ALTRAC Light Rail

D&C JV


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December 2015
Revision A

Revision Control box

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Details of Revision Amendments

The latest approved version of this Report will be available for all Project personnel on the Electronic Document Management System - TeamBinder. Each new revision to the report will be distributed to all required personnel for review and approval.

The revision number is included on the cover page of the document number. The document will be allocated a new revision number each time a change is made to the document.

When a new revision to the document is available, a notification email will be distributed to all project personnel by the Document Control Team advising of the update.

The functional Manager is responsible for the implementation and review of the report. The Project Director will approve new revisions of the report via the review and approval process as detailed in the Document Control Procedure.

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Executive Summary

This Archaeological Research Design for Moore Park forms an addendum to the Aboriginal Cultural Heritage Assessment Report (ACHAR) and Aboriginal Technical Report (ATR).

The report responds to the detailed design of subsurface impacts and excavation methodology specific to Moore Park, which were refined following the finalisation of the ACHAR and ATR. The report also considers the results of recent geotechnical testing and the understanding of archaeological potential within the construction footprint, and presents three methodological options for Aboriginal archaeological testing and salvage:

- Option 1—an open stepped excavation;
- Option 2—box shoring excavation; and
- Option 3—push tube excavation.

Option 3—push tube excavation is presented as the most feasible methodology for the control it is likely to afford in terms of identifying, recording and interpreting archaeological deposits and the management of key hazards associated with the archaeological investigation of this part of Moore Park at depth (including water inflow and potential trench collapse) to limit WHS issues.

Push tube excavation will involve the use of a Sonic drill rig to sample 300mm diameter cores at 20m intervals across the proposed sample area, subject to modifications for constraints such as services and trees, to test for the presence of Aboriginal objects. The sample deposit from each push tube will be removed and inspected, recorded and sampled for sieving to determine the presence of Aboriginal objects. The report provides an analysis of this sample grid size, and determines that it is sufficient to determine the presence or absence of archaeological deposits within the study area. If an archaeological deposit is positively identified, additional push tube samples would be placed at closer intervals to determine the nature and extent of the archaeological deposit and until a reasonable sample of the deposit is salvaged.

This report has been prepared in accordance with CoA B56 and B57. The methodology has been developed in consultation with the Office of Environment and Heritage (OEH) and the Registered Aboriginal Parties (RAPs), following CoA B56(a) and B57(a). CoA B57(a) also requires that this investigation program be prepared to the satisfaction of the Secretary.

The archaeological program is scheduled to commence in early January 2016.
CBD and South East Light Rail

Aboriginal Cultural Heritage Assessment Report and Aboriginal Technical Report

Addendum Report—Archaeological Research Design for Moore Park

Report prepared for Acciona Infrastructure Australia

December 2015
Report Register

The following report register documents the development and issue of the report entitled CBD and South East Light Rail—Aboriginal Cultural Heritage Assessment Report and Aboriginal Technical Report, Addendum Report—Archaeological Research Design for Early Works at Moore Park undertaken by GML Heritage Pty Ltd in accordance with its quality management system.

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Quality Assurance

GML Heritage Pty Ltd operates under a quality management system which has been certified as complying with the Australian/New Zealand Standard for quality management systems AS/NZS ISO 9001:2008.

The report has been reviewed and approved for issue in accordance with the GML quality assurance policy and procedures.

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Cover Image: Moore Park west facing east along extant footpath (GML 2013).
GML Heritage

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1.0 Moore Park Tunnel—Aboriginal Archaeological Research Methodology

1.1 Introduction

GML Heritage (GML) has been commissioned by Acciona Infrastructure Australia to prepare a supplementary Archaeological Research Design (ARD) for the CBD and South East Light Rail (CSELR) Early Works at Moore Park. This report forms an addendum to the CSELR Aboriginal Cultural Heritage Assessment Report (ACHAR) and Archaeological Technical Report (ATR) prepared by GML in September 2015. It utilises the findings of recent geotechnical investigations to refine the methodology suitable for assessing Aboriginal archaeological potential at this location. As detailed design for subsurface impacts in this area has now been completed, this report provides a detailed methodology for archaeological testing and salvage which responds to the proposed impacts and excavation methodology specific to Moore Park.

1.2 Project Description

The CSELR comprises the construction and operation of a new light rail service—approximately 12km of new light rail track from Circular Quay to Central, then from Central to Kingsford and Randwick via Surry Hills and Moore Park. The route of the CSELR is shown in Figure 1.1.

The study area has been divided into five precincts:

- City Centre precinct (Circular Quay to Chalmers Street);
- Surry Hills precinct (Devonshire Street to South Dowling Street);
- Moore Park precinct (South Dowling Street to Alison Road);
- Kensington/Kingsford precinct (Alison Road to Kingsford, including junction); and
- Randwick precinct (Alison Road to Randwick).

Stabling facilities will be provided at Randwick and Lilyfield.

This report refers to the Moore Park precinct, located between South Dowling Street and Alison Road, Moore Park (Figure 1.2).

1.3 Statutory Context

The Sydney Light Rail Project is approved as State Significant Infrastructure (SSI-6402) thus is not subject to the approvals provisions of the Heritage Act 1977 (NSW) (Heritage Act) and the National Parks and Wildlife Act 1974 (NSW) (NPW Act). This report has been prepared in accordance with the Conditions of Approval approved on 4 June 2014, particularly Conditions B56 and B57.

B 56. Prior to the commencement of construction activities within the Moore Park Precinct, in areas within the vicinity of registered PADs and for other areas of the SSI that have the potential to yield Aboriginal objects, the Proponent shall:

(a) undertake archaeological investigation of this site using a methodology prepared in consultation with the OEH (Aboriginal heritage) and the Aboriginal stakeholders; and
(b) report on the results of the archaeological investigation, including recommendations (such as for further archaeological work) in consultation with the OEH and to the satisfaction of the Secretary, and shall include, but not necessarily be limited to:

(i) consideration of measures to avoid or minimise disturbance to Aboriginal objects where objects of moderate to high significance are found to be present;

(ii) where impacts cannot be avoided, recommendations for any further investigations or salvage under B57; and

(iii) management and mitigation measures to ensure there are no additional impacts due to pre-construction and construction activities.

B57. Prior to the commencement of construction activities affecting the Moore Park precinct where Aboriginal objects of moderate to high significance are found to be present and cannot be avoided (B56(ii)), the Proponent shall:

(a) develop a detailed salvage strategy, prepared in consultation with the OEH (Aboriginal heritage) and the Aboriginal stakeholders. The investigation program shall be prepared to the satisfaction of the Secretary; and

(b) undertake any further archaeological excavation works recommended by the results of the Aboriginal archaeological investigation program.

Within twelve months of completing the above work, unless otherwise agreed by the Secretary, the Proponent shall submit a report containing the findings of the excavations, including artefact analysis and Aboriginal Site Impacts Recording Forms (ASIR), and the identification of final storage location for all Aboriginal objects recovered (testing and salvage), prepared in consultation with the Aboriginal stakeholders, the OEH (Aboriginal heritage) and to the satisfaction of the Secretary. A copy of this report shall be provided to the relevant Council.

1.4 Consultation

1.4.1 Aboriginal Community Consultation

TfNSW commenced the consultation process for the CSELR project in 2013, registering interested Aboriginal stakeholders for the entire project in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents.¹

The following Registered Aboriginal Parties (RAPs) have been identified as the key relevant stakeholders for the project, and will continue to be consulted throughout the CSELR project:

- the La Perouse Local Aboriginal Land Council (LPLALC);
- Darug Aboriginal Cultural Heritage Assessments (DACHA);
- Darug Land Observations (DLO); and
- Tocomwall.

In accordance with the Conditions of Approval B56 and B57 all Aboriginal stakeholders have been provided with the opportunity to review and provide comments on previous methodologies, and project documents including the ACHAR/ATR. The four relevant RAPs listed above were provided with a copy of this report for review and comment (Appendix A). They were also invited to a meeting to discuss the methodology on Tuesday 1 December. No RAPs attended this meeting. DLO provided a written response (Appendix A). Mr Gordon Morton of DACHA provided verbal comment on Tuesday 1 December that he is satisfied with the report.
1.4.2 OEH Consultation

The 'push-tube' sampling methodology proposed for the archaeological investigation at Moore Park has not been previously utilised in Australia. Development of this methodology has involved consultation with a number of informed experts, including the geotechnical providers and the OEH.

In accordance with Conditions of Approval B56 and B57, OEH have been given the opportunity to review and comment on ACHAR/ATR. A copy of this report was provided to OEH for review and comment. OEH declined to comment (Appendix A).

In August 2015, the OEH provided informal advice to GML on the potential use of 'push-tube' sampling, to access archaeological deposits contained in deep sand sheet. The OEH advice was provided without prejudice, as it was not project specific; rather the consultation aimed to understand whether the OEH held an opinion on the proposed method, and their requirements should such a method be proposed as an actual archaeological process. The outcomes of the consultation with OEH have informed this ARD.

1.5 Archaeological Background

The ethno-history of the study area, information on the NSW Aboriginal Heritage Information Management System (AHIMS), landscape characterisation and previous predictive models have been researched and presented previously in the ACHAR for the project. This report should be referred to for detail on landscape context, environmental conditions and the Aboriginal heritage background which underpins this ARD.

1.5.1 History

The Moore Park precinct is located within the large complex of undulating sand dunes and wetlands which extend with a north to south orientation from Botany Bay in the east to Sheas Creek in the west. The soil landscape in the CSELR study area is characterised by Tuggerah soils, which generally consist of fine to medium-grained marine quartz sand, and are often deep (over 2m). An extensive wetland system—including the Lachlan Swamps—is associated with the dune field. The Moore Park Precinct terminates at the beginning of the Lachlan Swamp system.

The sand dune and wetland environment around the Moore Park precinct is characterised by eastern banksia scrub vegetation communities on the sand and freshwater sedge swamp communities within the wetlands. The eastern banksia scrublands are likely to have included kangaroos, wallabies, possums, bandicoots, fruit bats (grey-headed flying foxes) and a range of birds, snakes and lizards. The freshwater wetlands would have been inhabited by a diverse range of animals which would have been consumed by Aboriginal people, including waterbirds, eels, tortoises, freshwater mussels, shellfish and fish.

1.5.2 AHIMS Sites

No Aboriginal sites were recorded on AHIMS within the study area when searches were undertaken in April 2015. Two sites were recorded within a 1km search buffer. These included Moore Park AS1 (45-6-3155), where Aboriginal objects were retrieved from a distinct darker grey sand profile—from a depth of 0.9 to 1m in Test Pit 4. This site was identified and salvaged by Artefact during CSELR Early Works. The second site was a rock art site (45-6-0647) which was located in Darvill Street but has been destroyed by roadworks.
Aboriginal archaeological test excavations undertaken for the Eastern Distributor (at the western extent of the study area) indicated that extensive fill (up to 1.5m) caps natural soil deposits. No known Aboriginal sites were recorded. At the northern end of Moore Park, excavations associated with the Shared Path Bridge over Anzac Parade revealed mixed fill up to 0.5m deep, with areas of significant disturbance associated with service trenches. Beneath that, natural sand layers were found intact across the remainder of excavated areas. Further south at the Moore Park Tennis Centre, natural sand was found below nineteenth and twentieth-century fills varying in depth between 0.5m to over 2m. Archaeological testing undertaken by GML—in conjunction with contamination testing for the area in the Randwick Stabling Yard—identified Aboriginal stone artefacts within 1m of the surface.

Historical excavations at Prince of Wales Hospital identified Aboriginal archaeological evidence in the form of three hearths and a small number of flaked artefacts. It was concluded that 'this site was formed under conditions of high [human] mobility, perhaps the result of short-term forays, and represents a different settlement and subsistence pattern to that observed at contact and in the archaeological record during the last 3000 years'.

The low number of sites recorded on AHIMS in close proximity to Moore Park likely reflects the limited investigation of Aboriginal archaeology in that area to date, rather than any meaningful indication of the way Aboriginal people utilised this landscape.

The presence of Site 45-6-3155 and the artefacts at the Randwick Stabling Yard indicates that despite historical disturbance to surface deposits, evidence of Aboriginal occupation of the area is extant within the intact soil horizon preserved beneath historical fills.

The natural background density of Aboriginal artefacts across the wider Sydney CBD region, including the study area, is not well understood. All Aboriginal material present at sites in this area has been brought into the area from an external source. All artefacts would be related to an occupation or use activity undertaken by Aboriginal people during the Holocene (from c10,000 years ago to the present) or Pleistocene (from c10,000 years ago to initial colonisation by Aboriginal people c40,000 years ago).

There are some locations that provide evidence for intensive landscape use by Aboriginal people. This evidence appears as dense deposits of stone artefacts, earth mounds, burials, hearths, oven/fire pits, heat retaining stone, etc. Such locations may relate to long-term subsistence strategies by Aboriginal people and provides information relating to their economy, demography and society.

1.5.3 Archaeological Zoning

The 2013 CSELR Heritage Impact Assessment (HIA) defined four management zones of Aboriginal archaeologtical potential. The zones were distinguished based upon the likelihood of Aboriginal archaeological features being present and the risk that works associated with the CSELR could impact Aboriginal archaeology.

In line with the CSELR ACHAR and ATR, the potential for Aboriginal archaeology is designated by zones. These zones are defined by the archaeological potential in conjunction with the extent of proposed impacts; thus Zones 1 and 2 have both been assessed to have moderate to high potential for Aboriginal archaeology but differ with respect to the impact from the proposed works (Table 1.1).
Table 1.1 Definitions of the Four Aboriginal Archaeological Management Zones.

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<th>Aboriginal Archaeological Potential</th>
<th>Moderate or high Aboriginal archaeological potential</th>
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<td>Impact Description</td>
<td>CSELR works would have a major to moderate adverse impact on the archaeological resource</td>
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<th>Aboriginal Archaeological Potential</th>
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<th>Aboriginal Archaeological Potential</th>
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<td>Impact Description</td>
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<td>Impact Description</td>
<td>CSELR works would have no impact on the archaeological resource because no resource is deemed to be present</td>
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The following assessment of archaeological potential for the Moore Park precinct is taken from the CSELR ACHAR and ATR, and a summary of all Aboriginal cultural heritage associated with the Moore Park precinct is provided in Table 1.2.

The review of the local environmental context, historic period land use and results from limited nearby archaeological excavations and geotechnical investigation surveys indicates that despite extensive cutting and filling to stabilise naturally swampy areas and create level open spaces, the current study area is located over a deep dune system. Aboriginal people have used this dune system for the last 10,000 years, with evidence in the form of hearths (camp fires) and stone artefact sites. Where present, these sites are small in extent, although they appear to retain high levels of integrity and condition.

Available evidence for archaeological site types associated with the Botany sands indicates that potential sites may include open artefact scatters and, where sandstone platforms are found, potential rock engravings. There is some limited potential for organic remains such as middens or Aboriginal burials to also be present, if environmental conditions permit.

As a result of the significant landscape modifications, it is likely that along much of the precinct the upper stratigraphic levels have been disturbed to some extent, but precise mapping of the extent and depth of disturbance is not possible. Previous investigations undertaken in Moore Park indicate that disturbance and/or introduced fill is present 1 to 2 metres below the current ground surface across the area, and this is supported by the data from geotechnical analysis.

As a consequence of non-focused long-term low-density Aboriginal occupation of the entire dune, moderate historic period impacts and limited archaeological investigations in the surrounding area, no specific Aboriginal archaeological patterning can be determined for the Moore Park precinct. However, deeper intact soil profiles may have potential for Aboriginal archaeological evidence to be present, such as stone objects and/or hearths. Organic remains such as middens or burials may be present, if environmental conditions permit—for example, if pH is close to neutral, if there are very desiccated conditions or, conversely, if there are low fluvial but anaerobic and waterlogged conditions. 13
Table 1.2 Overview of Aboriginal Heritage Associated with the Moore Park Precinct.

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<td>Archaeological (scientific) Potential</td>
<td>Moore Park Potential Archaeological Deposit (PAD) 1—Intact Quaternary Sediments identified beneath historical/modern fills at depths between 0.5 and 2.5m. These are potentially deep, stratified deposits which may yield middens, burials, stone artefacts, hearths and ground ovens.</td>
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<td>Historical Connections</td>
<td>Centennial Parklands, Moore Park, Queens Park—State Heritage Register (SHR 01384) as part of a complex of Aboriginal places used as a natural resource for social, ceremonial and subsistence purposes in the pre-colonial and post-contact periods</td>
</tr>
<tr>
<td>Aesthetic Character</td>
<td>None at present; however, any archaeological evidence recovered may have aesthetic value, depending on its nature and integrity.</td>
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<tr>
<td>Social Connections</td>
<td>Any Aboriginal cultural remains identified would have social significance.</td>
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1.6 Description of Works

Prior to the commencement of excavation and construction at Moore Park, establishment of one site compound (Moore Park East) will be undertaken. Moore Park West mobilisation will be for the site set up of the tunnel construction only. This requires the relocation of existing footpaths, construction of hoarding, and installation of site sheds and services. The works at Moore Park East are not anticipated to cause any impacts to subsurface natural deposits; only minor topsoil stripping and demountable foundation work is required, impacting the upper fill layer.

The proposed works in this precinct involve construction of a tunnel from South Dowling Street beneath the western section of the parkland through to the eastern side of Anzac Parade. The construction will require open excavation of two dive structures (bottom-up construction), and the tunnel through Moore Park West (top-down construction) (Figure 1.4). The construction will involve open excavation up to depths of 10m. The footprint of the tunnel is approximately 9.5m deep in the permanent state (temporarily approximately 14m wide in the open-cut section), with battering requiring additional impacts up to 20m each side. This will be bulk excavated by machine, with the removed material to be used in other areas of the project as fill.

Where the tunnel alignment sits adjacent to the bridge and runs through to the Eastern Side of Anzac Parade, excavation is constrained by limited closure of the road and the construction boundary, with a temporary diversion through Moore Park east. As these works are on the current alignment of Anzac Parade, they cannot be mitigated by archaeological testing due to the construction methodology and requisite limits on Anzac Parade’s closure. The tunnel in this section will be constructed ‘top-down’. Walls will be excavated from the existing ground level, with concrete poured in and set. Completion of these walls will allow mechanical excavation to a depth of 3m below the final wall height, allowing for the installation and construction of the precast roof plants with a cast in-situ roof over the top. This will hold the diaphragm walls in place, which will be excavated to a depth of 12 to 15m. The area will then be backfilled, and the structure tunnelled and internally finished (Figure 1.4).

The archaeological investigation of the Moore Park PAD 1 previously identified in the area prior to the construction of the tunnel will be undertaken as a two-stage salvage investigation as discussed below.

1.7 Introduction to the Research Design

The proposed works will impact on potential Aboriginal artefacts and sites that may be present within the study area.
The results from geotechnical investigations have yielded information about environmental conditions (such as compaction of sand and height of the water table). This data, along with detailed design information, has allowed for the development of the tailored methodology to undertake archaeological investigations (test and salvage excavation) within the constraints of the site conditions and proposed development impacts. This ARD methodology is provided as an addendum to the ACHAR.

The objective of archaeological test and salvage excavations is:

[to] collect information about the nature and extent of sub-surface Aboriginal objects, based on a sample derived from sub-surface investigations. Test excavations contribute to the understanding of site characteristics and local and regional prehistory and they can be used to inform conservation goals and harm mitigation measures for the proposed activity.

In order to achieve this objective for the project, research questions were established in the ACHAR to guide the archaeological process and provide the basis for questioning the data collected. Key research questions are reiterated below for reference purposes.

1.7.1 Key Research Questions for the Study Area

- What is the nature and extent of the Aboriginal archaeological remains present within the PADs of the study area?
- Does the project area contain spatially intact, stratified archaeological deposits?
- Does the archaeological resource contain deposits which can be dated (radio-carbon or OSL), subject to pollen analysis or other assessments which may yield new scientific information relating to Aboriginal use of this landscape?
- Is there chrono-stratified evidence linked to distinct changes in Aboriginal technology or in response to environmental changes?
- Is the archaeological deposit (and recovered assemblage) culturally and/or publically significant?

1.8 Archaeological Research Design

The following mechanism for archaeological works is based on an analysis of suitable locations and provides a rigorous tailored methodology for assessment of the archaeological resources present within the proposed impact zone.

A summary of the likely archaeological deposit, its stratigraphic context, and issues associated with the site provides context to the excavation strategies. Three options for test excavation sampling are discussed; sampling under the most feasible option is then further assessed. Potential methodologies for salvage excavation are explored and rationalised in case required. A description of the information that will be obtained for geomorphological, landscape and Aboriginal artefact and site analysis is also provided.

1.8.1 The Nature of the Potential Aboriginal Archaeological Deposit

The nature of the Botany Sand Sheet has been inferred from geotechnical borehole information and nearby sites. Aboriginal archaeology has not been proven to be confined to any particular stratigraphic layer, depth or location within the Botany Sand Sheet due to very limited testing being undertaken previously in the area and no comparative analysis of sites being available.
While artefacts have been found in the aeolian-formed Botany Sand Sheet, the closest comparable stratigraphic excavations have been undertaken in the alluvial-formed Parramatta Sand Sheet (PSS). Observations from excavations of the PSS have found that:

- the 'hotspot' densities of archaeological material are separated by 20–30m in the PSS;
- the density of material intra-hotspot was at least 8m in extent;
- between these hotspots there was relatively little archaeological material, a low density of zero to one artefact per metre;
- when excavated, all hotspots contained chrono-stratified archaeological deposits—this suggests Aboriginal continuation in use of specific locations intra-site for thousands of years; and
- the evidence recovered was not limited to stone artefacts, but included evidence for cooking and heating events with the use of clay heat retainers.

A comparison of these findings with the Botany Sand Sheet cannot be undertaken due to the limited work that has been done on the Botany Sand Sheet, but the information above provides some basis for determining a suitable sample population and strategy.

In terms of comparison with the PSS, the influence of taphonomic processes associated with the setting down of the Botany Sand Sheet and alluvium would need to be determined. The obvious contrast between the two locations is the depth of deposit—the study area contains several metres of sand and alluvium below the fill, compared to only 1m of sand at George Street, Parramatta—the centre of the PSS investigations. The Botany Sand Sheet study area holds the potential for:

- a lengthy stratigraphic profile which may include evidence of long-term deposition resulting from Aboriginal activity over a possible period of 30,000 years;
- a truncation of the archaeological sequence in the upper 1.5m due to levelling and filling once the majority of the Botany Sand Sheet had formed in this location and following European settlement; and
- a time-based deposit of archaeological materials, with both older and more recent assemblages.

Given the undulating nature of bedrock, Botany Sand Sheet, and fill, it is possible the Botany Sand Sheet PADs could present a combination of stratigraphical profiles reflecting the different geomorphological formation processes.

1.8.2 Hazards Associated with Test Excavation

In order to understand the nature and extent of the archaeological resource, and thus prepare a statement of heritage value, it will be necessary to undertake archaeological test excavation.

However, the study area presents considerable challenges in terms of the quantity of fill material covering intact soil and sand horizons, and the presence of the water table. The depth of potential archaeology and proposed impact extends to 15m. As the diaphragm walls (the only impact to extend to 15m) are in an active road zone, they will not be accessible to archaeological investigation. Archaeological investigations will therefore not exceed 10m, ie the footprint of excavation for the tunnel. This depth of potential archaeological excavation presents challenges—not the least of which is work health and safety (WHS).
Fill is present across the entire study area at various depths (Figure 1.5). Across two-thirds of the PAD area the fill has a depth of around 1m; the northwest sector of the study area has up to 3.5m of fill. The depth of fill and subsequent depth of sandy natural soil horizons which will be impacted means that opening archaeological trenches would require the removal of fill, accompanied by shoring and battering to create a safe work environment for archaeological excavation and sampling of the natural sand horizons.

The water table is present at around 10m below the current surface level (Figures 1.6, 1.7 and 1.8). As the proposed maximum accessible depth of works extends to water table (or just below), soil and sand deposits below it will need to be archaeologically tested to confirm the presence or absence of archaeological deposits. It may be assumed that all archaeological trenches opened deeper than 8 to 10m will have water seep into them unless dewatering occurs. An understanding of the rate of water recharge is important, but cannot be confirmed until test excavation commences. If open trenches are proposed, it is likely that regular daily water pumping would need to be maintained to dewater the excavation area—it is possible that deep wells for diverting water away from the excavation area may be required. Given the depth of excavation, all water management measures would need to be within shored and battered trenches.

The Botany Sand Sheet generally has a low level of deposit stability—evidenced by the geotechnical information (Figure 1.5). This poses a serious safety issue when combined with the excavation of deeper deposits near or below the water table. It may not be possible to excavate at depth unless a substantial dewatering process is undertaken as discharging water may collapse the section wall uncontrollably. This represents a serious hazard and significant WHS issues when combined with deep excavation within a shored and battered pit area.

1.8.3 Three Options for Test Excavation

Based upon the hazards posed by this site, there are three potential methods for archaeological test excavation of the Botany Sand Sheet at Moore Park:

- Option 1—an open stepped excavation;
- Option 2—box shoring excavation; and
- Option 3—push tube excavation.

These options are displayed in Figures 1.6–1.8 and summarised in Table 1.3. Discussion of each option is presented below.

Option 1—an open stepped excavation, with horizontal benching and shoring of the area allowing access to the lower portions of the PAD area (Figure 1.6). Benches need be shored to provide a working surface. Excavation could be by a combination of machine and hand. The outcome would be a large excavation area measuring 11m by 11m (if the lowest deposits are to be sampled). Under this option, excavation of three to four of these trenches across the PAD is proposed. Option 1 would sample large areas of the PAD, particularly nearer the surface, resulting in a high level of impact to the archaeological deposit. Below 4m, it may not be possible to use a machine due to stability of the excavation surface and depth. Because the stability of the substrate is uncertain near and below the water table, this mode of sampling may not be suitable for testing below 3m. As such, this method of excavation could miss an archaeological deposit (Figure 1.7). However, a precise record of the extent and nature of any recovered deposits could be recorded. Backfilling of these trenches may not be
possible due to their size—there would be a high risk of trench collapse following excavation and prior to any salvage exercise.

Option 2—box-shored excavation involves piling metal sheets into the ground to create a ‘box’ which is consequentially machine excavated in spits of around 200mm. Hand excavation is not possible under this option. The depth of excavation is limited by the depth accessible by machine. The nature of the excavation means that access into the excavation pit is not possible. Sufficient excavation would need to be undertaken to confirm the presence of a deposit—between 10 to 15 trenches would need to be excavated. It is possible this method of excavation could miss deposits (Figure 1.7).

It should be possible to excavate the box-shored trenches to the base of the deposit, dependent on the limitations of the machine, without collapsing the trench walls. Backfilling of the trenches is possible, although a large quantity of sterile material would be required (which may prove difficult to remove should salvage excavation be required).

Option 3—push tube excavation (300mm tube diameter) using a drill rig. The drill rig uses vibration to push a metal tube into the deposit to the required depth. A vacuum is used to hold the deposit in place as it is extracted from the ground inside the tube. A plastic tube is then placed around the metal push tube and the deposit moved into it. The deposit can be inspected, recorded and sampled at any required interval for sieving. Following drilling the excavated tube hole would be immediately filled with gravel. This method allows extraction of deposit in a carefully controlled way, including deposits below the water table. The main problem associated with the method is the small diameter of the push tube (maximum possible is 300mm). Therefore, sufficient samples would need to be extracted to confirm whether a deposit is present and in what density. The advantage of push tubes is that a tightly-packed grid of samples can be taken across the whole study area, providing assurance as to whether a deposit is present or not (Figure 1.8).

Table 1.3 Overview of the Three Options for Test Excavation.

<table>
<thead>
<tr>
<th></th>
<th>Option 1—open stepped excavation</th>
<th>Option 2—box-shored excavation</th>
<th>Option 3—push tube excavation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of excavation areas</td>
<td>At least 11m by 11m</td>
<td>Minimum 2-3m</td>
<td>300mm diameter (0.07m³)</td>
</tr>
<tr>
<td>Possible number of excavation areas</td>
<td>3-4</td>
<td>15-20</td>
<td>~60</td>
</tr>
<tr>
<td>Speed of excavation</td>
<td>Slow</td>
<td>Slow</td>
<td>Moderate</td>
</tr>
<tr>
<td>Removal of fill required prior to excavation</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Dewatering required</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Likelihood of trench collapse because of water table</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Work health and safety hazard</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Impact on the archaeological resource</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Chance of identifying archaeology</td>
<td>Medium, although large portions of the site will not be sampled</td>
<td>Medium, sufficient boxes need to be sunk to guarantee identification of a deposit</td>
<td>Medium, if sampling is sufficiently intensive</td>
</tr>
</tbody>
</table>
1.8.4 Feasibility of Options for Test Excavation

Option 1 represents the least feasible option because of the high level of risk associated with the hazards, especially trench collapse. This mode of excavation may also miss archaeological deposits unless a very large proportion of the study area is excavated.

Option 2 is feasible, but an absence of complete sampling across the study area (resulting in the possibility of missing the deposit) combined with an absence of the ability to record non-stone based cultural items means it is not the preferred method of excavation.

Option 3—push tube excavation, is considered the most feasible methodology to adopt as it allows:

- identification of archaeological deposit;
- inspection and recording of the deposit;
- maintenance of deposit integrity through the excavation process;
- determination of whether the deposit is stratified; and
- management of the key hazards associated with the study area, particularly water inflow and potential trench collapse, to limit WHS issues.

This mode of excavation is economically efficient in terms of time and expense required for achieving the test excavation program prior to the commencement of construction works.

1.8.5 Sample Population and Strategy

The targeted population is defined by the extent of the study area boundary and the extent of significant impacts (both depth and lateral dimensions of impact footprint) within the study area. Archaeological sampling will be targeted to locations that have archaeological potential and are not highly disturbed and/or posing a danger to the fieldworkers (ie avoiding the service corridors).
The locations that would be subject to archaeological works have been defined through assessment of:

- areas that will not be impacted through the proposed works, as no excavation needs to occur;
- areas that are not accessible for archaeological investigation;
- geotechnical information;
- the assessment of levels of disturbance across the study area; and
- soils and landforms that have a high potential for Aboriginal sites.

These factors define the zones within the study area that are suitable for and require archaeological works. Analysis of these factors has limited and restricted the scale of archaeological sampling within the study area. As the proposed works occur in a defined area for the installation of the light rail tunnel, excavation of all zones identified as having archaeological potential would not represent a good conservation outcome. Archaeological works will only occur within zones that have archaeological potential and that will be impacted by the proposed works. Further, the extent of archaeological investigations will be limited to the footprint of the impact of the tunnel excavation works. This is in line with the *Australia ICOMOS Burra Charter 2013* (the Burra Charter) principles of doing as much as necessary and as little as possible to manage and mitigate impacts to heritage values.

### 1.8.6 Analysis of Sample Grid Size

Provided that an appropriately spaced sample grid is applied, push tubes allow a study area to be properly sampled and assessed. This analysis of grid spacing considers grids at 20m and infill at 10m and 5m intervals—and the consequential identification of an archaeological deposit. Grid spacing rationale must achieve a balance between the positive identification of an archaeological deposit, allowing the research questions to be addressed, and the minimisation of impact to archaeological deposits.

The Code of Practice recommends 500mm by 500mm test units, on a 10 or 20m grid, which has been shown to be adequate to sample and positively identify Aboriginal archaeological deposits in open sites on the Cumberland Plain. However, Moore Park may be located over the Botany Sand Sheet and alluvial soils, which hold different properties to Cumberland Plain Blacktown, South Creek, Lucas Heights or Luddenham soil landscapes. A key question is whether sampling using Option 3 (the 300mm diameter push tube) would be capable of identifying an archaeological deposit and at what density the sample grid needs to be set. To address this question, the density and distribution of archaeological material recovered from Aboriginal site RTA-G1 on the PSS has been analysed to demonstrate the nature, extent and depth of potential deposits associated with sand bodies in Sydney.

Spatial mapping of the archaeological deposits from the open excavation of RTA-G1 is presented in Figure 1.9. The longest extent of excavation that demonstrates the variable nature of an archaeological deposit within the PSS is horizontal row 60. If 10m or 20m spacing were applied to the results of row 60's excavation, the consequential result of sampling at such spacing can be understood (Table 1.4). The density of material recovered from a 500mm by 500mm test unit (the standard sampling unit under the Code of Practice) and from a 300mm push tube (Option 3) are shown to illustrate the proportional reduction in objects recovered using each sample size.
Table 1.4 Analysis of Distribution of Aboriginal objects from site RTA-G1. (Source: JMCHM 2005: Figure 20)

<table>
<thead>
<tr>
<th>Baseline (m)</th>
<th>35</th>
<th>36</th>
<th>37</th>
<th>45</th>
<th>46</th>
<th>47</th>
<th>55</th>
<th>56</th>
<th>57</th>
<th>65</th>
<th>66</th>
<th>67</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density of material/m²</td>
<td>137</td>
<td>146</td>
<td>120</td>
<td>21</td>
<td>15</td>
<td>12</td>
<td>23</td>
<td>10</td>
<td>51</td>
<td>20</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Density of material recovered if sampled by 500mm² test unit (as defined under the Code of Practice)</td>
<td>34</td>
<td>37</td>
<td>30</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>13</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Density of material recovered if sampled by Option 3 (a 300mm diameter push tube)</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The variability in the distribution of archaeological material is apparent from the open excavation, with recovered densities between 146/m² (baseline=36m) and 11/m² (baseline=66m). Application of either a 20m or 10m grid would have resulted in the identification (including defining the nature and extent) of the archaeological deposit, whether a 1m, 500mm or 300mm sample size unit had been applied. The difference between the sample unit sizes is obviously the quantity of recovered material. For Option 3, the use of 10m and 20m grids can be contrasted.

Applying a 10m grid the minimum quantity of recovered material would have been a total of 13 objects—10, 1, 1 and 1 objects—(sampled at baseline=36m, 46m, 56m and 66m respectively), whilst the maximum quantity of material would have been 16 objects—10/9, 2/1, 2/4, 2/2—(sampled at baseline=35/37m, 45/47m, 55/57m and 65/67m respectively). In no instances would the 300mm push tube have returned zero objects using the 10m grid.

Applying a 20m grid the minimum quantity of recovered material would have been a total of 2 objects—1 and 1 objects—sampled at baseline=46m and 66m respectively; whilst the maximum quantity of material would have been 12 objects—9 and 4—sampled at baseline=37m and 57m respectively). In no instances would the 300mm push tube have returned zero objects using the 20m grid.

While these calculations are predicated on an assumption that artefacts are evenly distributed throughout any 1m² area (which is not necessarily the real world scenario), it is concluded that either an initial sampling grid with 10m or 20m spacing would enable the identification and mapping of presence or absence of Aboriginal archaeological sites within a sand sheet.

Whilst spacing on a 20m grid would identify whether Aboriginal objects are present, this grid will not provide sufficient detail to confirm the extent of the material; thus once the presence of Aboriginal objects is confirmed on the 20m grid, additional push tubes would be required to define the extent of a site.

For recent open excavation scenarios (eg, East Leppington), expansion (following testing within a 500mm by 500mm test unit) was triggered by a density of three or more objects. As such, comparison between the measure of the test unit and a 300mm push tube (Table 1.5) indicates that the presence of any Aboriginal objects in a push tube warrants some form of further investigation. To confirm the presence of Aboriginal objects—their density and spatial vertical correlation—an infill sample at 10m and, possibly 5m, between two locations that both yield one or more stone objects would be needed. Such a sample could confirm the nature and extent of the deposit and verify whether it was of sufficient density to warrant open or salvage excavation.
In undertaking the analysis of material density, and thus scientific value, it is necessary to consider both the horizontal and vertical distribution of the recovered material. For example, should the recovered stone artefacts be distributed across multiple layers (Figure 1.10, Tubes 1–3), this is likely to be reflective of a low density of material synonymous with a background scatter. Such a scatter would not be considered for further open or salvage excavation. However, if sequential push tubes yielded objects from a single stratigraphic layer this could indicate a holistic concentration of archaeological deposit (Figure 1.10, Tubes 4–6), which may warrant further work (RTA-G1 yielded distinct banding of archaeological material with depth). To clearly define the presence and depth of the archaeological deposit, two further push tubes were strategically placed in this example (Figure 1.11, Tubes A and B). Tube A yielded an object, which is vertically distinct from those in Tubes 1 and 2; thus indicating that the archaeology in this location was a low density background scatter. Tube B yielded a further five objects from the same horizontal layer as Tubes 4, 5 and 6, indicating that spit two contained a concentrated archaeological deposit (Figure 1.11, green band), potentially with densities up to 50 artefacts/metre (compared to the real world RTA-G1 data, Table 1.4).

Consequential management of these deposits could confidently argue that no further work were required for the space around Tubes 1–3, whilst archaeological salvage would be warranted for the deposit associated with Spit 2, Tubes 4–6.

1.8.7 Archaeological Testing Locations—the Proposed Sampling Grid (Option 3)

On the basis of the analysis presented above, as well as the proposed impact footprint of the tunnel and substation, a sample grid with 20m spacing is suitable to identify whether an archaeological deposit is present. The establishment of sampling on a 20m grid is proposed inside the impact areas. Test push tubes are to be placed, offset from the centreline of the proposed tunnel and substation impact areas, in two transects at 20m intervals to detect the presence or absence of Aboriginal artefacts. An indicative layout of these test locations is shown in Figure 1.12. If required, push tubes will be relocated to avoid known utilities, as shown in Figure 1.13. If identified, an archaeological deposit would require additional sampling on a 10m grid if further deposits were identified; this sampling process would clarify the nature and extent of the deposit. Following the example presented from Parramatta, further push tubes may be placed at 5m intervals if two adjacent locations (on the 10m grid) yield one or more Aboriginal objects. A valid analysis of the horizontal and vertical distribution of objects, and any other Aboriginal evidence, would be possible based on this sampling pattern.

Following this, if salvage is required for substantial intact or high density Aboriginal archaeological deposits, additional salvage test tubes will be placed where necessary to salvage a reasonable sample (eg, 10 per cent or a proportion determined by the excavation director) of the Aboriginal archaeological site identified within the works’ footprint. The methodology for this is explained in Section 1.10

Degree of Layout Precision

The test push tube locations will be set out by a surveyor, with minor variations where physical features on the ground necessitate—based on the sample pattern developed in this methodology and in the field for additional test pits to define site extents and salvage. Additional test push tubes will initially be placed at 10m spacing around the original 20m-spaced test push tubes that contain Aboriginal artefacts, at cardinal points, and then on a 5m grid. If a dense stratigraphically intact deposit is identified, further push tubes may be placed as required to salvage as much as possible of the archaeology within the study area. Additional test push tubes and salvage push tubes will be set out in the field by hand, using standard surveying techniques, and then surveyed in by the qualified
surveyor before archaeological works are completed. Spatial control of testing locations and vertical excavation will be sufficiently precise to define the location (x, y and z coordinates) of Aboriginal deposits across the study area, and to allow the research questions to be addressed.

1.9 Test Excavation Methodology

The general methodology for Aboriginal archaeological test excavation on the Light Rail project has been defined in the ACHAR. However, the Moore Park sampling strategy for undertaking test excavation requires site specific consideration because of the specific site conditions, level of Aboriginal archaeological potential and depth of impacts proposed at Moore Park.

An understanding of earlier archaeological work provides a context for previously identified Aboriginal artefacts. There is a basic correlation between densities of Aboriginal artefacts recorded during previous testing and the zoning which identifies the area as having a potential for Aboriginal archaeological deposits.

Each test location will require excavation using a Terra Test Sonic Drilling System rig for application of the push tube methodology. Push tubes will be excavated to the maximum depth of tunnel excavation impact—that is approximately 10m below the current surface level.

On removal of a push tube, the excavated sediment extracted will be slid inside a plastic tube for archaeological inspection. The deposit will be photographed with a scale to record the nature of the deposit and recorded as per Section 1.11 below.

Each excavated push tube will be subject to archaeological sampling. The initial inspection will determine whether visible evidence is present for historical archaeological deposits, stone objects, carbon, cuts, and fill deposits (including baked clay balls or stone heat retainers). Should there be obvious stratigraphical layers or sequences—eg, historical archaeology, followed by alluvium followed by sand—the archaeological director shall record the deposits then separate them for wet sieving.

A geomorphological sampling and analysis of at least one push tube will be undertaken. Should the geomorphologist and/or excavation director confirm the push tube demonstrates the presence of a soil horizon that cannot contain an archaeological deposit, eg fill or a B/C horizon clay, this portion of the sample will not be subject to further analysis or sieving.

Historical archaeological deposits will be recorded, separated and sieved by stratigraphy. No sub-stratigraphical sample sieving will be necessary, unless determined by the archaeological excavation director.

Aboriginal archaeological deposits will be recorded, separated and sieved also by stratigraphy. However, for uniform sand/alluvium deposits, the sample will be divided into 100mm (maximum) spits for wet sieving. This sub-stratigraphical separation will determine whether artefact stratigraphy is present intra-deposit.

If carbon or other features are present, these will be sampled for further analysis.

Due to the moist nature of the soils within the study area and the effect moist soils have in disguising stone artefacts, wet sieving will be required for both the testing and salvage works. Sieves with a 3mm or 5mm mesh will be set up at a central location, and push tube deposits will be sieved stratigraphically or by arbitrary spit (whichever is appropriate) into a basin (small skip bin or similar) to trap the slurry for disposal. Water for sieving would be provided from the water mains or by a water truck service that
would also be responsible for water-reuse from the basin for the sieves and disposal of the dirty water once it is beyond reuse. Disposal of slurry would be the responsibility of the contractor.

Push tube testing and sieving will continue until the point at which it no longer becomes possible to obtain reliable archaeological samples due to the presence of the water table or the extent of maximum impact from the proposed works is reached. If a series of push tubes is sampled across the study area sufficient to demonstrate to the archaeologist that the study area does not contain a deposit capable of bearing an archaeological deposit, the excavation program will cease.

The excavation director must sign off the completion of Aboriginal archaeological excavation at each test pit prior to continued excavation works being undertaken. Appropriate time must be allowed to adequately complete the excavations at each location, especially if scientifically and socially significant deposits are encountered. The excavation director will have the authority to halt excavations to appropriately and adequately assess or record archaeological features.

Should any push tube contain one or more Aboriginal objects, then surrounding 10m-interval push tubes will be excavated, with consideration of the extent of impacts. This additional excavation is required to confirm whether there is a deposit suitable for further investigation. Should adjacent push tubes contain objects, further push tubes should be initially located at 5m intervals to confirm the nature and stratigraphical relationship of the objects. Should no Aboriginal objects be recovered in the excavation of the initial 10m grid, it will be deemed that the study area does not hold a potential for Aboriginal objects and that no further excavation is required.

1.10 Salvage Excavation Methodology

If substantial intact or high density Aboriginal archaeological deposits were to be located during the test excavation phase, then it may be necessary to salvage the archaeological deposit prior to development occurring. Some potential salvage excavation areas may possess relatively deep deposits; therefore, the methods for excavation to depth, if development will impact these deposits, have been considered in relation to WHS conditions. Salvage of deep deposits will be attempted using additional push tubes due to the safety and site constraints as well as the risks as outlined in Section 1.8.2. The need for salvage excavation would be determined during the test excavation phase. Any salvage works would be undertaken immediately following the testing phase. The minimum extent of salvage excavation would be determined by the presence, size and significance of Aboriginal archaeological deposits that would be unavoidably impacted by the proposed development works. Additional salvage push tubes will be placed where necessary within the works’ footprint to salvage a reasonable sample (10 per cent, or a proportion determined by the excavation director) of the identified Aboriginal archaeological site.

Where Aboriginal archaeological deposits are within 1.5m of the surface, locations will be surveyed-in and the overlying fill will be carefully removed by a machine with flat-edged batter bucket under the direction of an archaeologist. After this, a grid of 500mm x 500mm excavation units will be laid out, working from the known location of artefacts outwards (but constrained to within the footprint of proposed surface and subsurface impacts). Each 500mm x 500mm excavation unit will be dug by hand using a shaving action, in spits or by stratigraphic layer where stratigraphy is identified.

All salvaged deposits will be wet sieved by stratigraphy or arbitrary spit through 3mm or 5mm sieves as per the testing phase, and all Aboriginal stone artefacts retrieved and recorded in correspondence to their excavation unit and spit or layer. Salvage excavations by open hand excavation will continue until:
• the Aboriginal archaeological deposit is entirely removed (within the maximum impact of the proposed works);
• artefact densities fall below five objects per square metre;
• the unusual archaeological characteristics, features or specific Aboriginal tool types are no longer present within the area, subject to additional test excavation; and
• the extent of the footprint of the proposed impact is reached; or
• to the satisfaction of the Excavation Director.

This approach is adopted in order to understand the extent of the resource discovered and sufficiently salvage the site to mitigate any impacts of the proposed development works.

The archaeological excavation director must sign-off the completion of Aboriginal archaeological salvage excavation prior to continued excavation. Appropriate time must be allowed to adequately complete the excavations at each location, particularly where scientifically and socially significant deposits are encountered.

1.11 Alternative Excavation Methods

The aim is for all push tubes to be excavated in one length (a 10m sample). However, due to the nature of sand and the presence of the water table, smaller lengths of excavation may be required to maintain the structural integrity of deposit inside each push tube. The length/quantity of material recovered in each push tube will be determined by Terra Test (the geotechnical operators). Should 10m of excavation not be possible at a location, the reasons for this should be recorded.

The push tube method of excavation has not been undertaken in an archaeological context before. However, Terra Test has a high degree of confidence the mode of excavation will be successful and have successfully completed environmental soil sampling using this technique. The methodology for investigation must be sufficiently flexible to allow some alternative sampling should push tubes excavation prove unsuccessful. The following method is designed to allow sampling of the study area in this instance.

If 300mm push tubes cannot be excavated, a 200mm diameter of push tube could be attempted. Should push tube excavation be entirely unsuccessful, a form of mechanical open excavation will be required. In order to address a proportion of the research questions, it is proposed to open a minimum of four 2m by 3m machine excavation trenches (following excavation Option 2). These trenches would be entirely excavated stratigraphically or in 100–500mm spits (if stratigraphy is not identified or within excavation units when these have significant depth). All deposits capable of bearing an archaeological signature will be wet sieved.

Sampling under Option 2 would be limited in terms of the number of trenches possible, thus the extent of sample size across the Moore Park PADs would be reduced. Nevertheless, this sampling strategy should still aim to fulfil the project’s objectives and address the research questions.

1.12 Data to be Collected and Recording Methodology

Data will be recorded for each push tube and salvage sample on context sheets specifically tailored for this investigation. Data collected will include: push tube or pit number, location, landform, aspect, spit details (depth as excavated and soil characteristics), number of stone artefacts (or other feature/s) per
spit, total number of artefacts, the identification of any features or inclusions (such as carbon),
taphonomic factors (ie disturbance, bioturbation etc), soil characteristics, section and plan diagrams
(especially noting where features are present), and a recommendation as to whether the push tube
requires salvage.

Running totals of artefacts and features, as well as in-the-field comparison between push tube and
salvage areas, will be made in order to track results in the field along each of the trenching areas. This
will allow for a logical progression of push tube or salvage area expansion. This data will also assist
with the staging of works, informing the decision to progress along the proposed transect of push tube
locations as required in conjunction with Early Works project.

The excavation director will supervise all recording and determine whether additional push tubes
should be opened (in addition to those defined by the sample grid) and whether a push tube requires
salvage. The excavation director may also determine when less than the maximum proposed push
tubes would be sufficient to understand the study area's Aboriginal archaeological potential and
manage and mitigate proposed impacts to any Aboriginal archaeology.

1.13 On-Site Organisation

A works zone has been fenced off for the archaeological excavation. This is sufficient in size to allow
the excavation works to proceed. It is estimated that the Terra Test Sonic Drilling System rig required
for the push tube methodology can excavate approximately 25m of deposit per day. Sufficient
archaeological support must be provided to allow this quantity of deposit to be recorded, assessed,
sampled and wet sieved. The archaeological team will require a minimum of two archaeologists and
two Aboriginal representatives from the RAPs. Liaison with a geomorphologist will be required during
works to provide analysis of the deposit and to clarify its nature.

Following the completion of the archaeological investigations, Acciona will be responsible for the safety
of the site and the backfilling of each test pit with clean fill.

1.14 Unexpected Finds and Human Skeletal Remains

Finds during the Aboriginal archaeological investigations of anything other than the Aboriginal
archaeological deposits would be managed in accordance with the CSELR Unexpected Finds
Procedure (Appendix A).

Should Aboriginal archaeological test pits be undertaken in areas where impacts to historical
archaeological excavation has not previously been carried out, the Historical Archaeological Research
Design21 should be followed to mitigate any potential impacts to historical archaeological remains.

Should shell material and/or human skeletal material be encountered during the works:

- all works in the immediate vicinity of the find will cease immediately;
- a skeletal/faunal remains specialist should be called to identify whether the remains are human;
  and
- if remains are identified as human, the NSW Police and the NSW Coroner's Office must be
  notified as per the Unexpected Finds Procedure (Appendix B).
1.15 Cataloguing and Summary Report

Following the completion of all test and salvage excavation in the study area, all recovered Aboriginal stone artefacts will be subject to cataloguing by a GML specialist. All relevant stone artefact attributes will be recorded in a comparable manner to other regional artefact studies and in accordance with Holdaway and Stern,22 and the Department of Environment, Climate Change and Water, Requirement 19.23

A summary report, including landscape analysis will be prepared by GML staff, assisted by the field archaeologists present during the archaeological works. The excavation summary report will be provided to the RAPs and the OEH for future reference.

The information contained within the summary report will be a valuable document to reference for future heritage values assessment on the Botany Sands landform around the study area, and more broadly within eastern Sydney.

1.16 Management of Aboriginal Objects

Following the proposed archaeological test and salvage excavation works, consultation will occur with the RAPs to determine the precise mechanism for long-term management of any Aboriginal artefacts recovered from the study area. During initial cataloguing and preparation of the summary report, the Aboriginal stone artefacts would be kept at GML’s office.
Figure 1.1 The CSELR Project overview and precincts. (Source: Transport for NSW 2015)
Precinct 3: Moore Park
- 2015 Auger hole
- 2015 Bore hole

Figure 1.2 Map of the Moore Park study area, with previous geotechnical locations marked. (Source: GoogleEarth 2015)

Figure 1.3 Plan showing proposed site compounds at Moore Park. (Source: Acciona Infrastructure 2015)
Figure 1.4 Plan showing proposed impacts at Moore Park. (Source: Acciona Infrastructure, 2015)
Figure 1.5 The Botany Sand Sheet profile at Moore Park, as understood from geotechnical information. (Source: Coffey, May 2014).

Figure 1.6 Option 1—schematic example of open stepped excavation. (Source: GML, 2015)
Figure 1.7 Option 2—schematic example of box-shored excavation. (Source: GML 2015)
Figure 1.8 Option 3—schematic example of push tube excavation. (Source: GML 2015)
Figure 1.9 Stone artefact density mapping of site RTA-G1. Note: all stratigraphical information has been compressed to create this.
### Figure 1.10
Hypothetical example of artefact density showing horizontal and vertical distribution, tubes at 20m spacing. (Source: GML 2015)

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### Figure 1.11
Two additional push tubes (Tube A and B) placed at 10m spacing to confirm the extent of the archaeological deposit. (Source: GML 2015)

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Figure 1.12 Indicative layout of test push tube locations, at 20m spacing. (Source: Altrac with GML overlays 2015)

Figure 1.13 Indicative layout of test push tube locations, modified for existing services. (Source: Altrac with GML overlays 2015)
1.17 Endnotes


8. Artefact Heritage, CBD and South East Light Rail Project, Moore Park Tennis Centre Early Works—Archaeological Salvage Excavation Methodology, report prepared for KMH Environmental, September 2014.


14. GHD, CBD and South East Light Rail—Field Engineering Logs, draft report prepared for Acciona Infrastructure Australia, 2015.


20. Jo McDonald CHM, Archaeological salvage excavation of Site RTA-G1, 109–113 George Street, Parramatta NSW, report prepared for Landcom, 2005, Table 1.


24. Jo McDonald CHM, Archaeological salvage excavation of Site RTA-G1, 109–113 George Street, Parramatta NSW, report prepared for Landcom, 2005 Figure 20.
2.0 Appendix

Appendix A
Consultation Record
- Copies of letters sent to RAPs and OEH
- Response from DLO
- Response from OEH

Appendix B
Unexpected Finds Procedure
Appendix A

Consultation Record

- Copies of letters sent to RAPs and OEH
- Response from DLO
- Response from OEH
19 November 2015

Darug Aboriginal Cultural Heritage Assessments (DACHA)

Ref: SLR-AIA-M10-000-CORR-001241
Re: CBD and South East Light Rail Project—ACHAR/ATR Addendum Report—Archaeological Research Design for Moore Park

Dear [Name],

Please find enclosed an addendum report to the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the CBD and South East Light Rail (CSELR) project. This addendum report presents a detailed methodology for the archaeological management and mitigation of works associated with the construction of the CSELR tunnel at Moore Park.

In accordance with the Ministers Conditions of Approval for SSI-6042, Acciona wish to consult with the project’s Registered Aboriginal Parties in relation to this documentation.

You are invited to provide a written or verbal response to the enclosed report by Thursday 3 December. Your earliest attention to this matter would be greatly appreciated as the timing of the project is critical. Verbal and written comments will be recorded for incorporation into the report.

Due to the limited review period available for this document, given the critical nature of this scope of works within the CSELR project, Acciona also invite you to attend a voluntary meeting to discuss the report with Acciona and GML on Tuesday 1 December.

This meeting will be held at 10am on Tuesday 1 December 2015 at the Acciona Infrastructure Australia offices at Level 7, 280 Elizabeth Street, Surry Hills. Please advise [Name] if you will be attending this meeting.

Any feedback on this document can be sent to:

Att: [Name]
Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
Surry Hills NSW 2010.

Comments can also be made by email [email].

Should you wish to discuss this document further, or provide verbal comment, please call [Name].
Yours sincerely,

[Signature]

Heritage Management Officer

Enclosures:

19 November 2015

Ref: SLR-AIA-M10-000-CORR-001243
Re: CBD and South East Light Rail Project—ACHAR/ATR Addendum Report—Archaeological Research Design for Moore Park

Dear Mr [Redacted]

Please find enclosed an addendum report to the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the CBD and South East Light Rail (CSELR) project. This addendum report presents a detailed methodology for the archaeological management and mitigation of works associated with the construction of the CSELR tunnel at Moore Park.

In accordance with the Ministers Conditions of Approval for SSI-6042, Acciona wish to consult with the project’s Registered Aboriginal Parties in relation to this documentation.

You are invited to provide a written or verbal response to the enclosed report by Thursday 3 December. Your earliest attention to this matter would be greatly appreciated as the timing of the project is critical. Verbal and written comments will be recorded for incorporation into the report.

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This meeting will be held at 10am on Tuesday 1 December 2015 at the Acciona Infrastructure Australia offices at Level 7, 280 Elizabeth Street, Surry Hills. Please advise [Redacted] if you will be attending this meeting.

Any feedback on this document can be sent to:

Att: [Redacted]
Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
Surry Hills NSW 2010.

Comments can also be made by email [Redacted]

Should you have any questions or wish to provide verbal comment, please call [Redacted]
Yours sincerely,

[Signature]

Heritage Management Officer

Enclosures:

19 November 2015

Dear [Name],

Please find enclosed an addendum report to the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the CBD and South East Light Rail (CSELR) project. This addendum report presents a detailed methodology for the archaeological management and mitigation of works associated with the construction of the CSELR tunnel at Moore Park.

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Any feedback on this document can be sent to:

Att: [Name]
Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
Surry Hills NSW 2010.

Comments can also be made by email.

Should you have any questions or wish to provide verbal comment, please call [Phone Number].

Ref: SLR-AIA-MIO-000-CORR-001244
Re: CBD and South East Light Rail Project—ACHAR/ATR Addendum Report—Archaeological Research Design for Moore Park
19 November 2015

La Perouse Local Aboriginal Land Council

Attention: [Name]

Ref: SLR-AIA-M10-000-CORR-001245

Re: CBD and South East Light Rail Project—ACHAR/ATR Addendum Report—Archaeological Research Design for Moore Park

Dear Mr [Name],

Please find enclosed an addendum report to the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the CBD and South East Light Rail (CSELR) project. This addendum report presents a detailed methodology for the archaeological management and mitigation of works associated with the construction of the CSELR tunnel at Moore Park.

In accordance with the Ministers Conditions of Approval for SSI-6042, Acciona wish to consult with the project’s Registered Aboriginal Parties in relation to this documentation.

You are invited to provide a written or verbal response to the enclosed report by Thursday 3 December. Your earliest attention to this matter would be greatly appreciated as the timing of the project is critical. Verbal and written comments will be recorded for incorporation into the report.

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This meeting will be held at 10am on Tuesday 1 December 2015 at the Acciona Infrastructure Australia offices at Level 7, 280 Elizabeth Street, Surry Hills. Please advise [Name] if you will be attending this meeting.

Any feedback on this document can be sent to:

Att: [Name]
Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
Surry Hills NSW 2010.

Comments can also be made by email ([Email Address]). Should you have any questions or wish to provide verbal comment, please call [Number].
Yours sincerely,

[Signature]

Heritage Management Officer

Enclosures:

19 November 2015

Office of Environment and Heritage
Planning and Aboriginal Heritage Section

Attention:

Ref: SLR-AIA-MI0-000-CORR-001247
Re: CBD and South East Light Rail Project—ACHAR/ATR Addendum Report—Archaeological Research Design for Moore Park

Dear [Name],

Please find enclosed an addendum report to the Aboriginal Cultural Heritage Assessment Report (ACHAR) for the CBD and South East Light Rail (CSELR) project. This addendum report presents a detailed methodology for the archaeological management and mitigation of works associated with the construction of the CSELR tunnel at Moore Park.

In accordance with the Conditions of Approval for SSI-6042, Acciona wish to consult with OEH on this documentation.

You are invited to provide a written or verbal response to the enclosed report by Thursday 3 December. Your earliest attention to this matter would be greatly appreciated as the timing of the project is critical. Verbal and written comments will be recorded for incorporation into the report.

Due to the limited review period available for this document, given the critical nature of this scope of works within the CSELR project, Acciona also invite you to attend a voluntary meeting to discuss the report with Acciona, GML and the Registered Aboriginal Parties on Tuesday 1 December 2015.

This meeting will be held at 10am on Tuesday 1 December 2015 at the Acciona Infrastructure Australia offices at Level 7, 280 Elizabeth Street, Surry Hills. Please advise if you wish to attend this meeting.

Any feedback on this document can be sent to:

Att: [Name]
Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
Surry Hills NSW 2010.

Comments can also be made by email (acciona@structure.com.au).
Should you have any questions or wish to provide verbal comment, please call [redacted].

Yours sincerely,

[Signature]

Heritage Management Officer

Enclosures:

29th November 2015

Acciona Infrastructure Australia
Level 7, 280 Elizabeth Street
SURRY HILLS NSW 2010

Dear [Name]

RE: CBD & South East Light Rail Project
Ref: SLR-AIA-MI0-000-CORR-001244

Aboriginal Cultural Heritage Assessment Report

Darug Land Observations Pty Ltd is satisfied with the draft cultural heritage assessment report for the CBD and South East Light Rail Project.

In relation to where the Aboriginal artefacts are kept for long-term management, Darug Land Observations Pty Ltd would prefer the artefacts to be re-buried on Country (survey site).

Darug Land Observations Pty Ltd would like to receive a copy of the Section 90 Aboriginal Heritage Impact Permit (AHIP).

Furthermore, Darug Land Observations Pty Ltd would be involved in the monitoring of the top soil removal and all other form of works to be carried out on the site.

Yours sincerely,

[Signature]

Darug Land Observations Pty Ltd

[Signature]

Darug Elder
CBD and South East Light Rail Project - ACHAR/ ATR Addendum Report - Archaeological Research Design for Moore Park

Sent: Wednesday, 25 November 2015 3:09 PM
To: [Redacted]
Cc: [Redacted]

Dear Ms [Redacted],


As per previous correspondence with Acciona and GML, I reiterate that OEH has not requested to be involved in this capacity. OEH does not wish to review or provide comment on any further documentation regarding Aboriginal cultural heritage in relation to the CBD and South East Light Rail project. The documentation should be sent to the consent authority, being the Department of Planning and Infrastructure.

Kind regards,

Archaeologist
Regional Operations Group
Office of Environment and Heritage
PO Box 644, Parramatta NSW 2124
W: www.environment.nsw.gov.au

This email is intended for the addressee(s) named and may contain confidential and/or privileged information. If you are not the intended recipient, please notify the sender and then delete it immediately. Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL
Appendix B

Unexpected Finds Procedure
Unexpected Find Uncovered

Discovery of Unexpected Finds
• Stop work immediately in the area of the discovered find/s.
• Ensure that no further disturbance occurs.
• Do not handle any of the finds so as to prevent further misplacement.
• Inform the project Site Manager, who will inform the Project Heritage Consultant/Archaeologist and TfNSW.
• Cordon off the area with temporary fencing including highly visual elements (tapes, witches hats, construction bollards).

Contact Project Heritage Consultant/Archaeologist
• To limit unnecessary callout first take a photo of the find in its original location and email/text to the project archaeologists for the initial assessment.
• Liaise with Site Manager and Environmental Manager, who will be responsible for notifying the Project Director and organising a site inspection for the project archaeologist, if required.
• If human remains are suspected, contact the NSW Police and Coroner’s Office.
• Do not recommence work in the area of the find/s.

Notifications
• If the finds include significant Historical Archaeological Relics, Aboriginal objects and/or Aboriginal skeletal remains the Project Archaeologist and/or Project Manager will consult with relevant organisations including the NSW Heritage Division, OEH, Aboriginal stakeholders, Department of Planning and Environment, and/or Sydney Water or any other relevant state organisation.

Recording
• The Project Heritage Consultant/Archaeologist is to record the finds in accordance with the established methodology for the project.
• Do not recommence work in the area of the find/s and allow adequate time and working conditions for recording.

Management of Unexpected Finds
• Any items of heritage significance not previously identified in the 2013 HIA would be managed in accordance with MCoA B99e(ii), including an assessment of significance.
• Assessment of the significance of the unexpected find/s will determine whether the finds can be further impacted/removed or if they require another form of management (for example, preservation in situ and incorporation in the design.

Finds Requiring Preservation
• If the find/s are found to be significant and require preservation in situ and incorporation into the design, appropriate conservation and modification of the design will be undertaken.

Finds Not Requiring Preservation
• If the find/s does not require preservation, the Project Heritage Consultant/Archaeologist is to finalise the recording and provide a sign off for further impact/removal and for construction work to proceed.

The Project Heritage Consultant/Archaeologist will maintain the records for submission to the relevant organisation/s and/or final reporting.