNSW].

Dean-Jones, P. (1991). *Proposed Clay/Shale Extraction, Lot 3 DP 623799, Adams Road, Luddenham Archaeological Survey*.

Dean-Jones, P., & Mitchell, P. B. (1993). *Hunter Valley Aboriginal Sites Assessment Project. Environmental Modelling for Archaeological Site Potential in the Central Lowlands of the Hunter Valley*. Unpublished report for NSW National Parks and Wildlife Service.

Department of Environment, C. C. and W. N. (2010). *FACT SHEET 2 What is an Aboriginal cultural landscape?* Department of Environment, Climate Change and Water NSW.

Department of Infrastructure and Regional Development. (2016). *Western Sydney Airport - Environmental Impact Statement*.

Douglas, P., & McDonald, J. (1993). *Archaeological Investigation of RH/CD5, PAD17 (RH/CD10) and PAD 18 (RH/CD6) at Rouse Hill, NSW: Test Excavation Report*. Unpublished report for Rouse Hill (Stage 1) Pty Ltd.

Eco Logical Australia. (2011). *Box Hill Precinct Planning Study - Biodiversity Assessment*. Unpublished report for NSW Department of Planning.

Environmental Resources Management Australia Pty Ltd. (2003). *Aboriginal and Historic Heritage Assessment - Claremont Meadows*. Unpublished report for Land Solutions.

Environmental Resources Management Australia Pty Ltd. (2006a). *Aboriginal Archaeological Salvage Excavation Report of Aboriginal Site OAD1 at Claremont Meadows*. Unpublished report for Landcom.

Environmental Resources Management Australia Pty Ltd. (2006b). *Lots 8, 10, 11 (DP27107) & Lot 19 (DP239091), Caddens Road, Claremont Meadows, Heritage Assessment*. Unpublished report for Landcom.

Environmental Resources Management Australia Pty Ltd. (2010). *Claremont Meadows South West 1, Section 90 Excavation, Aboriginal Heritage Excavation Report*. Unpublished report for Investa Property Group.

Fanning, P. C., & Holdaway, S. J. (2004). Artifact Visibility at Open Sites in Western New South Wales, Australia. *Journal of Field Archaeology*, 29, 255–271.

Fanning, P. C., Holdaway, S. J., Rhodes, E. J., & Bryant, T. G. (2009). The Surface Archaeological Record in Arid Australia: Geomorphic Controls on Preservation, Exposure, and Visibility. *Geoarchaeology*, 24(2), 121–146.

Flynn, M. (1994). *People and Place: Aspects of Parramatta Riverside History in the Early Colonial Period*. Unpublished report for Parramatta City Council.

Flynn, M. (1995a). *Parramatta & the Aboriginal People of the Sydney Region Part 1: 1788-1810*. Unpublished report for Parramatta City Council.

Flynn, M. (1995b). *Place of Eels: Parramatta and the Aboriginal Clans of the Sydney Region: 1788-1845*. Unpublished report for Parramatta City Council.

GML Heritage Pty Ltd. (2010). Colebee and Nurragingy Land Grant. Retrieved from <http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5056189>

GML Heritage Pty Ltd. (2012). *East Leppington Aboriginal Archaeological Technical Report*. Unpublished report for Stockland Development.

GML Heritage Pty Ltd. (2013). *Defence Establishment Orchard Hills, NSW: Heritage Management Plan*.

GML Heritage Pty Ltd. (2016). *East Leppington Open Area Archaeological Excavation Report*. Unpublished report for Stockland Development Pty Ltd.

Godden Mackay Logan Pty Ltd. (1995). *Conservation Plan for Bringelly Radio Receiving Station Complex, Telstra Corporation, Mobile Satellite and Radio Services, Badgery's Creek Rd, Bringelly NSW*.

- Godwin, L. (2011). The Application of Assessment of Cumulative Impacts in Cultural Heritage Management: A Critique. *Australian Archaeology*, 73(73), 88–91.
- Gould, R. (1969). Puntutjarpa Rockshelter: A Reply to Messrs Glover and Lampert. *Archaeology and Physical Anthropology in Oceania*, 4, 229–237.
- Government Architect New South Wales. (2020). *Designing with Country*.
- Grave, P., Attenbrow, V., Sutherland, L., Pogson, R., & Forster, N. (2012). Non-Destructive PXRF of Mafic Stone Tools. *Journal of Archaeological Science*, 39(6), 1674–1686.
<https://doi.org/10.1016/j.jas.2011.11.011>
- Haglund, L. (1978). *Major Airport Needs of Sydney Study: Survey of Aboriginal Sites and Relics*. Unpublished report to MANS Committee.
- Hanrahan, J. (1981). *Report on Proposed Subdivision at South Werrington, Near Penrith*. Unpublished report for the Housing Commission of NSW.
- Helen Brayshaw Heritage Consultants. (1996). *M4 Upgrade, Archaeological Survey for Aboriginal Sites for Proposal to Upgrade the M4 Motorway from Church Street Parramatta to Coleman Street, Marys Hill and Prospect to Emu Plains*. Unpublished report for SWR Constructors Pty Ltd.
- Hiscock, P. (1993a). Bondian Technology in the Hunter Valley, New South Wales. *Archaeology in Oceania*, 28, 65–76.
- Hiscock, P. (1993b). The Distribution of Points Within Nauwalabila 1. *The Beagle*, (10), 173–178.
- Hiscock, P. (1994). Technological Responses to Risk in Holocene Australia. *Journal of World Prehistory*, 8(3), 267–292.
- Hiscock, P. (2002). Pattern and Context in the Holocene Proliferation of Backed Artefacts in Australia. In R. Elston & S. Kuhn (Eds.), *Thinking Small: Global Perspectives on Microlithization* (pp. 163–177). Archaeological Papers of the American Anthropological Association.
- Hiscock, P. (2006). Blunt and to the Point: Changing Technological Strategies in Holocene Australia. In I. Lilley (Ed.), *Archaeology of Oceania: Australia and the Pacific Islands* (pp. 69–95). Oxford: Blackwell.
- Hiscock, P. (2008). *Archaeology of Ancient Australia*. London: Routledge.
- Hiscock, P., & Attenbrow, V. (1998). Early Holocene Backed Artefacts From Australia. *Archaeology in Oceania*, 33(2), 49–63.
- Hiscock, P., & Attenbrow, V. (2004). A Revised Sequence of Backed Artefact Production at Capertee 3. *Archaeology in Oceania*, 39(2), 49–63.
- Hofman, J. L. (1986). Vertical Movement of Artifacts in Alluvial and Stratified Deposits. *Current Anthropology*, 27(2), 163–171.
- Horton, D. R. (1996). *Aboriginal Australia*. Canberra, ACT: Aboriginal Studies Press.
- Hunter, J. (1793). *An Historical Journal of the Transactions at Port Jackson and Norfolk Island, ...Including the Journals of Governors Phillip and King, and of Lieut. Ball; and the Voyages from the First Sailing of the Sirius in 1787 to the Return of that Ship's Company to*. London: J. Stockdale [Republished 1968 Australian Facsimile Editions No. 148, Libraries Board of South Australia, Adelaide].
- ICOMOS (Australia). (2013). *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Retrieved from Australia ICOMOS website: <http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>
- Irish, P. (2017). *Hidden in Plain View: The Aboriginal People of Coastal Sydney*. Sydney: NewSouth Publishing.
- JAJV. (2019). *M12 Motorway Concept Design and Environmental Impact Assessment - Archaeological Assessment Report DRAFT*.
- Jo McDonald Cultural Heritage Management Pty Ltd. (1997a). *Archaeological Salvage of Site RMI at*

Richmond, NSW: Test and Salvage Excavation Report. Unpublished report for Restifa & Partners.

Jo McDonald Cultural Heritage Management Pty Ltd. (1997b). *Interim Heritage Management Report: ADI Site St Marys. Volume 1 - Test Excavation Report.* Unpublished report for Lend lease - ADI Joint Venture.

Jo McDonald Cultural Heritage Management Pty Ltd. (2000). *Archaeological Survey For Aboriginal Sites : Proposed Light Industrial Subdivision, "Austral Site", Mamre Road, Erskine Park, NSW.*

Jo McDonald Cultural Heritage Management Pty Ltd. (2001a). *Salvage Excavations of Six Sites along Caddies, Second Ponds, Smalls and Cattai Creeks in the Rouse Hill Development Area, NSW.* Unpublished report for Rouse Hill Infrastructure Consortium.

Jo McDonald Cultural Heritage Management Pty Ltd. (2001b). *Survey for Aboriginal Sites, 1503 Elizabeth Drive, Kemps Creek, NSW, October 2001.*

Jo McDonald Cultural Heritage Management Pty Ltd. (2002a). *Archaeological Excavations at Balfour Drive, Kellyville, NSW (Site RH/SC5). Archaeological Salvage Programme Prior to Residential Development.* Unpublished report for Mepstead & Associates on behalf of Bake Investments Pty Ltd and Cardno BLH Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2002b). *Archaeological Excavations at Windsor Road, Kellyville, NSW (Site RH/CD12: NPWS #45-5-962).* Unpublished report for Australand Holdings Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2003). *Archaeological Salvage Excavations at the proposed Xavier College: Site ADI 47+48 (NPWS #45-5-1048), Ninth Avenue, Llandilo, NSW.* Unpublished report for PMDL on behalf of the Catholic Education Office, Diocese of Parramatta, NSW.

Jo McDonald Cultural Heritage Management Pty Ltd. (2005a). *Archaeological Salvage Excavation of Eight Archaeological Landscapes in the Second Ponds Creek Valley, Rouse Hill Development Area, NSW.* Unpublished report for Rouse Hill Infrastructure Pty Ltd and Landcom.

Jo McDonald Cultural Heritage Management Pty Ltd. (2005b). *Archaeological Salvage Excavation of Site CG1 (NPWS #45-5-2648), at the Corner of Charles & George Streets, Parramatta, NSW.* Unpublished report for Meriton Apartments Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2005c). *Archaeological Salvage Excavation of Site RTA-G1, 109-113 George Street, Parramatta, NSW.* Sydney: Unpublished report for Landcom.

Jo McDonald Cultural Heritage Management Pty Ltd. (2006a). *Archaeological Salvage Excavation at the St Marys Project Eastern Precinct: Site ADI:EPI (NPWS #45-5-2994).* Unpublished report for Lend Lease.

Jo McDonald Cultural Heritage Management Pty Ltd. (2006b). *Archaeological Salvage Excavation of Site CG3: 101a-105 George Street, Parramatta, NSW.* Unpublished report for Rahi Developments Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2006c). *Archaeological Salvage Excavation of the Colebee Release Area, Schofields, NSW: Volume 1.* Unpublished report for Medallist Gold Holdings Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2007). *Salvage Excavation of Four Archaeological Sites in the Caddies Creek Precinct, Rouse Hill Regional Centre, NSW.* Unpublished report for Lend Lease GPT (Rouse Hill) Pty Ltd.

Jo McDonald Cultural Heritage Management Pty Ltd. (2008a). *Archaeological Salvage at ADI-FF22: The ADI Eastern Precinct Fauna Fence, St Marys.* Unpublished report for Delfin Lend Lease.

Jo McDonald Cultural Heritage Management Pty Ltd. (2008b). *Assessment of Aboriginal Heritage, Lot 2, DP 771679 Gipps Street, Claremont Meadows.*

Jo McDonald Cultural Heritage Management Pty Ltd. (2008c). *Austral Land Mamre Rd, Erskine Park: Archaeological Salvage Excavations.* Unpublished report for Macquarie Goodman.

Jo McDonald Cultural Heritage Management Pty Ltd. (2009a). *Archaeological Subsurface Investigations at the Cadden's Release.* Unpublished report for Landcom.

Jo McDonald Cultural Heritage Management Pty Ltd. (2009b). *Archaeological Subsurface Investigations at WP3 and WP4 - Western Precinct St Mary's Development Site*. Unpublished report for Marylands Development Company.

Jo McDonald Cultural Heritage Management Pty Ltd. (2010). *Archaeological Assessment of the Proposed Sewer and Water Mains Associated with the Marsden Park Industrial Precinct, Stage I*. Unpublished report for APP.

Johnson, D. L. (1989). Subsurface Stone Lines, Stone Zones, Artifact-Manuport Layers, and Biomantles Produced by Bioturbation via Pocket Gophers (*Thomomys bottae*). *American Antiquity*, 54(2), 370–389.

Johnson, D. L., Domier, J. E. J., & Johnson, D. N. (2005). Reflections on the Nature of Soil and Its Biomantle. *Annals of the Association of American Geographers*, 95(1), 11–31.

Jones, R., & White, N. (1988). Point Blank: Stone Tool Manufacture at the Ngilipitji Quarry, Arnhem Land 1981. In B. Meehan & R. Jones (Eds.), *Archaeology with Ethnography: An Australian Perspective* (pp. 51–87). Canberra: Department of Prehistory, Research School of Pacific Studies, Australian National University.

Kelleher Nightingale Consulting Pty Ltd. (2009). *Marsden Park Industrial Precinct: Aboriginal Heritage Assessment*. Unpublished report to NSW Department of Planning.

Kelleher Nightingale Consulting Pty Ltd. (2012). *Werrington Arterial Road M4 Motorway to Great Western Highway Cultural Heritage Assessment Report*. Unpublished report for Roads and Maritime Services.

Kelleher Nightingale Consulting Pty Ltd. (2013a). *M4 Managed Motorway from Lapstone (Western End) to Strathfield (Eastern End). Review of Environmental Factors: Aboriginal Archaeological Survey Report*.

Kelleher Nightingale Consulting Pty Ltd. (2013b). *Sydney Science Park Planning Proposal: Aboriginal Heritage Assessment. Report to APP Corporation Pty Ltd*.

Kelleher Nightingale Consulting Pty Ltd. (2016a). *M4 Managed Motorway, from Lapstone (Western End) to Church Street, Parramatta (Eastern End). Review of Environmental Factors: Cultural Heritage Assessment Report*.

Kelleher Nightingale Consulting Pty Ltd. (2016b). *The Northern Road Upgrade Stage 3 Jamison Road, Penrith to Glenmore Parkway, Glenmore Park Aboriginal Cultural Heritage Assessment Report*. Unpublished report for Roads and Maritime Services.

Kelleher Nightingale Consulting Pty Ltd. (2018a). *Sydney Science Development Luddenham, NSW Aboriginal Archaeological Assessment Test Excavation Report*.

Kelleher Nightingale Consulting Pty Ltd. (2018b). *Sydney Science Park Development Luddenham, NSW Cultural Heritage Assessment Report*.

Koettig, M., & Hughes, P. J. (1995). *Test Excavations at RS1 Regentville near Penrith on the Cumberland Plain*. Unpublished report for Pacific Power.

Kohen, J. (1985). *Aborigines in the West: Prehistory to Present*. Armidale: Western Sydney Project.

Kohen, J. (1986). *Prehistoric settlement in the Western Cumberland Plain: Resources, Environment and Technology*. Macquarie University.

Kohen, J. (1986). *Prehistoric Settlement in the Western Cumberland Plain: Resources, Environment and Technology*. Macquarie University, Sydney.

Kohen, J. (1988). The Dharug of the Western Cumberland Plain: Ethnography and Demography. In B. Meehan & R. Jones (Eds.), *Archaeology with Ethnography: An Australian Perspective* (pp. 238–250). Canberra: Department of Prehistory, Research School of Pacific Studies, Australian National University.

Kohen, J. (1990). *A Dictionary of the Dharug Language: the Inland Dialect*. Blacktown: Blacktown and District Historical Society.

- Kohen, J. (1993). *Darug and their Neighbours: The Traditional Aboriginal Owners of the Sydney Region*. Sydney: Darug Link in association with Blacktown and District Historical Society.
- Kohen, J. (1995). *Aboriginal Environmental Impacts*. Sydney: UNSW Press.
- Kohen, J., Knight, A., & Smith, K. V. (1999). *Uninvited Guests: An Aboriginal Perspective on Government House and Parramatta Park*. Sydney: National Trust of Australia.
- Kohen, J., & Lampert, R. (1987). Hunters and Fishers in the Sydney Region. In D. J. Mulvaney & J. P. White (Eds.), *Australians to 1788* (1st ed., pp. 343–365). Sydney: Fairfax, Syme & Weldon Associates.
- Kohen, J., Stockton, E., & Williams, M. (1984). Shaws Creek KII Rockshelter: A Prehistoric Occupation Site in the Blue Mountains Piedmont, Eastern New South Wales. *Archaeology in Oceania*, 19(2), 57–73.
- Kuskie, P. J. (2000). An Aboriginal Assessment of the Proposed Mount Arthur North Coal Mine, Near Muswellbrook, Hunter Valley, New South Wales. In HLA-Envirosciences Pty. Ltd. (Ed.), *Environmental Impact Statement and Statement of Environmental Effects, Proposed Jerrys Plains Coal Terminal, Rail Spur and Associated Infrastructure*. Canberra: Report prepared by South Eastern Archaeology to Umwelt (Australia) Pty. Ltd.
- Lachlan, M. (1818). *Diary: 10 April 1816 - 1 July 1818*. ML Ref: A773 [Microfilm Reel CY301].
- Lance, A., & Hughes, P. J. (1984). *Second Sydney Airport Aboriginal Archaeological Study: Badgerys Creek/Wilton*. Unpublished report to Kinhill Stearns Pty Ltd.
- Lawton, B. A., & Officer, I. (2016). *CENSUS 2016 TOPIC PAPER Indigenous population of Greater Western Sydney*. (02).
- Liverpool City Council. (2016). *Liverpool City Council Aboriginal Cultural Protocols*.
- Long, A. (2003). *Scarred Trees: An Identification and Recording Manual*. Prepared for Aboriginal Affairs Victoria.
- Lourandos, H. (1983). Intensification. A Late Pleistocene-Holocene Archaeological Sequence from Southwestern Victoria. *Archaeology in Oceania*, 18, 81–94.
- Lourandos, H. (1997). *Continent of Hunter-Gatherers. New Perspectives in Australian Prehistory*. Cambridge: Cambridge University Press.
- Lourandos, H., & Ross, A. (1994). The Great “Intensification Debate”: Its History and Place in Australian Archaeology. *Australian Archaeology*, 39, 54–63.
- Lydon, E. C. J. (2005). Men in Black: the Blacktown Native Institution and the Origins of the Stolen Generation. In J. Lydon & T. Ireland (Eds.), *Object Lessons: Archaeology and Heritage in Australia* (pp. 201–224). Melbourne: Australian Scholarly Publishing.
- M2A. (2020). *Sydney Metro Greater West Technical paper 3: Biodiversity Development Assessment Report*.
- Matthews, R. H. (1903). The Dharruk Language. *Journal of the Royal Society of New South Wales*, 35, 155–160.
- Matthiesen, H. (2004). In Situ Measurement of Soil pH. *Elsevier*, 31(10), 1373–1381. Retrieved from <https://doi.org/10.1016/j.jas.2004.03.005>
- McBryde, I. (1973). Stone Arrangements and a Quartzite Quarry at Brewarrina. *Mankind*, 9, 118–121.
- McBryde, I. (1984). Kulin Greenstone Quarries: The Social Contexts of Production and Distribution for the Mt William site. *World Archaeology*, 16(2), 267–285.
- McCarthy, F. D. (1948). The Lapstone Creek Excavation: Two Culture Periods Revealed in Eastern New South Wales. *Records of the Australian Museum*, 22(1), 1–34.
- McCarthy, F. D. (1964). The Archaeology of the Capertee Valley, New South Wales. *Records of the Australian Museum*, 26(6), 197–264.
- McCarthy, F. D. (1967). *Australian Aboriginal Stone Implements* (2nd Ed.). Sydney: The Australian Museum Trust.

- McDonald, J. (1986). *Preliminary Archaeological Reconnaissance of the Proposed Schofields Regional Depot, Plumpton, N.S.W.* Unpublished report for the Metropolitan Waste Disposal Authority.
- McDonald, J. (1993). *Excavation of Two Sites on Eastern Creek (PB1 and PB2), Doonside.* Unpublished report for Blacktown City Council.
- McDonald, J. (2008). *Dreamtime Superhighway: Sydney Basin Rock Art and Prehistoric Information Exchange.* Canberra: Australian National University Press.
- McDonald, J., Mitchell, P., & Rich, E. (1996). *A Further Investigation of Site RS1 (#45-5-892) at Regentville, Mulgoa Creek, Western Sydney, NSW.* Unpublished report for Pacific Power.
- McDonald, J., & Rich, E. (1994). The Discovery of a Heat Treatment Pit on the Cumberland Plain, Western Sydney. *Australian Archaeology*, (38), 46–47.
- McDonald, R. C., & Isbell, R. F. (2009). Soil Profile. In *Australian Soil and Land Survey Field Handbook* (Third Edit, pp. 147–200). Collingwood: CSIRO Publishing.
- Mitchell, P. B. (2009). *Soil Materials and Landscape Disturbance on the Southwestern Sector of the ADI Site at St Marys in Relation to Aboriginal Archaeological Investigations.* Unpublished report for Jo McDonald CHM.
- Moore, M. W. (2000). Technology of Hunter Valley microlith assemblages, New South Wales. *Australian Archaeology*, 51, 28–39.
- Moore, M. W. (2013). Simple Stone Flaking in Australasia: Patterns and Implications. *Quaternary International*, 285, 140–149.
- Nanson, G. C., Young, R. W., & Stockton, E. (1987). Chronology and Palaeoenvironment of the Cranebrook Terrace (near Sydney) Containing Artefacts More than 40,000 Years Old. *Archaeology in Oceania*, 22, 72–78.
- National Heritage Studies Pty Ltd. (1990). *Report on Test Excavations at Schofields, N.S.W.* A Report to R.W. Corkery and Co.
- Navin Officer Heritage Consultants Pty Ltd. (1997). *Technical Paper No. 11 Aboriginal Cultural Heritage.*
- Navin Officer Heritage Consultants Pty Ltd. (2007). *Replacement Flows Project: Cultural Heritage Impact Assessment.*
- Navin Officer Heritage Consultants Pty Ltd. (2015). *Western Sydney Airport - Aboriginal Cultural Heritage Assessment.* Unpublished report for GHD.
- Navin Officer Heritage Consultants Pty Ltd. (2017). *Initial Survey and Salvage Plan Western Sydney Airport - Enabling Activities Aboriginal Cultural Heritage Management Plan.*
- NSW Department of Environment Climate Change & Water. (2010a). Aboriginal Cultural Heritage Consultation Requirements for Proponents. In *National Parks*. Department of Environment, Climate Change and Water.
- NSW Department of Environment Climate Change & Water. (2010b). *Aboriginal Cultural Heritage Consultation Requirements for Proponents.* Department of Environment, Climate Change and Water.
- NSW Department of Environment Climate Change & Water. (2010c). *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.* Department of Environment, Climate Change and Water.
- NSW Office of Environment & Heritage. (2011). *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW.* Office of Environment and Heritage.
- Parry, N. (2005). "Lock, Maria (1805–1878)", Australian Dictionary of Biography. Retrieved from National Centre of Biography website: <http://adb.anu.edu.au/biography/lock-maria-13050>
- Paton, T. R., Humphreys, G. S., & Mitchell, P. B. (1995). *Soils: A New Global View.* London: UCL Press.
- Peacock, E., & Fant, D. W. (2002). Biomantle Formation and Artifact Translocation in Upland Sand

- Soils: An Example from the Holly Springs National Forest, North-Central Mississippi, U.S.A. *Geoarchaeology*, 17(1), 91–114.
- Pearson, M., & Sullivan, S. (1995). *Looking After Heritage Places: The Basics of Heritage Planning for Managers, Landowners and Administrators*. Carlton: Melbourne University Press.
- Peterson, N. (1976). *Tribes and Boundaries in Australia* (N. Peterson, Ed.). Canberra: Australian Institute of Aboriginal and Torres Strait Islander Studies.
- Phillip, A. (1789). *The Voyage of Governor Phillip to Botany Bay: with Contributions from Other Officers of the First Fleet and Observations on Affairs of the Time by Lord Auckland*. London: Debrett [Republished 1970 by Angus & Robertson in assoc. with Royal Australian Historical Society].
- Phillip, A. (1791). *Extracts of Letters from Arthur Phillip, Esq. Governor of New South Wales to Lord Sydney*. London: Debrett [Reprinted 1963 Australiana Facsimile Editions No 15, Public Library of South Australia, Adelaide].
- Przywolnik, K. (2007). *The Western Sydney Regional Aboriginal Heritage Study*. Unpublished report to DECCW.
- Rhoads, J.W.; Dunnett, G. (1985). *Aboriginal Resources Planning Study: City of Penrith*. Unpublished report prepared for the National Parks and Wildlife Service of New South Wales.
- Roads and Maritime Services. (2019a). *M12 Motorway Aboriginal Cultural Heritage Assessment Report*. Retrieved from <https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SI-9364%2120191004T003628.449 GMT>
- Roads and Maritime Services. (2019b). *M12 Motorway Environmental Impact Statement - Appendix I Aboriginal Cultural Heritage Assessment*. Unpublished report.
- Ross, A. (1976). *Inter-Tribal Contacts: What the First Fleet Saw*. University of Sydney.
- Ross, A. (1988). Tribal and Linguistic Boundaries in Sydney at the Time of First British Settlement: A Reassessment of the Evidence. In G. Aplin (Ed.), *A Difficult Infant: Sydney Before Macquarie* (pp. 42–53). Sydney: University of New South Wales Press.
- Shiner, J. (2008). *Place as Occupational Histories: An Investigation of the Deflated Surface Archaeological Record of Pine Point and Langwell Stations, Western New South Wales, Australia* (BAR Intern). Oxford: Archaeopress.
- Smith, C., & Burke, H. (2007). *Digging It Up Down Under: A Practical Guide to Doing Archaeology in Australia*. New York: Springer.
- Smith, L. (1988). *Aboriginal Site Planning Study in the Sydney Basin Stage 1: The Cumberland Plain - Interim Report: Site Survey and Site Analysis on the Northern Cumberland Plain*. Sydney: Unpublished report for NSW National Parks and Wildlife Service.
- Steele, D. (1999). *Archaeological Survey Report for land between Luddenham & Mamre Roads, Luddenham, NSW*. Unpublished report prepared for Camelot Grange Pty Ltd.
- Steele, D. (2001). *Preliminary Archaeological Test Excavation Project within Land Between Luddenham and Mamre Roads*. Unpublished report for Camelot Grange Pty Ltd.
- Steele, D. (2004). *Aboriginal Heritage Conservation Action Plan. Application for a Section 90 Heritage Impact Permit (Consent with Salvage & Collection). Twin Creeks Estate, Luddenham Road, Luddenham, NSW*. Unpublished report for Luddenham Management Pty Ltd.
- Steele, D. (2007). *Aboriginal Archaeological Excavation & Monitoring Report: Twin Creeks Estate, Luddenham Road*. Unpublished report for Luddenham Management Pty Ltd.
- Stein, J. K. (1983). Earthworm Activity: A Source of Potential Disturbance of Archaeological Sediments. *American Antiquity*, 48(2), 277–289.
- Streat, B., & Pavinich, Y. (2018). *Aboriginal Test Excavation Report Lot 2 Section 4 DP 2954 111-1141 Elizabeth Drive, Cecil Park, NSW (Fairfield LGA)*.
- Sutton, M., Huntley, J., & Anderson, B. (2013). "All our sites are of high significance" Reflections from

recent work in the Hunter Valley - Archaeological and Indigenous perspectives. *Journal of Australian Association of Consulting Archaeologists*, 1, 1–15.

Tench, W. (1793). Sydney's First Four Years, being a Reprint of A Narrative of the Expedition to Botany Bay and A Complete Account of the Settlement at Port Jackson. In L. F. Fitzhardinge (Ed.), 1788. London: Debrett & G. Nichol [Reprinted 1961 by Angus and Robertson in assoc. with Royal Australian Historical Society].

Thorp, W. (1986). *The Penrith Heritage Study – The Historical Archaeology Component*.

Tozer, M. (2003). The Native Vegetation of the Cumberland Plain, Western Sydney: Systematic Classification and Field Identification of Communities. *Cunninghamia*, 8(1), 1–75.

Troy, J. (1994). *The Sydney Language*. Canberra: J. Troy.

URS Australia Pty Ltd. (2001). *Gipps Street Landfill Rehabilitation Proposal: Environmental Impact Statement, Werrington, NSW*.

Walker, F. (1906). Penrith and district: some items of Early Australian history. *Journal and Proceedings of the Royal Australian Historical Society*, 2, 43–48.

Western Sydney Airport. (2019). *Western Sydney Airport Aboriginal Cultural Heritage Construction Environmental Management Plan*.

White, B., & McDonald, J. (2010). Lithic Artefact Distribution in the Rouse Hill Development Area, Cumberland Plain, New South Wales. *Australian Archaeology*, (70), 29–38.

White, E. (1997). *Knapping Floors in the Central Hunter Lowlands, NSW*. Unpublished manuscript.

White, J. (1790). *Journal of a Voyage to New South Wales*. Piccadilly, London: J. Debrett [Republished in 1962 by Angus & Robertson in assoc. with the Royal Australian Historical Society, Sydney].

Williams, A. N., Atkinson, F., Lau, M., & Toms, P. S. (2014). A Glacial Cryptic Refuge in South-East Australia: Human Occupation and Mobility from 36,000 years ago in the Sydney Basin, New South Wales. *Journal of Quaternary Science*, 29(8), 735–748.

Williams, A. N., Mitchell, P., Wright, R., & Toms, P. (2012). A Terminal Pleistocene Open Site on the Hawkesbury River, Pitt Town NSW. *Australian Archaeology*, 85–97.

Worgan, G. B. (1788). *Journal of a First Fleet Surgeon*. Sydney: Republished 1978 by The Library Council of New South Wales in assoc. with the Library of Australian History [The William Dixon Foundation Publication No. 16].

WSA Co. (2018). *Western Sydney Airport Construction Environmental Management Plan Aboriginal Cultural Heritage Construction Environmental Management Plan*.

Appendix A

Consultation requirements

Appendix A Consultation log

Table A-1 Consultation requirements

No.	Consultation guideline requirements	How we addressed this
4.1.1	<p>Proponents are not required to comply with the requirements of steps 4.1.2 to 4.1.7 where there is an approved determination of native title that native title exists in relation to the proposed construction footprint. In this circumstance, proponents need only consult with the native title holders. If a prescribed body corporate has been established to hold native title on behalf of the native title holders then proponents should consult with the prescribed body corporate. Where native title is determined to exist over part of the proposed construction footprint, proponents are required to comply with the requirements of steps 4.1.2 to 4.1.7 in relation to the area not covered by the native title determination (NSW Department of Environment Climate Change & Water, 2010a: 10).</p>	<p>Searches were undertaken of the National Native Title Tribunal register through the NNTT website on 26/9/2019. Searches were made of the Local Government Areas (LGAs) for Penrith City Council, Liverpool City Council and Camden Council. Under the Register of Native Title Claims no results were found under the search criteria. One claim was present in the Liverpool City Council search for the South Coast People, but it was located to the southeast of the construction footprint and outside its bounds. A search of the National Native Title Register for the same three LGAs had no results. A search of Applications and Determinations identified one dismissed application and two discontinued applications in the Penrith City Council area. The aforementioned claim for the South Coast People was an active application in the Liverpool City Council area, along with two dismissed, three discontinued and two rejected applications. There were two discontinued and one rejected application in the Camden Council area. Based on the data available on the NNTT registers there are no active registrations, claims or applications intersecting with the construction footprint.</p>

No.	Consultation guideline requirements	How we addressed this
4.1.2	<p>Proponents are responsible for ascertaining, from reasonable sources of information, the names of Aboriginal people who may hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places. Reasonable sources of information could include (a) to (g) below. Proponents must compile a list of Aboriginal people who may have an interest for the proposed project and hold knowledge relevant to determining the cultural significance of Aboriginal objects and/or places by writing to: (a) the relevant DECCW EPRG regional office [now OEH]; (b) the relevant Local Aboriginal Land Council(s); (c) the Registrar, Aboriginal Land Rights Act 1983 for a list of Aboriginal owners; (d) the National Native Title Tribunal for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements; (e) Native Title Services Corporation Limited (NTSCORP Limited); (f) the relevant local council(s); (g) the relevant catchment management authorities for contact details of any established Aboriginal reference group. In that correspondence, proponents must include the information required in 4.1.3 (a) and (b) (NSW Department of Environment Climate Change & Water, 2010a: 10).</p>	<p>Letters and emails were sent on 15 May 2019 to the following agencies requesting contact details for groups relevant to the intended study: Office of Environment and Heritage, Deerubbin Local Aboriginal Land Council, Gandangara Local Aboriginal Land Council, Tharawal Local Aboriginal Land Council, Office of the Registrar, Native Title Services Corporation Limited (NTSCorp Ltd), Penrith City Council, Liverpool Council, Camden Council and Greater Sydney Local Land Services (formerly Catchment Management Authorities (CMA)). A search was also undertaken of the National Native Title Tribunal register for a list of registered native title claimants, native title holders and registered Indigenous Land Use Agreements. All required information was contained in the letters that were sent. The names that were provided by these agencies were then invited to register in this project, using the contact details that were provided in the agency responses.</p>

No.	Consultation guideline requirements	How we addressed this
4.1.3	<p>Proponents must write to the Aboriginal people whose names were obtained in step 4.1.2 and the relevant Local Aboriginal Land Council(s) to notify them of the proposed project. The proponent must also place a notice in the local newspaper circulating in the general location of the proposed project explaining the project and its exact location. The notification by letter and in the newspaper must include:</p> <ul style="list-style-type: none"> a. the name and contact details of the proponent; b. a brief overview of the proposed project that may be the subject of an application for an AHIP, including the location of the proposed project; c. a statement that the purpose of community consultation with Aboriginal people is to assist the proposed applicant in the preparation of an application for an AHIP and to assist the Director General of DECCW [now OEH] in his or her consideration and determination of the application; d. an invitation for Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal object(s) and/or place(s) in the area of the proposed project to register an interest in a process of community consultation with the proposed applicant regarding the proposed activity. e. a closing date for the registration of interests (NSW Department of Environment Climate Change & Water, 2010a: 11). 	<p>Newspaper advertisements were published in the Liverpool Leader on 22 May 2019, the Penrith Press on 23 May 2019 and the Western Weekender on 17 May 2019. These papers were identified by News Local and the Guide to Australian Newspapers as the appropriate publications, being delivered to the suburbs containing and surrounding the project for this assessment. A letter inviting registration was sent, either by email or post, to all potential registrants (as identified by agency responses in step 4.1.2) on 30 August 2019.</p>
4.1.4	<p>There must be a minimum of 14 days from the date the letter was sent or notice published in the newspaper to register an interest. The time allowed to register an interest should reflect the project's size and complexity (NSW Department of Environment Climate Change & Water, 2010a: 11).</p>	<p>The newspaper advertisements were published in the Liverpool Leader on 22 May 2019, the Penrith Press on 23 May 2019 and the Western Weekender on 17 May 2019.</p>
4.1.5	<p>The proponent must advise Aboriginal people who are registering an interest that their details will be forwarded to DECCW [now OEH] and the Local Aboriginal Land Council (LALC) unless they specify that they do not want their details released (NSW Department of Environment Climate Change & Water, 2010a: 11).</p>	<p>This advice was included in the letter sent inviting registration.</p>

No.	Consultation guideline requirements	How we addressed this
4.1.6	The proponent must make a record of the names of each Aboriginal person who registered an interest and provide a copy of that record, along with a copy of the notification from 4.1.3 to the relevant DECCW [now EES] EPRG regional office and LALC within 28 days from the closing date for registering an interest (NSW Department of Environment Climate Change & Water, 2010a: 11).	Registration for interested parties to be consulted with on this project was kept open for a prolonged period to ensure a comprehensive response and the best possible resource for gathering information on the cultural values of the study area. Notification of the Registered Aboriginal Parties names that registered for this project along with a copy of the notification were sent to Deerubbin Local Aboriginal Land Council (DLALC), Gandangara Local Aboriginal Land Council (GLALC) and OEH (now Heritage NSW) on 21 May 2020. As per the request of two of the registrants their details were not included in these notifications.
4.1.7	LALCs holding cultural knowledge relevant to determining the significance of Aboriginal objects and places in the proposed construction footprint who wish to register an interest to be involved in consultation must register their interest as an Aboriginal organisation rather than as individuals (NSW Department of Environment Climate Change & Water, 2010a: 11).	Deerubbin Local Aboriginal Land Council and Gandangara Local Aboriginal Land Council both registered for consultation on this project.
4.1.8	Where an Aboriginal organisation representing Aboriginal people who hold cultural knowledge has registered an interest, a contact person for that organisation must be nominated. Aboriginal cultural knowledge holders who have registered an interest may indicate to the proponent they have appointed a representative to act on their behalf. Where this occurs, the registered Aboriginal party must provide written confirmation and contact details of those individuals to act on their behalf (NSW Department of Environment Climate Change & Water, 2010a: 11).	A contact person was nominated by each Registered Aboriginal Party.

No.	Consultation guideline requirements	How we addressed this
15C	<p>At least 14 days before undertaking any test excavations the relevant DECCW [now EES] EPRG regional office (refer to Appendix C) must be notified, in writing, of the following:</p> <ul style="list-style-type: none"> • the location of the proposed test excavation and the subject area • the name and contact details of the legal entity with overall responsibility for the project • the name and contact details of the person who will be carrying out the test excavations where this is different to the legal entity with overall responsibility for the project • the proposed date of commencement, and estimated date of completion, of the test excavations • the location of the temporary storage location for any Aboriginal objects uncovered during the test excavations. <p>A copy of the sampling strategy for test excavation must also be provided (NSW Department of Environment Climate Change & Water, 2010b: 25).</p>	<p>This will be undertaken prior to any test excavation (none has occurred or been scheduled to date).</p>

Appendix B

Agency responses

Appendix B Agency responses

Table B-1 Agency Consultation

Agency	Contact	Date Sent	Comment
Office of Environment and Heritage (OEH)	Planning and Aboriginal Heritage Section PO Box 668 Parramatta NSW 2124 Phone: (02) 9995 5000 Fax: (02) 9995 6900	15/5/2019	List provided by OEH Aboriginal Heritage Planning Officer Barry Gunther on 24 May 2019.
Deerubbin Local Aboriginal Land Council	PO Box 40, Penrith NSW 2751	15/5/2019	Email received registering DLALC for consultation.
Gandangara Local Aboriginal Land Council	PO Box 1038 Liverpool NSW 2170	15/5/2019	No response received from GLALC.
Tharawal Local Aboriginal Land Council	220 West Parade Couridjah NSW 2571	15/5/2019	Email received registering TLALC for consultation.
Office of the Registrar of Indigenous Corporations	PO Box 112 Glebe NSW 2037	15/5/2019	Reply received by email from project Officer Elizabeth Loane, providing potential contacts.
Native Title Services Corporation Limited (NTSCorp Ltd)	PO Box 2105 Strawberry Hills NSW 2012	15/5/2019	No response received from NTSCorp Ltd.
Penrith City Council	601 High Street Penrith NSW 2750	15/5/2019	No response received from Penrith City Council.
Liverpool Council	52 Scott Street Liverpool NSW 2170	15/5/2019	Response received from Community Development Officer Norma Burrows, providing a list.
Camden Council	70 Central Avenue, Oran Park, 2570	15/5/2019	List provided by Ana Cristina Lage, Heritage and Urban Design Advisor, on 27/5/2019.
Greater Sydney Local Land Services (formerly Catchment Management Authorities (CMA))	Hawkesbury Nepean CMA Head Office 159 Auburn Street Goulburn NSW 2580	15/5/2019	No response received from Greater Sydney Local Land Services

Appendix C

Newspaper
advertisements

Appendix C Newspaper advertisements

The Aboriginal Stakeholder Consultation newspaper advertisement was published in the Liverpool Leader on 22 May 2019, the Penrith Press on 23 May 2019 and the Western Weekender on 17 May 2019. The full advertisements are included following in newspaper extracts.

Motoring	Notices
<p>Cars Wanted</p> <p>AAAA ANY CAR TRUCK UTE VAN 4WD Bought fr. \$500 or \$50 TO \$30,000 4 USED CARYARD OR WRECKING & SCRAP Call BOB NOW 24/7 0424 163 489 100% FREE PICKUP IN 1HR or BEST PRICE CASH, LOCAL SERVICE IBUYUSED CARS.COM.AU Year 1918-2019 REGISTERED OR UNREGISTERED, RUNS OR BROKEN, DAMAGE OR CLEAN</p> <p>buy search sell Call 13 11 13</p>	<p>General Notices</p> <p>Aboriginal Stakeholder Consultation Sydney Metro Greater West (SMGW) Proponent: Sydney Metro c/- M2A Level 25, 680 George Street Sydney, NSW 2000 Australia</p> <p>Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network.</p> <p>Sydney Metro Greater West is the new railway line which will service Greater Western Sydney and the new Western Sydney International (Nancy-Bird Walton) Airport. Sydney Metro is seeking to identify Aboriginal persons or organisations who wish to be consulted in relation to an Aboriginal cultural heritage assessment for this planned transport infrastructure project across the suburbs of Kingswood, Werrington, St Marys, Claremont Meadows, Orchard Hills, Luddenham, Badgerys Creek, Greendale, Bringelly and Rossmore, NSW.</p> <p>Interested Aboriginal persons or organisations who hold cultural knowledge relevant to this project are requested to register their interest in writing to:</p> <p>Darran Jordan AECOM Australia Pty Ltd PO Box 9410, QVB Post Office, Sydney, NSW 1230 PH: +61 2 8034 0021 Fax: +61 2 8034 0001 Email: darran.jordan@aecom.com</p> <p>Expressions of interest should include current contact details. The closing date for registration is 3 June 2019.</p> <p>Please be advised that the details of all parties who register will be forwarded to the Office of Environment and Heritage and the relevant Local Aboriginal Land Councils unless specified otherwise.</p> <p>Ka-ching! Make bank, sell your stuff for free with Buy Search Sell.</p> <p>FREE TO LIST</p> <p>Visit buysearchsell.com.au <small>*This offer is available to private party sellers advertising in the marketplace section online only.</small></p> <p>buy search sell</p> <p>Reclaim the garage Call 13 11 13</p> <p>buy search sell</p>

Figure C-1 Liverpool Leader extract, 22 May 2019

Motoring	Notices
<p>Cars Wanted</p> <p>TOP CASH 7 DAYS For all Cars, Vans, Utes, 4x4, Trucks, etc. \$250 - \$30,000* Call George 0404 714 714 <small>*Cash/Finance apply</small></p> <p>WE WILL BEAT ANY PRICE 1HR PICKUP or 100% free removal WE ARE LOCAL</p> <p>Sold!</p> <p>buy search sell</p>	<p>General Notices</p> <p>Aboriginal Stakeholder Consultation Sydney Metro Greater West (SMGW) Proponent: Sydney Metro c/- M2A Level 25, 680 George Street Sydney, NSW 2000 Australia</p> <p>Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network.</p> <p>Sydney Metro Greater West is the new railway line which will service Greater Western Sydney and the new Western Sydney International (Nancy-Bird Walton) Airport. Sydney Metro is seeking to identify Aboriginal persons or organisations who wish to be consulted in relation to an Aboriginal cultural heritage assessment for this planned transport infrastructure project across the suburbs of Kingswood, Werrington, St Marys, Claremont Meadows, Orchard Hills, Luddenham, Badgerys Creek, Greendale, Bringelly and Rossmore, NSW.</p> <p>Interested Aboriginal persons or organisations who hold cultural knowledge relevant to this project are requested to register their interest in writing to:</p> <p>Darran Jordan AECOM Australia Pty Ltd PO Box 9410, QVB Post Office, Sydney, NSW 1230 PH: +61 2 8034 0021 Fax: +61 2 8034 0001 Email: darran.jordan@aecom.com</p> <p>Expressions of interest should include current contact details. The closing date for registration is 3 June 2019.</p> <p>Please be advised that the details of all parties who register will be forwarded to the Office of Environment and Heritage and the relevant Local Aboriginal Land Councils unless specified otherwise.</p>
Real Estate	Notices
<p>Coastal Properties</p> <p>ABSOLUTE BARGAIN 1 Acre Farmlet \$69,950 pay \$7k now & \$1k x62 mths projected return 10% P.A. 04 17 007 792 18 (open)</p> <p>Shared Accommodation</p> <p>WOODCROFT Single working male 35+ large fully furnished room in modern home, close shops/ trans. \$180 PW includes exp. aircon, foxtel & internet ☎ 0415 465 015</p>	<p>General Notices</p>

Figure C-2 Penrith Press extract, 23 May 2019

Can you conquer the biggest burrito of all?



Nicole Barton, Emily Feszczuk, Nathan Taylor and Troy Dodds take on the challenge

For all the big lovers of Mexican food out there, Mad Mex in Westfield Penrith has just the thing for you and your taste buds.

For the month of May you and your amigos can battle it out to see who can defeat a one kilo burrito in the quickest time.

The Weekender's news team took part in the annual Big Burrito Challenge this week, with sports journalist Nathan Taylor crowned the office champion.

If you are one of the first 10,000 people to conquer the Big Burrito in one sitting you will walk home with a limited-edition, Luchador-themed bottle-opener keychain which will grant you free guacamole at any Mad Mex in 2019.

Challengers can fully customise their Big Burrito to their personal dietary requirements with meat, vegan or vegetarian options all available.

As usual, each Big Burrito is packed full of Mad Mex's authentic and fresh ingredients including their delicious black beans made to their famous recipe and homemade pico de gallo. You can also add shredded lettuce, grated cheese, sour cream and spicy salsas depending on how brave you are.

The Big Burrito is \$25 and available until the end of the month, so head down to become a champion and win free guac for the rest of the year!

For more information, visit www.madmex.com.au.

Aboriginal Stakeholder Consultation

Sydney Metro Greater West (SMGW)

Proponent: Sydney Metro c/- M2A Level 25,
680 George Street Sydney, NSW 2000 Australia

Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network.

Sydney Metro Greater West is the new railway line which will service Greater Western Sydney and the new Western Sydney International (Nancy-Bird Walton) Airport. Sydney Metro is seeking to identify Aboriginal persons or organisations who wish to be consulted in relation to an Aboriginal cultural heritage assessment for this planned transport infrastructure project across the suburbs of Kingswood, Werrington, St Marys, Claremont Meadows, Orchard Hills, Luddenham, Badgerys Creek, Greendale, Bringelly and Rossmore, NSW.

Interested Aboriginal persons or organisations who hold cultural knowledge relevant to this project are requested to register their interest in writing to:

Darran Jordan
AECOM Australia Pty Ltd
PO Box Q410, QVB Post Office,
Sydney, NSW 1230
Ph: +61 2 8934 0621
Fax: +61 2 8934 0001
Email: darran.jordan@aecom.com

Expressions of interest should include current contact details.
The closing date for registration is **3 June 2019**.

Please be advised that the details of all parties who register will be forwarded to the Office of Environment and Heritage and the relevant Local Aboriginal Land Councils unless specified otherwise.

the western weekend • Friday, May 17, 2019

Figure C-3 Western Weekender extract, 17 May 2019

Appendix D

Expression of Interest
(EOI) letter

Appendix D Expression of Interest (EOI) letter



M2A AECOM & WSP
Level 25, 680 George Street
Sydney, NSW
2000 Australia

+61 2 8934 0000 tel
+61 2 8934 0001 fax
ABN 20 003 848 925

30 August 2019

Re: Aboriginal Cultural Heritage Assessment - Invitation to Register Interest

To whom it may concern

I am writing to inform you that M2A (AECOM Australia Pty Ltd (AECOM) and WSP) has been commissioned by Sydney Metro to undertake an Aboriginal cultural heritage assessment for the proposed Sydney Metro Greater West project. Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network. Sydney Metro proposes to construct and operate a new metro rail line (known as Sydney Metro Greater West) with intermediate stations between the T1 Western Line in the north and the Western Sydney Aerotropolis (Aerotropolis) in the south.

I am writing to you as it has been identified that you may have an interest in registering for consultation in relation to this assessment. To register for consultation in this project, please write, email or phone:

Darran Jordan
M2A
c/- AECOM Australia Pty Ltd
PO Box Q410, QVB Post Office,
Sydney, NSW 1230
Ph: +61 2 8934 0821
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To be involved in the consultation process, registrations must be received by 14 September 2019.

Please note that in accordance with Section 4.1.6 of OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*, AECOM is required to provide a record of all Registered Aboriginal Parties (RAPs) for this assessment to OEH and the relevant Local Aboriginal Land Council/s. Should you not wish your details to be released please notify me as part of your response to this letter. Please also note that registration for consultation does not guarantee employment for the fieldwork component of the assessment.

I look forward to your participation in the assessment of this project.

Yours sincerely

A handwritten signature in black ink that reads 'D. Jordan'.

Darran Jordan
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Appendix E

EES and LALC notification

Appendix E EES and LALC notification

This appendix has been removed for the public exhibition version of this technical paper.

Appendix F

Draft assessment
methodology

Appendix F Draft assessment methodology

Please note: changes have occurred to the project terminology and refinements have been made to the project data since the assessment methodology was authored. References to Sydney Metro Greater West in the document are to what is now called Sydney Metro Western Sydney Airport. The total art sites in the AHIMS search results has been reduced by one and artefact scatter sites increased by one due to an incorrect site classification identified in the extensive search results. As the draft assessment methodology is included here to show the document that was provided to RAPs it has not been altered.

17 September 2019

Re: Sydney Metro Greater West Aboriginal Cultural Heritage Assessment – Draft Methodology

To whom it may concern

Thank you for registering for the Aboriginal Cultural Heritage Assessment for the Sydney Metro Greater West project. I am writing to provide you with a copy of the draft methodology for this assessment. It would be appreciated if you could review this and respond with any comments, proposed changes or questions. Please write, email or phone with your responses to:

Darran Jordan
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PO Box Q410, QVB Post Office,
Sydney, NSW 1230
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Fax: +61 2 8934 0001
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Thanks and I look forward to consulting with you further as this project progresses.

Yours sincerely



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Draft Assessment Methodology – Sydney Metro Greater West Aboriginal Cultural Heritage Assessment

1.0 Introduction

Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network. Sydney Metro proposes to construct and operate a new metro rail line (known as Sydney Metro Greater West) with intermediate stations between the T1 Western Line in the north and the Western Sydney Aerotropolis (Aerotropolis) in the south (the Project).

M2A (a joint venture between AECOM Australia Pty Ltd (AECOM) and WSP) has been commissioned by Sydney Metro to undertake an Aboriginal cultural heritage assessment for the proposed Sydney Metro Greater West project in accordance with relevant statutory guidelines including the NSW Office of Environment and Heritage's *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) and *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a).

This draft assessment methodology provides background information on the proposal and details M2A's proposed approach to the current assessment. It is being provided to all Registered Aboriginal Parties (RAPs) in accordance with Sections 4.3.1 and 4.3.2 of OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a). A brief review of existing archaeological data for the Project area is also provided to give context to M2A's proposed assessment methodology.

2.0 The Project area

The current Project area is defined as approximately 1km either side of the area within which the Project will fall (Figure 1). The topography of the investigation area is relatively flat between St Marys and Werrington, with higher ground towards Claremont Meadows. Elevations are generally flat towards Orchard Hills, with slightly lower lying areas occurring along Blaxland Creek. Through Orchard Hills, Badgerys Creek and Bringelly, the valley and floodplain of South Creek and its tributaries dominate the gently undulating topography. The Project area will be further refined as detailed design is progressed and potential options are chosen.

3.0 Assessment Objectives

The purpose of this assessment is to identify known and potential Aboriginal heritage constraints within the Project area and appropriate management advice. The overarching objectives of the current Aboriginal Cultural Heritage Assessment (ACHA) are as follows:

- To identify the Aboriginal cultural heritage values of the Project area by way of background research, archaeological field investigation and consultation with RAPs;
- To assess the potential impact of the proposed development on any identified Aboriginal cultural heritage values within the Project area (if relevant); and
- To provide an appropriate management strategy to avoid or minimise potential harm to any identified Aboriginal cultural heritage values within the Project area.

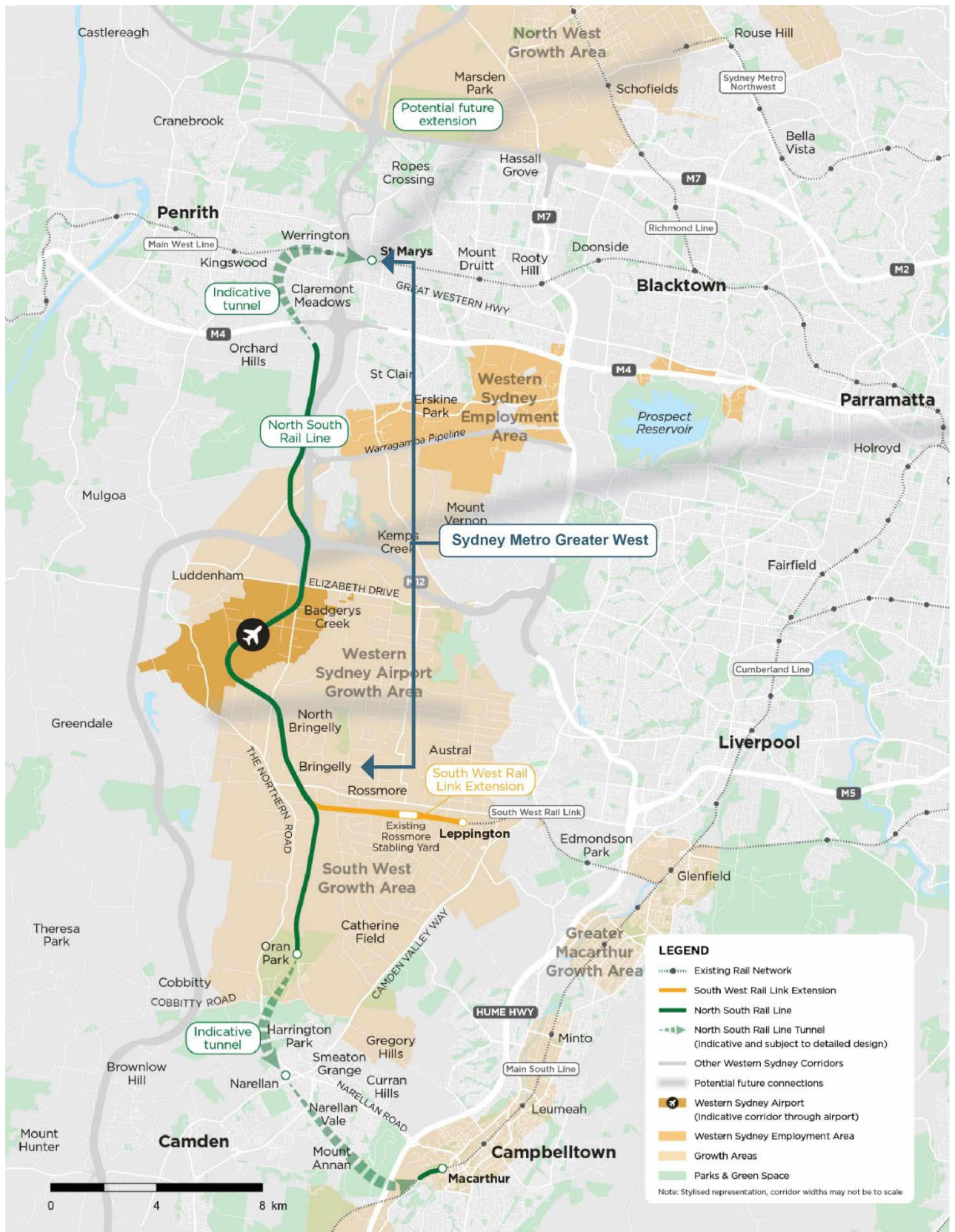


Figure 1 Project area

Source: Transport for NSW – Corridors Project

4.0 Archaeological Context

4.1 AHIMS database

The AHIMS database, administered by OEH, contains records of all Aboriginal objects reported to the Director General of the Department of Premier and Cabinet in accordance with Section 89A of the *National Parks and Wildlife Act 1974*. It also contains information about Aboriginal places, which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

Three searches of the AHIMS database were undertaken on 1 April 2019 (Search IDs 411399, 411404 and 411419) covering in total an approximate area of 58 km by 9 km. This AHIMS search area was centred on the Project area, but also included sites in the immediately surrounding region as well. A total of 301 sites were identified in these search results (see Table 1).

As is typical for the Cumberland Plain, artefact scatters and isolated artefact sites with and without other forms of archaeological evidence were the most common site type represented within the AHIMS search area. Other, comparatively poorly represented types included six Potential Archaeological Deposits (PADs), three modified trees, three art sites and one grinding groove site. It should be noted that a PAD is not a site, rather it is an area of potential awaiting verification of site status following further investigation to determine the presence or absence of subsurface artefact bearing cultural deposits.

There were 24 Destroyed sites listed in the search results as well, referring to sites that have been destroyed under the conditions of a permit issued by OEH, usually for development works. The destroyed sites were all located in the northern portion of the Project area, generally falling between St Marys and Claremont Creek. They were destroyed under permits 3762, 3752, 4001, 4096 and 4228. They were destroyed as a part of developing a regional depot at Plumpton and M4 upgrade road works between Church Street, Parramatta and Coleman Street, St Marys, as well as between Prospect and Emu Plains. These works included impacts in the suburbs of Riverstone, Schofields and Quakers Hill.

There were also two registrations listed as Not a Site. The category Not a Site refers to a registration which, on further investigation, has been verified as not being of Aboriginal origin (ie - verified as not having been created by Aboriginal people).

It should also be noted that the AHIMS search result data contains multiple inaccuracies. It is possible that some of the artefact scatter sites may be isolated artefacts, as information on the number of artefacts located in site areas is not present for all of those identified in the search results. Coordinate inaccuracy for AHIMS data is also known from past assessments to be an issue. The given coordinates only represent a centroid, not the full extent of a site's area. As summarised in Table 1, there are 301 registered Aboriginal sites within and in the area surrounding the Project area.

Table 1 AHIMS search results

Site type	Number	%
Artefact Scatter	214	71.1%
Isolated Artefact	47	15.6%
Destroyed	25	8.3%
Potential Archaeological Deposit (PAD)	6	2%
Modified Tree	3	1%
Art Site	3	1%
Not a Site	2	0.7%
Grinding Groove	1	0.3%
Total	301	100

Of the 301 sites within the larger search area, a total of 206 sites were found to be listed within the bounds of the Project area (see Figure 2 - removed from exhibition version). These sites are summarised in Table 2.

Table 2 AHIMS sites within the Project area

Site type	Number	%
Artefact Scatter	139	67.5%
Isolated Artefact	34	16.5%
Destroyed	23	11%
Potential Archaeological Deposit (PAD)	3	1.5%
Modified Tree	3	1.5%
Art Site	2	1%
Not a Site	1	0.5%
Grinding Groove	1	0.5%
Total	206	100

Of the 206 sites located within the Project area, a total of 76 sites were identified as listed within the bounds of the Western Sydney International airport site (see Table 3). The assessment undertaken for the proposed development works at Western Sydney International concluded that at least 39 of the open artefact sites (comprising both artefact scatters and isolated artefacts) would be impacted by the proposed construction activities. Mitigation and management measures have already been instigated for the identified sites within the bounds of Western Sydney International to minimise the impacts on cultural heritage (Commonwealth of Australia 2016).

Table 3 AHIMS sites within the Western Sydney International section of the Project area

Site type	Number	%
Artefact Scatter	63	82.9%
Isolated Artefact	12	15.8%
Grinding Groove	1	1.3%
Total	76	100

4.2 Previous Aboriginal Heritage Investigations

Existing AHIMS data indicates that numerous Aboriginal archaeological investigations have been carried out across the Project area over the past three decades. As in other parts of the Cumberland Plain, the majority of these investigations have been limited to survey. However, a number of investigations involving test and/or salvage excavation programs have also been undertaken. For contextual purposes, the results of a selection of these investigations are summarised in Table 4.

Taken together, the results of previous surface and subsurface investigations have identified that past Aboriginal occupation and land use was consistent with that of the Cumberland Plain as a whole. Collectively this attests to an occupational emphasis on elevated low gradient landforms adjacent to higher order watercourses, as well as an emphasis on the procurement, transport, pre-processing and reduction of silcrete as a primary raw material for artefact manufacture.

Table 4 Previous Aboriginal Archaeological Investigations

Author	Project	Investigation type	Summary of results
(Dallas 1982)	An archaeological survey at Riverstone, Schofields and Quakers Hill, NSW	Survey	Seven artefact scatters and four isolated artefacts were identified during survey. Identified impacts included erosion and ploughing. Eastern Creek was the main water source in proximity to these sites. Site density ranged from 2 to 50. Silcrete was the most common raw material, with others including chert, quartz, chalcedony and petrified wood. Artefact types included cores and flakes. Two of the sites were noted as having abundant stone resources on the ridges adjacent to them.
(McDonald 1986)	Archaeological reconnaissance of the proposed Schofield regional depot at Plumpton, NSW	Survey and Test Excavation	Surface artefact scatters were identified across the entire area, but density was found to reduce away from the ridgelines (being the source of raw materials). Sites were found to cluster around water courses and low ridges. Four out of five excavated test pits (50 cm by 50 cm) contained artefacts. Silcrete was the most common material.
(Dallas 1988)	Preliminary archaeological study of the Luddenham Equestrian Centre, Luddenham Road, Erskine Park, NSW	Survey	12 artefact scatters were identified and an area of PAD was defined.
(Jo McDonald Cultural Heritage Management Pty Ltd 2000)	Archaeological Survey for Aboriginal Sites : Proposed Light Industrial Subdivision, "Austral Site", Mamre Road, Erskine Park, NSW	Survey	Five artefact scatters and three isolated artefacts were identified. Salvage works were recommended prior to development proceeding.
(Jo McDonald Cultural Heritage Management Pty Ltd 2008)	Austral Land Mamre Rd, Erskine Park: Archaeological Salvage Excavations	Salvage	Salvage excavations were undertaken with 298 m ² excavated and 8,867 artefacts retrieved from subsurface deposits. Artefact density was found to be tied to stream order. Use of silcrete as a raw material diminished as the distance from silcrete sources increased. Backed blades were present as was evidence of bipolar flaking.
(Appleton 2002)	The Archaeological Investigation of Lot 2, DP 120673 The Site of a Proposed New Clay and Shale Extraction Area - Old Wallgrove Road	Survey	Two isolated artefacts and an area of PAD were identified during survey at this location.

Author	Project	Investigation type	Summary of results
	Horsley Park, West of Sydney NSW		
(Biosis Research Pty Ltd 2008)	Rosehill Recycled Water Scheme Preliminary Cultural Heritage Assessment	Survey	No sites were identified during survey, although it was noted that one artefact scatter and one PAD were both located in close proximity. An area of sensitivity was demarcated.
(Commonwealth of Australia 2016)	Western Sydney Airport Environmental Impact Statement	Survey and Test Excavation	Survey and test excavation were carried out at the proposed site for the Western Sydney International airport in May 2015. In addition to previously recorded sites, a total of 23 new sites were identified, comprising 14 subsurface artefact deposits (identified during test excavation), nine open artefact sites (determined by the surface expression of artefacts) and one grinding groove site. A total of 39 sites (all open artefact sites) were identified within impact areas for the proposed development.

5.0 Draft Methodology

5.1 Overview

The approach that M2A intends to adopt for undertaking the assessment includes the following key components:

1. Background research;
2. Survey and consultation with RAPs to identify known sites and areas of archaeological and cultural potential within the Project area;
3. Preparation of an ACHAR to present the results of the survey and consultation, with recommendations for further investigation, if required.

If the recommendations of the ACHAR identify that further works are required, those works would consist of:

4. Additional survey, with RAPs, targeting high sensitivity areas proposed for impacts;
5. A program of archaeological test excavation, with RAPs, of areas of high archaeological sensitivity proposed for impacts;
6. Consultation with RAPs regarding the cultural values of the Project area; and
7. Preparation of an Aboriginal Archaeological Report (AAR) and an updated ACHAR for the Project area detailing the results of the above with appropriate management/mitigation measures for any identified Aboriginal heritage values.

The proposed methodologies for each of these components are detailed in the sections below.

5.2 Background Research

The following tasks will be undertaken for the background research component of the assessment:

1. Searches of OEH's AHIMS database;
2. A review of associated site cards and reports to clarify site contents, extents and statuses;
3. A review of the landscape context of the Project area, with a particular emphasis on its implications for the nature and distribution of Aboriginal archaeological materials;
4. A review of relevant archaeological and ethnohistoric information for the Project area and environs; and
5. Preparation of a predictive model for the Aboriginal archaeological record of the Project area.

5.3 Survey

An initial survey is proposed of the Project area with RAP representatives to identify and map known sites and areas of archaeological and cultural sensitivity.

If any Aboriginal archaeological sites are identified during the survey they will be recorded to the standard required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*. All sites will be comprehensively photographed following artefact recording.

5.4 Preparation of ACHAR

An ACHAR will be produced for the EIS. This will contain the results of the background research, survey and consultation to date. It will provide recommendations for further works, if required, in relation to both known and potential Aboriginal cultural heritage within the Project area.

5.5 Social/Cultural Values Assessment for the ACHAR

Aboriginal community consultation for the assessment will be undertaken in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a). RAP representatives are in the best position to provide information on the Aboriginal social/cultural heritage values of the Project area. During the assessment process, M2A will consult with RAPs regarding the cultural heritage values of the Project area. This will include as a minimum:

- A request for any comments regarding the Aboriginal cultural heritage values of the Project area;
- Discussion of cultural heritage values during fieldwork; and

- Provision of a draft ACHAR to all RAPs for their review and comment.

The following sections provide detail on the further work that will be undertaken, if required.

5.6 Further Survey

If the recommendations of the ACHAR identify that further works are required, an archaeological survey would be undertaken, targeting areas of high sensitivity proposed for impacts. Survey would be undertaken by a combined field team of archaeologists and an appropriate number of RAP field representatives, and would involve survey of the identified portions of the Project area.

5.7 Test Excavation

The recommendations of the ACHAR for the EIS will determine whether further works are required. Further works, if required, may also include test excavation. A program of archaeological test excavation determines the presence or absence of subsurface archaeological deposits. If test excavation is required it would be undertaken by a combined field team of archaeologists and an appropriate number of rostered RAP field representatives.

Archaeological subsurface investigations for the Project will be undertaken in accordance with OEH's *Code of Practice for Archaeological Investigation of Aboriginal Objects*. Where subsurface investigations are required, test pits will be excavated to culturally sterile horizons. Excavated sediment will be dry-sieved through 5 mm wire-mesh sieves. Any Aboriginal objects recovered during sieving will be bagged by square and spit. Representative profiles in each excavation unit will be drawn and photographed. Test pit stratigraphy will be recorded on pro forma test pit recording sheets using standard sedimentological terms and criteria (after McDonald & Isbell, 2009). All test pits will be backfilled after excavation.

All flaked stone artefacts recovered during subsurface investigations will be subject to macroscopic attribute analysis in an off-site location, with the number of attributes recorded per specimen differing by technological type. It is proposed that, subject to RAP endorsement, all stone artefacts recovered during test excavation will ultimately be reburied within the Project area in a non-impact area. Reburial will be undertaken in accordance with Requirement 26 of the *Code of Practice*.

5.8 Social/Cultural Values Assessment for the updated ACHAR

Ongoing Aboriginal community consultation for the assessment will be undertaken in accordance with OEH's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010a). This will continue through the period of additional work, if required, with all RAPs to be provided with a copy of the draft AAR and updated ACHAR for review and comment. Any comments made within the submission period prior to finalisation of the report will be incorporated into it.

5.9 Updated Aboriginal Cultural Heritage Assessment (ACHAR) and Aboriginal Archaeological Report (AAR)

Following additional survey and test excavation works, if required, an AAR and updated ACHAR will be produced, detailing the results of the archaeological field investigation and cultural assessment.

The draft AAR and ACHAR will assess the importance of Aboriginal cultural heritage values within the Project area. In addition, the draft reports will assess the potential impact of the proposed development on identified Aboriginal cultural heritage values and identify appropriate mitigation and management strategies to avoid or minimise potential harm to such values.

The reports will be prepared in accordance with the following statutory guidelines issued by the New South Wales (NSW) Office of Environment and Heritage (OEH):

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011); and
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b).

6.0 References Cited

- Appleton, J. 2002. *The Archaeological Investigation of Lot 2, DP 120673 The Site of a Proposed New Clay and Shale Extraction Area - Old Wallgrove Road Horsley Park, West of Sydney NSW*.
- Biosis Research Pty Ltd. 2008. *Rosehill Recycled Water Scheme: Aboriginal Archaeological and Cultural Heritage Assessment*. Unpublished report for Jemena Management Pty Ltd.
- Commonwealth of Australia. 2016. *Western Sydney Airport Environmental Impact Statement*.
- Dallas, M. 1982. An Archaeological Survey at Riverstone, Schofields and Quakers Hill, N.S.W.
- Dallas, M. 1988. *Preliminary archaeological study of the Luddenham Equestrian Centre, Luddenham Road, Erskine Park, NSW*.
- Jo McDonald Cultural Heritage Management Pty Ltd. 2000. *Archaeological Survey For Aboriginal Sites : Proposed Light Industrial Subdivision, 'Austral Site', Mamre Road, Erskine Park, NSW*.
- Jo McDonald Cultural Heritage Management Pty Ltd. 2008. *Austral Land Mamre Rd, Erskine Park: Archaeological Salvage Excavations*. Unpublished report for Macquarie Goodman.
- McDonald, J. 1986. *Preliminary Archaeological Reconnaissance of the Proposed Schofields Regional Depot, Plumpton, N.S.W.* Unpublished report for the Metropolitan Waste Disposal Authority.
- McDonald, R.C., & Isbell, R.F. 2009. Soil Profile. In *Australian Soil and Land Survey Field Handbook*, 147–200. Collingwood: CSIRO Publishing
- NSW Department of Environment Climate Change & Water. 2010a. *Aboriginal Cultural Heritage Consultation Requirements for Proponents*. Department of Environment, Climate Change and Water.
- NSW Department of Environment Climate Change & Water. 2010b. *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. Department of Environment, Climate Change and Water.
- NSW Office of Environment & Heritage. 2011. *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*. Office of Environment and Heritage.

Appendix G

RAP responses to draft
assessment
methodology

Appendix G RAP responses to draft assessment methodology

This appendix has been removed for the public exhibition version of this technical paper.

Appendix H

RAP responses to draft
ACHAR

Appendix H RAP responses to draft ACHAR

This appendix has been removed for the public exhibition version of this technical paper.

Appendix I

Regional archaeological
context

Appendix I Regional archaeological context

The Sydney Region

Available archaeological data indicate that Aboriginal people have occupied the Sydney region⁴ for at least 36,000 years (Williams *et al.*, 2014). Late Pleistocene/early Holocene occupation of the region is evidenced by radiometric dates from both coastal and hinterland sites (see Attenbrow, 2010:18, Table 3.1). Excavated material culture assemblages from these periods have been interpreted as evidence of relatively small populations of Aboriginal people employing settlement patterns of high residential and low logistical mobility (Attenbrow 2010:152-154; McDonald, 2008: 39; Williams *et al.*, 2014). Late Pleistocene/early Holocene chipped stone assemblages attest to a preference for silicified tuff sourced from secondary geological sources such as the Hawkesbury-Nepean River gravels (McDonald, 2008; Williams *et al.*, 2014). However, they also indicate the exploitation of other raw material types such as silcrete, quartzite, petrified wood and quartz. Direct freehand percussion appears to have been the dominant reduction technique employed by Late Pleistocene/early Holocene Aboriginal knappers, with bipolar flaking comparatively poorly represented in available assemblages. Retouched 'tools' include unifacially-flaked pebble implements, dentated saws, burins and a variety of scrapers, with unmodified utilised flakes also well represented (Kohen *et al.*, 1984; Williams *et al.*, 2014). Stone tools such as these will have been complemented by a range of organic implements such as wooden digging sticks, spears and boomerangs. However, these do not survive archaeologically (Attenbrow, 2010:154).

Compared with the late Pleistocene/early Holocene, archaeological evidence for mid-to-late Holocene Aboriginal occupation of the Sydney Region abounds (for recent syntheses see Attenbrow 2010; McDonald 2008). In keeping with broader Australian developments (e.g., Allen and O'Connell, 1995; Beaton, 1985; Brumm and Moore, 2005; Attenbrow *et al.*, 2009; Lourandos, 1983, 1997; Lourandos and Ross, 1994), the social and economic systems of Aboriginal groups living in the region during this period appear to have become increasingly complex. Available archaeological data, for example, suggest a significant increase in site establishment and population densities over time, as well as a concomitant growth in the size and complexity of social aggregation (but see Attenbrow (2012) and Hiscock (2008) for cautionary notes on the interpretive significance of radiometric date graphs). Growing economic specialisation is indicated by the emergence and/or proliferation of complex fishing and stoneworking technologies, with the latter linked variously to increased foraging risk associated with greater climatic variability as well as other variables such as redefinition of social space, reduction of resources and increased logistical pre-equipping (Attenbrow *et al.* 2009; McDonald, 2008: 40). Complex, long-distance exchange networks are also attested archaeologically (e.g., Attenbrow *et al.*, 2012; Grave *et al.*, 2012) as are important developments in artistic activities (McDonald, 2008). Higher levels of stylistic heterogeneity in pigment and engraved art across the region, for example, have been linked to increasing territoriality (McDonald, 2008: 42).

With some modification, McCarthy's (1967) *Eastern Regional Sequence* (ERS) of stone artefact assemblages remains the dominant chronological framework for Aboriginal occupation of the region. Based on appreciable changes in the composition of chipped stone artefact assemblages over time, the ERS hypothesises a three phase sequence of 'Capertian' (earliest), 'Bondaian' and 'Eloueran' (most recent) assemblages and was developed on the basis of McCarthy's (1948, 1964) pioneering analyses of stratified flaked stone assemblages from Lapstone Creek rockshelter, on the lower slopes of the Blue Mountains eastern escarpment, and Capertee 3 rockshelter in the Capertee Valley north of Lithgow (see Table I-1). At present, the most widely cited characterisation of the ERS in the Sydney region is that of a four-phase sequence beginning with the *Pre-Bondaian* (McCarthy's *Capertian*) and moving successively through the Early, Middle and Late phases of the *Bondaian*, the last of which equates to McCarthy's (1967) *Eloueran* phase. The tripartite division of the Bondaian is based principally on the presence/absence and relative abundance of backed artefacts (Attenbrow, 2010: 101). However, other factors, such as changes in the abundance of bipolar artefacts and different stone materials, as well as the presence/absence of edge-ground hatchet-heads are also relevant.

⁴ Following Attenbrow (2012a), the land bounded by the coast on the east, by the Hawkesbury-Nepean River in the north and west, and by a line running east-west through Picton and Stanwell Park in the south.

Table I-1 McCarthy's (1967) Eastern Regional Sequence (ESR) of stone artefact assemblages

Current phasing	McCarthy's (1967) Phasing	Approximate date range	Backed artefact frequency	Bipolar artefacts	Edge-ground hatchet heads
Pre-Bondaian	Capertian	36,000-8,000 BP	Absent	Rare	Absent
Early Bondaian	Bondaian	8,000-4,000 BP	Very low	Rare	Absent
Middle Bondaian		4,000-1,000 BP	Very high	Increasingly common	Present
Late Bondaian	Eloueran	1,000 BP to European contact	Low	Very common	Present

McDonald's (2008) Behavioural Land Use Model

Drawing, in particular, on the results of several large-scale archaeological salvage projects across the northern Cumberland Plain, including those undertaken for the various stages of the Rouse Hill Infrastructure Project (e.g., Jo McDonald CHM, 2001, 2005a), McDonald (2008) has proposed a behavioural model for prehistoric Aboriginal land use in the Sydney region. Developed in partnership with lithic analyst Beth White over several years, McDonald's (2008) model remains the most comprehensive model of its type for the region. The model, which differs from existing land use models for the region (i.e., Kohen, 1986, 1988; Kohen & Lampert, 1987; Ross, 1976, 1988) in its explicit, dual emphasis on stone artefact technology and rock art, is summarised below.

According to McDonald's (2008) model, Aboriginal groups occupying the Sydney region during the late Pleistocene/early Holocene were highly mobile. Groups travelled considerable distances between base camps and camped proximate to exploited resources (McDonald, 2008:39). Group territories at this time were large and the preferred raw material for flaked stone tool manufacture was silicified tuff. This raw material was sourced principally from the Hawkesbury-Nepean River gravels (McDonald, 2008:40). Transported lithics were used in woodworking and animal butchery and comprised large cores and simple flake-based implements. Though large, transported cores and implements served as portable raw material supplies and were curated. Backed artefacts were rarely produced during these periods (McDonald, 2008:40). In the late Pleistocene, rock art served as a communicative medium for emphasising broad-scale group cohesion. Social networks at this time were more open and extensive than those recorded at contact (McDonald, 2008:41).

Rising seas associated with the Post-Glacial Marine Transgression (c.21-6.5ka) forced groups previously occupying the region's coastal plain inland. Former low lying valleys and flats were converted into bays and estuaries. Initially, population densities remained relatively low. However, over time, these increased dramatically, necessitating social mechanisms to mediate uncontrolled and potentially hostile interactions between groups (McDonald, 2008:349). Pigment and engraved art was one of several such mechanisms and was now used to assert both local group distinctiveness and larger-scale (i.e., cultural bloc) cohesion. By 4,000 BP, groups were occupying smaller territories on a more permanent basis. Groups occupying the Cumberland Plain and surrounding sandstone country now did so on a full time-basis though movement between biogeographic zones still occurred (McDonald, 2008:40). Rockshelters in the latter zone were increasingly used for artefact manufacture and discard. Mobility strategies became increasingly logistically-organised, with groups exploiting the resources of well-defined foraging ranges out of base camps located in environmentally strategic locations (i.e., in terms of resource availability) (McDonald, 2008:40).

The stone artefact technology being employed by Aboriginal people occupying the Sydney region underwent substantial change as a result of these broader changes in demography and settlement organisation. Locally available lithic raw materials were increasingly utilised and there was an overall diminution in the size of utilised toolkits (McDonald, 2008:40). On the Cumberland Plain, silcrete was the preferred raw material and was frequently heated to improve flaking quality. Stone packages were most commonly prepared at exploited stone sources before being transported to residential and other task-specific sites for further use. Blanks selected for reduction were typically reduced via freehand percussion, with bipolar reduction sometimes also utilised. Various core reduction methods were

employed, with asymmetric alternating flaking frequently used. During the Middle Bondaian period (c.4,000 to 1,000 years Before Present (BP)), backed artefacts were manufactured in large numbers across numerous sites, with 'industrial' scale production occurring at some sites. These tools were utilised in range of craft and subsistence activities including bone-working, wood-working, plant processing and animal butchery.

During the Late Bondaian period (c.1,000 years to European contact), there was a reduced emphasis on the occupation of rockshelters, with open camp site locations now foci for habitation. This shift away from rockshelters was a response to the increased spatial requirements of larger social groups associated with a dual social system (McDonald, 2008:349). During times of seasonal abundance, groups lived in large, semi-permanent open 'villages'. However, in times of resource stress, these larger groups dispersed into smaller family or gender-based hunting/fishing groups who reverted to exploiting their traditional foraging ranges. An increased emphasis on bipolar flaking during this period was linked to an even more intensive use of locally available stone. In coastal areas, backed artefacts all but ceased to be produced. Edge-ground hatchets were widely made and used across the region. As in earlier periods, rock art during the Late Bondaian continued to function as an important communicative medium for the assertion of both local group identity and broader culture area cohesion (McDonald 2008:350).

The Cumberland Plain

Concentrated archaeological investigation of the Aboriginal archaeological record of Sydney's Cumberland Plain can be traced to the early-to-mid 1980s, a period marked by a rapid growth in residential and other forms of development across the Plain. Intensive development activities since this time have secured the Cumberland Plain's place as one of the most intensively investigated archaeological regions in Australia, with potentially thousands of Aboriginal archaeological investigations involving survey and/or excavation having now been undertaken (the exact number difficult to calculate due to the limited circulation of many reports). The majority of these investigations were undertaken as part of larger environmental impact assessments associated with residential development and affiliated infrastructure projects. Unsurprisingly, these investigations have varied significantly in scale and scope, ranging from targeted small-scale surveys to complex, multi-phase survey and excavation projects over large areas. Nonetheless, together they have revealed a rich and diverse record of past Aboriginal occupation, with thousands of Aboriginal archaeological sites now registered in the AHIMS database.

Open artefact sites: distribution, contents and definition

Surface and subsurface distributions of stone artefacts, variously referred to as open artefact sites, open sites and open camp sites are the most common and widely distributed form of Aboriginal archaeological site on the Cumberland Plain (see Attenbrow, 2010: Plate 12; Przywolnik, 2007: 46, Table 4.2). Other site types, such as modified trees, quarries, grinding grooves and rockshelters with deposit and/or art or PAD, have also been identified but are comparatively rare. Accordingly, open artefact sites remain the most intensively investigated component of the Aboriginal archaeological record of the Cumberland Plain, with site distribution and the technology of associated flaked stone artefact assemblages, in particular, comprising key research topics (e.g., AMBS, 2000; Craib et al., 1999; Jo McDonald CHM, 2001, 2003, 2005a, 2006a, 2006b, 2006c, 2007, 2009a, 2009b; Kohen, 1986; White & McDonald, 2010).

Existing archaeological survey data for the Cumberland Plain indicate a strong trend for the presence of open artefact sites along watercourses, specifically, on creek banks and 'flats' (i.e., flood/drainage plains), terraces and bordering lower slopes. Although this distribution pattern can be attributed in part to geomorphic dynamics and archaeological sampling bias, with extensive fluvial erosion activity along watercourses resulting in higher levels of surface visibility and, by extension, concentrated survey effort, an occupational emphasis on watercourses is supported by the results of numerous subsurface investigations (e.g., AMBS, 2000; Craib et al., 1999; GML, 2012, 2016; Jo McDonald CHM, 2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b). Collectively, these investigations have demonstrated that assemblage size and complexity tend to vary significantly in relation to stream order and landform, with larger, more complex⁵ assemblages concentrated on elevated, low gradient

⁵ Those containing a wider variety of raw materials and technological types and/or higher mean artefact densities and features such as knapping floors.

landform elements adjacent to higher order watercourses. Artefact distributions associated with major creek lines and confluences tend to consist of localised high density artefact concentrations set within lower density artefact scatters across the broader landscape. Outside of these contexts, surface and subsurface artefact distributions have typically been found to be sparse and discontinuous and are often referred to as 'background scatter', being "artefactual material which is insufficient in number or in association with other material to suggest focussed activity in a particular location" (Douglas and McDonald, 1993).

Flaked stone artefacts dominate archaeological assemblages from recorded open artefact sites on the Cumberland Plain, with heat shattered rock also well represented. Items such as complete and broken grindstones, hammerstones and edge-ground hatchet heads have also been recorded though comparatively infrequently. With the notable exception of 'knapping floors'⁶, a relatively common component of the Aboriginal archaeological record of the Cumberland Plain, associated archaeological features (e.g., hearths, ground ovens and heat treatment pits) have proven elusive (but see AHMS, 2013; GML, 2016; McDonald and Rich, 1994; Jo McDonald CHM, 2009a for examples). Investigated knapping floors across the Plain have varied considerably in size and complexity, with the largest and most complex examples identified through excavation as opposed to surface survey (e.g., Jo McDonald CHM, 2001, 2005a, 2006b, 2007). Backed artefacts (i.e., Bondi points, geometric microliths and elouera) are a common feature of knapping floors and most of these features were likely specifically associated with their production. In common with regions such as the Hunter Valley (e.g., Hiscock, 1993; Moore, 2000), available evidence supports the suggestion that backed artefact manufacture on the Cumberland Plain was a highly structured or systematic activity.

Although relevant to a variety of site types, geomorphic processes such as soil erosion and colluvial/fluvial aggradation are of particular relevance to the identification and definition of open artefact sites. As in other archaeological contexts (e.g., Dean-Jones & Mitchell, 1993), the visibility of open artefact sites across Sydney's Cumberland Plain can, for the most part, be attributed to such processes, which have variously exposed or obscured them. Critically, surface artefacts invariably represent only a fraction of the total number of artefacts present within recorded surface open artefact sites across the Plain, with a typical surface to subsurface artefact ratio of 1:25 proposed (Jo McDonald CHM, 2005b: 35). Artefact exposure, unsurprisingly, is highest on erosional surfaces and lowest on depositional ones. At the same time, in many areas, surface artefacts have been shown through dispersed testing programs to form part of more-or-less continuous subsurface distributions of artefacts, albeit with highly variable artefact densities linked to environmental variables such as distance to water, stream order and landform (e.g., White & McDonald, 2010). The presence or absence of surface artefacts on the Cumberland Plain, therefore, is not a reliable indicator of Aboriginal archaeological sensitivity.

Flaked stone artefact technology

Virtually indestructible, flaked stone artefacts are a ubiquitous element of the Aboriginal archaeological record of the Cumberland Plain and have assumed a prominent position in archaeological reconstructions of past Aboriginal land use across the region. To date thousands of surface-collected and excavated flaked stone assemblages from across the Cumberland Plain have been analysed, with individual assemblage sizes, research questions, aims, analytical methodologies and terminological schemes varying significantly between researchers and projects. Studies to date have ranged from basic descriptive accounts of assemblage composition in typological terms to detailed reconstructions of past stone reduction and quarrying behaviours through rigorous technological analyses. Particularly informative analyses in the context of the Cumberland Plain include those conducted by Jo McDonald CHM (2001, 2003, 2005a, 2006a, 2006b, 2006c, 2007, 2009a, 2009b) as part of archaeological salvage projects associated with development activities within the Rouse Hill Development Area (RHDA), the former Australian Defence Industries site at St Marys and the Colebee Release Area. Technological analyses of stone artefact assemblages recovered from fluvial sand bodies adjacent to the Parramatta (Jo McDonald CHM, 2005b, 2005c, 2006b) and Hawkesbury Rivers (AHMS 2013;

⁶ Following White (1997:8), knapping floors can be defined as activity areas "where primacy was given the systematic reduction of stone, with or without additional activities being carried out".

Williams *et al.* 2012) have likewise proven highly informative, particularly with respect to the documentation of diachronic changes in raw material use and stone artefact technologies.

Available technological and typological data for surface collected and excavated flaked stone artefact assemblages from the Cumberland Plain suggest that the majority of these assemblages belong to what is known as the 'Australian small-tool tradition', a term coined by Gould (1969) to describe what was then thought to be the first appearance, in the mid-Holocene⁷, of a new suite of flaked stone tool forms in the Aboriginal archaeological record of Australia, including backed artefacts, adzes and points (both unifacially and bifacially flaked). Complex, hierarchically-organised reduction sequences associated with the production of these tools contrast markedly with the simple sequences of earlier periods (Moore, 2011). Tools of the Australian small-tool tradition, it has been suggested, formed part of a portable, standardised and multifunctional tool kit aimed specifically at risk reduction (Hiscock, 1994, 2002, 2006). Stone artefact assemblages from late Pleistocene and early Holocene contexts, in contrast, are described by archaeologists as belonging to the 'Australian core tool and scraper tradition', a term first used by Bowler *et al.* (1970) to describe the Pleistocene assemblages recovered from Lake Mungo in western NSW. Bowler *et al.* (1970) saw the main components of these assemblages - core tools, steep-edged scrapers and flat scrapers - as characteristic of early Australian Aboriginal assemblages and as being of a distinctly different character to those associated with the preceding small-tool tradition. In southeastern Australia, including the Cumberland Plain, the Australian 'small-tool' and 'core tool and scraper' traditions are most commonly described in terms of McCarthy's (1967) ERS, with 'Capertian' assemblages assigned to the latter tradition and 'Bondaian' assemblages to the former.

Flaked stone artefact assemblages from excavated and surface collected/recorded open artefact sites on the Cumberland Plain attest to the exploitation of a diverse range of lithic raw materials (Corkill, 1999, 2005). However, two rock types - silcrete and silicified tuff (also known as indurated mudstone) - dominate the region's existing stone artefact record. Other, less commonly exploited raw materials represented in excavated and surface collected/recorded assemblages include quartz, quartzite, petrified wood, chert and various fine-grained volcanics. Alongside silcrete and silicified tuff, these materials occur variously in a number of geological formations and units across the Cumberland Plain (for a detailed review see Corkill 1999). Oft-cited sources include the Tertiary St Marys (Ts) and Rickabys Creek Gravel (Tr) formations, as well as the various unconsolidated Pleistocene units that line as terraces the present day and abandoned channels of the Nepean-Hawkesbury River (e.g., the Cranebrook Formation (Qpc)). Holocene gravel banks along the same river system have likewise been identified as a potentially significant raw material source.

In common with the Sydney region as a whole (Attenbrow, 2010:120-121), various excavated assemblages from the body and peripheries of the Cumberland Plain (e.g., Jo McDonald CHM, 2001a, 2005a; Williams *et al.*, 2012, 2014) attest to a shift, over time, in the relative significance of particular raw materials for flaked stone artefact manufacture, principally silcrete and silicified tuff but also quartz. An 'early' (i.e., Pre-Bondaian) emphasis on the procurement and reduction of silicified tuff, for example, appears to have given way to a 'later' (i.e., Bondaian) emphasis on silcrete. Quartz use, meanwhile, appears to have peaked in the late Holocene. For the Cumberland Plain, these changes have been linked, in particular, to broader changes in settlement organisation, with a decline in levels of residential mobility over time prompting more intensive use of locally available stone (Jo McDonald CHM, 2005a).

In the northwestern portion of the Cumberland Plain, the Tertiary St Marys Formation has been singled out as a particularly important source of silcrete for flaked stone artefact manufacture. Mapped at various localities across the Mulgoa Creek, South Creek and Eastern Creek catchments, the best known and most intensively investigated outcrops of this formation occur on Plumpton Ridge, a low but locally prominent ridgeline separating the floodplains of Eastern Creek and Bells Creek between the suburbs of Plumpton and Riverstone. The subject of numerous archaeological investigations since the early 1980s (e.g., Australian Museum Business Services, 2002; Baker, 1996; Barry, 2005; McDonald, 1986), Jo McDonald CHM's (2006c) large-scale archaeological salvage works across what is now Stonecutters Ridge Golf Club unequivocally identified Plumpton Ridge as a major Aboriginal

⁷ More recent research into the chronology of backed artefacts and points in Australia (e.g., Hiscock & Attenbrow 1998, 2004; Hiscock 1993b) has demonstrated a long history of production and use for these implement types, with both types now known to have been produced, albeit in small numbers, in the early Holocene and likely in the late Pleistocene as well.

quarry site. At the same time, they highlighted a number of important trends in relation to the procurement and reduction of silcrete obtained from this source. Trends in the relative frequencies of raw material types, artefact types and the size of silcrete artefacts in local excavated assemblages, for example, were attributed to a process of 'distance-decay' (Jo McDonald CHM's 2006c: 61).

Procurement evidence at documented Aboriginal quarry sites across the Cumberland Plain, including Plumpton Ridge, has to date consisted of varying surface and/or subsurface densities of flaked stone artefacts in direct spatial association with naturally occurring Tertiary gravel deposits (silcrete dominant). Topographic indicators of 'open cut' mining activities, such as localised circular/semi-circular depressions or trenches (cf. Binns & McBryde, 1972; Jones & White, 1988; McBryde, 1973, 1984), have yet to be identified, though this is unsurprising given the nature of the lithic deposits being quarried. Alongside those from the ADI:EPI and ADI:FF2 quarry sites within the former Australian Defence Industries site (Jo McDonald CHM, 2006a, 2008a), excavated flaked stone artefact assemblages from the SA25 and SA26 sample areas on the upper eastern flank of Plumpton Ridge, detailed in Jo McDonald CHM, 2006c, have provided a robust technological 'signature' for Aboriginal quarry sites on the Cumberland Plain. Amongst other activities, such as limited tool production/discard and later stage core reduction, stone procurement/reduction activities at exploited stone sources appear to have included 'primary' or early stage clast reduction as well as deliberate heat treatment and fracturing (Jo McDonald CHM, 2006c).

Backed artefacts dominate the retouched components of the majority of dated and undated Bondaian assemblages from the Plain and, as such, the technology of their manufacture has received considerable analytical and interpretive attention. Studies by Jo McDonald CHM (2001, 2003, 2005a, 2006a, 2006b, 2007, 2009a, 2009b), in particular, have demonstrated that backed artefact manufacture on the Cumberland Plain was a highly structured or systematic activity involving a complex system of raw material procurement, transportation, preparation and reduction. Differences in the technological character of recovered cores across the region attest to a significant degree of variability in the methods used by Aboriginal knappers to produce flakes for backed artefact manufacture. However, certain techniques (e.g., asymmetric alternating flaking and Hiscock's (1993) 'tranchet technique') are particularly well represented. Evidence for the deliberate heat treatment of silcrete blanks, both as part of systematic backed artefact manufacture activities and other reduction activities, is abundant and widespread, with excavated and surface collected assemblages attesting to the use of heat at various points in the reduction process. As in other contexts (e.g., Hiscock 1993), the thermal alteration of Cumberland Plain silcrete appears to have significantly improved the flaking quality of the stone, increasing the lustre and smoothness of fracture surfaces.

Chronology of occupation

In common with the Sydney region as a whole, evidence for late Pleistocene/early Holocene (i.e., Pre-Bondaian/Early Bondaian) Aboriginal occupation of the Cumberland Plain is sparse, with confirmed or potential evidence from these periods obtained from only a limited (<20) number of sites/landscapes. Well documented examples include Rouse Hill sites RH/CC2 (Jo McDonald CHM, 2001), RH/SC5 (Jo McDonald CHM, 2002b), RH/CD12 (Jo McDonald CHM, 2002a) and RHCD7 (Jo McDonald CHM, 2007); Richmond site RMI (Jo McDonald CHM, 1997a); PT12 near Pitt Town (Williams *et al.*, 2012, 2014); Jamisons Creek, Emu Plains (Kohen *et al.*, 1984); Power Street Bridge 2, Doonside (McDonald, 1993), Regentville RS1, Regentville (Koettig & Hughes, 1995; McDonald *et al.*, 1996), the Parramatta CBD (AHMS 2013; Austral Archaeology, 2007; Jo McDonald CHM, 2005b, 2005c, 2006b) and the Windsor Museum site (Austral Archaeology, 2011; Williams *et al.* 2012; Williams *et al.* 2014). Claims of a c.40 ka year old date for five 'flaked pebbles' recovered from a gravel pit associated with the Cranebrook Terrace near Penrith (Nanson *et al.* 1987) have been widely questioned, [insert references to critiques] with legitimate concerns raised over the artefactual status of these pebbles, their provenance and association with available dates (but see Williams *et al.* 2017 for the results of more recent work at Cranebrook Terrace). For most sites, late Pleistocene/early Holocene occupation has been inferred on the basis of the technological and typological characteristics of recovered flaked stone artefact assemblages as opposed to radiometric dates.

At present, the oldest securely dated archaeological site on the Cumberland Plain is the PT12 site at Pitt Town, with compliance-based archaeological excavations across a source-bordering dune at this site, which overlooks the Hawkesbury River, producing a suite of Optically-Stimulated Luminescence (OSL) dates suggestive of Aboriginal occupation from at least 36,000 years ago (and potentially earlier) (Williams *et al.* 2012, 2014). Closer to the coast, Late Pleistocene/early Holocene occupation

of a sandy fluvial terrace adjacent to the Parramatta River (i.e., the Parramatta Sand Sheet) has been proposed by Jo McDonald CHM (2005b, 2005c, 2006b) and seems likely on the basis of available radiometric dates and assemblage characteristics.

In stark contrast to the late Pleistocene/early Holocene, evidence for mid-to-late Holocene (i.e., Middle to Late Bondaian) Aboriginal occupation of the Cumberland Plain abounds, with numerous excavated sites producing assemblages that can be confidently assigned to these periods on the basis of radiometric dates and/or their typological/technological profiles. Available radiometric dates indicate a steady increase in the number of sites occupied over the course of the Holocene, with a peak in the 2nd millennium BP (see, for example, Przywolnik 2007: 53, Fig. 4.6). Taken at face value, this data suggests a progressive increase in the Aboriginal population of the Cumberland Plain over the course of the Holocene. However, following Hiscock (2008: 230-233), it seems likely that the directional population growth suggested by such data is, to a certain extent at least, a product of differential site preservation, with younger sites better preserved than older ones. Other factors, such as the burial of older sites through sediment deposition and bias in the location of archaeological surveys and excavations, may also be relevant.

Critical to any discussion concerning the antiquity of Aboriginal occupation across the Cumberland Plain are the well-documented difficulties surrounding the dating of open artefact sites with active 'biomantles' (*sensu* Paton et al. 1995; see Dean-Jones & Mitchell, 1993; Balek 2002; Hofman 1986; Johnson et al. 2005; Johnson 1989; Paton et al. 1995; Peacock & Fant 2002; Stein 1983). On the Cumberland Plain, the term biomantle is typically used as a collective descriptor for the 'A' soil horizons of the Plain's dominant texture contrast or duplex soil profiles⁸, which tend to be relatively thin (<30 cm) and exhibit extensive evidence of bioturbation in the form of roots, open/infilled burrows, live insects and/or earthworms and stone lines⁹. However, it is noted that the uppermost portions of underlying 'B' soil horizons can also exhibit such evidence and form part of the biomantle (e.g., AECOM, 2015a). As highlighted by Dean-Jones & Mitchell (1993) and others (e.g., Balek, 2002; Johnson, 1989), excavated finds assemblages from archaeological sites with active biomantles are subject to a range of interpretive constraints, with intact depositional stratigraphy unlikely to be preserved and inset archaeological features (e.g., hearths and heat treatment pits) representing the only reliable means of dating (with any specificity) intercepted archaeological events (Mitchell, 2009: 4). Any stone artefacts discarded at the surface in landscapes with active biomantles are likely, over time, to have been incorporated into the soil profile through bioturbation, with depth of artefact burial ultimately corresponding to the base of major biological activity (i.e., the base of the biomantle). Where biomantles remain relatively undisturbed, horizontal patterns of artefact discard may be preserved. However, in heavily disturbed contexts, the preservation of such patterning is unlikely (Mitchell 2009: 4).

For archaeologists working on the Cumberland Plain, the analytical and interpretive constraints posed by intensive bioturbation have, in combination with a real paucity of dateable features, led to a reliance on the dating of excavated archaeological finds through relative means, specifically, through consideration of the typological and technological composition of associated flaked stone artefact assemblages and reference to a modified version of McCarthy's (1967) ESR, the broad temporal parameters of which are now well established. While offering a useful chronological framework within which to assess diachronic changes in stone artefact technologies and raw material use, the largely undated and palimpsest character of the Cumberland Plain's lithic record represents a significant analytical and interpretive obstacle for period-specific reconstructions of Aboriginal mobility regimes (cf. Cowan, 1999). Well dated assemblages from sites retaining stratified deposit(s) are rare, with the most comprehensively dated sequences to date coming from deep fluvial sand bodies adjacent to the Hawkesbury and Parramatta Rivers (i.e., AHMS, 2013; Jo McDonald CHM, 2005c; Williams et al., 2012, 2014). While the preservation and dating potential offered by such bodies has been amply demonstrated, the same cannot be said of alluvial valley fill sequences outside of these major river valley contexts, with comparatively little research directed towards investigating the age, genesis or evolution of alluvial valley fill sequences within the Cumberland Plain's numerous creek valleys, nor

⁸ These profiles are characterised by loamy topsoils and silty clay to clay subsoils, with boundaries between these two units typically clear to abrupt. Clayey subsoils have formed by *in situ* weathering of the parent material, while topsoils are derived from a combination of *in situ* weathering and the deposition of colluvially and/or fluvially transported materials.

⁹ Stone lines, where present, typically occur at the interface between the A and B horizons.

their potential for preserving at depth (i.e., within buried paleosols) Aboriginal archaeological materials of varying ages, including those of Late Pleistocene/Early Holocene antiquity (but see AHMS, 2015; Barham, 2005, 2007; Jo McDonald CHM, 2005a for notable exceptions). Nonetheless, the limited work that has been conducted in this regard suggests considerable research potential, particularly with respect with the development of chronological frameworks for contextualising and interpreting the flaked stone artefact assemblages recovered from such sequences.

Site distribution and occupation models

A number of Aboriginal site distribution and occupations models have been proposed for the Cumberland Plain over the past four decades, with early models (e.g., Kohen, 1986; Smith, 1989) based principally, or exclusively, on surface evidence and more recent models (e.g., AMBS, 2000; Jo McDonald CHM, 1997b) taking into account both surface and excavated evidence. As indicated in Table I-2, Aboriginal site distribution on the Cumberland Plain has been linked to a variety of environmental factors, with proximity to water, stream order, landform and geology (including proximity to known stone sources) variously highlighted as key determinants.

Table I-2 Aboriginal site distribution and occupation models for the Cumberland Plain

Researcher(s)	Year	Summary of model
Dallas and Witter	1983	<p>Sites closer to silcrete and other raw material sources will tend to contain more cores and waste chips and less utilised material than sites which are located further away. They will also contain more block fractured pieces, a higher frequency of cortex, and the artefacts will generally be larger than those at sites not associated with raw material sources.</p> <p>In areas of raw material abundance, artefacts will be discarded earlier in the reduction sequence and will generally be larger and occur in a variety of forms.</p> <p>Raw material abundance, quality and size will influence assemblage variability.</p> <p>Sites located away from raw material sources will exhibit a wider variety of activities and a higher number of utilized pieces than those closer to them.</p>
Kohen	1986	<p>Proximity to water and geological context are key determinants for site location.</p> <p>Sites can be categorized as one of three types according to their function:</p> <p>camping sites, which have a wide range of activities represented in the archaeological record; woodworking sites, where there is a high proportion of implements to debitage present; and hunting sites, which contain a relatively small number of unworked flakes and are sometimes associated with backed blades.</p> <p>The greatest proportion of sites are located on Wianamatta Shale substrates.</p> <p>The number of artefacts found at a site and site size are more closely correlated to the nature and degree of disturbance at a site than any behavioural factors. The more disturbed the site, the greater the visibility and hence the greater quantity of artefacts recorded.</p> <p>Sites with high artefact densities tend to be found within 100 m of permanent water sources.</p>

Researcher(s)	Year	Summary of model
Smith	1989	<p>Sites are most likely to occur in association with water sources. Permanency of the water source, however, is not a determining factor for site location, with a significant quantity of sites found along temporary creek lines.</p> <p>Sites on the Londonderry Clay/Rickabys Creek Formation are likely to be found in association with gravel exposures.</p> <p>Sites dominated by silcrete are less likely to be found west of Marsden Park and South Creek than east of those areas. Isolated finds in these areas are also less likely to be made from silcrete.</p> <p>Sites east of South Creek are likely to be principally stone tool and silcrete manufacturing and processing sites.</p> <p>Sites in the northern Cumberland Plain are expected to have a lower frequency of implements than those in the south.</p> <p>Woodland areas will typically contain sites at lower densities than open forest areas.</p> <p>Surface sites appear to be more common than subsurface sites, and undisturbed stratified sites are rare due to the degree of disturbance.</p> <p>Sites with over 50 artefacts are rare, although very large sites (500+ artefacts) do occur. There is no apparent patterning to the occurrence of these large sites. The pattern of distribution of site size appears to be determined predominantly by visibility.</p> <p>Sites cannot be divided neatly into 'single use' categories, as most sites were the location of numerous activities.</p>
Jo McDonald CHM	1997b	<p>The size (density and complexity) of archaeological features will vary according to permanence of water (i.e., stream order), landscape unit and proximity to lithic resources.</p> <p>In the headwaters of upper tributaries (i.e., first order creeks) archaeological evidence will be sparse and represent little more than a background scatter;</p> <p>In the middle reaches of minor tributaries (second order creeks) will be archaeological evidence for sparse but focussed activity (e.g., one-off camp locations, single episode knapping floors).</p> <p>In the lower reaches of tributary creeks (third order creeks) will be archaeological evidence for more frequent occupation. This will include repeated occupation by small groups, knapping floors (perhaps used and re-used), and evidence of more concentrated activities.</p> <p>On major creeklines will be archaeological evidence for more permanent or repeated occupation. Sites will be complex and may even be stratified.</p> <p>Creek conjunctions may provide foci for site activity and the size of the confluence (in terms of stream ranking nodes) could be expected to influence the size of the site.</p> <p>Ridgetop locations between drainage lines will usually contain limited archaeological evidence although isolated knapping floors or other forms of one-off occupation may be in evidence in such a location.</p> <p>Naturally occurring silcrete will have been exploited and evidence for extraction activities (decortication, testing and limited knapping) would be found in such locations.</p>

Researcher(s)	Year	Summary of model
		Sites in close proximity to an identified stone source would cover a range of size and cortex characteristics. As one moves away from the resource, the general size of artefacts in the assemblage should decrease, as should the percentage of cortex.
AMBS	2000	<p>Spatial patterning in chipped stone artefact distributions adjacent to major creek lines can - in certain instances - be accommodated under a three-tiered model of 'Activity Overprint Zones' incorporating 'complex', 'dispersed' and 'sparse' zones.</p> <p>Complex zones will exhibit overlapping knapping floors and high density concentrations of artefacts indicative of repeated, long-term occupation events.</p> <p>Dispersed zones may include knapping floors. However, these are typically spatially discrete due to less frequent occupation.</p> <p>Sparse zones will exhibit consistently low frequencies/densities of artefacts. Artefact discard in these zones is likely to have resulted from discard in the context of use or loss rather than manufacture.</p> <p>Flaked stone artefact production and maintenance will leave a more obtrusive archaeological signature than resource extraction (e.g., food collection and processing). These activities will also occur closer to the residential core while resource extraction will typically occur away from it.</p>
Jo McDonald CHM	2005a	<p>Most areas - even those with sparse or no surface manifestations - contain sub-surface archaeological deposits.</p> <p>Where lithic concentrations are found in stable and aggrading landscapes, they are largely intact and have the potential for internal structural integrity. Sites in alluvium (shallow and deep) possess potential for stratification.</p> <p>While ploughing occurs in many parts of the Plain, this only affects the deposit up to c.30 cm depth, and even then ploughed knapping floors have been located which are still relatively intact.</p> <p>Contrary to earlier models for the region, many areas contain extremely high artefact densities, with variability appearing to depend on the range of lithic activities present. Densities in excess of 400-600 artefacts per m² are not uncommon.</p> <p>The complexity of the Cumberland Plain's archaeological record is far greater than was previously identified on the basis of surface recording and more limited test excavation. The time span of Aboriginal occupation has been demonstrated to be far greater than was originally thought.</p> <p>Gross patterning is identifiable on the basis of environmental factors: archaeological landscapes on permanent water are more complex than sites on ephemeral or temporary water lines.</p>

White and McDonald's (2010) analysis of lithic artefact distribution in the RHDA provides a suitably robust dataset for assessing the validity of some of the key predictions of the models outlined above. Based on the results of over a decade of intensive test excavation in the RHDA, this study remains the most comprehensive of its type currently available for the Cumberland Plain. As indicated, Aboriginal site distribution on the Cumberland Plain has been linked to a variety of environmental factors, with distance to water, stream order, landform and geology (including proximity to known stone sources) variously highlighted as important influences. White and McDonald's (2010) analysis both supports and negates various aspects of the postulated relationships between these factors and Aboriginal site patterning on the Cumberland Plain. Key findings can be summarised as follows:

- Artefact distributions do not, as implied by the models of Kohen (1986) and Smith (1989), form bounded 'sites' but rather 'landscapes'
- Artefact distribution does, as variably expressed by AMBS (2000), Kohen (1986), Jo McDonald CHM (1997b, 2005) and Smith (1989), appear to vary with proximity to water, albeit to different extents based on stream order
- Artefact density does, as suggested by Jo McDonald CHM (1997b, 2005), appear to vary significantly with stream order
- Artefact density does, as suggested by Jo McDonald CHM (1997b, 2005), appear to vary significantly with landform
- Aboriginal archaeological sites on the Cumberland Plain cannot, as proposed by Jo McDonald CHM (2005), be adequately characterized on the basis of surface evidence alone. Most areas, regardless of surface indications, contain subsurface archaeological deposit(s)
- The orientation of open land surfaces appears to have influenced the selection of artefact discard locations in the lower portions of valleys, with generally higher densities on lower slopes facing north and north-east
- Distance from known silcrete sources does not, on present evidence at least, appear to have influenced intensity of artefact discard (cf. Dallas & Witter 1983)
- Trends in artefact density and distribution indicate long-term, large scale patterns. Short term models of settlement organization are insufficient to account for these artefact distributions
- Social and/or symbolic factors may have influenced site selection along with the distributions of economic and other resources.

More recently, AHMS (2015), employing a comparable analytical methodology to White and McDonald (2010), undertook an analysis of lithic artefact distribution across sixteen northwestern Cumberland Plain landscapes subject to dispersed testing and/or targeted open area salvage excavations. The dataset for this analysis, which sought, in common with White and McDonald's (2010) study, to identify patterns in artefact discard¹⁰ comprised 2,988 artefacts from 345 dispersed test pits (1 m²) along multiple pipeline corridors. In common with White and McDonald (2010: 32-33), AHMS found that artefact distribution within their sampled landscapes varied significantly in relation to both stream order and landform, with mean artefact densities highest in 3rd order landscapes (16.7 artefacts/m²) and on terraces (16.9 artefacts/m²). Interestingly, however, the mean artefact density for 3rd order landscapes in AHMS's (2015) dataset (i.e., 16.7 artefacts/m²) was found to exceed that for 4th order landscapes in the RHDA dataset (13.9 artefacts/m²). The mean artefact density for creek flats in AHMS's dataset (7.8 artefacts/m²) was likewise found to exceed its counterpart in the RHDA dataset (3.8 artefacts/m²), suggesting that creek flats in AHMS's sampled landscapes may have been more favoured for occupation than those in the RHDA or, alternatively, that creek flats in the RHDA had been subject to more intensive flood-erosion activity (resulting in a greater loss of artefacts).

In keeping with White and McDonald's (2010:34) results, AHMS found that in 2nd order landscapes, artefact density was highest within 50 m of water. Distance to water in 4th order landscapes was not assessed by AHMS. However, in a comparable finding to White and McDonald's (2010:34, Table 9) 4th order dataset, AHMS found that in 3rd order landscapes, artefact density was highest between 51 and 100 m from water. Consideration of 1st and 3rd order landscapes in combination likewise showed that mean artefact density was highest between 51 and 100 m of water, suggesting, in combination with the above, that landform elements located at a slightly greater distance to creeks (and particularly larger creeks) were favoured for sustained/repeated occupation¹¹. While limited to lower slopes, AHMS's analysis of artefact distribution in relation to slope aspect revealed both similarities and differences with the RHDA dataset, with southeast-facing lower slopes in AHMS's sampled landscapes exhibiting the highest mean artefact density (as opposed to north/northeast-facing slopes in the RHDA dataset), followed by northeast-facing lower slopes. Finally, AHMS's analysis of artefact distribution in relation to distance to known silcrete sources produced an entirely different result to

¹⁰ And, by extension, past Aboriginal land use preferences.

¹¹ For the RHDA, White and McDonald (2010:33) attributed a comparable finding to factors such as allowing animals to drink and catching a cool breeze.

White and McDonald's (2010:35, Table 12) analysis of the same relationship, with the latter revealing a pattern of increasing artefact density with increasing distance from known sources. In AHMS's dataset, artefact density was highest within two to three kilometres of known silcrete sources. However, outside of this finding, no clear patterning was evident, suggesting, in line with White and McDonald's (2010) findings, that distance to known silcrete sources likely had little influence over artefact discard rates.

Appendix J

AHIMS Search Results

Appendix J AHIMS Search Results

This appendix has been removed for the public exhibition version of this technical paper.

Appendix K

Previous and current
AHIPS

Appendix K Previous and current AHIPs

This appendix has been removed for the public exhibition version of this technical paper.

Appendix L

Ethnographic context

Appendix L Ethnographic context

Introduction

As in other parts of NSW and Australia more broadly, non-Aboriginal people occupying the Sydney region began to document Aboriginal culture from first contact, with explorers, missionaries, settlers and the like recording their observations of Aboriginal people and/or their material culture in letters, journals and official reports. Many of these accounts are overtly Eurocentric in tone and the content and veracity of some is, at best, questionable. Nonetheless, taken together, they form an important source of information on Aboriginal lifeways at the time of British colonisation and can, in conjunction with available archaeological data, be used to generate working predictive models of prehistoric Aboriginal land use.

Key sources, both primary and secondary, for the languages and lifeways of the Aboriginal people occupying the Sydney region at and following British colonisation include: Attenbrow (2010); Barrallier (1802 [1975]); Bradley (1792 [1961]); Brook & Kohen (1991); Collins (1798 [1975], 1802 [1971]); Dawes (1790a, 1790b); Flynn (1994, 1995a, 1995b); Hunter (1793 [1968]); Irish (2017); Kohen (1985, 1986, 1988, 1993); Kohen and Lampert (1987); Kohen et al. (1999); Matthews (1903); McDonald (2008); Phillip (1789 [1970], 1791 [1963]); Tench (1793 [1979]); Troy (1994); White (1790 [1962]) and Worgan (1788). While a detailed review of these sources is beyond the scope of this report, salient information is summarised in the sections below.

The Darug language and people

The Map of Indigenous Australia (Horton, 1996) indicates that the study area falls wholly within the traditional Darug (also spelt Dhaŋ-rook, Dharrook, Dhaŋrook, Dharruk and Dharug) language area. Darug is believed to have been spoken from the Hawkesbury River in the north, to Appin in the south, and from the coast west across the Cumberland Plain into the Blue Mountains (Figure L-1). Early sources (e.g., Collins 1798 [1975]; 1802 [1971]; Tench 1793 [1961]; Dawes 1790a, 1790b; Phillip in Hunter 1793 [1961]) and more recent linguistic research (e.g., Troy 1994) indicate that two distinct dialects of Darug were spoken at the time of European contact, a coastal dialect, spoken on the Sydney peninsula and the country to the north of Port Jackson, and a hinterland dialect, spoken on the Cumberland Plain from Appin in the south to the Hawkesbury River in the north (Attenbrow 2010: 34). This linguistic division is thought to correspond to a broader economic division between 'coastal' and 'hinterland' Darug-speaking peoples, with the accounts of several early observers (e.g., Bradley 1792 [1961]; Collins 1798 [1975], 1802 [1971]; Phillip 1788 in Attenbrow 2010:63; Tench 1793 [1979]) suggestive of a 'coastal', marine-oriented subsistence economy¹² and contrasting 'inland' economy focused on the exploitation of land mammals, plant foods and freshwater faunal resources. Notably, early sources (e.g., Barrallier 1802 [1975]; Collins 1798 [1975]; Tench 1793 [1961]) suggest that there was little contact between coastal and hinterland groups.

Some idea of population size for the coastal Darug at contact is provided by Attenbrow (2010), who suggests that the area around Port Jackson likely supported a minimum population density of 0.75 persons/one square kilometre (i.e., 1 person/1.3 square kilometres). Attenbrow's estimate is based Governor Phillip's own estimate of the Aboriginal population of this area, made in 1788. Phillip, reporting to Lord Sydney on 15 May 1788, estimated a total population of not "less than one thousand five hundred" (Phillip 1788 in Attenbrow, 2010: 17). Attenbrow (2010:17), citing Hunter (1793 [1968]:62), notes that "population densities for the hinterland (west of Parramatta) were initially assessed by the colonists as being less than those along the coast" but urges interpretive caution given the deleterious effects of 1789 smallpox epidemic, which "had killed many people living to the west of Rose Hill before Phillip's 1791 expedition crossed the Cumberland Plain to the Hawkesbury-

¹² Note that available archaeological evidence suggests that the historically documented seafood bias in the diets of coastal Darug speaking peoples has been overemphasised, with excavated bone assemblages from coastal rockshelter sites (e.g., Balmoral Beach, Angophora Reserve) attesting to the importance of terrestrial and avian fauna in coastal diets.

Nepean River". More recently, Kohen (1995) has estimated a minimum overall density of around 0.5 persons per square kilometre for the hinterland zone.

In common with other regions of NSW (e.g., Attenbrow, 2010) and Australia more broadly (Peterson, 1976), available historical records suggest that the primary units of social organisation amongst the Darug were the clan and band. Kohen and Lampert (1987) equate the term 'clan' with 'band'. However, Attenbrow (2010) draws a distinction between the two, with clans comprising local descent groups and bands, land-using groups who, though not necessarily all of the same clan¹³, camped together and cooperated daily in hunting, fishing and gathering activities. Individual bands will have habitually occupied and exploited the resources of particular tracts of land. However, the territorial boundaries of each band will have been permeable or elastic in the sense of complex kinship ties facilitating inter-band territorial movements and the reciprocal use and/or exchange of resources. Early accounts (e.g., Collins 1798 [1975:453]; Tench 1793 [1979:292]) indicate that clan names were derived from the country on which the members of the clan lived.

Nurragingy, a Darug leader who, alongside another Aboriginal man named Colebee, was granted a 30 acre parcel of land adjacent to Richmond Road in the present day suburb of Colebee is referred to in Governor Macquarie's diary as the 'Chief of the South Creek Tribe' (Macquarie, 25 May 1816). Kohen (1993: 68) notes that this 'tribe' typically camped on Charles Marsden's estate close to junction of South and Eastern Creeks.

¹³ Some individuals may have been related through marriage.

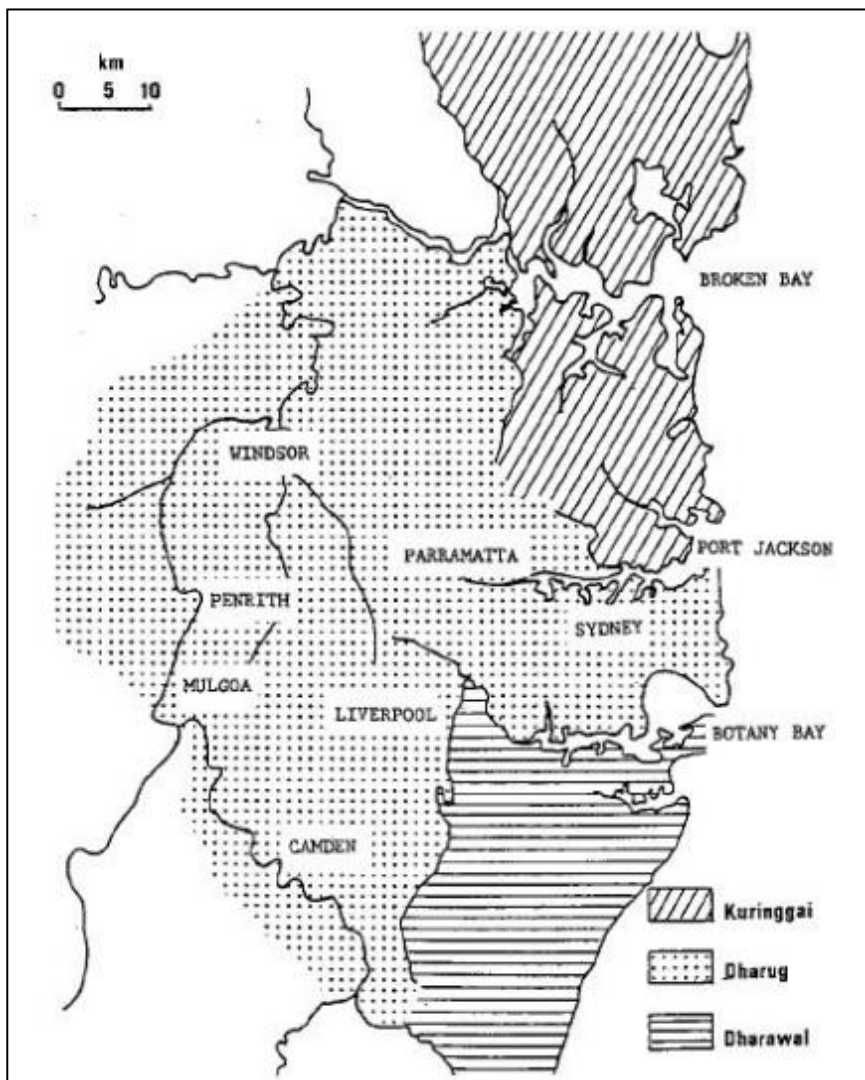


Figure L-1 Aboriginal language group boundaries in the Sydney Region (from Kohen 1993: 241, Fig. 1)

The size of the individual bands occupying the Cumberland Plain at contact was no doubt activity and season dependent. However, an upper limit of around 50 individuals, consisting of several nuclear families, has been suggested (Kohen, 1988: 239). Individual band sizes notwithstanding, much larger groups of Aboriginal people, numbering in the hundreds, are known to have come together for events such as corroborees, ritual combats and feasts (Attenbrow 2010; Kohen et al. 1999). Unlike many Australian Aboriginal groups, social organisation amongst the Darug did not comprise a class system based on moieties or sections but rather was based on clan membership attained through patrilineal descent (Attenbrow, 2010: 57; Kohen, 1993: 35). Totemic affiliations were inherited from a person's father and, along with clan membership, were the basis upon which marriages were arranged and initiations carried out.

Available historical records indicate that a wide range of marine and freshwater fauna were exploited by Darug-speaking peoples for food and other resources (for a detailed discussion see Attenbrow, 2010:62-84). Along the coast, an emphasis on the exploitation of marine resources, principally fish and shellfish, is attested in the writings of several early observers (e.g., Bradley, 1792 [1969: 133]; Collins, 1798 [1975:456, 461, 495]; Phillip 1788 in Attenbrow, 2010:63; Tench, 1793:125, 195 [1979]:233, 287). Further inland, historical records suggest an emphasis on the hunting of land mammals (e.g., Barrallier, 1802 [1975:2 n4]; Collins 1798 [1975:456]; Tench 1793:121 [1979:230]), with kangaroos, wallabies, possums, gliders, fruit bats (i.e., flying foxes), dingos, koalas and wombats variously reported as having been either hunted and/or eaten (Attenbrow, 2010:71). Possums, in particular, appear to have been major food source in the hinterland, with a number of early observers remarking

on the tree climbing skills of the 'woods people' and detailing procurement techniques (e.g., Hunter, 1793 [1968]; Trench, 1793 [1979]; Collins, 1798 [1975]; Barrallier, 1802 [1975]). Freshwater fish, shellfish and eels, as well as platypus, are also known to have been exploited by hinterland groups (e.g., Barrallier, 1802 [1975:2]; Collins, 1798 [1975:461-63], 1802 [1971:321-22]; Phillip in Hunter, 1793 [1968:523]; Trench, 1793 [1979:230]), as are various types of birds.

Compared with their faunal counterparts, the plant food resources of coastal and hinterland Darug-speaking peoples are poorly represented in the writings of early colonial observers. Nonetheless, available descriptions do suggest that plants formed a regular part of the diets of groups in both areas (see Attenbrow, 2010:77-8). Along the coast, a "vegetable catalogue" consisting of "a few berries, the yam and fern root, the flowers of the different Banksia, and at times some honey" is reported by Collins (1798 [1975:462-63]). Further inland, along the Hawkesbury-Nepean River, yams appear to have been particularly important food item (see, for example, Hunter 1793 [1968:153]).

A wide range of hunting and gathering 'gear' was employed by Darug speaking peoples, with distinctive repertoires for men and women (McDonald, 2008: 24). Men's gear included several different forms of spears (variously barbed), spear throwers, clubs, 'swords', boomerangs, shields and hafted stone hatchets known as mogo. Women's toolkits, in contrast, included fishing hooks, lines and sinkers, digging sticks and various containers (shell and wood). Net bags made from plaited wood fibre appear to have been used both men and women (see Attenbrow, 2010: 91). Bark canoes were also widely used (Attenbrow, 2010:87).

Two principal forms of shelter appear to have been utilised by Darug speaking peoples at the time of European contact: rockshelters and small huts built from sheets of bark, branches and bushes. In keeping with the linguistic division of the Darug language into coastal and hinterland dialects, differences in the nature of huts built along the coast and in the hinterland are attested in early colonial writings, with the former reportedly larger and "formed of pieces of bark from several trees put together in the form of an oven with an entrance, and large enough to hold six or eight people" (Collins 1798 [1975: 460]). Unlike those living along the coast, Darug-speaking peoples occupying the Cumberland Plain appear to have relied heavily on bark huts (Hunter 1793 [1968]:60-61). Regarding settlement duration, as Attenbrow (2010:54) has observed, "there is little direct historical evidence for the length of time people stayed at any one campsite (be it a rockshelter or bark hut), how often they moved, or what motivated them to move to another campsite". Kohen and Lampert (1987), for their part, have argued that "some bands probably lived at one campsite for months of each year and regularly returned to it". However, this argument is not universally accepted (e.g., Attenbrow, 2010:55; McDonald, 2008).

Evidence for ceremonial or ritual behaviour amongst Darug-speaking peoples can be found in the writings of a number early observers, with documented 'ceremonial' activities including corroborees, male initiation ceremonies, ritual combats and various burial, body adornment and personal decoration practices (Attenbrow 2010:126-42). While available colonial records provide only scant information on the belief systems of Darug-speaking peoples, reference to the 19th century writings of people such as L.E Threlkeld, A.W Howitt, R.H Matthews, W. Ridley and W.J Enright, suggests that spiritual authority amongst Darug clans was likely vested in a number of ancestral beings, with Baiame or Daramulan - the supreme creative being - a central figure (Attenbrow 2010:127).

Post-contact history

In common with other parts of NSW and Australia more generally, the post-contact history of the Darug-speaking peoples of the Sydney region is primarily one of dispossession and loss, with groups alienated from their traditional hunting, gathering and camping grounds, populations decimated by a combination of introduced diseases¹⁴ and frontier violence (Attenbrow 2010:14-15, 21-22) and surviving groups subject to various colonial initiatives aimed at assimilating them into an ostensibly superior European way of life. The post contact history also demonstrates survival and resilience with the western Sydney Aboriginal population now exceeding 41,887 according to a 2016 census (Lawton & Officer, 2016), representing a large and active regional Aboriginal population in NSW.

¹⁴ As highlighted by Attenbrow (2010:21-22), a major initial cause of depopulation amongst the Darug was the April 1789 smallpox epidemic, which "hit the local [Aboriginal] population horrific effect" and is estimated to have killed "well over half" of Sydney's Aboriginal population (Attenbrow 2010:21).

While the Darug clans of the Cumberland Plain were undoubtedly observing them, most of the early colonial expeditions away from the coast - including Governor Phillip's Expedition to Belle Vue (Prospect Hill) in April 1788 - did not encounter any Aboriginal people. Traces of their presence, however, including huts, camp fires, burning trees and partially-eaten food, were encountered "at every step" (Tench 1791 [1979:154]; see also Phillip 1789 [1970:55]). That Aboriginal people were clearly occupying the "inland" came as a surprise to the exploring colonists, as the prevailing opinion at the time was that this area was uninhabited or, at best, had a very low Aboriginal population density. Once made, initial contacts between Aboriginal people and the exploring colonists appear to have been friendly in nature, "with exchange of gifts and a general atmosphere of co-operation" (Kohen, 1985).

Establishment of the settlement at Rose Hill (Parramatta) in November 1788 did not, at least initially, result in the loss of the goodwill that characterised the region's earliest Aboriginal-European contacts (such as the Wangal, recorded as occupying from Rose Hill down the south side of the Parramatta River (Barns & Mar, 2018:19)), with Collins 1798 [1975:137], for example, reporting the existence at Parramatta of a barter system in which local Aboriginal people (including Bolloderree (Ballederry)) and resident military officers exchanged fish for small amounts of bread and salt beef. Relations, however, appear to have soured quickly, with the aforementioned barter system at Parramatta ending abruptly in mid-1791 as a result of the unprovoked destruction of Bolloderree's canoe, an act that led to the retaliatory spearing (by Bolloderree) of a settler at 'The Flats' (near Kissing Point) and his subsequent banishment from Parramatta by Governor Phillip.

Together with the growth of Parramatta township itself, the early (1791) establishment of "out-settlements" at Prospect and Toongabbie, and subsequent establishment of farms along the Hawkesbury River, restricted Aboriginal peoples' access to their traditional lands and food resources and precipitated what Kohen (1993) has referred to as the "First Australian War". Along the Hawkesbury River, the widespread destruction¹⁵ of traditional yam beds, which provided a dietary staple for inland Darug clans, has been identified as a significant contributing factor to the particularly violent conflict that characterised Aboriginal-settler relations in this part of the Sydney region from the mid-1790s to early-1800s (Kohen 1993:63). Here, as in other parts of the Sydney region, loss of access to traditional hunting and gathering grounds was one of a number of sources of Aboriginal settler-conflict, with unprovoked murders, the kidnapping and rape of Aboriginal women and unfair work conditions on farms also contributing to poor relations and/or directly resulting in armed conflict (Kohen, 1993:62-67).

While numerous acts of Aboriginal resistance to the spread of European settlement across the Sydney region can be identified in available historical records, the guerrilla war waged by Pemulwuy, a Bidjigal man from the George's River area, is undoubtedly the best known. Between 1791 and his death in 1802, Pemulwuy, who first came to the attention of Europeans in December 1790 when he speared Governor Phillip's gamekeeper McIntire, is believed to have organised numerous raids on settler farms around present-day Parramatta, Toongabbie, Prospect and Ryde, and to have speared many travellers around Botany Bay and the Georges River (Flynn, 1995b:135). In March 1797, Pemulwuy was involved in an armed confrontation on the streets of Parramatta, which resulted in him being severely wounded and taken to Parramatta hospital, where he was chained by his ankle. Despite his wounds and ankle chain, Pemulwuy managed to escape from hospital and was soon after observed at the mouth of the Georges River "...having perfectly recovered from his wounds" (Collins, 1798 [1975:70]). Widely known and respected in his community due to his various acts of resistance and evasion, many Aboriginal people believed Pemulwuy to be invincible. Nonetheless, on 2 June 1802, while still at large, Pemulwuy was shot dead and decapitated, his head subsequently preserved in spirits and sent to England. After his death, Governor King acknowledged Pemulwuy as "an active, daring leader of his people" and "brave and independent character" (King to Hobart, 30 October 1802; King to Banks 5 June 1802). Pemulwuy's resistance activities in the greater Parramatta area were continued by his son Tedbury, who was arrested in 1805 and 1809 for robberies and was shot (non-fatally) by Edward Luttrell at Parramatta in February 1810 (Flynn, 1995b:63).

Aboriginal-European relations across the Cumberland Plain are reported to have "entered a new phase" from 1816 onward, with the massacre of 14 Aboriginal men, women and children at Appin in April of that year, undertaken as part of a government sanctioned 'punitive expedition', all but putting

¹⁵ i.e., as a result of vegetation clearance and the planting of crops.

an end to regional hostilities (Kohen, 1993:68). With populations decimated by introduced diseases and frontier violence, and many clans alienated from their traditional country, Aboriginal people increasingly turned to Europeans to meet their basic needs (Kohen, 1993:68). While traditional practises continued in many areas, many survivors began to congregate on the estates of Europeans sympathetic to their plight, with the 'Mulgoa Tribe', for example, congregating on the estate of William Cox in the Mulgoa Valley, and the 'South Creek Tribe' typically residing on Charles Marsden's estate close to the junction of South and Eastern Creeks.

Governmental initiatives to 'civilise' the Cumberland Plain's remaining Aboriginal population can also be traced to this period, with Governor Macquarie, the fifth and last autocratic Governor of New South Wales (1810-1821), pursuing a policy of assimilation aimed at encouraging Aboriginal people "to become regular Settlers" and conciliating "them as much as possible to our Government and Manners" (Macquarie 1816 in Brook & Kohen, 1991:44; Macquarie 1811 in Kohen et al., 1999:78). Macquarie's key initiatives to this end were the Parramatta Native Institution, established in December 1814, and the annual Native "Conference" or "Feast", with the latter serving the "dual purpose of "conciliating the Aboriginal people of the settled areas and encouraging them to give up their children for placement in the Institution" (Flynn, 1995b:90). Held annually¹⁶ until 1833, when judged ineffective by then Governor, Sir Richard Bourke, the Native Feasts were also "designed to facilitate the imposition of administrative structures on the surviving clans" (Flynn, 1995b:96), namely, the division of attendees into their respective "tribes" and the election, amongst each "tribe", of a "chief" that could be held responsible for the behaviour of the members of his group and act as a "conduit for any grievances they had" (Flynn, 1995b:96). Post-1833, it was Governor Bourke¹⁷ who initiated the distribution of blankets through local magistrates, with the resulting "Returns of Natives", taken between 1834 and 1843, providing "a kind of Aboriginal census for these years" (Flynn, 1995b:107) and confirming the presence of several hundred Aboriginal people within the Sydney region into the 1840s.

Established in the context of a series of frontier skirmishes in mid-1814, the Parramatta Native Institution, which was in operation from 1814 to 1822, functioned as a school for teaching Aboriginal children reading, writing, arithmetic and Christian religion, as well as manual labour and agriculture (boys only) and needlework, knitting and spinning (girls only) (Brook & Kohen, 1991). Fluctuating pupil numbers over the life of the institution have been attributed to a range of factors, with many Aboriginal children, for example, running away from the school to re-join their families (Brook & Kohen, 1991:70; Kohen et al., 1999:83). In 1823, the Native Institution was moved by Governor Brisbane to a parcel of land adjoining what was then known as the 'Black Town', a community of Aboriginal people living on and around Governor Macquarie's 30 acre land grant to Colebee and Nurragingy.

While continuing immigration to the area has shaped the community and broader society up to the present day, the continuing presence of Aboriginal people has been a constant factor. "Our ancestors' voices are echoed in our own as we still live in these changed, but beautiful places," Aunty Edna Watson commented when interviewed as part of the Waves of People historical study, which situated Aboriginal people within the diverse multicultural area of contemporary Parramatta, a sentiment equally pertinent to all of the Cumberland Plain (Barns & Mar, 2018:12). In the contemporary society of this area there are numerous Aboriginal people active in a variety of cultural interactions, from Local Aboriginal Land Council interaction with Aboriginal communities, participation in site identification, protection and management, the production of art and cultural events and many other dynamic ways that continue to be a vibrant part of the modern world. The connections from extant sites as evidence of past Aboriginal activity in the landscape through to the integral activities of contemporary communities reinforces the resilience of Aboriginal people and the adage that this always was and always will be Aboriginal land.

The Blacktown Native Institution

The Blacktown Native Institution (BNI) was a colonial initiative aimed at assimilating Sydney's Aboriginal population into an ostensibly British way of life. The subject of numerous investigations since the early 1980s, both archaeological and historical in nature (e.g., Austral Archaeology, 2005; Bickford, 1981; Bosis, 2010; Brook & Kohen, 1991; GML, 2010; Lydon, 2005; Jo McDonald CHM, 2010; Navin Officer, 2007), the BNI was a successor to The Native Institution established by Governor

¹⁶ No feast was held in 1815 due to drought.

¹⁷ Bourke was in office from 1831-37.

Macquarie at Parramatta in 1814 in the context of increasingly violent conflict between settlers and Aboriginal people across the Sydney region. As with its predecessor, the BNI functioned as both a school and agricultural farm, with enrolled pupils instructed on Christianity, reading, writing, arithmetic and, dependent on sex, agriculture (boys only) and needlework (girls only). Today, the Institution site comprises a more-or-less vacant block of land. However, at the height of its operation, the Institution featured a schoolhouse, which doubled as a residence, a kitchen, a coach house, stables, gardens and a stockyard (Figure L-2). Drinking water was obtained on-site from Bells Creek, then known as Gidley Chain of Ponds. Subsequent to its closure in 1829 as a result of rising costs and difficulties surrounding both the acquisition and retention of students, the Institution reserve and its associated buildings were bought and sold several times, with prominent colonial figure Sydney Burdekin a notable owner between 1877 and his death in 1899. Changes in ownership notwithstanding, land in the vicinity of the BNI is known to have remained a focal area for Aboriginal activity/occupation throughout the 19th century.

Formal archaeological investigations within the BNI site include those undertaken by Bickford (1981), Austral Archaeology (2005) and Biosis (2010). Bickford's (1981) early investigation, carried out as part of a larger study of contact period sites on the Cumberland Plain, involved a combination of documentary research and archaeological survey. A notable archaeological outcome of Bickford's investigation was the identification of a contact period artefact scatter on the north-western side of Bells Creek. This comprised a low-density scatter of stone artefacts, early-to-mid 19th century pottery and pieces of convict brick spread "over a wide area" (Bickford 1981:15). Bickford (1981) argued that the contents and location of this site were consistent with available historical records for the Institute, which indicate that Aboriginal adults, presumably parents and/or relatives of pupils, were living in the vicinity of the schoolhouse. A scarred tree was also identified further along Bells Creek, northwest of the contact site. Structural evidence in the area of the schoolhouse was limited to sandstone footings belonging to 'Lloydhurst', the country residence of post-BNI owner Sydney Burdekin.

More recent archaeological investigations within the BNI site have included sub-surface testing. In 2005, Austral Archaeology undertook a cultural monitoring and salvage excavation program in southernmost portion of the BNI site in response to the widening of an existing drain under Rooty Hill Road North for the Westlink M7 project (Austral Archaeology, 2005). As part of this program, six trenches covering a total area of 30 m² were opened. Extant soil profiles were found to be highly disturbed, with modern rubbish encountered in lower spits. No Aboriginal stone artefacts were recovered during excavation. However, large quantities of non-artefactual silcrete were retrieved. In common with Austral Archaeology's findings, Biosis' (2010) program of test excavation in the northern end of the BNI site, which included 35 shovel test pits (5.6 m² in total), found extant soil profiles to be disturbed. Excavated finds consisted of one Aboriginal artefact and 71 pieces of modern and historical material, with historical artefacts consisting predominantly of bottle fragments of late 19th to early 20th century date.

The Blacktown Native Institution site was handed back to the Darug people in October 2018 in recognition of its historical and cultural significance. The Blacktown Native Institution has been recognised as being of State heritage significance because of its combination of historic, social and archaeological values, described as follows in its SHR listing:

The Blacktown Native Institution played a key role in the history of colonial assimilation policies and race relations. The site is notable for the range of associations it possesses with prominent colonial figures including: Governor Macquarie, Governor Brisbane, Samuel Marsden, William Walker and Sydney Burdekin. The Blacktown Native Institution site is valued by the contemporary Aboriginal community and the wider Australian community as a landmark in the history of cross-cultural engagement in Australia. For Aboriginal people in particular, it represents a key historical site symbolising dispossession and child removal. The site is also important to the Sydney Maori community as an early tangible link with colonial history of trans-Tasman cultural relations and with the history of children removed by missionaries. The Blacktown Native Institution is a rare site reflecting early 19th century missionary activity. The site has the potential to reveal evidence that may not be available from other sources about the lives of the children who lived at the school and the customs and management of the earliest Aboriginal school in the colony. The site also has the potential to contain archaeological evidence relating to later phases of land use, including the period the property was owned by Sydney Burdekin. In addition, the site may contain evidence of Aboriginal camps which may

provide information about how Aboriginal people, accustomed to a traditional way of life, responded to the changes prompted by colonisation (NSW SHR 2013).

Colebee and Nurragingy Land Grant

The Colebee and Nurragingy Land Grant, located directly northeast of the BNI site on the eastern side of Richmond Road, was a 30 acre (12 ha) parcel of land jointly granted to Darug men Nurragingy (Creek Jemmy) and Colebee by Governor Macquarie in 1816. Colebee and Nurragingy were awarded the grant by Governor Macquarie in recognition of their involvement as guides in a series of punitive military expeditions to capture or kill Aboriginal people involved in disputes with white settlers around Appin, Cowpastures, Windsor, Parramatta and along the banks of the Hawkesbury-Nepean River. These expeditions were Governor Macquarie's response to increasing violence between settlers and Aboriginal people over limited resources. Governor Macquarie also presented Nurragingy with a "brass gorget" or breast plate inscribed with his name and the title 'Chief of the South Creek Tribe' (Lachlan, 1818). Although the land grant was verbally granted to both men, as attested in Macquarie's own journal (Lachlan, 1818), the grant was registered in Colebee's name only (Brook & Kohen 1991:38-39). Colebee is reported to have stayed only briefly on the grant whereas Nurragingy and his wife Mary appear to have lived there more-or-less permanently until around 1827 (Brook & Kohen, 1991:40). Cited reasons for the selection of the grant by Colebee and Nurragingy include the site's proximity to Plumpton Ridge, a major Aboriginal quarry site, the presence of a semi-reliable supply of drinking water in the form of Bells Creek, and the fact that the area formed part of the traditional land of Nurragingy's clan (Brook & Kohen, 1991: 45; GML, 2010).

During Nurragingy and Colebee's tenure, land within the grant was utilised for growing crops and rearing livestock. A bark and log hut with a chimney, built by ex-convict Sylvanus Williams in 1819 under Governor Macquarie's commission, served as Nurragingy and his wife's residence. A subsequent improvement to the property comprised its fencing, at government expense, in 1823 (Brook & Kohen, 1991: 41). Following the death of Nurragingy and Colebee, the property is known to have passed to Colebee's younger sister, Maria Locke (1843). Maria was a student at the Parramatta Native Institution from 1815 and her marriage to ex-convict Robert Locke in 1824 was the first such officially sanctioned union. The Locke family continued to live on the land until approximately 1917 (Parry, 2005). Today the land consists predominantly of undeveloped rural land (GML, 2010).

To date, no archaeological excavations have been undertaken within the boundaries of the Colebee and Nurragingy Land Grant site, with previous field assessments limited to surface survey. Excavations undertaken in the vicinity include those carried out by Austral Archaeology (2005) and Biosis (2010) within the BNI site and Biosis' (2010) program of test excavation within the boundaries of a previously identified area of PAD (WSPAD3) to the south of the grant site. Excavations within WSPAD3 resulted in the recovery of 32 silcrete artefacts from a total of 74 shovel probes, with large quantities of naturally-occurring silcrete also recovered.

As with the BNI site, the Colebee and Nurragingy Land Grant has been recognised as being of State heritage significance, described as follows in its SHR listing:

The Colebee/Nurragingy Land Grant is a site of state heritage significance because of its combination of historical, social and cultural values. The site was the first land grant ever given to Aboriginal people in Australia. The land grant is associated with two significant Aboriginal figures from the early colonial period-Nurragingy and Colebee-to whom the land was jointly granted in 1816. The location of the land grant is significant because it was an Aboriginal choice, being on land belonging to Nurragingy's clan. The land grant is valued by the contemporary Aboriginal community and the wider Australian community as a landmark in the history of cross-cultural engagement in Australia. For Aboriginal people, in particular, it represents a key historical site symbolising Aboriginal resilience and enduring links to the land (NSW SHR, 2013).

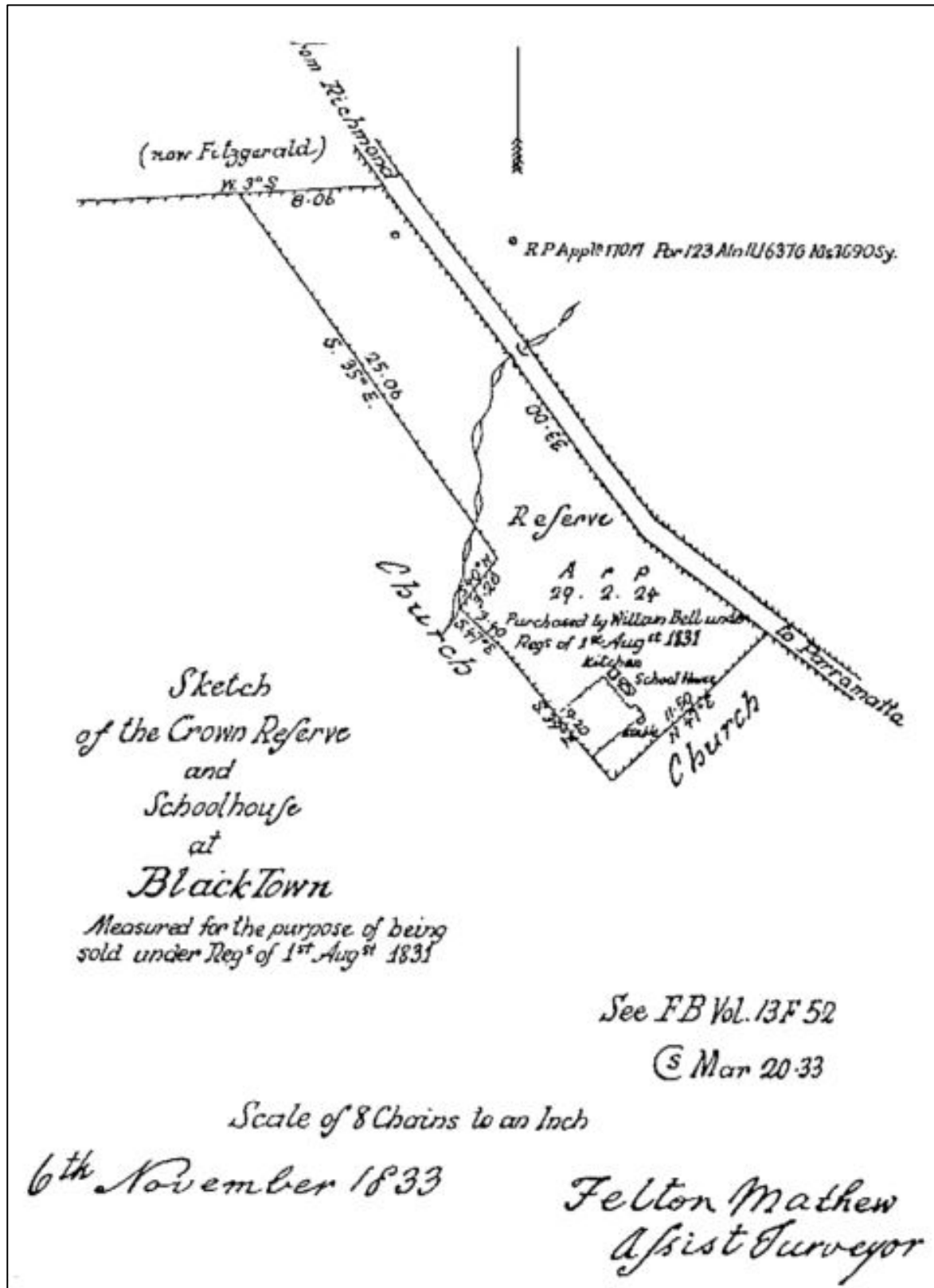


Figure L-2 1833 sketch plan of the Blacktown Native Institution Reserve (from Jo McDonald CHM, 2010: 19, Figure 5)