Appendix

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Appendix L

Cultural heritage assessment report

January 2020

Roads and Maritime Services

Western Harbour Tunnel and Warringah Freeway Upgrade

Technical working paper: Cultural heritage assessment report

January 2020

Prepared for

Roads and Maritime

Prepared by

Jacobs Group (Australia) Pty Limited

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Contents

Abbreviations

ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHCRP	Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010
AFG	Aboriginal Focus Group
AHIMS	Aboriginal Heritage Information Management System
DEC	Department of Environment and Conservation (now the Department of Premier and Cabinet (Heritage))
DECCW	Department of Environment, Climate Change and Water
DPIE	Department of Planning, Industry and Environment
EP&A Act	*Environmental Planning and Assessment Act 1979*
GIS	Geographic Information Systems
Jacobs	Jacobs Group (Australia) Pty Ltd
LALC	Local Aboriginal Land Council
LEP	Local environmental plan
NPW Act	*National Parks and Wildlife Act 1974*
Metro LALC	Metropolitan Local Aboriginal Land Council
OEH	Office of Environment and Heritage (now the Department of Premier and Cabinet (Heritage))
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation (Roads and Maritime, 2011)
RAP	Registered Aboriginal Party
The project	Western Harbour Tunnel and Warringah Freeway Upgrade

Executive summary

The Western Harbour Tunnel and Beaches Link is a NSW Government initiative to provide additional road network capacity across Sydney Harbour and to improve connectivity with Sydney's northern beaches. The Western Harbour Tunnel and Beaches Link program of works includes:

- The Western Harbour Tunnel and Warringah Freeway Upgrade project
- The Beaches Link and Gore Hill Freeway Connection project.

The Western Harbour Tunnel and Warringah Freeway Upgrade project comprises a new tolled motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to connect to the Beaches Link and Gore Hill Freeway Connection project.

This report documents the stages of the Aboriginal cultural heritage assessment of the study area (including any Aboriginal sites located within 50 metres of the project). It includes an environmental and historical background, an outline of the consultation carried out with Aboriginal stakeholders, a cultural values assessment, a significance assessment, an impact assessment and the development of management recommendations specific to each Aboriginal site identified within the study area.

This report has been prepared to meet the Secretary's environmental assessment requirements for the project, issued on 15 December 2017 (Application number SSI 17_8863), and complies with the *Procedure for Aboriginal and Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime Services 2011).

A separate study was carried out to identify potential submerged Aboriginal sites (Cosmos Archaeology 2020). The area studied by Cosmos Archaeology is outlined in Appendix E (Potential Submerged Sites Assessment).

Summary of consultation

For this assessment, Aboriginal stakeholder consultation was carried out in accordance with Roads and Maritime PACHCI. The consultation procedures documented in the PACHCI ensure compliance for Roads and Maritime projects with statutory requirements and Department of Premier and Cabinet (Heritage) policies.

- Identification of key Aboriginal stakeholders began in June 2017 when a search of the National Native Title Register and the Register of Aboriginal Owners established under the *Aboriginal Land Rights Act 1983* was carried out to identify key Aboriginal stakeholders for the project. Native title does not exist in the study area and there are no current claims in the study area. The Metropolitan Local Aboriginal Land Council (Metro LALC) was identified as the only LALC within the study area
- A letter introducing the project was sent to the Metro LALC and advertisements were placed in newspapers in June 2017 to notify Aboriginal people with cultural knowledge of the study area of the proposed works and requesting their participation in the PACHCI process. Following the statutory response time of 28 days for responses to these letters, Registered Aboriginal Parties (RAPs) for the project were registered for subsequent consultation
- The next stage involved the engagement of Aboriginal stakeholders for a pedestrian site survey. Nominated site officers from the Metro LALC were engaged to participate in archaeological surveys carried out in June and August 2017. During these surveys, site officers were provided an opportunity to comment on the potential for Aboriginal cultural material to be present within the study area, the cultural significance of any Aboriginal cultural heritage sites identified during the survey and management recommendations, including recommendations for further assessment
- The first Aboriginal Focus Group (AFG) was held on 28 September 2017 at The Old Northbridge Bowling Club. All RAPs were invited to this AFG. Before the AFG, the draft archaeological survey

report and archaeological methodology was issued to the RAPs for review and comment, allowing a statutory response time of 28 days

- At the end of the 28 day review period, the archaeological methodology had been approved by multiple RAPs. An email and a letter were sent to all RAPs confirming that no further changes would be made to the archaeological methodology. The methodology proposed no test excavation for the study area.

Summary of cultural values assessment

The cultural values assessment involved consultation with RAPs for the project during all stages of fieldwork (inclusive of site survey and test excavation). The Aboriginal cultural values assessment was carried out by Andrew Costello and Andy Roberts (senior archaeologists at Jacobs). No specific knowledge holders for the study area were identified during the consultation process. However, the information provided by the RAPs contributed to an understanding of the cultural value of the broader landscape within which the project would be located. The RAP site officers provided information about the traditional presence of Aboriginal people in the landscape, ceremonial sites and the impact of post-contact land management practices on their traditional land, and subsequently their culture (Section 5).

Through heritage register searches, review of previous archaeological reports, research of the study area's archaeological context and field survey and test excavation, a total of nine Aboriginal cultural places of local significance were identified. These cultural places are associated with Aboriginal archaeological sites identified during the archaeological assessment and are in keeping with the existing recorded Aboriginal sites on the Aboriginal Heritage Information Management System (AHIMS). Four of the sites were unable to be assessed during the archaeological assessment due to private property access constraints. The identified sites were:

- Waverton Park Cave (45-6-2181)
- Waverton Park (45-6-1270)
- Coal Loader 1 (45-6-2762)
- Whale Rock (45-6-0026)
- Quarantine Cave: Waverton (45-6-2180)
- Yerroulbin Cave (45-6-2287) (unable to be accessed during field work)
- Long Nose Point 1 (45-6-1901) (unable to be accessed during field work)
- Shed Cave (45-6-2672) (unable to be accessed during field work)
- 5 Hands Shelter (45-6-2967) (unable to be accessed during field work).

Assessment of the archaeological significance of these sites identified four sites as having high overall significance and one site as having moderate overall significance. The four sites that were not able to be accessed have been given moderate-high overall significance.

The majority of potential impacts on Aboriginal sites within the study area would likely occur during the construction phase of the project. While none of the sites would be directly impacted by the project, all nine would potentially be indirectly impacted due to:

- Indirect impacts on Aboriginal sites associated with surface construction works located within the study area due to vibration
- Indirect impacts from tunnel construction on Aboriginal sites located directly above or within 50 metres of the tunnel alignment, due to vibration or settlement
- Indirect impacts during operation (such as water runoff and visibility).

No previously recorded Aboriginal heritage sites that could be verified during field work are located within the construction footprint at the surface. However, sites are located directly above or within 50 metres of construction activities or the main tunnel alignment (the study area). This includes Waverton Park Cave (45-6-2181), which would be located directly above the main tunnel alignment.

An assessment of potential submerged Aboriginal archaeological sites has been carried out. As potential rock overhangs are submerged and concealed by marine sediments, they cannot be readily accessed and assessed. The assessment of impacts on submerged Aboriginal sites is therefore based on the potential for such sites to exist, using available geophysical information and an understanding of site formation processes. Further pre-construction investigation would be required to confirm the presence of submerged sites and their condition. If confirmed, identification and documentation of remains would occur.

Management recommendations

Management recommendations were developed for the Aboriginal sites located in or within 50 metres of the study area. In general, the first principle of cultural heritage management is to avoid impact before applying mitigation. Where complete avoidance of sites by the project is not possible, mitigation measures for impacted areas of each of the archaeological sites are presented.

General mitigation measures for the management of impact to archaeological sites would also be implemented. These include the *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015), a procedure for managing the discovery of human remains, and the provision for cultural and historic heritage awareness training for personnel engaged in work that may impact archaeological sites.

A summary of the recommendations for archaeological sites is included below, with full recommendations presented in Section 9.

Table E0-1 Summary of management and mitigation measures for Aboriginal sites within the study area

Ref	Management and mitigation measures	Application
AH1	Prior to construction, further consultation with Department of Premier and Cabinet (Heritage), the Metro LALC and the RAPs will be carried out to decide an appropriate course of action for previously recorded Aboriginal sites not assessed during archaeological surveys due to site accessibility constraints. If new information regarding site condition and location is identified during consultation suggesting the sites may be subject to impacts due to vibration and settlement, then mitigation measures AH2, AH3 and AH4 will apply. If during construction works a site is located, Department of Premier and Cabinet (Heritage), an appropriately qualified archaeologist and the Metro LALC will be contacted and the site will be re-recorded in situ. If the site is determined to be within the construction footprint, consultation between Department of Premier and Cabinet (Heritage), Roads and Maritime, Metro LALC and RAP groups will occur with the aim of avoiding, minimising and managing adverse impacts on the site before construction works at the location recommence.	Yerroulbin Cave (45-6-2287) Long Nose Point 1 (45-6-1901) 5 Hands Shelter (45-6-2967) Shed Cave (45-6-2672)
AH2	The following process will be carried out to confirm where vibration monitoring at terrestrial AHIMS sites will be required:	All registered AHIMS sites located within 50

Ref	Management and mitigation measures	Application
	a) Terrestrial Aboriginal site condition surveys will be completed using photogrammetry and 3D-capture techniques to determine which AHIMS sites are considered to be structurally unsound b) Where this determination cannot be made, the AHIMS site will be considered to be structurally unsound c) A screening of vibration intensive activities within 50 metres of structurally unsound sites will be carried out to identify activities that have the potential to exceed vibration levels of 2.5 millimetres per second Sites identified as being both structurally unsound and having potential for exceedance in vibration levels of 2.5 millimetres per second will be identified as requiring vibration monitoring.	metres of the project construction footprint
AH3	Vibration monitoring will be carried out at AHIMS sites that have been identified as requiring monitoring in accordance with the process outlined in mitigation measure AH2. Where possible, works will be conducted in a manner to minimise vibration levels, to less than 2.5 millimetres per second at all structurally unsound AHIMS sites.	All registered AHIMS sites subject to vibration intensive activities determined to be structurally unsound (see AH2)
AH4	If vibration monitoring identifies that vibration levels exceed 2.5 millimetres per second at AHIMS sites that have been identified as requiring monitoring, a site visit will be organised with a representative from Metro LALC to record any changes to the integrity of the site that may have resulted from construction vibration, and updated site cards must be prepared accordingly. Condition surveys may include further photogrammetry and 3D-capture techniques.	All registered AHIMS sites subject to vibration intensive activities determined to be structurally unsound (see AH2)
AH5	If at any time during construction of the project, any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains are discovered they will be managed in accordance with the Roads and Maritime *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015e).	WHT/WFU
AH6	Cultural and historic heritage awareness training will be carried out for personnel engaged in work that may impact heritage items before commencing works for the project.	WHT/WFU
AH7	The need for further high-resolution geophysical survey/s to identify the presence of submerged rock overhangs concealed by marine sediments will be investigated in consultation with a maritime archaeology advisor. If it is determined that a high resolution geophysical survey could produce the desired results, the geophysical survey will be carried out.	Sydney Harbour south and north cofferdams (WHT5 and WHT6)
AH8	The following mitigation measures will be carried out if the geophysical survey described in AH7 is inconclusive or if the geophysical survey identifies rock overhangs at least 1.2 metres in height: a) Excavations will be visually monitored after WHT5 and WHT6 cofferdams have been de-watered in order to identify voids within the bedrock and identify potential rock shelters b) In consultation with a suitably experienced geomorphologist, criteria will be established for the identification of pre-	Sydney Harbour south and north cofferdams (WHT5 and WHT6)

Ref	Management and mitigation measures	Application
	inundation soil deposits (peat, charcoal, roots, etc) and where necessary, samples of marine sediments will be collected to identify if pre-inundation soil deposits are evident If pre-inundation soil deposits are evident then a controlled archaeological investigation will be carried out to recover any artefacts, subject to bed rock conditions and safety constraints within the cofferdams.	
AH9	Prior to construction, determination of whether dredged soil units have potential to contain cultural material will be carried out by a palaeo-geomorphologist through review of existing borehole information. If the potential to encounter cultural material is identified, then an appropriate sampling protocol will be designed so that samples can be collected during construction if feasible.	Dredging works in the immediate vicinity of borehole B215W in Area A, located between Yurulbin Point and Balls Head (Cosmos Archaeology, 2020)

1. Introduction

This section provides an overview of the Western Harbour Tunnel and Warringah Freeway Upgrade (the project), including its key features and location. It also outlines the Secretary's environmental assessment requirements addressed in this technical working paper.

1.1 Overview

The Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018) proposes a vision of three cities where most residents have convenient and easy access to jobs, education and health facilities and services. In addition to this plan, and to accommodate for Sydney's future growth the NSW Government is implementing the *Future Transport Strategy 2056* (Transport for NSW, 2018), a plan that sets the 40-year vision, directions and outcomes framework for customer mobility in NSW. The Western Harbour Tunnel and Beaches Link program of works is proposed to provide additional road network capacity across Sydney Harbour and to improve transport connectivity with Sydney's northern beaches. The Western Harbour Tunnel and Beaches Link program of works include:

- The Western Harbour Tunnel and Warringah Freeway Upgrade project which comprises a new tolled motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to connect to the Beaches Link and Gore Hill Freeway Connection project

- The Beaches Link and Gore Hill Freeway Connection project which comprises a new tolled motorway tunnel connection across Middle Harbour from the Warringah Freeway and Gore Hill Freeway to Balgowlah and Killarney Heights and including the surface upgrade of Wakehurst Parkway from Seaforth to Frenchs Forest and upgrade and integration works to connect to the Gore Hill Freeway at Artarmon.

A combined delivery of the Western Harbour Tunnel and Beaches Link program of works would unlock a range of benefits for freight, public transport and private vehicle users. It would support faster travel times for journeys between the Northern Beaches and south, west and north-west of Sydney Harbour. Delivering the program of works would also improve the resilience of the motorway network, given that each project provides an alternative to heavily congested harbour crossings.

1.2 The project

Roads and Maritime Services (Roads and Maritime) is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* to construct and operate the Western Harbour Tunnel and Warringah Freeway Upgrade, which would comprise two main components:

- A new crossing of Sydney Harbour involving twin tolled motorway tunnels connecting the M4-M5 Link at Rozelle and the existing Warringah Freeway at North Sydney (the Western Harbour Tunnel)
- Upgrade and integration work along the existing Warringah Freeway, including allowance for connections to the Beaches Link and Gore Hill Freeway Connection project (the Warringah Freeway Upgrade).

Key features of the Western Harbour Tunnel component of the project are shown in Figure 1-1 and would include:

- Twin mainline tunnels about 6.5 kilometres long and each accommodating three lanes of traffic connecting the stub tunnels from the approved M4-M5 Link at Rozelle to the Warringah Freeway and to the Beaches Link mainline tunnels at Cammeray. The crossing of Sydney Harbour between Birchgrove and Waverton would involve a dual, three lane, immersed tube tunnel

- Connections to the stub tunnels at the M4-M5 Link project in Rozelle and to the mainline tunnels at Cammeray (for a future connection to the Beaches Link and Gore Hill Freeway Connection project)
- Surface connections at Rozelle, North Sydney and Cammeray, including direct connections to and from the Warringah Freeway (including integration with the Warringah Freeway Upgrade), an off ramp to Falcon Street and an on ramp from Berry Street at North Sydney
- A ventilation outlet and motorway facilities (fit out and commissioning only) at the Rozelle Interchange
- A ventilation outlet and motorway facilities at the Warringah Freeway in Cammeray
- Operational facilities including a motorway control centre at Waltham Street, within the Artarmon industrial area and tunnel support facilities at the Warringah Freeway in Cammeray
- Other operational infrastructure including groundwater and tunnel drainage management and treatment systems, signage, tolling infrastructure, fire and life safety systems, lighting, emergency evacuation and emergency smoke extraction infrastructure, CCTV and other traffic management systems.

Key features of the Warringah Freeway Upgrade component of the project are shown in Figure 1-2 and would include:

- Upgrade and reconfiguration of the Warringah Freeway from immediately north of the Sydney Harbour Bridge through to Willoughby Road at Naremburn
- Upgrades to interchanges at Falcon Street in Cammeray and High Street in North Sydney
- New and upgraded pedestrian and cyclist infrastructure
- New, modified and relocated road and shared user bridges across the Warringah Freeway
- Connection of the Warringah Freeway to the portals for the Western Harbour Tunnel mainline tunnels and the Beaches Link tunnels via on and off ramps, which would consist of a combination of trough and cut and cover structures
- Upgrades to existing roads around the Warringah Freeway to integrate the project with the surrounding road network
- Upgrades and modifications to bus infrastructure, including relocation of the existing bus layover along the Warringah Freeway
- Other operational infrastructure, including surface drainage and utility infrastructure, signage, tolling, lighting, CCTV and other traffic management systems.

A detailed description of the project is provided in Chapter 5 (Project description) and construction of the project is described in Chapter 6 (Construction work) of the environmental impact statement. The project alignment at the Rozelle Interchange shown in Figure 1-1 and Figure 1-3 reflects the arrangement presented in the environmental impact statement for the M4-M5 Link, and as amended by the proposed modifications. The project would be constructed in accordance with the finalised M4-M5 Link detailed design (refer to Section 2.1.1 of Chapter 2 (Assessment process) of the environmental impact statement for further details).

The project does not include ongoing motorway maintenance activities during operation or future use of residual land occupied or affected by project construction activities, but not required for operational infrastructure. These would be subject to separate planning and processes at the relevant times.

Subject to the project obtaining planning approval, construction is anticipated to commence in 2020 and is expected to take around five to six years to complete.

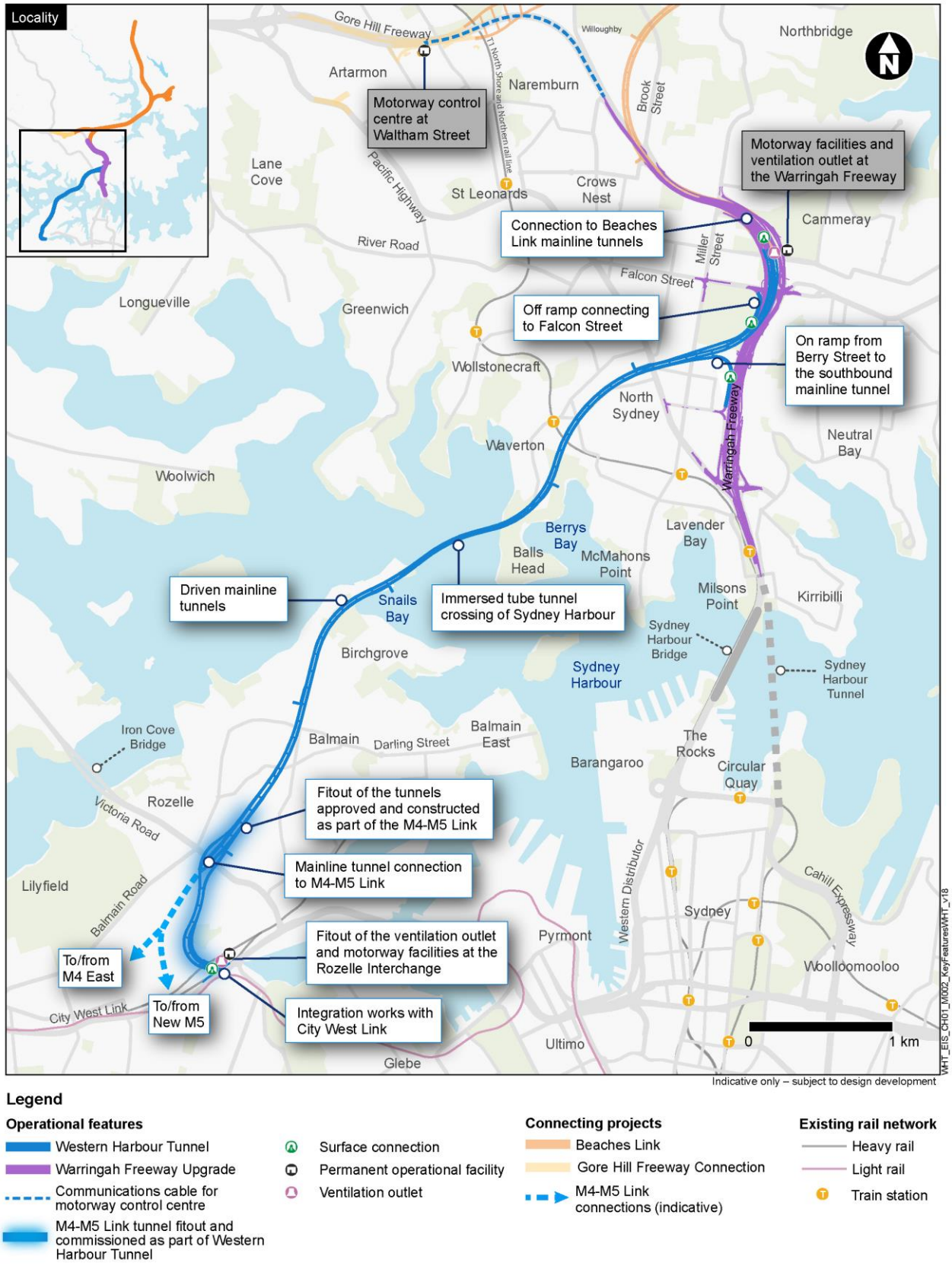


Figure 1-1 Key features of the Western Harbour Tunnel component of the project

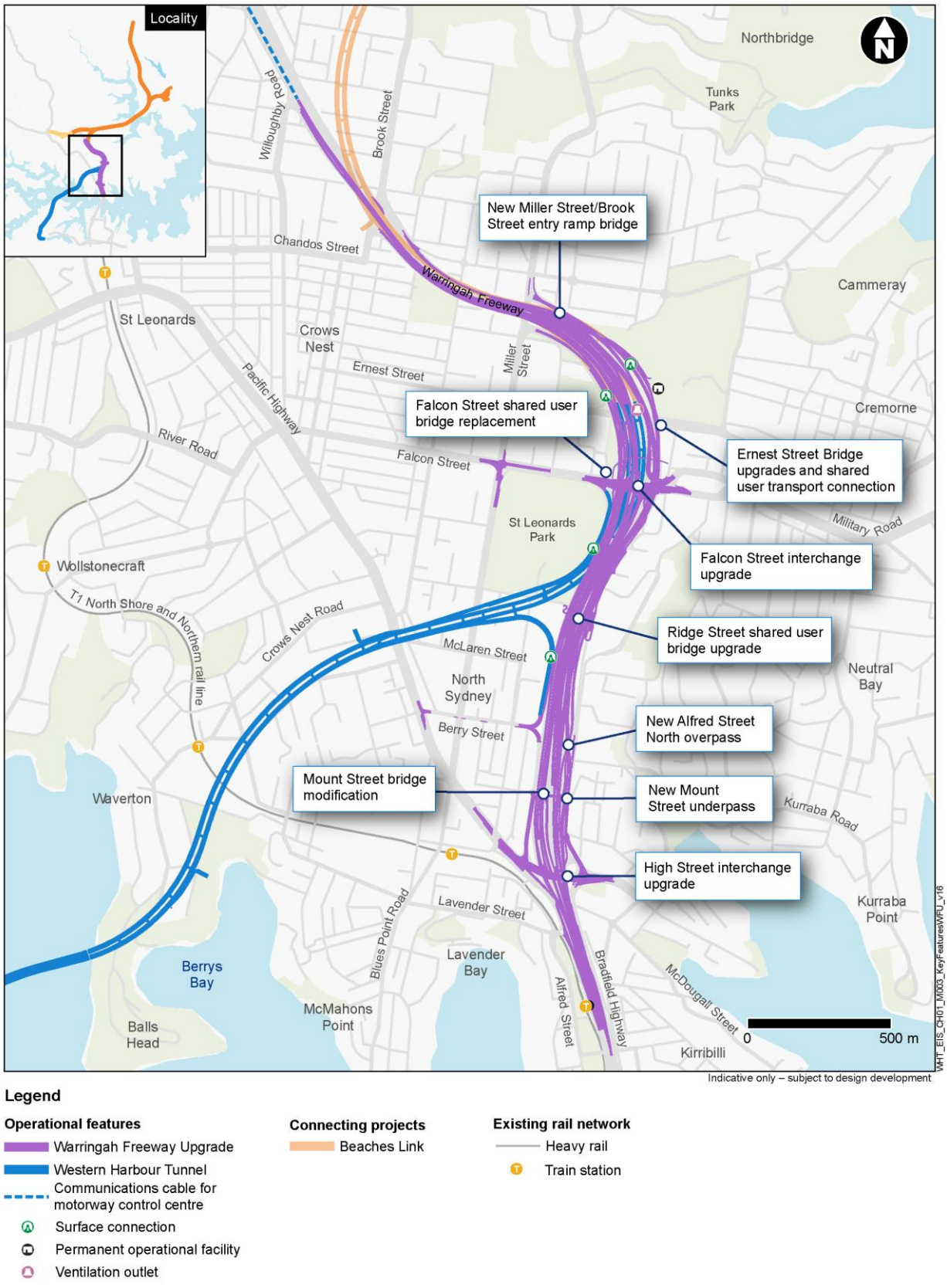


Figure 1-2 Key features of the Warringah Freeway Upgrade component of the project

1.3 Key construction activities

The area required to construct the project is referred to as the construction footprint. The majority of the construction footprint would be located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities and to construct the tunnel connections, tunnel portals and operational ancillary facilities.

Key construction activities would include:

- Early works and site establishment, with typical activities being property acquisition and condition surveys, utilities installation, protection, adjustments and relocations, installation of site fencing, environmental controls (including noise attenuation and erosion and sediment control) and traffic management controls, vegetation clearing, earthworks and demolition of structures, establishment of construction support sites including acoustic sheds and associated access decline acoustic enclosures (where required), construction of minor access roads and the provision of property access, temporary relocation of pedestrian and cycle paths and bus stops, temporary relocation of swing moorings within Berrys Bay and relocation of historic vessels
- Construction of Western Harbour Tunnel, with typical activities being excavation of tunnel construction accesses, construction of driven tunnels, cut and cover and trough structures and construction of cofferdams, dredging activities in preparation for the installation of immersed tube tunnels, casting and installation of immersed tube tunnels and civil finishing and tunnel fitout
- Construction of operational facilities comprising of a motorway control centre at Waltham Street in Artarmon, motorway and tunnel support facilities and ventilation outlets at the Warringah Freeway in Cammeray, construction and fitout of the project operational facilities that form part of the M4-M5 Link Rozelle East Motorway Operations Complex, a wastewater treatment plant at Rozelle and the installation of motorway tolling infrastructure
- Construction of the Warringah Freeway Upgrade, with typical activities being earthworks, bridgeworks, construction of retaining walls, stormwater drainage, pavement works and linemarking and the installation of road furniture, lighting, signage and noise barriers
- Testing of plant and equipment, and commissioning of the project, backfill of access declines, removal of construction support sites, landscaping and rehabilitation of disturbed areas and removal of environmental and traffic controls.

Temporary construction support sites would be required as part of the project (refer to Figure 1-3), and would include tunnelling and tunnel support sites, civil surface sites, cofferdams, mooring sites, wharf and berthing facilities, laydown areas, parking and workforce amenities. Construction support sites for Western Harbour Tunnel would include:

- Rozelle Rail Yards (WHT1)
- Victoria Road (WHT2)
- White Bay (WHT3)
- Yurulbin Point (WHT4)
- Sydney Harbour south cofferdam (WHT5)
- Sydney Harbour north cofferdam (WHT6)
- Berrys Bay (WHT7)
- Berry Street north (WHT8)
- Ridge Street north (WHT9)
- Cammeray Golf Course (WHT10)
- Waltham Street (WHT11).

During the construction of the Warringah Freeway Upgrade, smaller construction support sites would be required to support the construction works (as shown on Figure 1-3). These include:

- Blue Street (WFU1)
- High Street south (WFU2)
- High Street north (WFU3)
- Arthur Street east (WFU4)
- Berry Street east (WFU5)
- Ridge Street east (WFU6)
- Merlin Street (WFU7)
- Cammeray Golf Course (WFU8)
- Rosalind Street east (WFU9).

A detailed description of construction works for the project is provided in Chapter 6 (Construction work) of the environmental impact statement.

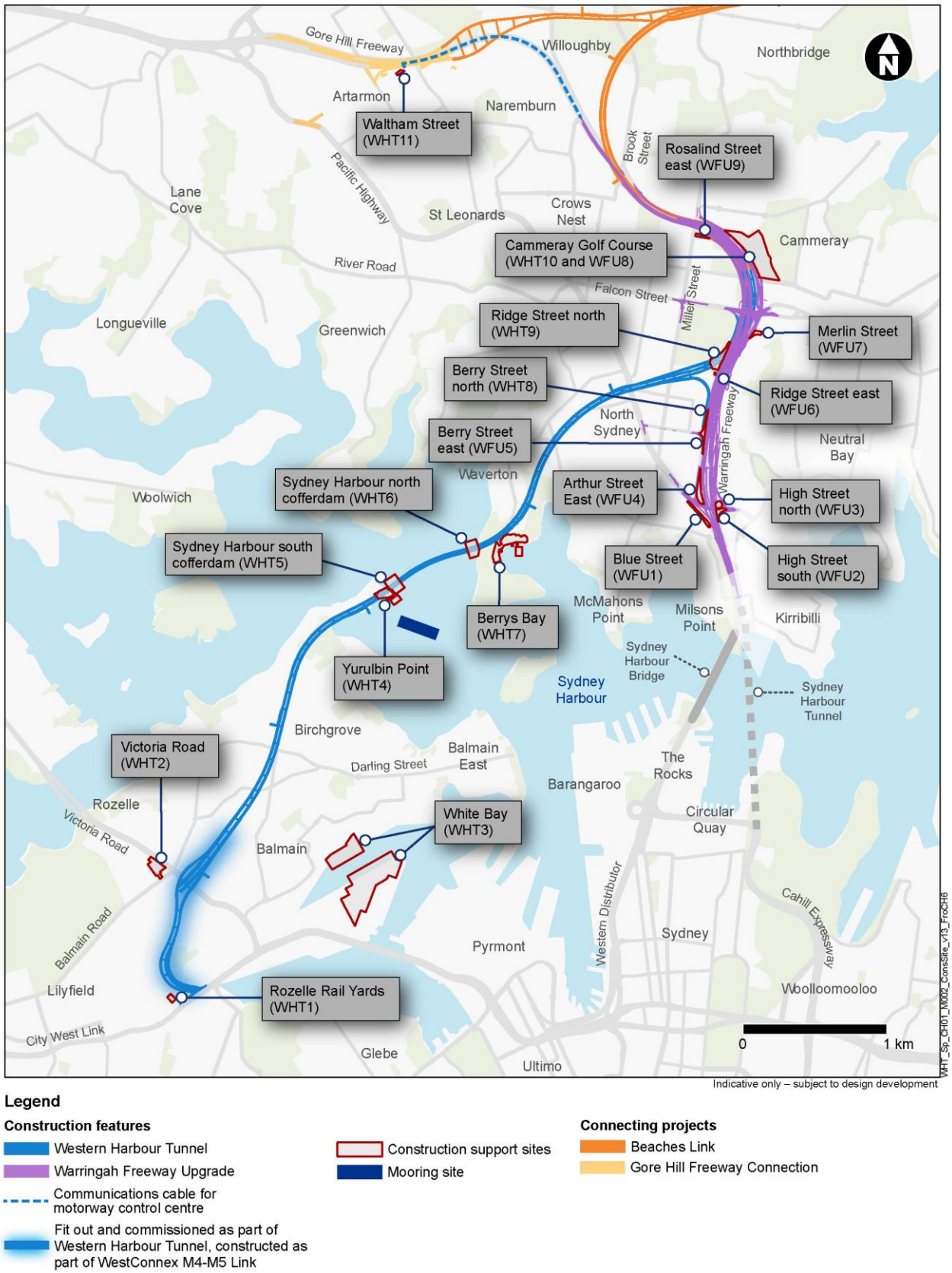


Figure 1-3 Overview of construction support sites

1.4 Project location

The project would be located within the Inner West, North Sydney and Willoughby local government areas, connecting Rozelle in the south with Naremburn in the north.

Commencing at the Rozelle Interchange, the mainline tunnels would pass under Balmain and Birchgrove, then cross Sydney Harbour between Birchgrove and Balls Head. The tunnels would then continue under Waverton and North Sydney, linking directly to the Warringah Freeway to the north of the existing Ernest Street bridge.

The motorway control centre would be located at Waltham Street, Artarmon, with a trenched communications cable connecting the motorway control centre to the Western Harbour tunnel along the Gore Hill Freeway and Warringah Freeway road reserves.

The Warringah Freeway Upgrade would be carried out on the Warringah Freeway from around Fitzroy Street at Milsons Point to around Willoughby Road at Naremburn. Upgrade works would include improvements to bridges across the Warringah Freeway, and upgrades to surrounding roads.

1.5 Purpose of this report

This report has been prepared to support and inform the environmental impact statement for the project and to address the environmental assessment requirement of the Secretary of the Department of Planning and Environment ('the Secretary's environmental assessment requirements').

This report has been prepared generally in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW, 2011) and the *Procedure for Aboriginal and Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime Services, 2011). The scope of this Aboriginal Cultural Heritage Assessment Report (ACHAR) is as follows:

- Carry out consultation with Aboriginal stakeholders in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRP) (DECCW, 2010a) as part of the heritage assessment process to determine potential impacts of proposed activities on Aboriginal objects and places
- Conduct a detailed cultural values assessment for the study area, including desktop review of available ethnographic information and interviews with registered Aboriginal knowledge holders
- Conduct an archaeological assessment of the study area, including a desktop assessment (with register search), archaeological field survey and, if required, further assessment via test excavation. Full details of this assessment are documented in the Archaeological Assessment Report, included as Appendix D (Archaeological Assessment Report)
- Complete a significance assessment of Aboriginal cultural heritage values identified to be potentially impacted by the project. This includes both scientific (archaeological) and cultural significance for Aboriginal heritage sites and places. Cultural significance will be determined in consultation with the RAPs for the project
- Provide an assessment of the potential impacts on Aboriginal archaeological sites and cultural heritage values as a result of the project
- Develop management and mitigation measures for the potential impacts on archaeological sites as a result of the project.

1.6 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to the ACHAR, and where these requirements are addressed in this report are outlined in Table 1-1.

Table 1-1 Secretary's environmental assessment requirements – Aboriginal heritage

Secretary's environmental assessment requirements	Where addressed
1) The Proponent must identify and assess any direct and/or indirect impacts (including cumulative, vibration and visual impacts) to the heritage significance of listed (and nominated) heritage items inclusive of:	
a) Aboriginal places and objects, as defined under the *National Parks and Wildlife Act 1974* and in accordance with the principles and methods of assessment identified in the current guidelines	This report, in particular Sections 2, 4, 5, 6, 7 and 8.
b) Aboriginal places of heritage significance, as defined in the Standard Instrument – Principal Local Environmental Plan	Section 2, 4, 5, 6, 7 and 8.
c) environmental heritage, as defined under the Heritage Act 1977 (including potential items of heritage value, conservation areas, open space heritage landscapes, built heritage landscapes and archaeology)	Refer to Technical working paper: Non-Aboriginal heritage (Jacobs 2020).
d) items listed on the State, National and World Heritage lists (including Cockatoo Island);	Refer to Technical working paper: Non-Aboriginal heritage (Jacobs 2020).
e) heritage items and conservation areas identified in local and regional planning environmental instruments covering the project area	Refer to Technical working paper: Non-Aboriginal heritage (Jacobs 2020).
f) marine items of potential heritage significance within Sydney Harbour, such as any shipwrecks within proximity to the Balls Head Coal Loader wharf.	Refer to Technical working paper: Marine heritage (Cosmos Archaeology, 2020)
2) Where impacts to State or locally significant heritage items or archaeology are identified, the assessment must:	
a) include a significance assessment and statement of heritage impact for all heritage items including any unlisted places that are assessed of heritage value	Section 7
b) provide a discussion of alternative locations and design options that have been considered to reduce heritage impacts	Section 8.1 and Chapter 4 of the environmental impact statement

Secretary's environmental assessment requirements	Where addressed
c) in areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment and management plan in line with Heritage Council guidelines which includes a methodology and research design to assess the impact of the works on the potential archaeological resource and to guide physical archaeological test excavations and include the results of these excavations. This is to be carried out by a suitably qualified archaeologist and is to discuss the likelihood of significant historical, maritime and Aboriginal archaeology on the site, how this may be impacted by the project, and includes measures to mitigate any impacts	For Aboriginal cultural heritage impacts, refer to Section 8 and Section 9 For non-Aboriginal heritage matters, refer to Technical working paper: Non-Aboriginal heritage (Jacobs, 2020).
d) consider potential impacts to the Balls Head Coal Loader particularly associated with vibration and disturbance as part of the ongoing works. Due to the potential significance of this site, options to ensure that it is not impacted must be considered	Refer to Technical working paper: Non-Aboriginal heritage (Jacobs, 2020).
e) consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, increased traffic, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant)	Section 8
f) provide a comparative analysis to inform the rarity and representative value of any heritage places proposed for demolition	No sites are proposed for demolition
g) outline mitigation measures to avoid and minimise identified impacts in accordance with the current guidelines; and	Section 9
h) be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria).	Section 1.8
3) Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, meeting the minimum qualification requirements specified in section 1.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b).	Section 1.8

1.7 Study area

For the purposes of this report, the study area is defined as the construction footprint associated with surface works, plus land above the tunnel alignments. To account for potential impacts due to vibration or settlement, a 50 metre search area around the surface works and tunnel alignments has also been considered in this impact assessment.

A separate study was carried out to identify potential submerged Aboriginal sites (Cosmos Archaeology 2020). The study area applied to the consideration of potential submerged Aboriginal sites is outlined in Appendix E (Potential Submerged Sites Assessment).

1.8 Authorship

This report has been written by Alistair Carr and Andrew Costello (senior archaeologists at Jacobs) and Chelsea Jones (graduate archaeologist at Jacobs). Alistair and Andrew hold appropriate qualifications for carrying out the following investigation as required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b). The report was reviewed by Dr David Collard (technical lead, Roads and Heritage, Jacobs).

The Potential Submerged Sites Assessment (Cosmos Archaeology, 2020) was written by Cosmos Coroneos, a qualified maritime archaeologist.

Table 1-2 provides a summary of qualfications held by those involved in the preparation of the assessment.

Table 1-2 Qualifications of cultural heritage assessment report authors

Name	Qualifications
Alistair Carr	Bachelor of Arts (Archaeology, Ancient History, English) University of Sydney, 2000 Bachelor of Arts (Honours – Archaeology) La Trobe University, 2012
Andrew Costello	Bachelor of Arts (Honours - Classics and Archaeology, Double major Anthropology) University of Melbourne, 2003
Chelsea Jones	Bachelor of Arts (Honours) - University of Queensland, 2016
David Collard	Doctor of Philosophy (Archaeology), University of Nottingham, 2011 Master of Arts (Archaeology), University of Melbourne, 2005 Postgraduate Diploma of Arts (Archaeology), University of Melbourne, 2003 Graduate Diploma of Arts (Archaeology), University of Melbourne, 2001 Bachelor of Engineering (Aerospace), Royal Melbourne Institute of Technology, 1999

2. Legislative and policy framework

The following Commonwealth and State legislation is relevant to the Aboriginal cultural heritage assessment:

- Commonwealth legislation:
  - *Native Title Act 1993.*
- NSW legislation:
  - *Environmental Planning and Assessment Act 1979* (EP&A Act)
  - *National Parks and Wildlife Act 1974* (NPW Act)
  - *Heritage Act 1977*.

These Acts and their relevant sections and subordinate instruments and guidelines (eg codes of practice, guidelines, etc) that govern the project are described in Table 2-1.

Aboriginal cultural heritage investigative works for the project have also followed the PACHCI (Roads and Maritime, 2011). The process outlined in the PACHCI is consistent with and gives effect to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) and consultation requirements across all Roads and Maritime projects. The PACHCI outlines a four-stage process for investigating potential impacts on Aboriginal cultural heritage. It includes a process of consultation with Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal object(s) and/or places(s) in a study area.

Table 2-1 Legislative and policy framework for Aboriginal cultural heritage

Reference	Requirements
Commonwealth legislation and guidelines	
Native Title Act 1993	This Act recognises and protects native title. The National Native Title Tribunal is a Commonwealth Government agency set up under this Act and mediates native title claims under the direction of the Federal Court of Australia. The National Native Title Tribunal maintains the following registers: • National Native Title Register • Register of Native Title Claim • Unregistered claimant applications • Register of Aboriginal land use agreements. The ACHCRP (DECCW, 2010a) stipulates that where relevant, consultation must be conducted with native title holders or registered native title claimants in accordance with the *Native Title Act 1993.* There are no current native title claimants or native title holders for the study area (as of March 2019).

Reference	Requirements
State legislation	
EP&A Act 1979	The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* provide the framework for environmental planning and assessment in NSW. This Act requires environmental impacts on be considered before development or project approval. In NSW, environmental impacts are interpreted as including impacts on cultural heritage. The project is declared to be State significant infrastructure under Division 5.2 of the EP&A Act. This is because the project is a type of activity listed under clause 1(1) in Schedule 3 of *State Environmental Planning Policy (State and Regional Development) 2011*. Clause 14 of the planning policy declares development listed in Schedule 3 to be State significant infrastructure pursuant to section 5.12(2) of the EP&A Act. The Minister for Planning and Public Spaces is the approval authority for State significant infrastructure.
NPW Act 1974	The NPW Act provides for the protection of Aboriginal objects and Aboriginal places in NSW. Under the NPW Act (Section 5): • An Aboriginal object is defined as any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habited both before and concurrent with the occupation of that area by persons of European 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 (Section 90) of the NPW Act requires an Aboriginal Heritage Impact Permit to be obtained if impacts on Aboriginal objects and/or places are anticipated. Consultation with Aboriginal communities is required under Department of Premier and Cabinet (Heritage) (previously NSW Office of Environment and Heritage (OEH)), policy when an application for an Aboriginal Heritage Impact Permit is required. While an Aboriginal Heritage Impact Permit is not required if the project is approved under Division 5.2, Part 5, of the EP&A Act, a similar level of assessment is nonetheless required in accordance with the Secretary's environmental assessment requirements for the project.
Heritage Act 1977	The *Heritage Act 1977*, administered by Department of Premier and Cabinet (Heritage), protects the States' natural and cultural heritage. Aboriginal heritage is primarily protected under the NPW Act but may be subject to the provisions of the *Heritage Act 1997* if the item is listed on the State Heritage Register or subject to an interim heritage order.
Relevant guidelines and policies	
***Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011)**	This document provides guidelines for the investigation and assessment of Aboriginal cultural heritage (under Part 6 of the NPW Act) to explore the harm of a proposed activity on Aboriginal objects and declared Aboriginal places and to clearly set out which impacts are avoidable, and which are not. The document provides: • Guidance on the process for investigation and assessing Aboriginal cultural heritage in NSW • Department of Premier and Cabinet (Heritage) requirements for an Aboriginal cultural heritage assessment report (ACHAR). This assessment has been carried out in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011)

Reference	Requirements
***Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRP) (DECCW 2010a)**	The ACHCRP (DECCW 2010a) establishes the requirements for consultation (under Part 6 of the NPW Act) with Aboriginal stakeholders as part of the heritage assessment process to determine potential impacts of proposed activities on Aboriginal objects and places and to inform decision making for any application for an Aboriginal Heritage Impact Permit. The ACHCRP comprises four stages with associated timeframes which must be adhered to: • Stage 1 — notification of project proposal and registration of interest (14 days from date letter sent to register as a registered Aboriginal stakeholder) • Stage 2 — presentation of information about the proposed project (set up Aboriginal Focus Group (AFG) meetings, prepare info, etc) • Stage 3 — gathering information about cultural significance (28 days for registered Aboriginal stakeholders to provide a review and feedback of the methodology) • Stage 4 — review of draft cultural heritage assessment report (registered Aboriginal stakeholders have 28 days from sending of the report to make submissions). This assessment has been carried out in accordance with ACHCRP (DECCW, 2010a)
***Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b)**	The *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) sets out the detailed requirements for archaeological investigations of Aboriginal objects in NSW for activities that require assessment under Part 4 or Part 5 of the EP&A Act. An Aboriginal Heritage Impact Permit to carry out test excavation is not required if complying with this code, as sub-surface testing complying with it are excluded from the definition of harm to an Aboriginal object. The code sets out the following in detail: • Minimum qualifications for anyone carrying out archaeological investigation under the code in NSW • Assessment steps required to be carried out for all archaeological investigation • Assessment steps that may be required to be carried out to adequately characterise the Aboriginal objects being investigated. This assessment has been carried out in accordance with the Code of Practice.

3. Consultation

Aboriginal stakeholder engagement and involvement is an important component in the identification of Aboriginal sites and cultural values in the study area. This section presents a summary of consultation carried out to date for the project and outlines the various stages of consultation. Appendix A (Consultation) contains documents of the consultation carried out for the project, including AFG meeting minutes, examples of letters sent to RAPs and knowledge holders, native title search results, records of cultural heritage values interviews and a detailed consultation log.

3.1 Summary of consultation

For this assessment, Aboriginal stakeholder consultation was carried out in accordance with Roads and Maritime PACHCI, which ensures compliance with statutory requirements and Department of Premier and Cabinet (Heritage) policies, particularly the ACHCRP (DECCW, 2010a).

The PACHCI provides Aboriginal people with the opportunity to participate in decision making regarding the management of their cultural heritage by providing Roads and Maritime with information regarding cultural significance and providing input into management options. It includes a process of community consultation with Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places in a study area.

The following consultation activities have been carried out to date:

- Identification of key Aboriginal stakeholders began in June 2017 with a search of the National Native Title Register and the Register of Aboriginal Owners established under the *Aboriginal Land Rights Act 1983*. Metro LALC were identified as the only LALC within the study area. No previous native title claims have been established in the study area
- A letter introducing the project was sent to the Metro LALC as the only LALC identified within the study area
- Advertisements were placed in newspapers in June 2017 to notify Aboriginal people with cultural knowledge of the study area
- Following the statutory response time of 28 days following these notifications, RAPs for the project were registered for subsequent consultation
- Nominated site officers representing the Metropolitan LALC were engaged to participate in archaeological surveys carried out in May, June and August 2017. During these surveys, site officers were provided an opportunity to comment on the potential for Aboriginal cultural material to be present within the study area, the cultural significance of any Aboriginal cultural heritage sites identified during the survey and proposed management recommendations, including recommendations for further assessment
- All RAPs were invited to attend an initial AFG held on 28 September 2017 at The Old Northbridge Bowling Club, Northbridge. The draft archaeological survey report and archaeological methodology were issued to the RAPs before the AFG for review and comment
- At the end of the 28 day review and comment period, multiple RAPs had expressed approval of the archaeological methodology. An email and a letter were sent to the RAPs confirming that no further changes would be made to the archaeological methodology. The methodology proposed no test excavations within the project study area.

The following sections provide further details of the consultation carried out to date, following the four-stage process outlined in the PACHCI. Only actions relating directly to the consultation process are referred to below.

3.2 PACHCI Stage 1

Stage 1 of the PACHCI involved a desktop risk assessment to determine whether the project would potentially impact Aboriginal cultural heritage and require further assessment or investigation. This included an assessment of potential impacts on Aboriginal lands, objects and places defined under the NPW Act.

The desktop risk assessment determined that impacts on Aboriginal cultural heritage were possible given the study area and locations to be impacted through construction works. As such, the assessment progressed to the next stage of the PACHCI.

3.3 PACHCI Stage 2

Consultation activities carried out during Stage 2 of the PACHCI are summarised in Table 3-1.

Table 3-1 Consultation activities carried out during Stage 2 of the PACHCI

Stage 2 PACHCI action	Consultation activities
Action 1 – Identification of key Aboriginal stakeholders	• The National Native Title Tribunal was contacted on 1 June 2017 to identify any registered native title claimants or native title holders for the options assessment area. Documents provided in response by the National Native Title Tribunal are presented in Appendix A • The documents provided by the National Native Title Tribunal indicated that there were no current native title claimants or native title holders for the study area at the time • The Metro LALC was identified as the relevant LALC for the entirety of the study area • A search of the Register of Aboriginal Owners established under the *Aboriginal Land Rights Act 1983* was requested on 19 June 2017 and a response was received on 26 June 2017. The response stated that there did not appear to be any Registered Aboriginal Owners connected to the study area. It was suggested that the Metro LALC be contacted to assist with identifying other Aboriginal stakeholders for the project.
Action 2 – Engage Aboriginal stakeholders to carry out a site survey	• Site officers nominated by the Metro LALC were engaged to participate in the archaeological survey. Details of this participation are presented in the consultation records in Appendix A.
Action 3 and Action 4 – Carry out the pedestrian site survey	• Site officers nominated by the Metro LALC participated in archaeological surveys, including consultation during the surveys (refer to Appendix A): ▪ Pedestrian survey of the Balls Head and Yurulbin Park study area on 16 May 2017 ▪ Pedestrian survey of the St Leonards Park, Cammeray Golf Course and ANZAC Park study areas on 17 May 2017.
Action 5 – Aboriginal stakeholder(s) prepare cultural heritage survey report	• In accordance with PACHCI, the Metro LALC was requested to provide a cultural heritage survey report to Roads and Maritime advising on Aboriginal cultural heritage issues that may arise as a result of the project. No cultural heritage survey report from the Metro LALC has been received to date.

3.4 PACHCI Stage 3

As outlined in PACHCI and the ACHCRP (DECCW, 2010a), where harm to Aboriginal objects or places is likely to occur, formal consultation will be carried out as per the process outlined in these documents.

As the initial Stage 2 archaeological survey identified that harm to Aboriginal objects or places had the potential to occur, formal consultation began in accordance with Stage 3 of the PACHCI (Roads and Maritime Services, 2011). Due to the anticipated complexity of the consultation process for the project, including predictions that several stakeholder groups would register an interest in the project, actions one to six of the PACHCI Stage 3 process began before the completion of Stage 2. Stage 3 consisted of several subsequent actions, as summarised in Table 3-2.

Table 3-2 Consultation activities carried out during Stage 3 of the PACHCI

Stage 3 PACHCI (consultation actions only)	Consultation activities
Action 1 – Seek the names of Aboriginal people with cultural knowledge by letter or notify native title holders	• The following organisations were written to during June and July 2017 seeking the details of Aboriginal people who may have an interest in the project and who may hold cultural knowledge about objects and places in the study area: ▪ The Department of Premier and Cabinet (Heritage) (Sydney office) ▪ The NSW Aboriginal Land Council ▪ The Metro LALC ▪ The Aboriginal Heritage Office, a regional organisation that partners with councils predominantly in the Sydney metropolitan area ▪ The Registrar appointed under the *Aboriginal Land Rights Act 1983* ▪ The National Native Title Tribunal ▪ The Native Title Services Corporation Limited ▪ Inner West Council ▪ North Sydney Council. • Following the statutory response time of 14 days, a list of 20 Aboriginal groups (including the Metro LALC and the Aboriginal Heritage Office) with potential cultural knowledge of the study area was compiled. Appendix A provides a complete list of nominated groups or people.
Action 2 – Notify Aboriginal people with cultural knowledge by letter	• On 1 August 2017, a letter of notification was sent to all of the Aboriginal groups or people identified at that time (refer to Action 1) inviting them to register their interest in the project.
Action 3 – Notify Aboriginal people with cultural knowledge by advertisement	• Advertisements inviting Aboriginal groups or people to register their interest in the project were placed in the public notices section of the following newspapers on 14 June 2017: ▪ *Koori Mail* ▪ *Indigenous Times* ▪ *Inner West Courier* ▪ *North Shore Times* ▪ *Manly Daily* ▪ *Mosman Daily* ▪ *Central Sydney Magazine*.

Stage 3 PACHCI (consultation actions only)	Consultation activities
Action 5 – Prepare a register of Aboriginal parties	• A register of Aboriginal parties who responded to the notification letters and advertisements was compiled and continues to be maintained for the project. Each RAP was sent a letter confirming receipt of its registration. A total of 19 RAPs were registered for the project.
Action 6 – Send the names of registered parties to Department of Premier and Cabinet (Heritage) and LALCs	• The list of RAPs was issued to Department of Premier and Cabinet (Heritage) and the Metropolitan LALC on 11 October 2017.
Action 7 – Send invitation to attend an Aboriginal focus group meeting and draft methodology for review	• On 13 September 2017, invitations to attend the initial AFG meeting were sent to Department of Premier and Cabinet (Heritage) and all RAPs registered at the time. Included with the invitation letters was: ▪ An agenda for the AFG meeting ▪ A copy of the Roads and Maritime PACHCI Resource 19 – Aboriginal site officer application form ▪ A draft copy of the Western Harbour Tunnel and Beaches Link program of works archaeological methodology (Carr and Costello 2017).
Action 8 – Hold an Aboriginal Focus Group (AFG) meeting	• To date there have been two AFG meetings for the project: **AFG 1** ▪ An initial AFG for the project was held on 28 September 2017. The agenda and minutes for this meeting are presented in Appendix A ▪ At this meeting, several presentations to RAPs were made including a project overview, results of the archaeological survey and the proposed archaeological methodology. Consultation with RAPs at this meeting was recorded and is presented in Appendix A. Some RAPs also completed site officer application forms at the meeting **AFG 2** ▪ A second AFG for the project was held on 11 October 2019. The agenda and minutes for the meeting are presented in Appendix A. ▪ At this meeting, an overview of the project was presented. The Aboriginal cultural heritage assessment report and proposed management strategy were discussed. Attendees were provided with the opportunity to raise and discuss any comments or queries regarding the project. Minutes of the AFG were recorded and are presented in Appendix A.
Action 9 – Provide meeting minutes to Aboriginal parties	• Written summary of comments and minutes from the AFGs were provided to Aboriginal parties via email and letter and presented at subsequent meetings.
Action 10 – Finalise methodology	• Review of the archaeological methodology began on 11 September 2017 when the draft methodology was sent to the RAPS and Department of Premier and Cabinet (Heritage). Multiple RAPs approved the methodology in draft form • The review period ended on 9 October 2017 and an email was sent to RAPs confirming that there had been no changes requested to the archaeological methodology and that it was finalised following the statutory review period of 28 days.

Stage 3 PACHCI (consultation actions only)	Consultation activities
Action 14 – Engage Aboriginal site officers	• Aboriginal site officers were engaged for archaeological fieldwork from 8 January to 24 January 2018 • Discussions about the process of the cultural values assessment occurred at AFG 1. Letters were sent to RAPs on 9 November 2017 specifying that all nominations for Aboriginal cultural knowledge holders were required before 22 November 2017. Refer to Section 5 for further details on the cultural values assessment.
Action 15 – Implement archaeological testing methodologies	• Aboriginal site officers were engaged for archaeological fieldwork from 8 January to 24 January 2018.

3.5 Potential submerged sites assessment

RAPs were emailed regarding the Potential Submerged Sites Assessment on 5 March 2018 and a 28 day timeframe was provided for responses. The email included recent information on the assessment and a proposed methodology for further investigation for comment. No responses were provided from RAPs. The Potential Submerged Sites Assessment is included as Appendix E (Potential Submerged Sites Assessment) and was presented at AFG 2. No comments or questions were provided from RAPs.

3.6 Consultation log

A log summarising all of the consultation conducted with Aboriginal parties about the project is provided in Appendix A.

3.7 Further consultation

As outlined in PACHCI and the ACHCRP (DECCW, 2010a), a copy of this ACHAR was provided to Department of Premier and Cabinet (Heritage) and all RAPs for the project for review and comment. A review period of at least 28 days was allowed, which closed on 25th October 2019. In addition, the draft ACHAR was presented and discussed at AFG 2.

Written feedback was provided by two RAPs, supporting the recommendations and conclusion of the ACHAR. No further written feedback was received.

Notification requirements under section 24KA of the *Native Title Act 1993* apply where construction work is required on Crown land and where the land has not been acquired by Roads and Maritime. Notification in accordance with this section will occur concurrent with the public display of the environmental impact statement.

4. Background information

4.1 Environmental context

The study area is located in highly urbanised areas of the inner west and lower north shore suburbs of Sydney. It extends from Rozelle in the south to Naremburn in the north. The study area crosses Sydney Harbour between Birchgrove and Waverton. Its landform is characterised by the deep, drowned valley of Sydney Harbour, which is bordered by steep headlands of exposed Hawkesbury Sandstone with some low hills and rises.

The study area extends across a single landscape region which for the purposes of this assessment is named Western Harbour.

4.1.1 Western Harbour

The Western Harbour landscape region is bordered by steep headlands of exposed Hawkesbury Sandstone with some low hills and rises on Permian sediments. Within this landscape region the study area crosses low gradient spurs from Rozelle towards Birchgrove, the steep cliffs of Balls Heads and the lower gradient of Berrys Bay foreshore.

4.2 Topography

The Sydney Basin Bioregion encompasses the catchments of Hawkesbury-Nepean, Shoalhaven and Hunter river systems (OEH, 2016). The topography of the study area is generally characterised by ridge lines along peninsulas extending into Sydney Harbour. The landscape slopes gently downwards towards the water at Birchgrove and Balls Head. Terrain elevation towards the Rozelle end of the study area sits at about 10 metres Australian Height Datum and decreases slightly towards Birchgrove. Sydney Harbour depths range to 40 metres below sea level and incline towards about 90 metres Australian Height Datum at North Sydney.

4.3 Geology and soils

The study area is located within the Sydney Basin, a large depositional geological feature that spans from Batemans Bay in the south, to Newcastle in the north and Lithgow in the west.

The *Sydney 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983) indicates that the majority of the study area is underlain by geological units associated with the Wianamatta Group. Hawkesbury Sandstone underlies the majority of the study area, with isolated occurrences of Ashfield Shale in the north-eastern portion of the study area, around North Sydney and Neutral Bay. In addition, areas of disturbed ground (man-made fill) are mapped within the Rozelle Rail Yards, White Bay, Birchgrove Park and Waverton Park.

The *Sydney 1:100,000 Soil Landscape Series Sheet 9130* (Soil Conservation of NSW, 1966) identifies many soils underlying the study area (refer to Table 4-1). Hawkesbury Sandstone–derived soils (ie Gymea and Hawkesbury soil types) are extensive within the study area, occurring from Rozelle to North Sydney. Residual soils derived from Ashfield Shale are limited to the North Sydney/Cammeray area.

Table 4-1 Soil units underlying the study area

Soil unit	Description
Blacktown (bt)	• Landscape – found on gently undulating rises on Wianamatta Group shales with local reliefs of up to 30 metres and slopes of less than five per cent

Soil unit	Description
	• Soils – soils are shallow to moderately deep, with hardsetting mottled texture contrast soils. Red and brown podzolic soils found on crests grading to yellow podzolic soils on lower slopes and in drainage lines • Limitations – Blacktown soils are moderately reactive, with a highly plastic subsoil, and low fertility and poor drainage.
Hawkesbury	• Landscape – found on rugged, rolling to very steep hills on Hawkesbury Sandstone with local reliefs of 40 to 200 metres, slopes of > 25 per cent and rock outcrops of > 50 per cent • Soils – shallow (< 50 centimetres), discontinuous lithosols/siliceous sands associated with rock outcrops, earthy sands, yellow earths and some yellow podzolic soils on the inside of benches and along joints and fractures • Limitations – extreme soils erosion hazard, mass movement (rockfall) steep slopes, rock outcrop, shallow, stony, highly permeable soils with low fertility.
Gymea	• Landscape – undulating to rolling low hills on Hawkesbury Sandstone with local reliefs of 20 to 80 metres and slopes of 10 to 25 per cent and rock outcrops of < 25 per cent • Soils – shallow to moderately deep yellow earths and earthy sands on crests and on the inside of benches • Limitations – high soil erosion, rock outcrop, shallow highly permeable soil and very low soil fertility.
Disturbed	• Landscape – the topography varies from level plains to undulating terrain and has been disturbed by human activity to a depth of at least 100 centimetres • Soils – the original soil has been removed, greatly disturbed or buried. Most of these areas have been levelled to slopes of < five per cent. Landfill includes soil, rock, building and waste material. The original vegetation has been completely cleared • Limitations – depend on the nature of fill material. Potential for subsidence resulting in a mass movement hazard, and soil impermeability leading to poor drainage and low fertility. Care must be taken when these sites are developed.

4.4 Hydrology

The study area intersects the estuary of Sydney Harbour. The estuary opens up from the entrance to form Port Jackson, and then divides into three main branches; Middle Harbour to the north and the Parramatta and Lane Cove rivers extending south, then westward away from the heads. The estuary is about 30 kilometres long, with a total catchment of 500 square kilometres (Sydney Institute of Marine Science, 2016). The study area lies to the east of the confluence of the Parramatta and Lane Cove rivers.

The bathymetry of Sydney Harbour is complex and comprises dredged channels for shipping and several deep holes of about 28 to 45 metres, separated by shoals with depths of three to five metres (Sydney Institute of Marine Science, 2016).

4.5 Climate

The Bureau of Meteorology weather station at Sydney (Observatory Hill) (site number 066062) is broadly representative of weather conditions in the study area. The annual average daily maximum and minimum temperatures are 21.8°C and 13.8°C, respectively. On average, January is the hottest month with an average daily maximum temperature of 26.0°C. July is the coldest month, with an average daily minimum temperature of 8.1°C. The wettest month is April, with 128.5 millimetres falling over nine rain days. The average annual rainfall is 1215.7 millimetres over an average of 99 rain days per year.

4.6 Vegetation

The landscape within the study area is highly urbanised and is characterised by planted native vegetation mixed with exotic or invasive species. Vegetation within built-up areas of the study area is generally limited to planted exotic and native street trees and vegetation within backyards, public parks and reserves. Almost all vegetation mapped within the study area by OEH (2016) is classified as urban exotic/native.

Coastal Sandstone Foreshores Forest occurs around the foreshores of Sydney Harbour at elevations of less than 35 metres above sea level. Coastal Sandstone Foreshores Forest within or near the study area is mapped by OEH (2016) at Balls Head, Berrys Bay, Waverton Park and Cremorne. The canopy is characterised by *Angophora costata* with *Eucalyptus pilularis, Eucalyptus piperita* or *Eucalyptus botryoides*. The understorey consists of moderately dense cover of *Pittosporum undulatum, Glochidion ferdinandi* and *Elaeocarpus reticulatus,* with occasional scattered *Banksia integrifolia*.

The biodiversity values of the study area are discussed in detail in Technical working paper: Biodiversity development assessment report (Arcadis, 2020). This has found that:

- A small area of Plant Community Type 1778: Smooth-barked Apple - Coast Banksia/Cheese Tree open forest on sandstone slopes on the foreshores of the drowned river valleys of Sydney was identified by WSP (2017) in the south-west of the subject land at Berrys Bay, Waverton (above buildings that would be used as site offices) and in Yurulbin Park at Birchgrove. This community type corresponds to Coastal Sandstone Foreshores Forest
- A search of the Threatened Biodiversity Data Collection identified 20 threatened ecological communities listed under the *Biodiversity Conservation Act 2016* as known or likely to occur within the Sydney Basin – Pittwater Interim Biogeographic Regionalisation for Australia subregion, but there is a low potential for this to occur within the biodiversity study area
- Two threatened flora previously recorded within the study area (Narrow-leaved Black Peppermint (*Eucalyptus nicholi)*) and Wallangarra White Gum (*Eucalyptus scoparia*)) occur well outside their known geographic range and are assumed to have been planted. Three other threatened species have a low or moderate likelihood of occurrence within the biodiversity study area (Sunshine Wattle (*Acacia terminalis* subsp*. Terminalis*)*, Epacris purpurascens* var*. purpurascens* and Magenta Lilly Pilly (*Syzygium paniculatum*))*.*

4.7 Historical and current land use

Early historical sources describe much of the vegetation in the study area as open woodland. This vegetation would have been regularly burnt by Aboriginal people through firestick farming techniques for the purposes of hunting and cultivation of food bearing plants. In the early 20th century many of the mature trees were cut down exposing underlying sandstone and causing erosion. The lower shoreline areas were likely to have been used for fishing and hunting with rock shelters around the water's edge commonly used for shelter. Larger camping areas would have existed on the headlands overlooking the harbour (Attenbrow, 2010).

The waterways would have provided Aboriginal people with an abundant source of floral and faunal resources, particularly bird and reptile species. Elevated, well-drained areas overlooking such resource rich areas, such as the crests and upper slopes of rises, would have made ideal camping locations.

Current land use within the study area is varied but generally dominated by residential development, particularly in the western and northern extents. Pockets of industrial development are located around Rozelle, White Bay and North Sydney with commercial development scattered across much of the entire study area. Balls Head was extensively cleared before it became a public reserve, which allowed it to regenerate a pre-European landscape.

The archaeological implications of the land uses discussed in this section include the potential disturbance or destruction of Aboriginal sites in areas of significant residential, industrial and commercial development. Conversely, in areas of remnant landscape, Aboriginal sites, where present, may be relatively undisturbed. The foreshore areas and rugged topography within sections of the study area may mean that Aboriginal sites such as rock shelters or middens may exist relatively intact in people's backyards. For example, the previously recorded sites at Yurulbin Point, Birchgrove.

4.8 Key observations

Key observations to be drawn from a review of the existing environment and landscape context of the study area are as follows:

- Waterways within the study area would have been sources of floral and faunal resources
- There is likelihood of scattered midden material to occur along parts of the water margin within the study area
- Much of the study area has been subject to large scale landscape modification as a result of development. Disturbance from urban and industrial development, freeways and roads have removed most of the deposit in which Aboriginal objects would have been originally located. Areas of grossly disturbed terrain are unlikely to retain in situ or intact evidence of past Aboriginal occupation owing to the severity of past ground surface disturbances that have occurred within them. However, there is the potential for incidental survival of Aboriginal sites within private land
- Hawkesbury Sandstone outcrops and escarpments are located in association with harbour landforms. These areas may contain Aboriginal rock shelter sites and engravings
- Soils within the study area are varied according to region and landform and will have varying levels of archaeological potential.

4.9 Ethnography

Ethnographic information relating to the Aboriginal occupation of the study area and surrounding region is derived from publications and other surviving forms of documents which were compiled by early European explorers, settlers, missionaries and government officials who went to the region during the mid to late 19th century (Martinez, 2010).

The following information was compiled from several written sources based on language research and ethnohistoric observations. It should be noted that the information provided here does not necessarily reflect the opinions of the Metro LALC regarding its affiliations and boundaries.

4.9.1 Social organisation

Early historical accounts described two dominant tribes occupying the Sydney region, these being the Guringai people and the Dharawal people. Historical accounts suggest the Guringai territory extended from Lake Macquarie to Botany Bay, while the Dharawal territory extended from south of Botany Bay to the Shoalhaven River. Interaction between these two groups was frequent to facilitate exchange of raw materials and other resources (Stanbury, 1979).

Aboriginal people in the Sydney area were considered to have complex social organisations (Peterson, 1976). Tribal groups controlled descent and land 'ownership', although there is evidence that some groups were unrestricted in their movements throughout the region (Rich, 1985). Aboriginal society incorporated several hierarchical levels and groups. However, the boundaries which distinguished each of these groups have been described as fluid. The smallest group of the hierarchy, a 'family', consisted of man, his wife/wives, their children and sometimes also included their parents (Peterson, 1976). The secondary social unit of Aboriginal people, termed 'band', consisted of around 30 to 50 people who hunted, foraged and roamed around together. Their mobility is suggested to reflect seasonal exploitation of resources.

Multiple bands that shared the same language, that were related by marriage, shared similar customs and met to perform ceremonial enactments were called a tribe, a term now considered to be outdated and not generally applicable to Aboriginal society. (Peterson, 1976; Stanbury, 1979).

Aboriginal kinship extended beyond traditional European familial ties to include other members of their community. Patrilineal descent dictates clan membership and each local clan was related to specific totems, typically an animal or bird, which clan members were forbidden from hunting or eating. Beyond this, social status was hierarchical within groups and between different groups. Senior men, termed 'elders', constituted the representative heads of the Aboriginal group. The *Karadji* comprised senior men involved in initiation ceremonies and also in healing ceremonies (Attenbrow, 2010).

This hierarchy also extended to mediate cultural law, with those who broke the law punished accordingly. Punishments could involve ritual combats where others could throw spears at the offender with only a shield to defend himself. Conversely, there is no indication in historical accounts that women held specific rights or powers. Gender was distinguished linguistically with the use of the suffix 'leon' to the name of that person (Attenbrow, 2010).

The family unit or extended family group made habitual use of the land. Food resources were largely seasonal and were more abundant in warmer months. As resources became scarcer in winter, larger units broke up into smaller units. There appears to have been a strong division of labour, with women providing vegetables, shellfish and fish caught with a hook and line, while men hunted and fished using spears (Attenbrow, 2010).

Aboriginal people in the Sydney region appear to have lived primarily on fish and shellfish, supplemented with kangaroos, other marsupials and vegetable food such as fern roots and macrozamia nuts. Specifically, marine subsistence included a range of fish, crabs, crayfish, and some inclusion of seals and whales (Attenbrow, 2010).

4.9.2 Material culture

Ethnohistorical observations suggest that Aboriginal people in the Sydney area primarily used tools made from organic materials rather than stone. Common tools included fishing spears, spear throwers, wooden clubs, parrying sticks and shields, fish hooks, canoes, net bags and wooden dishes (Kuskie, 1997). Fish hooks dominate the type of shell elements recovered in the Sydney region and have been recovered from numerous sites including Port Jackson, Royal National Park and Broken Bay. British colonial accounts describe Aboriginal fish hooks as curved but not barbed. Hooks were generally composed of shell (Kuskie, 1997) but sometimes included the use of wood or bone, or even in some cases the talons of birds (Attenbrow, 2010). Ranging between 13 to 50 millimetres in length, these hooks were unbarbed and crescent in shape, including small notches to attach fishing line. Fishing line consisted of two strands of bark, tree, shrub fibre or animal fur (Attenbrow, 2010). Small stones (*gna'mmul*) were attached to the end of fishing lines and used as sinkers. It is suggested that bait, rather than attached to the hook itself, consisted of chewed mussels spat into the water (Attenbrow, 2010).

Used for general transport and fishing, canoes are described as between 1.2 metres and 4.2 metres in length and around 1.2 metres wide (Barralier, 1802 cited in Brayshaw, 1986; Threlkeld cited in Gunson, 1974). Depending on the size of the tribe, each had six to eight canoes. Ethnographic studies indicate that women primarily used canoes with hooks and line, while men predominantly used fishing spears (Worgan, 1978). Canoes comprised a single sheet of bark held together at the ends with vines. Ground-edge hatchets, wooden mallets and stone wedges were used to cut the shape of the canoe from the bark. When removed, the bark was softened through heating with fire and the ends fastened together.

To facilitate mobile subsistence strategy many of the tools and weapons used by the Aboriginal groups of Sydney were multi-functional and portable. Spears were used for both hunting and warfare and shields and clubs were used as weapons but also, in some cases, as musical instruments. The two different types of fishing spears include a *callar* and *mooting (*Attenbrow, 2010). The *callar* is a large spear with four prongs

and the *mooting* is a smaller version of this (Attenbrow, 2010). There are few observations of land animal hunting in the Sydney region, and this may be attributed to the available coastal resources. However, fire was used to facilitate the capture of prey, and beyond direct subsistence purposes Aboriginal people used burning strategies to 'shape' the landscape for predictable subsistence, shelter and general lifestyle needs (Gammage, 2012).

Other items such as stone hatchets, small sticks or 'switches' and spear throwers were used for the collection of shellfish, grub and other food plants. Shells, wooden dishes, net bags and folded bark baskets were used to store and transport these resources (Attenbrow, 2010). Ethnographic studies indicate kangaroo bones were used to make combs or awls. Awls were used for sewing possum and kangaroo skin, headbands and belts (Brayshaw, 1986; Kuskie, 1997). Tree bark material served several purposes, including fire for torches used for nocturnal fishing parties, bedding and clothing, and in some cases to line the bottom of canoes. Cockle and oyster shells were reworked to use as tools to process plants and wood.

Sandstone rock shelters were used over much of the Sydney area as occupation sites. Exposed sandstone outcrops throughout the region would have provided a useful abrasive and platform for shaping shell, wood and other stone implements. Pigment images, stencils and engravings displayed in rock shelters depict the use of boomerangs, shields and stone hatchets. McDonald (2008) suggests that visual culture, such as rock engravings, may have communicative implications relating to group identification behaviour. During the Pleistocene epoch, social networks between Aboriginal groups would have been more extensive and widespread than during the contact period. Evidence indicates that artistic motifs such as rock engravings may have been used as a pictorial communication system within the region. McDonald (2008 p. 41) explains this correlation as:

> "Rock art, and symbolic behaviour generally, is seen as an important facilitator and component of increasing and continuing social complexity across the region throughout the late Holocene".

McDonald (2008) suggests that social hierarchies and territorial boundaries may have changed and diversified as a result of sea level changes during the Holocene. This diversity is thought to have motivated the development of characteristic art motifs for particular groups and hierarchies within those groups. Some evidence of this is thought to have now disappeared under the now submerged Sydney coastal plain (McDonald, 2008 p. 41). However, the orientation and additional decoration of some of the anthropomorphs and shield engravings are thought to demonstrate some of these cultural divisions.

Ethnohistorical accounts detail that clothing was not worn for the majority of the year with a few exceptions. These exceptions included the use of bark cloaks in the rain and use of skin coats in the colder hinterland areas. Personal decoration is reported to have been full-bodied, elaborate and carried out by everyone: children and adults, both female and male. Adornment items included the use of arm, waist and headbands, pendants and necklaces and the decorative use of painted and scarred designs. Such decoration, however, was primarily for utilitarian purposes of identification rather than purely aesthetic appeal. Adornment items distinguished people based on their respective clan and status within society and recognised important occasions such as funerals and initiations (Attenbrow, 2010).

4.9.3 Subsistence

Archaeological evidence from sites in the broader region indicate a reliance on shellfish as an important food resource. Large assemblages of animal bone have also been previously recovered from Sydney coastal middens along the ocean shoreline, in particular at Port Jackson, Balmoral Beach and Vaucluse (Attenbrow, 2010).

Evidence of dugong butchery has also been recovered from St Peters in the 1880s. The cut marks and other scars on the skeletal elements were interpreted to reflect butchery of the marine mammal for subsistence purposes. Evidence of consumption of seals has also been identified at coastal shell middens. However, this inclusion is only minimal which indicates that seal was either not a primary food item or that the carcass was processed or eaten away from campsites. Shell middens at Balmoral Beach and

Cammeray indicate that sea turtle was also incorporated in the early Aboriginal diet of the Sydney region (Australian Museum, 2009).

Aboriginal people in the region may have also eaten different bird species. Regional archaeological deposits have been known to include remains of Short-tailed Shearwaters (*Puffinus tenurostris*), Little Penguins (*Eudyptula minor*) and petrels (Australian Museum, 2009). Midden material in the study area also incorporates marsupial and macropod osteological material (refer to site cards for the Balls Head area) suggesting a varied diet that was not overly reliant on any particular food resource.

4.9.4 Summary

The Sydney Basin has a rich Aboriginal heritage. Aboriginal occupation focused on accessing resources from diverse ecological areas, seasons and conditions. Coastal areas, smaller rivers, creeks and swamps would have been associated with occupation sites, hunting and inter-clan contact, as well as facilitating travel.

Aboriginal occupation in the Sydney area is known to have extended beyond the Last Glacial Maximum, when the environment was drier and significantly cooler and the permanent water sources even more critical to survival. Evidence of Aboriginal occupation in NSW dates back to around 50,000 to 60,000 years at Lake Mungo and up to 30,000 years at Parramatta. Archaeological excavation in the Port Jackson area has shown that Aboriginal people were living around the harbour foreshores of Port Jackson gathering shellfish at least 4500 years ago (Attenbrow, 2010). The onset of the Holocene brought increasing temperatures and precipitation, changing the coastal landscape of the Sydney region substantially. Campsites in bedrock valleys were abandoned, and plateau tops and ridgelines became the new habitat for many Aboriginal people. Tools associated with Holocene assemblages in the Sydney area are characterised by backed artefacts such as Bondi points, geometric microliths and Eloueras. These tools indicate multi-purpose functionality (Attenbrow, 2010) and are associated with technological changes referred to as the Australian Small Tool Tradition.

Before the arrival of Europeans, Aboriginal people lived in small family or clan groups that were associated with particular territories or places. The Aboriginal language group spoken across Sydney before European settlement was known as Darug. Two dialects of Darug are suggested to have been used: the coastal dialect and the hinterland dialect. The coastal dialect of the Darug language is thought to have covered the area south from Port Jackson, north from Botany Bay and west from Parramatta (Attenbrow 2010). The hinterland dialect is attributed to the area west of the Cumberland Plain.

Another language, Gringai, is thought to have been spoken north of Port Jackson (Australian Museum, 2009). The term Kuring-gai was originally adopted from a reference to the ‘Gringai’ that was claimed to span from the Macleay river to the south of Sydney (Aboriginal Heritage Office, 2015).

At the time of British arrival, the North Shore was inhabited by the Cammeraygal (also known as Gamaraigal and Kameragal) people with groups camped at Milsons Point, Manly and Lane Cove (Morris, 1986). The first record of contact with Aboriginal people on the north shore of Sydney was on the Lane Cove River in 1788. It was recorded that Aboriginal people lived in rock shelters and ate oysters and fish (Morris, 1986). During the 19th century, Port Jackson in particular was used as an entry point for convicts and settlers and an export point for resources such as gold, wool, timber and seals. Aboriginal archaeological records associated with the post-contact period are present throughout the Sydney Harbour region. However, the material sources are sparse. A primary example is the La Perouse rock engravings created in 1931 in commemoration of the opening of the Harbour Bridge (refer to site card for Aboriginal Heritage Information Management System [AHIMS] ID: 45-6-0873) (Irish, 2011).

4.10 AHIMS register and search

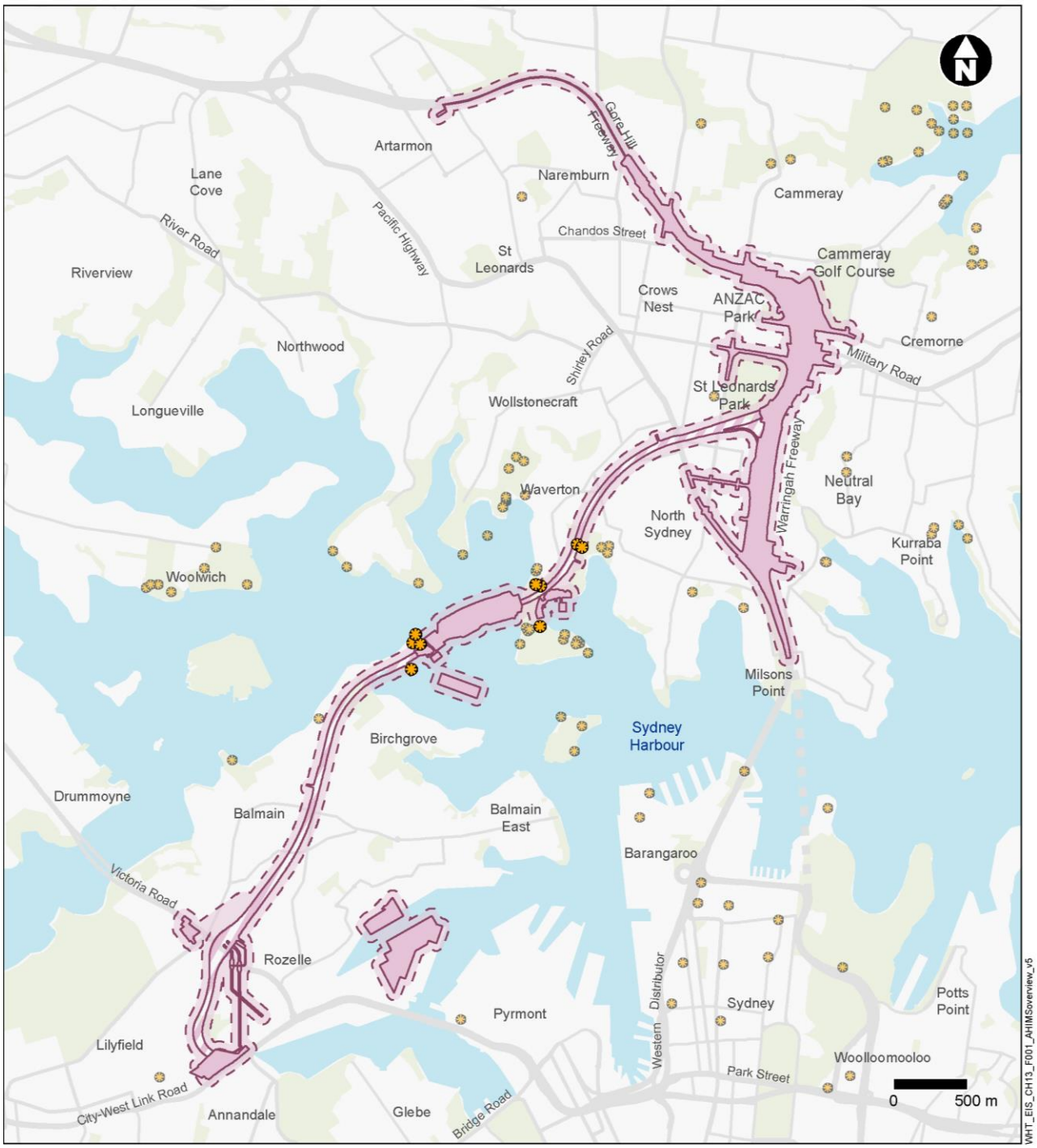
A search of AHIMS, Commonwealth and State Heritage Registers and relevant local environmental plans was carried out by Andrew Costello (senior archaeologist at Jacobs) on 1 May 2017 for a search area

extending 300 metres from the project construction footprint. As project refinements were made during the Stage 3 PACHCI process, this search area was refined to 50 metres. Nine sites were identified as being within the study area.

Of these nine sites, the location of five sites was verified through the archaeological surveys carried out for the project. These sites are referred to in this ACHAR as part of the significance assessment, impact assessment and management recommendations.

Of the nine sites, the locations of four sites were not verified during the archaeological surveys carried out for the project due to private property access constraints, presumed destruction of the site or incorrect spatial data on AHIMS site cards. A desktop assessment has been carried out on inaccessible sites due to private property constraints based on settlement and vibration modelling. It is recommended that these sites are visited before the start of construction for further detailed assessment.

Aboriginal sites within the study area are mapped in Figure 4-1 and Figure 4-2. This mapping details Aboriginal sites using spatial data recorded in corresponding AHIMS site cards. Sites that could not be inspected and verified are shown as per the coordinates provided in the AHIMS site cards.



Legend

Construction features

- 50 metre area around construction footprint
- Construction footprint
- Tunnel

AHIM sites

- AHIMS site within 50 metres of the construction footprint
- AHIMS site over 50 metres from the construction footprint

Figure 4-1 Aboriginal sites (registered on AHIMS) entire project alignment

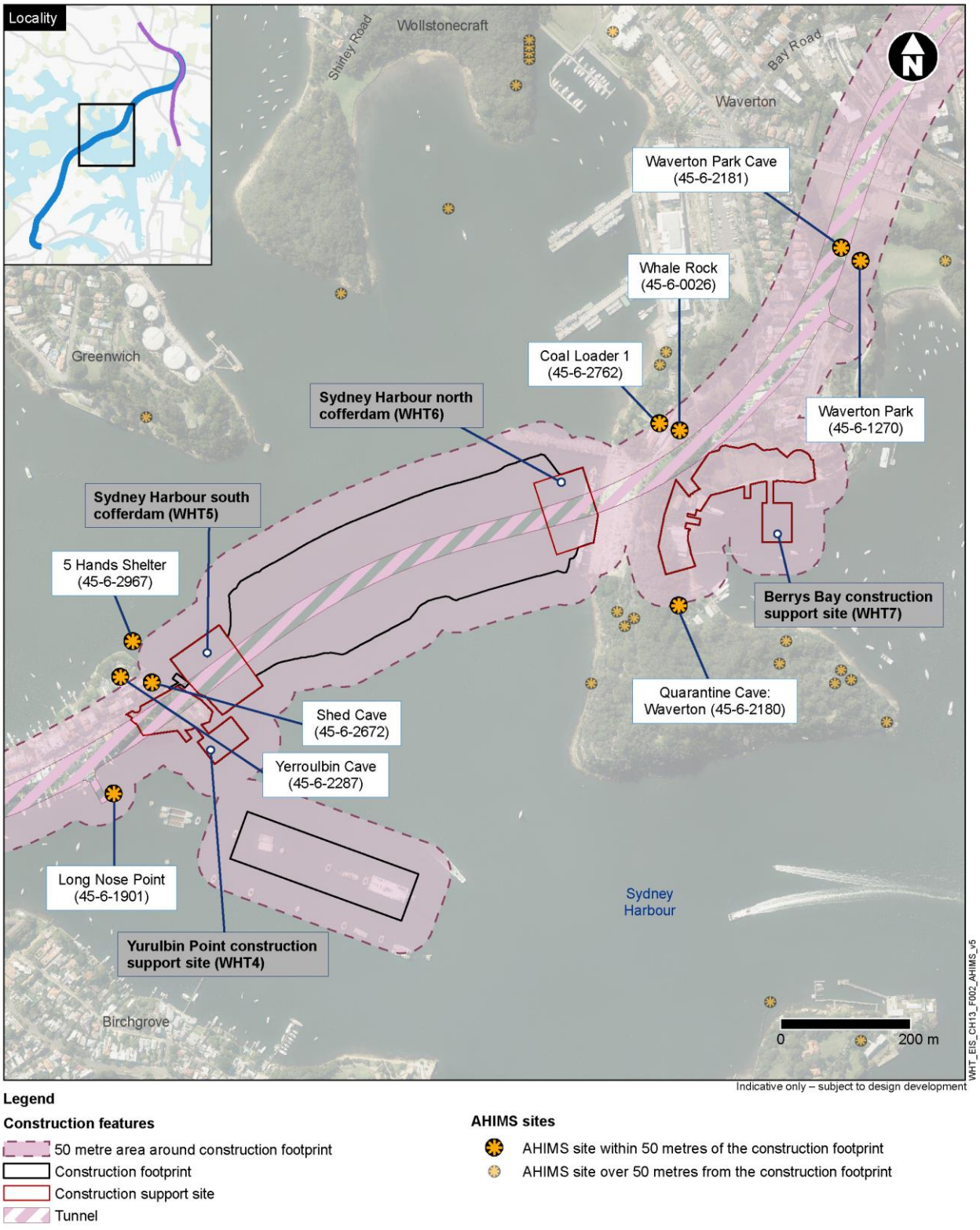


Figure 4-2 Aboriginal sites (registered on AHIMS) in the project study area

5. Aboriginal cultural values assessment

5.1 Introduction

The cultural values assessment in this report includes cultural information collected during consultation, field surveys and the test excavation program. The Aboriginal cultural values assessment was carried out by Andrew Costello and Andy Roberts (senior archaeologists at Jacobs).

5.2 Methodology

The assessment involved consultation through a several methods with knowledge holders as identified by the registered Aboriginal parties for the project (refer to Section 3 for further details of consultation). The cultural assessment was based on:

- Reviewing the Western Harbour Tunnel and Beaches Link program of works archaeological survey report (Costello et al, 2017) completed for the project
- Reviewing literature relevant to the study area and the surrounding landscape
- Consultation with knowledge holders for the region during AFG meetings
- Consultation with knowledge holders at arranged meetings (eg oral history recording, site visits and fieldwork with knowledge holders)
- Consulting with Aboriginal site officers during fieldwork regarding Aboriginal objects and cultural values.

The information provided has contributed to an understanding of the cultural value of the broader landscape within which the project would be located. Knowledge holders have provided information about the traditional presence of Aboriginal people in the landscape, ceremonial sites and the impact of European land management practices on their traditional land, and subsequently their culture. The cultural assessment identified locations of Aboriginal cultural value within the study area.

5.3 Cultural significance

Cultural significance can be associated with or attached to any place, places and objects by any individual, group or groups of people. Cultural significance is embodied in the place itself: its fabric, setting, use, associations, meanings, records, connected places and objects. Place is a geographically defined area, and may include tangible features that embody the physically identifiable landscape; as well as intangible features such as conceptual ideas or spiritual beliefs held over places or landscapes irrespective of observable physical evidence (Australia ICOMOS, 2013).

Australia ICOMOS (2013) defines cultural significance as:

> "Aesthetic, historic, scientific, social or spiritual value for past, present or future generations.
>
> Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects."

5.4 Identified Aboriginal cultural heritage values

The consultation process with stakeholders and on-site discussions with site officers have identified a variety of cultural heritage values within the regional landscape (refer to Table 5-1). It should be noted, however, that not all of these cultural values have been identified within the study area during the archaeological assessment.

Table 5-1 Cultural heritage values identified by registered Aboriginal parties

Cultural heritage value	Description
Resource gathering locations and techniques	The RAPs noted that fish, plants and other foods are still available throughout the region. The main resource gathering locations, and the techniques used, are vaguely known and passed down through the generations.
Rock shelters	The RAPs identified rock shelters as culturally significant as they provide a link between occupation of the region, the gathering of resources, land care rejuvenation, and communication between other groups. In the course of the fieldwork, the identified rock shelter site locations containing stone artefact scatters or middens were noted as having these types of cultural significance.
Middens	The RAPs identified middens as culturally significant as they provide a link between occupation of the region, the gathering of resources and land care rejuvenation, and were important terrestrial, territorial markers on the landscape, facilitating communication between other groups. In the course of the fieldwork, the identified midden site locations were noted as having these types of cultural significance.
Scarred trees	Scarred trees are of great importance to RAPs as they can be of sacred and ceremonial importance. Due to European land use and agricultural practices, scarred trees can often be the only remaining markers for ceremonial sites and burials in the landscape. None were noted during the field work or cultural values assessment.
Watercourses, bays, water holes or springs	Permanent water bodies are culturally significant as a central location for gathering of people, resource collection and camping. During field work RAPs indicated certain watercourses and bays within the harbour as important sources of food as well as significant for ceremonial practices. Watercourses, tides, islands and bays are often associated with spiritual beings. The length of the Parramatta River, to its mouth in the harbour, was considered to represent an important spiritual creature, an eel whose eye was Goat Island.
Native plants and animals	Native plants and animals are significant to RAPs. During field work, the fauna and flora were occasionally mentioned in context with spiritual importance, particularly eels, fish, bivalves and snakes. During the consultation process, native plants and animals were often mentioned in discussion with resource collection.
Burial sites	Burial sites are of great importance and are generally of high concern to Aboriginal people as the locations of burials are rarely documented. The RAPs identified the landscape features chosen for burial sites as being areas near campsites and on sandy rises near the shoreline of the harbour and within rock shelters near Berrys Bay.
Engraving sites and areas of spiritual significance	The RAPs referred to rock engravings as highly important areas. These sites were often connected to pathways which link spiritual and ceremonial sites, as well as travel corridors throughout the landscape between the coast and higher ground. During the recording of the engravings, RAPs expressed a profound sense of wonder and feeling of belonging and continuation of cultural practice. Several cultural protocols were observed while recording the rock engravings: no whistling or singing at night, observance of men's and women's sites and acknowledgment of elders and country at each site to ensure safe passage.
Post-contact sites	Post-contact sites are those that have gained significance to Aboriginal people since the arrival of European settlers. No post-contact sites were identified during the archaeological assessment of the study area.

Cultural heritage value	Description
Massacre sites	These sites are of significant importance to Aboriginal people and are often difficult to discuss. No massacre sites were identified during the archaeological assessment of the study area.
Cultural knowledge	The RAPs expressed concern for the loss of cultural knowledge and the meanings embedded in the landscape of the region. There are no identified knowledge holders that could be identified for the project who may possess more detailed cultural knowledge of the landscape and its spiritual meaning. The RAPs felt that the loss that began with early colonisation has been exacerbated by significant development in the region. The sense of loss and belonging instils a feeling of guilt that the country is not being protected for the future generations and that there is poor cultural heritage management.

5.4.1 Oral testimonies and statements of cultural significance

As no knowledge holders for the project were disclosed by the site officers or registered Aboriginal parties, no direct interviews were held. The following testimonies from site officers for the project were recorded during the test excavation and survey program in January 2018.

James (Jamie) Eastwood

Jamie was interviewed after completion of the survey for the cultural values assessment on 24 January 2018. Jamie has lived and worked in Sydney for almost 20 years, mostly on cultural heritage projects. Most of his knowledge is from his family and his work. Jamie's understanding is that the area around Berrys Bay and Balls Head is the last of the undisturbed land within the area close to the central business district and North Sydney. Most of the study area has been extensively disturbed by roads, rail, bridges, industrial areas and settlement to the point that there is little undisturbed land left. That which is left is therefore much more notable.

5.5 Aboriginal cultural values within the study area

As summarised in Table 5-2, this cultural assessment has identified nine Aboriginal cultural values within the study area. These Aboriginal cultural values are associated with existing Aboriginal sites.

Table 5-2 Aboriginal cultural values within the study area

Cultural value name (AHIMS ID)	Description
Sites verified during field surveys	
Waverton Park Cave (45-6-2181)	Rock shelter and midden
Waverton Park (45-6-1270)	Midden
Coal Loader 1 (45-6-2762)	Rock shelter and midden
Whale Rock (45-6-0026)	Large rock engraving site with multiple engravings
Quarantine Cave: Waverton (45-6-2180)	Rock shelter and midden
Sites unable to be assessed due to property access constraints	
5 Hands Shelter (45-6-2967)	Rock shelter, midden and art site
Yerroulbin Cave (45-6-2287)	Rock shelter, midden and art site

Cultural value name (AHIMS ID)	Description
Long Nose Point 1 (45-6-1901)	Rock shelter, midden and art site
Shed Cave (45-6-2672)	Rock shelter, midden and art site

6. Summary of archaeological assessment

This section summarises the archaeological assessment carried out to inform the cultural heritage assessment. Full details of the archaeological assessment for the project can be found in the Archaeological Assessment Report which accompanies this report (refer to Appendix D).

6.1 Assessment methodology

The archaeological assessment was conducted in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b) and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (DECCW, 2011). The assessment broadly consisted of the following stages:

1) Desktop assessment to develop a predictive model
2) Archaeological survey.

Stage 2 of the archaeological assessment included extensive consultation with and involvement by the registered Aboriginal parties (refer to Section 3).

6.1.1 Desktop assessment

Existing data were reviewed (including previous archaeological investigations specific to the study area and AHIMS searches) to identify any gaps in the assessments and to develop a predictive model to aid in identifying areas within the study area more likely to contain archaeological sites (refer to Section 2, Appendix C (Archaeological methodology)).

6.1.2 Archaeological survey

During the archaeological survey, all previously recorded AHIMS sites within the study area were visited (where possible). Four AHIMS sites could not be accessed due to private property constraints (refer to Table 5-2). Survey of the study area was carried out on foot and by vehicle, during which notes were taken regarding the ground surface visibility, integrity (land condition) and archaeological sensitivity. All data were recorded on a hand-held global positioning system unit and photographs were taken. All Aboriginal archaeological sites/objects identified during the survey were recorded to the standard required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b). The results of the archaeological survey are detailed in the Archaeological Assessment Report (refer to Appendix D).

In accordance with requirement 5 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b), the archaeological survey adopted a sampling strategy which targeted each distinct landform within a given soil landscape. Where the predictive model determined landforms of high potential archaeological sensitivity, these landforms were targeted for full survey coverage with an awareness of the likelihood of certain site types potentially occurring within particular landforms. Full coverage of the study area associated with sensitive landforms was carried out with the nominated site officer from the Metro LALC where practical. The sampling strategy had the following objectives:

- Areas of higher visibility and exposures of the ground surface were targeted for particular scrutiny for the presence of midden material or stone artefacts
- All mature trees in the study area were inspected for cultural modification and scarring
- Any areas with potential rocky outcrops close to waterways were inspected for grinding grooves, waterholes and wells
- Exposed sandstone platforms with potential for engravings were targeted
- The following details were recorded for each surveyed area:

- Landform
- Ground surface exposure and nature of exposure
- Visibility as a result of vegetation
- Degree of disturbance
- Nature of current and historical land use.

In conjunction with the PACHCI process, an assessment of potential submerged Aboriginal sites was carried out within the marine environment of the project area. A field survey, in the form of a diving investigation, took place over five days between 13 and 19 December 2017. The dive investigation focused on identifying the nature of anomalies for the maritime heritage component of the project as well as natural features which could be associated with the surviving remains of submerged Aboriginal sites. As such, diving took place along two locations where rock outcrops were visible on the side scan sonar and indicated the potential for the presence of rock overhangs which could have associations with past human occupation.

6.1.3 Archaeological methodology

An archaeological methodology for the Western Harbour Tunnel and Beaches Link program of works was developed and issued to RAPs in September 2017 (Carr and Costello, 2017). This methodology included the project and is based on the results of the archaeological survey. The methodology was designed to be generally in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b), the requirements of Stage 2 of the PACHCI and the Secretary's environmental assessment requirements for the project. The archaeological methodology can be found in Appendix C. The archaeological methodology recommended no test excavation requirements in the Western Harbour Tunnel and Warringah Freeway Upgrade study area and focuses on archaeological methodology for the Beaches Link and Gore Hill Freeway connection study area (which is not part of the project).

6.2 Results

Archaeological assessment of the study area, including desktop assessment and archaeological survey, identified a total of nine archaeological sites, many of which contain multiple site components (Table 6-1). The location and extent of the below sites is shown in the Western Harbour Tunnel Archaeological Assessment Report (Appendix D).

Table 6-1 Archaeological sites identified within the study area

Site name (AHIMS ID)	Description
Sites verified during field surveys	
Waverton Park Cave (45-6-2181)	Rock shelter and midden
Waverton Park (45-6-1270)	Midden
Coal Loader 1 (45-6-2762)	Rock shelter and midden
Whale Rock (45-6-0026)	Large rock engraving site with multiple engravings
Quarantine Cave: Waverton (45-6-2180)	Rock shelter and midden
Sites unable to be assessed due to property access constraints	
5 Hands Shelter (45-6-2967)	Rock shelter, midden and art site
Yerroulbin Cave (45-6-2287)	Rock shelter, midden and art site

Site name (AHIMS ID)	Description
Long Nose Point 1 (45-6-1901)	Rock shelter, midden and art site
Shed Cave (45-6-2672)	Rock shelter, midden and art site

No new Aboriginal cultural heritage sites were identified during the archaeological survey. Several previously registered sites located within the study area were re-inspected, where access was possible. Details of all the sites re-inspected can be found in the Archaeological Assessment Report (Appendix D). No new potential archaeological deposits were identified during the survey. As a result, test excavations in the study area were not required to inform the ACHAR.

6.2.1 Potential submerged sites assessment

Potential submerged Aboriginal sites refer to archaeological sites inundated since the rise in sea levels that occurred in Sydney Harbour during the most recent post-glacial marine transgression around 12,000 to 7000 years ago. Aboriginal sites that could occur in inundated areas of the study area include:

- Rock shelters with occupation evidence and deposit
- Engraving and applied pigment art and axe grinding grooves on sandstone ledges and faces
- Middens and/or stone artefact scatters on sandstone platforms and within soil profiles
- Fish traps on shallow, wide and gently sloping sandstone platforms.

The probability of these surviving intact, or at all, depends on how the sea rose – gradually or as an encroaching active shoreline with wave and tidal action, and the subsequent pattern of tidal flow. Between Yurulbin Point and Balls Head, Aboriginal sites may have a lesser likelihood of surviving inundation due to present strong tidal flows. Elsewhere in the area, data collected from geotechnical drilling for the project indicate that, for a time during the latest sea level rise, water flow was sufficiently slow to allow sedimentary build-up that was potentially capable of trapping, burying and effectively protecting archaeological sites and deposits. Further discussion of the potential for Aboriginal sites to survive as submerged sites is provided in Appendix E (Potential Submerged Sites Assessment).

Table 6-2 summarises areas of submerged Aboriginal archaeological potential relevant to the project.

Table 6-2 Summary of areas of submerged Aboriginal archaeological potential

Location	Potential Aboriginal site type	Archaeological potential	Predicted potential location within study area
Between Yurulbin Point and Waverton	Stone artefacts, midden deposits and fish traps	Moderate to high	In identified peat deposits formed above residual soils (as shown from geotechnical investigations).
	Stone artefacts and midden deposits	Low	In identified residual soils.
	Rock shelters, art, grinding grooves, middens, stone artefact scatters, quarry sites and fish traps	Very low	Buried beneath at least 10 metres of marine sediment.

Location	Potential Aboriginal site type	Archaeological potential	Predicted potential location within study area
Berrys Bay	Rock shelters, grinding grooves, middens and/or stone artefact scatters, stone quarry sites, fish traps.	Moderate to high	In potential residual soils and/or sandstone overhangs/ledges, creek lines that may occur buried beneath Holocene marine sediments, up to 20 metres thick below the current bed of the harbour surface.
White Bay	Rock shelters, grinding grooves, middens and/or stone artefact scatters, stone quarry sites, fish traps.	Moderate to high	In potential residual soils and/or sandstone overhangs/ledges, creek lines that may occur buried beneath Holocene marine sediments, up to 20 metres thick below the current bed of the harbour surface as well as under reclamation.

7. Significance assessment

7.1 Methodology

7.1.1 Basis for assessment

A significance assessment is made up of several significance criteria that attempt to define why a site is important. Such assessment recognises that sites may be important for different reasons to different people, and even at different times. The assessment of Aboriginal cultural heritage in this assessment is based upon the four values of the Australia ICOMOS Burra Charter (Australia ICOMOS, 2013):

- Social values
- Historical values
- Scientific values
- Aesthetic values.

Each of these values is assessed below for Aboriginal sites in the study area, and an overall significance is assigned based on an average across the values. This is inherently a reductive process, and oversimplifies what is important for different reasons to a range of different stakeholders, but is a necessary process in being able to create comparative values between sites. The significance of each site ultimately informs the management of sites and places.

It should be noted that only existing Aboriginal sites within the study area have been assessed for significance.

7.1.2 Social significance

The significance of a heritage item does not relate only to its scientific or research value. Aboriginal people's views on the significance of archaeological sites are usually related to traditional, cultural and educational values, although some Aboriginal people also value any scientific information a site may be able to provide.

Aboriginal cultural significance was assessed from consultation with the nominated site officers for the relevant RAPs during and following field assessments. It should be noted that Aboriginal significance assessed in this manner may not reflect the views of all members of the community.

7.1.3 Historic significance

The historic value of a site is determined through its association with historically important people, events or activities.

7.1.4 Scientific significance

Research potential or scientific significance of an Aboriginal archaeological site can be assessed by using the criteria set out below. Each criterion is rated as low, moderate or high.

- **Site integrity** – the integrity of a site refers to its state of preservation, or condition. A site can be disturbed through several factors including natural erosion processes, destructive land use practices or repeated use of a site in the past by both humans and animals
- **Site structure** – structure refers to a site's physical dimensions, that is, size and stratigraphy. A large site or a site with stratified deposits has more research potential than small sites and/or surface scatters. Sometimes, however, specific research questions may be aimed at smaller sites in which

case they would be rated at a higher significance than normal. Site structure cannot be assessed for scarred trees or isolated artefacts

- **Site contents** – this category refers to the range and type of occupation debris found in a site. Generally, complex art sites, extensive quarries with associated debris and surface sites that contain a large and varied amount of organic and non-organic materials are considered to have greater research potential than those sites with small, uniform artefacts, single motif art sites and small quarries with little or no debris. For scarred trees, contents may refer to the size and type of scar and/or how many scars there are on the one tree
- **Representativeness and rarity** – Representativeness refers to how much variability exists between the subject site and others inside or outside the subject area. It also considers the types of sites already conserved in the area and how much connectivity between sites exists. Rarity considers how often a particular site type occurs in an area. Assessment of representativeness and rarity requires some knowledge of the background archaeology of the area or region in which a study is being carried out. Rarity also relates to whether the subject site or area is important in demonstrating a distinctive way of life, custom, process, land use, function or design which is no longer practiced (OEH, 2011).

7.1.5 Aesthetic significance

This refers to the sensory value of a place, and can include aspects such as form, texture, and colour, and can also include the smell and sound elements associated with use or experience of a site (Australia ICOMOS, 2000). Additionally, in the context of the current investigation the aesthetic significance may also relate to a setting that allows its place in a larger and more complex landscape to be better understood and appreciated. Aesthetic significance can be closely linked to the social value of a site.

7.1.6 Scale of significance

Significance of sites and places is assigned to different geographic scales, such as local, regional, state and national, appropriate to the scale of importance. For example, K'Garri (Fraser Island) is significant at a national (and world) scale, whereas a local historic building may only be significant on a local scale. This is reflected in the variety of heritage lists held by local councils, up to State and Federal government. In scale of significance, the criteria presented above as well as educational or research potential, representativeness and rarity (Australia ICOMOS, 2013) have been considered in determinations of significance.

Each site has been assessed and its scale of significance has been identified as being of importance at the State, regional or local level. Each site has also been given a grading of its significance overall based on the grading of each of the individual values. The grading of low, moderate and high has been assigned comparatively across the sites investigated in the region.

7.2 Statements of significance

Significance assessments for the five Aboriginal sites identified during the cultural heritage assessment of the study area are presented below.

7.2.1 Waverton Park Cave (45-6-2181)

Table 7-1 Statement of significance – Waverton Park Cave (45-6-2181)

Criterion	Assessment
Social significance	Consultation with the RAPs has identified that all Aboriginal cultural heritage values within the study area are considered to be of high cultural (social) significance (refer to consultation in Section 3 and Section 5). This is particularly the case for Waverton Park Cave, which is a rock shelter with midden site. The site has high social significance at the local level as it provides tangible evidence

Criterion	Assessment
	of the use of the area by Aboriginal people and because it is a multi-component site (shelter and midden).
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having moderate integrity, moderate structure, potential sub-surface deposit, and high representativeness/rarity. The integrity and structure of the site is moderate as the site may have been subject to disturbance as a result of being located within an urban environment. There is also evidence of further disturbance to site integrity through the presence of a fallen slab in the north-east of the shelter. The site is made up of more than one component (midden and rock shelter) and hence has increased the scientific significance.
Aesthetic significance	The site has moderate aesthetic significance at the local level as it is a rock shelter near Sydney Harbour and has a pleasant east-facing perspective.
Summary statement of significance	Waverton Park Cave is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its integrity and structure, high representativeness and rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

7.2.2 Waverton Park (45-6-1270)

Table 7-2 Statement of significance – Waverton Park (45-6-1270)

Criterion	Assessment
Social significance	Waverton Park is a shell midden located in a highly urbanised environment. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having low-moderate integrity, moderate structure, potential sub-surface deposit, and high representativeness/rarity. The integrity and structure of the site is moderate as the site is likely to have been subject to disturbance as a result of being located within an urban environment. While shell middens are not an uncommon Aboriginal site, they are rare in Sydney Harbour near the study area due to development and associated disturbance of archaeological sites.
Aesthetic significance	The site has low aesthetic significance at the local level as it is located within a heavily developed urban environment.
Summary statement of significance	Waverton Park is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its high representativeness and rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

7.2.3 Coal Loader 1 (45-6-2762)

Table 7-3 Statement of significance – Coal Loader 1 (45-6-2762)

Criterion	Assessment
Social significance	Coal Loader 1 is made up of shell, non-human bone and organic material. The shell is on a slope with a stone floor and butchered animal bone present. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate scientific significance at the local level as it is ranked as having low-moderate integrity, low-moderate structure, and high representativeness/rarity. The integrity and structure of the site is low-moderate as the site is likely to have been subject to disturbance as a result of being located under a residence within an urban environment. While shell middens and butchery debris are not uncommon Aboriginal site types, they are rare in the Western Harbour region due to development and associated disturbance of archaeological sites. Coal Loader 1 is therefore ranked as having a high representativeness/rarity.
Aesthetic significance	The site does not meet this criterion.
Summary statement of significance	Coal Loader 1 is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate scientific significance due to its high representativeness and rarity although it is likely the site is disturbed due to its location under a residence. The site has moderate-high research and educational potential about the manner in which local Aboriginal populations lived in the area.

7.2.4 Whale Rock (45-6-0026)

Table 7-4 Statement of significance – Whale Rock (45-6-0026)

Criterion	Assessment
Social significance	Whale Rock is made up of a series of rock engravings. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site has been referred to in historical sources (Campbell 1899). It is a well-known rock engraving in the Sydney Harbour region and has been analysed and recorded several times over the past 150 years. It therefore should be considered to have high historical significance.
Scientific significance	The site has high scientific significance at the local level as it is ranked as having moderate-high integrity, high structure, and high representativeness/rarity. The integrity and structure of the site is moderate-high as part of the rock surface was destroyed during construction of Balls Head Drive.
Aesthetic significance	The site has high aesthetic significance at the local level as it is a variety of rock engravings at Berrys Bay on Sydney Harbour with a pleasant west-facing site aspect.

Summary statement of significance	Whale Rock is of high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has high scientific significance due to its high representativeness and rarity. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

7.2.5 Quarantine Cave: Waverton (45-6-2180)

Table 7-5 Statement of significance – Quarantine Cave: Waverton (45-6-2180)

Criterion	Assessment
Social significance	Quarantine Cave: Waverton consists of a small north-facing rock shelter and a sandy shell midden floor. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people and because it is a multi-component site (shelter and midden).
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having moderate integrity, moderate structure, potential sub-surface deposit and high representativeness/rarity. The integrity and structure of the site is moderate as the site is likely to have been subject to disturbance through more recent European use. This is evident through the presence of lumps of coal identified in surface material. While rock shelter and shell middens are not uncommon Aboriginal site types, they are rare in the Western Harbour region due to development and associated disturbance of archaeological sites. The Aboriginal site is also a multi-component site (shelter and midden) which adds further scientific significance.
Aesthetic significance	The site has moderate aesthetic significance at the local level as it is a rock shelter near Sydney Harbour and has a pleasant, north-facing perspective.
Summary statement of significance	Quarantine Cave: Waverton is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its high representativeness/rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

7.3 Summary of significance

The summary of the significance assessment of Aboriginal sites located within the study area is presented below in Table 7-6. Mapping of all Aboriginal sites identified within the study area is presented in Figure 4-1 and Figure 4-2.

Table 7-6 Summary of the significance assessment for identified Aboriginal sites located within the study area

Name (AHIMS ID)	Social significance	Historical significance	Scientific significance	Aesthetic significance	Overall significance
Waverton Park Cave (45-6-2181)	High	N/A	Moderate-high	Moderate	Moderate-high
Waverton Park (45-6-1270)	High	N/A	Moderate-high	Low	Moderate-high

Coal Loader 1 (45-6-2762)	High	N/A	Moderate	N/A	Moderate-high
Whale Rock (45-6-0026	High	High	High	High	High
Quarantine Cave: Waverton (45-6-2180)	High	N/A	Moderate-high	Moderate	Moderate-high
Sites unable to be inspected due to private property constraints					
5 Hands Shelter (45-6-2967)	All sites unable to be visited during assessment are suggested to hold high overall significance. Significance will be assessed and updated once access is available.				
Yerroulbin Cave (45-6-2287)					
Long Nose Point (45-6-1901)					
Shed Cave (45-6-2672)					

7.3.1 Potential Submerged Sites Significance Assessment

The Potential Submerged Sites Assessment (Appendix E) contains a significance assessment for potential submerged sites.

The assessment examines the proposed tunnel alignment on the bed of Sydney Harbour. Using modelling based on remote sensing information, it identifies the sensitivity of different zones based on the likelihood that they retain archaeological deposits pre-dating sea-level rise. Any Aboriginal sites or artefacts that pre-date sea level rise are likely to hold high archaeological and cultural significance.

Any potential submerged Aboriginal archaeological sites are likely to have very high scientific significance due to the potential to yield information that would contribute to an understanding of the NSW natural and cultural history. Submerged Aboriginal archaeological sites and Pleistocene Aboriginal archaeological sites are both, on their own, rare site types within a NSW context. The identification of submerged Pleistocene landscapes and associated Aboriginal archaeological resources would be an extremely rare discovery within Australia.

8. Impact assessment

The potential impacts on Aboriginal cultural places and archaeological sites recorded within the study area have been considered. The study area has been developed to also consider potential impacts related to vibration and settlement risk identified for the project (Technical working paper: Noise and vibration (Renzo Tonin, 2020)).

This section looks specifically at those areas where a site or place may be directly or indirectly impacted due to its location within the study area.

8.1 Impact avoidance

All recorded Aboriginal sites within the study area have been considered in relation to the proposed road construction, operation and associated activities, and wherever possible, Roads and Maritime has sought to avoid and reduce impacts on Aboriginal sites.

As outlined in Chapter 4 of the environmental impact statement, the process for selection of the preferred tunnel alignment and construction method included consideration of 10 strategic corridors and over 15 different combinations of tunnelling methods. Selection of the preferred corridor required consideration of various technical and environmental factors including opportunities to minimise heritage impacts and included constraints mapping.

To inform the constraints mapping, extensive AHIMS searches were carried out in May and June 2016 for the strategic corridors and a wider search was also carried out to gain information on the archaeological context of the study area. Opportunities to avoid areas of high archaeological potential, for example associated with outcropping sandstone bedrock, undisturbed land and land in proximity to waterways, were identified. Throughout design development and refinement, the project's alignment and associated required infrastructure has been modified where possible, to avoid or reduce the impact to identified Aboriginal sites, particularly those of high significance. In particular, the location of construction support sites, and the use of cofferdams, were adopted in part to avoid land-based impacts to recorded Aboriginal heritage and areas of high archaeological potential.

Despite these refinements, some impacts would still occur at several identified Aboriginal sites without appropriate harm minimisation and mitigation measures being in place.

8.2 Potential impacts

The majority of potential impacts on Aboriginal sites within and adjacent to the study area may occur during the construction phase of the project. Potential impacts may include:

- Direct impacts such as the removal, modification or destruction of an Aboriginal site
- Indirect impacts associated with construction vibration generated by tunnelling or surface works and the settlement of land due to tunnelling below or near Aboriginal sites
- Indirect impacts associated with Aboriginal site setting (visual impacts, changes to vistas/landscapes), dust, changes to ongoing use or environmental association.

Based on the results of this assessment and in consultation with the RAPs:

- There are no Aboriginal sites that would be directly impacted by the project
- One archaeological site – Quarantine Cave: Waverton (45-6-2180) – is located within 50 metres of surface works and may be subject to indirect impacts associated with vibration and settlement
- One archaeological site – Waverton Park Cave (45-6-2181) – is located directly above the tunnel alignment and may be subject to indirect impacts associated with vibration and settlement

- Three archaeological sites – Waverton Park (45-6-1270), Coal Loader 1 (45-6-2762) and Whale Rock (45-6-0026) – are located within 50 metres of the tunnel alignment and may be subject to indirect impacts associated with vibration and settlement.

The four archaeological sites at Yurulbin Point, Birchgrove that could not be inspected (45-6-2967, 45-6-2287, 45-6-1901 and 45-6-2672) are likely to be within 50 metres of the tunnel alignment or surface construction works. No Aboriginal sites were identified within the construction footprint at the surface at this location.

Maps showing the project construction footprint in relation to Aboriginal sites identified through this assessment are presented in Section 4. The potential impact on Aboriginal sites recorded within the study area is summarised in Table 8-3.

8.2.1 Types of potential indirect impacts

8.2.1.1 Vibration from tunnelling and at-surface activities

Vibration from construction activities has the potential to result in physical damage to Aboriginal sites. Depending on the outcomes of vibration modelling, the vibration levels may exceed the minimum working distance to achieve a screening level of 2.5 mm/s for Aboriginal sites. The vibration screening level of 2.5 mm/s for avoiding damage to Aboriginal sites is a conservative figure based on modelling provided by the Australian Government Department of Industry, Innovation and Science (Deutsches Institut für Normung, 1999). It assumes that all Aboriginal sites are structurally unsound and that the most sensitive items are located at the closest point to the tunnel. A large rock-hammer could be used during bench clearing tunnelling activities, which typically has a minimum working distance during tunnelling of 20 metres for unsound structures (Renzo Tonin, 2020).

If the vibration levels are expected to exceed this goal, mitigation and management measures would be implemented as outlined in Section9. This would include carrying out Aboriginal site condition surveys before and after construction and conducting continuous vibration monitoring during vibration intensive construction works.

8.2.1.2 Settlement from tunnel excavation

Tunnel excavation, combined with the subsequent impacts on groundwater levels, is expected to result in settlement at the ground surface. To assess the impact on Aboriginal sites (particularly rock shelters and engravings), it is important to estimate potential levels of settlement.

Numerical groundwater modelling was carried out to consider possible settlement resulting from groundwater drawdown (WSP ARUP, 2019). The approximate depths to groundwater and extent of groundwater drawdown is provided in Technical working paper: Groundwater (Jacobs, 2020). No Aboriginal sites were identified as being affected by groundwater drawdown through additional wetting or drying of the rock. Any potential impacts associated with groundwater drawdown from tunnel excavation would be limited to settlement due to stress redistribution induced by tunnel excavation.

The project tunnels would be constructed almost entirely in Hawkesbury Sandstone. For the project tunnel alignment, predicted surface settlement contours due to stress redistribution induced by tunnel excavation involve a maximum predicted surface settlement range of between 15 millimetres and 24 millimetres directly above the mainline tunnels. A damage classification model (CIRIA, 1996) used for the project describes this settlement range as having a ‘slight’ degree of sensitivity due to the potential for cracks to form in buildings. Settlement values of between less than five millimetres and 25 millimetres have been predicted at Aboriginal heritage sites located directly above the mainline tunnels (WSP ARUP, 2019, Table 8).

For the greater Sydney region, Sefton’s (Sefton, 1996) investigation of the effects of mining-related subsidence on Aboriginal rock shelter sites remains the most useful study into the effects of subsidence on rock shelters specifically (note, rock engravings are not covered in this study). The results of Sefton’s

analysis showed that the determining probability of subsidence related impacts on a rock shelter was overhang size, with larger shelters (greater than 50 cubic metres) at greater risk of impact. No rock shelter site less than 50 cubic metres was found to have been impacted by subsidence, and impacts on larger shelters were also rare (Sefton, 1996). All rock shelters within the study area are significantly smaller than 50 cubic metres, suggesting that harm from subsidence related impacts would be unlikely to these Aboriginal site types.

8.2.1.3 Shore wash and coastal erosion impact

Shore wash from on-water construction activities has the potential to impact coastal Aboriginal sites, particularly shell middens which may be disturbed through shore wash and coastal erosion impact.

The likely shore wash deriving from on-water construction activity for the project has been assessed (Technical working paper: Navigation impact assessment (Royal Haskoning DHV, 2020)). The effects of the shore wash on Aboriginal sites has been determined to be negligible. However, in order to ensure that marine construction traffic does not create wash that could impact on the wave climate, a speed limit has been recommended to ensure that vessels do not operate at or near the critical threshold speed that could cause shore wash impact (Royal Haskoning DHV, 2020 p. 40).

8.2.1.4 Environmental setting

The environmental setting of Aboriginal sites has the potential to be impacted through construction activity. This can be caused through vegetation removal or other changes to an Aboriginal site's aesthetic and environmental setting due to impacts from construction activity.

The environmental setting of Aboriginal sites will be protected through maintaining an appropriate level of nearby vegetation to protect the existing environmental aesthetic conditions. Vegetation will also be replanted after construction to re-establish pre-existing conditions (see Technical working paper: Urban design, landscape character and visual impact (WSP Arup, 2020)).

8.2.1.5 Potential submerged sites impact assessment

Potential rock overhangs are submerged and concealed by marine sediments and they cannot be readily accessed and assessed. The assessment of impacts on submerged Aboriginal sites is therefore based on the potential for such sites to exist, using available geophysical information and an understanding of site formation processes.

The predictive model provides a basis for assessing potential impacts and identified that there is documented physical evidence of Aboriginal occupation and land use patterns along the Port Jackson shoreline and the broader Sydney Basin.

The extent to which sites may have survived inundation is dependent on the length and intensity of exposure to water movement and wave action. While the study area considered for the project focused on areas of potential direct and indirect impacts, in the relatively enclosed waters of Sydney Harbour, the rate of survival can be expected to be greater than at sites situated in what would have been more open country, eastwards of the current coastline.

Construction activities associated with excavations within the cofferdams, dredging and piling may have direct and indirect impacts on potential submerged Aboriginal sites. The majority of potential impacts on submerged Aboriginal sites would likely occur during construction rather than operation, and may include:

- Direct impacts from construction activities such as dredging, piling and excavation within the cofferdams
- Indirect impacts associated with construction vibration generated by construction activities near to Aboriginal sites.

Further investigation would be required to confirm the presence of submerged sites and their condition. If confirmed, the identification and documentation of such remains would demonstrate that such remains could be present across Sydney Harbour, and the information obtained in this project would be invaluable in managing this resource on both a State and national level, into the future.

A summary of potential impacts on submerged Aboriginal heritage is provided in Table 8-1.

Table 8-1 Summary of potential impacts on submerged Aboriginal terrestrial sites

Location	Potential Aboriginal site type	Archaeological potential	Significance of direct impacts	Significance of indirect impacts
Between Yurulbin Point and Waverton	Stone artefacts, midden deposits and fish traps	Moderate to high in one localised area	Moderate (without mitigation)	Negligible
	Stone artefacts and midden deposits	Low	Negligible-moderate (without mitigation)	Negligible
	Rock shelters, art, grinding grooves, middens, stone artefact scatters, quarry sites and fish traps	Very low	Negligible-moderate (without mitigation)	Negligible
Berrys Bay	Rock shelters, grinding grooves, middens and/or stone artefact scatters, stone quarry sites, fish traps.	Moderate to high	Negligible to minor	Negligible
White Bay	Rock shelters, grinding grooves, middens and/or stone artefact scatters, stone quarry sites, fish traps.	Moderate to high	Negligible to minor	Negligible

8.2.2 Significance of impact

Table 8-2 has been developed to assess the level of potential impact and associated significance for Aboriginal sites within the study area. The significance of impact ratings corresponds with the damage classification model used for the project (CIRIA, 1996).

Table 8-2 Impact assessment matrix

Impact rating	Scale	Intensity	Duration/frequency
Major	Medium – large	Moderate – high	Permanent/irreversible
Moderate	Small – medium	Moderate	Medium – long-term
Minor	Small/localised	Low	Short-term/reversible

Impact rating	Scale	Intensity	Duration/frequency
Negligible	Little or no potential physical impact to an Aboriginal site. Includes rock shelters that are less than 50 cubic metres in size.		

Table 8-3 Impact assessment for Aboriginal archaeological sites within the study area

Heritage item name (AHIMS ID)	Heritage item type	Overall significance	Location relative to study area	Type of potential impact	Description	Significance of potential impact
Waverton Park Cave (45-6-2181)	Shelter with midden	High	Directly above the mainline tunnels at Waverton Over 50 metres from surface works at Berrys Bay	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being within the minimum working distance for unsound structures. This may pose a risk to the structural integrity of the site if not minimised and managed.	Moderate
				Indirect – settlement	Settlement at this location is predicted to be 20-25 millimetres. Rock shelter is less than 50 cubic metres in size.	Negligible
Waverton Park (45-6-1270)	Midden	High	Within 50 metres of the mainline tunnels at Waverton Over 50 metres from surface works at Berrys Bay	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
Coal Loader 1 (45-6-2762)	Shell: non-human bone and organic material	Moderate	Located within 50 metres of the mainline tunnels at Waverton Over 50 metres from surface works at Berrys Bay Construction Support site (WHT7) and the Sydney Harbour north cofferdam (WHT6)	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
Quarantine Cave: Waverton (45-6-2180)	Shelter with midden	High	Located within 50 metres of surface construction works at Waverton	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
Whale Rock (45-6-0026)	Rock engraving	High	Located within 50 metres of the mainline tunnels at Waverton	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible

Heritage item name (AHIMS ID)	Heritage item type	Overall significance	Location relative to study area	Type of potential impact	Description	Significance of potential impact
			Over 50 metres from surface works at Berrys Bay construction support site (WHT7) and the Sydney Harbour north cofferdam (WHT6)	Indirect – settlement	Settlement at this location is predicted to be less than 10 millimetres.	Negligible
Yerroulbin Cave (45-6-2287)	Shelter with midden and art	Moderate - high	Assumed to be within 50 metres of the mainline tunnels at Birchgrove. Potentially within 50 metres of surface construction works at the Yurulbin Point construction support site (WHT4) and Sydney Harbour south cofferdam (WHT5)	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
Long Nose Point 1 (45-6-1901), 9 Numa Street, Birchgrove	Shelter with midden and art	Moderate - high	Assumed to be within 50 metres of the mainline tunnels at Birchgrove. Potentially within 50 metres of surface construction works at the Yurulbin Point construction support site (WHT4) and Sydney Harbour south cofferdam (WHT5)	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
Shed Cave (45-6-2672)	Shelter with midden and art	Moderate - high	Assumed to be within 50 metres of the mainline tunnels at Birchgrove. Potentially within 50 metres of surface construction works at the Yurulbin Point construction support site (WHT4) and Sydney Harbour south cofferdam (WHT5)	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible
				Indirect – settlement	Settlement at this location is predicted to be less than 10 millimetres.	Negligible

Heritage item name (AHIMS ID)	Heritage item type	Overall significance	Location relative to study area	Type of potential impact	Description	Significance of potential impact
5 Hands Shelter (45-6-2967)	Shelter with midden and art	Moderate - high	Assumed to be within 50 metres of the mainline tunnels at Birchgrove Potentially within 50 metres of surface construction works at the Yurulbin Point construction support site (WHT4) and Sydney Harbour south cofferdam (WHT5)	Indirect – vibration	Vibration impact to the Aboriginal site has been identified as being outside the minimum working distance for unsound structures.	Negligible

Note: Each AHIMS site has been assessed for indirect impacts associated with settlement. With the exception of Waverton Park Cave (45-6-2181), Shed Cave (45-6-2672) and Whale Rock (45-6-0026) all sites within the study area are outside of the zone of potential settlement impacts.

8.3 Cumulative impacts

Cumulative impacts can be defined as the combined effects of environmental or social impacts that occur because of multiple activities and developments with similar impacts within a particular local area and region. There is currently no defined or endorsed process for the assessment of cumulative impacts on Aboriginal cultural heritage in NSW. However, the assessment of cumulative impacts on cultural heritage values must take into account the fact that many cultural values are non-renewable, associated with a finite and limited number of surviving places and objects.

Ideally, an assessment of cumulative impacts should be measured against a baseline of data which characterises the existing cultural resources to be impacted and the cumulative loss already realised. In the case of the local and regional contexts of the Western Harbour Tunnel and Warringah Freeway Upgrade project, effective datasets of such cultural heritage information do not exist. The AHIMS database provides a register of known Aboriginal sites in NSW but is limited in its application due to the selective factors which affect the registration of recordings. Gaps in archaeological survey mean that the AHIMS register does not provide a complete baseline for a comprehensive cumulative impact assessment. However, as the only baseline data available it does help inform qualitative observations and discussion on the cumulative impact.

The study area contains a total of nine Aboriginal terrestrial sites (Table 8-3). The overall significance of the Aboriginal sites falls within a range of moderate to high. Therefore, the regional Aboriginal cultural heritage values across the project would be reduced significantly by the cumulative impacts from the project if serious harm was to occur at a site.

It has been determined that the project may result in potential indirect impacts on these nine sites due to vibration or settlement. However the significance of these potential indirect impacts would be negligible at all sites. Potential negligible or indirect impacts on a site are not considered to result in any cumulative impacts on the region's archaeology. If mitigation and harm minimisation measures to avoid impacts on the Aboriginal sites assessed followed, the increasing rarity of intact Aboriginal sites within the urbanised Sydney region would not be impacted. Therefore, the project would not result in a cumulative impact on the region's archaeology.

Furthermore, the project physically overlaps with the Beaches Link and Gore Hill Freeway project at Warringah Freeway, where surface works are required between Waverton and Cammeray to connect the Warringah Freeway, and at the motorway control centre at Waltham Street, within the Artarmon industrial area. In these locations, no existing AHIMS sites or impacts on Aboriginal cultural heritage were identified. As such, it is considered that the project would not contribute to cumulative impacts in this location. No further cumulative impact assessment has therefore been carried out.

9. Management recommendations

To manage impacts on Aboriginal sites and cultural heritage values, the broad objectives for the project are to:

- Avoid or minimise impacts on significant cultural heritage
- Preserve as much cultural heritage in its original environment as possible
- Maintain cultural heritage through preservation and increased knowledge.

9.1 Terrestrial sites

The first principle of cultural heritage management is impact avoidance and minimisation before mitigation. If it is not possible to completely avoid sites, then mitigation is required for parts of sites that are not going to be impacted. Where complete avoidance is not possible, management recommendations must be implemented for impacted areas of each of the archaeological sites.

These recommendations have been developed to avoid significant impacts and where impacts are unavoidable, to effectively mitigate impacts. Management recommendations have been drafted in accordance with the type of impact on the site and the significance of the site. All management recommendations have been presented to relevant registered Aboriginal parties. A summary of the management recommendations for Aboriginal sites is provided in Table 9-1.

All accessible Aboriginal sites located within the study area have been visited during PACHCI Stage 3 fieldwork and new, in-depth site cards have been prepared for each site. Updated recording has involved preparing extensive photographic records, stratigraphic drawings, site plans, landform descriptions, updated condition assessments, flora and faunal surveys, and community consultation. This activity has provided accurate baseline data for measuring any potential disturbance to sites during construction.

Cultural heritage has little intrinsic value as material fabric. Most of its importance is created in the connections it draws to stories and places and events that we value, and the insights it gives on our changing past and present. As such, interpretation is an essential element of heritage conservation, identifying and communicating those values and connections to the broader public. It applies to sites that are to be impacted as a mitigation, and to projects and areas to ensure that new work fits into its context and environment, and improves established community, social, heritage and urban design values, as set out in the Burra Charter (Australia ICOMOS, 2013).

Heritage impacts for the project occur at a low level and are generally moderate impacts on places of local heritage significance. Much of the impact is dispersed and out of the public gaze. Traditional heritage interpretation such as place-based signage may not be appropriate.

9.2 Potential submerged sites

The underlying principle in safeguarding the cultural heritage significance of maritime heritage is to avoid or minimise any direct, indirect and long-term impacts on a site. This approach is refined and adjusted depending on the level of cultural heritage significance of an item or site, the risk of impact and the scale of impact. The scale or consequence of impact relates to the degree of loss of cultural heritage significance.

The proposed works that could most likely impact potential submerged Aboriginal sites are dredging and excavation within the cofferdams. Without mitigation, the potential impacts could range from negligible to moderate. Other activities such as piling are assessed to have a negligible to minor impact on the potential submerged Aboriginal sites.

Three forms of mitigation measures have been proposed. The first measure involves an investigation into whether a high-resolution geophysical survey may be of assistance in identifying rock overhangs

concealed by marine sediments. If it is determined that a high-resolution geophysical survey could produce the desired results, then the geophysical survey would be carried out.

The second measure would be required if the geophysical survey is inconclusive or if there are distinct rock overhangs measuring at least 1.2 metres in height identified. This measure includes monitoring of excavations within Sydney Harbour south and north cofferdams (WHT5 and WHT6). Should evidence of a void in the bedrock appear that displays the characteristics of a potential rock shelter, a controlled archaeological investigation to recover any artefacts would take place. The extent of the investigation would be determined by the constraints of the bedrock conditions and safety constraints of the cofferdams.

In areas where dredging or piling is proposed, a third measure would involve engagement with a palaeo-geomorphologist prior to construction to determine whether soil units have potential to contain cultural material through the review of existing borehole information. If potential is identified, an appropriate sampling protocol would be designed so materials could be sampled, sieved and inspected.

These measures have been designed to use the opportunity afforded by large scale and deep excavations within Sydney Harbour to capture information related to potential submerged Aboriginal sites during the course of the project. The Potential Submerged Sites Assessment (Appendix E) provides further detail on the impact assessment and mitigation measures.

Table 9-1 Management and mitigation measures for Aboriginal sites within the study area

Ref	Phase	Impact	Environmental management measure	Location
AH1	Pre-construction and construction	Aboriginal heritage – vibration, and settlement impacts	Prior to construction, further consultation with Department of Premier and Cabinet (Heritage), the Metro LALC and the RAPs will be carried out to decide an appropriate course of action for previously recorded Aboriginal sites not assessed during archaeological surveys due to site accessibility constraints. If new information regarding site condition and location is identified during consultation suggesting the sites may be subject to impacts due to vibration and settlement, then mitigation measures AH2, AH3 and AH4 will apply. If during construction works a site is located, Department of Premier and Cabinet (Heritage), an appropriately qualified archaeologist and the Metro LALC will be contacted and the site will be re-recorded in situ. If the site is determined to be within the construction footprint, consultation between Department of Premier and Cabinet (Heritage), Roads and Maritime, Metro LALC and RAP groups will occur with the aim of avoiding, minimising and managing adverse impacts on the site before construction works at the location recommence.	Yerroulbin Cave (45-6-2287) Long Nose Point 1 (45-6-1901) 5 Hands Shelter (45-6-2967) Shed Cave (45-6-2672)
AH2	Pre-construction and construction	Aboriginal heritage – vibration impacts	The following process will be carried out to confirm where vibration monitoring at terrestrial AHIMS sites will be required: a) Terrestrial Aboriginal site condition surveys will be completed using photogrammetry and 3D-capture techniques to determine which AHIMS sites are considered to be structurally unsound b) Where this determination cannot be made, the AHIMS site will be considered to be structurally unsound c) A screening of vibration intensive activities within 50 metres of structurally unsound sites will be carried out to identify activities that have the potential to exceed vibration levels of 2.5 millimetres per second Sites identified as being both structurally unsound and having potential for exceedance in vibration levels of 2.5 millimetres per second will be identified as requiring vibration monitoring.	All registered AHIMS sites located within 50 metres of the project construction footprint

Ref	Phase	Impact	Environmental management measure	Location
AH3	Construction	Aboriginal heritage – vibration impacts	Vibration monitoring will be carried out at AHIMS sites that have been identified as requiring monitoring in accordance with the process outlined in mitigation measure AH2. Where possible, works will be conducted in a manner to minimise vibration levels, to less than 2.5 millimetres per second at all structurally unsound AHIMS sites.	All registered AHIMS sites subject to vibration intensive activities determined to be structurally unsound (see AH2)
AH4	Construction	Aboriginal heritage – vibration impacts	If vibration monitoring identifies that vibration levels exceed 2.5 millimetres per second at AHIMS sites that have been identified as requiring monitoring, a site visit will be organised with a representative from Metro LALC to record any changes to the integrity of the site that may have resulted from construction vibration, and updated site cards must be prepared accordingly. Condition surveys may include further photogrammetry and 3D-capture techniques.	All registered AHIMS sites subject to vibration intensive activities determined to be structurally unsound (see AH2)
AH5	Construction	Unexpected discovery of historical heritage materials, features or deposits	If at any time during construction of the project, any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains are discovered they will be managed in accordance with the Roads and Maritime *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime Services, 2015e).	WHT/WFU
AH6	Construction	Aboriginal heritage – impacts	Cultural and historic heritage awareness training will be carried out for personnel engaged in work that may impact heritage items before commencing works for the project.	WHT/WFU
AH7	Pre-construction	Maritime Aboriginal heritage impacts	The need for further high-resolution geophysical survey/s to identify the presence of submerged rock overhangs concealed by marine sediments will be investigated in consultation with a maritime archaeology advisor. If it is determined that a high resolution geophysical survey could produce the desired results, the geophysical survey will be carried out.	Sydney Harbour south and north cofferdams (WHT5 and WHT6)

Ref	Phase	Impact	Environmental management measure	Location
AH8	Construction		The following mitigation measures will be carried out if the geophysical survey described in AH7 is inconclusive or if the geophysical survey identifies rock overhangs at least 1.2 metres in height: a) Excavations will be visually monitored after WHT5 and WHT6 cofferdams have been de-watered in order to identify voids within the bedrock and identify potential rock shelters b) In consultation with a suitably experienced geomorphologist, criteria will be established for the identification of pre-inundation soil deposits (peat, charcoal, roots, etc) and where necessary, samples of marine sediments will be collected to identify if pre-inundation soil deposits are evident c) If pre-inundation soil deposits are evident then a controlled archaeological investigation will be carried out to recover any artefacts, subject to bed rock conditions and safety constraints within the cofferdams.	Sydney Harbour south and north cofferdams (WHT5 and WHT6)
AH9	Pre-construction and construction	Maritime Aboriginal heritage impacts	Prior to construction, determination of whether dredged soil units have potential to contain cultural material will be carried out by a palaeo-geomorphologist through review of existing borehole information. If the potential to encounter cultural material is identified, then an appropriate sampling protocol will be designed so that samples can be collected during construction if feasible.	Dredging works in the immediate vicinity of borehole B215W in Area A, located between Yurulbin Point and Balls Head (Cosmos Archaeology, 2020)

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Appendix A. Consultation

MINUTES

Meeting title	Aboriginal Focus Group #2 – Western Harbour Tunnel & Warringah Freeway Upgrade		
Date and time	Friday 11 October 2019 / 2:45pm to 4:15pm		
Venue	McMahons Point Community Centre, 165 Blues Point Road, McMahons Point, NSW 2060		
Chairperson	[redacted]		
Attendees	[redacted]	*LD* *GP* *DP* *AN* *KR* *SY* *CB* *AC* *PK* *MK* *RJ* *TJ* *SF* *KT*	*RMS* *RMS* *RMS* *RMS* *RMS* *RMS* *Jacobs* *Jacobs* *Kamilaroi - Yankuntjatjara* *Kamilaroi - Yankuntjatjara* *Murrabidgee* *Murragadi* *Tocomwall* *Metro LALC*

		Responsible person / Due date
1.	**Agenda items**	
1.1	**Acknowledgement to Country**	Note
1.2	**Introductions**	Note
1.3	**Project Overview** - Western Harbour Tunnel & Beaches Link program - Design revised following community engagement - Beaches link project EIS to follow Western Harbour Tunnel EIS	Note
1.4	**Aboriginal Cultural Heritage Assessment approach** - Assessment applicable to the Western Harbour Tunnel project - Draft CHAR is in accordance with the SEARs, OEH guidelines and PACHI - Assessment consisted of desktop, AHIMS searches and site surveys	Note
1.5	**Terrestrial Aboriginal Cultural Heritage assessment** - 9 registered sites where 5 were surveyed - Archival recording and condition assessments were carried out against their original records - 4 sites were inaccessible at time of surveys and are to be inspected following EIS exhibition	Note
1.6	**Potential Submerged Aboriginal sites** - Potential sites refer to those prior to rise in sea levels approx. 18,000 years ago	Note

		Responsible person / Due date
	- Magnetometer survey was carried out to delineate geological features as potential sites, based on the potential for such sites to exist, are submerged and concealed by marine sediments - Potential for direct and indirect impacts from cofferdam construction and dredging	
1.7	**Environmental Management Strategies** - All ancillary and construction sites are located in disturbed areas - Prioritised areas of past disturbance for project infrastructure - Standard management procedure; Unexpected heritage items (RMS, 2015) - Heritage Interpretation Strategy - Further geophysical survey, site surveys with RAP site officers of the previously inaccessible sites, as well as investigation and recovery of potential submerged sites	AC
1.8	**RAP Comments on CHAR / Cultural Values** - **Whale Rock:** query concerning how the assessment of potential settlement due to tunnelling and groundwater changes on the project has been considered at this site. In addition, what geotechnical advice/inputs has been provided to support the assessment. An example was provided by a RAP of an underground mining project where a drop in groundwater resulted in cracking and peeling of above lying sandstone / rock engraving. - **Aboriginal participation:** discussion on the application of APIC/IPP at the design stage of the project, as well as RMS/TfNSW implementation. - **Mitigation / Management:** A RAP indicated that some recordings of rock shelters in the area had been previously undertaken. No further comment received concerning the Heritage Interpretation Strategy. - **CHAR Consultation:** AC sought feedback from RAPs on CHAR. No comments or concerns with the CHAR were raised. - **CHAR Reviews:** An attendee raised query concerning payment for reviews according to RMS policy.	Various
2.	**General Items**	
2.1	**Summary of key points and next steps** - Project has been designed to minimise impacts to heritage sites - Two of the sites assessed have a moderate to minor indirect impact rating - No sites were assessed as having a direct impact from the project - RMS will ensure that the ACHAR addresses query raised in regards to Whale Rock [Post meeting note: In section 8.2.1.2 of ACHAR no Aboriginal sites are identified as being affected by groundwater drawdown. Table 8-3 of the ACHAR includes impact assessment for Whale Rock, including settlement. Potential impacts assessed as negligible) - RAPs did not raise any comments with the CHAR or its assessment as detailed in the AFG - Further surveys to be carried out on the project with RAP site officers - LD to respond separately to individual who raised query on CHAR reviews in item 1.8 above.	AC / LD

From: [redacted]
Sent: Wednesday, 9 October 2019 10:27 AM
To: whtbl
Subject: Western Harbour Tunnel draft Aboriginal cultural heritage assessment report

[redacted]

Thank you for your report, we agree & support all your recommendations regarding Western Harbour Tunnel.

Regards
Phil

[redacted]

From: [redacted]
Sent: Wednesday, 9 October 2019 10:42 AM
To: whtbl
Subject: RE: Western Harbour Tunnel draft Aboriginal cultural heritage assessment report

Hi,

We would like to receive updates on the project.

Thanks
Phil

[redacted]

From: whtbl <whtbl@rms.nsw.gov.au>
Sent: Wednesday, October 9, 2019 10:27:45 AM
To: [redacted]
Subject: Automatic reply: Western Harbour Tunnel draft Aboriginal cultural heritage assessment report

Thank you for your email.

The Project Team thanks everyone who provided feedback on the Proposed Reference Design for Western Harbour Tunnel and Beaches Link.

Our period for feedback extended from Thursday 26 July 2018 and closed on Saturday 1 December 2018.

The Project Team will continue its broader engagement activities as we prepare for the Environmental Impact Statements.

We welcome your further comments at any time.
All feedback received after Saturday 1 December will continue to be recorded in the project database.

If you would like to receive project updates, please reply to this email and request to be added to our email database.

Western Harbour Tunnel & Beaches Link
Roads and Maritime Services - Motorways
T: 1800 931 189

Transport
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From: whtbl <whtbl@rms.nsw.gov.au>
Sent: Wednesday, 9 October 2019 8:37 AM
To: [redacted]
Cc:
Subject: FW: Western Harbour Tunnel draft Aboriginal cultural heritage assessment report

Adam,

Please see below FYI/FYA as appropriate.

Kind regards
Sara

From: [redacted]
Sent: Tuesday, 8 October 2019 2:59 PM
To: whtbl
Subject: Western Harbour Tunnel draft Aboriginal cultural heritage assessment report

Dear RMS
I have read the project information and draft ACHAR for the Western Harbour Tunnel, I endorse the recommendations made, please feel free to contact me if you require further information.
Kind regards

[redacted]

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Subject	**Western Harbour Tunnel and Beaches Link Aboriginal Focus Group Meeting 1**		
Project	WHTBL		
Project No.	IA146500	**File**	Document1
Prepared by	Chelsea [redacted]	**Phone No.**	[redacted]
Location	Old Northbridge Bowling Club, Warners Park, The Outpost	**Date/Time**	September 28, 2017
Participants	[redacted]		
Copies to	[redacted]	**Apologies**	[redacted]

Notes		Action
1	**Acknowledgement to Country:** [redacted] Roads and Maritime Aboriginal Cultural Heritage Officer	
2	**Introduction & Apologies:** [redacted] Roads and Maritime Aboriginal Cultural Heritage Officer	

Please select a legal entity from the Change Document Details option on the Jacobs ribbon
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Meeting Minutes

Western Harbour Tunnel and Beaches Link
Aboriginal Focus Group Meeting 1
September 28, 2017

Notes		Action
3	**Objectives of meeting:** [redacted] Roads and Maritime Aboriginal Cultural Heritage Officer • Objectives - Present an introduction and overview of the project, including a map and plan of the proposed project/study area. • Provide an opportunity for RMS, Jacobs and the Aboriginal parties to clearly define their roles, functions and responsibilities (This is also an opportunity for participants to discuss how they want future meetings held, such as preferred times, venues, terms of reference, etc) • Outline the impact assessment process - explain the EIS process and the relevant legislation. The investigations are being done in accordance with the *Code of practice for archaeological investigation of Aboriginal objects in NSW 2010.* SEARS may be defined later. • Discuss the draft methodology for the preparation of the cultural heritage assessment report and present the results of the preliminary site survey and the draft archaeological methodology. That is, the proposed method for undertaking further archaeological investigations and/or mitigation management as sent out with the letter of invitation. • Provide an opportunity for the Aboriginal parties to provide the names of knowledge holders in the community identify (including self-nomination), and raise and discuss any cultural concerns, perspectives and assessment requirements. Aboriginal parties may not wish to share information with other registered parties. RMS and Jacobs will respect the sensitive nature of the information provided, and will use this information in a manner agreeable to the provider. Contact details are provided at the end of the presentation should people wish to share or express information in a more private manner. • Discuss the need for a site visit to familiarise the Aboriginal parties with the scope of the project and the potential impacts on the study area.	

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Meeting Minutes

Western Harbour Tunnel and Beaches Link
Aboriginal Focus Group Meeting 1
September 28, 2017

Notes	Action

• Invite the Aboriginal parties to nominate people (including self-nomination) to be considered for engagement in the following archaeological roles:
  ○ Site officer.
  ○ Trainee site officer.
• Advise the Aboriginal parties that participation as a registered party in the consultation process is separate to any engagement as a site officer. Payments will only be made to people who are engaged by RMS as Aboriginal site officers, or engaged by a consultant as a knowledge holder. Payment will not be made to Aboriginal parties as part of the general consultation process. Details regarding payments for the provision of services can be found in Appendix A.	

4 **The Project – Design overview:** [redacted] Roads and Maritime, Western Harbour Tunnel and Beaches Link design lead • Looking at construction and environmental aspects. Discussing why we are implementing the project, when and where. Project design includes three main components: The Beaches link, the Western Harbour Tunnel and the Warringah Highway upgrade. • The **Beaches Link connection** extends from northern beaches to existing motorway network. The northern beaches are currently not strongly serviced by public transport. This Motorway connection which facilitate rapid transit buses. The approximate beaches travel time to the city center is 86 minutes. The construction of the Beaches link component of WHTBL will condenser this down to roughly 30 minutes. The Beaches hospital construction will most likely see the Beaches area become an urban centre and this will allow easier access to this as well as the wider French's Forest area. The construction will facilitate quicker and more efficient transport from north to south routes and east to west routes to and from the northern beaches area. • **Western Harbour tunnel** links the westconnex and existing Harbour network. It will extend from North	

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Meeting Minutes

Western Harbour Tunnel and Beaches Link
Aboriginal Focus Group Meeting 1
September 28, 2017

Notes	Action
Sydney corridor to connect to what will be the M4 M5 connection. Therefore, essentially creating an inaugural bypass of the city center. This is arranged to systemize same traffic flow so only people heading to the same area are going the same way. • Significant upgrade to the **Warringah freeway**. Extends from the Sydney Harbour bridge to Harbour tunnel and up to Artarmon hill. Without upgrade to this area the WHTand BL connections would not be feasible. • Impacts of *transition from surface to tunnel* will be most severely impacted so close attention to environmental and cultural aspects of these areas are being focused on particularly. • Paleo valleys for the WHTBL necessitate a revised construction strategy compared to previous Sydney tunneling endeavors. Sediment levels are about 15m so not very deep but will allow some bulk fuel vessels. Sediment is not the sort of rock we can tunnel through. Appropriate sediment at 40-50m and we are not digging that low because this is the crossover area between rock and sediment. Still developing concept but essentially looking at using same technology as Sydney tunnel which was an immersed road connection. Investigating a range of technologies to use for this but the immersed road connection will facilitate the highest road alignment. Rock interfaces would be offshore at about 20metres. Birchgrove, Roselle and Waverton areas in particular will use the immersed tech. • Steel immersed tube unit will be fitted out on the inside and on the Harbour floor up to Balgowlah and Wakehurst parkway. • Depths for Northbridge area approximately 90m . • Burnt bridge creek 65m approximately • Harbour crossing 25m • Essentially the project will provide a separate orbital bypass so that traffic destination are diverted to the same way. • [redacted] – enviro and Planning approvals: NSW government came out in March and said they were going to undertake preliminary investigation of	

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Meeting Minutes

Western Harbour Tunnel and Beaches Link
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September 28, 2017

	Notes	Action
	WHTBL. This involved: carrying out geotechnical investigations, going to market to talk to construction workers and finally community and stakeholder engagement. • Requirements for RMS and Jacobs were to compile an EIS. Currently in early days of the EIS process. Currently in process of preparing state significant structure applications. Looking at going back to government early next year and if we get the go ahead we will finish compiling EIS.	
5	**Project planning and program:** [redacted] Roads and Maritime, Western Harbour Tunnel and Beaches Link Project Director • Introduction of himself as the program director. 1980s there was talk about overlay for a surface motorway but delayed because tunneling was proposed as a more appropriate production avenue. Bus journeys and travel times are erratic for the beaches link area and this will facilitate efficacy of this. First tunnel added in 1990. Currently, if you want to go west or south you have to go over the bridge and this causes extensive congestion. The project will move most of this traffic from the CBD and will facilitate optimized connection of all the connecting areas. Public transport has limited availability so this will also facilitate more efficient private transport avenues.	
6	**Field Survey report results and proposed Archaeological sub-surface methodology discussion:** [redacted] Jacobs Senior Archaeologist • 55 previously registered AHIMS sites within 300m of the study corridor. Most are rock art sites so because the project development is proposed underground tunneling these are unlikely to be impacted. Most will not be impacted at all but assessment of where exactly they were located was still necessary. The AHIMS site types include: middens, rock shelters and engravings. Being such a highly urbanized area there was once a lot of aboriginal heritage but a lot of this has since been destroyed. Therefore, the importance of these remaining sites is acknowledged. A lot of these sites were located on private property so not	

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Meeting Minutes

Western Harbour Tunnel and Beaches Link
Aboriginal Focus Group Meeting 1
September 28, 2017

Notes	Action
all sites could be accessed but most/all sites in public area sites were re-identified. Some sites recorded have since been destroyed so could no longer be relocated. Stage 2 PACHI survey undertaken by qualified archaeologists from Jacobs and a representative Metro LALC. Assessment identified only 3 PADS that were still intact. Historical photography will be used to examine landscape and reformation processes of these PAD areas. Prior to development, the Artarmon PAD most likely was one entire pad but has been divided up owing to this development. • Flat Rock Creek has the potential to maintain some sub-surface deposits. Also there is historical site associated with Henry Lawson in this area. • Burnt Bridge Creek retains some potential but is very modified by previous construction and now includes very dense scrub. Possible potential for grinding grooves but visibility for the area is quite low. Areas along creek bed and terracing also have the potential to hold deposits. • Wakehurst Parkway widening. Rock engravings present near here and the national park and manly dam. Walking and bush bike trails are fairly disturbed and thickly vegetated but we were able to view most engravings, however there are potential obscured ones also. In particular, horizontal sandstone bedrock potential for engraving. The methodology looks at how we might identify potential new engraving sites despite this low visibility. Any knowledge pertaining to sites within this area would be great. Tunnels may be indirectly impacted through vibration. Therefore, sites and rock shelters and deposits will be closely monitored. • Updating of site cards based on our investigation will also be undertaken. The methodology also recommends further investigation: looking into historic photographs, re-record these sites, monitor sites to ensure indirect impacts will be managed and avoid sites where possible. • The methodology also suggests shovel test probes will be inserted at intervals to see if there is an intact deposit and if any Aboriginal artefacts still remain.	

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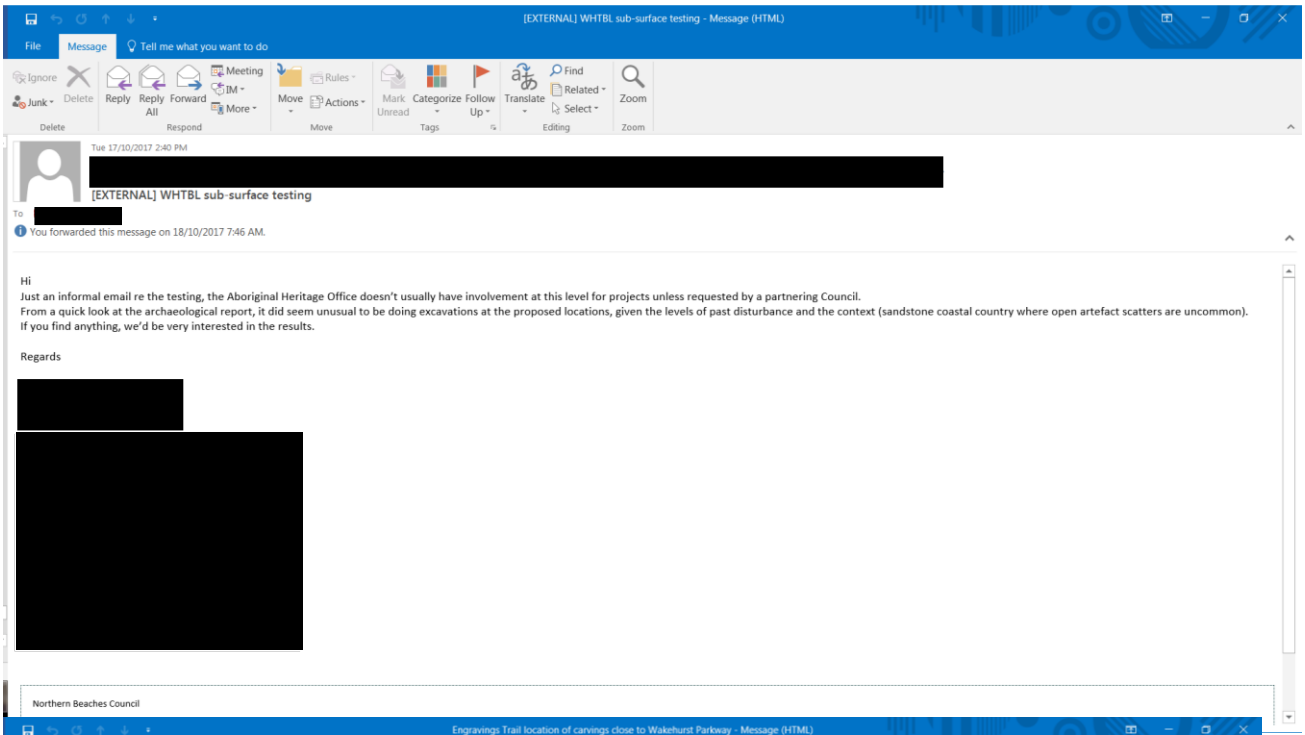

[EXTERNAL] WHTBL sub-surface testing - Message (HTML)

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Tue 17/10/2017 2:40 PM

[redacted]

[EXTERNAL] WHTBL sub-surface testing

To [redacted]

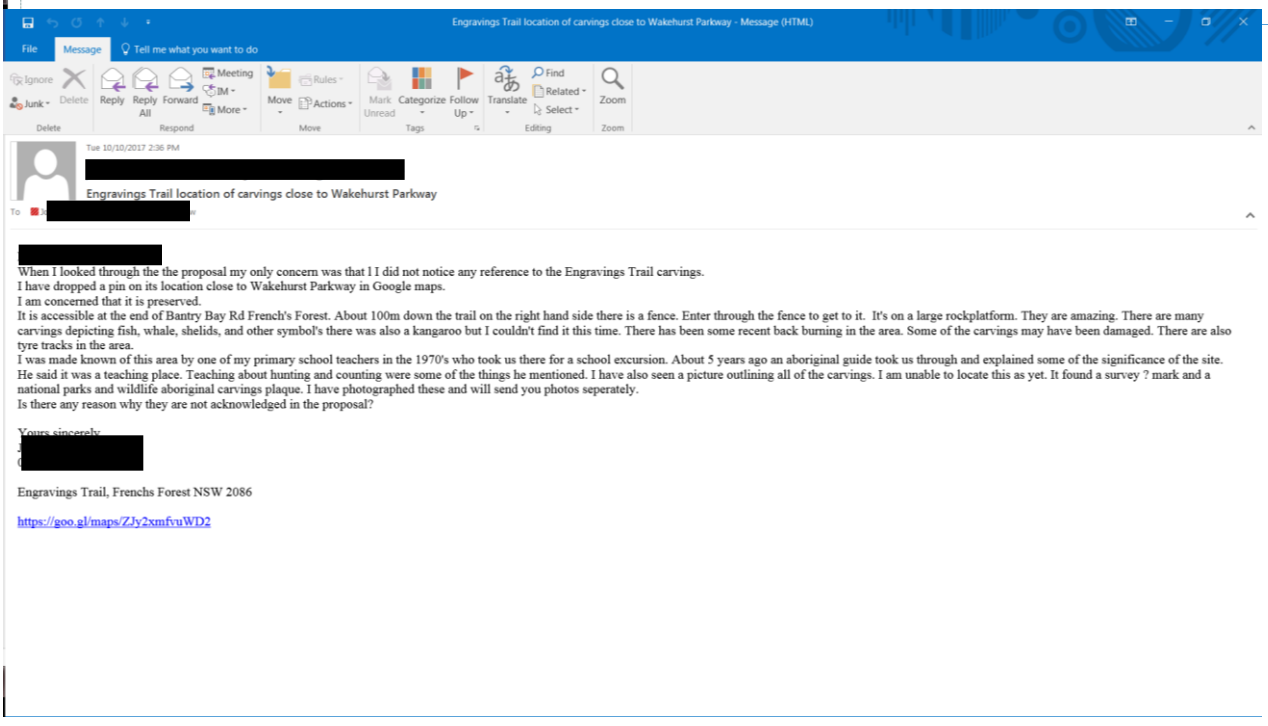
You forwarded this message on 18/10/2017 7:46 AM.

Hi
Just an informal email re the testing, the Aboriginal Heritage Office doesn't usually have involvement at this level for projects unless requested by a partnering Council.
From a quick look at the archaeological report, it did seem unusual to be doing excavations at the proposed locations, given the levels of past disturbance and the context (sandstone coastal country where open artefact scatters are uncommon).
If you find anything, we'd be very interested in the results.

Regards

[redacted]

Northern Beaches Council



Engravings Trail location of carvings close to Wakehurst Parkway - Message (HTML)

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Tue 10/10/2017 2:36 PM

[redacted]

Engravings Trail location of carvings close to Wakehurst Parkway

To [redacted]

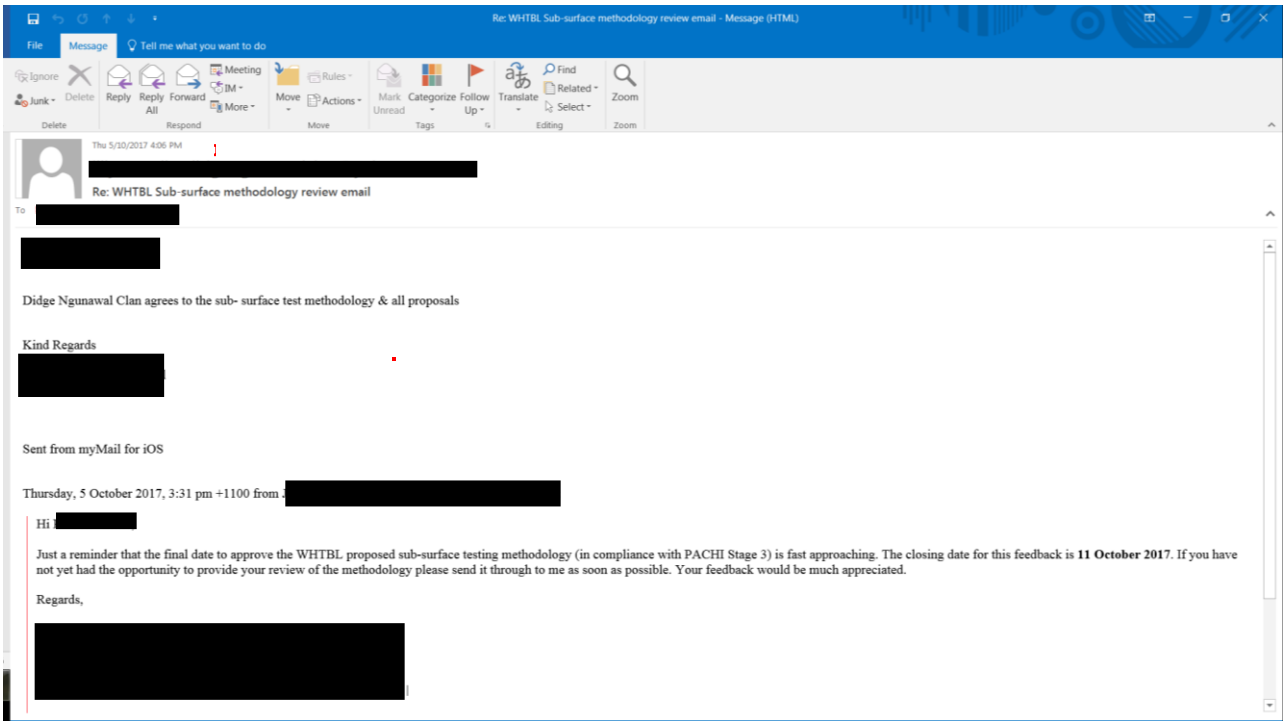
[redacted]

When I looked through the the proposal my only concern was that I I did not notice any reference to the Engravings Trail carvings.
I have dropped a pin on its location close to Wakehurst Parkway in Google maps.
I am concerned that it is preserved.
It is accessible at the end of Bantry Bay Rd French's Forest. About 100m down the trail on the right hand side there is a fence. Enter through the fence to get to it. It's on a large rockplatform. They are amazing. There are many carvings depicting fish, whale, shelids, and other symbol's there was also a kangaroo but I couldn't find it this time. There has been some recent back burning in the area. Some of the carvings may have been damaged. There are also tyre tracks in the area.
I was made known of this area by one of my primary school teachers in the 1970's who took us there for a school excursion. About 5 years ago an aboriginal guide took us through and explained some of the significance of the site. He said it was a teaching place. Teaching about hunting and counting were some of the things he mentioned. I have also seen a picture outlining all of the carvings. I am unable to locate this as yet. It found a survey ? mark and a national parks and wildlife aboriginal carvings plaque. I have photographed these and will send you photos seperately.
Is there any reason why they are not acknowledged in the proposal?

Yours sincerely
[redacted]

Engravings Trail, Frenchs Forest NSW 2086

https://goo.gl/maps/ZJy2xmfvuWD2



Re: WHTBL Sub-surface methodology review email - Message (HTML)

File Message Tell me what you want to do

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Thu 5/10/2017 4:06 PM

[redacted]

Re: WHTBL Sub-surface methodology review email

To [redacted]

[redacted]

Didge Ngunawal Clan agrees to the sub- surface test methodology & all proposals

Kind Regards

[redacted]

Sent from myMail for iOS

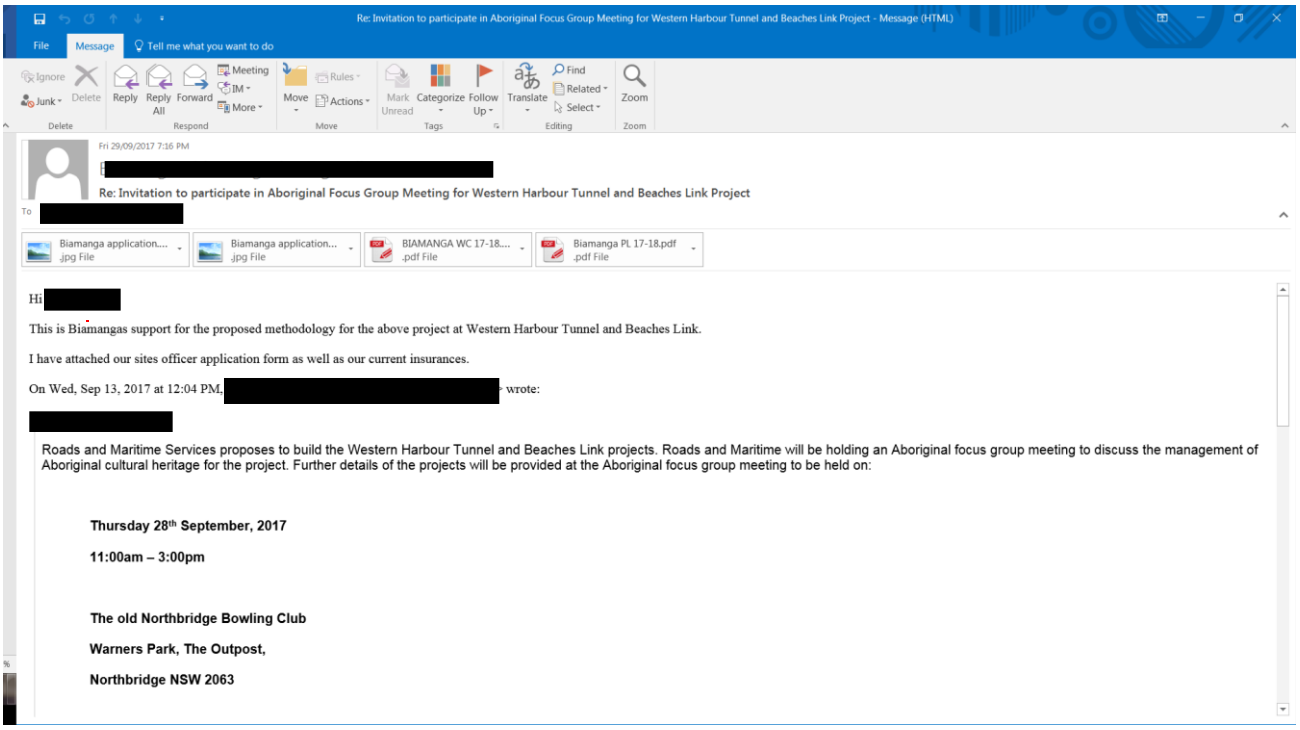
Thursday, 5 October 2017, 3:31 pm +1100 from [redacted]

Hi [redacted]

Just a reminder that the final date to approve the WHTBL proposed sub-surface testing methodology (in compliance with PACHI Stage 3) is fast approaching. The closing date for this feedback is **11 October 2017**. If you have not yet had the opportunity to provide your review of the methodology please send it through to me as soon as possible. Your feedback would be much appreciated.

Regards,

[redacted]



Re: Invitation to participate in Aboriginal Focus Group Meeting for Western Harbour Tunnel and Beaches Link Project - Message (HTML)

File Message Tell me what you want to do

Ignore Junk Delete Reply Reply All Forward Meeting IM More Move Rules Actions Mark Unread Categorize Follow Up Translate Find Related Select Zoom

Delete Respond Move Tags Editing Zoom

Fri 29/09/2017 7:16 PM

[redacted]

Re: Invitation to participate in Aboriginal Focus Group Meeting for Western Harbour Tunnel and Beaches Link Project

To [redacted]

Biamanga application.... .jpg File | Biamanga application... .jpg File | BIAMANGA WC 17-18.... .pdf File | Biamanga PL 17-18.pdf .pdf File

Hi [redacted]

This is Biamangas support for the proposed methodology for the above project at Western Harbour Tunnel and Beaches Link.

I have attached our sites officer application form as well as our current insurances.

On Wed, Sep 13, 2017 at 12:04 PM, [redacted] wrote:

[redacted]

Roads and Maritime Services proposes to build the Western Harbour Tunnel and Beaches Link projects. Roads and Maritime will be holding an Aboriginal focus group meeting to discuss the management of Aboriginal cultural heritage for the project. Further details of the projects will be provided at the Aboriginal focus group meeting to be held on:

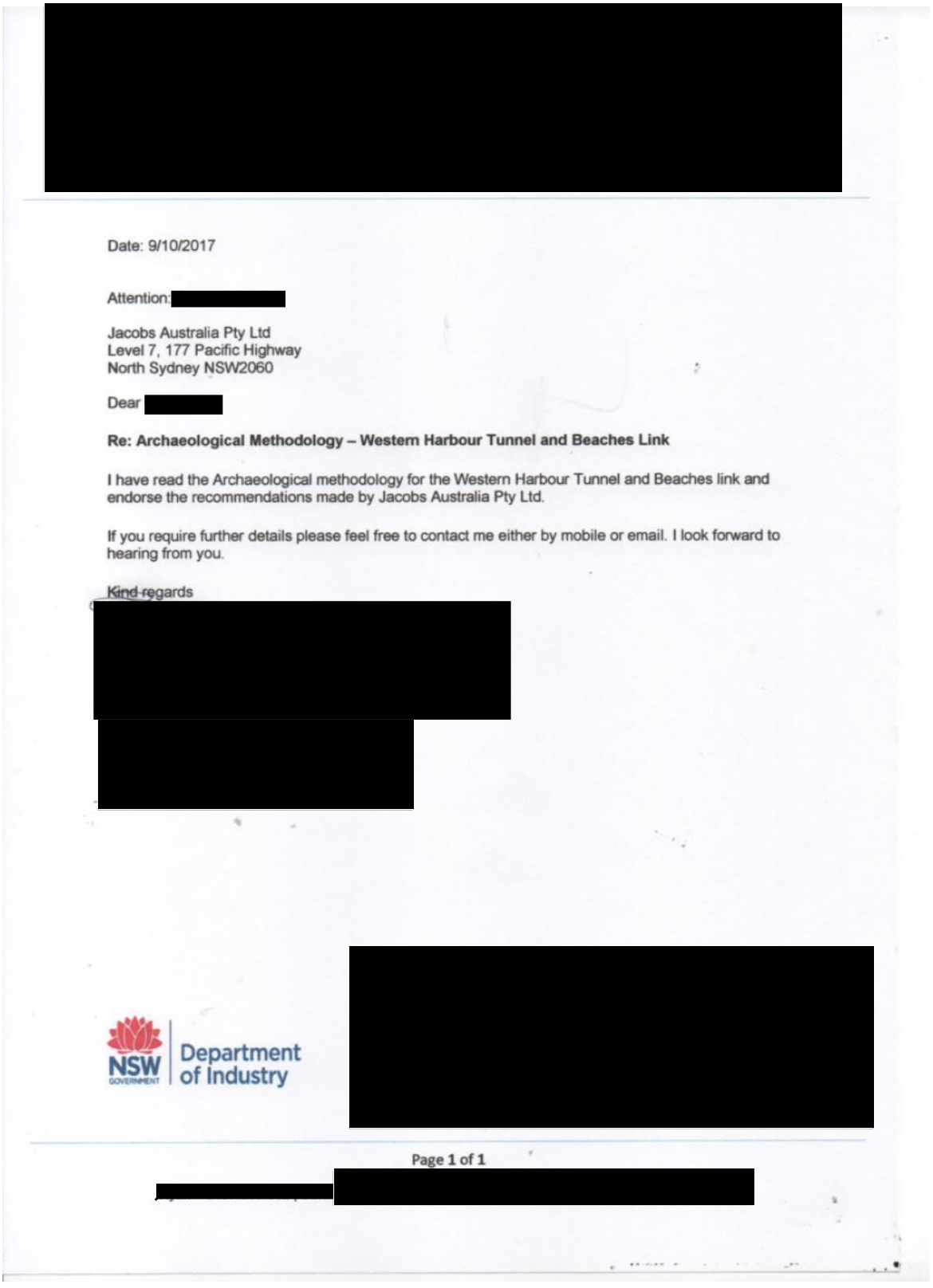
Thursday 28th September, 2017

11:00am – 3:00pm

The old Northbridge Bowling Club

Warners Park, The Outpost,

Northbridge NSW 2063



[redacted]

Date: 9/10/2017

Attention: [redacted]

Jacobs Australia Pty Ltd
Level 7, 177 Pacific Highway
North Sydney NSW2060

Dear [redacted]

Re: Archaeological Methodology – Western Harbour Tunnel and Beaches Link

I have read the Archaeological methodology for the Western Harbour Tunnel and Beaches link and endorse the recommendations made by Jacobs Australia Pty Ltd.

If you require further details please feel free to contact me either by mobile or email. I look forward to hearing from you.

Kind regards

[redacted]

NSW GOVERNMENT Department of Industry

[redacted]

Page 1 of 1

[redacted]

[redacted]

26th September 2017

[redacted]

Dear [redacted]

RE: WESTERN HARBOUR TUNNEL & BEACHES LINK PROJECT

Archaeological Methodology

[redacted] has reviewed the archaeological methodology, and supports the methodology for the proposed Western Harbour Tunnel and Beaches Link Project.

In relation to the long-term storage of recovered artefacts, if any, [redacted] strongly believes recovered artefacts should be reburied on country (the study area).

Furthermore, [redacted] would be involved in the monitoring of the topsoil removal, test excavations and all other form of works to be carried out on the site.

Yours sincerely,

[redacted]

[redacted]

Application Name:	Eora People
Application (NNTT) No:	NC98/10
Application (Fed Crt) No:	NG6099/98
State:	NSW
Region:	NSW/ACT
Date Application Made:	01/05/98
Date Registration Test	02/05/99
Decision made:	
Decision:	Not Accepted
Decision Type:	Abbreviated Decision

Information relevant to the Decision

The delegate has considered all information and documents in the working/registration test files for NC 95/9; NC96/11; NC 98/9; NC 98/10; NC 98/11 and NC98/12.

In relation to each application:

The Tribunal wrote to the applicants on 1 October 1998 regarding the requirements of the registration test and advising that the further information or amendments were required by 1 January 1999.

The applicants wrote to the Tribunal on 20 January 1999 requesting an extension for 6 weeks. The Tribunal wrote to the applicants on 25 January 1999 granting an extension to 12 March 1999.

In relation to NC 98/11 only the Tribunal also wrote to the applicants on 3 March 1999 providing a preliminary assessment of the application against the conditions of the registration test and sought further information or amendments from the applicants by 19 March 1999.

The applicants wrote to the Tribunal on 8 March 1999, seeking a further extension until 1 April 1999, which was granted.

The applicants wrote to the Tribunal on 30 March 1999 seeking a further extension until 14 April 1999, which was granted on 31 March 1999 with the condition that any further extensions would only be granted upon the Registrar or his delegate seeing proof of the applicants' ability to engage with the registration process, which could be evidenced by a draft of the proposed amended application.

The Tribunal wrote to the applicants on 20 April 1999, noting that no further information or amendments had been received, and advising that unless further information or amendments were received by 27 April 1999 the Registrar's delegate would proceed to consider the applications for registration.

The applicants wrote to the Federal Court, cc the Tribunal, on 14 April 1999 seeking a further extension until 15 June 1999. That request for an extension was not approved and the Registrar's delegate proceeded to apply the conditions of the registration test.

Reasons for Decision

1. The applications have not been amended, nor has additional information been provided, nor things done, in order that it might satisfy the provisions of the amended Native Title Act 1993 relating to registration.

2. There has been generally no attempt to satisfy the formal and procedural conditions as set out in 190C(2), 190C(4) and 190C(5).

3. In particular, the applicants have not provided affidavits (as specified in 62(1)(a)) and as required for the satisfaction of 190C(2). I do not accept that the affidavits lodged with the original applications satisfy the full substantive requirements of s62(1)(a)(i) to s62(1)(a)(v).

4. Further, the applicants have not provided evidence that the applications have been certified by each representative Aboriginal /Torres Strait Islander body that could certify the applications (as set out in 190C(4)(a)). In the alternative, the applicants have not provided evidence that the applicant(s) is a member of the native title claim group and is authorised to make the applications and to deal with matters arising in relation to them, by all the other persons in the native title claim group (that is, to satisfy the requirements as set out in 190C(4)(a) and 190C(4)(b)).

5. Finally, the applicants have not supplied a statement to the effect thatthe requirement set out in paragraph 190C(4)(b) has been met, and that sets the grounds on which the Delegate should consider that it has been met. For this reason I am not satisfied that the conditions in subsection 190C(4) is met.

6. Given the failure in respect to 190C(2) and 190C(4) I have not considered it necessary to apply the test in respect to the merits questions in 190B.

DECISION

The applications ARE NOT ACCEPTED for registration pursuant to s190A of the *Native Title Act* 1993

Written notice of the decision and the reasons for the decision, are to be provided to the applicant and to the Federal Court, in accordance with s190D of the *Native Title Act*.

National Native Title Tribunal

Extract from the National Native Title Register

Determination Information:

Determination Reference:	Federal Court Number(s): NSD6003/2000 NNTT Number: NND2001/001
Determination Name:	Metropolitan Local Aboriginal Land Council
Date(s) of Effect:	23/05/2001
Determination Outcome:	Native title does not exist

Register Extract (pursuant to s. 193 of the *Native Title Act 1993*)

Determination Date:	23/05/2001
Determining Body:	Federal Court of Australia

ADDITIONAL INFORMATION:

Not Applicable

MATTERS DETERMINED:

Native title does not exist in relation to land situated at Forestville known as [redacted] Forestville.

Note: The National Native Title Register may, in accordance with s. 195 of the Native Title Act 1993, contain confidential information that will not appear on the Extract.

National Native Title Tribunal

Extract from Schedule of Native Title Applications

Application Reference: Federal Court number: NSD6061/1998

NNTT number: NC1997/008

Application Name: Darug Tribal Aboriginal Corporation

Application Type: Claimant

Application filed with: National Native Title Tribunal

Date application filed: 12/05/1997

Current status: Discontinued - 08/03/2011

Registration information: Please refer to the Register of Native Title Claims/National Native Title Register (as appropriate) for registered details of this application.

Registration decision status: Accepted for registration

Registration history: Registered from 12/05/1997 to 29/09/1999 Registered from 13/12/2000 to 08/03/2011

Applicants: [redacted]

Address(es) for Service: [redacted]

Additional Information

Not applicable

Persons claiming to hold native title:

The native title claim group comprises all the members of the Darug Tribal Aboriginal Corporation

Discontinued

and their descendants.

Native title rights and interests claimed:

1. Subject to paragraphs 2 - 5 below the applicants claim the full and free enjoyment of the following native title rights in relation to area subject to application.

(a) a right to possess, occupy, use and enjoy the claimed area

(b) a right to make decisions about the use and enjoyment of the claimed area

(c) a right of access to the claimed area

(d) a right to control the access of others to the claimed area

(e) a right to use and enjoy the resources of the claimed area

(f) a right to control the use and enjoyment of others of resources of the claimed area

(g) a right to trade in resources of the claimed area

(h) a right to receive a portion of any resources taken by others from the claimed area

(i) a right to maintain and protect places or importance under traditional laws, customs and practices in the claimed area

(i) a right to maintain, protect and prevent the misuse of cultural knowledge of the common law holders associated with the claim area.

2. With respect to those parts of the area the subject of the application which are, or have been the subject of a previous non-exclusive possession act within the meaning of s23F of the NTA, the applicants claim the native title rights and interests set out in 1 above subject to the rights and interests created in the "non exclusive possession act" which are not inconsistent with the rights and interests claimed and, in the case of rights granted which are inconsistent with the rights and interests claimed, subject to any suspension of the native title rights and interests which those inconsistent rights and interests cause.

3. With respect to those parts of the area the subject of the application which are, or have been, the subject of

(a) a Category B intermediate period act within the meaning of s232C

(b) a Category C intermediate period act within the meaning of s232D or

(c) a Category D intermediate period act within the meaning of s232E

the applicants claim the native title rights and interests set out in 1 above subject to the rights and interests created in the "non exclusive possession act" which are not inconsistent with the rights and interests claimed and, in the case of rights granted which are inconsistent with the rights and interests claimed, subject to any suspension of the native title rights and interests which those inconsistent rights and interests cause.

4. With respect to those parts of the area the subject of the application which are, or have been the subject of

(a) a Category B past act within the meaning of s230

(b) a Category C past act within the meaning of s231 or

(c) a Category D past act within the meaning of s232

the applicants claim the native title rights and interests set out in 1 above subject to the rights and interests created in the "non exclusive possession act" which are not inconsistent with the rights and interests claimed and, in the case of the rights granted which are inconsistent with the rights and interests claimed, subject to any suspension of native title rights and interests which those inconsistent rights and interests cause.

5. The native title rights and interests identified above do not extend to ownership of any minerals, petroleum or gas which are wholly owned by the Crown.

6. The native title rights and interests identified above do not include a claim for exclusive occupation and use of off shore areas as defined by s253.

Disclaimer

Application Area:

State/Territory: New South Wales
Brief Location: Sydney
Primary RATSIB Area: New South Wales
Approximate size: 174.9010 sq km
(Note: There may be areas within the external boundary of the application that are not claimed.)
Does Area Include Sea: No

Area covered by the claim (as detailed in the application):

Information identifying the boundaries of:

a) the area covered by the application; and

b) any areas within those boundaries that are not covered by the application.

(a) 18 x AO size colour maps (1 x locality & 17 x enlargements), 1 x A3 locality map and a 21 page tenure/parcel identifier produced by the Surveyor General's Department have been filed with the National Native Title Tribunal. The 21 page tenure/parcel identifier is "Attachment C".

(b) Subject to clauses (d) and (e) the area covered by the application excludes any land or waters covered by:

(i) a schedule interest;

(ii) a freehold estate;

(iii) a commercial lease that is neither an agricultural lease nor a pastoral lease;

(iv) an exclusive agricultural lease or an exclusive pastoral lease;

(v) a residential lease;

(vi) a community purpose lease;

(vii) a lease dissected from a mining lease as referred to in s23B(2)(vii);

(viii) any lease (other than a mining lease) that confers a right of exclusive use over particular land or waters;

which was validly vested or granted on or before 23 December 1996.

(c) subject to clauses (d) and (e) the area covered by the application excludes any area covered by the valid construction or establishment of any public work, where the construction or establishment of the public work commenced on or before 23 December 1996.

(d) Where the act specified in (b) and (c) falls within the provision of

(i) s23B(9) - Exclusion of acts benefiting Aboriginal peoples or Torres Straight Islanders;

(ii) s23B(9A) - Establishment of a national or state park;

(iii) s23B99B) - Acts where legislation provides for non-extinguishment;

(iv) s23B(9C) - Exclusion of Crown to Crown grants; and

(v)s23B(10) - Exclusion by regulation,

the area covered by the act is not excluded from this application.

(e) Where an act referred to in clauses 2 and 3 covers land or waters referred to in:

s47 - Pastoral leases held by native title claimants;

s47A - Reserves etc covered by claimant applications; and

Discontinued

s47B - Vacant crown land covered by claimant applications,

the area covered by the act is not excluded from the application.

(f) Where an area is covered by a previous non-exclusive possession act (s 23F) the native title claim group does not claim the native title rights and interests set out in clause 1 of Attachment E to the exclusion of all others.

(g) The area covered by the application excludes land where native title has been extinguished at common law.

Attachments: 1. Map & Tenure/Parcel Identifier , 21 pages - A4, 24/05/2000

NNTT Contact Details

Address:
National Native Title Tribunal
Sydney Office
Level 16, Law Courts Building
Queens Square
SYDNEY NSW 2000

GPO Box 9973
SYDNEY NSW 2001

Telephone: (02) 9227 4000
Freecall: 1800 640 501
Fax: (02) 9227 4030
Web Page: www.nntt.gov.au

End of Extract

National Native Title Tribunal

Extract from Schedule of Native Title Applications

Application Reference: Federal Court number: NSD6175/1998
NNTT number: NP1998/001

Application Name: [redacted]

Application Type: Compensation

Application filed with: National Native Title Tribunal

Date application filed: 08/07/1998

Current status: Discontinued - 23/03/1999

Applicants:

Address(es) for Service: [redacted]

Additional Information

Not applicable

Persons claiming compensation:

Native title rights and interests for which compensation is claimed:

None

Details of acts claimed to have extinguished or affected native title:

None

Discontinued

Application Area:

State/Territory: New South Wales
Brief Location: Undetermined
Primary RATSIB Area: New South Wales
Approximate size: 11294.1520 sq km
(Note: There may be areas within the external boundary of the application that are not claimed.)
Does Area Include Sea: No

Area covered by the claim (as detailed in the application):

As NC98/8

Attachments:

NNTT Contact Details

Address: National Native Title Tribunal
Sydney Office
Level 16, Law Courts Building
Queens Square
SYDNEY NSW 2000

GPO Box 9973
SYDNEY NSW 2001

Telephone: (02) 9227 4000
Freecall: 1800 640 501
Fax: (02) 9227 4030
Web Page: www.nntt.gov.au

End of Extract

[redacted]		
Date	**Form of Contact**	**Summary**
24/06/2017	Email	Invitation to participate in Aboriginal consultation response. Worked on numerous projects in Western Sydney area.
27/06/2017	Email	Attachment included in response. Copy of email saved.
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Letter	Invitation to participate in Aboriginal consultation response.
09/08/2017	Email	ROI and asking for confirmation of registration of interest to participate in WTBL
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
28/09/2017	In person	Scott was called to see if he was going to attend workshop as he is down as a RAP. He explained that he had advice from his insurer that he should think twice about attending such workshops. This was because there was no remuneration for him or his staff and they would not be covered by their insurer in the event of an accident (when travelling to the meeting for example). He stated that even if they were to receive $1.00 for travel reimbursement then they would be covered but without it, it was just too risky for his business. He suggested other RAPs (especially those connected to corporations) were also becoming risk averse as well. He also pointed out that as the meeting was being held in the middle of a business day it impacted their work commitments. He will not travel to such meetings until this issue is resolved.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
21/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
28/09/2017	Email	Email stating that Callendulla supports the proposed methodology. Site officer forms and insurances attached, and email saved to project folder.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
05/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Email to inform that Walbunja will be attending AFG
6/10/2017	Email	Email requesting another copy of the sub-surface methodology to peruse
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
21/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Email confirmation attendance of AFG
28/09/2017	Email	Email stating that Murramarang supports the proposed sub-surface methodology. Site officer forms and insurances attached and saved
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
21/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Email confirmation of attendance at AFG
29/09/2017	Email	Email stating that Biamanga support the proposed methodology. Site officer forms and current insurances attached and saved
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
17/08/2017	Email	Registration of interest received. Invitation to participate in Aboriginal consultation response. Office specialises in community consultations and has members that comprise traditional owners. Do not accept or support persons not from Darug nation that comment on area. Will not volunteer. Payment for discriminated exclusion DLO specified.
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Cannot personally attend but wishes to be included. Site officer forms included in email and letter in reply to archaeological methodology attached (approval).
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
17/08/2017	Email	Registration of interest received. Senior Aboriginal person who actively participates in the protection of Aboriginal Cultural Heritage in Sydney Basin.
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
13/09/2017	Phone	Called to confirm completion of site officer form and attendance at the AFG by himself or a representative of Kamilaroi. Also enquired if trainees were able to participate in the site work and was informed that logistics of this have not yet been confirmed.
14/09/2017	Phone	Called to confer he has a conflicting family engagement so will send a representative to the AFG instead.
28/09/2017	In person	Owing to health problems Ricky is unable to participate in field work at the moment, but wants to be included in the project.
6/10/2017	Email/Phone	Forgot to send through his site officer forms to the AFG and wishes for me to email him a copy of the company's address so that he may mail them. Also commented on sub-surface methodology saying it is brilliant and very comprehensive.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology
12/10/2017	Mail	Site officer forms

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
24/08/2017	Email	Registration of interest received. Family lived in area for many years and has worked as a site officer for many companies over the years.
13/09/2017	Email	Invitation mail out

[redacted] Vickylee [redacted]		
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Confirmation of attendance at AFG
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted] J [redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
27/08/2017	Email	Registration of interest received.
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Confirmation that representative will be attending the AFG.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
21/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
26/09/2017	Email	Confirmation of attendance at AFG
28/09/2017	Email	Emailing stating that Goobah support the proposed sub-surface methodology. Site officer forms and current insurances attached.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted] Carroll and P [redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email and Letter	Invitation to participate in Aboriginal consultation
04/08/2017	Email	Registration of interest received
13/09/2017	Email and Letter	Invitation mail out
26/09/2017	Email and Letter	Agenda mail out
13/09/2017	Email	Acceptance of invitation to attend AFG.
15/09/2017	Email	Email containing completed site officer forms and asking for confirmation that we had now received these forms
28/09/2017	In person	Paul is from the south coast and is very keen to be involved in the project and has worked on many test excavation and salvage programs
5/10/2017	Email	Email approving the proposed sub-surface test methodology and all proposals

[redacted] and Pa[redacted]		
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted] David Watts		
Date	**Form of Contact**	**Summary**
03/08/2017	Email and Letter	Invitation to participate in Aboriginal consultation
04/08/2017	Email	Registration of interest received
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email and Letter	Invitation to participate in Aboriginal consultation
27/08/2017	Email	Registration of interest received. Would like to be involved. Knows of engravings on Wakehurst Parkway
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
10/10/2017	Email	Wanted to know where survey was carried out – maps are not adequate. Pleased impact will not be on Garigal National Park side of Wakehurst Parkway. Would like a chance to visit the site. Wants to be involved in survey and excavation. Knew that cymbidium orchids once grew at burned Bridge Creek near Balgowlah. Endorsed methodology.
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted] Berte Davis		
Date	**Form of Contact**	**Summary**
26/09/2017	Email	Roads and Maritime forwarded expression of interest on behalf of Joanne
26/09/2017	Email	Cannot attend AFG but wishes to be sent meeting minutes and be involved in the next stage of the consultation process
6/10/2017	Email	Requested another copy of the sub-surface methodology
11/10/2017	Email	Sent reminder to respond to sub-surface methodology
12/10/2017	Email	Wanted to ensure that the Wakehurst engravings site was included in the methodology. Emailed back to clarify the methodology is only referring to recording of new engraving sites and that Wakehurst will be avoided but has already been inspected by archaeologist alongside Metro LALC. Response and original email saved in project folder.

[redacted]		
Date	**Form of Contact**	**Summary**
01/08/2017	Email	Invitation to participate in Aboriginal consultation
26/09/2017	In person	[redacted] has lived in or near the study area all her life. She knows where further engravings are on the Wakehurst Parkway and was concerned about the project impacting them. After hearing the proposed methodology, she said she felt relief that they were being property assessed and protected and would like to be involved in the project. [redacted] is saddened by all of the development going on at Frenchs Forest and Waringah Road, especially the new hospital. It is unrecognisable from the place she grew up in. [redacted] would like tea to be available for participants at the next AFG.
28/09/2017	In person	Asked for Bilinga, Gunyuu, Munyungu, Murrumbul and Wingikara to be registered as RAP groups
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted] Johnson		
Date	**Form of Contact**	**Summary**
13/09/2017	Email	Invitation mail out
26/09/2017	Email	Agenda mail out
28/09/2017	Email	Wishes to be included as a RAP
11/10/2017	Email	Sent reminder to respond to sub-surface methodology

[redacted]		
Date	**Form of Contact**	**Summary**
21/09/2017	Email	Invitation to AFG 1
26/09/2017	Email	Reminder of upcoming AFG
05/10/2017	Email	Reminder to respond to sub-surface methodology
10/10/2017	Email	List of registered RAPS

Other Consultation			
Date	**Form of Contact**	**Contact**	**Summary**
26/08/2017	Email	[redacted]	Search conducted by [redacted] does not indicate registered Aboriginal owners pursuant to Division 3 of the *Aboriginal Land Rights Act 1983*. Suggested to contact Metro LALC.
8/08/2017	Email	[redacted]	Adjustment of size of advertisement to make invitation and plan clearer.
17/08/2017	Letter and Email	[redacted]	Department of Premier and Cabinet (Heritage) haven't received any request for stakeholders from you for that project. If you require a stakeholder list, please send the list through to the Senior Team Leader Planning, Greater Sydney Division, Regional Operations, PO Box 644, Parramatta, NSW 2124.

Other Consultation			
28/08/2017	Letter and Email	[redacted]	Asking for an appointment to discuss project. Reply stated that with regard to meeting next week about the Western Harbour Tunnel and Warringah Freeway Upgrade project, this is an state significant development. Department of Premier and Cabinet (Heritage) does not have a regulatory role in state significant development projects and their role is to provide advice to the Department of Planning and Environment. Department of Premier and Cabinet (Heritage) does not meet with proponents or their consultants in relation to these projects.
1/08/2017	Letter		Invitation to participate in Aboriginal consultation
1/08/2017	Letter		Invitation to participate in Aboriginal consultation
1/08/2017	Letter		Invitation to participate in Aboriginal consultation
1/08/2017	Letter		Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
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1/08/2017	Email	e	Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
1/08/2017	Email	e	Invitation to participate in Aboriginal consultation
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1/08/2017	Email	t	Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation

Other Consultation			
1/08/2017	Email	[redacted]	Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
1/08/2017	Email		Invitation to participate in Aboriginal consultation
09/9/2017	Email		Email explaining Manager Transport and Civil Infrastructure Assets cannot provide list of names of aboriginal people and suggestion to consult the Aboriginal Housing Office instead.
17/10/2017	Email		Query from the Aboriginal Housing Office regarding why we are proposing to excavate already very disturbed areas?
17/10/2017	Email		Response to query

Transport
Roads & Maritime
Services

Invitation to Register

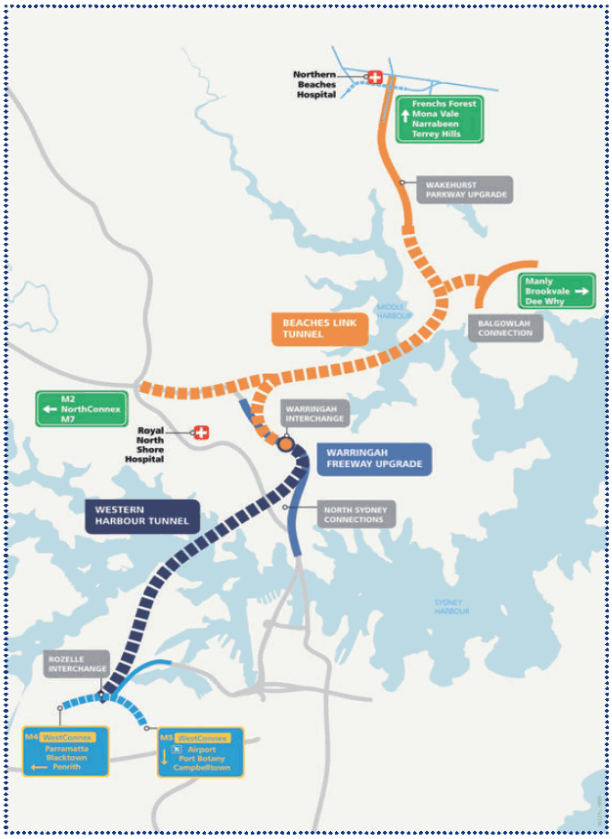
The NSW Government has announced the next stage of planning and the preferred route for the proposed Western Harbour Tunnel and Beaches Link. Western Harbour Tunnel would run from WestConnex at Rozelle Interchange, cross beneath Sydney Harbour and link with the Warringah Freeway at North Sydney. The Beaches Link would run from the Balgowlah area, cross under Middle Harbour and connect with the Warringah Freeway. Beaches Link includes east-west links to the Gore Hill Freeway, providing much need connectivity between economic zones such as Macquarie Park and the Northern Beaches.

Roads and Maritime Services invites Aboriginal people and Aboriginal groups that hold cultural knowledge relevant to determining the significance of Aboriginal objects and places for the Western Harbour Tunnel and Beaches Link Project to register to be consulted.

The proposal is likely to be subject to assessment and approval under Part 5.1 of the *Environmental Planning and Assessment Act 1979*. The purpose of this consultation is to inform the preparation of an Environmental Impact Statement for the proposal. Further information is provided on the following website **www.rms.nsw.gov.au/projects/sydney-north/western-harbour-tunnel-beaches-link/index.html.**

The proposal may result in Roads and Maritime Services:

- Applying for an Aboriginal Heritage Impact permit (AHIP) under Part 6 of the *National Parks and Wildlife Act 1974* and/or
- Undertaking investigations in accordance with the *Code of Practice for Archaeological Investigations* of Aboriginal Objects in New South Wales
- Undertaking an environmental impact assessment under the *Environmental Planning and Assessment Act 1979*.



To register your interest, please contact:
Andrew Costello
Jacobs Group Australia
Level 7, 177 Pacific Highway
NORTH SYDNEY NSW 2060
Email: andrew.costello@jacobs.com

Registrations must be received by phone or in writing by **Wednesday 28 June 2017.**

For more information please contact us on 1800 789 297, motorwaydevelopment@rms.nsw.gov.au or visit rms.nsw.gov.au.

A07322

Figure A-10-1 Newspaper advertisement

Appendix B. *Standard Management Procedure: Unexpected Heritage Items* (Roads and Maritime, 2015)

Transport Roads & Maritime Services

Unexpected Heritage Items

Heritage Procedure 02

November 2015

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Contents

Appendices

Please note

This procedure applies to all development and activities concerning roads, road infrastructure and road related assets undertaken by Roads and Maritime.

For advice on how to manage unexpected heritage items as a result of activities related to maritime infrastructure projects, please contact the Senior Environmental Specialist (Heritage).

1 Purpose

This procedure has been developed to provide a consistent method for managing unexpected heritage items (both Aboriginal and non-Aboriginal) that are discovered during Roads and Maritime activities. This procedure includes Roads and Maritime's heritage notification obligations under the *Heritage Act 1977* (NSW), *National Parks and Wildlife Act 1974* (NSW), A*boriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) and the *Coroner's Act 2009* (NSW).

This document provides relevant background information in Section 3, followed by the technical procedure in Sections 6 and 7. Associated guidance referred to in the procedure can be found in Appendices A-H.

2 Scope

This procedure assumes that an appropriate level of Aboriginal and non-Aboriginal heritage assessment has been completed before work commences on site. In some cases, such as exempt development, detailed heritage assessment may not be required.

Despite appropriate and adequate investigation, unexpected heritage items may still be discovered during maintenance and construction works. When this happens, this procedure must be followed. This procedure provides direction on when to stop work, where to seek technical advice and how to notify the regulator, if required.

This procedure applies to <u>all</u> Road and Maritime construction and maintenance activities

This procedure **applies to**:

- The discovery of any unexpected heritage item (usually during construction), where Roads and Maritime does not have approval to disturb the item or where safeguards for managing the disturbance (apart from this procedure) are not contained in the environmental impact assessment.
- All Roads and Maritime projects that are approved or determined under Part 3A (including Transitional Part 3A Projects), Part 4, Part 5 or Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), or any development that is exempt under the Act.

This procedure must be followed by Roads and Maritime staff, alliance partners (including local council staff working under Road Maintenance Council Contracts, [RMCC]), developers under works authorisation deeds or any person undertaking Part 5 assessment for Roads and Maritime.

This procedure **does not** apply to:

- The legal discovery and disturbance of heritage items as a result of investigations being undertaken in accordance with OEH's *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (2010); an Aboriginal Heritage Impact Permit (AHIP) issued under the *National Parks and Wildlife Act 1974*; or an approval issued under the *Heritage Act 1977*[1].
- The legal discovery and disturbance of heritage items as a result of investigations (or other activities) that are required to be carried out for the purpose of complying with any environmental assessment requirements under Part 3A (including Transitional Part 3A Projects) or Part 5.1 of the EP&A Act.
- The legal discovery and disturbance of heritage items as a result of construction related activities, where the disturbance is permissible in accordance with an AHIP[2]; an approval issued under the *Heritage Act 1977*; the Minister for

[1] RMS' heritage obligations are incorporated into the conditions of heritage approvals.

[2] RMS *Procedure for Aboriginal cultural heritage consultation and investigation* (2011) recommends that Part 4 and Part 5 projects that are likely to impact Aboriginal objects during construction seek a whole-of-project AHIP. This type of AHIP generally allows a project to impact known and potential Aboriginal objects within the entire project area, without the need to stop works. It should be noted that an AHIP may exclude impact to certain objects and areas, such as burials or ceremonial sites. In such cases, the project must follow this procedure.

Planning's conditions of project approval; or safeguards (apart from this procedure) that are contained in the relevant environmental impact assessment.

All construction environment management plans (CEMPs) must make reference to and/or include this procedure (often included as a heritage sub-plan). Where approved CEMPs exist they must be followed in the first instance. Where there is a difference between approved CEMPs and this procedure, the approved CEMP must be followed. Where an approved CEMP does not provide sufficient detail on particular issues, this procedure should be used as additional guidance. When in doubt always seek environment and legal advice on varying approved CEMPs.

3 Types of unexpected heritage items and their legal protection

The roles of project, field and environmental staff are critical to the early identification and protection of unexpected heritage items. **Appendix A** illustrates the wide range of heritage discoveries found on Roads and Maritime projects and provides a useful photographic guide. Subsequent confirmation of heritage discoveries must then be identified and assessed by technical specialists (usually an archaeologist).

An 'unexpected heritage item' means any unanticipated discovery of an actual or potential heritage item, for which Roads and Maritime does not have approval to disturb[3] or does not have a safeguard in place (apart from this procedure) to manage the disturbance.

These discoveries are categorised as either:

(a) Aboriginal objects

(b) Historic (non-Aboriginal) heritage items

(c) Human skeletal remains.

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

3.1 Aboriginal objects

The *National Park and Wildlife Act 1974* protects *Aboriginal objects* which are defined as:

"*any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non Aboriginal extraction, and includes Aboriginal remains*"[4].

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

IMPORTANT!

All Aboriginal objects, regardless of significance, are protected under law.

If any impact is expected to an Aboriginal object, an Aboriginal Heritage Impact Permit (AHIP) is usually required from the Office of Environment and Heritage (OEH)[5]. Also, when a person becomes aware of an Aboriginal object they must notify

[3] Disturbance is considered to be any physical interference with the item that results in it being destroyed, defaced, damaged, harmed, impacted or altered in any way (this includes archaeological investigation activities).
[4] Section 5(1) *National Park and Wildlife Act 1974*.
[5] Except when Part 3A, Division 4.1 of Part 4 or Part 5.1 of the *EP&A Act* applies.

the Director-General of OEH about its location[6]. Assistance on how to do this is provided in Section 7 (Step 5).

3.2 Historic heritage items

Historic (non-Aboriginal) heritage items may include:

- Archaeological 'relics'
- Other historic items (i.e. works, structures, buildings or movable objects).

3.2.1 Archaeological relics

The *Heritage Act 1977* protects *relics* which are defined as:

"*any deposit, artefact, object or material evidence that relates to the settlement of the area that comprises NSW, not being Aboriginal settlement; and is of State or local heritage significance*"[7].

Relics are archaeological items of local or state significance which may relate to past domestic, industrial or agricultural activities in NSW, and can include bottles, remnants of clothing, pottery, building materials and general refuse.

IMPORTANT!

All relics are subject to statutory controls and protections.

If a relic is likely to be disturbed, a heritage approval is usually required from the NSW Heritage Council[8]. Also, when a person discovers a relic they must notify the NSW Heritage Council of its location[9]. Advice on how to do this is provided in Section 7 (Step 5).

3.2.2 Other historic items

Some historic heritage items are not considered to be 'relics'; but are instead referred to as works, buildings, structures or movable objects. Examples of these items that Roads and Maritime may encounter include culverts, historic road formations, historic pavements, buried roads, retaining walls, tramlines, cisterns, fences, sheds, buildings and conduits. Although an approval under the *Heritage Act 1977* (NSW) may not be required to disturb these items, their discovery must be managed in accordance with this procedure.

As a general rule, an archaeological relic requires discovery or examination through the act of excavation. An archaeological excavation permit under Section 140 of the Heritage Act is required to do this. In contrast, 'other historic items' either exist above the ground's surface (e.g. a shed), or they are designed to operate and exist beneath the ground's surface (e.g. a culvert).

[6] This is required under s89(A) of the *National Park and Wildlife Act 1974* (NSW) and applies to **all projects** assessed under Part 3A, Part 4, Part 5 and Part 5.1 of the *EP&A Act*, including exempt development.

[7] Section 4(1) *Heritage Act 1977*.

[8] Except when Part 3A, Division 4.1 of Part 4 or Part 5.1 of the *EP&A Act* applies.

[9] This is required under s146 of the *Heritage Act 1977* and applies to **all projects** assessed under Part 3A, Part 4, Part 5 and Part 5.1 of the *EP&A Act*, including exempt development.

Despite this difference, it should be remembered that relics can often be associated with 'other heritage items', such as archaeological deposits within cisterns and underfloor deposits under buildings.

3.3 Human skeletal remains

Human skeletal remains can be classed as:

- Reportable deaths
- Aboriginal objects
- Relics

Where it is suspected that less than 100 years has elapsed since death, human skeletal remains come under the jurisdiction of the State Coroner and the *Coroners Act* 2009 (NSW). Under s 35(2) of the Act, a person must report the death to a police officer, a coroner or an assistant coroner as soon as possible. This applies to all human remains less than 100 years old[10] regardless of ancestry. Public health controls may also apply.

Where remains are suspected of being more than 100 years old, they are considered to be either Aboriginal objects or non-Aboriginal relics depending on the ancestry of the individual. Aboriginal human remains are protected under the *National Parks and Wildlife Act 1974*, while non-Aboriginal remains are protected under the *Heritage Act 1977*.

The approval and notification requirements of these Acts are described above in sections 3.1 and 3.2. Additionally, the discovery of Aboriginal human remains also triggers notification requirements to the Commonwealth Minister for the Environment under s 20(1) of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth).

IMPORTANT!

All human skeletal remains are subject to statutory controls and protections.

All bones must be treated as potential human skeletal remains and work around them must stop while they are protected and investigated urgently.

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Guidance on what to do when suspected human remains are found is in **Appendix E**.

[10] Under s 19 of the *Coroners Act 2009*, the coroner has no jurisdiction to conduct an inquest into reportable death unless it appears to the coroner that (or that there is reasonable cause to suspect that) the death or suspected death occurred within the last 100 years.

4 Responsibilities

The following roles and responsibilities are relevant to this procedure:

Role	Definition/responsibility
Aboriginal Cultural Heritage Advisor (ACHA)	Provides Aboriginal cultural heritage advice to project teams. Acts as Aboriginal community liaison for projects on cultural heritage matters. Engages and consults with the Aboriginal community as per the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*.
Aboriginal Sites Officer (ASO)	Is an appropriately trained and skilled Aboriginal person whose role is to identify and assess Aboriginal objects and cultural values. For details on engaging Aboriginal Sites Officers, refer to Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*.
Archaeologist (A)	Professional consultant, contracted on a case-by-case basis to provide heritage and archaeological advice and technical services (such as reports, heritage approval documentation etc). Major projects with complex heritage issues often have an on call Project archaeologist.
Project Manager (PM)	Ensures all aspects of this procedure are implemented. The PM can delegate specific tasks to a construction environment manager, Roads and Maritime site representatives or regional environment staff, where appropriate.
Regional Environment Staff (RES)	Provides advice on this procedure to project teams. Ensuring this procedure is implemented consistently by supporting the PM. Supporting project teams during the uncovering of unexpected finds. Reviewing archaeological management plans and liaising with heritage staff and archaeological consultants as needed.
Registered Aboriginal Parties (RAPs)	RAPs are Aboriginal people who have registered with Roads and Maritime to be consulted about a proposed Roads and Maritime project or activity in accordance with OEH's Aboriginal cultural heritage consultation requirements for proponents (2010).
Senior Environmental Specialist (Heritage) (SES(H))	Provides technical assistance on this procedure and archaeological technical matters, as required. Reviewing the archaeological management plans and facilitating heritage approval applications, where required. Assists with regulator engagement, where required.
Team Leader - Regional Maintenance Delivery (TL-RMD)	Ensures Regional Maintenance Delivery staff stop work in the vicinity of an unexpected heritage item. Completes Unexpected Heritage Item Recording Form 418 and notifies WS-RMD.
Technical Specialist	Professional consultant contracted to provide specific technical advice that relates to the specific type of unexpected heritage find (eg a forensic or physical anthropologist who can identify and analyse human skeletal

	remains).
Works Supervisor - Regional Maintenance Delivery (WS-RMD)	Ensures Regional Maintenance Delivery staff are aware of this procedure. Supports the Team Leader - Regional Maintenance Delivery during the implementation of this procedure and ensures reporting of unexpected heritage items through environment management systems.

5 Acronyms

The following acronyms are relevant to this procedure:

Acronym	Meaning
A	Archaeologist
ACHA	Aboriginal Cultural Heritage Advisor
AHIP	Aboriginal Heritage Impact Permit
ASO	Aboriginal Site Officer
CEMP	Construction Environment Management Plan
OEH	Office of Environment and Heritage.
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PM	Project Manager
RAP	Registered Aboriginal Parties
RES	Regional Environmental Staff
SES(H)	Senior Environmental Specialist (Heritage)
TL-RMD	Team Leader – Regional Maintenance Division
RMD	Regional Maintenance Delivery
RMS	Roads and Maritime
WS-RMD	Works Supervisor - Regional Maintenance Division

6 Overview of the Procedure

On discovering something that could be an unexpected heritage item ('the item'), the following procedure must be followed. There are eight steps in the procedure. These steps are summarised in **Figure 1** below and explained in detail in Section 7.

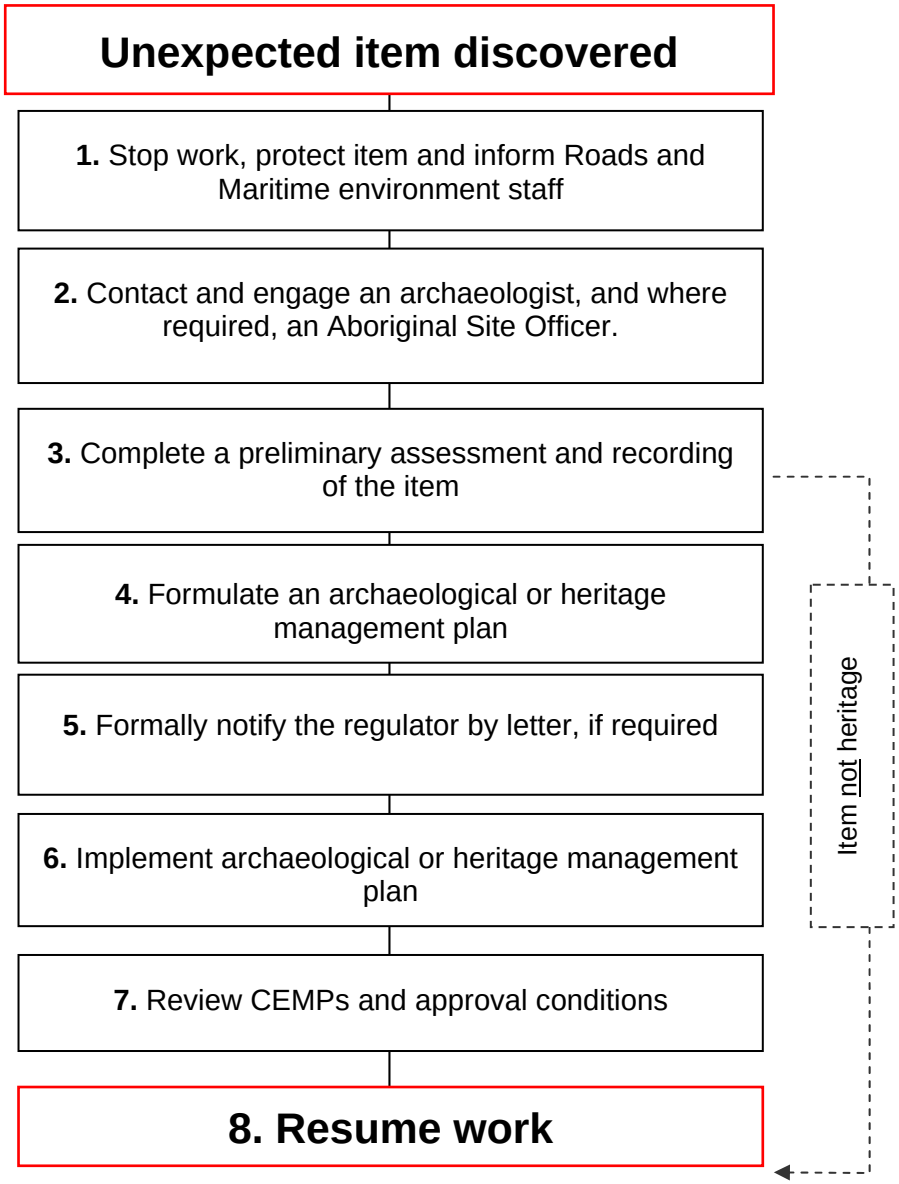


Figure 1: Overview of steps to be undertaken on the discovery of an unexpected heritage item.

IMPORTANT!

RMS may have approval or specific safeguards in place (apart from this procedure) to impact on certain heritage items during construction. If you discover a heritage item and you are unsure whether an approval or safeguard is in place, STOP works and follow this procedure.

7 Unexpected heritage items procedure

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

Aboriginal Cultural Heritage Advisor (ACHA); Aboriginal Sites Officer (ASO); Archaeologist (A); Project Manager (PM); Regional Environment Staff (RES); Registered Aboriginal Parties (RAPs); Senior Environmental Specialist (Heritage) (SES(H)); Team leader – Roads and Maintenance Division (TL - RMD); Works supervisor – Roads and Maintenance Division (WS - RMD).

Step	Task	Responsibility	Guidance & Tools
1	**Stop work, protect item and inform Roads and Maritime environment staff**		
1.1	Stop all work in the immediate area of the item and notify the Project Manager or Team Leader-RMD. (For maintenance activities, the Team Leader is to also notify the Works Supervisor-RMD)	All	**Appendix A** (Identifying Unexpected Heritage items)
1.2	Establish a 'no-go zone' around the item. Use high visibility fencing, where practical.	PM or TL-RMD	
1.3	Inform all site personnel about the no-go zone. No further interference, including works, ground disturbance, touching or moving the item must occur within the no-go zone.	PM or TL-RMD	
1.4	Inspect, document and photograph the item using 'Unexpected Heritage Item Recording Form 418'.	PM or TL-RMD	**Appendix B** (Unexpected Heritage Item Recording Form 418) **Appendix C** (Photographing Unexpected Heritage items)

Step	Task	Responsibility	Guidance & Tools
1.5	Is the item likely to be bone? If **yes**, follow the steps in Appendix E – 'Uncovering bones'. Where it is obvious that the bones are human remains, you must notify the local police by telephone immediately. They may take command of all or part of the site. If **no**, proceed to next step.	PM or WS-RMD	**Appendix E** (Uncovering Bones)
1.6	Is the item likely to be: a) A relic? (A relic is evidence of past human activity which has local or state heritage significance. It may include items such as bottles, utensils, remnants of clothing, crockery, personal effects, tools, machinery and domestic or industrial refuse) and/or b) An Aboriginal object? (An Aboriginal object may include a shell midden, stone tools, bones, rock art or a scarred tree). If **yes**, proceed directly to Step 1.8 If **no**, proceed to next step.	PM or WS-RMD	**Appendix A** (Identifying heritage items)
1.7	Is the item likely to be a "work", building or standing structure? (This may include tram tracks, kerbing, historic road pavement, fences, sheds or building foundations). If **yes**, can works avoid further disturbance to the item? (E.g. if historic road base/tram tracks have been exposed, can they be left in place?) If **yes**, works may proceed without further disturbance to the item. Complete Step 1.8 within 24 hours. If works cannot avoid further disturbance to the item, works must not recommence at this time. Complete the remaining steps in this procedure.	PM or WS-RMD	**Appendix A** (Identifying heritage items)

Step	Task	Responsibility	Guidance & Tools
1.8	Inform relevant Roads and Maritime Regional Environmental Staff of item by providing them with the completed 'Form 418'.	PM or WS-RMD (RES)	**Appendix D** (Key Environmental Contacts)
1.9	Regional Environmental Staff to advise Project Manager or Works Supervisor whether RMS has an approval or safeguard in place (apart from this procedure) to impact on the 'item'. (An approval may include an approval under the *Heritage Act*, the *National Parks and Wildlife Act* or the *Planning and Assessment Act*). Does RMS have an approval, permit or appropriate safeguard in place to impact on the item? If **yes**, work may recommence in accordance with the approval, permit or safeguard. There is no further requirement to follow this procedure. If **no**, continue to next step.		
1.10	Liaise with Traffic Management Centre where the delay is likely to affect traffic flow.	PM or WS-RMD	
1.11	Report the item as a 'Reportable Event' in accordance with the Roads and Maritime *Environmental Incident Classification and Reporting Procedure*. Implement any additional reporting requirements related to the project's approval and CEMP, where relevant.	PM or WS-RMD	RMS Environmental Incident Classification and Reporting Procedure
2	**Contact and engage an archaeologist and, where required, an Aboriginal site officer**		
2.1	Contact the Project (on-call) Archaeologist to discuss the location and extent of the item and to arrange a site inspection, if required. The project CEMP may contain contact details of the Project Archaeologist. OR	PM or WS-RMD (A; RES; SES(H))	Also see **Appendix D** (Key Environmental Contacts)

Step	Task	Responsibility	Guidance & Tools
	Where there is no project archaeologist engaged for the works, engage a suitably qualified and experienced archaeological consultant to assess the find. A list of heritage consultants is available on the RMS contractor panels on the Buyways homepage. Regional environment staff and Roads and Maritime heritage staff can also advise on appropriate consultants.		Buyways
2.2	Where the item is likely to be an Aboriginal object, speak with your Aboriginal Cultural Heritage Advisor to arrange for an Aboriginal Sites Officer to assess the find. Generally, an Aboriginal Sites Officer would be from the relevant local Aboriginal land council. If an alternative contact person (ie a RAP) has been nominated as a result of previous consultation, then that person is to be contacted.	PM or WS-RMD (ACHA; ASO)	
2.3	If requested, provide photographs of the item taken at Step 1.4 to the archaeologist, and Aboriginal Sites Officer if relevant.	PM or WS-RMD (RES)	**Appendix C** (Photographing Unexpected Heritage items)
3	**Preliminary assessment and recording of the find**		
3.1	In a minority of cases, the archaeologist (and Aboriginal Sites Officer, if relevant) may determine from the photographs that no site inspection is required because no archaeological constraint exists for the project (*eg the item is not a 'relic', a 'heritage item' or an 'Aboriginal object*'). Any such advice should be provided in writing (eg via email) and confirmed by the Project Manager or Works Supervisor - RMD.	A/PM/ASO/ WS-RMD	Proceed to Step 8
3.2	Arrange site access for the archaeologist (and Aboriginal Sites Officer, if relevant) to inspect the item as soon as practicable. In the majority of cases a site inspection is required to conduct a preliminary assessment.	PM or WS-RMD	
3.3	Subject to the archaeologist's assessment (and the Aboriginal Sites Officer's assessment, if relevant), work may recommence at a set distance from the item. This is to protect any other archaeological material that may exist in the vicinity, which has not yet been uncovered. Existing protective fencing established in Step 1.2 may need to be adjusted to	A/PM/ASO/ WS-RMD	

Step	Task	Responsibility	Guidance & Tools
	reflect the extent of the newly assessed protective area. No works are to take place within this area once established.		
3.4	The archaeologist (and Aboriginal Sites Officer, if relevant) may provide advice after the site inspection and preliminary assessment that no archaeological constraint exists for the project (*eg the item is not a 'relic', a 'heritage item' or an 'Aboriginal object'*). Any such advice should be provided in writing (eg via email) and confirmed by the Project Manager or Works Supervisor - RMD.	A/PM/ASO/ WS-RMD	Proceed to Step 8
3.5	Where required, seek additional specialist technical advice (such as a forensic or physical anthropologist to identify skeletal remains). Regional environment staff and/or Roads and Maritime heritage staff can provide contacts for such specialist consultants.	RES/SES(H)	**Appendix D** (Key Environmental Contacts)
3.6	Where the item has been identified as a 'relic', 'heritage item' or an 'Aboriginal object' the archaeologist should formally record the item.	A	
3.7	The regulator can be notified informally by telephone at this stage by the archaeologist, Project Manager (or delegate) or Works Supervisor - RMD. Any verbal conversations with regulators must be noted on the project file for future reference.	PM/A/WS-RMD	
4	**Prepare an archaeological or heritage management plan**		
4.1	The archaeologist must prepare an archaeological or heritage management plan (with input from the Aboriginal Sites Officer, where relevant) shortly after the site inspection. This plan is a brief overview of the following: (a) description of the feature, (b) historic context, if data is easily accessible, (c) likely significance, (d) heritage approval and regulatory notification requirements, (e) heritage reporting requirements, (f) stakeholder consultation requirements, (g) relevance to other project approvals and management plans etc.	A/ASO	**Appendix F** (Archaeological/ Heritage Advice Checklist)
4.2	In preparing the plan, the archaeologist with the assistance of regional environment staff must review the CEMP, any heritage sub-plans, any conditions of heritage approvals, conditions of project approval (and or Minister's Conditions of Approval) and heritage assessment documentation (eg Aboriginal Cultural Heritage Assessment Report). This will outline if the unexpected item is consistent with previous heritage/project approval(s)	A/RES/PM	**Appendix F** (Archaeological/ Heritage Advice Checklist)

Step	Task	Responsibility	Guidance & Tools
	and/or previously agreed management strategies. The Project Manager and regional environment staff must provide all relevant documents to the archaeologist to assist with this. Discussions should occur with design engineers to consider if re-design options exist and are appropriate.		
4.3	The archaeologist must submit this plan as a letter, brief report or email to the Project Manager outlining all relevant archaeological or heritage issues. This plan should be submitted to the Project Manager as soon as practicable. Given that the archaeological management plan is an overview of all the necessary requirements (and the urgency of the situation), it should take no longer than two working days to submit to the Project Manager.	A	
4.4	The Project Manager or Works Supervisor must review the archaeological or heritage management plan to ensure all requirements can reasonably be implemented. Seek additional advice from regional environment staff and Roads and Maritime heritage staff, if required.	PM/RES/SES(H)/ WS-RMD	
5	**Notify the regulator, if required.**		
5.1	Review the archaeological or heritage management plan to confirm if regulator notification is required. Is notification required? If **no**, proceed directly to Step 6 If **yes**, proceed to next step.	PM/RES/SES(H)/ WS-RMD	
5.2	If notification is required, complete the template notification letter.	PM or WS-RMD	**Appendix G** (Template Notification Letter)
5.3	Forward the draft notification letter, archaeological or heritage management plan and the site recording form to regional environment staff and Senior Environmental Specialist (Heritage) for review, and consider any suggested amendments.	PM/RES/SES(H)/ WS-RMD	

Step	Task	Responsibility	Guidance & Tools
5.4	Forward the signed notification letter to the relevant regulator (ie notification of relics must be given to the Heritage Division, Office of Environment and Heritage (OEH), while notification for Aboriginal objects must be given to the relevant Aboriginal section of OEH). Informal notification (via a phone call or email) to the regulator prior to sending the letter is appropriate. The archaeological management plan and the completed site recording form must be submitted with the notification letter. For Part 3A and Part 5.1 projects, the Department of Planning and Environment must also be notified.	PM or WS-RMD	**Appendix D** (Key Environmental Contacts)
5.5	A copy of the final signed notification letter, archaeological or heritage management plan and the site recording form should be kept on file by the Project Manager or Works Supervisor- RMD and a copy sent to the Senior Environmental Specialist (Heritage).	PM or WS-RMD	
6	**Implement archaeological or heritage management plan**		
6.1	Modify the archaeological or heritage management plan to take into account any additional advice resulting from notification and discussions with the regulator.	A/PM or WS-RMD (RES)	
6.2	Implement the archaeological or heritage management plan. Where impact is expected, this would include such things as a formal assessment of significance and heritage impact assessment, preparation of excavation or recording methodologies, consultation with registered Aboriginal parties, obtaining heritage approvals etc, if required.	PM or WS-RMD (RAPs and RES)	PACHCI Stage 3
6.3	Where heritage approval is required contact regional environment staff for further advice and support material. Please note time constraints associated with heritage approval preparation and processing. Project scheduling may need to be revised where extensive delays are expected.	PM/RES/WS-RMD	
6.4	For Part 3A/Part 5.1 projects, assess whether heritage impact is consistent with the project approval or if project approval modification is required from the Department of Planning and Environment. Seek advice from regional environment staff and Environment Branch specialist staff if unsure.	PM/RES	

Step	Task	Responsibility	Guidance & Tools
6.5	Where statutory approvals (or project approval modification) are required, impact upon relics and/or Aboriginal objects must not occur until heritage approvals are issued by the appropriate regulator.	PM or WS-RMD	
6.6	Where statutory approval (or Part 3A/Part 5.1 project modification) is not required and where recording is recommended by the archaeologist, sufficient time must be allowed for this to occur.	PM or WS-RMD	
6.7	Ensure short term and permanent storage locations are identified for archaeological material or other heritage material is removed from site, where required. Interested third parties (eg museums or local councils) should be consulted on this issue. Contact regional environment staff and Senior Environmental Specialist (Heritage) for advice on this matter, if required.	PM or WS-RMD	
7	**Review CEMPs and approval conditions**		
7.1	Check whether written notification is required to be sent to the regulator before re-commencing work. Where this is not explicit in heritage approval conditions, expectations should be clarified directly with the regulator.	PM	
7.2	Update the CEMP, site mapping and project delivery program as appropriate with any project changes resulting from final heritage management (eg retention of heritage item, salvage of item). Updated CEMPs must incorporate additional conditions arising from any heritage approvals, and Aboriginal community consultation if relevant. Include any changes to CEMP in site induction material and update site workers during toolbox talks.	PM	
8	**Resume work**		
8.1	Seek written clearance to resume project work from regional environment staff and the archaeologist (and regulator, if required). Clearance would only be given once all archaeological excavation and/or heritage recommendations (where required) are complete. Resumption of project work must be in accordance with the all relevant project/heritage approvals/determinations.	RES/A/PM/WS-RMD	
8.2	If required, ensure archaeological excavation/heritage reporting and other heritage	PM/A/WS-RMD	

Step	Task	Responsibility	Guidance & Tools
	approval conditions are completed in the required timeframes. This includes artefact retention repositories, conservation and/or disposal strategies.		
8.3	Forward all heritage/archaeological assessments, heritage location data and its ownership status to the Senior Environmental Specialist (Heritage). They will ensure all heritage items in Roads and Maritime ownership and/or control are considered for the Roads and Maritime S170 Heritage and Conservation Register.	PM/SES(H)/ WS-RMD	
8.4	If additional unexpected items are discovered this procedure must begin again from Step 1.	PM/TL-RMD	

Step	Task	Responsibility	Guidance & Tools
	approval conditions are completed in the required timeframes. This includes artefact retention repositories, conservation and/or disposal strategies.		
8.3	Forward all heritage/archaeological assessments, heritage location data and its ownership status to the Senior Environmental Specialist (Heritage). They will ensure all heritage items in Roads and Maritime ownership and/or control are considered for the Roads and Maritime S170 Heritage and Conservation Register.	PM/SES(H)/ WS-RMD	
8.4	If additional unexpected items are discovered this procedure must begin again from Step 1.	PM/TL-RMD	

8 Seeking advice

Advice on this procedure should be sought from Roads and Maritime regional environment staff in the first instance. Contractors and alliance partners should ensure their own project environment managers are aware of and understand this procedure. Regional environment staff can assist non-Roads and Maritime project environment managers with enquires concerning this procedure.

IMPORTANT!

Roads and Maritime Services staff and contractors are not to seek advice on this procedure directly from the Office of Environment and Heritage without first seeking advice from regional environment staff and heritage policy staff.

Technical archaeological or heritage advice regarding an unexpected heritage item should be sought from the contracted archaeologist. Technical specialist advice can also be sought from heritage policy staff within Environment Branch to assist with the preliminary archaeological identification and technical reviews of heritage/archaeological reports.

9 Related information

Contact details: Senior Environmental Specialist (Heritage), Environment Branch, 02 8588 5754

Effective date: 01 February 2015

Review date: 01 February 2016

This procedure should be read in conjunction with:

- Roads and Maritimes' *Heritage Guidelines 2015.*
- Roads and Maritime Services *Environmental Incident Classification and Reporting Procedure*
- Roads and Maritime's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*
- RTA *Environmental Impact Assessment Guidelines.*

This procedure replaces:

- Procedure 5.5 ("*unexpected discovery of an archaeological relic or Aboriginal object*") outlined in the RTA's *Heritage Guidelines* 2004.

Other relevant reading material:

- NSW Heritage Office (1998), *Skeletal remains: guidelines for the management of human skeletal remains*.
- Department of Environment and Conservation NSW (2006), *Manual for the identification of Aboriginal remains.*
- Department of Health (April 2008), *Policy Directive: Burials - exhumation of human remains*[11].

[11] http://www.health.nsw.gov.au/policies/pd/2008/pdf/PD2008_022.pdf

Appendix A

Identifying Unexpected Heritage Items

The following images can be used to assist in the preliminary identification of potential unexpected items (both Aboriginal and non-Aboriginal) during construction and maintenance works. Please note this is not a comprehensive typology.

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

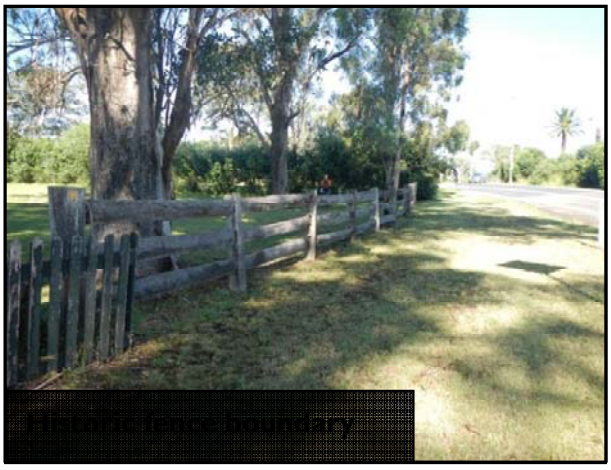
Top left hand picture continuing clockwise: Woodstave water pipe with tar and wire sealing (Horsley Drive); Tram tracks (Sydney); Brick lined cistern (Clyde); Retaining wall (Great Western Highway, Leura).

Top left hand picture continuing clockwise: Road pavement (Great Western Highway, Lawson); Sandstone kerbing and guttering (Parramatta Road, Mays Hill); Telford road (sandstone road base, Great Western Highway, Leura); Ceramic conduit and sandstone culvert headwall (Blue Mountains, NSW); Corduroy road (timber road base, Entrance Road, Wamberai).

Top left hand corner continuing clockwise: Alignment Pin (Great Western Highway, Wentworth Falls); Survey tree (MR7, Albury); Survey tree (Kidman Way, Darlington Point, Murrumbidgee); Survey tree (Cobb Highway, Deniliquin); Milestone (Great Western Highway, Kingswood, Penrith); Alignment Stone (near Guntawong Road, Riverstone). Please note survey marks may have additional statutory protection under the *Surveying and Spatial Information Act 2002*.

Remnant Bridge Piers

Mine Shaft



Timber fence boundary

Dairy shed

Top left hand corner continuing clockwise: Remnant bridge piers (Putty Road, Bulga); Wooden boundary fence (Campbelltown Road, Denham Court); Dairy shed (Ballina); Golden Arrow Mine Shaft.

Top left hand corner: Culturally modified stone discovered on Main Road 92, about two kilometres west of Sassafras. The remaining images show a selection of stone

artefacts retrieved from test and salvage archaeological excavations during the Hume Highway Duplication and Bypass projects from 2006-2010.

Appendix B

Unexpected Heritage Item Recording Form 418

Unexpected heritage item recording form

Date:		**Recorded by:** (Include name and position)	
Project name:			
Description of works being undertaken (eg Removal of failed pavement by excavation and pouring concrete slabs in 1m x 1m replacement sections).			
Description of exact location of item (eg Within the road formation on Parramatta Road, east bound lane, at the corner of Johnston Street, Annandale, Sydney).			

Description of item found (What type of item is it likely to be? Tick the relevant boxes).

A. A relic	☐	A 'relic' is evidence of a past human activity relating to the settlement of NSW with local or state heritage significance. A relic might include bottles, utensils, plates, cups, household items, tools, implements, and similar items.
B. A 'work, building or structure'	☐	A 'work' can generally be defined as a form infrastructure such as tram tracks, a culvert, road base, a bridge pier, kerbing, and similar items.
C. An Aboriginal object	☐	An 'Aboriginal object' may include stone tools, stone flakes, shell middens, rock art, scarred trees and human bones.
D. Bone	☐	Bones can either be human or animal remains. **Remember that you must contact the local police immediately by telephone if you are certain that the bone(s) are human remains.**
E. Other	☐	

Provide short description of item (eg Metal tram tracks running parallel to road alignment. Good condition. Tracks set in concrete, approximately 10cms (100 mm) below the current ground surface).	

Sketch
(Provide a sketch of the item's general location in relation to other road features so its approximate location can be mapped without having to re-excavate it. In addition, please include details of the location and direction of any photographs of the item taken).

Action taken (Tick either A *or* B)

A. Unexpected item **would not** be further impacted on by works ☐

Describe how works would avoid impact on the item. (eg The tram tracks will be left *in situ*, and recovered with road paving).

B. Unexpected item **would be** further impacted on by works ☐

Describe how works would impact on the item. (eg Milling is required to be continued to 200 mm depth to ensure road pavement requirements are met. Tram tracks will need to be removed).

Project manager / works supervisor signature	

Appendix C

Photographing Unexpected Heritage Items

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

Context and detailed photographs

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

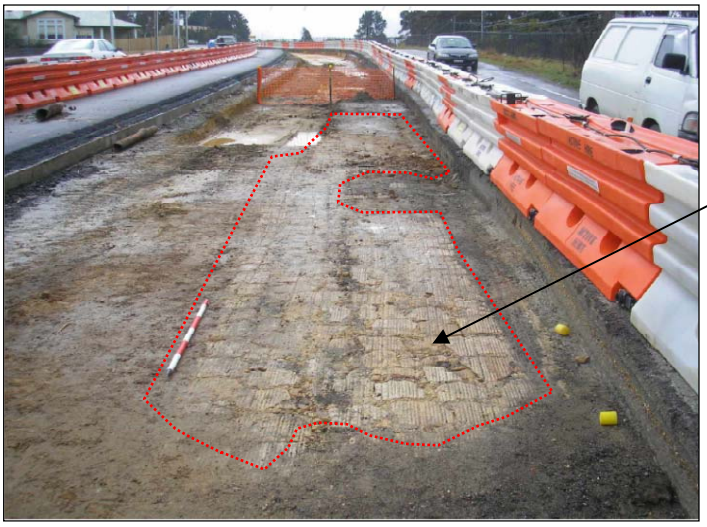


Figure 2: Close up detail of the sandstone surface showing material type, formation and construction detail. This is essential for establishing date of the feature.

Figure 1: Telford road uncovered on the Great Western Highway (Leura) in 2008.

Photographing distinguishing features

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

Figure 3: Ceramic bottle artefact with stamp.

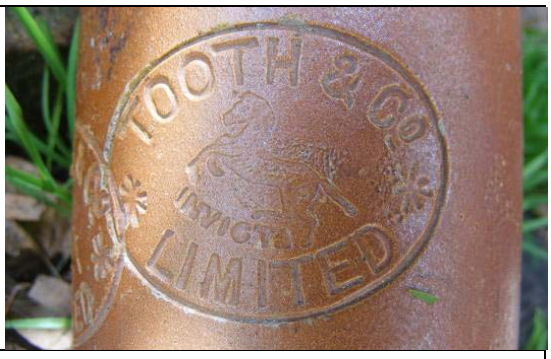


Figure 4: Detail of the stamp allows '*Tooth & Co Limited*' to be made out. This is helpful to a specialist in gauging the artefact's origin, manufacturing date and likely significance.

Photographing bones

The majority of bones found on site will those of be recently deceased animal bones often requiring no further assessment (unless they are in archaeological context). However, if bones are human, Roads and Maritime must contact the police immediately (see Appendix F for detailed guidance). Taking quality photographs of the bones can often resolve this issue quickly. Heritage staff in Environment Branch can

confirm if bones are human or non-human if provided with appropriate photographs. Ensure that photographs of bones are not concealed by foliage (Figure 5) as this makes it difficult to identify. Minor hand removal of foliage can be undertaken as long as disturbance of the bone does not occur. Excavation of the ground to remove bone(s) should not occur, nor should they be pulled out of the ground if partially exposed. Where sediment (adhering to a bone found on the ground surface) conceals portions of a bone (Figure 6) ensure the photograph is taken of the bone (if any) that is not concealed by sediment.

Figure 5: Bone concealed by foliage.

Figure 6: Bone covered in sediment

Ensure that all close up photographs include the whole bone and then specific details of the bone (especially the ends of long bones, the *epiphysis*, which is critical for species identification). Figures 7 and 8 are examples of good photographs of bones that can easily be identified from the photograph alone. They show sufficient detail of the complete bone and the epiphysis.

Figure 7: Photograph showing complete bone.

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

Appendix C

Key Environmental Contacts

Key environmental contacts

Hunter region	Environmental Manager (Hunter)	4924 0440
	Aboriginal Cultural Heritage Advisor	4924 0383
Northern region	Environment Manager (North)	6640 1072
	Aboriginal Cultural Heritage Advisor	6604 9305
Southern region	Environmental Manager (South)	6492 9515
	Aboriginal Cultural Heritage Advisor	4221 2767
South West region	Environment Manager (South West)	6937 1634
	Aboriginal Cultural Heritage Advisor	6937 1647
Sydney region	Environment Manager (Sydney)	8849 2516
	Aboriginal Cultural Heritage Advisor	8849 2583
Western region	Environment Manager (West)	6861 1628
	Aboriginal Cultural Heritage Advisor	6861 1658
Pacific Highway Office	Environment Manager	6640 1375
Regional Maintenance Delivery	Environment Manager	9598 7721
Environment Branch	Senior Environmental Specialist (Heritage)	8588 5754

Heritage Regulators

Heritage Division Office of Environment and Heritage Locked Bag 5020 Parramatta NSW 2124 Phone: (02) 9873 8500	Department of the Environment (Clth) GPO Box 787 Canberra ACT 2601 Phone: (02) 6274 1111
Office of Environment and Heritage (Sydney Metropolitan) Planning and Aboriginal Heritage Section PO Box 668 Parramatta NSW 2124 Phone: (02) 9995 5000	Office of Environment and Heritage (North Eastern NSW) Planning and Aboriginal Heritage Section Locked Bag 914 Coffs Harbour NSW 2450 Phone: (02) 6651 5946
Office of Environment and Heritage (North Western NSW) Environment and Conservation Programs PO Box 2111 Dubbo NSW 2830 Phone: (02) 6883 5330	Office of Environment and Heritage (Southern NSW) Landscape and Aboriginal Heritage Protection Section PO Box 733 Queanbeyan NSW 2620 Phone: (02) 6229 7188

Project-Specific Contacts

Position	Name	Phone Number
Project Manager		
Site/Alliance Environment Manager		
Regional Environmental Officer		
Aboriginal Cultural Heritage Advisor		
Consultant Archaeologist		
Local Police Station		
OEH: Environment Line		131 555

Appendix E

Uncovering Bones

This appendix provides Project Managers with (1) advice on what to do when bones are discovered; (2) guidance on the notification pathways; and (3) additional considerations and requirements when managing the discovery of human remains.

1. First uncovering bones

Stop all work in the vicinity of the find. All bones uncovered during project works should be **treated with care and urgency** as they have the potential to be human remains. Therefore they must be identified as either human or non-human as soon as possible by a qualified forensic or physical anthropologist. These specialist consultants can be sought by contacting regional environment staff and/or heritage staff at Environment Branch.

On the very rare occasion where it is *instantly obvious* from the remains that they are human, the Project Manager (or a delegate) should **inform the police by telephone** prior to seeking specialist advice. It will be obvious that it is human skeletal remains where there is no doubt, as demonstrated by the example in Figure 1. Often skeletal elements in isolation (such as a skull) can also clearly be identified as human. Note it may also be obvious that human remains have been uncovered when soft tissue and clothing are present.

Figure 1: Schematic of a complete skeleton that is 'obviously' human[12].

Figure 2: Disarticulated bones that require assessment to determine species.

This preliminary phone call is to let the police know that Roads and Maritime is undertaking a specialist skeletal assessment to determine the approximate date of death which will inform legal jurisdiction. The police may wish to take control of the site at this stage. If not, a forensic or physical anthropologist must be requested to make an on-site assessment of the skeletal remains.

[12] After Department of Environment and Conservation NSW (2006), *Manual for the identification of Aboriginal Remains*: 17.

Where it is not 'obvious' that the bones are human (in the majority of cases, illustrated by Figure 2), specialist assessment is required to establish the species of the bones. Photographs of the bones can assist this assessment if they are clear and taken in accordance with guidance provided in Appendix C. Good photographs often result in the bones being identified by a specialist without requiring a site visit; noting they are nearly always non-human. In these cases, non-human skeletal remains must be treated like any other unexpected archaeological find.

If the bones are identified as human (either by photographs or an on-site inspection) a technical specialist must determine the likely ancestry (Aboriginal or non-Aboriginal) and burial context (archaeological or forensic). This assessment is required to identify the legal regulator of the human remains so **urgent notification** (as below) can occur. Preliminary telephone or verbal notification by the Project Manager or regional environment staff is considered appropriate. This must be followed up later by Roads and Maritime's formal letter notification as per Appendix G when a management plan has been developed and agreed to by the relevant parties.

2. Range of human skeletal notification pathways

The following is a summary of the different notification pathways required for human skeletal remains depending on the preliminary skeletal assessment of ancestry and burial context.

A. Human bones are from a recently deceased person (*less than* 100 years old).

> **☑ Action**
> A police officer must be notified immediately as per the obligations to report a death or suspected death under s35 of the *Coroners Act 2009* (NSW). It should be assumed the police will then take command of the site until otherwise directed.

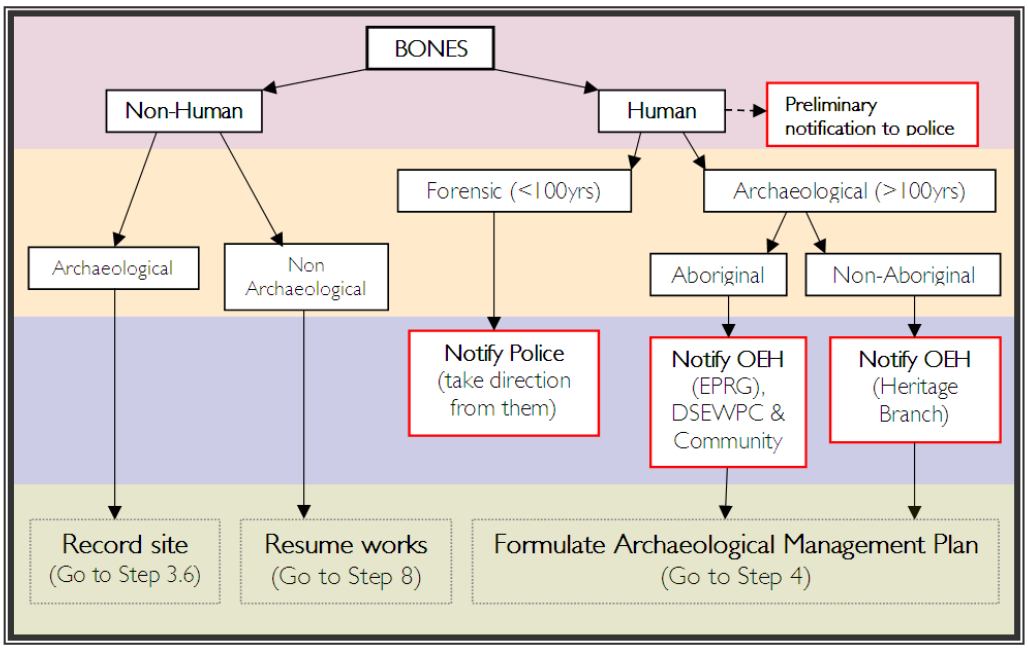
B. Human bones are archaeological in nature (*more than* 100 years old) and are likely to be *Aboriginal* remains.

> **☑ Action**
> The OEH and the RMS Aboriginal Cultural Heritage Advisor (ACHA) must be notified immediately. The ACHA must contact and inform the relevant Aboriginal community stakeholders who may request to be present on site. Relevant stakeholders are determined by the RTA's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*.

C. Human bones are archaeological in nature (*more than* 100 years old) and likely to be *non-Aboriginal* remains.

> **☑ Action**
> The OEH (Heritage Branch, Conservation Team) must be notified immediately.

The simple diagram below summarises the notification pathways on finding bones.



After the appropriate verbal notifications (as described in B and C), the Project Manager must proceed through the *Unexpected Heritage Items Procedure* to formulate an archaeological management plan (Step 4). Note no archaeological management plan is required for forensic cases (A), as all future management is a police matter. Non-human skeletal remains must be treated like any other unexpected archaeological find and so must proceed to recording the find as per Step 3.6.

3. Additional considerations and requirements

Uncovering archaeological human remains must be managed intensively and needs to consider a number of additional specific issues. These issues might include facilitating culturally appropriate processes when dealing with Aboriginal remains (such as repatriation and cultural ceremonies). Roads and Maritime's ACHA can provide advice on this and how to engage with the relevant Aboriginal community. Project Managers, more generally, may also need to consider overnight site security of any exposed remains and may need to manage the onsite attendance of a number of different external stakeholders during assessment and/or investigation of remains. Project Managers may also be advised to liaise with local church/religious groups and the media to manage community issues arising from the find. Additional investigations may be required to identify living descendants, particularly if the remains are to be removed and relocated.

If exhumation of the remains (from a formal burial or a vault) is required, Project Managers should also be aware of additional approval requirements under the *Public Health Act 1991* (NSW). Specifically, Roads and Maritime is required to apply to the Director General of NSW Department of Health for approval to exhume human remains as per Clause 26 of the *Public Health (Disposal of Bodies) Regulation 2002* (NSW)[13]. Further, the exhumation of such remains needs to consider health risks such as infectious disease control, exhumation procedures and reburial approval and registration. Further guidance on this matter can be found at the NSW Department of Health website.

In addition, due to the potential significant statutory and common law controls and prohibitions associated with interfering with a public cemetery, project teams are

[13] This requirement is in addition to heritage approvals under the *Heritage Act 1977*.

advised, when works uncover human remains adjacent to cemeteries, to confirm the cemetery's exact boundaries.

Appendix F

Archaeological Heritage Advice Checklist

The following checklist can be used by the Project Manager and the archaeologist to ensure all relevant archaeological issues are considered when developing the management plan required at Step 4 of this procedure.

An archaeological or heritage management plan can include a range of activities and processes, which differ depending on the find and its significance.

	Required	**Outcome/notes**
Assessment and investigation		
• Assessment of significance	Yes/No	
• Assessment of heritage impact	Yes/No	
• Archaeological excavation	Yes/No	
• Archival photographic recording	Yes/No	
Heritage approvals and notifications		
• AHIPs, Section 140, S139 exceptions etc	Yes/No	
• Regulator relics/objects notification	Yes/No	
• Roads and Maritime's S170 Heritage and Conservation Register listing requirements	Yes/No	
• Compliance with CEMP or other project heritage approvals	Yes/No	
Stakeholder consultation		
• Aboriginal stakeholder consultation requirements and how it relates to RTA *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI).	Yes/No	
• Advice from regional environmental staff, Aboriginal Cultural Heritage Advisor, Roads and Maritime heritage team.	Yes/No	
Artefact/ heritage item management		
• Retention or conservation strategy (eg items may be subject to long conservation and interpretation) • Disposal strategy (eg former road pavement) • Short term and permanent storage locations (interested third parties should be consulted on this issue).	Yes/No	
• Control Agreement for Aboriginal objects.	Yes/No	
Program and budget		
• Time estimate associated with archaeological or heritage conservation work.		
• Total cost of archaeological/heritage work.		

Appendix G

Template Notification Letter

PASTE INTO RMS LETTER TEMPLATE

"[Select and type date]"

[Select and type reference number]

[Select and type file number]

[Insert recipient's name and address, see **Appendix D**]

[Select and type salutation and name],

Re: Unexpected heritage item discovered during Roads and Maritime Services project works.

I write to inform you of an unexpected [select: relic, heritage item or Aboriginal object] found during Roads and Maritime Services construction works at [insert location] on [insert date]. [Where the regulator has been informally notified at an earlier date by telephone, this should be referred to here].

This letter is in accordance with the notification requirement under [select: Section 146 of the *Heritage Act 1977* (NSW) or Section 89(A) of the *National Parks and Wildlife Act 1974* (NSW) **NB:** There may be not be statutory requirement to notify of the discovery of a 'heritage Item that is not a relic or Aboriginal object].

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

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

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

Resulting from these preliminary findings, Roads and Maritime Services *[or contractor]* is proposing [provide a summary of the proposed archaeological/heritage approach (eg develop archaeological research design (where relevant), seek heritage approvals, undertake archaeological investigation or conservation/interpretation strategy). Also include preliminary justification of such heritage impact with regard to project design constraints and delivery program].

The proposed approach will be further developed in consultation with a nominated Office of Environment and Heritage staff member.

Please contact me if you have any input on this approach or if you require any further information.

Yours sincerely

[Sender name and position]

[Attach the archaeological/heritage management plan and site recording form].

About this release

Reference number	RMS 12.003 **|** PN 285 P02
Title	Unexpected Heritage Items Procedure
Parent procedure	RMS Heritage Guidelines
Prepared by	Environment Officer (Heritage) Gretta Logue Environment Officer (Heritage) Daniel Percival
Approved by	Manager Environmental Policy, Planning and Assessment Michael Crowley
Document location	Objective - SF2013/153770 / Unexpected heritage items procedure.doc
Document status	Version 1.0, 16 March 2015

Version	Date	Revision description
1.0	01/11/11	First issue
Revised	23 July 2012	Amended to reflect that (a) unexpected finds do not include items covered by a relevant approval; (b) Aboriginal people must be consulted where an unexpected find is likely to be an Aboriginal object; (c) the Department of Planning and Environment must be notified in accordance with Step 5 of this procedure for Part 3A and Part 5.1 projects.
Revised	09 October 2013	Amended to clarify that the procedure applies to all types of unexpected heritage items, not just archaeological items. The procedure introduces the term 'Historic Items' to cover both 'archaeological relics' and 'other historic items' such as works, structures, buildings and movable objects. The title of the document has been amended to better reflect this clarification.
Revised	16 March 2015	The procedure was streamlined to address all project types including maintenance works. The separate maintenance procedure (formerly Appendix B) was removed. Names and titles updated throughout.

Your comments and suggestions to improve this or any of the Heritage Guidelines and associated documents may be sent to:

Senior Environmental Specialist (Heritage)
Environmental Policy, Planning and Assessment
Environment Branch, Roads and Maritime Services
Level 17, 101 Miller Street
North Sydney, NSW 2060
Ph: 8588 5726

rms.nsw.gov.au

heritage@rms.nsw.gov.au

Customer feedback
Roads and Maritime
Locked Bag 928,
North Sydney NSW 2059

Transport
Roads & Maritime
Services

Appendix C. Archaeological methodology

Roads and Maritime Services

Western Harbour Tunnel and Warringah Freeway Upgrade

Archaeological methodology

September 2017

Prepared for

Roads and Maritime

Prepared by

Jacobs Group (Australia) Pty Limited

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Contents

Abbreviations

AFG	Aboriginal Focus Group
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
DEC Heritage)	Department of Environment and Conservation (now the Office of Environment and
DECCW	Department of Environment, Climate Change
DP&E	Department of Planning and Environment
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Jacobs	Jacobs Group (Australia) Pty Ltd
LALC	Local Aboriginal Land Council
OEH	Office of Environment and Heritage
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	potential archaeological deposit
RAP	registered Aboriginal party
Roads and Maritime	NSW Roads and Maritime Services
SEAR	Secretary's environmental assessment requirements
The project	Western Harbour Tunnels and Beaches Link

1. Introduction

This document presents an archaeological methodology for Aboriginal objects and places for the Western Harbour Tunnel and Beaches Link (WHTBL) Program (the project). The project would be declared state significant infrastructure and requires environmental assessment in accordance with Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (DoP).

The methodology is designed to be in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Code of Practice) (OEH 2010). The methodology will also be revised if necessary to meet the Secretary's Environmental Assessment Requirements (SEARs) for the project when they become available.

This archaeological methodology is designed in accordance with the requirements of Stage 2 of NSW Roads and Maritime Services (Roads and Maritime) *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHI) (Roads and Maritime Services 2011). The purpose of this methodology is to describe the implementation of recommendations for managing harm to Aboriginal cultural heritage, as outlined within the *Western Harbour Tunnel and Beaches Link Archaeological Survey Report – Aboriginal* (Costello and Brooks 2017).

The methodology presented in this document comprises two categories:

- A project specific test excavation methodology for further investigation of areas of potential archaeological deposit (PAD) identified within the construction boundary (Section 2 and Table 2.3). This Section also includes a recommended procedure for soil and vegetation removal to locate potential engravings (Section 2.2.2)

- A generic test excavation methodology for further investigation of areas of PAD identified through subsequent assessments as potentially impacted by the project (Section 2.2).

2. Further investigation

As detailed in the *WHTBL Archaeological Survey Report – Aboriginal V4* (Costello and Brooks 2017) desktop assessment and archaeological field survey of the project corridor has been carried out. This assessment identified three areas of PAD that require further investigation in the form of test excavation in order to confirm the presence of archaeological deposits and determine the nature, extent and significance of these deposits to inform the development of appropriate management recommendations.

The PADs requiring further investigation are listed in Table 2.1. Further investigation to locate potential engraving sites covered by vegetation and soil are listed in Table 2.2. Mapping with the location and extent of each PAD can be found in Appendix A.

A further four locations within the project corridor were identified during survey as having potential for rock engravings covered by vegetation and soil (Table 2.2).

Table 2.1 : PADs identified within the survey corridor

PAD names (AHIMS ID)	Assessment area	Likelihood of archaeological deposits	Landform (soil landscape)
Artarmon Park PAD	Northshore	Low-moderate	Gymea / Disturbed
Flat Rock Creek PAD	Northshore	Low-moderate	Gymea / Disturbed
Burnt Bridge Creek PAD	Balgowlah	Low-moderate	Gymea / Disturbed

Table 2.2 : Potential new engraving locations identified within the survey corridor

Potential engraving locations	Assessment area	Likelihood of archaeological deposits	Landform (soil landscape)
Wakehurst Parkway cultural landscape	Northshore	Moderate	Gymea / Disturbed
Artarmon Park	Northshore	Low-moderate	Gymea / Disturbed
Flat Rock Creek	Northshore	Low-moderate	Gymea / Disturbed
Burnt Bridge Creek	Balgowlah	Low-moderate	Gymea / Disturbed

2.1 Aims

The aims of the test excavation and approach to locating new and hidden engravings are to:

- Assess the presence of sub-surface archaeological deposits for all PADs
- Assess the presence of new engravings at the identified locations
- Identify the nature, depth, extent and significance of archaeological deposits within the boundary of the project
- Consult with registered Aboriginal parties (RAP) in regards to this work and the sites being tested
- Develop recommendations to minimise or mitigate potential impacts to any Aboriginal cultural heritage objects identified via the test excavation and through the location of potential new engraving sites.

Preliminary management recommendations and Aboriginal significance may be discussed informally in the field with nominated site offices during this time, however, recommendations will be discussed more formally at a post fieldwork Aboriginal Focus Group (AFG) meeting.

2.2 Methodology

It should be noted that this test excavation methodology is designed to be in accordance with Requirement 16 of *Code of Practise for Archaeological Investigation of Aboriginal Objects in NSW* (OEH 2010) and *Introduction to Rock Art Conservation* (DECC 2007).

2.2.1 Test Excavation

- Test excavation units will be placed on a systematic grid appropriate to the scale of the area being investigated, for example 10, 20 or 40 metre (m) intervals, or other justifiable and regular spacing depending upon observed disturbance of the area, and the predicted sensitivity of the landforms on which the PAD is located. The proposed test pit spacing, number of transects and excavation units required to adequately investigate each PAD within the survey corridor is presented below in Table 2.3. The exact placement and number of excavation units will be determined by the supervising archaeologist in consultation with site officers for the relevant RAP
- Test excavation units will only be placed within the boundaries of the project
- Test excavation units will not be placed in areas where significant ground disturbance has been identified in consultation with site officers for the relevant RAP
- Test excavations units will be excavated using hand tools only (for example shovels or trowels)
- Test excavations will be excavated in 500 mm x 500 mm units
- Test excavations units may be combined and excavated as necessary to understand the characteristics of any site identified. In general, the maximum continuous surface area of a combination of test excavation units at a single excavation point will be no greater than three square metres
- The maximum surface area of all test excavation will be no greater than 0.5 per cent of the PAD area being investigated (See Table 2.3)
- Where test excavations identify sub-surface archaeological deposits, additional excavation units will be placed five, 10 or 20 m away on the four cardinal points in order to establish the horizontal extent of the site
- The first excavation unit will be excavated and documented in 50 mm spits at each PAD being investigated. Based on the evidence of the first excavation unit, 100 mm spits or sediment profile/stratigraphic excavation (whichever is smaller) may then be implemented
- Test excavation units will be excavated to at least the base of the identified Aboriginal object-bearing units, and must continue to confirm the soils below are culturally sterile (B Horizon)
- All material excavated from the test excavation units will be dry sieved using a three or five mm aperture wire-mesh sieve
- Photographic and scale-drawn records of the stratigraphy/soil profile, features and informative Aboriginal objects will be made for each excavation points. This includes recording of the stratigraphy/soil profile of each distinct landform sampled and of each test excavation unit in which an archaeological feature or Aboriginal object were identified
- Soil colour and type, texture, acidity and stratification will be recorded to increase understanding of the sub-surface conditions of PADs and how they may relate to site formation processes influencing the presence and condition of sub-surface archaeological deposits
- Soil colours will be recorded from each soil strata identified, using a Munsell colour chart to ensure consistency

- Soil acidity will be measured for each soil type identified using a pH testing kit
- Test excavations units will be backfilled as soon as practicable
- The location of each excavation unit will be recorded using a mobile GIS Unit (Trimble® GeoXH™ GeoExplorer®,Trimble® Nomad or an IPAD with appropriate spatial capability). This allows for the spatial datasets collected in the field to be post-processed to sub-metre level accuracy once the GPS co-ordinates have been differentially corrected
- All artefacts retrieved during test excavation will be double bagged and labelled with appropriate contextual information. The artefacts will be analysed under laboratory conditions at the North Sydney Jacobs office
- The long term management arrangements for any recovered artefacts will be in consultation and agreement with the RAPs and in accordance with Section 3.7 of the Code of Practice (OEH 2010). The relevant Local Aboriginal Land Council (LALC) offices will be considered for the long storage of recovered artefacts following the test excavation program
- Following test excavation, an Aboriginal Site Impact Recording Form will be completed and submitted to the AHIMS Register as soon as practicable, for each Aboriginal Heritage Information Management Systems (AHIMS) PAD/site that has been the subject of test excavation in accordance with the requirements of the Code of Practice
- If suspected human skeletal remains are encountered, works potentially affecting the find would cease immediately and follow Requirement 25 of the Code of Practice would be followed.

2.2.2 Identifying new engraving locations

Where the potential for engravings, or petroglyphs (produced by breaking through or extracting the rock surface – pecking, pounding, abrading, scratching), exists within the project corridor and may be impacted, further investigation must be carried out to determine the absence of engravings prior to any impacts occurring. The first priority in rock art recording must always be to avoid harm to the art itself (including the panels or surfaces on which the art is located).

Where the absence of engravings is determined works can occur with approval from the archaeologist following consultation with the RAP in the field. Where the presence of rock engravings or petroglyphs within the project corridor are established by investigation all practicable steps must be taken to avoid any impacts to the site and a buffer of at least 5 m or an appropriate distance must be established around the site. Once identified the purpose of the exercise must be to document as much information as possible from the petroglyphs, without harming them.

Where the potential for engravings, or petroglyphs exists within the project corridor and the rock platform is covered by light soil deposit and vegetation the following methodology is designed to generally be in accordance with the recommended procedures for uncovering engravings as detailed in *Introduction to Rock Art Conservation* (DECC 2007).

- Remove vegetation with shovels, brooms or by hand where appropriate, taking care not to scratch the rock surface.
- Remove vegetation carefully as it often takes much of the soil with it.
- Examine small areas and work down slope. Some shovelling may be required to move accumulated soil.

The above techniques will occur in a targeted manner and will be directed through the identification of appropriate locations where sandstone rock platforms occur in elevated landscapes to search for engravings during PACHCI 3 fieldwork. Consultation will occur between field archaeologists and RAP representatives during fieldwork to determine these locations. A list of potential new engraving locations to be examined during PACHCI 3 fieldwork is detailed in Table 2.2.

As per the Conditions of Requirement 22 of the Code of Practice (OEH 2010), while undertaking rock art recording care must be taken to not physically interfere with any pictogram or petroglyph and to minimise movement on or over surfaces with petroglyphs. If an engraving is located an archaeologist in consultation with the RAP will:

- Wash down the site using anything from a knapsack water dispenser to a water tanker depending on the scale of the operation. In order to avoid the risk of surface damage, no high power water jet will be used.
- If necessary, remove soil up to one metre from the edge of the site to avoid future build up.
- If the area is damp allow time for the site to dry. It may then be dry brushed by hand using 100 mm bristle brushes, or larger, soft nylon brushes.
- To conserve the site, consider appropriate drainage and water diversion to prevent soil build up.

If a new engraving site is located, an Aboriginal Heritage Information Management System (AHIMS) form must be completed and submitted to the AHIMS Register as soon as practicable. When recording any new rock art or petroglyphs, care must be taken to avoid, with the exception of necessity (scales, string, tape measures or drawing frames for recording), putting equipment on the art or the surface containing the art.

Recording techniques will employ 3D laser scanning where appropriate, use high definition illumination at night to discern faint feature outlines, use modern photogrammetry techniques and other appropriate techniques and technologies. Photographs must capture:

- Context
- Landscape
- shelter/feature/platform.

2.2.3 Radiometric dating

Samples of organic material suitable for radiometric dating (charcoal, bone, shell, wood etc.) will be collected for the dating of archaeological deposits. The number of samples sent for dating will be determined on the suitability of the sample and the significance of the site. Samples will be collected as follows:

- Samples will be collected using clean nitrile gloves and placed in clean plastic sample bags
- Charcoal samples will also be wrapped in aluminium foil to prevent crushing
- Samples will be removed to the relevant temporary keeping place and dried out to avoid fungal growth during transport
- Samples will be packaged within hard plastic cases for transport to a radiocarbon dating laboratory.

Table 2.3 : Estimated transect and test pit numbers for each PAD

PAD name (AHIMS ID)	Approximate PAD area within the project corridor	Proposed test excavation techniques	Estimated transects	Estimated excavation unit number	Estimated Excavation unit spacing	Estimated excavation area (% of PAD area)	Notes
Artarmon Park PAD	10,412 m^2	Manual excavation	3	25	10 m		
Flat Rock Creek PAD	459 m^2	Manual excavation	4	20	10 m		Terrain will restrict access and ability to excavate
Burnt Bridge Creek PAD	4429 m^2	Manual excavation	5	30	10 m		

2.3 Personnel

Test excavation will be conducted by appropriately qualified and experienced archaeologists (as per Section 1.6 of the Code of Practice) and nominated site officers for the relevant RAP. Where sub-surface Aboriginal objects are identified, nominated site officers will be consulted regarding preferred management measures.

In general, it is proposed that a test excavation team consisting of two field archaeologists and a maximum of four nominated site officers conduct the test excavation. Where additional resources are required, it is proposed that a maximum ratio of one-two site officers to one field archaeologist is maintained, with a maximum of four field archaeologists and eight site officers engaged at any one time. A roster for site officer participation will be developed in consultation with Mark Lester (Aboriginal Cultural Heritage Advisor, Roads and Maritime). If required, a dedicated artefact specialist may also be engaged during the test excavation program to assist with the analysis of large volumes of artefacts.

2.4 Research Questions

Where test excavation identifies a previously unknown Aboriginal cultural heritage value (site) or previously unidentified components of a previously known site, the stratigraphic and artefact analyses detailed above will be utilised to address the following research questions:

- What is the full spatial extent, including depth, of the archaeological deposits?
- What are the key characteristics of the archaeological deposits that constitute the site? Key characteristics might include:
  - Site type (for example artefact scatter, grinding grooves, bora/ceremonial site, burial)
  - Site preservation
  - Contents of the site, particularly the stone artefact assemblage (where present)
  - Site chronology
- How do the key characteristics of the site compare with other known sites in the region?
- Given the key characteristics of the site, what is the significance of the site? Significance assessment will be based upon the four values of the Australia ICOMOS Burra Charter (Australia ICOMOS 2000):
  - Social values
  - Historical values
  - Scientific values. Scientific significance is based upon the following criteria:
    - Site integrity
    - Site structure
    - Site contents
    - Representativeness and rarity
  - Aesthetic values.

Depending on the results of the test excavation and the nature of any archaeological deposits identified additional research questions may be required.

2.5 Artefact analysis

2.5.1 Recorded attributes – artefact class

Stone artefacts can be separated into four main categories; flakes, cores, tools, and angular fragments. It is from these four categories that further distinctions can be made based on identifying specific attributes relating to the reduction process (Holdaway 2004 p. 24).

Flakes

Flakes are defined through the presence of attributes relating to conchoidal fracture (Holdaway and Stern 2008 p. 34). A conchoidal fracture originates from pre-existing flaws and creates what is known as a Hertzian cone (Clarkson 2007 p. 27). Flakes maintain both a ventral and dorsal surface and can be further categorised based on the completeness of the flake. Flakes are generally described as complete, proximal, medial, distal, complete split flakes, longitudinally split flakes and core rejuvenation flakes.

Cores

Cores are defined by the presence of negative flake scars, marking the location of previous flake removal (Holdaway & Stern 2008 p. 179). These flake scars can be used to describe the direction of flake removal (unidirectional, bi-directional, bifacial, multi-directional, and microblade). Cores also include the presence of one or more platforms and can exist as a complete core, or a core fragment, or broken core.

Tools

Tools maintain similar characteristics to flakes, but have evidence of retouch or use wear along lateral margins. Tools retain a ventral surface and can also be categorised based on completeness of artefact remaining, in a similar manner to flakes.

Angular fragments

Angular fragments are flaking debris with none of the above identifiable diagnostic features associated with stone reduction processes. Thus, the defining characteristics as detailed in the above three categories are missing on angular fragments (Hiscock 1988 p. 129).

Table 2.4 : Definition of technical categories to be used

Technological category	Definition
Complete flake	Has a ventral surface that preserves a complete fracture plane, has a platform (or impact point), lateral margins and a termination
Proximal flake	A broken flake that lacks a termination but retains one or more of the following: platform and/or impact point, bulb of percussion, bulbar scar and fissures
Medial flake	Absence of proximal and distal margins but have an identifiable ventral surface
Distal flake	Presence of a termination and the absence of a platform or impact point
Longitudinal split flake	A break that runs parallel to the flaking axis. The flake preserves a portion of the platform and/or impact point and has an identifiable termination
Angular fragment	A flake fragment that cannot be identified in any more detail
Core	Negative flake scarring, no positive scars and therefore no ventral surface

2.5.2 Raw material

Artefact size and morphology are often closely linked to raw material (Hiscock 1988). As such it is important to identify the types of raw material present in the project area. Raw material types are expected to primarily include silcrete and silicified volcanic tuff, as identified via desktop review of previous test excavation results in the area.

2.5.3 Cortex

Cortex will be recorded as a percentage of the artefact covered, the type of cortex and its location. The proportion of the artefact covered by cortex refers to the percentage of cortex located on the dorsal surface for flakes and tools. For cores and angular fragments it refers to the percentage of the whole artefact. Percentages will be given as 0%, 1-50%, 51-99%, and 100%. Cortex type will be defined as either cobble or slab. Cobble refers to water-rounded cortex and slab refers to cortex associated with exposed surfaces or outcrops.

Recording the percentage of remaining cortex on an artefact is important as cortex proportions in lithic assemblages are frequently used as an indicator to suggest reduction intensity (Andrefsky 1998 pp.101-2). They can also suggest distance from the raw material source (Andrefsky 1998 pp.101-2).

2.5.4 Termination

Flake or tool termination refers to the artefact's distal end. Terminations will be recorded as feather, hinge, step, plunge, and crushed. If the termination is not present it will be listed as absent. Differing terminations are the result of different applications of force during the flaking process. For example, a flake with a crushed termination is often the result of bipolar technology.

2.5.5 Platform

Platform types are useful as they indicate the level of work that has been dedicated to a core to enable flake detachment (Holdaway 2004 p. 28). As a result, it is possible to determine stage of reduction and provide information regarding the face of the core (Andrefsky 1998 pp. 89-96). Platforms will be as flaked, focal, and crushed. If the platform is not present it will be listed as absent.

2.5.6 Tools

Where required an analysis of formal tool types will be made to facilitate comparisons with assemblages previously excavated within or close to the project corridor.

2.5.7 Cores

Artefacts with negative flake scars originating from one or more platforms were identified as cores (Holdaway and Stern 2008). As cores are used in the production of flakes, a different set of attributes will be used to describe them. Core scar direction will be detailed as uni-directional, bi-directional, or multidirectional. The number of core platforms, as well as the length of the biggest negative flake scar, will also be recorded.

2.5.8 Metrical attributes

The following metrical attributes will be recorded for all artefacts:

- Maximum dimension – Will be measured on all artefacts, irrespective of technological type. This is defined as the furthest points of division on the artefact. Maximum dimension is a useful concept in that all artefacts present have at least two attributes that can be measured; maximum dimension and weight, regardless of technological type.

- Weight – All artefacts will be weighed, irrespective of technological type. Artefact weight is probably the most reliable size characteristic for discriminating between reduction stages of stone artefacts. It is easy to take and is replicable and it correlates well with other linear dimensions which all relate to the size of the flake (Andrefsky 1998 p. 96). Although small flakes may be removed early in the reduction sequence, the heavier material comes from the early stages of knapping and reduces thereafter.

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Appendix A. PAD location mapping

Figure A.1 : Artarmon Park PAD

Figure A.2 : Flat Rock Creek PAD

Figure A.3: Burnt Bridge Creek PAD

Appendix D. Archaeological Assessment Report

Roads and Maritime Services

Western Harbour Tunnel and Warringah Freeway Upgrade

Archaeological assessment report

January 2020

Prepared for

Roads and Maritime

Prepared by

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Abbreviations

ACHAR	Aboriginal Cultural Heritage Assessment Report
AFG	Aboriginal Focus Group
AHIMS	Aboriginal Heritage Information Management System
DECCW	Department of Environment, Climate Change and Water
EIS	Environmental impact statement
GIS	Geographic Information Systems
Jacobs	Jacobs Group (Australia) Pty Ltd
LALC	Local Aboriginal Land Council
NSW	New South Wales
OEH	Office of Environment and Heritage (now the Department of Premier and Cabinet (Heritage))
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	Potential archaeological deposit
RAP	Registered Aboriginal Party
Roads and Maritime	NSW Roads and Maritime Services
The project	Western Harbour Tunnel and Warringah Freeway Upgrade project

1. Introduction

This section provides an overview of the Western Harbour Tunnel and Warringah Freeway Upgrade (the project), including its key features and location. It also outlines the Secretary's environmental assessment requirements addressed in this technical working paper.

1.1 Overview

The Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018) proposes a vision of three cities where most residents have convenient and easy access to jobs, education and health facilities and services. In addition to this plan, and to accommodate for Sydney's future growth the NSW Government is implementing the *Future Transport Strategy 2056* (Transport for NSW, 2018), a plan that sets the 40-year vision, directions and outcomes framework for customer mobility in NSW. The Western Harbour Tunnel and Beaches Link program of works is proposed to provide additional road network capacity across Sydney Harbour and to improve transport connectivity with Sydney's northern beaches. The Western Harbour Tunnel and Beaches Link program of works include:

- The Western Harbour Tunnel and Warringah Freeway Upgrade project which comprises a new tolled motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to connect to the Beaches Link and Gore Hill Freeway Connection project
- The Beaches Link and Gore Hill Freeway Connection project which comprises a new tolled motorway tunnel connection across Middle Harbour from the Warringah Freeway and Gore Hill Freeway to Balgowlah and Killarney Heights and including the surface upgrade of Wakehurst Parkway from Seaforth to Frenchs Forest and upgrade and integration works to connect to the Gore Hill Freeway at Artarmon.

A combined delivery of the Western Harbour Tunnel and Beaches Link program of works would unlock a range of benefits for freight, public transport and private vehicle users. It would support faster travel times for journeys between the Northern Beaches and south, west and north-west of Sydney Harbour. Delivering the program of works would also improve the resilience of the motorway network, given that each project provides an alternative to heavily congested harbour crossings.

1.2 The project

Roads and Maritime Services (Roads and Maritime) is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* to construct and operate the Western Harbour Tunnel and Warringah Freeway Upgrade, which would comprise two main components:

- A new crossing of Sydney Harbour involving twin tolled motorway tunnels connecting the M4-M5 Link at Rozelle and the existing Warringah Freeway at North Sydney (the Western Harbour Tunnel)
- Upgrade and integration works along the existing Warringah Freeway, including infrastructure required for connections to the Beaches Link and Gore Hill Freeway Connection project (the Warringah Freeway Upgrade).

Key features of the Western Harbour Tunnel component of the project are shown in Figure 1-1 and would include:

- Twin mainline tunnels about 6.5 kilometres long and each accommodating three lanes of traffic in each direction, connecting the stub tunnels from the M4-M5 Link at Rozelle to the Warringah Freeway and to the Beaches Link mainline tunnels at Cammeray. The crossing of Sydney Harbour between Birchgrove and Waverton would involve a dual, three lane, immersed tube tunnel
- Connections to the stub tunnels at the M4-M5 Link project in Rozelle and to the mainline tunnels at Cammeray (for a future connection to the Beaches Link and Gore Hill Freeway Connection project)

- Surface connections at Rozelle, North Sydney and Cammeray, including direct connections to and from the Warringah Freeway (including integration with the Warringah Freeway Upgrade), an off ramp to Falcon Street and an on ramp from Berry Street at North Sydney
- A ventilation outlet and motorway facilities (fitout and commissioning only) at the Rozelle Interchange
- A ventilation outlet and motorway facilities at the Warringah Freeway in Cammeray
- Operational facilities including a motorway control centre at Waltham Street, within the Artarmon industrial area and tunnel support facilities at the Warringah Freeway in Cammeray
- Other operational infrastructure including groundwater and tunnel drainage management and treatment systems, signage, tolling infrastructure, fire and life safety systems, lighting, emergency evacuation and emergency smoke extraction infrastructure, CCTV and other traffic management systems.

Key features of the Warringah Freeway Upgrade component of the project are shown in Figure 1-2 and would include:

- Upgrade and reconfiguration of the Warringah Freeway from immediately north of the Sydney Harbour Bridge through to Willoughby Road at Naremburn
- Upgrades to interchanges at Falcon Street in Cammeray and High Street in North Sydney
- New and upgraded pedestrian and cyclist infrastructure
- New, modified and relocated road and shared user bridges across the Warringah Freeway
- Connection of the Warringah Freeway to the portals for the Western Harbour Tunnel mainline tunnels and the Beaches Link tunnels via on and off ramps, which would consist of a combination of trough and cut and cover structures
- Upgrades to existing roads around the Warringah Freeway to integrate the project with the surrounding road network
- Upgrades and modifications to bus infrastructure, including relocation of the existing bus layover along the Warringah Freeway
- Other operational infrastructure, including surface drainage and utility infrastructure, signage, tolling, lighting, CCTV and other traffic management systems.

A detailed description of the project is provided in Chapter 5 (Project description) and construction of the project is described in Chapter 6 (Construction work) of the environmental impact statement. The project alignment at the Rozelle Interchange shown in Figure 1-1 and Figure 1-3 reflects the arrangement presented in the environmental impact statement for the M4-M5 Link, and as amended by the proposed modifications. The project would be constructed in accordance with the finalised M4-M5 Link detailed design (refer to Section 2.1.1 of Chapter 2 (Assessment process) of the environmental impact statement for further details).

The project does not include ongoing motorway maintenance activities during operation or future use of residual land occupied or affected by project construction activities, but not required for operational infrastructure. These would be subject to separate planning and approval processes at the relevant times.

Subject to the project obtaining planning approval, construction is anticipated to commence in 2020 and is expected to take around six years to complete.

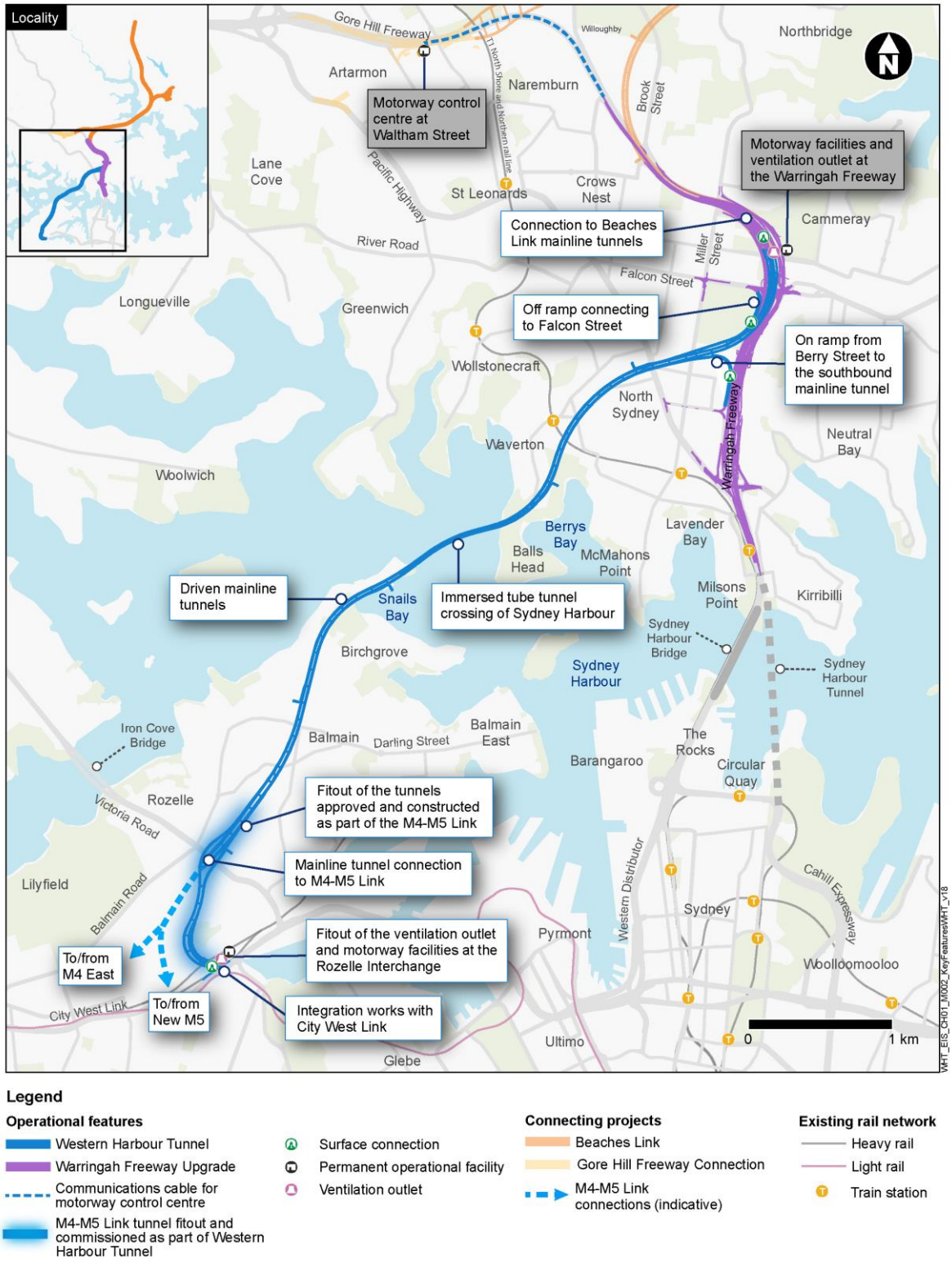
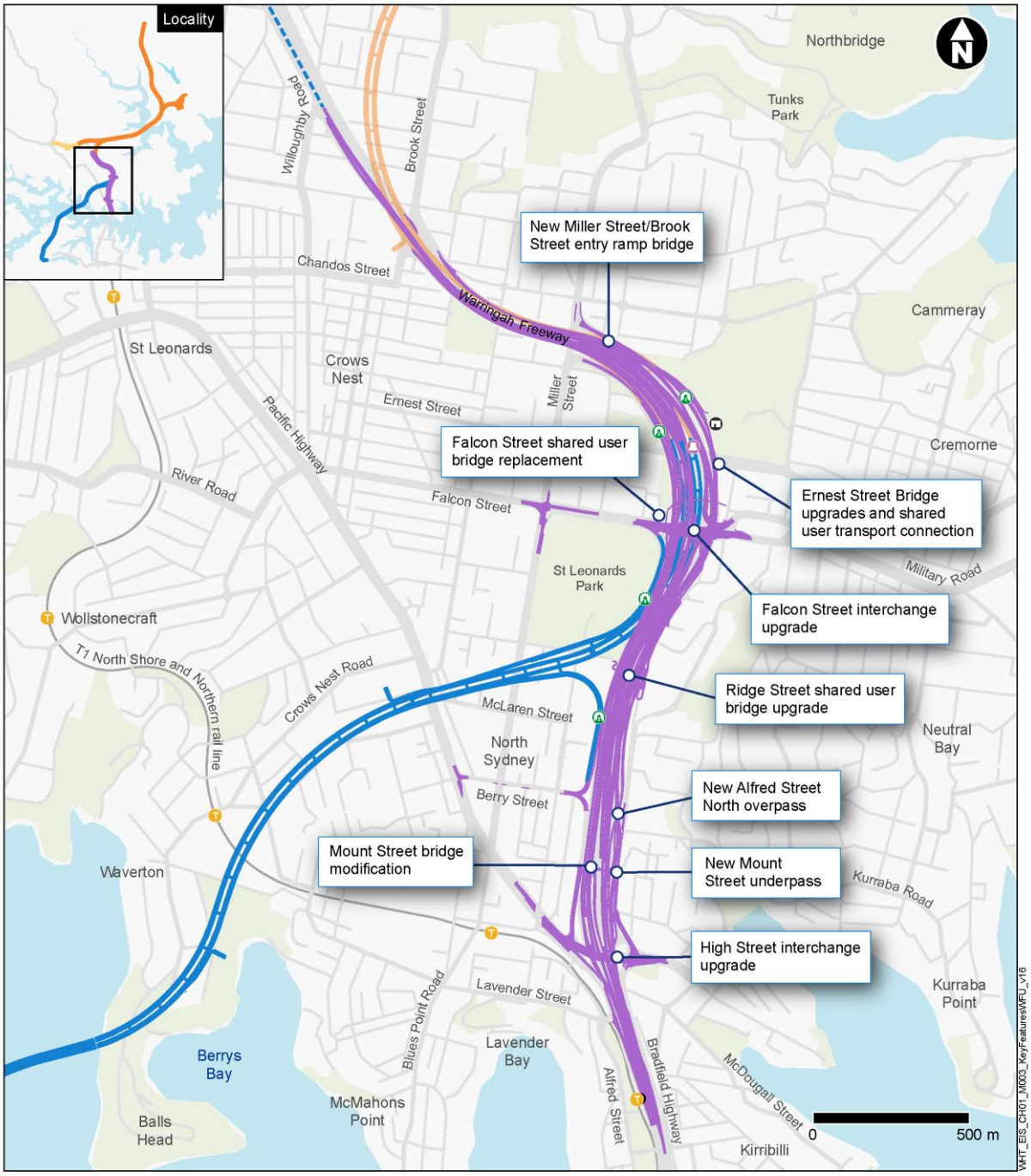


Figure 1-1 Key features of the Western Harbour Tunnel component of the project



Legend

Operational features
- Warringah Freeway Upgrade
- Western Harbour Tunnel
- Communications cable for motorway control centre
- Surface connection
- Permanent operational facility
- Ventilation outlet

Connecting projects
- Beaches Link

Existing rail network
- Heavy rail
- Train station

Figure 1-2 Key features of the Warringah Freeway Upgrade component of the project

1.3 Key construction activities

The area required to construct the project is referred to as the construction footprint. The majority of the construction footprint would be located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities and to construct the tunnel connections, tunnel portals and operational ancillary facilities.

Key construction activities would include:

- Early works and site establishment, with typical activities being property acquisition and condition surveys, utilities installation, protection, adjustments and relocations, installation of site fencing, environmental controls (including noise attenuation and erosion and sediment control) and traffic management controls, vegetation clearing, earthworks and demolition of structures, establishment of construction support sites including acoustic sheds and associated access decline acoustic enclosures (where required), construction of minor access roads and the provision of property access, temporary relocation of pedestrian and cycle paths and bus stops, temporary relocation of swing moorings within Berrys Bay and relocation of historic vessels
- Construction of Western Harbour Tunnel, with typical activities being excavation of tunnel construction accesses, construction of driven tunnels, cut and cover and trough structures and construction of cofferdams, dredging activities in preparation for the installation of immersed tube tunnels, casting and installation of immersed tube tunnels and civil finishing and tunnel fitout
- Construction of operational facilities comprising a motorway control centre at Waltham Street in Artarmon, motorway and tunnel support facilities and ventilation outlets at the Warringah Freeway in Cammeray, construction and fitout of the project operational facilities that form part of the M4-M5 Link Rozelle East Motorway Operations Complex, a wastewater treatment plant at Rozelle and the installation of motorway tolling infrastructure
- Construction of the Warringah Freeway Upgrade, with typical activities being earthworks, bridgeworks, construction of retaining walls, stormwater drainage, pavement works and linemarking and the installation of road furniture, lighting, signage and noise barriers
- Testing of plant and equipment, and commissioning of the project, backfill of access declines, removal of construction support sites, landscaping and rehabilitation of disturbed areas and removal of environmental and traffic controls.

Temporary construction support sites would be required as part of the project (refer to Figure 1-3), and would include tunnelling and tunnel support sites, civil surface sites, cofferdams, mooring sites, wharf and berthing facilities, laydown areas, parking and workforce amenities. Construction support sites for Western Harbour Tunnel would include:

- Rozelle Rail Yards (WHT1)
- Victoria Road (WHT2)
- White Bay (WHT3)
- Yurulbin Point (WHT4)
- Sydney Harbour south cofferdam (WHT5)
- Sydney Harbour north cofferdam (WHT6)
- Berrys Bay (WHT7)
- Berry Street north (WHT8)
- Ridge Street north (WHT9)
- Cammeray Golf Course (WHT10)
- Waltham Street (WHT11).

During the construction of the Warringah Freeway Upgrade, smaller construction support sites would be required to support the construction works (as shown on Figure 1-3). These include:

- Blue Street (WFU1)
- High Street south (WFU2)
- High Street north (WFU3)
- Arthur Street east (WFU4)
- Berry Street east (WFU5)
- Ridge Street east (WFU6)
- Merlin Street (WFU7)
- Cammeray Golf Course (WFU8)
- Rosalind Street east (WFU9).

A detailed description of construction works for the project is provided in Chapter 6 (Construction work) of the environmental impact statement.

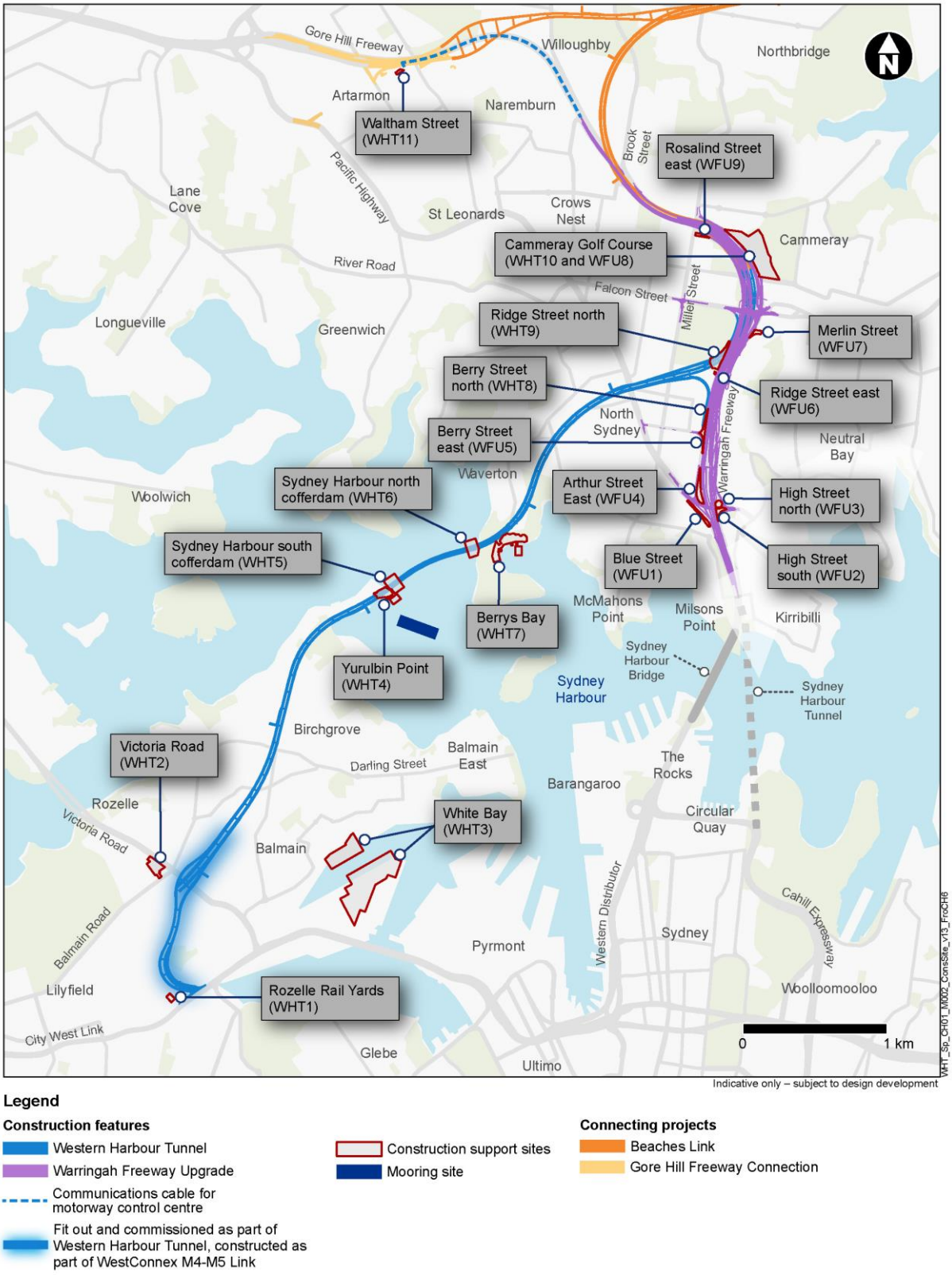


Figure 1-3 Overview of key construction support sites

1.4 Project location

The project would be located within the Inner West, North Sydney and Willoughby local government areas, connecting Rozelle in the south with Naremburn in the north.

Commencing at the Rozelle Interchange, the mainline tunnels would pass under Balmain and Birchgrove, then cross Sydney Harbour between Birchgrove and Balls Head. The tunnels would then continue under Waverton and North Sydney, linking directly to the Warringah Freeway to the north of the existing Ernest Street bridge.

The motorway control centre would be located at Waltham Street, Artarmon, with a trenched communications cable connecting the motorway control centre to the Western Harbour tunnel along the Gore Hill Freeway and Warringah Freeway road reserves.

The Warringah Freeway Upgrade would be carried out on the Warringah Freeway from around Fitzroy Street at Milsons Point to around Willoughby Road at Naremburn. Upgrade works would include improvements to bridges across the Warringah Freeway, and upgrades to surrounding roads.

1.5 Purpose of this report

This report has been prepared to support the environmental impact statement for the project and to +address the environmental assessment requirements of the Secretary of the Department of Planning, Industry and Environment (formerly Department of Planning and Environment) ('the Secretary's environmental assessment requirements').

The scope of the archaeological assessment detailed in this report is in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b) and *the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (DECCW 2011). While this report forms an appendix to the ACHAR for the project, it also must be a stand-alone technical report. This has involved:

- A desktop assessment, including a search of the AHIMS, to identify known Aboriginal heritage sites and areas of potential archaeological sensitivity that required further assessment, namely archaeological site survey
- An archaeological site survey with nominated site officers from the RAPs for the project to investigate known sites, and to investigate areas of potential archaeological sensitivity for the presence of previously unknown Aboriginal cultural heritage values, including PADs
- An archaeological test excavation of identified PADs to establish the extent and nature of any extant sub-surface cultural deposits
- Consultation with the nominated site officers for the registered RAPs during field investigations
- A significance assessment of Aboriginal cultural heritage values potentially impacted by the project. This includes both scientific (archaeological) and cultural significance for Aboriginal heritage sites and places. Cultural significance has been informed by the consultation with RAPs for the project.

The objective of the assessment documented in this report is as follows:

- Comply with the legislative requirements, codes of practice and assessment procedures relevant to the project (refer to Chapter 2 of the ACHAR)
- Comply with the Secretary's environmental assessment requirements for the project, issued on 15 December 2017 (Application number SSI 8863). Full details of the Secretary's environmental assessment requirements for the project relating to Aboriginal cultural heritage are provided in Section 1.1 of the ACHAR)
- Comply with Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) (Roads and Maritime Services 2011). In particular, this report constitutes an archaeological report as required for Stage 3 of PACHCI.

1.6 Study area

For the purposes of this report, the study area is defined as the construction footprint associated with surface works, plus land above the tunnel alignments. To account for potential impacts due to vibration or settlement, a 50 metre search area around the surface works and tunnel alignments has also been considered in this impact assessment.

A separate study was carried out to identify potential submerged Aboriginal sites (Cosmos Archaeology, 2020). The study area applied to the consideration of potential submerged Aboriginal sites is outlined in Appendix E (Potential Submerged Sites Assessment) of the ACHAR.

1.7 Authorship

This report has been written by Alistair Carr, Andrew Costello (Senior Archaeologists, Jacobs) and Chelsea Jones (Graduate Archaeologist, Jacobs). Alistair and Andrew hold appropriate qualifications for carrying out the following investigation as required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). The report was reviewed by Dr David Collard (Technical Lead, Roads and Heritage, Jacobs).

The Potential Submerged Sites Assessment (Cosmos Archaeology, 2020) was written by Cosmos Coroneos, a qualified maritime archaeologist.

2. Previous archaeological work

This chapter presents a review and synthesis of previous archaeological work in the immediate vicinity of the study area to provide context and a baseline for what is already known about Aboriginal cultural heritage in this area. This will be used to inform:

- The development of a predictive model for Aboriginal cultural heritage in and next to the study area
- The assessment of archaeological significance for any Aboriginal cultural heritage identified with the potential to be impacted by the project.

2.1 Archaeological context

Aboriginal occupation of the Sydney basin is likely to have spanned at least 20,000 years, although dates of more than 40,000 years have been obtained from artefacts found in gravels of the Cranebrook Terrace on the Nepean River (Stockton and Holland 1974). A study of the Sydney region reveals that Aboriginal sites are distributed across the whole range of physiographic units and environmental zones, although certain types of sites may be more frequently associated with certain parts of the landscape (for example, shelter sites are particularly common in areas of Hawkesbury Sandstone), and different parts of the landscape contain different resources, which may be seasonally available or highly localised. Hence, shell middens are common in the Port Jackson region around the shores of bays, rivers, harbours and the coast, in areas where shellfish are available. Accordingly, the Port Jackson archaeological record is different to that of the Cumberland Plain of Sydney, partly because of the different resources in these areas (Attenbrow 1990).

There is evidence of Aboriginal occupation throughout the study area, with areas of plentiful food resources associated with shorelines, riparian zones and nearby areas. During urban development, many of these areas have been covered by fill, concealing original formations. Some evidence of Aboriginal occupation may also be present along movement pathways and meeting and camping sites, which were often associated with ridgelines.

It should also be recognised that the archaeological evidence within any particular site can vary considerably in quantity and the range of evidence present, and that the number of sites or amount of archaeological evidence found in any specific area varies. Further, the distribution of presently recorded sites in some areas is unlikely to be indicative of the original distribution of Aboriginal sites and therefore may not be a reliable guide to the occupation history of that area (Koettig 1996). Accordingly, without professional archaeological assessment of an area, the sites most likely to have been recorded are those which are most obvious to non-professionals, such as rock shelters and art sites. Therefore, with Hawkesbury Sandstone outcrops underlying much of the study area it may be expected that occupation deposits will most frequently be found in rock shelters, and that art (including engravings) and axe grinding grooves will be present in the area as it contains the appropriate resources (sandstone). The Sydney Basin Rock Art Project (carried out by Jo McDonald over several years, for the National Parks & Wildlife Service (now DECCW) and as part of her doctoral research) revealed that most shelters with art are located on hilltops (with some found on valley bottoms and ridgetops). About a quarter of shelters with art sites are associated with known archaeological deposits. Most rock engravings are located on horizontal sandstone exposures on ridgetops or slopes and about 13 per cent of rock engravings are associated with axe grinding grooves (Brayshaw McDonald Pty Ltd 1990). However, it should be noted that some sites cannot be detected through inspection of the ground surface or rock surfaces alone and that shelters without visible occupation deposit may be Aboriginal sites (Koettig 1996 p. 57).

Archaeological and historical records show that marine and estuarine resources formed an important part of the subsistence activities of the Aboriginal people that inhabited the Port Jackson area around the shores of bays, rivers, harbours and the coast. The Aboriginal people of the coastal plain of NSW were hunter gatherers and able to exploit the marine environment (Morris 1986). Shellfish not only formed an

important subsistence resource, but were also used as fish-hooks, shafted onto spears, used for repairing spears, and for cutting (Attenbrow 2010). Other locally available raw materials, including quartz, were also favoured for cutting edges (Baker 2004). One of the earliest known land grants to Aboriginal people was made in the mid-1810s at Middle Head and, as such, may include more evidence of occupation than other sites (Morris 1986).

2.2 Other assessments

Leichhardt Municipal Council Heritage Study

A survey was carried out at Callan Point and Yurulbin Point (Huys *et al.* 1995) as part of a cultural heritage study for the Leichhardt Municipal Council. Detailed recordings were carried out for a previously identified open and shelter midden site, a shelter with art site, and two other rockshelters at Yurulbin Point (which were considered likely to have been used by past Aboriginal people). A possible midden and an isolated hammerstone artefact at Callan Point and an art site at White Horse Point were also recorded. It was recommended that the sites be conserved and protected by the use of boardwalks in public recreation areas. Further, it was considered likely that additional Aboriginal sites would be present along the shoreline of the Leichhardt Municipality, and it was recommended that a general archaeological survey of this area be carried out (Huys *et al.* 1995 p. 87).

The only known Aboriginal sites within Leichhardt are located in two areas at Callan Point within the grounds of Rozelle Hospital, and at Yurulbin Point where sections of the natural shoreline have remained largely undisturbed.

Evidence of other sites which may have existed has been destroyed by extensive reclamation of the shoreline and development. Three other sites have been identified on private land. Two are midden sites located under rock overhangs and the other is an art site with hand stencils and a charcoal outline of a shark.

F2 Freeway (now Hills M2 Motorway)

An archaeological survey along the route of the F2 (now the Hills M2 Motorway) – Castlereagh Freeway located two rock shelters with archaeological deposit (Haglund 1989). Both shelters contained middens with oyster and whelk shell recorded, while one also had possible remnants of stencil art along the back wall.

The route of the Hills M2 Motorway upgrade was investigated by AECOM in 2009/2010 (AECOM 2010). The route extended from Lane Cove Road in North Ryde to Windsor Road at Baulkham Hills. Fifteen Aboriginal sites were located within the Hills M2 Motorway corridor.

Lane Cove National Park

A comprehensive survey of the Lane Cove River State Recreation Area, now known as Lane Cove National Park, was conducted as part of an archaeological study (Conyers 1990). About one-third of Lane Cove National Park study area was surveyed. Seven previously unrecorded Aboriginal sites were located including two engraving sites, two middens, and three rock shelters with cultural deposits. Five potential habitation sites were also recorded along with three engraving sites which had previously been recorded.

In 2000, Bobbie Oakley completed a survey for a proposed sewerage upgrade within Lane Cove National Park (Oakley 2000). Two new Aboriginal sites were located in the southern portion of the National Park. Both new sites were shell midden scatters and associated areas of PAD. It was recommended that the sewer line should be redirected to avoid these sites or, if this was not possible, that further archaeological work such as test excavation should be conducted.

In 2011, Artefact Heritage conducted a survey of an area along the northern edge of Stringybark Creek in Lane Cove West, about three kilometres west of the northern construction site (Artefact Heritage 2011). A previously recorded rock shelter with a charcoal drawing of two fish was relocated. Although the shelter had been disturbed by construction of a sewer pipe, the rock art was recorded as being in good condition. No new Aboriginal sites were located during the survey.

Delhi Road at Ryde

Wirrina Consulting conducted a survey for the widening of Delhi Road at Ryde by the Roads and Traffic Authority (Wirrina Consulting 1995). During the survey, a previously recorded rock shelter with midden was revisited and recorded.

Tessa Corkhill conducted an excavation of a rock shelter with PAD at Riverside Corporate Park (Corkhill 1997). The PAD was first located in 1991 and it was recommended at that time that further investigation would be required if the site was to be affected by development. Ten test pits were excavated to bedrock at depths varying from 47 centimetres to 18 centimetres. Fourteen stone artefacts were recovered, although the deposit was found to be relatively disturbed with evidence of European material throughout much of the profile.

Artefact Heritage prepared an archaeological assessment for the North Ryde Station Precinct for a rezoning study (Artefact Heritage 2012). That investigation concluded there were no recorded Aboriginal objects within the study area and that, overall, there was limited potential for archaeological significance.

Chatswood West

Total Earth Care (2007) conducted an Aboriginal heritage and archaeological assessment of a property at 126 Greville Street at Chatswood West. The study area was located on the western margin of the main Chatswood Ridge near to channels draining into the Lane Cove River. The study area is located about 1.3 kilometres north-west of the northern construction footprint for the Western Harbour Tunnel and Beaches Link program of works.

Although the study area was located next to Blue Gum Creek, a tributary of Lane Cove River, Total Earth Care did not identify any Aboriginal objects or areas of archaeological potential. It was noted that there were no suitable areas for occupation within the study area and that areas of occupation were likely to have been located closer to Lane Cove River (Total Earth Care 2007).

The results of the assessment are noteworthy for the current investigation, as they suggest increased intensity of Aboriginal occupation in areas with estuarine resources such as Lane Cove River and its major tributaries.

North West Rail Link and Epping to Thornleigh Third Track

Archaeological investigations conducted for the North West Rail Link (now Sydney Metro Northwest) included an initial assessment of an earlier version of the proposed corridor by JMcD CHM (JMcD CHM 2006) and a later Aboriginal heritage assessment as part of the environmental impact statement prepared for major civil construction works (GML & JMcD CHM 2012). The assessment prepared by JMcD CHM identified the rail corridor between Epping and Beecroft train stations as demonstrating low archaeological sensitivity. The areas around Epping Station investigated for the environmental impact statement were described as disturbed with a high level of surface impact and no potential for Aboriginal heritage (GML & JMcD CHM 2012). These sites were situated in a similar ridge crest landform context to the current north shore component of the study area.

An Aboriginal cultural heritage assessment prepared by Artefact Heritage for the Epping to Thornleigh Third Track project did not identify any Aboriginal sites and concluded that the entire rail easement

between Epping and Thornleigh demonstrated low/no archaeological potential (Artefact Heritage 2012b). During the Epping to Thornleigh Third Track construction works, several unexpected Aboriginal finds were encountered. These sites included three surface artefact concentrations and one isolated find. The artefacts were identified on similar ridge crest landforms that exist within the current study area. The landform location (ridge crest) and distance from water was interpreted to suggest low associated archaeological potential (Artefact Heritage 2014). The generally high levels of surface disturbance associated with rail infrastructure and residential development also justified the assessment of low archaeological potential and low archaeological significance for each site.

Port Jackson

Remains of campsites at the Burrill Lake archaeological site have been used to approximate the date of Aboriginal occupation of the Port Jackson area to over 20,000 years ago (Poiner 1980). Several sites including shell middens, engravings, burials, shelters with art and archaeological deposits and open middens have been identified in the Port Jackson area. A survey conducted by Morris (1986) located four previously unidentified sites and one previously recorded site. These included two open midden sites, three shelter/midden sites and one rock engraving (Morris 1986).

2.3 Summary

The review of existing archaeological assessments near the study area confirms its location within a highly urbanised environment that has been subject to substantial disturbance. Remnant pockets of archaeological sensitivity and PAD will be associated with relatively undisturbed landforms. It is also noted through the review of previous archaeological assessments near the study area that the Sydney region has previously been subject to extensive archaeological survey and recording.

A review of previous assessments near the study area suggest that in the Sydney Harbour geographic region study area increased archaeological sensitivity will be associated with waterways, creek lines, associated elevated terraces, sandstone outcrops and alluvial terraces. Typical site types associated with these landscapes will be rock shelters, grinding grooves, engravings, middens, burials, artefact scatters and campsites. Although most of the sites within this landscape will have been previously identified and recorded, there is some potential for sites or artefact deposits to be found where major landscape development has not occurred.

Information compiled in this background review of previous archaeological assessments relevant to the development of a predictive model for site location is discussed further in Section 3.3

3. Desktop assessment results and predictive model

This chapter details the desktop assessment results and the methodology used for the predictive model.

The aims of the archaeological desktop assessment were to:

- Identify any known Aboriginal heritage sites or Aboriginal cultural places with potential to be impacted by the project
- Identify areas where there are likely to be previously unknown Aboriginal heritage sites with potential to be impacted by the project
- Fulfil requirements 1–4 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (OEH 2011).

3.1 Methodology

In order to complete the desktop assessment, the heritage and spatial data relating to the study area was used to inform:

- A search and review of the relevant Aboriginal heritage register – the AHIMS
- Use of the ArcGIS system established for this assessment to analyse the following datasets:
  - Data from AHIMS
  - Heritage data from previous archaeological assessments
  - Aerial imagery
  - The assessment area (the study area)
  - Soil landscape data
  - Contour data (one metre intervals).

This spatial data was then used to determine the areas of the study area that were likely to be of archaeological sensitivity and require further assessment in the form of archaeological survey. Archaeological survey is recommended where:

- There are known Aboriginal heritage sites and Aboriginal cultural places
- Landforms of moderate to high potential archaeological sensitivity are identified based upon the predictive model developed in Section 3.3.

3.2 Database searches

A search of AHIMS, Commonwealth and State heritage registers and relevant Local Environmental Plan registers in relation to the study area was carried out by Andrew Costello (Senior Archaeologist, Jacobs) on 1 May 2017 and updated on 25 May 2018. The database registry search was based on a search area of 300 metres to provide detail on sufficient Aboriginal sites in the geographic region for the development of accurate predictive models.

The results of the AHIMS search are presented in Appendix B (AHIMS search results) and Table 3-1. In summary, a total of 20 Aboriginal sites were identified. Most of these sites featured more than one component. They include:

- Six rock engravings
- 11 rock shelter/occupation sites
- 15 middens

- A single hand stencil
- A single PAD.

Of the 20 registered Aboriginal sites identified, nine are located within the study area. A description of these sites is provided in Table 3-1.

Table 3-1 AHIMS sites within 300 metres of the study area

AHIMS ID	Site name	Site type	Located within study area
45-6-2287	Yerroulbin Cave	Shelter, rock engraving and midden	Yes
45-6-2147	Ivy Cliff (Waverton Park)	Shelter with midden	-
45-6-1268	Balls Head Reserve	Midden	-
45-6-1269	Waverton Park, Waverton	Midden	-
45-6-1270	Waverton Park, Waverton	Midden	Yes
45-6-1901	Long Nose Point 1; Birchgrove; 9 Numa Street	Midden	Yes
45-6-0628	Balls Head Reserve, Waverton	Rock engraving	-
45-6-1232	Balls Head Unbelievable Cave	Shelter with rock engraving	-
45-6-2180	Quarantine Cave; Waverton	Shelter with midden	Yes
45-6-2181	Waverton Park Cave	Shelter with midden	Yes
45-6-0891	Balls Head Reserve 5 Hands Cave	Shelter, rock engraving and midden	-
45-6-1809	Birchgrove	Shelter, rock engraving and midden	-
45-6-0906	Waverton Park	Shelter with rock engraving	-
45-6-0026	Whale rock	Rock engraving	Yes
45-6-2672	Shed Cave – Birchgrove	Shelter	Yes
45-6-2762	Coal Loader 1	Midden	Yes
45-6-2763	Caltex 2	Midden	-
45-6-2764	Caltex 1	Midden	-
45-6-2966	Balls Head shelter NSC-073	PAD, midden and shelter	-

AHIMS ID	Site name	Site type	Located within study area
45-6-2967	5 Hands Shelter B NSC-074	Shelter, rock engraving and midden	Yes

3.3 Predictive modelling

Following a search of AHIMS, review of the previous literature, and analysis of relevant archaeological reports and assessments, predictive summary statements can be made about different geographical locations within the study area.

Western Harbour (including Rozelle and North Sydney)

There are geographic regions within the study area that are typically directly next to shorelines zones. The following statements can be made about these regions:

- Elevated landforms next to foreshore at Balls Head possess high archaeological potential
- Sandstone rock shelters along the shoreline may contain engravings, middens, art, burials and sub–surface scatters of stone artefacts
- The most archaeologically sensitive landforms would be shoreline zones and spur crests bordering the harbour, although all elevated landforms would have some archaeological potential
- Where present, intact sub-surface archaeological deposits may contain stone artefacts located within the top 200–300 millimetres of sediment where soil is present above the sandstone bedrock
- The most common site type would be engravings, middens and rock shelters with associated sub-surface scatters of stone artefacts.

Sensitivity ratings for the predictive model shown in Table 3-2 reflect the likelihood for archaeological sites to occur within a geographic region, as well as indicating the potential significance of the sites. For example, a high rating shows that the areas with these specific landform characteristics are predicted to have a higher potential for the discovery of archaeological sites.

Table 3-2 Predictive model based on landscape regions for the identification of areas of high, moderate and low archaeological sensitivity

Geographic region	Sensitive landforms within geographic region	Sensitivity rating	Site types associated with landscape	Issues relating to assigning sensitivity ratings
Sydney Harbour (including Rozelle and North Sydney)	Beaches, rocky shorelines, sandstone outcrops, headlands	High	Rock shelters, engravings, art sites, middens, burials, artefact scatters, scarred trees	Sites likely to be already recorded, unlikely to be unknown rock shelters or middens or artefact deposits.

It should be noted that, while most of the study area is located within geographic regions that have a high archaeological sensitivity rating, this sensitivity would typically be extinguished due to urban development.

3.3.1 Expected site types

The predictive model for site types developed for the study area shows that certain site types are more likely to be prevalent. The degree of preservation and intactness will vary dependent on historical and current land use and the nature of the site.

Rock shelters/occupation sites: These sites will be located in areas of prominent sandstone outcrops and may include archaeological features such as art, stone artefacts, middens and archaeological deposit. They will typically be found close to the shoreline within the study area.

Rock engravings: These sites will be located in areas containing flat sandstone suitable for engravings. These locations will typically be associated with rock shelters or sandstone outcrops on ridgelines or elevated landforms. These locations may have become obscured by vegetation and may not be visible without exposing the ground surface.

Midden sites: These sites will occur in tidal estuarine foreshore zones (that is, within 10 metres of high water level) in areas not subject to notable landscape modification. Shell midden sites may be considerable distances from existing foreshore areas and may represent past foreshore environments.

3.4 Conclusions from the desktop assessment

The aims of the desktop assessment were to identify any known Aboriginal heritage sites or Aboriginal cultural places with potential to be impacted by the project and identify areas where there are likely to be previously unknown Aboriginal heritage sites with potential to be impacted by the project.

The desktop assessment has identified a total of 20 previously recorded AHIMS sites within 300 metres of the study area and a total of nine AHIMS sites within the study area itself (the construction footprint and within 50 metres of the construction footprint).

The most common Aboriginal sites within 300 metres of the study area include rock engravings, rock shelters/occupation sites (these sites typically contain various archaeological components) and shell middens. The predictive modelling developed for the study area suggests that Aboriginal sites are associated with different landform features found within the Sydney Harbour geographic region. The predictive modelling suggests that specific landform features within the study area will have a higher sensitivity rating. However, the potential for identifying new Aboriginal sites will depend on prior ground disturbance and urbanisation. The archaeological survey will focus on the locations of known Aboriginal sites as well as sensitive landforms associated with the Western Harbour geographic region in the study area (Table 3-2).

4. Archaeological survey

4.1 Aims

The aims of the archaeological survey were to identify and record any existing surface evidence of past Aboriginal activity within the study area or areas of PAD. This was completed to develop strategies for avoiding or mitigating potential harm to Aboriginal sites. This included the inspection of any previously registered Aboriginal sites located within or next to the study area, as listed in Table 4-1. On-site consultation with the nominated site officer from the Metropolitan Local Aboriginal Land Council (LALC) and the Roads and Maritime Aboriginal Heritage Officer enabled the development of recommendations for any further assessment (such as further investigation and test excavation) and management.

During the archaeological survey, all previously recorded AHIMS sites within the study area were visited where possible. The survey of the study area was conducted on foot and by vehicle. Notes about the ground surface visibility, integrity (land condition) and archaeological sensitivity were taken. All data was recorded on a hand-held GPS unit and photographs were taken. All Aboriginal archaeological sites/objects identified during the survey were recorded to a standard required by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). The results of the archaeological survey are presented in Table 4-3.

4.2 Timing and personnel

Field surveys were carried out during May and February 2017 with the nominated site officer from the Metropolitan LALC present during all surveys. Details of fieldwork activities and the participation of the nominated site officer are provided in Table 4-1.

Table 4-1 Field survey timing and personnel

Date	Survey area	Jacobs personnel	Roads and Maritime personnel	Aboriginal stakeholder involvement
16 May 2017	Balls Head, Yurulbin Park, Berrys Bay	Andrew Costello	Mark Lester	Selina Timothy
2 February 2018 (boat survey)	Balls Head, Yurulbin Park, Berrys Bay, Birchgrove	Andrew Costello, Deb Farina	Lee Davison, Warwick Scott	Selina Timothy
15 February 2018	Berrys Bay (second survey at location to access previously fenced off area)	Deb Farina, Jane Rodd (ecologist), Laura Hoffman (ecologist)	-	-

4.3 Survey sampling strategy and methodology

In line with Requirement 5 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (OEH 2010b), the archaeological survey adopted a sampling strategy which targeted each distinct landform within a given soil landscape. Where the predictive model determined landforms of high potential archaeological sensitivity (refer to Table 3-2), these landforms were targeted for full survey coverage with an awareness of the likelihood of certain site types potentially occurring within particular landforms. Full coverage of the study area within landforms was carried out with the nominated site officer from Metropolitan LALC where possible. The sampling strategy had the following directives:

- Areas of higher visibility and exposures of the ground surface were targeted for particular scrutiny for the presence of engravings, midden material and stone artefacts
- Water margins were targeted for the presence of midden material
- All mature trees in the study area were inspected for cultural modification and scarring
- Hawkesbury Sandstone outcrops and escarpments located in association with Western Harbour landforms were targeted to assess potential for Aboriginal rock shelter sites and engravings
- Undisturbed parts of the study area in association with sensitive landforms (ie waterways) were targeted to assess presence of PAD.

The methodology for the archaeological survey consisted of:

- Pedestrian survey with nominated site officers from Metro LALC, which was carried out via transects (linear survey unit) with the field team walking parallel in about five metre intervals as ground conditions allowed, so that the survey of the study area was carried out by traversing the area in a systematic manner
- Mapping archaeological sites and PADs identified and survey transects into a Geographic Information System database
- Recording the following details for each surveyed area:
- Landform
- Ground surface exposure and nature of exposure
- Visibility as a result of vegetation
- Degree of disturbance
- Nature of current and historical land use.

AHIMS site recording forms were completed for any new Aboriginal site and PAD recorded and submitted to AHIMS.

4.4 Constraints

The information detailed in AHIMS site cards contains several examples of locational errors and many site record cards lack detail. AHIMS 45-6-2287, 45-6-1901, 45-6-2967 and 45-6-2672 were unable to be relocated due to private property constraints.

4.5 Results

Based on the results of the desktop assessment (refer to Table 4-3), all accessible areas within the study area recommended for archaeological site survey were surveyed in partnership with a representative from the Metropolitan LALC. Constraints on survey coverage included lack of private property access to adequately assess 5 Hands Shelter (45-6-2967), Yerroulbin Cave (45-6-2287), Long Nose Point (45-6-1901) and Shed Cave (45-6-2672).

Several previously registered sites located within the study area were re-inspected. Details of all the sites re-inspected can be found in Table 4-4. Additional details of the survey results are presented in Appendix E (Survey results). Mapping with the location of survey areas can be found in Appendix D (Archaeological survey areas). No new Aboriginal cultural heritage sites were identified during the archaeological survey, and no areas containing PAD were identified.

Due to no areas of PAD being identified in the study area, there was no requirement for test excavation works to occur. The Western Harbour Tunnel and Beaches Link program of works archaeological methodology (Carr and Costello 2017) detailed this finding and has been approved by RAPs.

4.5.1 Visibility, exposure and coverage

The detection of Aboriginal sites and cultural material is dependent upon ground surface visibility. Ground surface visibility is also affected by erosional processes and surface vegetation. Effective survey coverage calculations try to quantify the efficacy of the survey. The following formula for quantifying effective survey coverage (Witter 1990) was used to calculate effective coverage for the activity area (refer also to Table 4-2):

EC = (a) x (e) x (v) x (b), where:

- EC = effective coverage
- a = area surveyed in square metres
- e = erosion
- v = visibility
- b = background effect.

Table 4-2 Effective coverage rating definitions

Erosion rating (the index of sedimentation)	Visibility rating (estimation of the percentage of bare ground)	Background effect (measure of the occurrence of materials that impedes the detection of cultural deposits)
e	**v**	**b**
0.1 = aggrading surface 0.5 = stable surface 1.0 = degrading surface	0.1 = negligible visibility 0.2 = (1–25%) 0.3 = (26–50%) 0.4 = (51–75%) 0.5 = (76–99%) 1.0 = 100%	0.1 = high 0.5 = medium 1.0 = low

Approximately 100 per cent of the targeted survey areas detailed in Table 4-3 were surveyed during the standard assessment. Visibility fluctuated throughout the activity area dependent on vegetation coverage but was generally poor due to grass coverage. Visibility at times improved at survey locations associated with sandstone outcrops. However, these were typically covered in vegetation. The average total effective survey coverage was low, at 6.8 per cent (Table 4-3).

Table 4-3 Archaeological survey results summary

Targeted survey area based on predictive modelling	Total surveyed area (m²)	Erosion rating (e)	Visibility rating (v)	Background rating (b)	Effective survey coverage (m²)	Effective survey coverage (%)	Field survey results
Yurulbin Park	11,700	0.5	0.2	0.5	585	5	No Aboriginal cultural heritage or PAD identified. Property access constraints for inspecting known sites.
Balls Head and surrounds	23,200	0.5	0.3	0.5	1740	7.5	Several known sites re-inspected. No new Aboriginal cultural heritage or PAD identified.
St Leonards Park	31,500	0.5	0.2	0.5	1575	5	No Aboriginal cultural heritage or PAD identified.
Cammeray Golf Club	17,700	0.5	0.2	1.0	1770	10	No Aboriginal cultural heritage or PAD identified.
ANZAC Park	16,000	0.5	0.3	0.5	1200	7.5	No Aboriginal cultural heritage or PAD identified.
Total	**100,100**				**6870**		

Table 4-4 Sites re-inspected during the archaeological survey

AHIMS ID	Site name	Site type	Located within study area
45-6-0026	Whale rock	Rock engraving	Yes
45-6-2763	Caltex 2	Midden	-
45-6-1232	Balls Head Unbelievable Cave	Rock shelter with rock engraving	-
45-6-0628	Balls Head Reserve, Waverton	Rock engraving	-
45-6-0891	Balls Head Reserve 5 Hands Cave	Rock shelter with hand stencil	-
45-6-2180	Quarantine Cave, Waverton	Rock shelter with midden	Yes
45-6-2764	Caltex 1	Midden	-
45-6-2181	Waverton Park Cave	Rock shelter with midden	Yes
45-6-1270	Waverton Park, Waverton	Midden	Yes
45-6-2672	Coal Loader 1	Midden	Yes

5. Significance assessment

5.1 Methodology

5.1.1 Basis for assessment

A significance assessment is made up of several significance criteria that attempt to define why a site is important. Such assessment recognises that sites may be important for different reasons to different people and even at different times. The assessment of Aboriginal cultural heritage in this assessment is based upon the four values of the Australia ICOMOS Burra Charter (Australia ICOMOS 2013).

- Social values
- Historical values
- Scientific values
- Aesthetic values.

Each of these values is assessed below for Aboriginal sites in the study area, and an overall significance is assigned based on an average across the values. This is inherently a reductive process, and oversimplifies what is important for different reasons to a range of different stakeholders, but is a necessary process in being able to create comparative values between sites. The significance of each site ultimately informs the management of sites and places.

It should be noted that only existing Aboriginal sites within the study area have been assessed for significance.

5.1.2 Social significance

The significance of a heritage item does not relate only to its scientific or research value. Aboriginal people's views on the significance of archaeological sites are usually related to traditional, cultural and educational values, although some Aboriginal people also value any scientific information a site may be able to provide.

Aboriginal cultural significance was assessed from consultation with the nominated site officers for the relevant RAPs during and following field assessments. It should be noted that Aboriginal significance assessed in this manner may not reflect the views of all members of the community.

5.1.3 Historic significance

The historic value of a site is determined through its association with historically important people, events or activities.

5.1.4 Scientific significance

Research potential or scientific significance of an Aboriginal archaeological site can be assessed by using the criteria set out below. Each criterion is rated as low, moderate or high.

- Site integrity – The integrity of a site refers to its state of preservation, or condition. A site can be disturbed through a number of factors including natural erosion processes, destructive land use practices or repeated use of a site in the past by both humans and animals
- Site structure – Structure refers to a site's physical dimensions, that is, size and stratigraphy. A large site or a site with stratified deposits has more research potential than small sites or surface scatters. Sometimes,

however, specific research questions may be aimed at smaller sites, in which case they would be rated at a higher significance than normal. Site structure cannot be assessed for scarred trees or isolated artefacts

- Site contents – This category refers to the range and type of occupation debris found in a site. Generally, complex art sites, extensive quarries with associated debris and surface sites that contain a large and varied amount of organic and non-organic materials are considered to have greater research potential than those sites with small, uniform artefacts, single motif art sites and small quarries with little or no debris. For scarred trees, contents may refer to the size and type of scar and how many scars there are on the one tree
- Representativeness and rarity – Representativeness refers to how much variability exists between the subject site and others inside or outside the subject area. It also considers the types of sites already conserved in the area and how much connectivity between sites exists. Rarity considers how often a particular site type occurs in an area. Assessment of representativeness and rarity requires some knowledge of the background archaeology of the area or region in which a study is being carried out. Rarity also relates to whether the subject site or area is important in demonstrating a distinctive way of life, custom, process, land use, function or design which is no longer practiced (OEH 2011).

5.1.5 Aesthetic significance

This refers to the sensory value of a place, and can include aspects such as form, texture and colour, as well as the smell and sound elements associated with use or experience of a site (Australia ICOMOS 2000). Additionally, in the context of the current investigation, the aesthetic significance may also relates to a setting that allows its place in a larger and more complex landscape to be better understood and appreciated. Aesthetic significance can be closely linked to the social value of a site.

5.1.6 Scale of significance

Significance of sites and places is assigned to different geographic scales, such as local, regional, state and national, appropriate to the scale of importance. For example, K'Garri (Fraser Island) is significant at a national (and world) scale, whereas a local historic building may only be significant on a local scale. This is reflected in the variety of heritage lists held by local councils, up to state and federal government. In scale of significance, the criteria presented above as well as educational or research potential, representativeness and rarity (Australia ICOMOS 2000) have been considered in determinations of significance.

Each site has been assessed and its scale of significance has been identified as being of importance at the State, regional or local level. Each site has also been given a grading of its significance overall based on the grading of each of the individual values. The grading of low, moderate and high has been assigned comparatively across the sites investigated in the region.

5.2 Statements of significance

Significance assessments for the five Aboriginal sites identified during the cultural heritage assessment of the study area are presented in the tables below.

5.2.1 Waverton Park Cave (45-6-2181)

Table 5-1 Statement of significance – Waverton Park Cave (45-6-2181)

Criterion	Assessment
Social significance	Consultation with RAPs has identified that all Aboriginal cultural heritage values within the study area are considered to be of high cultural (social) significance (refer to consultation in Chapters 3 and 5 of the ACHAR). This is particularly the case for Waverton Park Cave, which is a rock shelter with midden site. The site has high social significance at the local level as it provides tangible

Criterion	Assessment
	evidence of the use of the area by Aboriginal people and because it is a multi-component site (shelter and midden).
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having moderate integrity, moderate structure, potential sub-surface deposit, and high representativeness/rarity. The integrity and structure of the site is moderate as the site may have been subject to disturbance as a result of being located within an urban environment. There is also evidence of further disturbance to site integrity through the presence of a fallen slab in the north-east of the shelter. The site is made up of more than one component (midden and rock shelter), which increases the scientific significance.
Aesthetic significance	The site has moderate aesthetic significance at the local level as it is a rock shelter near Sydney Harbour and has a pleasant east-facing perspective.
Summary statement of significance	Waverton Park Cave is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its integrity and structure, high representativeness and rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

5.2.2 Waverton Park (45-6-1270)

Table 5-2 Statement of significance – Waverton Park (45-6-1270)

Criterion	Assessment
Social significance	Waverton Park is a shell midden located in a highly urbanised environment. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having low-moderate integrity, moderate structure, potential sub-surface deposit, and high representativeness/rarity. The integrity and structure of the site is moderate as the site is likely to have been subject to disturbance as a result of being located within an urban environment. While shell middens are not uncommon Aboriginal sites, they are rare in Sydney Harbour near the study area due to development and associated disturbance of archaeological sites.
Aesthetic significance	The site has low aesthetic significance at the local level as it is located within a heavily developed urban environment.
Summary statement of significance	Waverton Park is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its high representativeness and rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

5.2.3 Coal Loader 1 (45-6-2762)

Table 5-3 Statement of significance – Coal Loader 1 (45-6-2762)

Criterion	Assessment
Social significance	Coal Loader 1 is made up of shell, non-human bone and organic material. The shell is on a slope with a stone floor and butchered animal bone present. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate scientific significance at the local level as it is ranked as having low-moderate integrity, low-moderate structure, and high representativeness/rarity. The integrity and structure of the site is low-moderate as the site is likely to have been subject to disturbance as a result of being located under a residence within an urban environment. While shell middens and butchery debris are not uncommon Aboriginal site types, they are rare in the Western Harbour region due to development and associated disturbance of archaeological sites. Coal Loader 1 is therefore ranked as having a high representativeness/rarity.
Aesthetic significance	The site does not meet this criterion.
Summary statement of significance	Coal Loader 1 is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate scientific significance due to its high representativeness and rarity although it is likely the site is disturbed due to its location under a residence. The site has moderate-high research and educational potential about the manner in which local Aboriginal populations lived in the area.

5.2.4 Whale Rock (45-6-0026)

Table 5-4 Statement of significance – Whale Rock (45-6-0026)

Criterion	Assessment
Social significance	Whale Rock is made up of a series of rock engravings. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people.
Historical significance	The site has been referred to in historical sources (Campbell 1899). It is a well-known rock engraving in the Sydney Harbour region and has been analysed and recorded several times over the past 150 years. It therefore should be considered to have high historical significance.
Scientific significance	The site has high scientific significance at the local level as it is ranked as having moderate-high integrity, high structure, and high representativeness/rarity. The integrity and structure of the site is moderate-high, as part of the rock surface was destroyed during construction of Balls Head Drive.
Aesthetic significance	The site has high aesthetic significance at the local level as it is a variety of rock engravings at Berrys Bay on Sydney Harbour with a pleasant west-facing site aspect.
Summary statement of significance	Whale Rock is of high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has high scientific significance due to its high representativeness and rarity. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

5.2.5 Quarantine Cave: Waverton (45-6-2180)

Table 5-5 Statement of significance – Quarantine Cave: Waverton (45-6-2180)

Criterion	Assessment
Social significance	Quarantine Cave: Waverton consists of a small north-facing rock shelter and a sandy shell midden floor. The site has high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people and because it is a multi-component site (shelter and midden).
Historical significance	The site does not meet this criterion. There are no known written or oral historical references to the site.
Scientific significance	The site has moderate-high scientific significance at the local level as it is ranked as having moderate integrity, moderate structure, potential sub-surface deposit and high representativeness/rarity. The integrity and structure of the site is moderate as the site is likely to have been subject to disturbance through more recent European use. This is evident through the presence of lumps of coal identified in surface material. While rock shelter and shell middens are not uncommon Aboriginal site types, they are rare in the Western Harbour region due to development and associated disturbance of archaeological sites. The Aboriginal site is also a multi-component site (shelter and midden) which adds further scientific significance.
Aesthetic significance	The site has moderate aesthetic significance at the local level as it is a rock shelter near Sydney Harbour and has a pleasant, north-facing perspective.
Summary statement of significance	Quarantine Cave: Waverton is of moderate-high significance at the local level. It is of high social significance at the local level as it provides tangible evidence of the use of the area by Aboriginal people. It has moderate-high scientific significance due to its high representativeness/rarity and potential for sub-surface archaeological deposit. The site has high research and educational potential about the manner in which local Aboriginal populations lived in the area.

5.3 Summary of significance

The summary of the significance assessment of Aboriginal sites located within the study area is presented below in Table 5-6. Mapping of all Aboriginal sites identified within the study area is presented in Figure 4-1 and Figure 4-2 of the ACHAR.

Table 5-6 Summary of the significance assessment for identified Aboriginal sites located within the study area

Name (AHIMS ID)	Social significance	Historical significance	Scientific significance	Aesthetic significance	Overall significance
Waverton Park Cave (45-6-2181)	High	N/A	Moderate-high	Moderate	Moderate-high
Waverton Park (45-6-1270)	High	N/A	Moderate-high	Low	Moderate-high
Coal Loader 1 (45-6-2762)	High	N/A	Moderate	N/A	Moderate-high
Whale Rock (45-6-0026	High	High	High	High	High
Quarantine Cave: Waverton	High	N/A	Moderate-high	Moderate	Moderate-high

Name (AHIMS ID)	Social significance	Historical significance	Scientific significance	Aesthetic significance	Overall significance
(45-6-2180)					
Sites unable to be inspected due to private property constraints					
Five Hands Shelter (45-6-2967)	All sites unable to be visited during assessment are suggested to hold high overall significance. Significance will be assessed and updated once access is available.				
Yerroulbin Cave (45-6-2287)					
Long Nose Point (45-6-1901)					
Shed Cave (45-6-2672)					

5.3.1 Potential Submerged Sites Significance Assessment

The Potential Submerged Sites Assessment (Appendix E, ACHAR) contains a significance assessment for potential submerged sites.

This examines the proposed tunnel alignment on the floor of the Harbour. Using modelling based on remote sensing information, it identifies the sensitivity of different zones based on the likelihood that they retain archaeological deposits pre-dating sea-level rise. Any Aboriginal sites or artefacts that predate sea level rise are likely to hold high archaeological and cultural significance.

Any potential submerged Aboriginal archaeological sites are likely to have very high scientific significance due to the potential to yield information that would contribute to an understanding of the NSW natural and cultural history. Submerged Aboriginal archaeological sites and Pleistocene Aboriginal archaeological sites are both, on their own, rare site types within a NSW context. The identification of submerged Pleistocene landscapes and associated Aboriginal archaeological resources would be an extremely rare discovery within Australia.

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Appendix A. Glossary

Aboriginal cultural heritage: The material (objects) and intangible (mythological places, dreaming stories etc) traditions and practices associated with past and present day Aboriginal communities.

Aboriginal Cultural Heritage Assessment Report: A report combining an Aboriginal archaeological assessment and Aboriginal cultural assessment, required to be submitted to the Office of Environment and Heritage for any Part 6 *National Parks and Wildlife Act 1974* approval or prepared for projects under Part 5.1 of the *Environmental Planning and Assessment Act 1979* where Aboriginal cultural heritage is identified as a key issue.

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 s.94 of the *National Parks and Wildlife Act 1974*.

Aboriginal Focus Group (AFG): This refers to organised meetings where RAPs can be consulted on Roads and Maritime projects.

Angular fragment: A flaked piece of stone that does not have characteristic features which allow for it to be positively identified as a flake, core or tool.

Archaeological site: A location that has evidence of past Aboriginal activity (both material and mythological/ritual).

Area of archaeological sensitivity: A part of the landscape that contains demonstrated occurrences of cultural material. The precise level of sensitivity will depend on the density and significance of the material.

Artefact scatter: Where two or more stone artefacts are found within an area of potential archaeological deposit or a site.

Geomorphic: Relating to the structure, shape and development of landforms.

Hinge termination: A hinge termination occurs when “the fracture meets the surface of the core at approximately right angles to the longitudinal axis of the flake” (Holdaway and Stern 2008:130). This can present as a rounded surface that curves downwards at the distal end of a flake.

Humic: Soil that contains organic matter (from ‘humus’).

In situ: A description of any cultural material that lies undisturbed in its original point of deposition.

Layer: In stratigraphy, it is used to describe a horizon (soil, rock, charcoal) that is distinct from its surrounds.

Midden: The term midden is a Danish word meaning a mound of kitchen refuse. In archaeological terms, a midden refers to an accumulation of shell deposited after people had collected and eaten shellfish. These could contain estuarine and fresh water shellfish species in addition to faunal remains, stone artefacts and charcoal from cooking fires. In many areas of northern NSW, burials have been recorded in direct association with midden deposits.

Potential archaeological deposit (PAD): A PAD is a location that is considered to have a potential for sub-surface cultural material. This is determined from a visual inspection of the site, background research of the area and the landform's cultural importance.

Registered Aboriginal Parties (RAPs): Members of a local Aboriginal land council, Aboriginal groups or other Aboriginal people who have registered their interest with Roads and Maritime to be consulted about a proposed project or activity.

Scarred trees: Trees that feature Aboriginal derived scars are distinct due to the scar's oval or symmetrical shape and the occasional use of steel, or more rarely, stone axe marks on the scar's surface. Scarred trees are identified by the purposeful removal of bark for use in the manufacture of artefacts such as containers, shields and canoes. The bark was also used for the construction of shelters. Other types of scarring include toeholds cut in the trunks or branches of trees for climbing purposes and the removal of bark to indicate the presence of burials in the area.

Sub-surface testing: An archaeological method used to determine the cultural sensitivity of an area by excavating small (0.5 metre x 0.5 metre) pits and recording the stratigraphy, material remains (such as stone tools) and disturbance.

TP: Acronym for 'test pit'. Generally, this refers to a 1-metre x 1-metre or 2-metre x 1-metre pit dug by shovel, trowel or mattock. Test pits were used to determine the extent of possible features (such as shell middens) in a controlled excavation of 50-millimetre spits.

Visibility: Refers to the degree to which the surface of the ground can be observed. This may be influenced by natural processes such as wind erosion or the character of the native vegetation, and by land use practices, such as ploughing or grading. It is generally expressed in terms of the percentage of the ground surface visible for an observer on foot.

Appendix B. AHIMS search results

Search results based on 300-metre search area around entire Western Harbour Tunnel and Beaches Link program of works construction footprint.

Office of Environment & Heritage

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : IA146500/4540
Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-2222	Clive Park 4;Northbridge;	AGD		Information redacted due to site location sensitivity		Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	1809
	Contact	Recorders						Permits		
45-6-2227	Beauty Point 9;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders						Permits		
45-6-2228	Beauty Point 8;Beauty Point;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	2025
	Contact	Recorders						Permits		
45-6-2278	Lilyfield Cave	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	102201
	Contact	Recorders						Permits		
45-6-2287	Yerroulbin Cave	AGD				Closed site	Valid	Shell : -, Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Midden	
	Contact	Recorders						Permits		
45-6-2147	Ivy Cliff (Waverton Park)	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	1809
	Contact	Recorders						Permits		
45-6-0271	Clive Park;Northbridge;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders						Permits		
45-6-2049	Bantry bay 1;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	1809,102473
	Contact	Recorders						Permits		
45-6-2072	Iron works cave;Dalton's Iron Store;(duplicate copy of 45-6-2223)	AGD				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	1809
	Contact	Recorders				F Mann		Permits		
45-6-1267	Balls Head Reserve	GDA				Open site	Valid	Shell : -, Artefact : -	Midden	1809
	Contact	Recorders				boriginal Heritage Office		Permits		
45-6-1269	Waverton Park Waverton	GDA				Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders				itage Office		Permits		
45-6-1270	Waverton Park Waverton	GDA				Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders				boriginal Heritage Office		Permits		
45-6-1271	Lavender Bay Milsons Point	GDA				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders				ge Office		Permits		
45-6-1901	Long Nose Point 1.;Birchgrove;9 Numa Street;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders						Permits		

Report generated by AHIMS Web Service on 24/05/2018 for Chelsea Jones for the following area at Search using shape-file WHTBL_AH_300mBufferProjectFootprinPOSTGOLD_Jacobs20180524.SHP with a buffer of 0 meters. Additional Info : Requested by Al - approved by Caitlin. Number of Aboriginal sites and Aboriginal objects found is 83

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : IA146500/4540
Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-0628	Balls Head Reserve Waverton	GDA		Information redacted due to site location sensitivity		Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**				Phil Hunt,Mr.R Taplin,Aboriginal Heritage Office		**Permits**		
45-6-0630	Berry Bay Balls Head Reserve; Campbells Cave	GDA				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**				,Mr.Phil Hunt,Aboriginal Heritage Office		**Permits**		
45-6-2111	Clive Park 3;	AGD				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**						**Permits**		
45-6-0645	Northbridge;Mowbray Point;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**						**Permits**		
45-6-0646	Northbridge;Mowbray Point;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**						**Permits**		
45-6-0654	Clive Park One;Northbridge;	AGD				Closed site	Valid	Shell : -, Artefact : -, Art (Pigment or Engraved) : -, Burial : -	Burial/s,Shelter with Art,Shelter with Midden	1809
	Contact	**Recorders**				K Cutmore		**Permits**		
45-6-0655	Frenchs Forest;Bantry Bay Road;	GDA				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	2183,2184,102473
	Contact	**Recorders**						**Permits**	347	
45-6-1232	Balls Head Unbelievable Cave	GDA				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**				riginal Heritage Office		**Permits**		
45-6-1234	Bluff Head;Foot Cave;	GDA				Closed site	Valid	Shell : -, Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Midden	
	Contact	**Recorders**						**Permits**		
45-6-1237	Yarra Bay;Captain Phillip Monument;	GDA				Open site	Valid	Shell : -, Artefact : -	Midden	274,102147
	Contact	**Recorders**				t,Aboriginal Heritage Office		**Permits**		
45-6-1987	Beauty Point 6;Beauty Point;	AGD				Closed site	Valid	Art (Pigment or Engraved) : -, Shell : -, Artefact : -	Shelter with Art,Shelter with Midden	2025
	Contact	**Recorders**				er		**Permits**		
45-6-1988	Beauty Point 7;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	**Recorders**				er		**Permits**		
45-6-1989	Beauty Point 4;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	2025

Report generated by AHIMS Web Service on 24/05/2018 for Chelsea Jones for the following area at Search using shape-file WHTBL_AH_300mBufferProjectFootprinPOSTGOLD_Jacobs20180524.SHP with a buffer of 0 meters. Additional Info : Requested by AI - approved by Caitlin. Number of Aboriginal sites and Aboriginal objects found is 83

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : IA146500/4540

Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders						Permits		
45-6-2180	Quarantine Cave;Waverton;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders				original Heritage Office		Permits		
45-6-2181	Waverton Park Cave;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders				original Heritage Office		Permits		
45-6-2025	Sangrado Reserve 1;	GDA				Open site	Valid	Artefact : -, Shell : -	Midden,Open Camp Site	
	Contact	Recorders						Permits		
45-6-2037	Pearl Bay;Beauty Point 9;	AGD				Open site	Valid	Artefact : -	Open Camp Site	2025
	Contact	Recorders						Permits		
45-6-0963	Frenchs Forest;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	254,102473
	Contact	Recorders				logists,Mr.R Taplin		Permits		
45-6-0662	Frenchs Forest;Bantry Bay;Wakehurst Parkway;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	102473
	Contact	Recorders						Permits		
45-6-0666	Frenchs Forest;Frenchs Forest Road;	GDA				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders						Permits		
45-6-0884	Middle Harbour Creek;East Lindfield;Switching Station Shelter;dredged shell;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	2047
	Contact	Recorders						Permits		
45-6-0891	Balls Head Reserve 5 Hands Cave	GDA				Closed site	Valid	Shell : -, Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Midden	
	Contact	Recorders				il Hunt,Aboriginal Heritage Office		Permits		
45-6-0899	Balgowlah;Bantry;	AGD				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	102473
	Contact	Recorders						Permits		
45-6-1978	Pearl Bay 1;Beauty Point;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	2025
	Contact	Recorders						Permits		
45-6-1979	Pearl Bay 2;Beauty Point;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1980	Pearl Bay 3;Beauty Point;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		

Information redacted due to site location sensitivity

Margrit Koettig,Michael Guider

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Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-1981	Pearl Bay 4;Beauty Point;	AGD	Information redacted due to site location sensitivity			Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1982	Pearl Bay 5;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1983	Beauty Point 1;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1984	Beauty Point 2;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1985	Beauty Point 3;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	2025
	Contact	Recorders						Permits		
45-6-1986	Beauty Point 5;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	2025
	Contact	Recorders						Permits		
45-6-0964	Balgowlah	GDA				Open site	Destroyed	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders						Permits		
45-6-0965	Balgowlah;200 FT Cave;	GDA				Closed site	Destroyed	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders						Permits		
45-6-1808	Seaforth;	GDA				Open site	Valid	Shell : -, Artefact : -, Burial : -	Burial/s,Midden	
	Contact	Recorders						Permits		
45-6-1809	Birchgrove	AGD				Closed site	Valid	Shell : -, Artefact : -, Art (Pigment or Engraved) : -	Midden,Shelter with Art	
	Contact	Recorders						Permits		
45-6-1700	Munro Park A.G.G.;	AGD				Open site	Valid	Grinding Groove : -	Axe Grinding Groove	1293
	Contact	Recorders						Permits		
45-6-0906	Waverton Park	AGD				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders						Permits		
45-6-0825	Myrtle Street	AGD				Open site	Not a Site	Art (Pigment or Engraved) : -	Not an Aboriginal Site	
	Contact	Recorders						Permits		

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Your Ref/PO Number : IA146500/4540
Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-0026	Whale rock	GDA				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders				trec,Mr.Phil Hunt,Aboriginal Heritage Office		Permits	2885	
45-6-0027	Balls Head Berry Island	GDA				Closed site	Valid	Art (Pigment or Engraved) : -, Shell : -, Artefact : -, Burial : -	Burial/s,Shelter with Art,Shelter with Midden	
	Contact	Recorders				Aboriginal Heritage Office		Permits		
45-6-0992	Chatswood;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders						Permits		
45-6-0993	Chatswood;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders						Permits		
45-6-0994	Chatswood;	AGD				Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders						Permits		
45-6-0995	Chatswood;	AGD				Closed site	Valid	Shell : -, Artefact : -	Shelter with Midden	
	Contact	Recorders						Permits		
45-6-0996	Clive Park Two;Northbridge;Cicada Pupa Cave	AGD				Closed site	Valid	Art (Pigment or Engraved) : -, Shell : -, Artefact : -	Shelter with Art,Shelter with Midden	1809
	Contact	Recorders				K Cutmore		Permits		
45-6-1002	Balgowlah;	AGD				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders						Permits		
45-6-1003	Frenchs Forest;	AGD				Closed site	Valid	Artefact : -	Shelter with Deposit	102473
	Contact	Recorders						Permits		
45-6-1004	Frenchs Forest;	AGD				Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	Recorders						Permits		
45-6-1587	Seaforth	GDA				Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	Recorders						Permits		
45-6-2672	Shed Cave - Birchgrove	AGD				Closed site	Valid	Habitation Structure : 1		
	Contact	Recorders						Permits		

Information redacted due to site location sensitivity

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Your Ref/PO Number : IA146500/4540
Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-2762	Coal Loader 1	AGD				Closed site	Valid	Shell : -, Non-Human Bone and Organic Material : -		
	Contact T Russell	Recorders				ologists,Mr.Phil Hunt,Aboriginal Heritage Office		Permits		
45-6-2763	Caltex 2	AGD				Closed site	Valid	Shell : -		
	Contact T Russell	Recorders				ologists		Permits		
45-6-2764	Caltex 1	AGD				Closed site	Valid	Shell : -		
	Contact T Russell	Recorders				ologists,Mr.Phil Hunt,Aboriginal Heritage Office		Permits		
45-6-2817	Beauty Point 14	AGD				Open site	Valid	Earth Mound : 1		
	Contact S Scanlon	Recorders						Permits		
45-6-2940	Rock engraving (Garigal National Park)	GDA				Open site	Valid	Art (Pigment or Engraved) : -		102473
	Contact	Recorders						Permits		
45-6-2966	Balls Head shelter NSC-073	GDA				Open site	Valid	Potential Archaeological Deposit (PAD) : -, Shell : -		
	Contact	Recorders				riginal Heritage Office		Permits		
45-6-2967	5 Hands Shelter B NSC-074	GDA				Open site	Valid	Shell : -		
	Contact	Recorders				riginal Heritage Office		Permits		
45-6-2961	Balls Head Midden NSC-058	GDA				Open site	Valid	Shell : -		
	Contact	Recorders				ge Office		Permits		
45-6-3076	Adderstone Shelter 2 NSC-082	GDA				Open site	Valid	Shell : 1		
	Contact	Recorders						Permits		
45-6-3077	Adderstone Shelter 1 NSC-081	GDA				Open site	Valid	Shell : 1		
	Contact	Recorders						Permits		
45-6-3011	Clive Park Midden WILL 169	GDA				Open site	Valid	Shell : 1		
	Contact	Recorders						Permits		
45-6-3012	Clive Park 8, Shelter Midden WILL 170	GDA				Closed site	Valid	Shell : -		
	Contact	Recorders						Permits		
45-6-3032	Wakehurst Engraving MAN 104	GDA				Open site	Valid	Art (Pigment or Engraved) : 1		
	Contact	Recorders						Permits		
45-6-3033	JAF Fenwick Engraving MAN 105	GDA				Open site	Valid	Art (Pigment or Engraved) : 1		
	Contact	Recorders						Permits		

Information redacted due to site location sensitivity

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Your Ref/PO Number : IA146500/4540
Client Service ID : 346930

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-3164	Trefoil Creek 1	GDA		Information redacted due to site location sensitivity		Open site	Valid	Art (Pigment or Engraved) : -		
	Contact	Recorders						Permits		
45-6-3361	FLAT ROCK CREEK PAD	GDA				Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders				(Australia) Pty Ltd - North Sydney		Permits		
45-6-3362	ARTARMON PARK PAD	GDA				Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders				(Australia) Pty Ltd - North Sydney		Permits		
45-6-3363	BURNT BRIDGE CREEK PAD	GDA				Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders				(Australia) Pty Ltd - North Sydney		Permits		

Report generated by AHIMS Web Service on 24/05/2018 for Chelsea Jones for the following area at Search using shape-file WHTBL_AH_300mBufferProjectFootprinPOSTGOLD_Jacobs20180524.SHP with a buffer of 0 meters. Additional Info : Requested by AI - approved by Caitlin. Number of Aboriginal sites and Aboriginal objects found is 83

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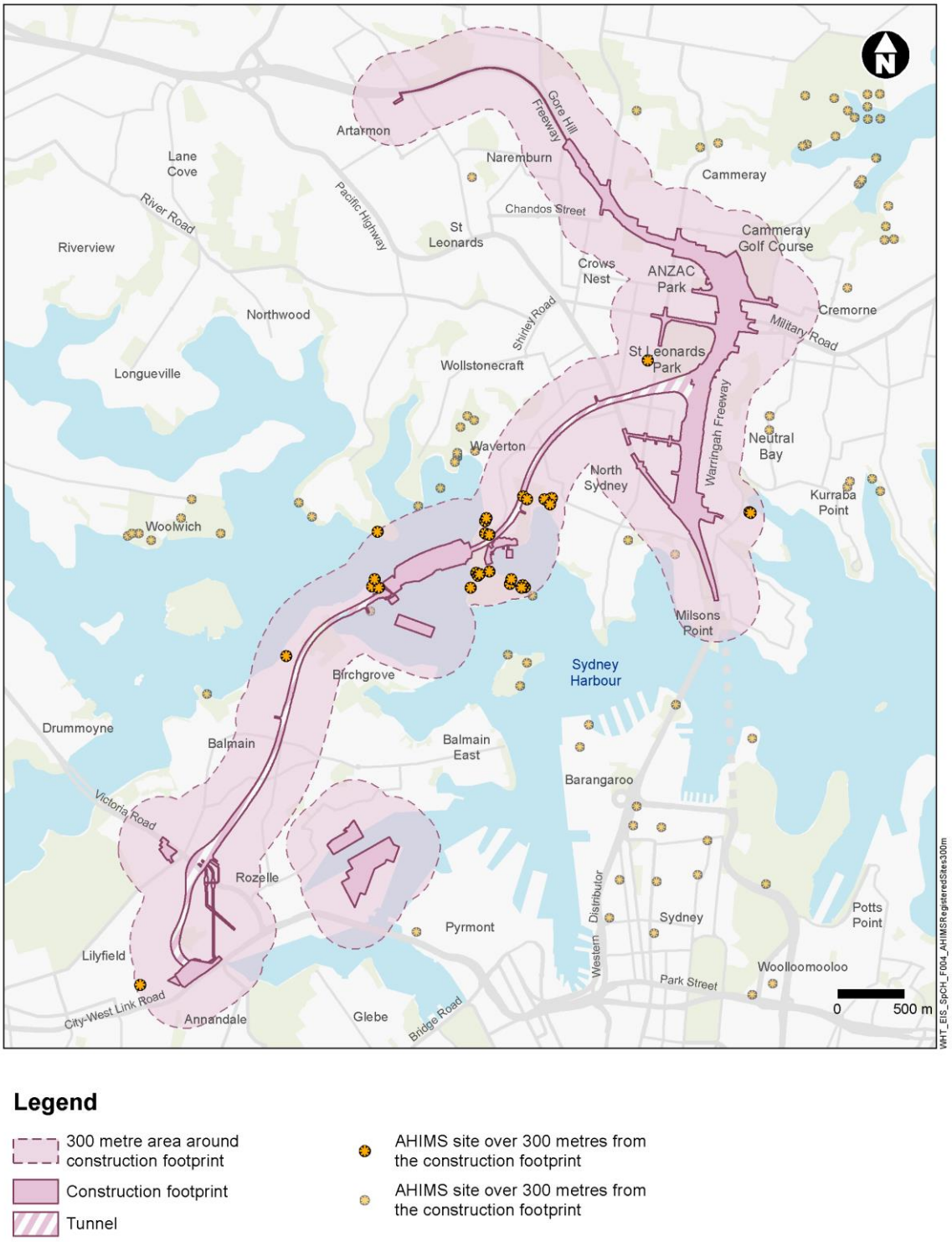
Appendix C. AHIMS registered sites within 300 metres of the study area

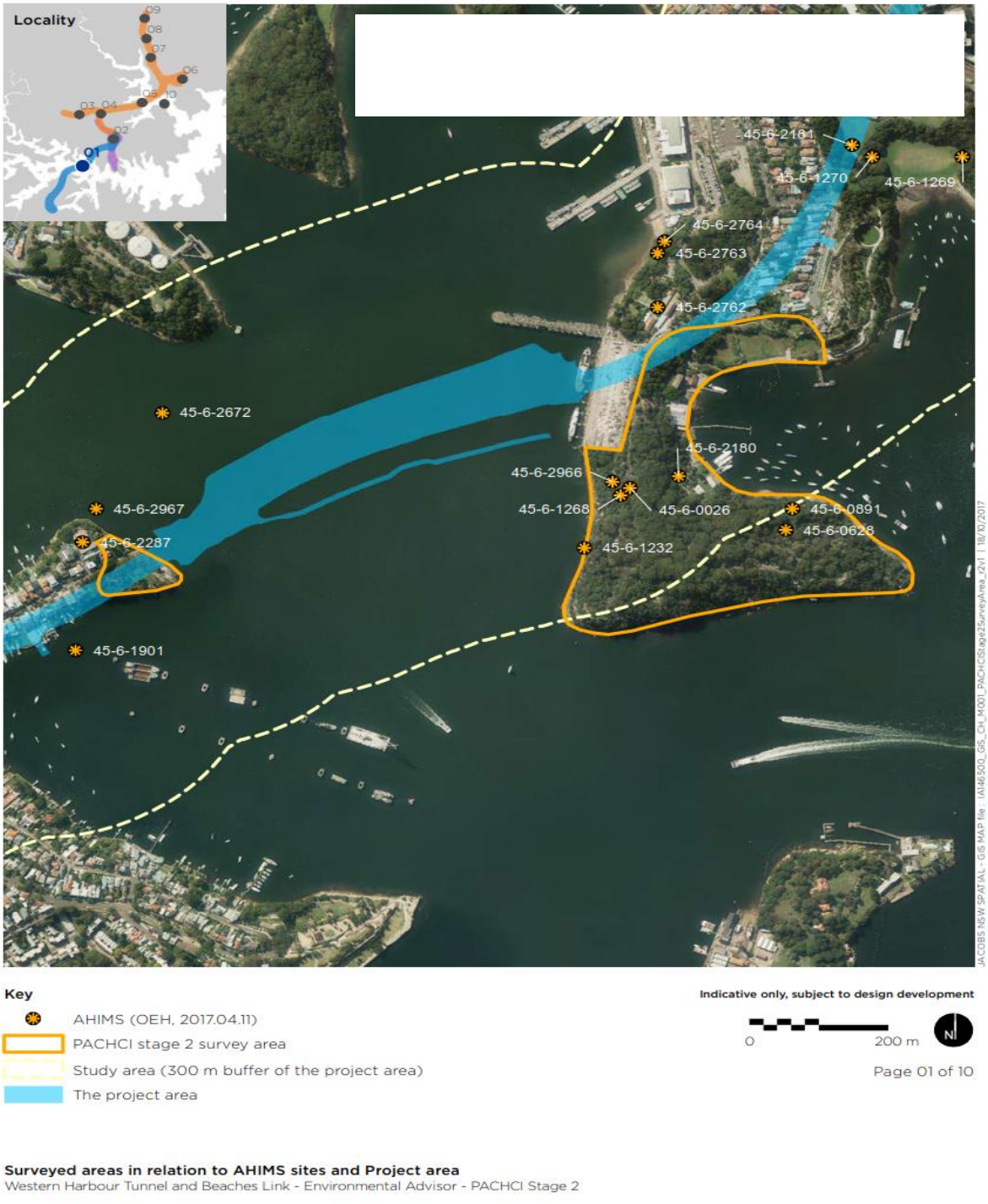


Legend

- 300 metre area around construction footprint
- Construction footprint
- Tunnel
- AHIMS site over 300 metres from the construction footprint
- AHIMS site over 300 metres from the construction footprint

Figure A-1 AHIMS registered sites within 300 metres of the construction footprint

Appendix D. Archaeological survey areas



Surveyed areas in relation to AHIMS sites and Project area
Western Harbour Tunnel and Beaches Link - Environmental Advisor - PACHCI Stage 2

Figure A-2 Archaeological survey areas

Figure A-3 Archaeological survey areas

Appendix E. Survey results

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
16/5/17	Balls Head	N/A	Selina Timothy (Metro LALC) Mark Lester (Roads and Maritime)	No access into private property. Unable to inspect some sites located on foreshore – due to steep/thick vegetation. Balls Head is a small headland reserve with extensive Aboriginal heritage, including an important engraving site and a large midden and shelter site. High sensitivity on the headland and foreshore with significant Aboriginal cultural heritage sites located throughout the area. Large rock shelter with midden (AHIMS ID: 45-6-2966) was excavated in 1960s and unearthed a burial. Hand stencils on the walls are no longer visible to the naked eye – may be perceptible using photogrammetry. Moderate risk is associated with impacts through shore-wash. Low risk associated with vibration during construction. Homeless persons have been sleeping in caves (AHIMS ID:45-6-0891) Balls Head is a popular walking area with signage describing the history and	None	 Photo by A Costello 16/5/17

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
16/5/17	Balls Head/ Coal Loader site			prehistory of the area and depicting Aboriginal activity and archaeology. AHIMD ID: 45-6-0026 The whale engraving has interpretive signage and is located in front of the coal loader site. It was first recorded in the late 1890s and was once painted white to enhance the outline. A series of smaller engravings are off to the side and a further gallery of engravings is reported to have been covered or destroyed by the development of the road and coal loader.		 Photo by A Costello 16/5/17 showing signage describing Aboriginal occupation and history of Balls Head

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
						 Photo by A Costello 16/5/17 showing whale engraving at Balls Head

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
						 Photo by A Costello 16/5/17 signage depicting whale and describing Aboriginal occupation and history of Balls Head

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
16/5/17	Coal Loader Site	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	No access into site. Area has been modified along foreshore, unable to determine if sites have been retained on foreshore. Area is out of study area, unlikely to be impacted.	None	 Photo by A Costello 16/5/17 looking north toward location of 45-6-2763 & 45-6-2764

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
16/5/17	Yurulbin Park	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	No access into private property. Yurulbin Park has moderate Aboriginal heritage sensitivity on the headland and foreshore with significant Aboriginal cultural heritage sites located nearby but protected by an established rock wall around the shoreline. Moderate risk is associated with impacts through shore-wash and vibration during construction.		 Photo by A Costello 16/5/17 looking north toward SHB from foreshore

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
16/5/17	Waverton Park	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	No access into private property. Waverton Park has moderate Aboriginal heritage sensitivity as several sites are recorded here, however this site is heavily modified.		 Photo by A Costello 16/5/17 looking south-west toward location of 45-6-2181

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
17/5/17	St Leonards Park	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	The area within St Leonards Park has been heavily modified and there are no Aboriginal heritage constraints.	None	 Photo by A Costello 17/5/17 looking south-west toward Nth Sydney

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
17/5/17	Cammeray Golf Course	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	The area within Cammeray Golf Course has been heavily modified through landscaping and there are no Aboriginal heritage constraints.	None	 Photo by A Costello 17/5/17 looking north over lake with highway to left

Survey Date	Location	New PAD (AHIMS ID)	LALC site officers	Notes	LALC comment	Image
17/5/17	ANZAC Park	N/A	Selina Timothy (Metro LALC) Mark Lester (RMS)	Some historic heritage considerations for the grove of trees, plaque and the valve outlet at western end. The area within ANZAC Park has been heavily modified and there are no Aboriginal heritage constraints.	None	 Photo by A Costello 17/5/17 looking south – S Timothy in foreground

Appendix E. Potential Submerged Sites Assessment

Roads and Maritime Services

Western Harbour Tunnel and Warringah Freeway Upgrade

Potential submerged sites assessment

January 2020

Prepared for

Roads and Maritime

Prepared by

Cosmos Archaeology Pty Ltd

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Western Harbour Tunnel and Beaches Link is a New South Wales (NSW) Government initiative to provide additional road network capacity across Sydney Harbour, and to improve connectivity with Sydney's Northern Beaches. This includes the Western Harbour Tunnel and Warringah Freeway Upgrade project, part of which comprises a new tolled motorway tunnel connection across Sydney Harbour.

Cosmos Archaeology Pty Ltd was engaged to satisfy the maritime heritage and underwater archaeological aspects of the Secretary's Environmental Assessment Requirements for this project. This included assessing potential submerged Aboriginal archaeological sites, with particular reference to possible terminal Pleistocene and early Holocene sites inundated by the last post-glacial global rise in sea levels and marine transgression that commenced 18,000 to 19,000 years ago.

This document addresses the potential for submerged Aboriginal sites and deposits to exist within the project area, and the potential impacts of the construction phase of the project on any such sites and deposits. It has been written as a memorandum to be appended to the Western Harbour Tunnel and Warringah Freeway Upgrade project Technical working paper: Cultural heritage assessment report (Jacobs, 2020). Non-Aboriginal maritime heritage for this project has been addressed in a separate report by Cosmos Archaeology.

The areas assessed in this study include the bed of the harbour between Yurulbin Point and Balls Head (Area A), the western portion of Berrys Bay (Area B) and White Bay, Rozelle (Area C). During the terminal Pleistocene and early Holocene, the landscape, environment and ecosystems of these areas would have been vastly different to that seen today. The area between Yurulbin Point and Balls Head formed the alignment of a meandering freshwater river passing through deeply incised sandstone gorges, fed by numerous creeks and streams originating in areas such as Berrys Bay and White Bay.

A predictive model for the study areas was prepared, identifying Aboriginal archaeological site and deposits that may have occurred prior to inundation, and the likelihood of such sites surviving inundation. This model was built on research regarding the physical setting of the study areas, both during the terminal Pleistocene glacial period and the current Holocene interglacial, documented physical evidence of Aboriginal occupation and land use patterns along the Port Jackson shoreline during the mid to late Holocene and the broader Sydney Basin during the terminal Pleistocene, and studies assessing the likelihood of archaeological sites and materials to survive inundation in an Australian context.

It was determined that the Aboriginal archaeological site types that may have occurred within the study areas include rock shelters with occupation evidence and deposits, possibly including engraved and pigment art, grinding grooves, midden deposits, stone artefact deposits and human burials, open archaeological deposits, including middens and stone artefacts, on exposed platforms, lower valley slopes and/or former alluvial or colluvial terraces, art and grinding grooves on exposed sandstone platforms and vertical faces, and fish traps. The extent to which such sites may have survived inundation is very much dependent on the length and intensity of exposure to water movement and wave action. In the relatively enclosed waters of Sydney Harbour, the rate of survival can be expected to be greater than at sites situated in what would have been more open country, eastwards of the current coastline.

The assessment of archaeological potential conducted in this study was augmented where possible by available geotechnical information obtained through seismic profiling and from borehole drilling. In Area A, the borehole drilling identified residual soils / palaeosols under marine sediments. Such soils have the potential to contain Aboriginal archaeological deposits however the residual soils identified appear to consist largely of 'B' horizon subsoils, which generally contain much lower frequencies of Aboriginal artefacts in terrestrial archaeological sites, compared to the upper 'A' horizon soil layer. As such, these residual soils were assessed to have Low archaeological potential. A localised area of palaeosol containing a stratum of peat was also identified in the borehole drilling in Area A. This area was assessed to have Moderate to High archaeological potential on the basis that it creates better preservation conditions for a range of Aboriginal archaeological remains, including well preserved organic archaeological remains and possibly the remains of fish traps. The remainder of Area A was assessed to have Very Low archaeological potential on the basis that geotechnical data did not indicate the potential presence of sizable rock shelters and that the area was relatively exposed to the faster flowing waters of the rising ancient Parramatta River, which would have reduced the chances of archaeological remains surviving. Areas B and C were assessed to have Moderate to High archaeological potential because of their more protected locations.

Consultation conducted by Jacobs Group Pty Ltd (2018) with Aboriginal knowledge holders identified by Registered Aboriginal Parties indicated that the range of site types and resources that may occur in the project area could be of cultural, social and spiritual significance. Submerged Aboriginal archaeological sites and deposits would also be of high scientific significance and research value.

The proposed work that could most likely impact potential submerged Aboriginal archaeological sites and deposits is the dredging and construction of the two cofferdams in Area A. Without mitigation, potential impacts on any submerged archaeological site that may exist could range from Negligible to Moderate. Other activities such as piling are assessed to have a Negligible to Minor impact on potential submerged Aboriginal sites across the remainder of Area A, as well as Areas B and C. In Area A, piling would take place in areas of very low submerged Aboriginal archaeological potential. In Areas B and C, piling would be unlikely to penetrate the marine sediments to layers of submerged Aboriginal archaeological potential, except in very localised areas.

Measures to mitigate potential impacts on any existing submerged Aboriginal archaeological sites and deposits are presented with the understanding that the occurrence of such sites has not been confirmed. Their presence would be extremely difficult to verify without further investigations on a relatively large scale, given their submersion and depth of burial under marine sediments, and such further investigation would by necessity involve disturbance of and impact to the potential archaeological resource. The mitigation measures are therefore designed to enable potentially valuable archaeological information to be captured and recorded as afforded by the large scale and deep excavations in Sydney Harbour during the course of the project. Such information could potentially include confirmation of the existence and survival of submerged Aboriginal archaeological sites and deposits, and could provide valuable insight into Aboriginal occupation of the Port Jackson region during the terminal Pleistocene and early Holocene periods.

The mitigation measures proposed commence with higher precision marine geophysical investigations and specialist input during the pre-construction phase to localise the areas of further interest, followed by monitoring of excavation for the cofferdams and sampling of sediments obtained during dredging.

1 INTRODUCTION

1.1 Overview

The Greater Sydney Commission's *Greater Sydney Region Plan – A Metropolis of Three Cities* (Greater Sydney Commission, 2018) proposes a vision of three cities where most residents have convenient and easy access to jobs, education and health facilities and services. In addition to this plan, and to accommodate for Sydney's future growth the NSW Government is implementing the Future Transport Strategy 2056 (NSW Government, 2018), a plan that sets the 40 year vision, directions and outcomes framework for customer mobility in NSW. The Western Harbour Tunnel and Beaches Link program of works is proposed to provide additional road network capacity across Sydney Harbour and to improve transport connectivity with Sydney's Northern Beaches. The Western Harbour Tunnel and Beaches Link program of works include:

- The Western Harbour Tunnel and Warringah Freeway Upgrade project comprises a new tolled motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and to connect to the Beaches Link and Gore Hill Freeway Connection project
- The Beaches Link and Gore Hill Freeway Connection project which comprises a new tolled motorway tunnel connection across Middle Harbour from the Warringah Freeway and Gore Hill Freeway to Balgowlah and Killarney Heights and including the surface upgrade of Wakehurst Parkway from Seaforth to Frenchs Forest and upgrade and integration works to connect to the Gore Hill Freeway at Artarmon.

A combined delivery of the Western Harbour Tunnel and Beaches Link program of works would unlock a range of benefits for freight, public transport and private vehicle users. It would support faster travel times for journeys between the Northern Beaches and south and west of Sydney Harbour. Delivering the program of works would also improve the resilience of the motorway network, given that each project provides an alternative to heavily congested harbour crossings.

1.2 Purpose of this document

This document has been prepared to support the Environmental Impact Statement (EIS) for the project. The EIS has been prepared to accompany the application for approval of the project, and to address the environmental assessment requirements of the Secretary of the Department of Planning, Industry and Environment (formerly the Department of Planning and Environment) (the Secretary's Environmental Assessment Requirements, or SEARs) issued on 15 December 2017 (Application number SSI 17_8862). The SEARs are presented in Technical working paper: Cultural heritage assessment report (Jacobs Group, 2020).

Cosmos Archaeology Pty Ltd was engaged by Roads and Maritime to satisfy the maritime heritage aspects of the SEARs. For that purpose, all aspects of underwater cultural heritage were examined including the potential for submerged Aboriginal sites. In consultation with Jacobs Group (Australia) and Roads and Maritime, it was decided that the assessment of the potential for submerged Aboriginal sites would be best placed as an appendix to the Technical working paper: Cultural heritage assessment report.

2 STUDY AREA

This potential submerged Aboriginal sites assessment covers three areas where construction activities related to the project would occur over water or over areas of former bed of the harbour (Figure 1):

- Area A, covering the proposed tunnel alignment and cofferdams between Yurulbin Point, Birchgrove and Balls Head, Waverton as well as the proposed construction facility at Yurulbin Park
- Area B, covering the proposed construction support site in the western half of Berrys Bay
- Area C, covering the construction support site at White Bay.

While these areas include portions of land, this assessment deals only with submerged Aboriginal sites, defined as all material culture associated with Aboriginal occupation that is situated on or under the bed of the harbour below the Highest Astronomical Tide, including the former bed of the harbour under reclamation.

Figure 1: Study area separated into Areas A, B and C (Base image: Google Earth)

3 ASSESSMENT PROCESS

Cosmos Archaeology Pty Ltd (2017a, 2017b) prepared an Issues Paper and Desktop Assessment for the project in 2017. The assessment drew on the findings of past reports. From this information, six areas were identified for initial assessment: four in Sydney Harbour and two in Middle Harbour. The areas in Sydney Harbour have remained largely the same, except that the relevant maritime heritage components of 'Zone F: Snails Bay' at Birchgrove have now been incorporated into Area A, while Zone F has been eliminated. These areas primarily cover the bed of the harbour but also include adequate buffers to account for areas of the foreshore that have may have been reclaimed as part of previous development.

This impact assessment report was carried out in four stages:

1. Baseline review
2. Establishing maritime heritage potential, significance and sensitivity
3. Assessing impacts and appropriate mitigation measures.

3.1.1 Baseline review

The start of the assessment process involved reviewing available information to understand the potential extent, variety, condition and significance of submerged Aboriginal sites within the study area, often referred to as a predictive model. This allowed more informed assessments to be prepared on the heritage significance of the resource, potential impacts on that resource, and the formulation of suitable mitigation measures.

The baseline review comprised two main components: a desktop literature and database review, and an examination of remote sensing data.

3.1.1.1 Desktop study

The desktop study involved examination of the following resources:

- Published books and articles on the marine environment and geomorphology of Port Jackson
- Published books and articles, and unpublished reports, detailing previous Aboriginal archaeological investigations and studies relevant to Port Jackson
- Published books and articles, and unpublished reports, detailing previous archaeological investigations and studies relevant to submerged Aboriginal sites
- Combined results of two searches of the NSW Office of Environment and Heritage Aboriginal Heritage Information Management System register, the first conducted in 2016 by Artefact Heritage Services (2016) for the HarbourLink Project and the second conducted in May 2017 by Jacobs Group Pty Ltd (2018) for the HarbourLink Project.

3.1.1.2 Remote sensing data review

The following remote sensing data was examined to identify areas where submerged Aboriginal sites could potentially occur.

Side scan sonar data

A side scan sonar survey was carried out for the project to map 'sea bed features and identify any significant features which could impact future drilling or near shore construction activities' (Earth Technology Solution Pty Ltd 2017a). The survey covered most of the proposed extent of the disturbance footprint for Area A, apart from a strip along the northern edge of measuring up to 500 by 25 metres (Figure 2). There is also a gap between the western edge of the side scan sonar survey in Berrys Bay and the shoreline. This is because existing maritime infrastructure, such as a slipway, impeded the survey vessel and tow-fish.

Side scan sonar can effectively map the surface terrain of the bed of the harbour and allow the identification of natural features and landform units of Aboriginal archaeological potential, such as rock outcrops or protruding ledges (see Section 5.1 for a discussion of the Aboriginal archaeological predictive model devised for the study area).

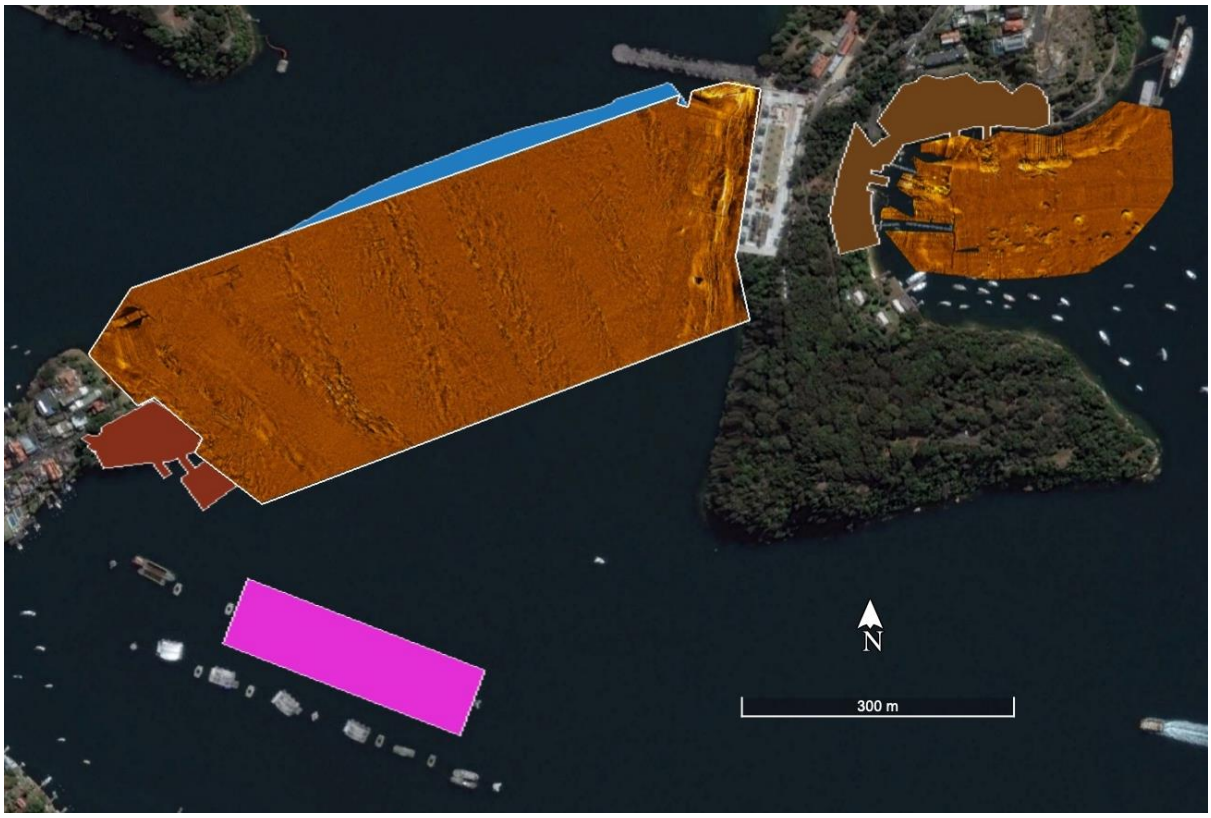

Figure 2: Extent of side scan sonar survey in relation to proposed extent of disturbance footprint in Area A. Note the solid pink strip at the top of the side scan sonar image between Birchgrove and Waverton**.** (Base image: Google Earth; data from Earth Technology Solution Pty Ltd 2017a)

Seismic reflection profiling survey

Seismic reflection profiling surveys were carried out in two of three areas - Area A and Area B. Sub-bottom profiling is the marine equivalent of ground penetrating radar. This form of remote sensing technology is primarily used to record geological strata below the bed of the harbour to assist engineers designing marine structures, and to inform dredge contractors of the material they will encounter. Seismic profiling is used to identify submerged terrestrial landscapes. Within the context of the study areas, the Holocene marine sediments can be identified and isolated, thereby revealing the Pleistocene landscape – and strata – prior to inundation (Figure 19). Seismic profiling may also be able to detect voids in the sandstone interface with Holocene sediments, suggesting possible large rock overhangs and therefore potential rock shelters.

The initial survey was carried out in May and June 2017 with the objective to 'map subsurface layers across the site to assess geological conditions for tunnel alignment assessment including the depth to top of rock and significant sediment layers, and provide sufficient spatial coverage to allow production of contour plans of these layers' (Earth Technology Solution Pty Ltd 2017a), see Figure 3. An additional survey was carried out in late October 2017 along the tunnel alignment next to Seaforth (Marine & Earth Sciences 2017).

Because the seismic reflection surveys were intended to identify the top of the bedrock and significant sediment layers, the data is very useful for assessing the potential for submerged terrestrial sites.

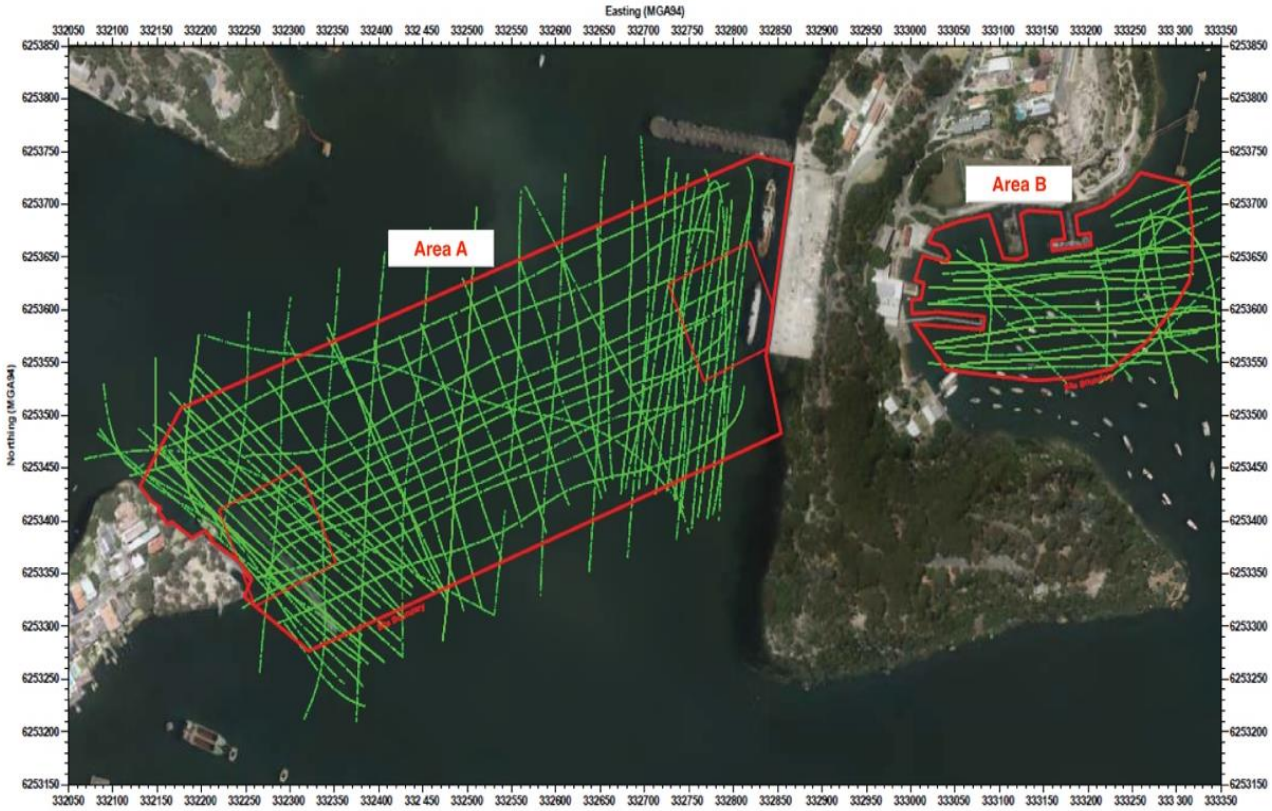

***Figure 3: Vessel track plot showing extent of seismic reflection survey in Areas A and B* (Earth Technology Solution Pty Ltd 2017a; Figure WH3).** The green lines show the where the survey collected the data

Core and non-core drilling

Geotechnical drilling took place at 74 locations within Area A throughout May and June 2017. A variety of techniques were deployed (Figure 4 and Figure 5). The data collected provides information about the occurrence of residual (ie pre-inundation) sediments, which may contain evidence of Pleistocene Aboriginal occupation.

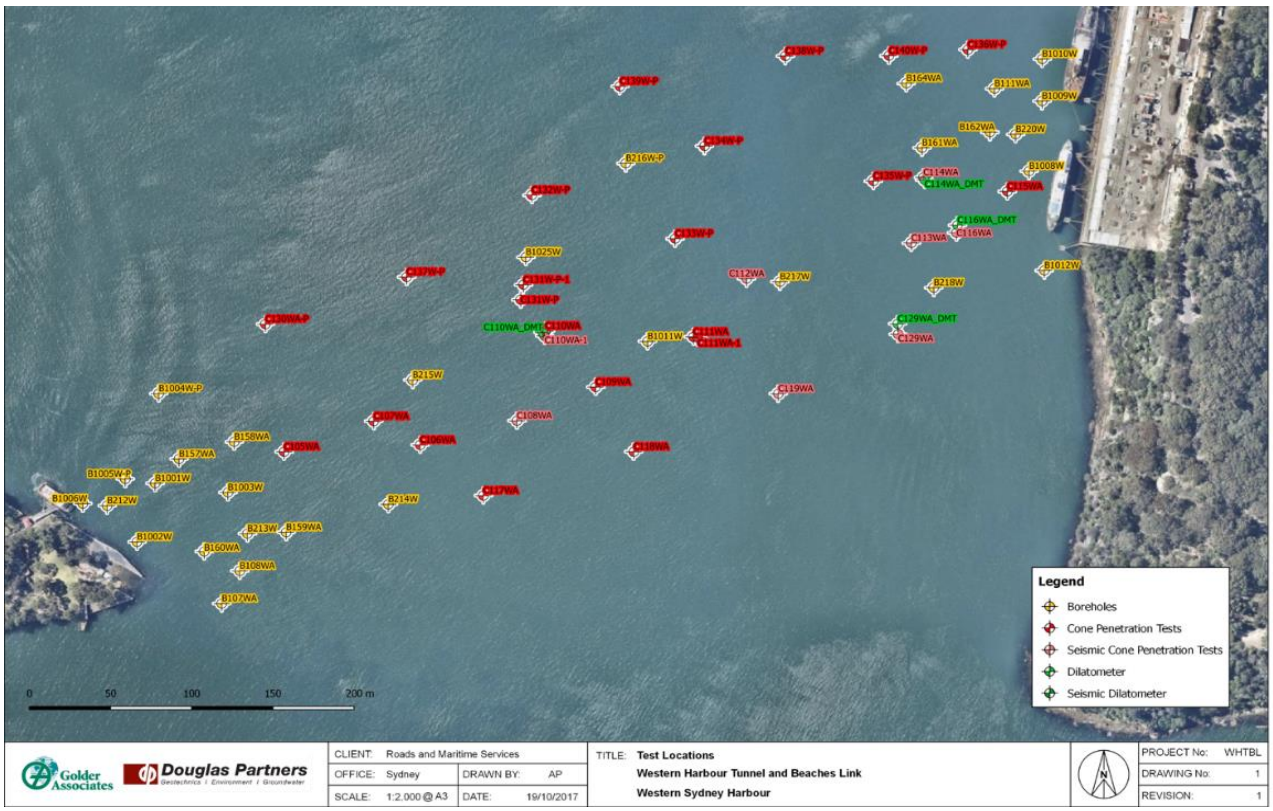

***Figure 4: Drilling sites within Area A* (**Golder Associates and Douglas Partners, October 2017**)**

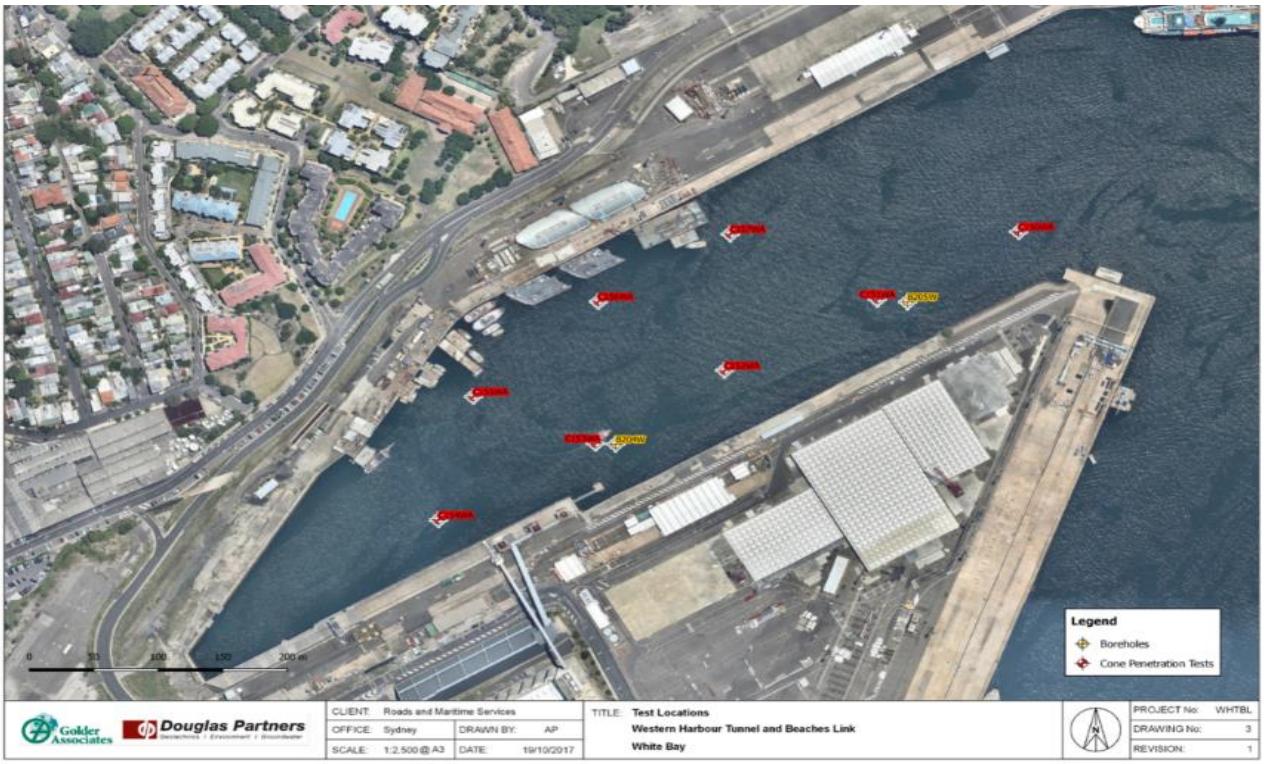

Figure 5: Drilling sites within Area C (Golder Associates and Douglas Partners, October 2017)

3.1.2 Establishing archaeological potential and significance

This document assesses the potential presence of Aboriginal cultural heritage, submerged or buried, within the study area. An important component of this assessment is the geotechnical or remote sensing carried out for this project. The data collected to date has been useful in focusing where diving investigations were to be conducted, but it has limitations, especially with regards to how the survey parameters have been set, the reliance on subjective interpretations of anomalies and sediment/soil strata, and level of detail provided in the geotechnical reporting.

The potential occurrence of submerged Aboriginal sites has been identified through predictive modelling based on an examination of the Pleistocene and Holocene environmental setting, current understanding and documented material evidence of Aboriginal land use patterns and examination of survival determinates associated with inundation, augmented with the findings of the geotechnical investigations carried out for this project (see Chapter 5.4 as well as the Cosmos Archaeology Pty Ltd November 2017a Maritime Archaeological Desktop Study). The level of maritime heritage potential has been rated according to the likelihood of it occurring, and is presented for Areas A, B and C in Sections 6.3, 7.3 and 8.3 respectively.

Understanding a site's Aboriginal cultural heritage significance is critical in determining a proportionate level of mitigation. This document follows the significance assessment criteria and approach presented in Section 7 of Technical working paper: Cultural heritage assessment report.

3.1.3 Assessing impact and appropriate mitigation measures

The identified impacts of the project are assessed for Areas A, B and C in Chapter 10. Based on the findings of the impact assessments, proportionate mitigation measures are presented in Section 11.

4 PHYSICAL SETTING

4.1 Port Jackson overview

Port Jackson is an estuary comprising three main bodies of water: Middle Harbour, Lane Cove and Parramatta River (Harris & O'Brien 1998). The estuary is 30 kilometres long and two kilometres across at the widest point (Birch 2007).

Port Jackson is a partially mixed estuary and occasionally stratified with an upper warmer fresh water plume after intense rainfall in the Parramatta River catchment (Harris & O'Brien 1998).

Tidal range is considered micro tidal – one metre on neap tides and two metres on spring tides – and typical current speeds range from 0.3 to 0.5 metres per second (0.6–1 knot). In constricted channels such as at The Spit and between Balls Head and Birchgrove, current speeds can reach one metre per second / two knots (Harris & O'Brien 1998). The areas with the strongest tidal flow also have the highest turbidity, with floating sediments derived from erosion and reworking. This suggests that the ebbing tide would be the most turbid.

The most frequent wind patterns are from the north-east (22 per cent of the time) and west (18 per cent of the time), although the strongest winds are from the south (17 per cent of the time) (Hedge, Ahyong & Booth 2014) .

There are five sedimentological units within Port Jackson. In the shallow off-channel embayments of the central harbour, the sediments are mud (Birch 2007). The bed of the harbour from the upper reaches of the estuary is composed of muddy sand, while the sand content increases towards the entrance to Port Jackson (Birch 2007). Rocky outcrops appear on the bed of the harbour throughout.

There are several deep holes within Port Jackson, with the deepest (46 metres) off Blues Point, west of the Harbour Bridge (Harris & O'Brien 1998). Their formation is most likely to be the result of tidal scouring. These holes, along with a number of rocky islands, shoals and basins, are separated by sills. The scour holes and sills would have affected water movement during sea level rise which in turn impacted on terrestrial sites as they were becoming inundated.

The bed of the harbour within the project area is composed chiefly of fluvial sediments, which are a mixture of muds and freshly weathered Hawkesbury Sandstone with some shale siltstone and feldspar also present (Harris & O'Brien 1998). The mud is mostly detrital but also contains a large organic component. Mud deposits close to the bed of the harbour surface are bioturbated and have shell layers.

4.2 Evolution of the submerged landscape

Port Jackson is a drowned valley type estuary comprised of three ancient valley systems through which Middle Harbour, Lane Cove River and Parramatta River currently flow (Harris & O'Brien 1998, Roy 1984). The configuration of the Port Jackson drainage system is controlled by the underlying geological structures of the Sydney Basin, formed as an uplifted coastal plain during the Permian-Triassic geologic period, 300–220 million years before present (BP). As fluvial creeks and rivers developed across the Sydney Basin, the waters began eroding pathways into the bedrock of Hawkesbury Sandstone, gradually creating deep and steep-sided river valleys – in some instances currently up to 85 metres deep (Birch 2007, Emerson & Phipps 1969, Roy 1984).

With the onset of the Quaternary ice age, 2.5 million years BP, large swings in global atmospheric and climatic conditions occurred every 40,000 – 100,000 years, resulting in cycles of prolonged cooling and glaciation, followed by a rapid shift to short interglacial periods of increased temperatures and glacial melting. During each glacial period, sea levels dropped as water became locked in ice sheets, draining the rivers, exposing continental shelves and creating extensive coastal plains. During the interglacial periods of milder climate, sea levels rose and the river valleys were flooded and partially infilled with sediment deposited by both marine and fluvial processes (Birch 2007, Harris & O'Brien 1998, Roy 1984).

The most recent glacial period commenced during the Pleistocene about 115,000 years BP, with maximal glaciation – termed the Last Glacial Maximum (LGM), reached between 24,000 to 18,000 years BP. Throughout the LGM, sea levels in the Australasian region were 100 to 130 metres below the current level and the eastern coastline of Australia was 25 to 30 kilometres further to the east (Hope 2005, Lewis *et al* 2013, Thom & Roy 1985). The Port Jackson catchment would have comprised a meandering river system running through deeply incised sandstone gorges, draining the sandstone plateaus to the west and north-west and fed by numerous creeks and streams – similar to the morphology of the Blue Mountains of today. Sediment deposition within the river systems during the

LGM would have been minimal, and the river beds would have been predominantly formed of eroded gravels (Birch 2007, Sale 2000, Thom & Roy 1985).

Between 19,000 to 18,000 years BP, a climate reversal ushered in the end of the last glacial period, causing deglaciation and a resultant rapid rise in global sea levels. About 11,700 years BP, the current interglacial period, the Holocene, commenced (Cohen *et al* 2013, Hope 2005). By about 10,000 years BP, sea levels along south-eastern Australia has risen to approximately 25 metres below current levels and the coastline was only three to five kilometres further east than present (Lewis *et al* 2013).

It was around this time that the Port Jackson embayment was flooded, drowning the ancient valley systems underlying the current Middle Harbour, Parramatta River, and its tributary Lane Cove River. The two ancient rivers joined, former ridges became promontories, valleys became inlets and some former hills became islands. As saline water was progressively flushed into the embayment the riverine ecosystems began altering as an estuarine environment gradually emerged. Marine sediments and tidal delta sands were also pushed landwards with the rising seas, infilling the mouth of Port Jackson whilst further sedimentation occurred in the middle and upper reaches via the deposition of estuarine muds and shelly sands (Birch 2007, Harris & O'Brien 1998, Roy 1984, Thom & Roy 1985).

Between about 7900 to 7700 years BP, the sea level along south-eastern Australia reached the present level, continuing to rise to a highstand of 1 to 1.5 metres above present level between 7700 to 7400 years BP. According to the majority of sea level data, the highstand remained stable along south-eastern Australia until about 2000 years BP, when the sea level gradually fell, with little if any oscillation, to the present position (Lewis *et al* 2013, Sloss, Murray-Wallace & Jones 2007).

5 ARCHAEOLOGICAL BACKGROUND

5.1 Regional context – Port Jackson shoreline

The most comprehensive regional study of the Aboriginal archaeological record in the Port Jackson catchment is the 'Port Jackson Archaeological Project' carried out by Val Attenbrow (1990, 1991, 1994, 2002, 2010), involving a combined analysis of previously recorded archaeological sites, oral histories, ethnographic accounts, archaeological survey and targeted archaeological excavation. The project study area extended along the coastline from Broken Bay in the north to the Royal National Park in the south, and west to the base of the Blue Mountains escarpment, and encompassed over 5000 identified Aboriginal archaeological sites (Attenbrow 1994, 2002, 2010).

The project revealed distinct patterning in the type and distribution of Aboriginal archaeological sites according to different landscapes, environments and resources in the catchment area, with an apparent occupational emphasis on coastal and estuarine environments. Of the hundreds of sites identified within coastal and estuarine zones, shell midden deposits were by far the most common, occurring along Middle Harbour, Lane Cove River, Vineyard Creek and Parramatta River / Sydney Harbour, from the river mouths to the inland extent of the estuarine reach. The second most prevalent site type was engraved rock art, followed by a small number of pigment (painted) art sites, stone artefact deposits, grinding grooves and human burials. Dates were obtained from some of the estuarine sites, indicating occupation from the mid to late Holocene, about 4500 to 5000 years BP, onwards (Attenbrow 1991, 2002, 2010), i.e. when the sea level along the coast of south-eastern Australia had been within 1 to 1.5 metres of present levels for about 3000 years (Lewis *et al* 2013) and the estuarine environment would likely have been similar to what it is today.

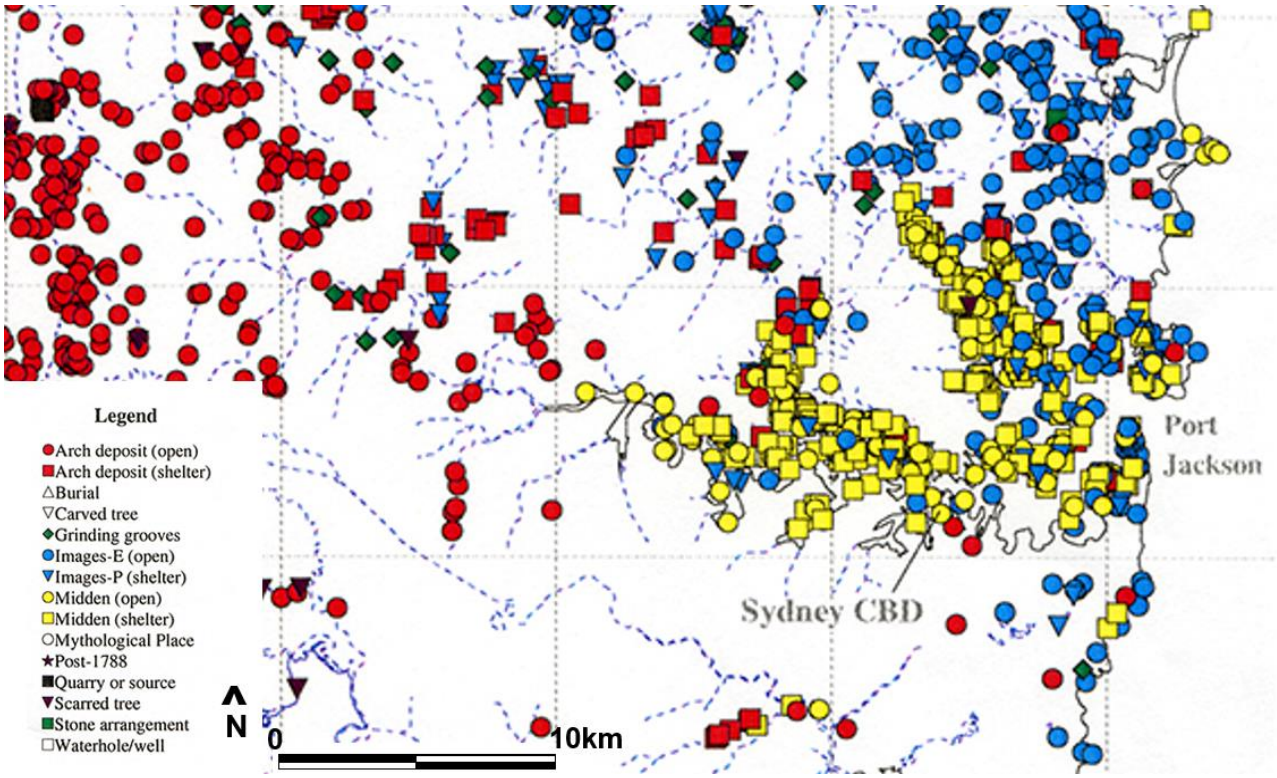

Figure 6: Distribution of identified Aboriginal archaeological sites in the Port Jackson catchment, centred on the coastal and estuarine zones (from Attenbrow, Baker & Martin, AMBS 2002)

Examination of the locational patterning of Aboriginal archaeological sites revealed that over 50 per cent of middens were situated in the immediate foreshore zone within 10 metres of the high tide mark, 15 per cent occurred on the edge of the foreshore zone and adjacent lower slopes, 25 per cent were situated on ridge-sides and the remainder (less than 10 per cent) were identified on upper slopes and ridge tops. Over 61 per cent of all middens occurred within rock shelters, with the remainder identified on a variety of open sandstone ledges and platforms. Rock engravings were found to occur primarily on open horizontal sandstone platforms, and occasionally on vertical sandstone faces or inside rock shelters, whilst pigment art was observed only in rock shelters – possibly due to the fact that pigment art is most likely to survive in weather-protected environments. Grinding grooves most commonly occurred on sandstone outcrops, ledges and platforms directly adjacent to a water source, and human burials were primarily found in coastal shell middens and inside rock shelters (Attenbrow 1994, 2002, 2010).

Analysis of excavated midden deposits indicated that Aboriginal populations around Port Jackson subsisted on marine, estuarine and terrestrial resources. Documented middens were found to be dominated by shellfish (primarily Sydney rock oysters, hairy mussels, Sydney cockles and Hercules club mud whelks), and fish (most commonly snapper, bream, leatherjacket and wrasse), however, small numbers of shark, seal, turtle, crab and crayfish remains were also identified, as well as bird remains (including muttonbirds and little penguins). Midden contents were also shown to vary according to geographical context, with lower estuary middens containing higher amounts of fish remains and mid to upper estuary middens containing comparatively little fish and much more shell – likely reflecting the larger fish diversity and biomass available in the lower estuarine environments compared to the greater availability and accessibility of shellfish species in the mid to upper estuarine reaches (Attenbrow 2002, 2010). Finally, evidence in some middens of numerous small bones from juvenile fish indicated the use of mass retrieval methods, such stationary fish traps or nets, although no physical evidence of surviving fish traps has yet been found in Port Jackson (Attenbrow & Steele 1995, Attenbrow 2002).

5.2 Pleistocene Aboriginal occupation in the Sydney Basin

Whilst the identified Aboriginal archaeological sites along the shores of Port Jackson appear to date to the mid the late Holocene only, Aboriginal populations are known to have occupied the greater Sydney Basin region for at least 36,000 years, well into the terminal Pleistocene glacial period and beyond the onset of the Last Glacial Maximum (LGM).

The earliest and most extensive evidence of Pleistocene Aboriginal occupation has been found in stone artefacts deposits within deep inland source-bordering sand dunes overlooking the Hawkesbury and Parramatta Rivers; notably the WBRP site, Windsor, dated to 27,000 years BP (Williams *et al* 2017), the RTA-G1 site, Parramatta, dated to 30,700 years BP (McDonald 2008), and the PT12 site, Pitt Town, dated to 36,000 years BP (Williams *et al* 2014). Several sites have yielded evidence of repeated occupation throughout the terminal Pleistocene, with PT12 in particular showing variable but uninterrupted occupation from 36,000 years BP until the early Holocene, with an actual increase in use at the onset and peak of the LGM (Williams *et al* 2014). Slightly older occupation dates have been obtained from artefacts found in Cranebrook Terrace gravels along the Nepean River (Nanson, Young & Stockton 1987). However, the stratigraphic association between these artefacts and dated sediments has since come under question, and these early dates remain disputed.

These sites identified within the Hawkesbury and Parramatta sand sheets provide strong indication of permanent regional Aboriginal populations within south-eastern Australia throughout the terminal Pleistocene. Occupation appears to have been largely confined to the major river corridors, with a focus on local resources and raw materials. The fact that the areas remained occupied, with use actually intensifying during the LGM, indicates that landscapes along the major rivers in the Sydney Basin served as refugia during this intensely cool and arid glacial period (Williams *et al* 2012, Williams *et al* 2014).

Whilst the Hawkesbury and Parramatta sand bodies have yielded the earliest occupation dates in the Sydney Basin, evidence of terminal Pleistocene Aboriginal occupation has also been found in the Kings Tableland rock shelter in the Blue Mountains, with cultural deposits dated to 22,000 years BP (Stockton & Holland 1974), a rock shelter at Burrill Lake, with deposits dated to 20,000 years BP (Lampert 1971) and an estuarine coastal midden site at Bass Point, Shell Cove, dated to 17,000 years BP (Bowdler 1970).

Ultimately, it is considered quite likely that Aboriginal populations occupied the Port Jackson catchment area throughout the terminal Pleistocene and the early Holocene utilising the sandstone escarpment landscape and freshwater resources of the ancient waterways prior to and during the arid LGM, and utilising the gradually emerging estuarine environment and associated food resources following the Holocene flooding of the embayment from around 10,000 years BP onwards. As the sea level along the south-eastern coast of Australia began to rise from about 18,000 years BP, reaching a highstand of 1 to 1.5 metres above current levels around 7700 to 7400 years BP, any physical evidence of terminal Pleistocene and early Holocene Aboriginal occupation along the valley floors and lower slopes of the Port Jackson embayment would have been progressively submerged.

5.3 Potential survival of submerged Aboriginal archaeological sites

Since the 1970s, thousands of submerged archaeological sites covering a timescale of up to 15,000 years BP have been documented around the world, particularly throughout the North Sea region (Denmark, Netherlands, Germany, France and Great Britain), the Adriatic Sea, Anatolian Peninsula and the North Atlantic (Canada and USA). A wide body of archaeological research has subsequently developed regarding the potential for evidence of human occupation to occur in submerged environments and the factors that affect archaeological site survival during transgressive sea level

changes (see Allen and Gardiner 2001, Bailey and Flemming 2008, Benjamin *et al* 2011, Fischer 2004, Koppel 2003, Masters 1983, Muche 1978, Stewart 1999 and Stright 1990).

Within an Australian context, investigation of submerged Aboriginal archaeological sites remains fundamentally theoretical as conclusive physical evidence is yet to be found. Nonetheless, detailed studies have been carried out involving the adaptation of international projects and predictive models to Australian landscapes, environmental conditions and identified patterns of Aboriginal land use and occupation. The most comprehensive and relevant investigation with regard to the current project is that conducted by Nutley (2006). Building on an adaptation of global archaeological and geomorphological research, combined with physical examinations of currently observable impacts of inundation on Holocene Aboriginal archaeological sites in Sydney Harbour, Nutley (2006) devised a predictive model regarding the potential for various Aboriginal site types to survive during periodic or permanent immersion in coastal, riverine and lacustrine Australian environments.

Nutley (2006) determined that estuarine systems formed from mature river systems, like Port Jackson, with low-energy backwaters, mudflats, swampland or marsh environments, are potentially capable of trapping and protecting cultural materials in increasing layers of sedimentation. Whilst contextual disturbance is likely to occur, artefacts that settle into such an anaerobic environment can avoid substantial damage. Archaeological sites that survive initial stages of inundation are likely to be subsequently buried and sealed in a gradual accumulation of overlying post-glacial marine and/or fluvial sediments. Ultimately, Nutley (2006) concluded that it is highly likely that a variety of Aboriginal occupation sites and artefacts have survived inundation in certain hydrodynamic and geological settings.

5.4 Predictive model

Based on a consideration of the physical environment, both Holocene and Pleistocene, documented Aboriginal site types and land use patterning in Port Jackson and comparable Hawkesbury Sandstone landscapes, and the inundation survival determinants devised by Nutley (2006), the following broad predictive model of submerged Aboriginal archaeological potential for the study areas is provided:

Aboriginal archaeological site types that could occur in the Hawkesbury Sandstone landscape	Potential of survival following inundation (based on survival determinants outlined in Nutley 2006)
Rock shelters in Hawkesbury Sandstone containing cultural evidence and deposits Rock shelters form through cavernous weathering and/or rock fall, and can occur in cliff faces, isolated outcrops and large fallen boulders. The size and configuration can vary greatly, however, various studies in Sydney Basin have shown that habitation shelters have a floor space of at least 2 m by 1 m and are at least 1.2 m in height (Attenbrow 2006). Cultural evidence inside a rock shelter could consist of midden deposits, stone artefact deposits, engraved art, pigment art, grinding grooves and human burials.	Rock shelters would be moderately resistant to the processes of inundation due to their bulk. Engraved art and grinding grooves within shelters may survive in hard sandstone settings, but are unlikely to survive long on soft sandstone as water movement gradually wears and abrades the rock surface. Pigment art is likely to be vulnerable to colonising marine organisms and chemical attack. Sandstone that absorbs pigment may retain that stain but may equally be susceptible to absorbing additional masking colouration from waterborne minerals. However, pigment art is known to have survived within air pockets in extensive inundated cave systems (such as Cosquer Cave, France). Cultural deposits may survive inside a rock shelter if the original depth of sediment and/or cultural deposit is considerable, or if the deposit is located in recessed floors, within fissures or under trapped boulders. Yet even in such conditions, survival is only likely during relatively rapid inundation in a low-energy environment. Stone artefacts are highly resistant to inundation due to their intrinsic hardness, however, may be vulnerable to abrasion and obscuring of diagnostic features in situations of slow inundation in a high-energy environment. Organic material, faunal remains (shell and bone) and human burials, however, are highly vulnerable to the processes of inundation. They may survive rapid inundation in a low-energy environment, or in situations where the remains were already buried in consolidated sediments or peat prior to being submerged. All such remains, however, may also be subject to biological degradation *in situ*.

Aboriginal archaeological site types that could occur in the Hawkesbury Sandstone landscape	Potential of survival following inundation (based on survival determinants outlined in Nutley 2006)
Engraved art and grinding grooves on exposed Hawkesbury Sandstone platforms, ledges and faces Exposed engraved art in Hawkesbury Sandstone landscapes usually occurs on smooth flat surfaces and occasionally vertical faces. Grinding grooves resulting from cultural activities, such as sharpening axes/hatchets or processing plant materials generally occur in close proximity to a water source (Attenbrow 2010).	As with engraved art and grinding grooves inside rock shelters, exposed engravings and grooves may survive inundation in hard sandstone settings but are particularly unlikely to survive long on soft sandstone, as water movement gradually wears and abrades the rock surface.
Open archaeological deposits, including middens and stone artefact deposits Midden deposits and/or stone artefact deposits in Hawkesbury Sandstone landscapes can occur on exposed sandstone surfaces and platforms, alluvial or colluvial terraces adjacent to water sources, on lower slopes, ridge sides and ridge tops (Attenbrow 2010).	Archaeological deposits on exposed surfaces are vulnerable to disturbance and dispersal through the processes of wave and current action during inundation. Former topsoil layers containing such deposits may be removed altogether, especially in high-energy environments. However, archaeological deposits may survive rapid, low-energy inundation, particularly if cultural materials were already buried at the time of submersion. As above, stone artefacts are highly resistant to inundation, though may be vulnerable to abrasion in cases of slow inundation in a high-energy environment. Organic materials and faunal remains, however, are highly vulnerable to potential physical damage and biological degradation as a result of inundation, unless buried within an anaerobic environment prior to being submerged.
Fish traps Fish traps are generally comprised of low stone arrangements or organic/reed fencing and occur on shallow, wide and gently sloping rock platforms, particularly in closed estuarine and bay settings and the tidal mouths of creeks and streams.	Fish traps constructed with organic materials are highly vulnerable to the processes of inundation, including physical damage, dispersal of elements and biological degradation. However, such structures may survive rapid, low-energy inundation, especially if they were buried in consolidated sediments or peat prior to being submerged. Fish traps constructed from stone are less vulnerable to the processes of inundation due to their intrinsic hardness and are likely to survive relatively intact, except within a high-energy inundation environment.

6 AREA A – YURULBIN POINT TO BALLS HEAD, SYDNEY HARBOUR

6.1 Physical setting

Area A covers of a stretch of Parramatta River / Port Jackson bounded on three sides by the promontories of Yurulbin Point, Manns Point and Balls Head (Figure 8). The line between Yurulbin Point and Manns Point is generally seen as the demarcation between Parramatta River and Port Jackson (Blaxell 2009). The natural foreshore on all three headlands comprises exposed Hawkesbury sandstone sloping quite steeply down to the water's edge. The Yurulbin Point shoreline, however, has been modified through reclamation and a significant portion of Balls Head is dominated by the large seawall of the former Balls Head Coal Loader.

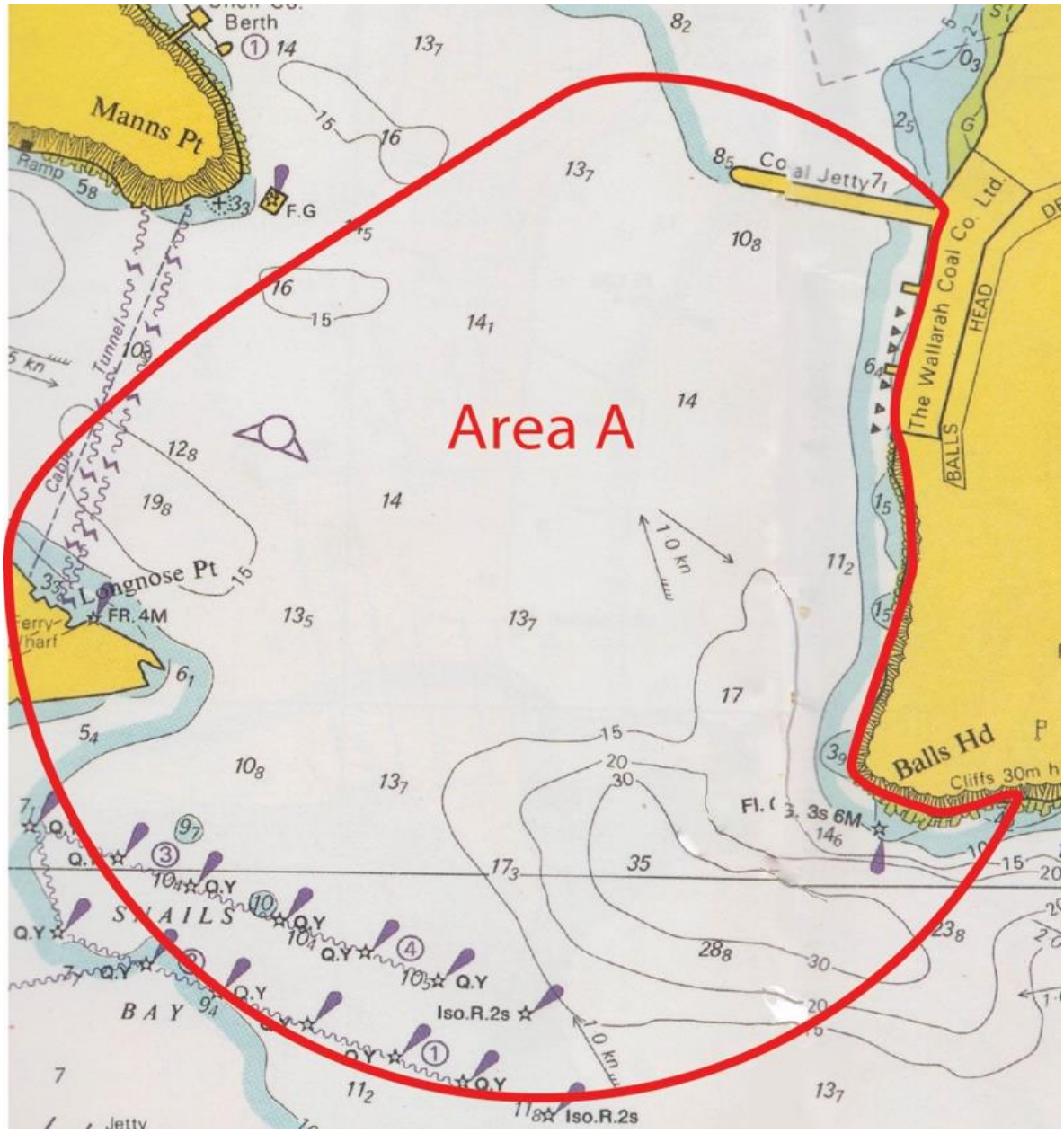

Figure 7: Portion of nautical chart showing Area A. *Depths are in metres* (Commonwealth of Australia / Crawford House Publishing 1995)

The current bed of the harbour within Area A is largely flat, levelling out to relatively shallow depths of 14 to 15 metres below the Australian Height Datum of mean sea level across most of the area (Figure 8). A deeper patch approximately – 20 metres below Australian Height Datum occurs to the north of Yurulbin Point, which is likely to be the result of tidal scouring. The tidal run between Balls Head, Manns Point and Yurulbin Point is quite high, reaching up to 1.7 knots (Maritime Services Board of NSW, 1963 revised to 1975) and during the geophysical survey for the project, the highest sea current flows were experienced in this area north of Yurulbin Point (Earth Technology Solution Pty Ltd, 2017b).

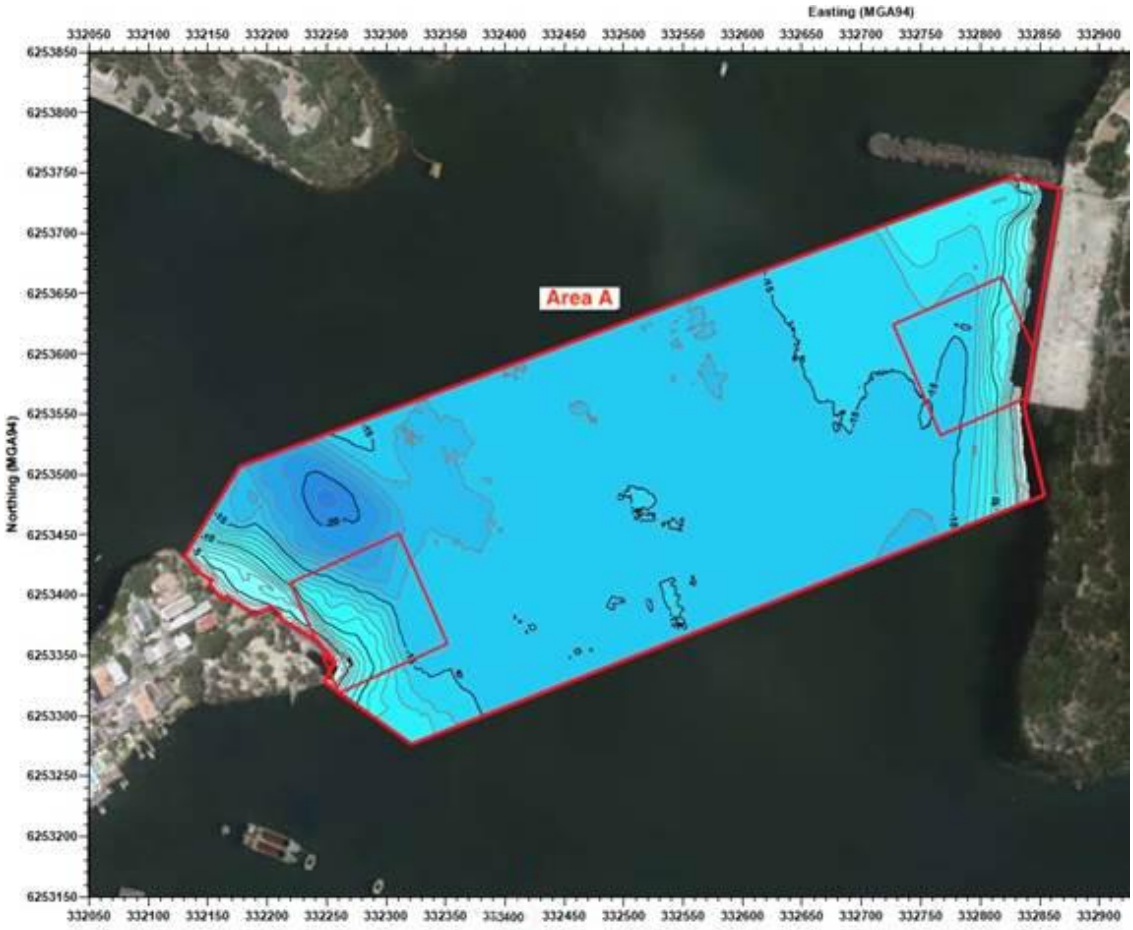

Figure 8: Bathymetric contour plan of Area A between Yurulbin Point and Balls Head, Sydney Harbour. *Depths are in metres AHD* (Earth Technology Solution Pty Ltd, 2017a)

The bed of the harbour rises sharply close to both Balls Head and Yurulbin Point, indicating that the steep sandstone bedrock of the headlands is not far below the bed of the harbour surface in these areas. Indeed, multi-beam sonar imaging revealed rock outcropping and boulders very close to the shoreline at Yurulbin Point (Figure 9). The composition of the bed of the harbour across the remainder of Area A ranges mostly from sand to silty sand, with areas of sandy clay gravel and clayey silt (Douglas Partners & Golder Associates 2017). The coarseness of the bed of the harbour sediments in places is most likely the result of the relatively high tidal flows in the area.

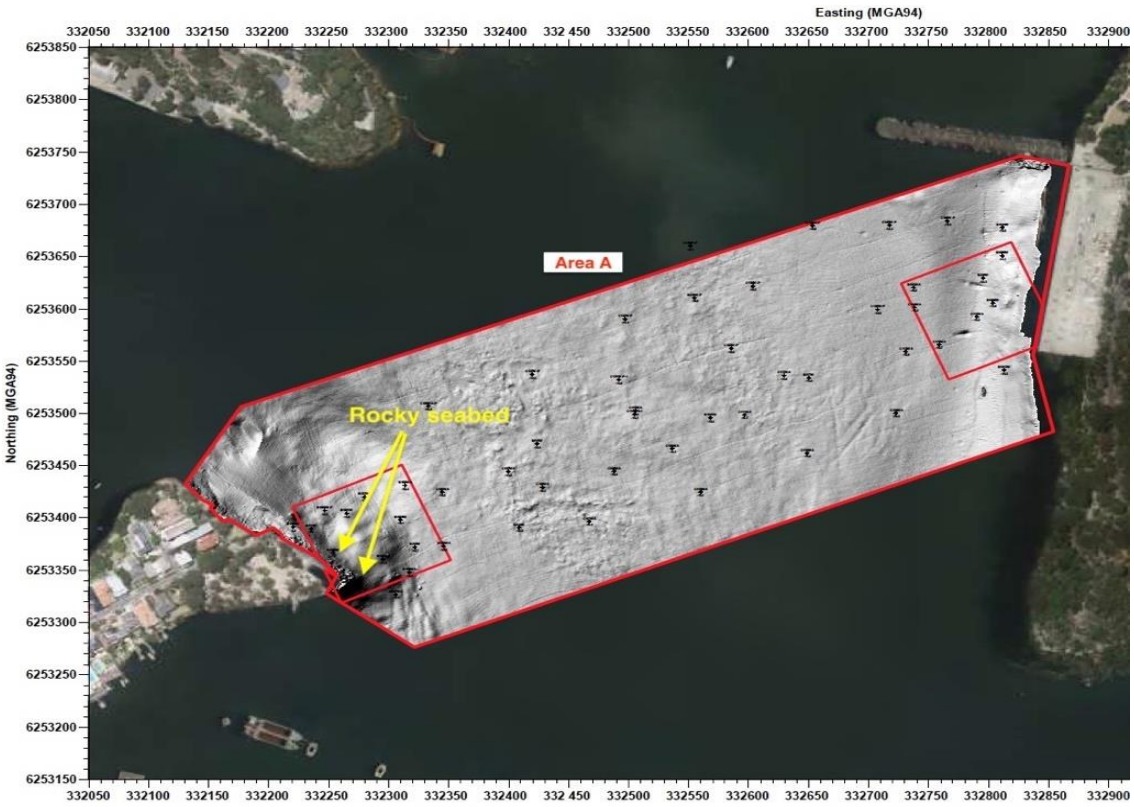

Figure 9: Bed of the harbour features within Area A showing rock outcrops and boulders near Yurulbin Point. Black spot marks and text are the locations of the boreholes drilled for this project (Earth Technology Solution Pty Ltd, 2017b: Figure WH2A).

The seismic profiling data obtained for this project indicates that the sandstone bedrock of Yurulbin Point headland continues eastwards as a relatively low, flat-topped shelf beneath the current bed of the harbour sediments (Figure 10 and Figure 11). The channels running along the northern side of this rock shelf and between the eastern extent of the shelf and the steep-sided bedrock of Balls Head represent the ancient courses of the Parramatta and Lane Cove Rivers – ie as they were prior to the last post-glacial sea level rise. During the terminal Pleistocene, these watercourses would have been smaller, freshwater rivers, running through a steep-sided sandstone valley and flowing around the extended headland that would have been exposed beyond Yurulbin Point. The climate and vegetation would also have been substantially different from the current landscape, likely resembling the Blue Mountains region of today.

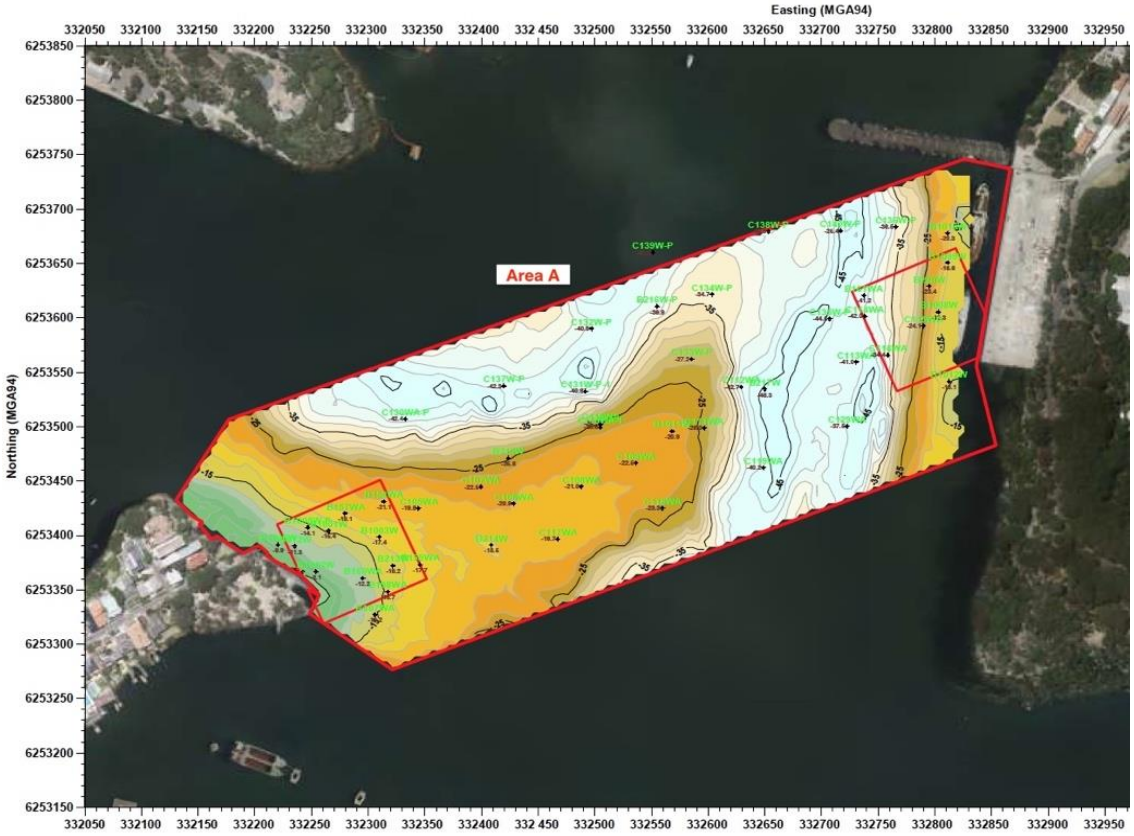

Figure 10: Seismic profiling - interpreted rock level contour plan for Area A. Heights are in metres below AHD (Earth Technology Solution Pty Ltd, 2017a: Figure WH6).

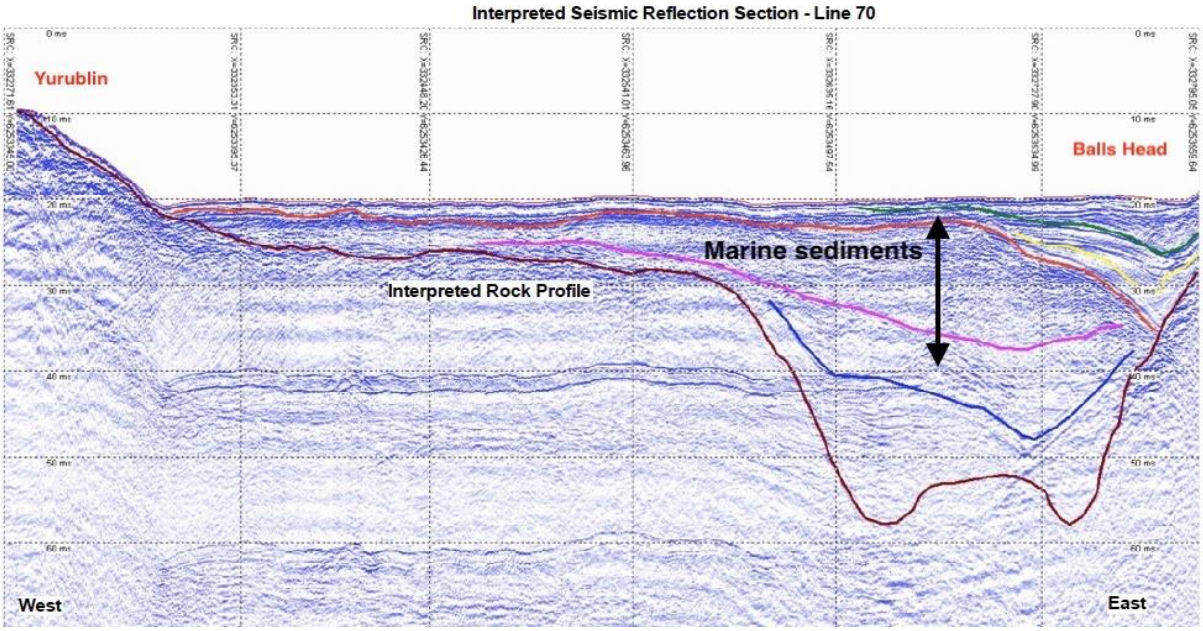

Figure 11: Seismic reflection profiles – Line 70 (run north-east to south-west between Yurulbin Point and Balls Head). (Earth Technology Solution Pty Ltd, 2017a: Figure B-WH4)**.**

A combination of the seismic refraction and borehole data obtained for this project further shows that the upper levels of the current bed of the harbour consist of Holocene marine sediments, deposited during and since the post-glacial inundation of the Parramatta and Lane Cove Rivers. Beneath these layers, however, areas of residual Pleistocene soil have survived, most notably across the surface of the ancient rock shelf extending from Yurulbin Point (Figure 12 and described in Table 1).

These residual soil deposits vary between 0.35 and 2.1 metres thick, and in some areas are not deeply buried. In borehole B108WA, the marine sediment deposits are only 0.5 metres thick while in B157WA the overlying marine sediments are 0.8 metres thick. The thickness of the overlying Holocene marine

sediment within the channel next to Balls Head, however, is about 30 metres (Earth Technology Solution Pty Ltd, 2017b).

The residual soils described appear to be 'B' Horizon type subsoils, which commonly contain much lower quantities of Aboriginal artefacts in terrestrial archaeological sites than the upper 'A' soil horizon. However, of particular interest is the identification of two overlying residual strata containing shell and peat in one borehole sample (B215W). This borehole is situated on the uppermost slope of the ancient promontory extending north-east from Yurulbin Point. This deposit would most likely have formed during sea level rise and suggests a period of still waters in this area before the ancient promontory was overtopped by rising waters.

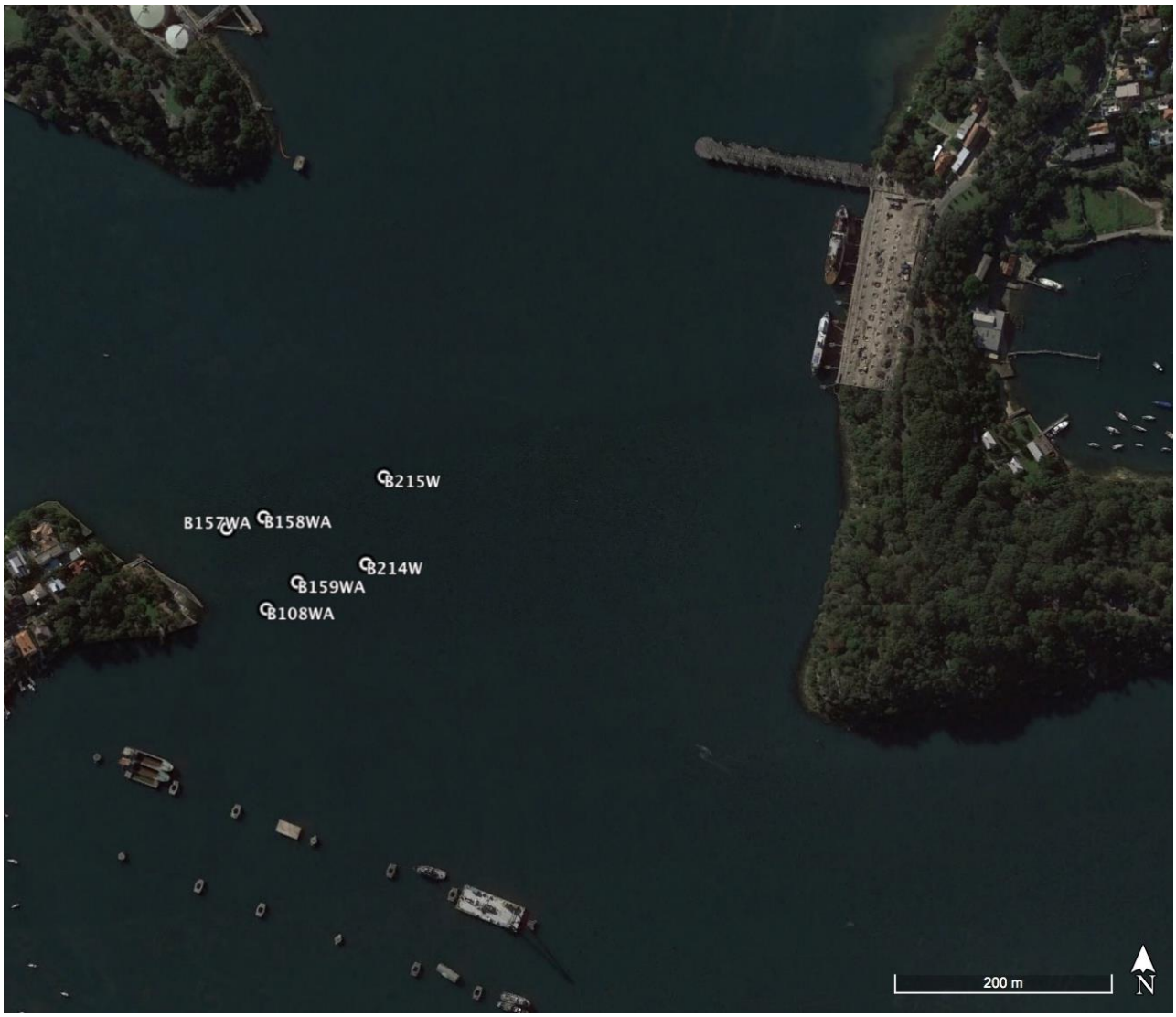

Figure 12: Location of boreholes in Area A where residual soils were identified. (Base image: Google Earth)

Table 1 Description of residual soils (in italics), with preceding stratum of marine sediments, found in boreholes in Area A (Douglas Partners and Golder Associates 2017)***.***

Borehole	R.L. at top (m)	Thickness (m)	Description of residual soil
B157WA	-18.0 *-18.8*	0.80 *0.35*	SANDY CLAY: dark grey, fine to coarse, with shell fragments to 60 mm *SAND: Pale orange and pale grey, fine to coarse grained sand, with silt (possibly weathered stone).*

Borehole	R.L. at top (m)	Thickness (m)	Description of residual soil
B158WA	-17.4 *-19.4*	2.00 *1.60*	SILTY SAND: dark brown, fine to coarse grained sand, poorly graded, sub-angular, with shells and shell fragments, trace clay *CLAYEY SAND: Dark orange-brown, medium to coarse grained sand, poorly graded, sub-angular, with silt, trace fine, iron-stained gravel (0.65 m thick).* *SANDY CLAY: Mottled brown, orange and grey, low to medium plasticity, medium to coarse sand, trace fine, iron-stained gravel (0.95 thick).*
B159WA	-15.6 -17.1	1.50 0.67	SAND: fine to coarse grained sand *SILTY CLAY: Pale grey, brown and red, medium plasticity, with fine grained sand (0.5 thick).* *SANDY SILTY CLAY: Pale grey and pale grey brown, low plasticity, fine to medium grained sand (0.17 thick).*
B108WA	-14.4 -14.9	0.50 0.80	SILTY SAND: dark grey, fine to coarse grained sand, poorly graded sub-angular, with shells and shell fragments *SILTY CLAYEY SAND: Pale grey, fine to medium grained sand, poorly graded, sub-angular*.
B214W	-16.8 -17.9	1.10 0.65	CLAY: grey with red brown, medium plasticity, with some fine to medium grained sand (0.13 thick) SANDY CLAY; brown (0.80 thick) SANDY CLAY: Grey and brown (0.5 m thick). CLAYEY SAND: Pale grey, fine to medium grained sand (0.15 m thick).
B215W	-23.7 -25.3	1.6 2.1	SILTY CLAY: Dark grey, high plasticity, with organic material including shells and peat (0.3 m thick). CLAYEY SAND: Dark grey, fine to medium grained sand, with organic material including shells and peat (1.3 m thick). *SAND: Orange brown, fine to coarse grained sand, trace clay (0.5 m thick).*

6.2 Known Aboriginal archaeological sites near Area A

Numerous Aboriginal archaeological sites have been identified on the Hawkesbury Sandstone headlands of Balls Head and Yurulbin Point, demonstrating that Aboriginal populations utilised the sandstone rock platforms, shelters and estuarine food resources of this particular part of Sydney Harbour – certainly, at least, during the mid to late Holocene.

Two searches of the NSW Office of Environment and Heritage Aboriginal Heritage Information Management Systems (AHIMS) register have been carried out as part of the broader Western Harbour Tunnel and Beaches Link program of works – the first conducted in 2016 by Artefact Heritage Services (2016) in 2016 and the second conducted in May 2017 by Jacobs Group Pty Ltd (2018).

An examination of the two AHIMS register searches identified 10 Aboriginal archaeological sites along the foreshore and immediate hinterland near Area A, including four rock shelters with cultural features and deposits at Yurulbin Point, two rock shelters with cultural deposits at Balls Head, three open shell midden sites at Balls Head and a horizontal rock engraving site at Balls Head. All sites are situated within the exposed Hawkesbury Sandstone landscape along the foreshore and immediate hinterland areas on both headlands (Table 2 and Figure 13).

Table 2: Aboriginal archaeological sites on the AHIMS register near Area A.

Site Id. No.	Site name	Site type	Environment
45-6-2287	Yerroulbin Cave	Rock shelter with art and shell midden	Exposed Hawkesbury sandstone landscape along foreshore of Yurulbin Point

Site Id. No.	Site name	Site type	Environment
45-6-2967	5 Hands Shelter B NSC-074	Rock shelter with shell midden	Exposed Hawkesbury sandstone landscape along foreshore of Yurulbin Point * GPS co-ordinates place this site at least 20 metres north of the Yurulbin Point foreshore
45-6-2672	Shed Cave	Rock shelter with shell midden	Exposed Hawkesbury sandstone landscape along foreshore of Yurulbin Point
45-6-1901	Long Nose Point 1	Rock shelter with shell midden	Exposed Hawkesbury sandstone landscape along foreshore of Yurulbin Point
45-6-2762	Coal Loader 1	Shell midden	Exposed Hawkesbury sandstone ridges behind foreshore on western side of Balls Head
45-6-0026	Whale rock	Horizontal rock engraving of a whale and human figures	Exposed Hawkesbury sandstone ridges behind foreshore on western side of Balls Head
45-6-2763	Caltex 2	Shell midden	Exposed Hawkesbury sandstone foreshore on western side of Balls Head
45-6-2764	Caltex 1	Shell midden	Exposed Hawkesbury sandstone foreshore on western side of Balls Head
45-6-2966	Balls Head shelter NSC-073	Rock shelter with shell midden and potential archaeological deposit	Exposed Hawkesbury sandstone ridges behind foreshore on western side of Balls Head
45-6-2180	Quarantine Cave, Waverton	Rock shelter with shell midden	Exposed Hawkesbury sandstone ridges behind western foreshore of Berrys Bay

Figure 13: Registered Aboriginal archaeological sites near Area A

It should be noted that the documented global positioning system (GPS) co-ordinates of one site – a rock shelter on Yurulbin Point (45-6-2967) – places it at least 20 metres north of the Yurulbin Point foreshore,

thus indicating it is underwater. However, this site is not directly identified on the AHIMS register as a submerged archaeological site and appears instead to be a foreshore rock shelter. The apparent location of this site within the maritime environment is almost certainly due to slight inaccuracies in the original GPS co-ordinates obtained, or incompatibility of different GPS datums. Ultimately, no submerged Aboriginal archaeological sites have previously been identified in or near Area A.

6.3 Potential submerged Aboriginal sites in Area A

Based on the physical landscape, remote sensing data, and the broad predictive model outlined in Section 5.4, the Aboriginal archaeological site types that could occur in Area A include:

- rock shelters containing occupation deposits (such as middens, stone artefacts, human burials) and/or other occupation evidence (such as art, grinding grooves)
- art and/or grinding groves on open sandstone ledges and vertical faces
- archaeological deposits, such as middens and/or stone artefact scatters, on sandstone platforms and lower valley slopes or terraces adjacent to the ancient watercourse
- fish traps on shallow, wide and gently sloping sandstone platforms.

The present-day strong tidal flow between Yurulbin Point and Balls Head, likely reflected in the traditional name of Yurulbin meaning ‘fast flowing water’, would tend to indicate a lower likelihood for such Aboriginal archaeological sites to have survived inundation within Area A.

However, evidence from some of the boreholes obtained within Area A indicates that, perhaps for a time during the last post-glacial sea level rise, water flow was sufficiently slow to allow for the creation of localised swamp or marsh lands – ie environments potentially capable of trapping, burying and effectively protecting Aboriginal archaeological sites and deposits.

The potential for each of the above listed Aboriginal site types to survive as submerged sites within Area A is outlined below.

Rock shelters with possible occupation evidence and/or deposits

The side scan sonar data obtained for this project showed no clear evidence of rock ledges protruding from the marine sediment, though there was some minor rock outcropping, mostly boulders next to the Yurulbin Point shoreline (see Figure 9). The ‘rock outcropping’ at the base of the former Balls Head Coal Loader wharf noted in the July 2017 geophysical report is very likely that of the wreck Unidentified Balls Head Bay 2 (see Cosmos Archaeology Pty Ltd, April 2018, *Western Harbour Tunnel and Warringah Freeway Upgrade Project, Maritime Heritage Impact Assessment*, prepared for Roads and Maritime Services) (Earth Technology Solution Pty Ltd 2017b).

The seismic refraction data available for this project does not have sufficient resolution to show voids within the bedrock at the interface with the marine sediments, and there are noted difficulties using this technology to differentiate with certainty between geological units such as dense sediments and weathering rock (Earth Technology Solution Pty Ltd 2017b).

Based on the above available information, there are potentially rock overhangs completely buried under marine sediments within Area A that could contain rock shelters. However, the absence of rock ledges protruding from the bed of the harbour suggests that any such rock shelter would be relatively small.

Engraved art and grinding grooves on sandstone ledges and faces

Erosion of the surface of any sandstone outcrops in Area A would be expected, given the high tidal flows around Yurulbin Point. As such, rock engravings are only likely to occur on the more protected ceilings and internal walls of any existing rock shelters.

Pigment rock art is known to have survived in extensive inundated cave systems within air pockets. There is a remote possibility of such sites being present within rock shelters in the study area.

Open area middens and/or stone artefact scatters

The borehole data collected for this project identified areas where residual soil matrices have survived under marine sediments. The locations within Area A where residual soils have been identified are shown in Figure 12 and described in Table 1. It is unclear whether the residual soils described are ‘B’ horizon subsoils, which may be expected to be largely sterile with respect to Aboriginal artefacts, or also include ‘A’ horizon type soils – soils at or just below the original ground surface – where there is higher potential for the presence of artefacts.

As can be seen in Table 1, the residual soil deposits are between 0.35 and 2.1 metres thick. Of interest is B215W, which has two strata that contain shell and peat. This borehole is situated on the uppermost slope of the ancient promontory extending north-east from Yurulbin Point (see Figure 12). This deposit would most likely have formed during sea level rise and suggests a period of still waters in this area before the ancient promontory was overtopped by rising waters. These peat deposits could contain evidence of Aboriginal occupation in the form of stone artefact material from surrounding areas, and artefacts washed down from the north-facing slopes from the promontory. Midden deposits could also be contained within these peat layers; however, organic material is much more vulnerable to the processes of inundation and biological degradation and has a lower likelihood of survival compared to stone artefacts.

Furthermore, in some boreholes, the residual soils are not deeply buried. In borehole B108WA, the marine sediment deposits are only 0.5 metres thick while in B157WA the overlying marine sediments are 0.8 metres thick.

Fish traps

Fish traps generally occur in calm estuarine and bay settings and the tidal mouths of creeks and streams. The Holocene landscape of Area A, with high tidal flows and no creek mouths, is thus unfavourable for the construction of fish traps. However, the peat deposits identified in the borehole samples suggest that the waters were calmer prior to the last post-glacial sea level rise and may have provided better conditions both for the construction and survival of fish traps.

There may be a higher likelihood of such site types having survived on the north- western slopes of the former low-lying ridge that extended from Yurulbin Point, as this area would have been protected from wind generated waves coming up the ancient Parramatta River from the expanding body of water that eventually becomes Sydney Harbour.

6.4 Summary of potential submerged Aboriginal sites in Area A

Area A has potential to contain remnants of submerged Aboriginal archaeological sites. It should be noted that the assessment is confined to areas of proposed impact within Area A, which are the only areas for which geophysical data is available (see Chapter 10).

Based on the predictive model for Area A, as outlined in the preceding section, the areas where submerged Aboriginal archaeological sites could occur within Area A have been separated by a rating of potential as defined in Table 3 and shown in Figure 14). The rating is based on a combination of likelihood of the site occurring with the likelihood of it surviving inundation. It is important to note that the information available at present allows only for assessments that indicate the likelihood of submerged archaeological remains within the current study area.

Table 3: Defining archaeological potential.

Archaeological Potential	*Likelihood of presence*
Moderate to High	50–100%
Low	25–49%
Very Low	2–24%
Remote	>0–1%

The absence of rock overhangs or rock ledges protruding from the bed of the harbour indicates that larger inundated potential rock shelters are unlikely to be present closer to the present bed of the harbour surface. Within the area where geotechnical data is available, the absence of detectable substantial rock overhangs buried under marine sediments reduces the likelihood that archaeological remains are present. Therefore, for the majority of the study area, the archaeological potential has been assessed as being Very Low.

Residual soils identified within the borehole testing could contain stone artefacts or midden deposits. However, these residual soils appear to consist largely of ‘B’ horizon subsoils, which generally have a much lower frequency of artefacts in terrestrial Aboriginal archaeological sites compared to upper ‘A’ horizon soils. As such these locales have been assessed as having Low archaeological potential. The boundaries of these locations are dotted, as the horizontal extent of these soil and sediment units cannot be determined.

The peat deposits (bore hole B215W) identified on the upper banks of the ancient watercourse that formed the ancient Parramatta River are more capable of containing well preserved cultural material. Such deposits have been assessed as having Moderate to High archaeological potential.

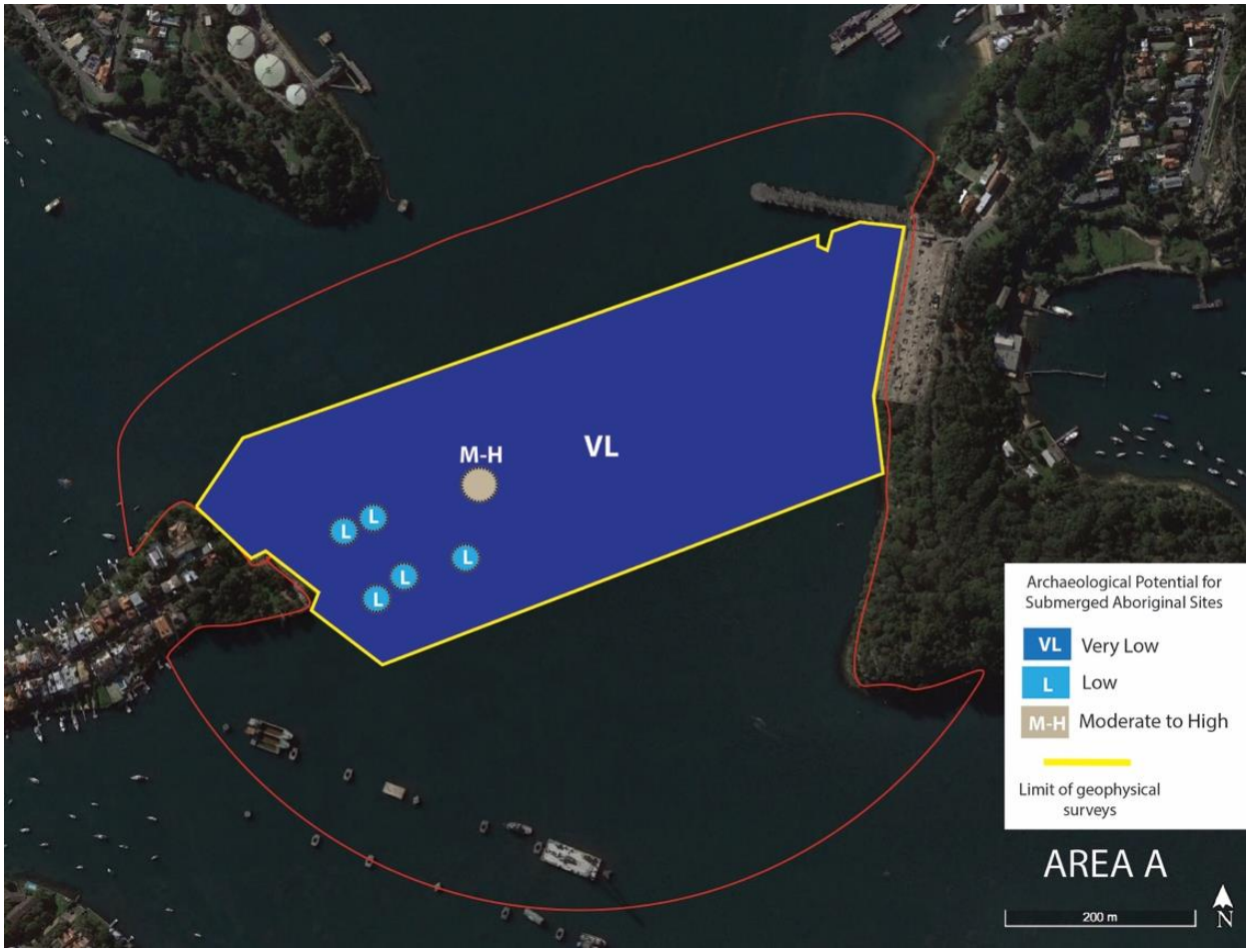

Figure 14: Archaeological potential for submerged Aboriginal sites within the study area

Table 4: Summary of areas of submerged Aboriginal archaeological potential in Area A

Archaeological potential level	Aboriginal site type	Predicted potential location within Area A
Moderate to high	Stone artefacts, midden deposits and fish traps	In identified peat deposits which have formed above residual soils in the western portion of Area A, as shown in borehole B215W.
Low	Stone artefacts and midden deposits	In identified residual soils, possibly 'B' horizon subsoils, in the western portion of Area A.
Very low	Rock shelters, art, grinding grooves, middens, stone artefact scatters and fish traps	Across the remainder of Area A, buried beneath at least 10 metres of marine sediment.

7 AREA B – BERRYS BAY

7.1 Physical setting

The current landscape of Area B consists of the eastern extent of Berrys Bay, opening to the south-east into Port Jackson. The bay entrance is dominated by the eastern face of Balls Head, forming a sandstone cliff 20 metres high sloping steeply down to the water edge (Figure 15).

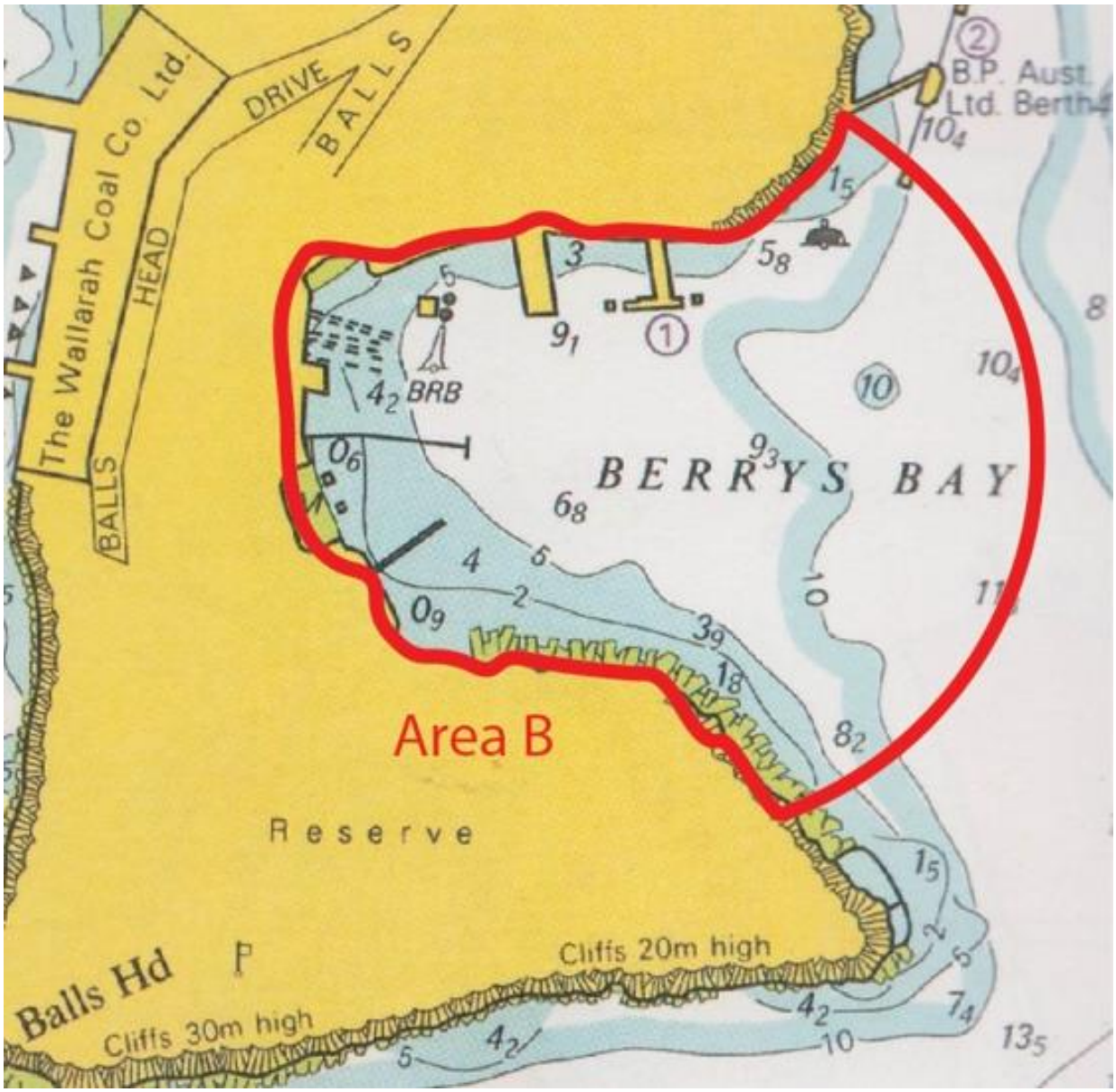

Figure 15: Portion of nautical chart showing Area B. Depths are in metres **(Commonwealth of Australia / Crawford House Publishing, 1995: Chart 24)**

The bed of the harbour of Berrys Bay, which is expected to be composed of a higher concentration of fluvial mud or silt than sand, slopes gradually down from the shoreline, reaching a maximum depth of about 12 metres below Lowest Astronomical Tide at the entrance to the bay. Bathymetric data acquired for this project in the western portion of Berrys Bay shows the bed of the harbour dropping away steeply along the northern shoreline to a depth of 10 metres Australian Height Datum (Figure 16). In contrast, the bed of the harbour gradient is gentler on the western and southern sides of the western portion of Berrys Bay. The northern and eastern shorelines of the western portion of Berrys Bay has been completely modified and is bounded with seawalls and slipways.

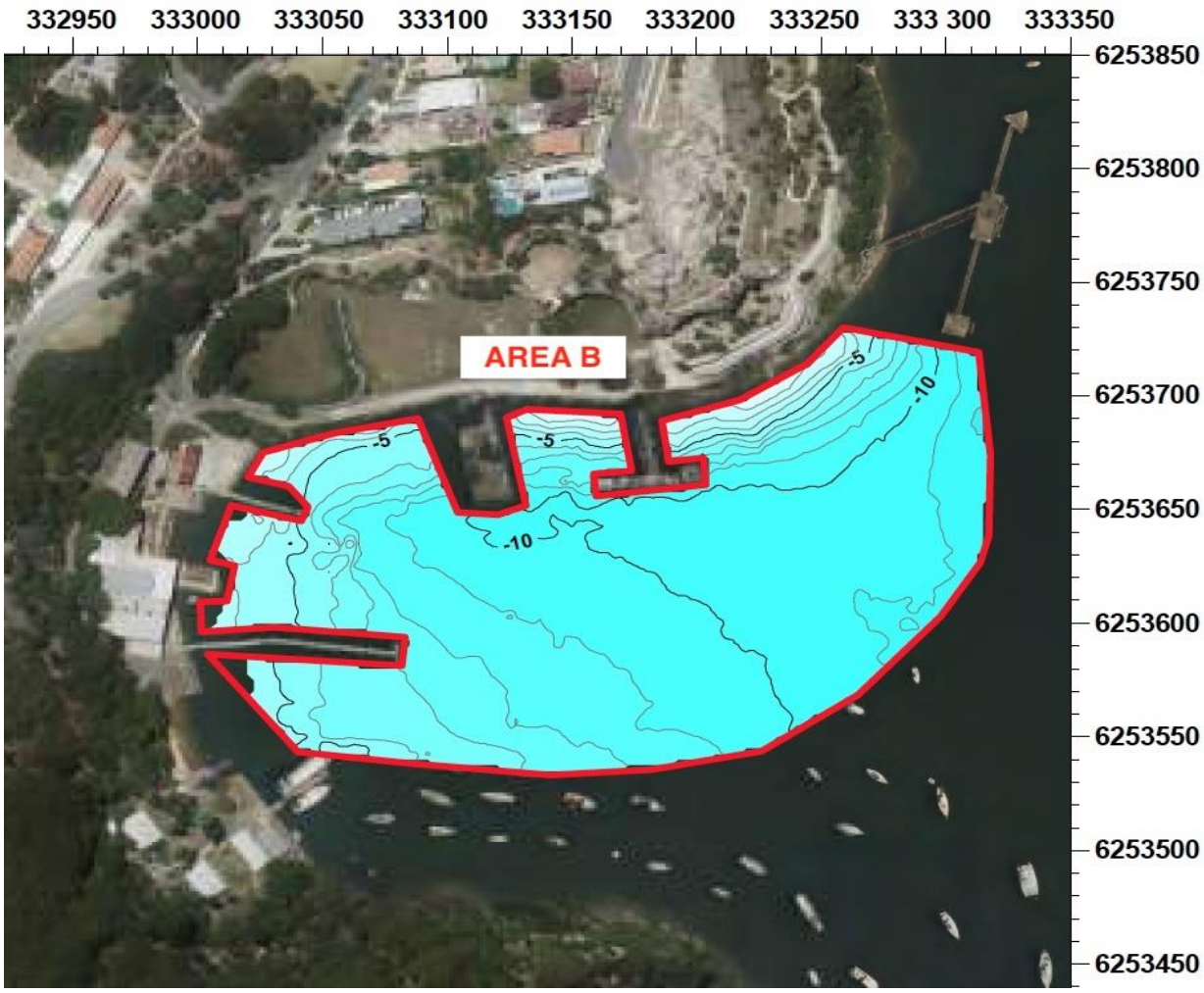

Figure 16: Bathymetric contour plan of western portion of Area B, Berrys Bay, Sydney Harbour. Depths are in metres AHD (Earth Technology Solution Pty Ltd, 2017a: Figure WH2)

The seismic profiling data obtained for this project shows the ancient course of Eastern Berrys Bay Creek with its headwaters in the vicinity of Woodleys Shipyard running in a south to south-easterly direction before meeting up with the North Berrys Bay Creek and flowing into the ancient Parramatta River (Figure 17).

The ancient valley profile can be clearly seen in seismic profiling carried out for the project, along with the thickness of sediment strata, of which the upper most layers, measuring approximately 20 metres thick, were most likely deposited since inundation (Figure 18 and Figure 19).

During the glacial period of the late Pleistocene, the area within Area B would have comprised the riverbed and banks of an ancient freshwater creek feeding into Parramatta River to the south-east. It would have also overlooked the lower- to mid-height walls of a relatively steep-sided valley of exposed Hawkesbury sandstone.

The climate and vegetation would also have been substantially different from the current landscape, likely resembling the Blue Mountains region of today.

Figure 17: Interpreted rock level contour plan for Area B. Heights are in metres below AHD. Dashed blue line indicates ancient creek line (Earth Technology Solution Pty Ltd, July 2017a: Figure WH6)

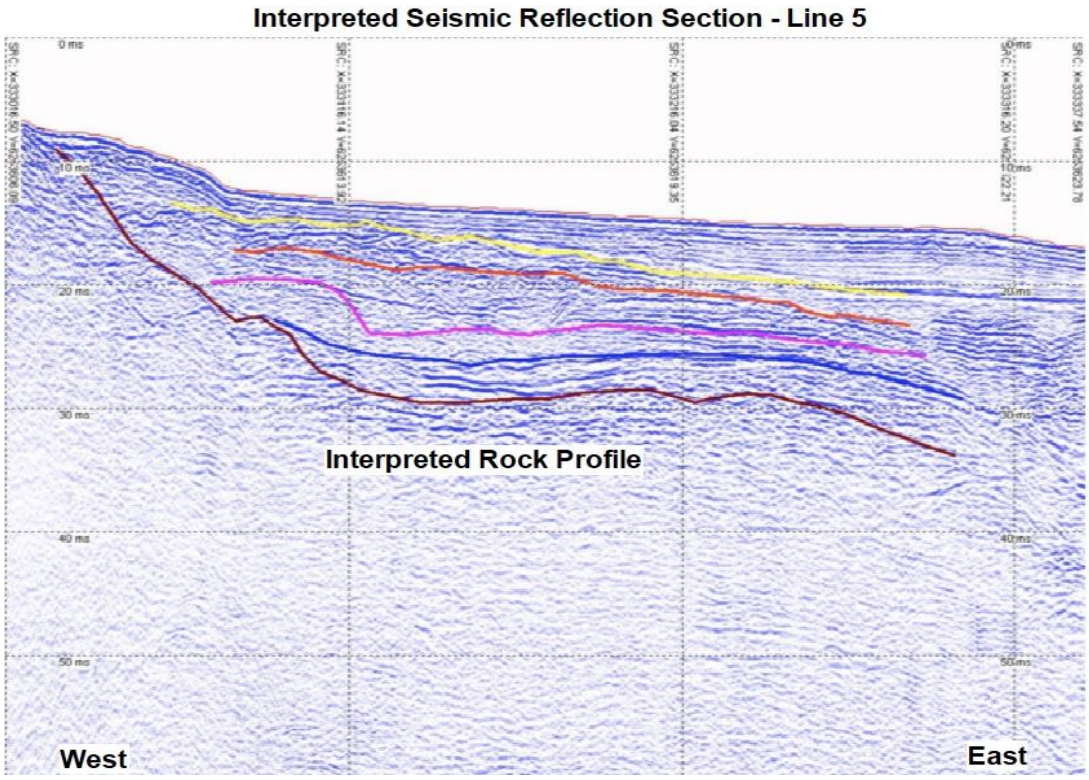

Figure 18: Seismic reflection profiles – Line 5 (run east-west across Berrys Bay) (Earth Technology Solution Pty Ltd 2017: Figure B-WH5)***. The horizontal coloured lines represent seismic sediment reflectors that have been correlated to sediment units identified from borehole data. These sediment units show alternating periods of deposition and erosion. It is uncertain how many of these strata are associated with marine sediments from the Holocene, but it is expected that the upper strata have been formed since inundation***

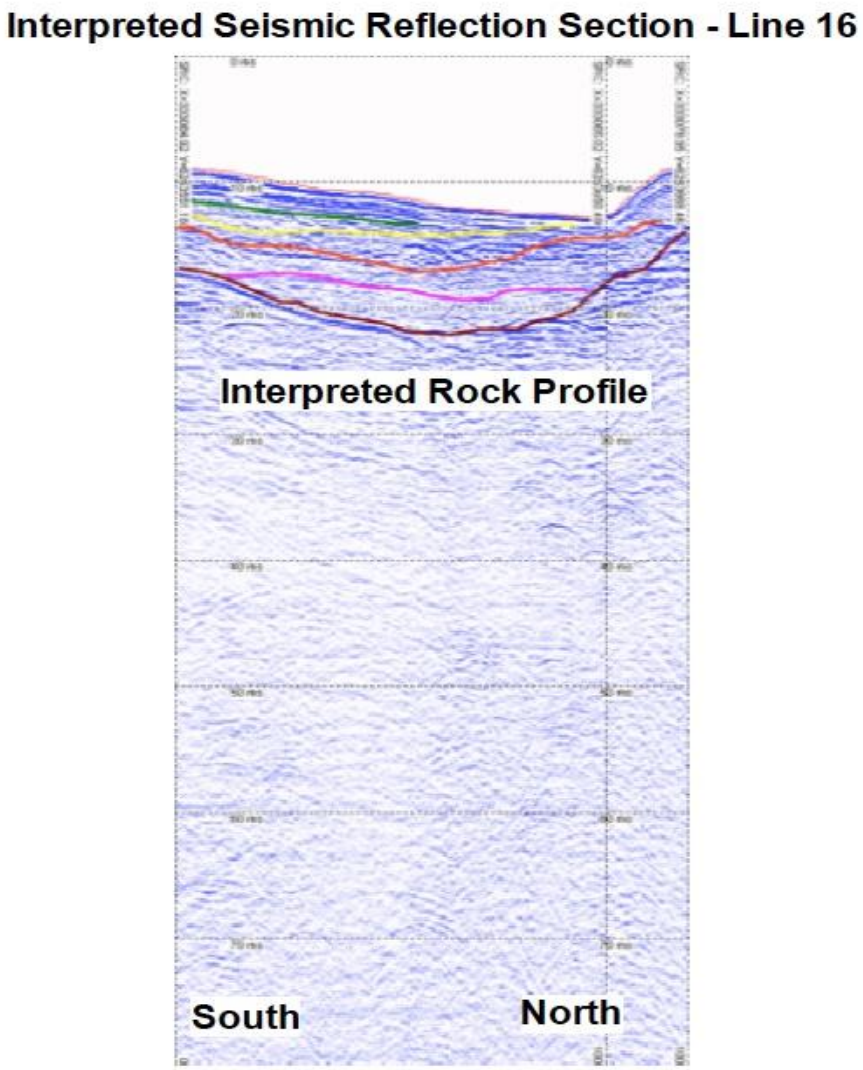

Figure 19: Seismic reflection profiles – Line 16 (run north-south across Berrys Bay)
(Earth Technology Solution Pty Ltd 2017: Figure B-WH5)

There is no borehole data carried out for the project that is available for Area B and the side scan sonar imagery – as borne out by the seismic profiling – shows no sandstone bedrock outcropping. As such, no further assessment can be made other than to state that archaeological evidence associated with Aboriginal occupation during the glacial period of the late Pleistocene may potentially occur within Area B, other than that it is likely to be buried underneath Holocene marine sediments, up to 20 metres thick.

7.2 Known Aboriginal archaeological sites near Area B

Numerous Aboriginal archaeological sites have been identified on the Hawkesbury Sandstone headland of Balls Head, demonstrating that Aboriginal populations utilised the sandstone rock platforms, shelters and estuarine food resources of this particular part of Sydney Harbour – certainly, at least, during the mid to late Holocene.

Two searches of the NSW Office of Environment and Heritage Aboriginal Heritage Information Management Systems (AHIMS) register have been carried out as part of the broader Western Harbour Tunnel and Beaches Link program of works – the first conducted in 2016 by Artefact Heritage Services (2016) and the second conducted in May 2017 by Jacobs Group Pty Ltd (2018).

An examination of the two AHIMS register searches identified five Aboriginal archaeological sites along the foreshore directly next to Area B. These five sites include four rock shelters, three with art, three with shell midden deposits and one also containing a human burial and one shell midden on an open sandstone ledge. All occur within the exposed Hawkesbury Sandstone landscape just behind the southern shore of Berrys Bay (Table 5 and Figure 20). There are no Aboriginal archaeological sites on the AHIMS register situated within the maritime environment of Area B.

Table 5: Aboriginal archaeological sites on AHIMS register near Area B.

Site Id. No.	Site name	Site type	Environment
45-6-2961	Balls Head Midden NSC-058	Shell midden	Exposed Hawkesbury sandstone landscape behind southern foreshore of Berrys Bay, towards south-western tip of Balls Head
45-6-0027	Balls Head Berry Island	Rock shelter with art, shell midden and human burial	Exposed Hawkesbury sandstone landscape behind southern foreshore of Berrys Bay, towards south-western tip of Balls Head
45-6-0630	Berry Bay Balls Head Reserve	Rock shelter with art	Exposed Hawkesbury sandstone landscape behind southern foreshore of Berrys Bay, towards south-western tip of Balls Head
45-6-0891	Balls Head Reserve, 5 Hands Cave	Rock shelter with art and shell midden	Exposed Hawkesbury sandstone landscape behind southern foreshore of Berrys Bay
45-6-2180	Quarantine Cave, Waverton	Rock shelter with shell midden	Exposed Hawkesbury sandstone ridges behind western foreshore of Berrys Bay

Figure 20: Location of registered Aboriginal archaeological sites near Area B

7.3 Potential submerged Aboriginal sites in Area B

Based on the physical landscape, remote sensing data, and the broad predictive model outlined in Section 5.4, the Aboriginal archaeological site types that could occur in Area B include:

- rock shelters containing occupation deposits (such as middens, stone artefacts, human burials) and/or other occupation evidence (such as art, grinding grooves)
- art and/or grinding groves on open sandstone ledges and vertical faces
- archaeological deposits, such as middens and/or stone artefact scatters, on sandstone platforms and lower valley slopes or terraces adjacent to the ancient watercourse
- fish traps on shallow, wide and gently sloping sandstone platforms.

Area B is relatively enclosed, protected from wind and wave action from most directions apart from the east and south-east, with the greatest fetch being less than 1.5 kilometres. For this reason, archaeological sites becoming inundated within Area B would have been less affected by wave action than Area A.

There is no borehole data available for Area B. The side scan sonar imagery – as borne out by the seismic profiling – shows no sandstone bedrock outcropping. As such, no further assessment can be made other than to state that submerged Aboriginal archaeological sites may potentially occur within Area B, buried under approximately 20 metres of marine sediments, most of which would have been deposited during the Holocene.

Based on the nature of the landscape from the post-glacial marine transgression through to the Holocene, it is considered very unlikely that Aboriginal archaeological sites or deposits would occur in the upper sediment levels within Area B, ie. within the proposed piling depth of about five metres below the current bed of the harbour surface.

7.4 Summary of potential submerged Aboriginal sites in Area B

Area B has potential to contain remnants of submerged Aboriginal archaeological sites. It should be noted that the assessment is confined to areas of proposed impact within Area A, which are the only areas for which geophysical data is available (see Chapter 10).

Using the definition of archaeological potential in Table 3, there is Moderate to High archaeological potential for all identified site types across Area B (Table 6). It is important to note that the information available at present allows only for assessments that indicate the likelihood of submerged archaeological remains being present, with this likelihood being a combination of a site having been present prior to inundation, and the likelihood of it surviving inundation.

Table 6: Archaeological potential for site types in Area B.

Archaeological potential level	Aboriginal site type	Predicted potential locations in Area B
Moderate to High	All forms identified - rock shelters, grinding groves, middens and / or stone artefact scatters, fish traps.	In potential residual soils and / or sandstone overhangs / ledges, creek lines that may occur buried beneath Holocene marine sediments, up to 20 metres thick below the current bed of the harbour surface.

8 AREA C – WHITE BAY, JOHNSTONS BAY AND GLEBE ISLAND

8.1 Physical setting

The current landscape of Area C consists of the highly modified and extensively reclaimed Glebe Island and the surrounding waters of White Bay and Johnstons Bay (Figure 21). The bed of the harbour of both bays is also highly altered, with water depths around Glebe Island maintained through dredging about 12 metres below Lowest Astronomical Tide to service the surrounding commercial port facilities. Before 20th century reclamation activities, Glebe Island was a true island, separated from the Rozelle foreshore by a narrow stretch of water. Borehole data collected for this project shows that the surface of the bed of the harbour is a mix of silt and silty sand (Douglas Partners & Golder Associates, 2017: Boreholes B204W and B205W).

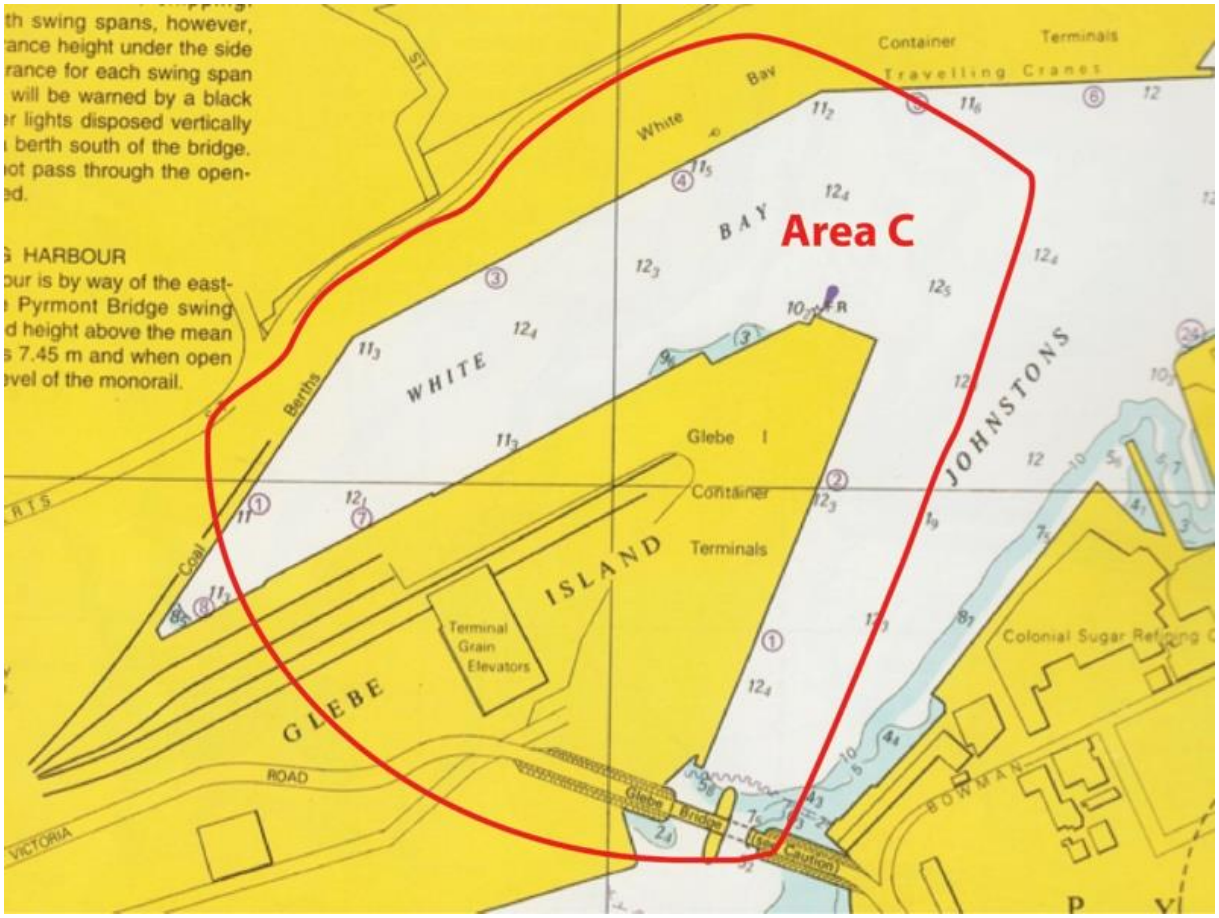

Figure 21: Portion of nautical chart showing Area C. Depths are in metres *(Commonwealth of Australia / Crawford House Publishing, 1995, Chart 25)*

No seismic profiling or side scan sonar survey was carried out for Area C. As no dredging is proposed for this area and that the sub-sea impacts would be extremely limited and localised, in the form of piling, the availability of such information would not have changed the impact assessment.

During the glacial period of the late Pleistocene, the area within Area C would have comprised the riverbed and banks along the confluence of at least four ancient freshwater creeks feeding into Parramatta River to the north. It would have also overlooked the lower- to mid-height walls of a relatively steep-sided valley of exposed Hawkesbury sandstone. Glebe Island would have represented the eastern extremity of a ridge extending north-east from the current Rozelle-Balmain peninsula. The climate and vegetation would have been significantly different from the current coastal landscape, more likely resembling the Blue Mountains region of today.

8.2 Known Aboriginal archaeological sites near Area C

There are no Aboriginal archaeological sites on the NSW Office of Environment and Heritage Aboriginal Heritage Information Management Systems register situated along the foreshore areas of either White or Johnstons Bay next to Area C. However, this is likely to be due to the substantial land reclamation and

development that has occurred in these areas since the early 20th century, rather than a true indication of a lack of prehistoric Aboriginal land use and activity across these landscapes.

8.3 Potential submerged Aboriginal sites in Area C

Based on the physical landscape, remote sensing data, and the broad predictive model outlined in Section 5.4, the Aboriginal archaeological site types that could occur in Area c include:

- rock shelters containing occupation deposits (such as middens, stone artefacts, human burials) and/or other occupation evidence (such as art, grinding grooves)
- art and/or grinding groves on open sandstone ledges and vertical faces
- occupation deposits, such as middens and/or stone artefact scatters, on sandstone platforms and lower valley slopes or terraces adjacent to the ancient watercourse
- fish traps on shallow, wide and gently sloping sandstone platforms.

Area C is relatively enclosed, protected from wind and wave action from all directions apart from the east and south-east, with the greatest fetch being less than 1.5 kilometres. For this reason, archaeological sites becoming inundated within Area C would have been less affected by wave action than Area A.

No seismic profiling or side scan sonar survey was carried out for Area C. The two boreholes drilled in this area for the project noted 0.15 metres of residual soil buried under 3.5 metres of marine sediments (B204W) and sandy estuarine-type deposit 0.9 metres thick under 12.1 metres of estuarine clay deposits (B205W) (Douglas Partners and Golder Associates, 2017). As such, no further assessment can be made other than to state that submerged Aboriginal archaeological sites may potentially occur within Area C, and that it is likely to be buried underneath up to 12 metres of Holocene marine sediments over which there is another three to five metres of reclamation. Based on the nature of the landscape from the post-glacial marine transgression through to the Holocene, it is considered very unlikely that Aboriginal archaeological sites or deposits would have occurred in the upper sediment levels within Area C or have survived in areas where dredging penetrated the upper sediment levels.

8.4 Summary of potential submerged Aboriginal sites in Area C

Area C has potential to contain remnants of submerged Aboriginal archaeological sites. It should be noted that the assessment is confined to areas of proposed impact within Area A, which are the only areas for which geophysical data is available (see Chapter 10).

Using the definition of archaeological potential in Table 3, there is Moderate to High archaeological potential for all identified site types across the study area (Table 7). It is important to note that the information available at present only allows for assessments that indicate the likelihood of submerged archaeological remains being present, with this likelihood being a combination of a site having been present prior to inundation, and the likelihood of it surviving inundation.

Table 7 Archaeological potential for site types in Area C.

Archaeological potential level	Aboriginal site type	Predicted potential locations in Area C
Moderate to High	All forms identified - rock shelters, grinding groves, middens and / or stone artefact scatters, fish traps.	In potential residual soils and / or sandstone overhangs / ledges, creek lines that may occur buried beneath Holocene marine sediments, up to 12 metres thick below the current bed of the harbour surface as well as under reclamation.

9 HERITAGE SIGNIFICANCE

9.1 Significance criteria

An assessment of cultural heritage significance seeks to understand and establish the importance or value that a site, place or landscape may have to the community at large. The concept of cultural significance is intrinsically connected to the physical components of a site, its location, setting and relationship with its surrounds as well as the traditional, spiritual, historical and social meaning attached to the site. The assessment of cultural significance is ideally a holistic approach that draws upon the response all these factors evoke from the community.

The Australia ICOMOS *Charter for the conservation of places of cultural significance 2013* – the Burra Charter – divides heritage significance into four main categories for the purpose of assessment: social, historic, scientific and aesthetic values. These principles have been adapted by the NSW Office of Environment and Heritage to specifically address the identification and assessment of Aboriginal cultural heritage (NSW Office of Environment & Heritage, Department of Premier & Cabinet, 2011).

Social value

Social value refers to the spiritual, traditional, historical or contemporary associations and attachments which the place or area has for the Aboriginal community. Places of social significance have associations with contemporary community identity, and social or cultural value is seen as the way in which people express their connection with a place and the meaning that place has for them. These places can have associations with tragic or warmly remembered experiences, periods, or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be identified through consultation with relevant Aboriginal communities.

Historic value

Historic value refers to the associations of a place with a person, event, phase, or activity of importance to the history of an Aboriginal community. Places of historic value may or may not have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). These places may also have 'shared' historic values with other (non-Aboriginal) communities – such as places of post-contact Aboriginal history.

Scientific value

Scientific value refers to the importance of a landscape, area, place, or object because of its archaeological and / or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or object and would consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

Aesthetic value

Aesthetic value refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use.

9.2 Assessment of Aboriginal heritage significance

An assessment of Aboriginal cultural heritage significance cannot be conducted without the input of Aboriginal stakeholders and communities – particularly with regard to social and historical values. As recognised by Office of Environment and Heritage, Aboriginal people are the primary determinants of the cultural significance of their heritage.

Jacobs Group Pty Ltd (2018) consulted with several Aboriginal knowledge holders as identified by the Registered Aboriginal Parties (RAPs) for the Western Harbour Tunnel and Beaches Link program of works with regards to cultural values within the project area. Table 8 provides a summary of the Aboriginal cultural values identified by knowledge holders during this consultation process, with regard to site types that might be present as submerged archaeological sites within the project area.

Table 8: Cultural values for terrestrial sites identified by Registered Aboriginal Parties during consultation with Jacobs Group Pty Ltd (2018).

Site type	Cultural values identified by Registered Aboriginal Parties
Rock shelters	The RAPs identified rock shelters as culturally significant as they provide a link between occupation of the region, the gathering of resources, land care rejuvenation and communication between other groups. In the course of the fieldwork, the identified rock shelter site locations containing stone artefact scatters or middens were noted as having these types of cultural significance.
Middens	The RAPs identified middens as culturally significant as they provide a link between occupation of the region, the gathering of resources and land care rejuvenation, and were important terrestrial, territorial markers on the landscape, facilitating communication between other groups. In the course of the fieldwork, the identified midden site locations were noted as having these types of cultural significance.
Watercourses, bays, water holes or springs	Permanent water bodies are culturally significant as central locations for gatherings of people, resource collection and camping. During fieldwork, the RAPs indicated certain water courses and bays within the harbour as important sources of food as well as significant for ceremonial practices. Watercourses, tides, islands and bays are often associated with spiritual beings. The length of the Parramatta River, to its mouth in the harbour, was considered to represent an important spiritual creature: an eel whose eye was Goat Island.
Engraving sites and areas of spiritual significance	The RAPs referred to rock engravings as highly important areas. These sites were often connected to pathways which link spiritual and ceremonial sites, as well as travel corridors throughout the landscape between the coast and higher ground. During the recording of the engravings, the RAPs expressed a profound sense of wonder and feeling of belonging and continuation of cultural practice. Several cultural protocols were observed while undertaking recording of the rock engravings: no whistling or singing at night, observance of men's and women's sites, and acknowledgment of elders and country at each site to ensure safe passage.
Burial sites	Burial sites are of great importance and are generally of high concern to Aboriginal people as the locations of burials are rarely documented. The RAPs identified the landscape features chosen for burial sites as being areas near campsites and on sandy rises near the shoreline of the harbour and within rock shelters near Berrys Bay.

With regard to scientific values, any surviving submerged Aboriginal archaeological sites would likely have very high cultural heritage significance due to their potential to yield information that would contribute to a greater understanding of NSW's natural and cultural history. Maritime Aboriginal archaeological sites and Pleistocene Aboriginal archaeological sites are both, on their own, rare site types within a NSW context; and the identification of submerged Pleistocene landscapes and associated Aboriginal archaeological resources would be a unique discovery within Australia (Nutley 2014, Nutley, Coroneos and Wheeler 2016, Ward, Larcombe and Veth 2015). An examination and analysis of such archaeological landscapes could contribute substantial information about Aboriginal technologies, land use strategies and utilisation of natural resources during the Pleistocene era; as well as important information about post-depositional processes and survival rates of Aboriginal archaeological sites and landscapes after sea level rise and inundation.

10 POTENTIAL IMPACTS ON SUBMERGED ABORIGINAL SITES

10.1 Approach to assessing impact

There are no known submerged Aboriginal sites within Areas A, B and C, but it has been possible to attribute archaeological potential based on available geophysical information, predictive modelling and an understanding of site formation processes. Without further investigation, more definitive statements regarding archaeological potential cannot be made, including the survival and integrity of sites.

The types and scale of all potential physical impacts on the bed of the harbour associated with the Western Harbour Tunnel program of works are described in detail in the supporting study on maritime heritage in Technical working paper: Marine heritage (Cosmos Archaeology, 2020).

For Areas A, B and C assessed in this report, the types of project activities that could impact submerged Aboriginal sites are:

- Dredging
- Piling (for temporary wharves and cofferdams)
- Excavation within the cofferdam.

These activities are considered to be direct impacts.

The following table has been developed by Jacobs Group Pty Ltd (2018) to assess the level of potential impact and associated significance for both known and potential Aboriginal sites within the project area. The significance of impact ratings corresponds with the damage classification model used for the project (CIRIA 1996).

Table 9 Rating of potential impacts (note that for the purposes of this study all Aboriginal heritage is considered to be of high significance)

Impact rating	Scale	Intensity	Duration / frequency
Major	Medium – large	Moderate – high	Permanent / irreversible
Moderate	Small – medium	Moderate	Medium – long term
Minor	Small / localised	Low	Short term / reversible
Negligible	Little or no potential physical impact on an Aboriginal site		

10.2 Area A

Zones of High and Moderate submerged Aboriginal archaeological potential are shown in Figure 22 and Table 10.

Impacts from dredging within these zones are rated as Moderate. This assessed impact reflects that dredging would be relatively localised, even though any evidence surviving would be considered to be of high heritage significance due to its rarity and ability to reveal more about submerged sites and Aboriginal occupation in the Sydney region during the terminal Pleistocene.

Dredging, including excavation within the cofferdams, would also impact areas of Very Low to Low archaeological potential, and the potential impacts could range from Negligible to Moderate.

Piling would occur in areas of Very Low archaeological potential. Any impacts arising from piling would be expected to be localised and therefore Minor.

Indirect impacts such as vibration would have a negligible impact, because any submerged Aboriginal remains would be buried and movement of individual artefacts would be minimal.

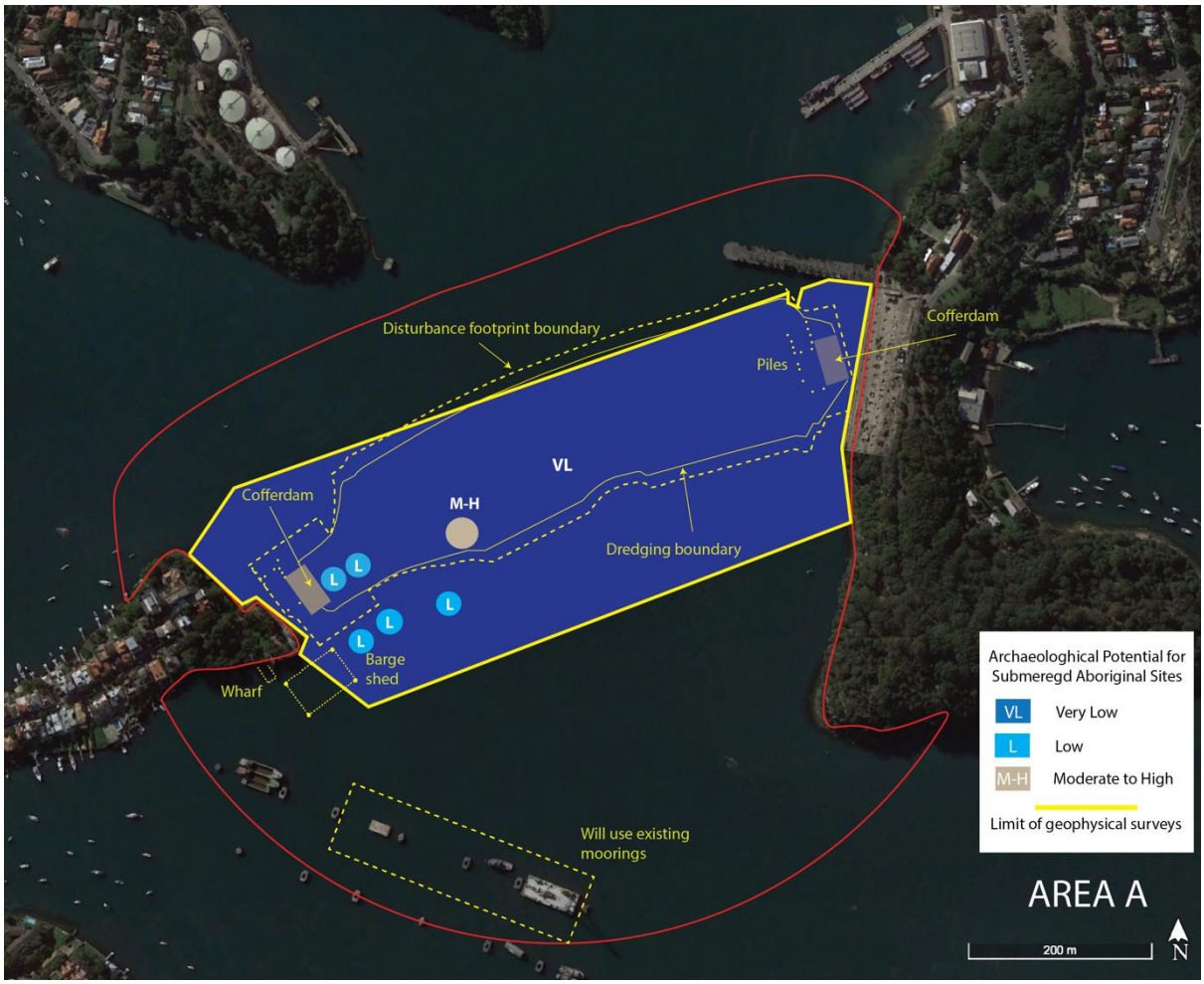

Figure 22: Activities with potential to impact on potential submerged Aboriginal sites in Area A

Table 10: Assessment of potential impacts on potential submerged Aboriginal sites in Area A.

Archaeological potential	Significance	Dredging (Direct)	Excavation (Direct)	Piling (Direct)	Vibration (Indirect)
Moderate to High (Borehole B215W)	High	Moderate (without mitigation)	N/A	N/A	Negligible
Low	High	Negligible to Moderate (without mitigation)	Negligible to Moderate (without mitigation)	Minor	Negligible
Very Low	High	Negligible to Moderate (without mitigation)	Negligible to Moderate (without mitigation)	Minor	Negligible

10.3 Area B

The only potential impacts on potential submerged Aboriginal sites within Area B would be in relation to piling for the temporary wharves and barge shed. The depth of piling would be unlikely to penetrate to sub-bed of the harbour strata containing Aboriginal archaeological remains. Should this occur, the impacts would be Negligible to Minor on account that the impacts would be localised, the diameter of a pile, and that artefacts would be dislocated as opposed to being removed/destroyed as would be the case with dredging.

10.4 Area C

The only potential impacts on potential submerged Aboriginal sites within Area C would be in relation to piling for the temporary wharves and barge shed. The depth of piling would be unlikely to penetrate to sub-bed of the harbour strata containing Aboriginal archaeological remains. Should this occur, the impacts would be Negligible to Minor on account that the impacts would be localised, the diameter of a pile, and that artefacts would be dislocated as opposed to being removed/destroyed as would be the case with dredging.

11 MANAGEMENT

11.1 Introduction

Appropriate heritage conservation management considers a number of factors:

- Heritage significance
- Relevant heritage policies
- Best practice
- The consultant's experience in forming and implementing mitigation measures in a marine environment.

The underlying principle in safeguarding the cultural heritage significance of maritime heritage is to avoid or minimise any direct, indirect and long-term impacts on a site. This approach is refined and adjusted depending on the level of cultural heritage significance of an item or site, the risk of impact and the scale of impact. The scale or consequence of impact relates to the degree of loss – immediate or gradual – of cultural heritage significance.

Generally, the appropriate management measure for a site of high significance, if impacts are assessed to be moderate or higher, would be to avoid the site or modify the design where feasible. The present state of knowledge about submerged Aboriginal remains within the study area is that there is a moderate to high archaeological potential for their presence in a localised area near the centre of Area A, with less archaeological potential elsewhere (see Figure 22). The proposed management measures would reduce the overall extent of impact on any submerged Aboriginal remains and their heritage significance. This is achieved by targeted pre-construction phase marine geophysical investigation in selected areas to confirm the presence of sites, followed by archaeological recording and recovery during the construction phase to realise the information value of such archaeological remains.

Given the current limited knowledge of submerged archaeological sites in eastern Australia, all information has value, including presence-absence data, the relationship between geophysical records and actual formations, and the condition of any submerged archaeological remains.

There are three mitigation measures proposed for this study area:

Mitigation measure 1	*Pre-construction investigations*
Mitigation measure 2	*Monitor excavation within cofferdams*
Mitigation measure 3	*Collect and sieve soil units identified as having potential to contain cultural remains*

These measures, along with associated flow diagrams, are presented below. A process flow chart is also provided at the end of this section describing how the mitigation of potential impacts on potential submerged Aboriginal sites can be managed throughout the various stages of the project.

11.2 Mitigation 1 – pre-construction investigations

This measure is to commence before the construction phase, with an investigation into whether a high resolution geophysical survey may be of assistance in identifying rock overhangs concealed by marine sediments (Figure 23).

If it is determined that a high resolution geophysical survey could produce the desired results, then the survey would be carried out. If the geophysical survey conclusively shows that there are no rock overhangs measuring at least 1.2 metres in height (from the rock base to the rock ceiling), no further work would be carried out. The 1.2 metre threshold has been set based on documented minimal heights of habitation shelters (see Section 5.4), combined with the assessment that any archaeological deposits within smaller shelters are very unlikely to have survived inundation and would be very difficult to identify in a marine environment. Any residual risk would need to be managed through an unexpected finds procedure.

However, if the geophysical survey is inconclusive or if there are distinct rock overhangs, then onsite visual monitoring of excavation would be carried out after the cofferdam has been de-watered (refer to Mitigation Measure 2).

11.3 Mitigation Measure 2 – Monitor excavation within the cofferdams

Mitigation measure 2 would be carried out if the geophysical survey discussed in Mitigation measure 1 is inconclusive or if there are distinct rock overhangs identified (see Figure 23). In this situation, visual monitoring of excavation would be carried out after the cofferdam has been de-watered. The aim of the monitoring would be to identify voids within the bedrock close to the interface with marine sediments. It is understood that voids and fissures in the bedrock are of interest for engineering purposes and the excavation would be monitored in any event.

In the event that a void in the bedrock appears that displays the characteristics of a potential rock shelter, then the marine sediments would be removed – either by pump or manually. Should the marine sediments bottom out onto the rock, no further action would be taken. If the characteristics of the marine sediments change or if fissures are evident, then samples of the sediments would be taken, preferably as an intact core sample.

In consultation with a suitably experienced geomorphologist a set of criteria would be established for the identification of pre-inundation soil deposits (peat, charcoal, roots, etc). If pre-inundation soil deposits are evident a controlled archaeological investigation to recover any artefacts would take place. The extent of the investigation would be determined by the constraints of the bed rock conditions and safety constraints within the cofferdams. The Environmental factors such as operating space within an overhang or viscosity of the pre-inundation soil would have an influence on the method of investigation, which should nonetheless aim to retain spatial and stratigraphic control if at all feasible.

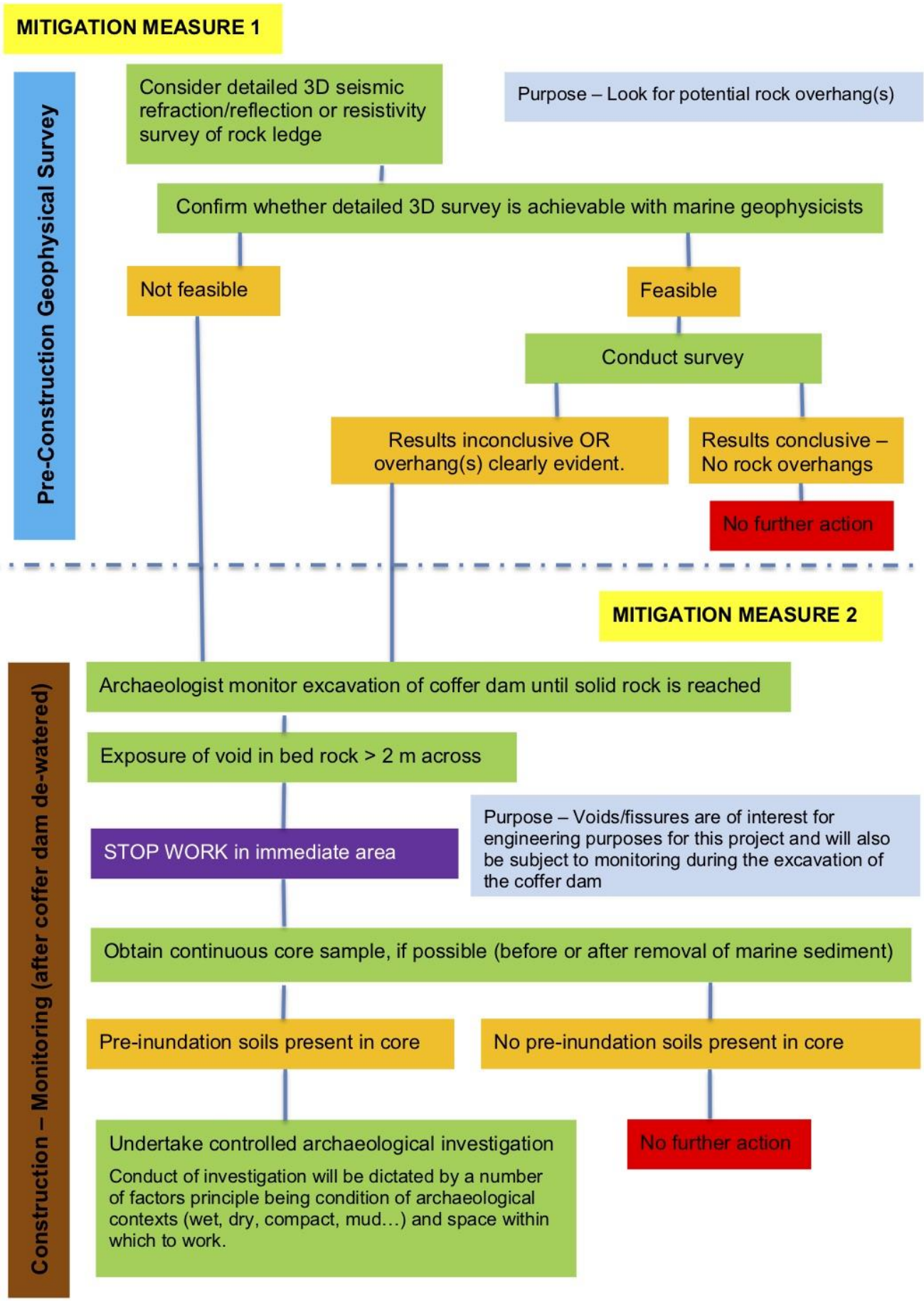

Figure 23: Flow chart of actions for Mitigation Measure 1 (Pre-construction investigations) and Mitigation Measure 2 (Monitor excavation within cofferdams)

11.4 Mitigation Measure 3 – Collect and sieve dredged soil units

This measure addresses the impacts on residual soil and peat deposits that would be affected by dredging or piling (Figure 25). The areas currently of interest are peat and residual soils in the immediate vicinity of B215W (see Figure 4, Figure 22 and Table 10).

Pre-construction determination of whether soil units have potential to contain cultural material would be carried out by a palaeo-geomorphologist through review of existing borehole information.

If potential is identified then an appropriate sampling protocol would be designed. Core sampling pre-construction may be a methodology that is appropriate.

If appropriate, closed system sampling may be carried out during dredging with large scoop samples placed on a barge deck where material can be sieved and inspected.

Obtaining bulk soil and sediment samples relating to the pre-inundation landscape during the construction phase could potentially cause relatively little disruption to the program but be of great value to archaeologists as well as other scientific disciplines. This procedure is not uncommon internationally, a well-publicised example being a recent project in the port of Rotterdam, which recovered sediments from late Pleistocene and early Holocene strata using a bucket dredge (Figure 24) (PIANC 2014). These sediments were deposited into 'bulka' bags and taken off site for sieving. A similar process was recently carried out in Sydney, on a land excavation, in an area with known late Pleistocene sand bodies. The sediment recovered from the port of Rotterdam project contained numerous fragments of animal bone and stone artefacts.

Figure 24 Example: Dredge spoil from Pleistocene deposits being placed into bulka bags for sieving off-site, Yangtze Harbour, Rotterdam* (PIANC 2014: Appendix V Figure 15). *Note that the backhoe dredge proposed for the project works is of a much larger scale that the one used in Rotterdam

The implementation of this measure would require input from experts in palaeosols and/or palaeogeomorphology, as well as obtaining a better understanding as to how the dredging and piling would be carried out. This would refine the methodology for when and how these deposits would be examined for evidence of pre-inundation occupations. Further discussion on feasibility of soil sample collection and an appropriate process for sample collection would therefore need to be agreed prior to the commencement of dredging works.

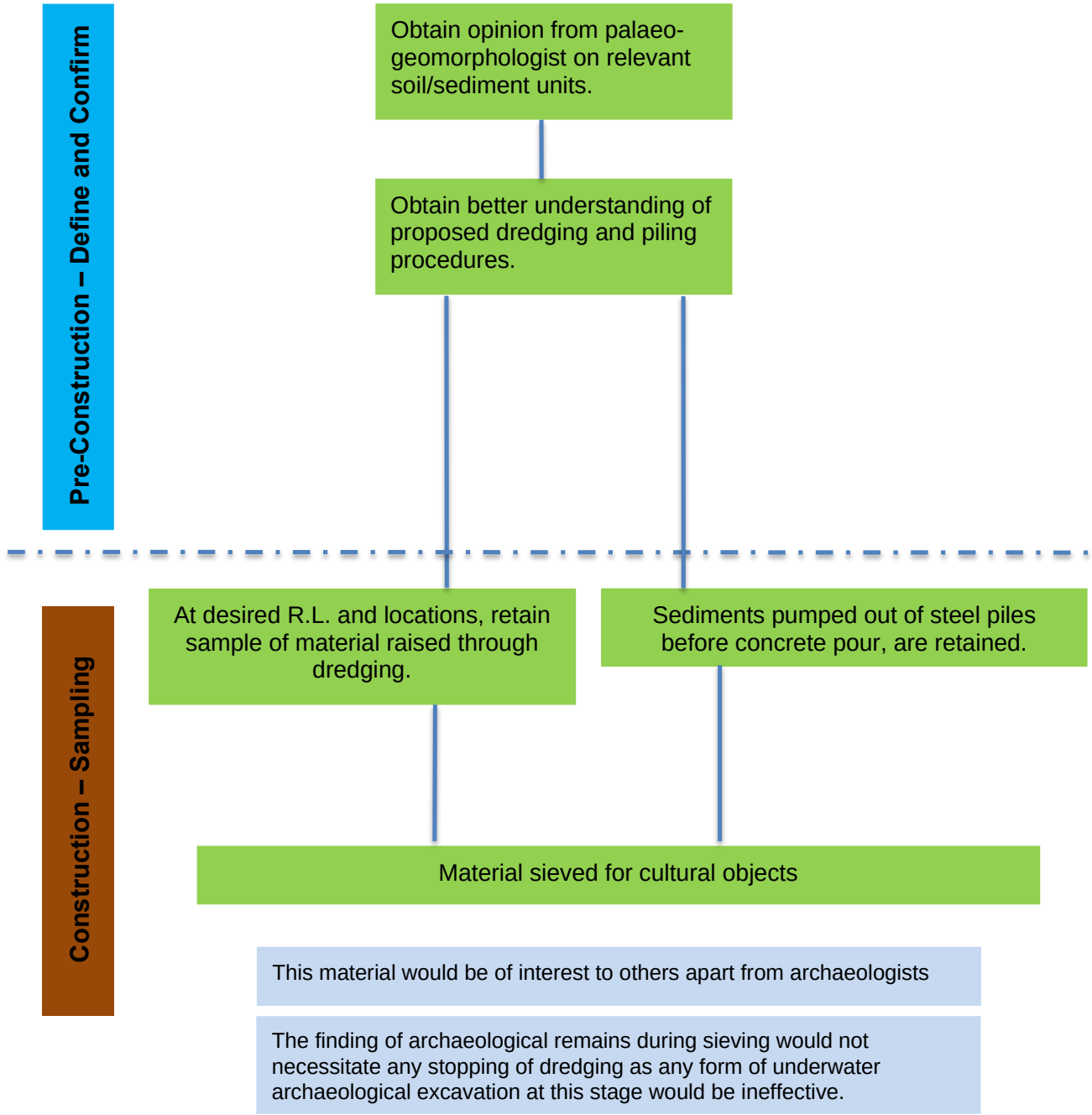

Figure 25: Flow chart of actions for Mitigation Measure 3 – Collect and sieve dredged soil units

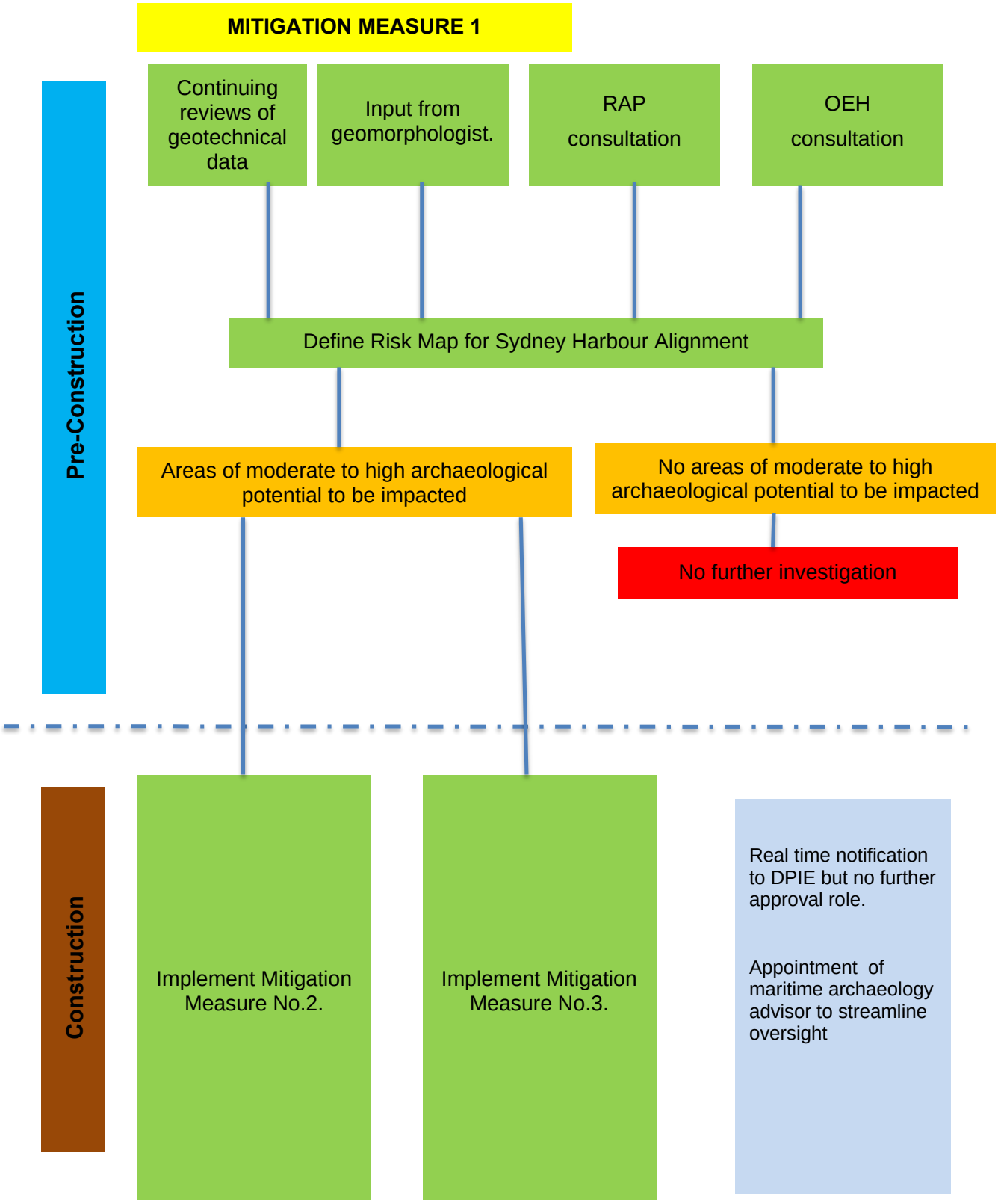

Figure 26: Process flow chart

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