



APPENDIX J

ABORIGINAL CULTURAL HERITAGE REPORT

CSR Advanced Manufacturing Hub

MOD3 - Aboriginal Cultural Heritage
Assessment Report

Report to CSR Building Products
Limited

Liverpool Local Government Area

February 2019



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EXECUTIVE SUMMARY

Background

In October 2016, CSR Building Products Limited (CSR) acquired Boral Bricks Pty Limited (Boral) brick business along the eastern seaboard of Australia and with it, the Badgerys Creek Brick Making Facility Site ('the Site'). Project Approval (PA10_0014) was given for the existing site (PA10-0014) under section 75W of the *Environmental Planning and Assessment Act 1979* and previous archaeological investigations were conducted by AECOM (2010) as part of that approval.

CSR now proposes to expand the site with the extension of the brick making facility and construction of a roof products manufacturing facility (Modification [MOD] 3) and establishment of a grid connected solar farm (Modification [MOD] 4). MOD3 (the study area) is the subject of this report, with MOD4 having been assessed in a separate, complimentary report (Artefact Heritage 2018c).

To satisfy the heritage requirements of PA10_0014, Artefact Heritage Services Pty Ltd (Artefact Heritage) was engaged by Element Environment (Element), on behalf of CSR, to undertake a desktop assessment and site inspection of a large area (the investigation area), as depicted in Figure 1.3, which encompasses the study area. The assessment found that areas of Aboriginal archaeological potential are located within the proposed impact area. Subsequently, Artefact Heritage was engaged by Element, on behalf of CSR to prepare an Archaeological Technical Report (ATR) for the study area (Artefact Heritage 2018b) which outlined the results of a survey and test excavation program. The results of the ATR were:

- Three new subsurface sites (BCBW18 AS 01 (AHIMS ID 45-5-5162), BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163)) were identified during subsurface testing:
 - BCBW18 AS 01 (AHIMS ID 45-5-5162) is a low-density artefact scatter and was assessed as being of low scientific significance
 - BCBW18 AS 02 (AHIMS ID 45-5-5164) is a low-density artefact scatter with a heat retainer hearth feature. This site type is considered rare and of high research potential.
 - BCBW18 AS 03 (AHIMS ID 45-5-5163) is a high-density artefact scatter that is considered to be of low scientific significance.
- One newly recorded surface site (BCBW18 If 01 (AHIMS ID 45-5-5165)) was identified during the survey.

Artefact Heritage (2018b) recommended that:

- An Aboriginal Cultural Heritage Assessment Report (ACHAR) must be prepared in compliance with the Aboriginal heritage requirements of PA10_0014
- Collection of surface artefacts across BCBW18 If 01 (AHIMS ID 45-5-5165) must be conducted prior to the commencement of the proposed works
- A conservation area with a 10 m buffer be placed around the hearth feature portion of BCBW18 AS 02 (AHIMS ID 45-5-5164)
- Long term arrangements for the management of excavated artefacts, involve reburial within the location specified in this ACHAR.

Artefact Heritage has prepared this ACHAR in accordance with the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (Office of Environment and Heritage 2011), the Aboriginal cultural heritage consultation requirements for proponents (Consultation Requirements) (Department of Climate Change and Water 2010b), Department of Planning & Environment comments issued 17 January 2018, and the Secretary's Environmental Assessment Requirements MP10_ 0014 MOD3

Consultation

Aboriginal community consultation has been conducted in accordance with the Consultation Requirements. A consultation log has been maintained which details all correspondence with the registered Aboriginal parties for the project (Appendix 1). Full records of consultation have also been provided in Appendix 2.

Summary of key findings

- Surface site, BCBW18 IF 01 (AHIMS ID 45-5-5165), identified during the survey, is not located within the study area and will not be impacted by the proposed works
- Only two of the sites identified during the test excavation programme, BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164), are located within the current study area
- The significance assessment found that BCBW18 AS 01 (AHIMS ID 45-5-5162) is of low scientific significance while BCBW18 AS 02 (AHIMS ID 45-5-5164) is high scientific significance
- The impact assessment found that impacts to BCBW18 AS 02 (AHIMS ID 45-5-5164) will be very minor and will not impact major features of the site
- The proposed development will have a total impact, with total loss of value on BCBW18 AS 01 (AHIMS ID 45-5-5162).

Recommendations

- Following completion of archaeological investigation, analysis and reporting, the assemblage retrieved from the test excavation should be reburied on site. Reburial should occur within the conservation area of BCBW18 AS 02 (AHIMS ID 45-5-5164). Reburial should be undertaken in accordance with consultation with the registered Aboriginal parties
- To keep consultation current, the registered Aboriginal parties should be sent an update on the project every six months until CSR receives approval for MOD3

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ABBREVIATIONS

ACHAR	Aboriginal Cultural Heritage Assessment Report
AFG	Aboriginal Focus Group
AHC	Australian Heritage Council
AHIP	Aboriginal Heritage Impact Permit
AHIMS	Aboriginal Heritage Information Management System
AHMS	Archaeological and Heritage Management Solutions
ALR Act	<i>Aboriginal Land Rights Act 1983</i>
AMS	Accelerator Mass Spectrometry
Artefact Heritage	Artefact Heritage Services Pty Ltd
ATR	Archaeological Technical Report
ATSIHP Act	<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i>
BCBW18 AS	Badgerys Creek Brick Works 18 Artefact Scatter
Boral	Boral Bricks Pty Limited
BP	Before Present (that is 1950)
CHL	Commonwealth Heritage List
Code of Practice	Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales 2010
Consultation Requirements	Aboriginal cultural heritage consultation requirements for proponents 2010
CSR	CSR Building Products Limited
DA	Development Application
DCP	Development Control Plan
DECCW	Department of Environment, Climate Change and Water (now OEH)
DNC	Didge Ngunawal Clan
DLO	Darug Land Observations
Element	Element Environment Pty Ltd
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Diversity Conservation Act 1999</i>
g	grams
GM	Geometric Microlith

GPS	Global Positioning System
Guide	Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW
ha	hectares
IF	Isolated Find
JMCHM	Jo McDonald Cultural Heritage Management
km	kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
MDCA	Mary Dallas Consulting Archaeologist
mm	millimetres
MOD	Modification
NHL	National Heritage List
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NTSCorp	Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory
OEH	Office of Environment and Heritage
PA	Project Approval
PAD	Potential Archaeological Deposit
Part 3A Repeal Act	<i>Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011</i>
RAP	Registered Aboriginal Party
RNE	Register of the National Estate
SEARs	Secretary's Environmental Assessment Requirements
The site	Badgerys Creek Brick Making Facility Site
SU	Survey unit
TP	Test pit
VENM	Virgin Excavated Natural Material

1.0 INTRODUCTION

1.1 Project description

In October 2016, CSR Building Products Limited (CSR) acquired Boral Bricks Pty Limited (Boral) brick business along the eastern seaboard of Australia and with it, the Badgerys Creek Brick Making Facility Site ('the Site'). The site is strategically placed in the Western Sydney Priority Growth Area and borders on the proposed Western Sydney Airport precinct. Project Approval (PA10_0014) was given for the existing site (PA10-0014) under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and previous archaeological investigations were conducted by AECOM (2010) as part of that approval.

CSR now proposes the construction of a roof products manufacturing facility (Modification [MOD] 3) and establishment of a grid connected solar farm (Modification [MOD] 4). The project is known as the CSR Advanced Manufacturing Hub.

MOD3 will involve:

- Advanced Manufacturing - Brick Production
 - Removal of most of the existing brick manufacturing equipment and replacement with new brick manufacturing equipment in the existing brick making facility
 - Increase in the building footprint of the existing brick making facility
 - Increase in the building footprint of the existing administration building
 - A NATA (National Association of Testing Authorities) Accredited Advanced Testing Laboratory
 - Extension to the existing visitor's carpark
 - An innovation centre
 - A weighbridge
 - Factory staff parking
 - A new access road to the factory staff parking area and for bulk material deliveries and dispatch
 - New rainwater tanks
 - A battery store
- Advanced Manufacturing - Roof Products Production
 - Construction and operation of a roof products manufacturing facility on CSR owned land outside the approved project boundary, immediately east of Pit 4
 - Modification to the approved project boundary to include the proposed roof products manufacturing facility, located on the adjacent property
 - The processing of sandstone (overburden material not used in brick production) for use in the manufacture of roof products on-site
- General
 - Re-commence operations at the site as approved in the Project Approval (PA10_0014), and expel the current mothballed status of the site

- Amendment to the extent of Pit 5 to include a 200 m buffer zone to neighbouring residential properties required under the *Mining Act 1992*
- An increase in the importation of raw materials from off-site for use in both the brick making and roof products manufacturing facilities
- Modifications to the approved noise bunds.

MOD4 will involve:

- The dewatering of Pit 1
- Continued extraction of clay material in Pit 1 to a depth of 35 m
- The importation of Virgin Excavated Natural Material (VENM) to backfill Pit 1 and potentially other pits, to rehabilitate the site and facilitate future development.
- The establishment of a grid connected solar farm. This will allow energy security through a more diverse energy mix, initiate a clean renewable energy source on-site, reduce the greenhouse gas emissions that contribute to global warming and improve the land utilisation on the eastern flank, outside of the approved project boundary.

This report focuses on MOD3 to the original project approval (PA10_0014).

1.2 Project approval framework

To realise the full potential of the Facility and allow it to meet the strategic needs of the brick, roof products and other building product manufacturing businesses, CSR requires modifications to the existing project Approval (PA10_0014). CSR are proposing three separate modifications (MOD2, MOD3 and MOD4) to their Project Approval (PA10_0014) under section 75W of the EP&A Act. MOD2 has already received Project Approval and requires no further archaeological assessment.

Desktop assessment of the eastern portion proposed under MOD3 and MOD4, identified areas of Aboriginal archaeological potential. Secretary's Environmental Assessment Requirements (SEARs) have been issued for MOD3 (MP10_0014 MOD3). The SEARs and where they are addressed in this report are summarised in Table 1.1

Table 1.1: Secretary's Environmental Assessment Requirements

SEAR	Section
The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) and consultation with OEH regional officers.	Section 8.0 Aboriginal cultural heritage assessment

Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.

Section 3.0 Aboriginal stakeholder consultation

Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.

Section 10.0 Impact assessment
Section 11.0 Management and mitigation

Separate SEARs have not been issued for MOD4, however, the Department of Planning and Environment commented that cumulative impacts within and between MOD3 and MOD4 be assessed.

As this project is being assessed under 75W of the EP&A Act permits issued under the *National Parks & Wildlife Act 1974* (NPW Act), principally an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act will not be not required.

1.3 Study area

The study area (Figure 1.1) is located in Badgerys Creek within the Liverpool Local Government (LGA) and within the boundaries of the Gandangara Local Aboriginal Land Council (LALC), Parish of Bringelly and County of Cumberland. The study area is located on land at 235 Martin Road in the suburb of Badgerys Creek approximately 41 kilometres (km) west of the Sydney Central Business District. The land is adjacent to the existing Badgerys Creek Quarry and Brickmaking Facility which is currently nonoperational.

The study area includes portions of:

- Lot 1 DP981161
- Lot 1 DP373863
- Lot 54 DP3050
- Lot 55 DP3050
- Lot 56 DP3050

The study area measures 422 metres (m) north-south by 240 m east-west and has total area approximately 9.6 hectares (ha). It is bound by CSR owned land to the south and east, 230 Martin Road to the north, and the CSR owned brick making facility site to the west.

The study area does not encompass the entire MOD3 area, as a portion of MOD3 had been previously assessed by AECOM (2010) and cleared of Aboriginal heritage (Figure 1.2). This portion had already obtained project approval under PA10_0014.

1.4 Background

Artefact Heritage was engaged by Element, on behalf of CSR, to undertake a desktop assessment and site inspection of a large area (the investigation area), as depicted in Figure 1.3, which encompasses the study area. The assessment found that areas of Aboriginal archaeological potential are located within the proposed impact area. Subsequently, Artefact Heritage prepared a methodology (Artefact Heritage 2018a) for an archaeological survey and test excavation within the study area and prepare an Archaeological Technical Report (ATR) (Artefact Heritage 2018b) (Appendix 3).

The survey was conducted on 20 August 2018 concurrently with the test excavation program. The test excavation program was conducted over five days between 20 August 2018 and 24 August 2018. The results of the survey and test excavation were the identification of three new subsurface sites (BCBW18 AS 01 (AHIMS ID 45-5-5162), BCBW18 AS 02 (AHIMS ID 45-5-5164), and BCBW18 AS 03 (AHIMS ID 45-5-5163)) and one new surface site (BCBW18 If 01 (AHIMS ID 45-5-5165)).

This Aboriginal Cultural Heritage Assessment Report (ACHAR) has been prepared in compliance with PA10_0014.

1.5 Study objectives

The objectives of this report are to:

- Assess the Aboriginal cultural heritage values of the study area, including archaeological and community cultural values, and the significance of identified values. This is also a requirement of the SEARs.
- Identify Aboriginal cultural heritage values that may be impacted by the proposed works, including consideration of cumulative impacts, and measures to avoid significant impacts. This is also a requirement of the SEARs.
- Ensure appropriate Aboriginal community consultation in the assessment process, as required by the SEARs.
- Identify any recommended further investigations, mitigation and management measures required, in compliance with the SEARs.
- To detail the results of the physical test excavation which investigated the areas of archaeological sensitivity and archaeological content of the study area, as required by the SEARS.

This ACHAR has been undertaken in accordance with the following guidelines:

- Secretary's Environmental Assessment Requirements (MP10_0014 MOD3) issued 15 December 2017.
- Department of Planning & Environment comments issued 17 January 2018.
- Aboriginal cultural heritage consultation requirements for proponents 2010 (Consultation Requirements) (Department of Environment, Climate Change & Water [DECCW] 2010a).
- The guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (the Guide) (Office of Environment & Heritage [OEH] 2011).

1.6 Limitations

This ACHAR is based on the previous ATR (Artefact Heritage 2018b) and the Aboriginal consultation process undertaken by Artefact Heritage (Section 3.0, Appendix 1 and 2) for the proposed roof products manufacturing site (MOD3).

1.7 Authors and contributors

This ACHAR was prepared by Ryan Taddeucci (Senior Heritage Consultant, Artefact Heritage) with management input and review from Vanessa Edmonds (Principal, Artefact Heritage).

Ryan has a Bachelor of Arts with Honours in Archaeology and a Masters of Museum Studies. Ryan has over five years' experience in Aboriginal cultural heritage management in NSW, WA and QLD.

Vanessa Edmonds (Principal, Artefact Heritage) directed the project, reviewed this report and provided management input and advice. Vanessa has a Bachelor of Arts in Australian Prehistory and a Master of Letters in Archaeology and Palaeoanthropology. Vanessa has over 30 years of experience in Aboriginal cultural heritage management nationally.

1.8 Report structure

The purpose of this report is to document the results of an investigation of Aboriginal heritage at the study area. As such, the structure of this report includes:

- Section 1 – Introduction
- Section 2 – Legislative context: outlines relevant legislation for this assessment
- Section 3 – Consultation: provides information on the Aboriginal consultation process and results
- Section 4 – Environmental context: provides an overview of the environmental conditions to provide context for the predictive model
- Section 5 – Aboriginal context: presents the results of the background ethnohistoric and literature research and database searches. This section also presents a predictive model as background to the survey sampling strategy
- Section 6 – Survey results: presents the methodology and results of the Aboriginal archaeological survey
- Section 7 – Archaeological test excavation: discusses the aims, timing and personnel, constraints, survey sampling strategy, methodology and coverage of the test excavation.
- Section 8 – Aboriginal cultural heritage assessment: outlines the methodology for conducting an Aboriginal cultural heritage assessment and the identified heritage values, based on stakeholder consultation.
- Section 9 – Significance assessment: full assessment of significance based on consultation with stakeholders following the review of this ACHAR and the ATR.
- Section 10 – Impact assessment: discussion of how the proposed works will impact the identified Aboriginal site and how to mitigate against the loss of heritage value.
- Section 11 – Management and mitigation measures: Outlines the proposed method of mitigating against loss of cultural value.

- Section 12 – Recommendations: summary of recommendations for further investigations and mitigation against loss of heritage values.
- Section 13 – References

Figure 1.1: Location of study area



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Figure 1.2: Project framework

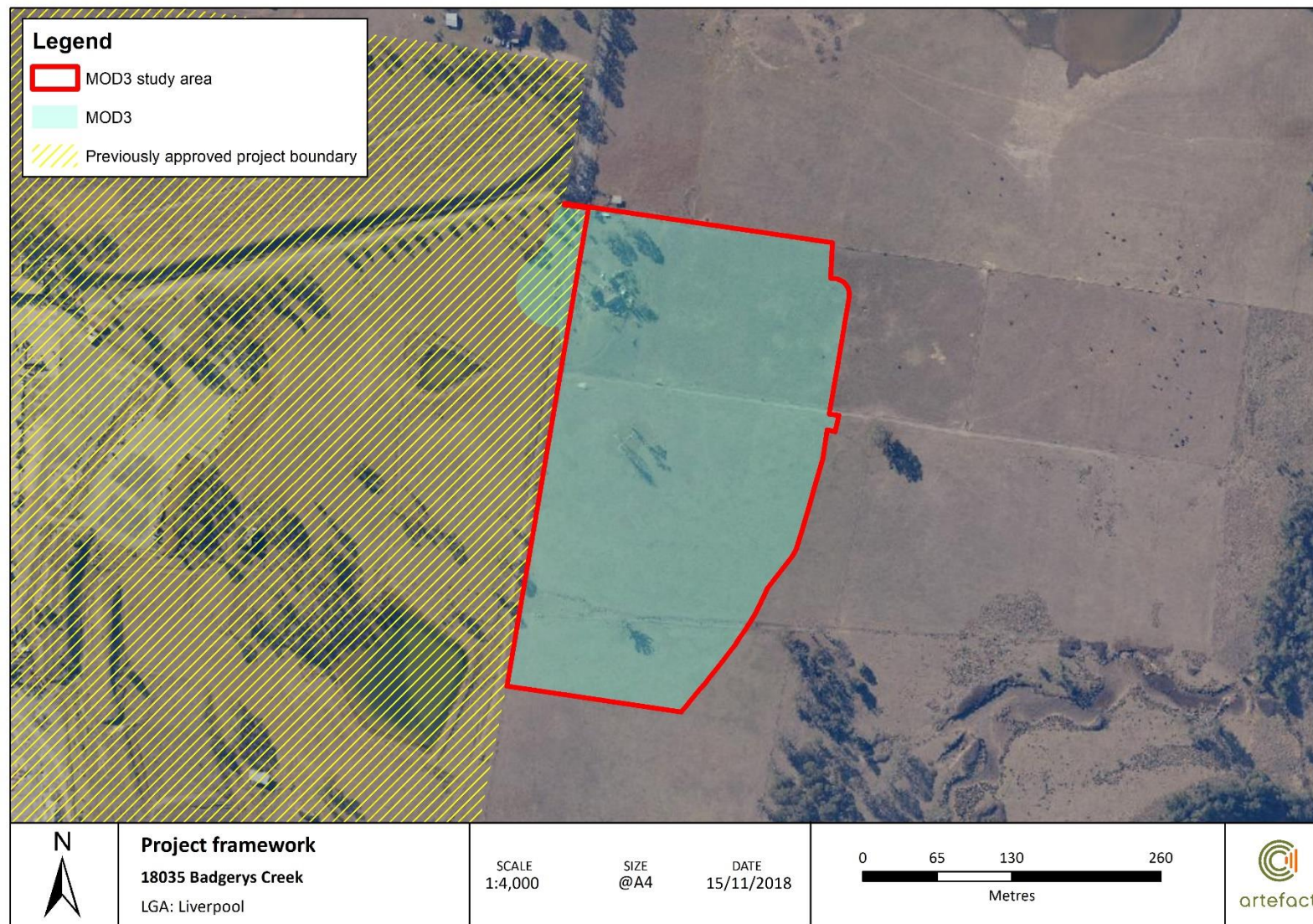
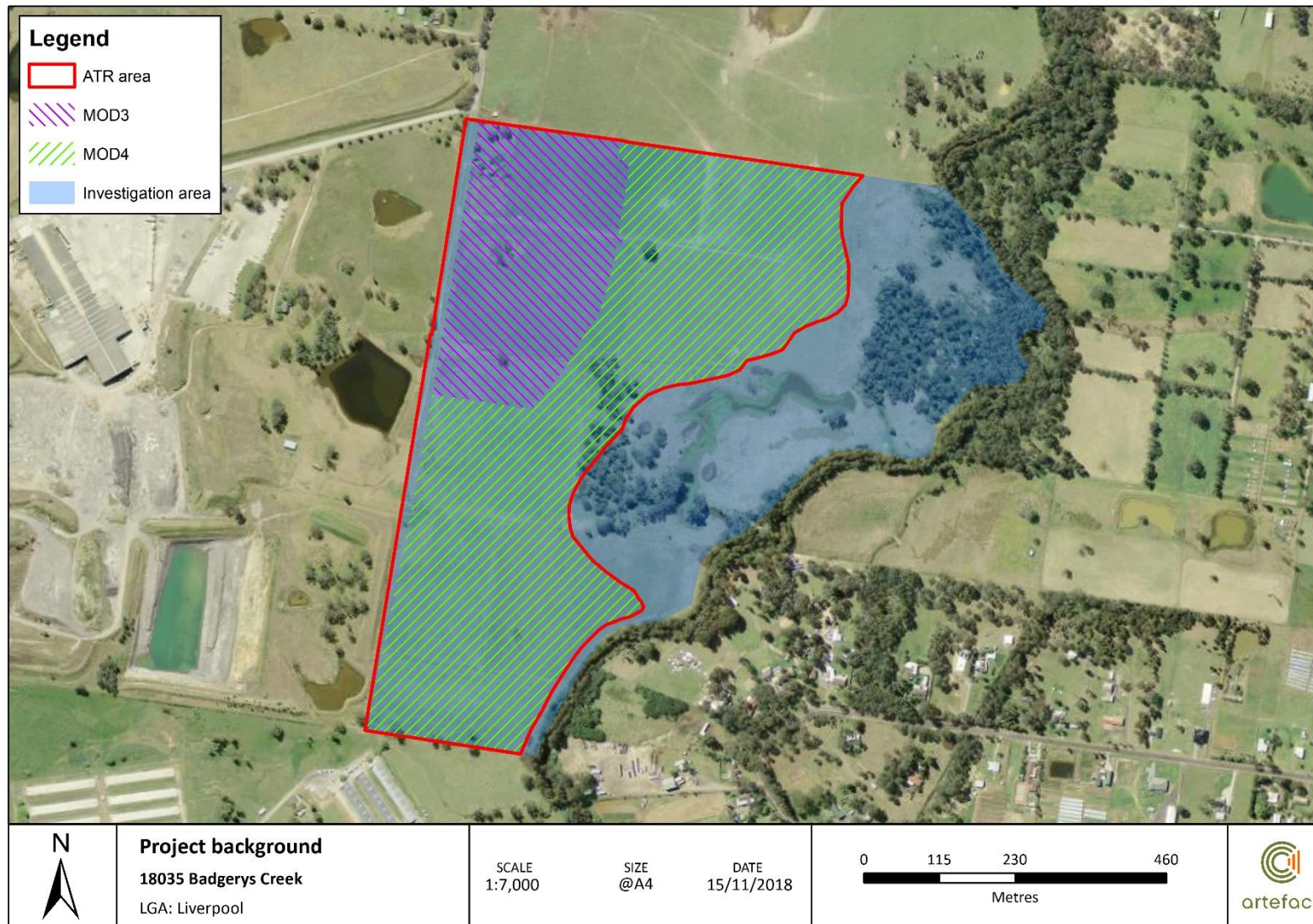


Figure 1.3: Project background



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2.0 LEGISLATIVE CONTEXT

2.1 State legislation

2.1.1 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act), administered by OEH provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the NPW Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under Section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only Aboriginal Heritage Impact Permit (AHIP) available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, Ecologically Sustainable Development principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.

As this project is considered State significant development (refer to section 2.1.4) permits issued under the NPW Act are not required.

2.1.2 *Native Title Act 1994*

The *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

One registered Native Title claim has been identified for the study area (Table 2.1).

Table 2.1: Schedule of Native Title Determination applications

Tribunal ID	Name	Date lodged	Registration status
NC2017/003	South Coast People	3 August 2017	Accepted for registration 31 January 2018

2.1.3 *Aboriginal Lands Right Act 1983*

The *Aboriginal Land Rights Act 1983* (ALR Act) established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the ALR Act to:

- (a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and
- (b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

There are no Registered Aboriginal Owners pursuant to Division 3 of the ALR Act for the project study area. The study area is within the boundary of the Gandangara Local Aboriginal Land Council (LALC).

2.1.4 *Environmental Planning & Assessment Act 1979*

Part 3A was repealed by the *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act), which commenced on 1 October 2011. Under the Part 3A Repeal Act, projects deemed to be transitional Part 3A projects will continue to be subject to Part 3A of the EP&A Act (as in force immediately before the repeal and as modified by the Part 3A Repeal Act). Transitional Part 3A projects include certain projects that were the subject of an existing approval under Part 3A.

As the Badgerys Creek Quarry and Brick Making Facility has a Project Approval that was granted under Part 3A of the EP&A Act, it is a transitional Part 3A project. The provisions of Part 3A (as in force immediately prior to its repeal) continue to be applicable to the Project. Therefore, the project is proposed to be assessed under s75W of the repealed Part 3A.

The transitional arrangements in the EP&A Act were repealed by the Environmental Planning and assessment Bill 2017. This moved transitional Part 3A projects to the current State significant development and State significant infrastructure pathways, and applications to modify such projects will no longer be made under Section 75W. This modification application has been made within the transitional timeframe and is not affected by the above arrangements.

However, the test excavation methodology was guided by the Code of Practice for Archaeological Investigation of Aboriginal objects in New South Wales (Code of Practice) (DECCW 2010b). Previous archaeological test excavations, within the wider region, were completed under the Code of Practice. Therefore, it is an applicable framework to use for comparative analysis of archaeological findings within the current test excavation.

2.2 Commonwealth legislation

2.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment and Heritage Legislation Amendment Act (No.1) 2003* amends the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to include 'national heritage' as a matter of National Environmental Significance and protects listed places to the fullest extent under the Constitution. It also establishes the National Heritage List (NHL) and the Commonwealth Heritage List (CHL).

The *Australian Heritage Council Act 2003* (AHC Act) establishes a heritage advisory body - the Australian Heritage Council (AHC), to the Minister for the Environment and Heritage and retains the Register of the National Estate (RNE).

The *Australian Heritage Council (Consequential and Transitional Provisions) Act 2003* repeals the *Australian Heritage Commission Act 1975*, amends various Acts as a consequence of this repeal and allows the transition to the current heritage system.

Together, the above three Acts provide protection for Australia's natural, Indigenous and non-Indigenous heritage. The features include:

- A new NHL of places of national heritage significance
- A new CHL of heritage places owned or managed by the Commonwealth

- The creation of the AHC, an independent expert body to advise the Minister on the listing and protection of heritage places
- Continued management of the Register of the National Estate (RNE).

National Heritage List

The NHL is a list of places with outstanding heritage value to the nation, including places which have Indigenous heritage values. The heritage values of these places are so important that they are protected under the EPBC Act. This means that a person cannot take an action that has, will have, or is likely to have, a significant impact on the national heritage values of a national heritage place without the approval of the Australian Government Minister for the Environment and Energy. It is a criminal offence not to comply with this law and there are significant penalties. There are no places listed on the NHL within the study area.

Commonwealth Heritage List

The CHL is a list of places managed or owned by the Australian Government. There are no places listed on the CHL within the study area.

Register of the National Estate

The Register of the National Estate (RNE) is an evolving record of Australia's natural, cultural and Aboriginal heritage places that are worth keeping for the future. The AHC compiles and maintains the RNE under the *Australian Heritage Council Act 2003*. Places on the RNE that are in Commonwealth areas, or subject to actions by the Australian Government, are protected under the EPBC Act by the same provisions that protect Commonwealth heritage places (see above).

Following amendments to the *Australian Heritage Council Act 2003*, the RNE was frozen on 19 February 2007, meaning no new places can be added, or removed. From 2012 all references to the RNE were removed from the EPBC Act and the AHC Act. The RNE is now maintained on a non-statutory basis as a publicly available archive. No Aboriginal sites were listed for Badgerys Creek on the RNE.

2.2.2 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSIHP Act), deals with Aboriginal cultural property (intangible heritage) in a wider sense. Such intangible heritage includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. These values are not currently protected under the NPW Act.

There is no cut-off date and the ATSIHP Act may apply to contemporary Aboriginal cultural property as well as ancient sites. The ATSIHP Act takes precedence over state cultural heritage legislation where there is conflict. The Commonwealth Minister who is responsible for administering the ATSIHP Act can make declarations to protect these areas and objects from specific threats of injury or desecration. The responsible Minister may make a declaration under Section 10 of the Commonwealth Act in situations where state or territory laws do not provide adequate protection of intangible heritage.

Where an Aboriginal individual or organisation is concerned that intangible values within the proposal are not being adequately protected they can apply to the Minister for a declaration over a place. No intangible places were identified during any stage of the heritage investigations undertaken by Artefact Heritage.

3.0 CONSULTATION

Aboriginal community consultation has been conducted in accordance with the Consultation Requirements. A consultation log has been maintained which details all correspondence with the registered Aboriginal parties for the project (Appendix 1). Full records of consultation have also been provided in Appendix 2.

3.1 Registration of Aboriginal parties

In accordance with step 4.1.2 of the Consultation Requirements, Artefact Heritage corresponded with the following organisations by letter and email on the 6 June 2018 requesting the details of Aboriginal people who may hold cultural knowledge relevant to determining the Aboriginal significance of Aboriginal objects and/or places within the local area:

- Greater Sydney Local Land Services
- Liverpool City Council
- Native Title Service Corporation
- Gandangara LALC
- Office of Environment and Heritage – Parramatta Office
- National Native Title Tribunal
- Office of the Registrar, *Aboriginal Land Rights Act 1983*

In addition to this, and in accordance with Step 4.1.3 of the Consultation Requirements, an advertisement was placed in Liverpool City Champion Advertisement on the 13 June 2018, inviting the participation of Aboriginal people who may hold cultural knowledge relevant to determining the Aboriginal significance of Aboriginal objects and/or places within the local area.

In accordance with Step 4.1.3 of the Consultation Requirements, on the 21 June 2018, emails or letters were sent to all Aboriginal persons or organisations identified through advertisement or through responses from agencies contacted as part of Step 4.1.2. In accordance with Step 4.2 the letters provided details about the location and nature of the proposal, as well as an invitation to register as an Aboriginal stakeholder.

Additional consultation details have been removed for public exhibition

4.0 ENVIRONMENTAL CONTEXT

The following information is primarily derived from Artefact Heritage (2018b).

4.1 Geomorphology and geology

The study area is located within the central portion of the Cumberland Plain, a large low-lying and gently undulating landform in the Sydney Basin. The formation of the basin began between 300 to 250 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow (Pickett and Alder 1997). The oldest, Permian layers of the Sydney Basin consist of marine, alluvial and deltaic deposits that include shales and mudstone overlain by Coal Measures.

The geology of the study area is characterised by the Triassic Wianamatta group which consists of black to dark grey shale and laminate on top of medium to coarse-grained quartz sandstone, very minor shale and laminate. The landforms are a result of the weathering of local bedrock. The underlying geology is the Hawkesbury sandstone that was laid down as river sediments and is described as medium to coarse grained quartz sandstone, this is overlain by the finer sedimentary material caps of Ashfield Shale. Hawkesbury Sandstone weathers to form thin, sandy soils with low water-retaining qualities.

4.2 Soils

The western portion of the study area is comprised of the Blacktown Residual Soil Landscape which has shallow to moderately deep, hard setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines (Figure 4.1).

The eastern portion of the study area comprises the South Creek Soil Landscape, an alluvial environment characterised by floodplains, valley flats and drainage depressions. The soils are often very deep, layered sediments over bedrock or relic soils. Plastic clays or structured loams occur in and immediately adjacent to drainage lines. Red and yellow podzolic soils are most common on terraces with small areas of structured grey clays, leached clay and yellow solodic soils (Bannerman and Hazelton 1990).

4.3 Hydrology and landforms

The study area is located 900 m east of Badgerys Creek, a second order stream. South Creek is approximately 640 m to the east, with the south of the study area bordered by a small ephemeral drainage channel associated with South Creek. The study area is located above the maximum probable flood plain (Figure 4.2).

The study area incorporates two landform elements including a hill crest, and slope. The north western portion is the highest location within the study area, it forms part of the low undulating hill crests between the two major water courses. From this point, the study area generally slopes in a south easterly direction towards South Creek. The slope is gradual with the lowest area located at the south eastern portion of the study area. There is a gradual incline towards the creek line, indicating a previous lower slope formation.

4.4 Vegetation

The study area would have once been covered by Alluvial Woodland. This community was characterised by a canopy, composed of *Eucalyptus amplifolia* (Cabbage Gum) and *E. moluccana* (Grey Box). Beneath the canopy, the ground cover was dominated by a mix of exotic and native

species including *Microlaena stipoides* (Weeping Grass), *Sida rhombifolia* (Paddy's Lucerne), *Einadia trigonos* and *Paspalum dilatatum* (Paspalum). Within the study area, Alluvial Woodland occurs in a landscape modified by agricultural practices (i.e. grazing) and is in moderate condition. This condition class also occurs within the centre of the study area and south eastern margins. Moderate condition Alluvial Woodland has experienced grazing and is in a disturbed state with a high portion of exotic species within the ground cover. There is also a 'high' condition class in the north eastern margin along South Creek. This condition is relatively intact and forms the largest patch of vegetation within the study area. A total of 8.75 ha of Alluvial Woodland occurred in the study area, comprising 17.5 per cent of the study area.

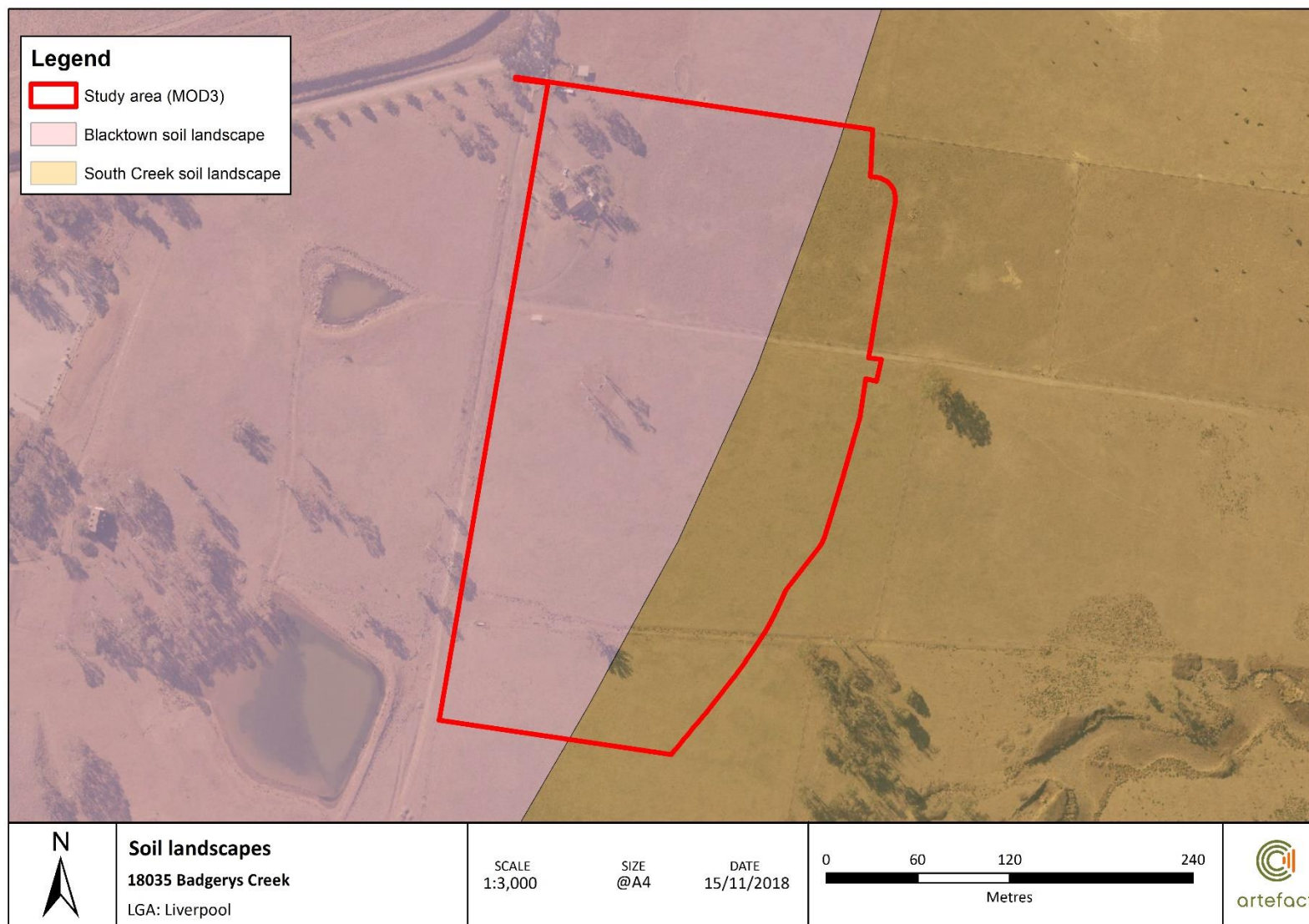
4.5 Land use

Exploration to the west of Sydney Cove began soon after initial colonisation, as it was found that the sandstone soils of coastal Sydney were unsuited for cultivation (Austral 2011). The Cumberland Plain, with its rich alluvial soils, offered better conditions for farming and land was cleared in the Cumberland Plain as early as the 1790s (Austral 2011).

The study area is located within a zone that has historically been characterised as rural in nature. The dominant activities within the vicinity from the nineteenth century onwards have been a mix of agricultural pursuits, including pastoralism, wheat and maize cropping and dairy farming. Ploughing works, associated with pastoralism, would typically impact the soil profile to a depth of approximately 300 mm.

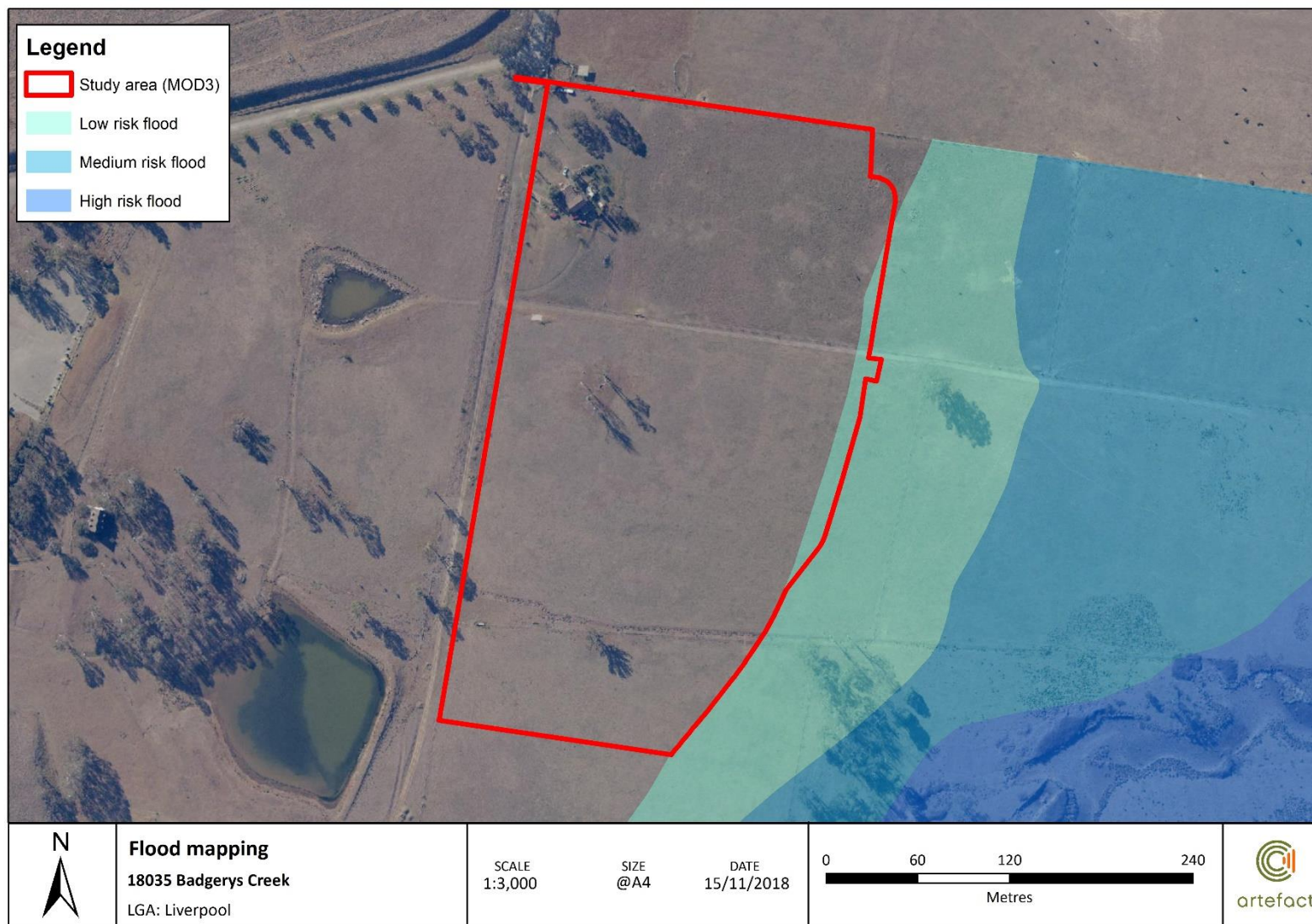
The north west section of the study area contains a brick residence with introduced species of willow and pine trees. Earthworks have occurred as the land has been built up and landscaping has occurred. The study area is generally cleared of native vegetation except for the remnant vegetation around the house and a small cropping of mature native gums in the centre of the study area. While there is evidence of extensive grazing practices the surface doesn't appear to have been ploughed but due to the lack of structural integrity provided by vegetation, the erosional prone soil of the slopes would have been affected by sheet wash and animal trampling over time.

Figure 4.1: Soil landscapes within the study area



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Figure 4.2: Flood mapping, study area outlined in red (Source: CSR)



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5.0 ARCHAEOLOGICAL CONTEXT

Assumptions about Aboriginal land use patterns are made on the basis of archaeological information gained from the local area, from observations made by colonists and settlers after settlement of the area, and from information known about available natural resources. The following information is primarily derived from Artefact Heritage (2018b).

5.1 Aboriginal ethnohistorical context

The study area is located near the boundaries of two Aboriginal language groups, Dharawal and Gundungurra (Tindale 1974). The Dharawal are placed in the area from the south side of Botany Bay and Port Hacking to north of the Shoalhaven River and inland to Campbelltown, Camden and Bargo. They are thought to have ranged further north into the Liverpool region, the boundaries defined today can only be used as indicative (Attenbrow 2010). The Gundungurra are described as occupying the southern rim of the Cumberland Plain, west of the Georges River, including a boundary area with the Dharawal in the Camden and Bargo locality.

As traditional territorial boundaries were fluid it is uncertain which group(s) occupied the study area (Peterson 1976). The current state of knowledge about the fluidity of tribal boundaries is based partly on studies of contemporary Aboriginal communities in northern and central Australia who were less affected by European colonisation, and partly on observations of tribal groups to the west and south-west of Sydney who had been severely affected by the disconnection from their lands cause by European colonisation (Thomson 1985).

There are also ethno-historical observations made by early explorers and settlers in the region, who first came into contact with the Aboriginal people of these areas in the 18th and 19th century. Wilson, during a 1798 expedition through the region, observed that people were wearing large skin cloaks. When James Backhouse travelled to the region in 1836, he noted that skin cloaks were still worn, but some European clothes and blankets were also used, and that ceremonies such as tooth avulsion were also practised (Koettig 1981).

In the early 1800s, relationships between the Aboriginal people of the area and the European settlers were in general amicable. Karskens (2010) notes several examples of close relationships between land owners and local Aboriginal people, including John Kennedy who gave the Dharawal protection on Teston Farm at Appin in later, not so peaceful, times (Karskens 2010). Relations between Aboriginal people and colonists did not remain amicable. A sustained drought during 1814 and 1815, and continued disenfranchisement of Aboriginal people from the land lead to tensions between farmers and Aboriginal people who remained to the southwest of Sydney. Aboriginal people were accused of stealing corn and potatoes and spearing cattle. A number of farmers were killed on their properties. In a dispatch Governor Macquarie wrote that,

The Native Blacks of this country...have lately broken out in open hostility against the British Settlers residing on the banks of the River Nepean near the Cow Pastures.

Aboriginal people were targeted, and it was ordered that Aboriginal men be strung from trees when they were killed as an example (Turbet 2011: 234).

In 1816, the tensions culminated in the Appin massacre when Aboriginal people where pursued by a detachment led by Captain James Wallis. Fourteen Aboriginal people of the Dharawal nation were shot or driven over a cliff to their deaths by the soldiers. The bodies of two of the Aboriginal men were strung up at the site (Turbet 2011).

Overall the devastation of the Aboriginal culture did not come about through war with the British, but instead through disease and forced removal from traditional lands. It is thought that during the 1789 smallpox epidemic over half of the Aboriginal people of the Sydney region died. This loss of life meant that some of the Aboriginal groups who lived away from the coastal settlement of Sydney may have disappeared entirely before Europeans could observe them or record their clan names (Karskens 2010: 452).

Into the nineteen and twentieth century's descendants of the Gundungurra and Dharawal groups continued to live across the southern margin of the Cumberland Plain along with Aboriginal people from other areas of NSW.

5.2 Regional archaeological context

The archaeological understanding of the early Aboriginal settlement of the Sydney Basin and surrounds is constantly expanding and developing. The oldest evidence of human occupation in the vicinity of the study area comes from Cranebrook Terrace, located 20 km north west of the study area (Attenbrow 2010: 18-20). Cranebrook Terrace has been dated to 41,700 years Before Present (BP) (ANU-4016).

The existing archaeological record is limited to certain materials and objects that were able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Archaeological analyses of these artefacts in their contexts have provided the basis for the interpretation of change in material culture over time. Technologies used for making tools changed, along with preference of raw material. Different types of tools appeared at certain times, for example ground stone hatchets are first observed in the archaeological record around 4,000 years BP in the Sydney region (Attenbrow 2010: 102). It is argued that these changes in material culture were an indication of changes in social organisation and behaviour.

The Eastern Regional Sequence was first developed by McCarthy in 1948 to explain the typological differences he was seeing in stone tool technology in different stratigraphic levels during excavations such as Lapstone Creek near the foot of the Blue Mountains (McCarthy 1948). The sequence had three phases that corresponded to different technologies and tool types (the Capertian, Bondaian and Eloueran). The categories have been refined through the interpretation of further excavation data and radiocarbon dates (Hiscock and Attenbrow 2005; JMDCHM 2005). It is now thought that prior to 8,500 years BP tool technology remained fairly static with a preference for silicified tuff, quartz and some unheated silcrete. Bipolar flaking was rare with unifacial flaking predominant. No backed artefacts have been found of this antiquity.

After 8,500 years BP silcrete was more dominant as a raw material, and bifacial flaking became the most common technique for tool manufacture. From about 4,000 years BP to 1,000 years BP backed artefacts appear more frequently. Tool manufacture techniques become more complex and bipolar flaking increases (JMDCHM 2006). It has been argued that from 1,400 to 1,000 years before contact there is evidence of a decline in tool manufacture. This reduction may be the result of decreased tool making, an increase in the use of organic materials, changes in the way tools were made, or changes in what types of tools were preferred (Attenbrow 2010:102). The reduction in evidence coincides with the reduction in frequency of backed blades as a percentage of the assemblage.

After European colonisation Aboriginal people of the Cumberland Plain often continued to manufacture tools, sometimes with new materials such as bottle glass or ceramics. There are a number of sites in Western Sydney where flaked glass has been recorded, for example at Prospect (Ngara Consulting 2003) and Oran Park (JMDCHM 2007).

5.3 Registered Aboriginal sites

The location of Aboriginal sites is considered culturally sensitive information. It is advised that this information, including the AHIMS data appearing on the heritage map for the proposal be removed from this report if it is to enter the public domain.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on the 5 March 2018 for sites registered within the following coordinates:

GDA 1994 MGA 56	292250 -- 294250 E 6245998 -- 6247998 N
Buffer	1000 m
Number of sites	30
AHIMS Search ID	331827

The distribution of recorded sites within the AHIMS search area is shown in Figure 5.1. The search located 30 registered sites within the vicinity of the study area, and no sites within the study area.

The frequency of recorded site types is summarised in Table 5.1 below.

Table 5.1: Frequency of site features within the AHIMS extensive search results

Site Feature	Frequency	Per cent
Artefact	27	90
Modified Tree (Carved or Scarred)	2	6.6
Art (Pigment or Engraved)	1	3.33
Total	30	100

The most frequent site feature in the search area is artefact site (n=27, 90 per cent). There are no previously registered Aboriginal sites recorded within the study area, only BCBW18 AS 01 (AHIMS ID 45-5-5162) was recorded as part of this study. The closest previously registered site is South Creek (AHIMS ID 45-5-0213), located 500 m to the east of the study area (Figure 5.1).

South Creek (AHIMS ID 45-5-0213)

This site was recorded by Ms Laila Haglund in 1978 as ‘artefacts’ and was described to be located on a ploughed low lying peninsula, at the loop formed by South Creek. Deep waterholes were also observed in the bends. Artefacts of flaked stone were scattered all over the ploughed area. The recorded coordinates place the site on the western bank of South Creek, however from the description it can be determined there is a coordinate error and that the probable real location is further east on the opposite bank of South Creek. The exact location was unable to be determined and as a result the site was not able to be relocated. Co-ordinate errors are common on the AHIMS database, particularly for sites recorded in AGD.

Figure 5.1: Previously recorded sites identified in AHIMS search (sites recorded during this study not mapped)

Map removed for public exhibition

5.4 Local archaeological context

A full description of previous studies was provided in the ATR (Artefact Heritage 2018b). Table 5.2 provides a summary of previous studies within close proximity of the study area. It was found that low density artefact scatters, primarily comprised of silcrete will be associated with crest landform within the Badgerys Creek area. Previous surveys have identified that surface artefact sites will most likely occur downstream from main creek lines.

Table 5.2: Summary of key studies

Author and date	Title
Navin Officer Heritage Consultants 2016	Western Sydney Airport
AECOM 2011	Boral Badgerys Creek Aboriginal Heritage Assessment – Addendum
AECOM 2010	Boral Bricks Aboriginal Heritage Impact Assessment
Navin Officer Heritage Consultants 1997	Environmental Impact Assessment for the Second Sydney Airport
Brayshaw 1995	Elizabeth Drive Upgrade Archaeological Survey for Aboriginal Sites
Haglund 1978	Archaeological Survey of Area Considered for Second Airport Southern Zone

5.5 Predictive model

Archaeological investigation across the Cumberland Plain has been comprehensive over the past 30 years, including survey, excavation and desktop analysis studies. This varied and intensive investigation has led to the development and continual refinement of a predictive model for Aboriginal occupation within the region.

The Cumberland Plain has been extensively studied due to the growth demand of the ever-increasing Sydney population. Regional studies have been done on the large Growth Centres of the North West and South West of the Cumberland Plain, west of Sydney Basin. White and McDonald (2010) have contributed to the debate over site prediction by discussing the nature of Aboriginal site distribution, interpreted through lithic analysis of excavated sites in the Rouse Hill Development Area (White and McDonald 2010). The Rouse Hill Development Area is located about 15 km north of the current study area, the watercourses in the development area (Caddies Creek and Second Ponds Creek) derive from the same source as South Creek, Hawkesbury River, and are of a similar stream order. The Soil landscapes are also reflective of those in the current study area, South Creek Soil Landscape along the high order watercourses and associated remnant Blacktown Soil Landscape. The study gave rise to the commonly referred Stream Order Model which provides a sound basis for archaeological investigations in the Cumberland plain. The paper provides a spatial and distributive analysis of Aboriginal objects in relation to freshwater resources and along varying landform units. The findings of this study highlighted the relationship between proximity to freshwater and landscape with archaeological evidence of Aboriginal occupation. The study found that artefact densities were most likely to be greatest on terraces and lower slopes within 100 m of freshwater resources (White and McDonald 2010). The predictive model identified that ridgelines and crests located between drainage lines will contain archaeological evidence though usually representative of background scatter (White and McDonald 2010).

While White and McDonald's (2010) predictive model can be seen as an indicative model of the archaeology of the Cumberland Plain, a more recent study has been conducted by Godden Mackay and Logan (GML 2012) at the East Leppington Precinct. The study utilised the Stream Order Model developed by White and McDonald (2010) in their investigations and three different and complementary models to explain their findings. The Stream Order Model is a regional based model and doesn't consider the small scale intra-landform variations that can affect the predictions of this model.

Owen and Cowie (2017) describe three other models that can be used to more accurately describe archaeological probability within the landscape. Economic Resource Model, Activity Overprinting Model and Domiciliary Spacing Model. The Economic Resource Model focuses on the resource zones, confluences of creeks are considered high resource zones due to the richness in flora and fauna. The model suggests that the evidence of Aboriginal activities will decrease with distance from these resource rich nodes. Activity Overprinting Model was used to explain the density of sites at increasing distances from the creek and Domiciliary Spacing Model was used to describe the features and spatial variation of a site.

In conjunction with these models, an understanding of the soil landscape and the nature and prevalence of cultural material within these contexts is important in the predictive model process. Deposits that contain cultural material are likely to exist within both Blacktown soil landscapes and South Creek soil landscapes however, these are generally not stratified. Blacktown soils retrieve cultural material in A Horizon deposits which generally extend approximately 300 mm below the ground surface. Stratified archaeological deposits are likely to be located within the South Creek soil landscape. These stratified deposits are most likely to exist within raised embankments where environmental forces, such as flash flooding, are less likely to have impacted Aboriginal cultural material situated on the ground surface. The deposits may have a vertical distribution that parallels alluvial deposition over time. The NSW Soil and Land Information System produced a technical report outlining the results of a core sample taken approximately 1.3 km north of the current study area, along the alluvial flats of South Creek. The results show that the South Creek soils extend to a depth of two metres in this area and may parallel the depth of deposit within the study area.

Every predictive model has its limitations and constraints and should be used as a guiding factor for future investigation and be used as a bridging tool to further current understanding of the Cultural environment.

Based on the recorded AHIMS sites, previous studies and the environmental context, predictions can be made on the type of Aboriginal archaeological evidence potentially present within the current study area. This evidence could be found in the form of certain site types:

- Open artefact scatters or isolated finds – this was the most common site feature from the AHIMS search and is the most prevalent source of evidence of Aboriginal occupation that has influenced the predictive models for many studies. The visibility of these sites is dependent on surface visibility and exposure and are affected by the nature of the soil landscape. The erosional nature of the Blacktown soils within the study areas suggest that possible deposits are susceptible to erosion, yet the depositional nature of permanent watercourses such as the South Creek soils gives rise to the probability of intact occupational records in the deep stratigraphic layers. Using the Stream Order Model and Economic Resource model we can assume there is a high likelihood for sites. Previous surveys within the wider area have identified that surface artefact sites will most likely occur downstream from main creek lines.

- Culturally modified scar trees – while extensive clearing occurred post-European contact these sites may occur in any pockets of mature native trees.
- Grinding grooves – these sites occur on sandstone outcroppings usually along waterways, swamps or water pans. The presence of these sites will be dependent on the availability of suitable sandstone sources. The underlying geology of the Soil Landscapes in the study area is the Wianamatta Group which contains the Minchinbury Sandstone, a fine to medium grained quartz Sandstone. Grinding grooves have been found along South Creek and Badgerys Creek.
- Sub-surface artefact sites – low density assemblies, primarily composed of silcrete will be associated with Crest landforms in the Badgerys Creek area.

6.0 ARCHAEOLOGICAL SURVEY

6.1 Aims

The aims of the archaeological survey were as follows:

- cover a representative sample of the study area that will potentially be impacted by the proposed works
- record any Aboriginal objects observed during the survey
- to liaise with RAP representatives regarding the proposed works and the archaeological potential of the study area
- to verify test excavation, transect locations with the RAP representatives, as outlined in the methodology (Artefact Heritage 2018a).

6.2 Timing and personnel

The archaeological survey was conducted over one day on 20 August 2018. Personnel and timing for the archaeological survey are presented in Table 6.1.

Table 6.1: Timing and personnel for the archaeological survey

Participant	Organisation	Role	Date of participation
Ryan Taddeucci	Artefact Heritage	Senior Heritage Consultant	20 August 2018
Julia McLachlan	Artefact Heritage	Heritage Consultant	20 August 2018
Cameron Mackay	Artefact Heritage	Archaeologist	20 August 2018
Paul Boyd	Didge Nguawal Clan	RAP	20 August 2018
Daniel Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	RAP	20 August 2018
Fred Trgwlynn	Darug Land Observations	RAP	20 August 2018
Jeff Hickey	Kamilaroi-Yankuntatjara Working Group	RAP	20 August 2018

6.3 Survey strategy and methodology

The ATR area was divided into nine survey units (SUs), based on landform and access, these units were numbered SU1 – SU9 (Figure 6.1). The entirety of SU1 and SU3 and portions of SU2 and SU4 – SU6 are contained within the study area.

The survey units were traversed on foot. A handheld Global Positioning System (GPS) was used to track the path of the survey team and record the coordinates of survey transects. The coordinate system projection used for all site recording was GDA94 MGA 56.

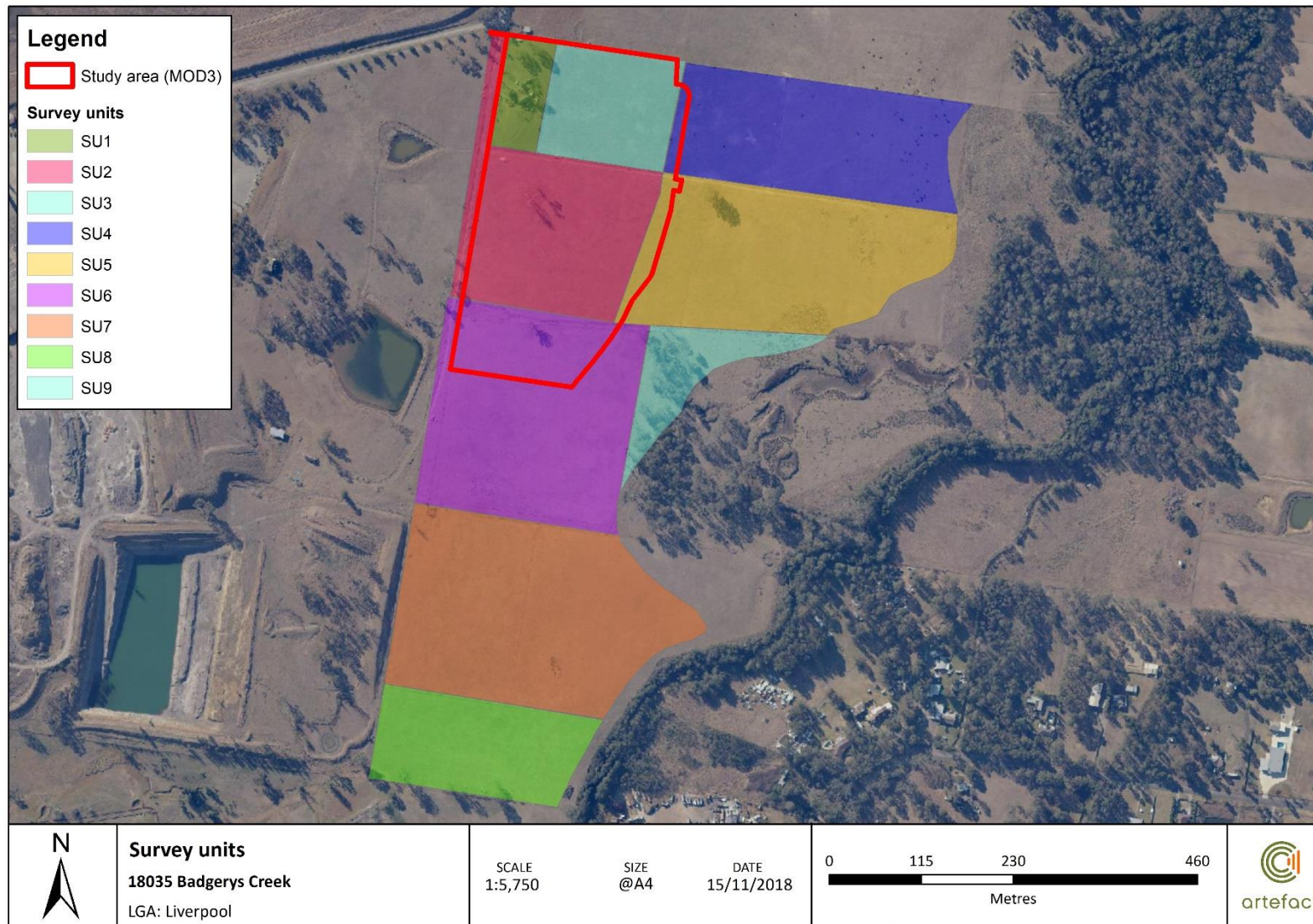
The survey was conducted with seven people traversing the area spaced 15 m apart. All ground exposures were examined for Aboriginal objects (stone artefacts, imported shell, or other traces of Aboriginal occupation). Old growth trees were examined for signs of cultural scarring and marking.

A photographic record was kept during the survey. Photographs were taken to record aspects of survey units including vegetation and disturbance. Scales were used for photographs where appropriate.

All visible surfaces were inspected, and old growth native trees were similarly targeted for evidence of cultural modification. Local landforms, evidence of land use history and previous research was used to inform assessments of archaeological potential. Full survey of SU1 was unachievable due to access restrictions to the property. Overall the visibility was low due to grass cover. Exposures were present in areas worn down by animal and livestock movement. Due the dryness of the landscape dust was also a factor that contributed to the low visibility.

The survey results in the identification of one newly recorded surface site (BCBW18 If 01 (AHIMS ID 45-5-5165)). However, BCBW18 If 01 (AHIMS ID 45-5-5165) is not located within the current study area (MOD3) and has been assessed in the MOD4 ACHAR (Artefact Heritage 2018c).

Figure 6.1: Survey units relative to the study area



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7.0 ARCHAEOLOGICAL TEST EXCAVATION

7.1 Aims

The aims of the archaeological test excavation were:

- Adequately identify the nature of any subsurface archaeological deposits, including preliminary comparisons with results of other subsurface archaeological investigations in the area.
- Assess the scientific significance of any archaeological deposits identified during the excavation, following the assessment of test excavation results.
- Provide an opportunity for registered Aboriginal stakeholders to comment on the Aboriginal cultural heritage values of the study area
- Provide the proponent with recommendations on opportunities to avoid impact and future requirements for further archaeological investigation where required.

7.2 Timing and personnel

Archaeological test excavations were conducted across five days from 20 August to 24 August 2018. Table 7.1 provides details of timing and personnel involved in the test excavation.

Table 7.1: Test excavation personnel and timing

Personnel	Organisation	Role	Dates
Vanessa Edmonds	Artefact Heritage	Principal	23 August 2018
Ryan Taddeucci	Artefact Heritage	Excavation supervisor	20 August – 24 August
Julia McLachlan	Artefact Heritage	Excavation supervisor	20 August – 24 August
Anna Darby	Artefact Heritage	Excavation assistant	20 August – 24 August
John Sokalik	Artefact Heritage	Archaeologist	20 August – 24 August
Amad Ghareb	Artefact Heritage	Archaeologist	20 August – 24 August
Cameron MacKay	Artefact Heritage	Archaeologist	20 August – 24 August
Paul Boyd	Didge Ngunawal Clan (DNC)	Site officer	20 August 2018
Adam King	Didge Ngunawal Clan (DNC)	Site officer	21 August – 24 August
Fred Trewlynn	Darug Land Observations (DLO)	Site officer	20 August – 24 August
Jeff Hickey	Kamilaroi-Yankuntatjara Working Group	Site officer	20 August – 24 August

Personnel	Organisation	Role	Dates
Daniel Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	Site officer	20 August – 22 August
Ebony Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	Site officer	23 August – 24 August

7.3 Test excavation strategy and methodology

Archaeological test excavation was undertaken to investigate the archaeological potential of various landforms across the ATR area. A comprehensive description of the test excavation program is provided in the ATR (Artefact Heritage 2018b) (Appendix 3).

Eight east-west oriented transects were placed across the ATR area to characterise the archaeological deposit of the landforms across the ATR area (Figure 7.5). The entirety of transect 6 and 7, and half of transect 3 are within the current study area. Six test pits (TPs) were placed on transect 7 and seven were placed along transect 6. Transect 3 featured ten TPs, with five within the current study area. All TPs within the study area were placed at intervals of 25 m on an orientation of 100 degrees from magnetic north (the alignment of the transects).

All TPs were excavated in arbitrary spits of 100 mm with the first TP in each line (a) excavated in 50 mm as a control. All retrieved deposit from each test pit was placed in buckets and transported to a sieve area. All retrieved deposit was dry sieved using 3 mm sieves.

7.4 Results of test excavation

The ATR resulted in the identification of three subsurface sites BCBW18 AS 01 (AHIMS ID 45-5-5162), BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163). BCBW18 AS 02 (AHIMS ID 45-5-5164) featured a heat retainer hearth. Post excavation analysis found that the three sites formed an archaeological complex. The complex is likely the result of repeated occupation by small groups who engaged in lower residential mobility and higher logistical mobility. Artefact manufacturing and activities associated with a clay heat retainer hearth would have occurred within the wider area (Artefact Heritage 2018b).

Two charcoal samples were obtained from the excavation of the hearth and were sent to the Waikato Radiocarbon Dating Laboratory for Accelerator Mass Spectrometry (AMS) dating. One of the samples was found to be unsuitable for the carbon dating process. However, the other sample yielded a result of 2,056 +/- 20 BP (Wk-48125).

Only BCBW18 AS 01 (AHIMS ID 45-5-5162) and a portion of BCBW18 AS 02 (AHIMS ID 45-5-5164) are located within the study area (Figure 7.6). BCBW18 AS 03 (AHIMS ID 45-5-5163) is not located within the current study area (MOD3) and has been assessed in the MOD4 ACHAR (Artefact Heritage 2018c).

Figure 7.1: Remnants of the *in situ* hearth, TPG1-4 (Photographed by A Darby, 24 August 2018)



Figure 7.2: Flake fragment from TP8G4, spit 1 (Photographed by A Darby, 3 September 2018)



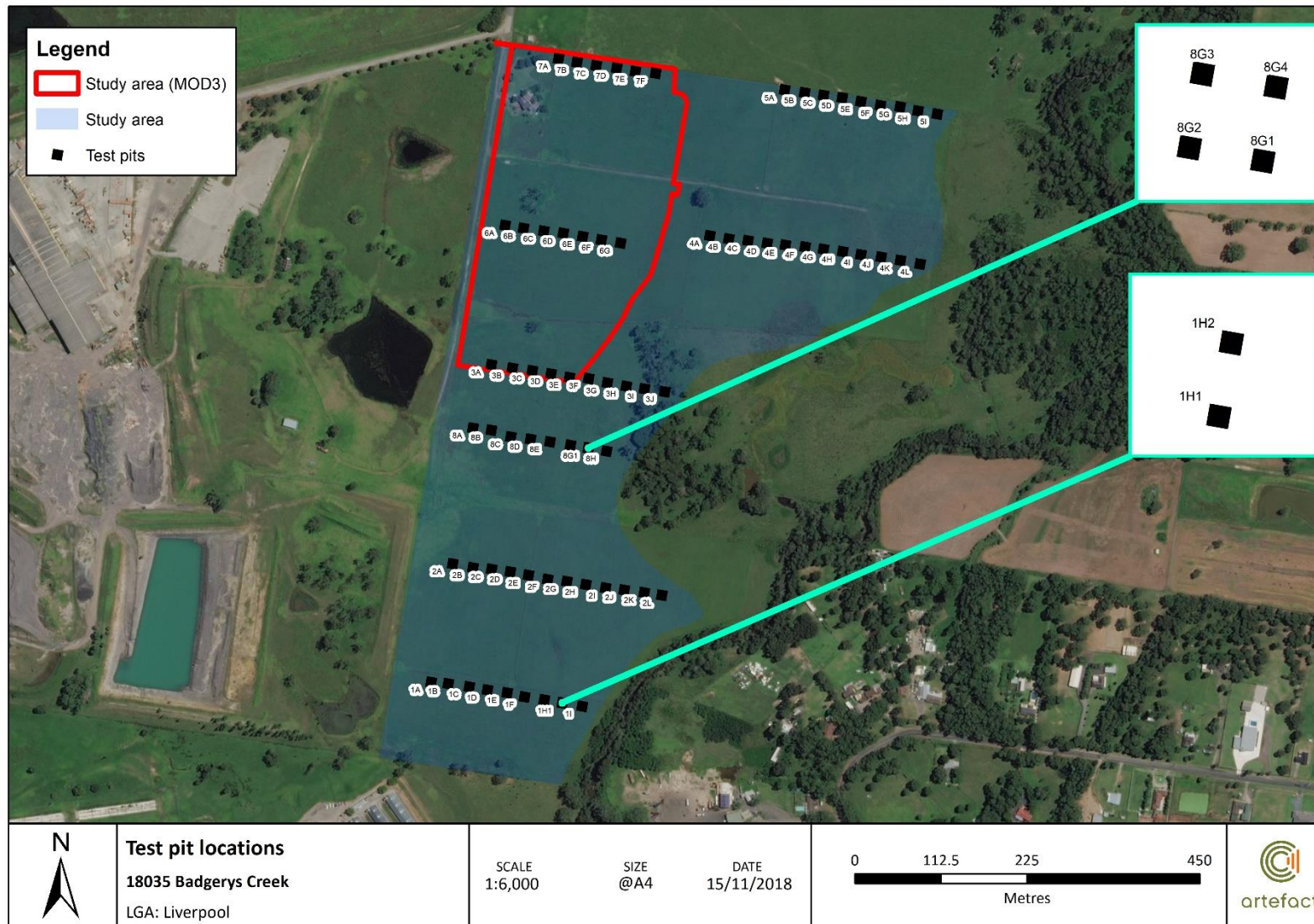
Figure 7.3: Burnt clay heat retainers from TP8G1, spit 3 (Photographed by A Darby, 3 September 2018)



Figure 7.4: View north from TP8E (Photographed by A Darby, 24 August 2018)



Figure 7.5: Location of test pits



Document Path: C:\Users\GIS\Desktop\GIS\GIS_Mapping\18035_Badgerys_Creek\MXD\181114\MOD3\pits_labels_mod3.mxd

Figure 7.6: Location of sites within extent of MOD3

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8.0 ABORIGINAL CULTURAL HERITAGE ASSESSMENT

8.1 Methodology

The cultural assessment in this report includes information collected through desktop assessment, consultation during the survey and through the consultation period for the RAP review of the ATR (Artefact Heritage 2018b). This information was collected by Ryan Taddeucci (Senior Heritage Consultant, Artefact Heritage).

8.2 Cultural landscape

The World Heritage Convention of United Nations Educational, Scientific and Cultural Organisation (UNESCO) defines a cultural landscape as one which has 'powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence, which may be insignificant or even absent' (UNESCO 1991). The relationship between Aboriginal Australians and the land is conceived in spiritual terms rather than primarily in material terms (Andrews et al 2006). Aboriginal cultural knowledge has been defined as:

Accumulated knowledge which encompasses spiritual relationships, relationships with the natural environment and the sustainable use of natural resources, and relationships between people, which are reflected in language, narratives, social organisation, values, beliefs and cultural laws and custom (Andrews et al 2006).

Aboriginal cultural knowledge was traditionally bequeathed through oral traditions from generation to generation. Within all Aboriginal communities there was a time of dislocation and upheaval associated with the arrival of colonial settlers. This widespread disruption resulted in much of the detailed knowledge and understanding of many of the elements of the cultural landscape being lost from the Aboriginal community, nonetheless many Aboriginal people maintain a strong connection to the land of their ancestors and collectively possess a wealth of knowledge passed down through the generations.

8.3 Identified Aboriginal cultural heritage values

Table 8.1 provides a summary of the Aboriginal cultural heritage values associated with the study area.

Table 8.1: Cultural heritage values identified for the study area and surroundings

Cultural heritage value	Description	Source
Archaeological evidence of Aboriginal occupation	Aboriginal people have expressed a strong view that sites and deposits associated with the archaeological record of Aboriginal occupation at Badgerys Creek were of high cultural value to Aboriginal people.	Navin Officer Heritage Consultants 2016 Justine Coplin (Darug Custodian Aboriginal Corporation)

Cultural heritage value	Description	Source
Badgerys Creek	The area is regarded as having characteristics which would have made it of significance in the traditional life of Aboriginal people of the pre-colonial past and, as such it should be retained in as natural state as possible	Navin Officer Heritage Consultants 2016
	The intangible cultural values of the landscape and its surviving biota were valued for their association with traditional culture and lore, and the sense of the place and social identity derived from them.	Justine Coplin (Darug Custodian Aboriginal Corporation)

9.0 SIGNIFICANCE ASSESSMENT

A total of two Aboriginal archaeological sites has been identified throughout a combination of pedestrian survey and subsurface testing (Figure 7.6). A significance assessment of the scientific, social, historic and aesthetic values of the study area is included below.

9.1 Significance assessment criteria

An assessment of the cultural heritage significance of an item or place is required in order to form the basis of its management. The Guide (OEH 2011: 10) provides guidelines, in accordance with the Burra Charter (Australia ICOMOS 2013) for significance assessment with assessments being required to consider the following criteria:

- Social values – does the area have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons
- Historic values – is the area important to the cultural or natural history of the local area and/or region and/or state
- Scientific values - does the area have the potential to yield information that will contribute to an understanding of the cultural and natural history of the local area and/or region and/or state
- Aesthetic values – is the area important in demonstrating aesthetic characteristics in the local area and/or region and/or state.

Scientific values should be considered in light of the following criteria:

- Research potential - does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness - how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity - is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential - does the subject area contain teaching sites or sites that might have teaching potential?

It is important to note that heritage significance is a dynamic value.

9.2 Significance assessment

9.2.1 Social and cultural value

The Consultation Requirements specifies that the social or cultural value of a place must be identified through consultation with Aboriginal people.

No specific areas of cultural significance within the study area were identified by RAP representatives during the field survey or test excavation program. However, BCBW18 AS 01 (AHIMS ID Pending) has moderate social significance as part of the wider cultural landscape and is physical evidence of the use of the area by Aboriginal people.

9.2.2 Historic value

Historic values refer to the association of the place with aspects of Aboriginal history. Historic values are not necessarily reflected in physical objects, but may be intangible and relate to memories, stories or experiences.

The study area is not known to be associated with any people, events or activities of historical importance to the Aboriginal community. The relatively small assemblage size recovered within the study area suggests that it was not the location of any significant event or activity in the pre-contact or post-contact past. At this level of assessment, the study area is considered not to be of historic significance.

9.2.3 Aesthetic value

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 (Australian ICOMOS 2000). Aesthetic significance can be closely linked to the social value of a site.

The study area has been subject to substantial modification to accommodate the construction of the residential structure in the northwest. Vegetation has been cleared to accommodate pastoral activities. As a result, the study area is considered to be of low aesthetic significance.

9.2.4 Scientific value

BCBW18 AS 01 (AHIMS ID 45-5-5162)

BCBW18 AS 01 (AHIMS ID 45-5-5162) is a low-density artefact scatter. The assemblage did not feature any especially representative or rare artefact types or raw materials. Therefore, the site is considered to be of low archaeological significance.

BCBW18 AS 02 (AHIMS ID 45-5-5164)

BCBW18 AS 02 (AHIMS ID 45-5-5164) is a low-density subsurface artefact scatter and hearth located on an intact landform. Low density artefacts scatters are common on the Cumberland Plain, however this site also features a clay heat retainer hearth, which is extremely rare within the regional context. The intact nature of the deposit presents an opportunity to use the obtained carbon dates to contribute towards a regional sequence of artefact assemblages. Due to the high research potential and rarity of the site, BCBW18 AS 02 (AHIMS ID 45-5-5164) is considered to be of high scientific significance.

Table 9.1: Summary of archaeological significance

Site name/AHIMS ID	Research value	Education potential	Representative value	Rarity	Overall scientific significance
BCBW18 AS 01 (AHIMS ID 45-5-5162)	Low	Low	Low	Low	Low
BCBW18 AS 02 (AHIMS ID 45-5-5164)	High	Moderate	High	High	High

9.3 Statement of significance

The study area contains Aboriginal sites which range from high to low scientific significance. All Aboriginal sites are considered to be of social and cultural significance to the contemporary Aboriginal community as part of an increasingly rare archaeological resource providing a tangible connection to the pre-contact Aboriginal people of the area. No specific historical or aesthetic values were identified during the assessment. Therefore, the study area is considered to be of moderate significance.

10.0 IMPACT ASSESSMENT

10.1 Proposed development

CSR are proposing various changes to the approved project. Some of these changes are located within the approved project boundary on land that was previously assessed and approved for disturbance. Other changes are located on CSR owned land, outside and immediately east of the approved project boundary, in the area defined as the 'study area' in Section 1.2. It is these changes that require further ground disturbance that was not assessed under the approved project, that need to be assessed for Aboriginal heritage values as part of the proposed MOD3. Works proposed in the study area under MOD3 include construction of the roof products manufacturing facility. The new roof products manufacturing facility and associated infrastructure would cover a total site area of 68,000 square metres, which would include:

- Approximately 5,810 square metres factory for housing the roof products manufacturing plant
- The future Monier expansion area covers approximately 2.3 ha
- Approximately 42,890 square metres concrete hardstand area for the storage of finished products
- Yard/batten storage shed footprint of approximately 1,000 square metres
- Guardhouse of approximately 75 square metres
- Storage Shed and Drivers Amenities of approximately 1,000 square metres
- Wind tunnel of approximately 100 square metres
- Three 100,000 litre rainwater tanks
- 46 light vehicle car parking spaces in a 1,174 square metres bitumen sealed carpark
- Weighbridge
- Stormwater basin
- Access road (1,821 square metres bitumen sealed).

10.2 Potential Aboriginal heritage impact

The test excavation program has provided evidence for the presence of Aboriginal objects within the study area. A summary of the impacts to the site identified during test excavation is provided in Table 10.1. This assessment is based on the impact area, which includes the areas required for construction of the proposed manufacturing facility, sediment basin, and future expansion. Figure 10.1 shows BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164) in relation to the current design plans.

Table 10.1: Impact assessment

Site name (AHIMS ID)	Type of harm	Degree of harm	Consequence of harm
BCBW18 AS 01 (AHIMS ID 45-5-5162)	Direct	Total	Total loss of value
BCBW18 AS 02 (AHIMS ID 45-5-5164)	Direct	Partial	Partial loss of value

10.2.1 Mitigation measures

The proposed works are likely to impact the majority of the geographic extent of BCBW18 AS01 (AHIMS ID Pending). Based on the identified low significance of the site, no further archaeological investigations are recommended.

A portion of BCBW18 AS 02 (AHIMS ID 45-5-5164) will also be impacted by the proposed works. However, as the portion of the site which will be impacted is of very low artefact density, it is unlikely that significant archaeological material remains within the impact area. Furthermore, CSR has indicated a preference towards conserving the hearth feature within BCBW18 AS 02 (AHIMS ID 45-5-5164) within a 10 m exclusion zone.

10.3 Ecologically Sustainable Development principles

In accordance with the guide, Ecologically Sustainable Development principles have been considered in preparation of this ACHAR, including options to avoid impacts to Aboriginal cultural heritage, assessment of unavoidable impacts, identification of mitigation and management measures, and taking account of Aboriginal community views. The principles of Ecologically Sustainable Development are detailed in the NSW *Protection of the Environment Administration Act 1991*. Ecologically Sustainable Development principles relevant to assessment of the current proposal as it relates to Aboriginal cultural heritage are considered below.

10.3.1 The integration principle

Decision-making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations (the integration principle). The proposal would comply with the integration principle in regard to Aboriginal heritage. The Aboriginal heritage values have been considered as part of the planning process for the proposed works.

10.3.2 The precautionary principle

If there are threats of serious or irreversible environmental damage, lack of full scientific confidence should not be used as a reason for postponing measures to prevent environmental degradation (the precautionary principle).

The combination of predictive models and the results of the test excavation have been used to assess the probable nature of the archaeological record within the study area. It has been assessed that there is very low potential for further archaeological material to be present within the study area.

The proposal adheres to the precautionary principle, in that test excavation has removed the majority of Aboriginal cultural material.

10.3.3 The principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (the principle of intergenerational equity).

The proposed works would adhere, as close as possible, to the principle of intergenerational equity by collating scientific and cultural information on former Aboriginal occupation of the study area through the archaeological survey and test excavation. The conservation of the hearth in BCBW18 AS 02 (AHIMS ID 45-5-5164) would ensure that Aboriginal resources are preserved for the education and benefit of future generations.

10.3.4 Conservation of biodiversity

Cultural values of biodiversity are intertwined with the lives of Aboriginal people and their use of the landscape. Biological impacts of the proposal are considered in a separate technical report.

10.3.5 Cumulative impacts

A cumulative impact is an impact on Aboriginal cultural heritage resulting from the incremental impact of the action/s of a development when added to other past, present and reasonably foreseeable future actions. There are 30 registered Aboriginal sites within an approximate 2 km buffer of the study area. Most of the registered sites are located to the west of the study area, between Badgerys Creek and South Creek. The sites impacted by the proposal have been assessed in light of their relationship to the archaeological landscape as a whole and their removal will result in a cumulative impact.

Of these 30 sites, 90 per cent are Artefact sites and, therefore, are considered common. Contour mapping indicates that these AHIMS sites are located on a similar landform and elevation to BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164). BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164) will be impacted by the proposal and have been assessed in light of their relationship to the archaeological landscape as a whole. Impact to BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164) will not result in a cumulative impact, as low-density artefact scatters are typical of the Cumberland Plain. While BCBW18 AS 02 (AHIMS ID 45-5-5164) does include a hearth, which is rare in the regional context, it will not be impacted by the proposed works.

The assessment of cumulative impacts is based on the AHIMS search data in section 5.3. The AHIMS search listed 30, valid, registered sites within 2 km of the study area. If the majority of those AHIMS sites are destroyed, then artefact sites would no longer be common to the area.

Figure 10.1: Location of sites in relation to impact area

Map removed for public exhibition

11.0 MANAGEMENT AND MITIGATION MEASURES

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved.

Where unavoidable impacts occur then measures to mitigate and manage impacts are proposed. Mitigation measures primarily concern preserving the heritage values of sites beyond the physical existence of the site. The most common methods involve detailed recording of Aboriginal objects, archaeological test and salvage excavations, artefact analysis and, where appropriate, reburial of Aboriginal objects in a location determined by the registered Aboriginal parties.

Mitigation measures vary depending on the assessment of archaeological significance of a particular Aboriginal site and are based on its research potential, rarity, representativeness and educational value. In general, the significance of a site would influence the choice of preferred conservation outcomes and appropriate mitigation measures, usually on the following basis:

- Low archaeological significance- Conservation where possible, but usually no mitigation required if impacts are unavoidable.
- Moderate archaeological significance- Conservation where possible. If conservation is not practicable, salvage excavations or similar mechanisms determined in consultation with the Aboriginal community may be necessary.
- High archaeological significance- conservation as a priority. Only if all practicable alternatives have been exhausted would impacts be considered justified. Comprehensive salvage excavations may be necessary.

Test excavations have removed most of the Aboriginal cultural heritage material within the study area. Therefore, no further archaeological investigations will be required.

11.1 Salvage excavations

BCBW18 AS 01 (AHIMS ID 45-5-5162) has been assessed as demonstrating low scientific significance due to the extremely low density. It is highly likely that the majority of the assemblage in the site area has been removed through the test excavation and therefore, salvage is not recommended.

The majority of BCBW18 AS 02 (AHIMS ID 45-5-5164) will not be impacted by the proposed works. The most significant portion of BCBW18 AS 02 (AHIMS ID 45-5-5164), is the hearth feature, which will not be impacted by the proposed work and will be protected by a 10 m buffer under the MOD4 works (Artefact Heritage 2018b and c). The impact area has been significantly tested through the MOD4 test excavation program, which found that the highest concentrations of artefacts are located nearest the creekline (Artefact Heritage 2018b). Therefore, it is unlikely that significant archaeological materials will be retrieved from salvage excavations within the MOD3 impact area. No salvage excavations are recommended for the portions of BCBW18 AS 02 (AHIMS ID 45-5-5164), impacted by the MOD3 works.

11.2 Discovery of human remains

If any human remains are discovered and/or harmed in, on or under the land, the following actions must be taken:

- Do not further move or disturb these remains
- Immediately cease all works at the particular location
- Secure the area so as to avoid further harm to the remains
- Notify the NSW police
- Notify OEH's Environment Line on 131 555 as soon as practicable and provide any available details of the remains and their location
- Not recommence any work at the particular location unless authorised in writing by OEH.

11.3 Changes to the proposed works

This ACHAR is based upon the most recent information made available to Artefact Heritage as of the date of preparation of this report. Any changes made to the proposal should be assessed by an archaeologist in consultation with the registered Aboriginal stakeholder groups. Any changes that may impact on Aboriginal sites not assessed during the current study may warrant further investigation and result in changes to the recommended management and mitigation measures.

11.4 Management of Aboriginal objects

Consultation with the RAPs as part of this assessment has indicated that appropriate long-term management strategy for the artefacts retrieved from the test excavation is that, all retrieved material be reburied on site at a location that has been reserved for no future impact. Further information regarding the consultation process and the location of the reburial is included in the ACHARs (Artefact Heritage 2018b and c).

CSR has amended the site development plans to conserve the entire extent of the hearth feature within BCBW18 AS 02 (AHIMS ID 45-5-5164) with a 10 m permanently fenced buffer. CSR have proposed that all artefacts retrieved during survey and subsurface test excavation for both MOD3 and MOD4 be reburied within the hearth exclusion zone.

11.5 Ongoing consultation with Aboriginal stakeholder groups

Consultation with the registered Aboriginal stakeholders would continue throughout the life of the project, as necessary. Ongoing consultation with registered Aboriginal stakeholders will take place throughout all facets of the project, including reburial of retrieved artefacts and in the event of any unexpected Aboriginal objects being identified during works. To keep consultation current, the registered Aboriginal parties should be sent an update on the project every six months until CSR receives approval of MOD3.

12.0 RECOMMENDATIONS

The following recommendations are based on consideration of:

- Statutory requirements under the NPW Act
- The results of the ACHAR and ATR
- The interests of the Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- Surface site, BCBW18 IF 01 (AHIMS ID 45-5-5165), identified during the survey, is not located within the study area and will not be impacted by the proposed works
- Only two of the sites identified during the test excavation programme, BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164), are located within the current study area
- The significance assessment found that BCBW18 AS 01 (AHIMS ID 45-5-5162) is of low scientific significance while BCBW18 AS 02 (AHIMS ID 45-5-5164) is high scientific significance
- The impact assessment found that impacts to BCBW18 AS 02 (AHIMS ID 45-5-5164) will be very minor and will not impact major features of the site
- The proposed development will have a total impact, with total loss of value on BCBW18 AS 01 (AHIMS ID 45-5-5162).

The following recommendations are made:

- Following completion of archaeological investigation, analysis and reporting, the assemblage retrieved from the test excavation should be reburied on site. Reburial should occur within the conservation area of BCBW18 AS 02 (AHIMS ID 45-5-5164). Reburial should be undertaken in accordance with consultation with the RAPs
- To keep consultation current, the registered Aboriginal parties should be sent an update on the project every six months until CSR receives approval of MOD3.

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14.0 APPENDICES

APPENDIX 1 – CURRENT CONSULTATION LOG

Removed for public exhibition

APPENDIX 2 – FULL CONSULTATION RECORDS

Removed for public exhibition

APPENDIX 3 – ARCHAEOLOGICAL TECHNICAL REPORT

CSR Advanced Manufacturing Hub

Archaeological Technical Report

Report to CSR Building Products
Limited

Liverpool Local Government Area

February 2019



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5	7 November 2018	Mark Ryan and Neville Hattingh	Mark Ryan and Neville Hattingh	13 November 2018	Client review	Fifth draft
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EXECUTIVE SUMMARY

In October 2016, CSR Building Products Limited (CSR) acquired Boral Bricks Pty Limited (Boral) brick business along the eastern seaboard of Australia and with it, the Badgerys Creek Brick Making Facility Site ('the Site'). Project Approval (PA10_0014) was given for the existing site (PA10-0014) under section 75W of the *Environmental Planning and Assessment Act 1979* and previous archaeological investigations were conducted by AECOM (2010) as part of that approval.

CSR now proposes to expand the site with the extension of the brick making facility and construction of a roof products manufacturing facility (Modification [MOD] 3) and establishment of a grid connected solar farm (Modification [MOD] 4).

To satisfy the heritage requirements of PA10_0014, Artefact Heritage Services Pty Ltd (Artefact Heritage) was engaged by Element Environment (Element), on behalf of CSR Building Products Limited (CSR), to undertake a desktop assessment and site inspection of a large area (the investigation area), as depicted in Figure 1.2, which encompasses the study area. The assessment found that areas of Aboriginal archaeological potential are located within the proposed impact area. Subsequently, Artefact Heritage was engaged by Element, on behalf of CSR, to prepare a methodology (Artefact Heritage 2018a) for an archaeological survey and test excavation within the study area.

The results of the due diligence assessment are incorporated into this Archaeological Technical Report (ATR). This document presents the methodology, results, and analysis of the archaeological survey and archaeological test excavation program that was undertaken within the study area. This assessment has been completed in support of an Environmental Assessment for the study area.

The objectives of the survey program were to:

- Identify and report Aboriginal sites within the study area and to assess the archaeological significance of any sites recorded.
- To liaise with RAP representatives regarding the proposed works and the archaeological potential of the study area
- To liaise with RAP representatives regarding the effectiveness of the placement of the proposed test excavation transects, as outlined in the methodology (Artefact Heritage 2018a).

The objectives of the test excavation program were to:

- Adequately identify the nature of any subsurface archaeological deposits, including preliminary comparisons with results of other subsurface archaeological investigations in the area.
- Assess the scientific significance of any archaeological deposits identified during the excavation, following the assessment of test excavation results.
- Provide an opportunity for registered Aboriginal stakeholders to comment on the Aboriginal cultural heritage values of the study area
- Provide the proponent with recommendations on opportunities to avoid impact and future requirements for further archaeological investigation where required.

It was found that:

- Three new subsurface sites (BCBW18 AS 01 (AHIMS ID 45-5-5162), BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163)) were identified during subsurface testing:
 - BCBW18 AS 01 (AHIMS ID 45-5-5162) is a low-density artefact scatter and was assessed as being of low scientific significance
 - BCBW18 AS 02 (AHIMS ID 45-5-5164) is a low-density artefact scatter with a heat retainer hearth feature. This site type is considered rare and of high research potential.
 - BCBW18 AS 03 (AHIMS ID 45-5-5163) is a high-density artefact scatter that is considered to be of low scientific significance.
- One newly recorded surface site (BCBW18 IF 01 (AHIMS ID 45-5-5165)) was identified during the survey.

It is therefore recommended that:

- An Aboriginal Cultural Heritage Assessment Report (ACHAR) must be prepared in compliance with the Aboriginal heritage requirements of PA10_0014.
- Collection of surface artefacts across BCBW18 IF 01 (AHIMS ID 45-5-5165) must be conducted prior to the commencement of the proposed works
- A conservation area with a 10 m buffer be placed around the hearth feature portion of BCBW18 AS 02 (AHIMS ID 45-5-5164)
- Long term arrangements for the management of excavated artefacts, involve reburial within the location specified in the ACHARs for MOD3 and MOD4 (Artefact Heritage 2018b and 2018c).

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ABBREVIATIONS

AHC	Australian Heritage Council
AHIP	Aboriginal Heritage Impact Permit
AHIMS	Aboriginal Heritage Information Systems
AHMP	Aboriginal Heritage Management Plan
ALR Act	<i>Aboriginal Land Rights Act 1983</i>
AMS	Accelerator Mass Spectrometry
Artefact Heritage	Artefact Heritage Services Pty Ltd
ASR	Aboriginal Survey Report
ATR	Archaeological Technical Report
ATSIHP Act	<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i>
BIF	banded iron formation
Boral	Boral Bricks Pty Limited
ACHAR	Aboriginal Cultural Heritage Assessment Report
CHL	Commonwealth Heritage List
Code of Practice	Code of Practice for Archaeological investigation of Aboriginal Objects in New South Wales
Consultation Requirements	Aboriginal cultural heritage consultation requirements for proponents 2010
CSR	CSR Building Products Limited
DA	Development Application
DECCW	Department of Environment, Climate Change & Water
DNC	Didge Ngunawal Clan
DLO	Darug Land Observations
Element	Element Environment
EPBC Act	<i>Environmental Protection and Biodiversity Act 1999</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
gm	grams
GML	Geometric Microlith
GPS	Global Positioning System

Guide	Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW
ha	hectares
km	kilometre
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Areas
m	metres
mm	millimetres
MNI	minimum number of individuals
MOD	Modification
MPC	Multiple platform core
NHL	National Heritage List
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NTSCorp	Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory
OEH	Office of Environment and Heritage
PA	Project Approval
PAD	potential archaeological deposit
Repeal Act	<i>Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011</i>
RAP	registered Aboriginal party
RNE	Register of the National Estate
SEARs	Secretary's Environmental Assessment Requirements
the Site	Badgerys Creek Brick Making Facility Site
SU	Survey unit
TP	Test pit

1.0 INTRODUCTION

1.1 Project description

In October 2016, CSR Building Products Limited (CSR) acquired Boral Bricks Pty Limited (Boral) brick business along the eastern seaboard of Australia and with it, the Badgerys Creek Brick Making Facility Site ('the Site'), which is strategically placed in the Western Sydney Priority Growth Area and borders on the proposed Western Sydney Airport precinct. Project Approval (PA10_0014) was given for the existing site under section 75W of the *Environmental Planning and Assessment Act 1979* and previous archaeological investigations were conducted by AECOM (2010) as part of that approval.

CSR now proposes the construction of a roof products manufacturing facility (Modification [MOD] 3) and establishment of a grid connected solar farm (Modification [MOD] 4). The project is known as the CSR Advanced Manufacturing Hub.

MOD3 will involve:

- Advanced Manufacturing - Brick Production
 - Removal of most of the existing brick manufacturing equipment and replacement with new brick manufacturing equipment in the existing brick making facility
 - Increase in the building footprint of the existing brick making facility
 - Increase in the building footprint of the existing administration building
 - A NATA (National Association of Testing Authorities) Accredited Advanced Testing Laboratory
 - Extension to the existing visitor's carpark
 - An innovation centre
 - A weighbridge
 - Factory staff parking
 - A new access road to the factory staff parking area and for bulk material deliveries and dispatch
 - New rainwater tanks
 - A battery store
- Advanced Manufacturing - Roof Products Production
 - Construction and operation of a roof products manufacturing facility on CSR owned land outside the approved project boundary, immediately east of Pit 4
 - Modification to the approved project boundary to include the proposed roof products manufacturing facility, located on the adjacent property
 - The processing of sandstone (overburden material not used in brick production) for use in the manufacture of roof products on-site
- General
 - Re-commence operations at the site as approved in the Project Approval (PA10_0014), and expel the current mothballed status of the site
 - Amendment to the extent of Pit 5 to include a 200 m buffer zone to neighbouring residential properties required under the *Mining Act 1992*

- An increase in the importation of raw materials from off-site for use in both the brick making and roof products manufacturing facilities
- Modifications to the approved noise bunds.

MOD4 will involve:

- The dewatering of Pit 1
- Continued extraction of clay material in Pit 1 to a depth of 35 m
- The importation of Virgin Excavated Natural Material (VENM) to backfill Pit 1 and potentially other pits, to rehabilitate the site and facilitate future development
- The establishment of a grid connected solar farm. This will allow energy security through a more diverse energy mix, initiate a clean renewable energy source on-site, reduce the greenhouse gas emissions that contribute to global warming and improve the land utilisation on the eastern flank, outside of the approved project boundary.

1.2 Study area

This report focuses on land at 235 Martin Road in the suburb of Badgerys Creek approximately 41 kilometres (km) west of the Sydney Central Business District (Figure 1.1). The land is adjacent to the existing Badgerys Creek Quarry and Brickmaking Facility which is currently nonoperational.

The study area includes portions of:

- Lot 1 DP981161
- Lot 54 DP3050
- Lot 55 DP3050
- Lot 56 DP3050
- Lot 57 DP3050
- Lot 58 DP3050
- Lot 59 DP3050

The study area is located within the Liverpool Local Government Area (LGA) and within the boundaries of the Gandangara Local Aboriginal Land Council (LALC). The study area is within the Parish of Bringelly and County of Cumberland.

The study area measures 940 metres (m) north-south by 560 m east-west and has a total area of approximately 37.4 hectares (ha). The study area is bound by Inghams Chicken to the south, South Creek to the east, Australian Native Landscapes and rural residential properties to the north and the existing Badgerys Creek Quarry and Brickmaking Facility to the west.

1.3 Background to this assessment

Artefact Heritage Services Pty Ltd (Artefact Heritage) was engaged by Element Environment (Element), on behalf of CSR, to undertake a desktop assessment and site inspection of a large area (the investigation area), as depicted in Figure 1.2, which encompasses the study area. The assessment found that areas of Aboriginal archaeological potential are located within the proposed

impact area. Subsequently, Artefact Heritage prepared a methodology (Artefact Heritage 2018a) for an archaeological survey and test excavation within the study area.

The results of the due diligence assessment are incorporated into this Archaeological Technical Report (ATR). This document presents the methodology, results, and analysis of the archaeological survey and archaeological test excavation program that was undertaken within the study area. This assessment has been completed in support of an Environmental Assessment for the study area.

The objectives of the survey program were to:

- Cover a representative sample of the study area that will potentially be impacted by the proposed works
- Record any Aboriginal objects observed during the survey
- to liaise with RAP representatives regarding the proposed works and the archaeological potential of the study area
- To verify test excavation, transect locations with the RAP representatives, as outlined in the methodology (Artefact Heritage 2018a).

The objects of the test excavation program were to:

- Adequately identify the nature of any subsurface archaeological deposits, including preliminary comparisons with results of other subsurface archaeological investigations in the area.
- Assess the scientific significance of any archaeological deposits identified during the excavation, following the assessment of test excavation results.
- Provide an opportunity for registered Aboriginal stakeholders to comment on the Aboriginal cultural heritage values of the study area
- Provide the proponent with recommendations on opportunities to avoid impact and future requirements for further archaeological investigation where required.

1.4 Project approval framework

To realise the full potential of the site and allow it to meet the strategic needs of the brick, roof products and other building product manufacturing businesses, CSR requires modifications to the existing Project Approval (PA10_0014). CSR are proposing three separate modifications (MOD 2, MOD3 and MOD4) to their Project Approval (PA10_0014), under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). MOD 2 has already received Project Approval and requires no further archaeological assessment.

Desktop assessment of the eastern portion proposed under MOD3 and MOD4, identified areas of Aboriginal archaeological potential. Secretary's Environmental Assessment Requirements (SEARs) have been issued for MOD3 (MP10_0014 MOD3).

The SEARs and where they are addressed in this report are summarised in Table 1.1.

Table 1.1: Secretary's Environmental Assessment requirements

SEAR	Section
The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the development and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011) and consultation with OEH regional officers.	This will be addressed in the ACHARs (Artefact Heritage 2018b and c)
Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.	Section 3.0 Aboriginal stakeholder consultation
Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.	Section 10.0 Impact assessment Section 11.0 Management and mitigation

Separate SEARs have not been issued for MOD4, however, the Department of Planning and Environment commented that cumulative impacts within and between MOD3 and MOD4 be assessed.

As this project is being assessed under 75W of the *Environmental Planning & Assessment Act 1979* permits issued under the *National Parks & Wildlife Act 1974* (NPW Act), principally an Aboriginal Heritage Impact Permit (AHIP) under Section 90 of the NPW Act will not be required.

The archaeological assessment will be conducted in accordance with the following approvals and guidelines:

- Secretary's Environmental Assessment Requirements (SEARs) (MP10_0014 MOD3) issued 15 December 2017.
- Department of Planning & Environment comments issued 17 January 2018.
- Aboriginal cultural heritage consultation requirements for proponents 2010 (Consultation Requirements) (Department of Environment, Climate Change & Water [DECCW] 2010a).
- The guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (the Guide) (Office of Environment & Heritage [OEH] 2011).

The test excavations were generally conducted in accordance with:

- Code of Practice for Archaeological Investigation of Aboriginal objects in New South Wales (Code of Practice) (DECCW 2010b).

1.5 Report authorship

This report was prepared by Ryan Taddeucci (Senior Heritage Consultant, Artefact Heritage) and Anna Darby (Graduate Heritage Consultant, Artefact Heritage), with management input and review from Vanessa Edmonds (Principal, Artefact Heritage).

Vanessa has graduate and post graduate qualifications in Aboriginal archaeology and palaeoanthropology and over 30 years of experience in cultural heritage management throughout Australia. Vanessa is a Full Member of the Australian Association of Consulting Archaeologists Inc.

Ryan has a Bachelor of Arts with Honours in Archaeology and a Master of Museum Studies. Ryan has six years archaeological consulting experience in NSW, Queensland and Western Australia.

Anna has a Bachelor of Science with Honours in Archaeology. In the past three years. Anna has been engaged in a number of archaeological excavations in the greater Sydney area and outback NSW.

Table 1.2 outlines the full list of contributors and their role in the completion of this report.

Table 1.2: List of contributors

Contributor	Task	Qualification	Position	Experience
Vanessa Edmonds	• Management input and technical review of this document • Direction of test excavation	• Bachelor of Arts • Master of Letters	Principal, Artefact Heritage	30+ years
Anna Darby	• Preparation of this report (Chapter 1-6)	• Bachelor of Science (Hons)	Heritage Consultant, Artefact Heritage	3 years
Ryan Taddeucci	• Preparation of this report (Chapter 7-12) • Supervision of field survey • Artefact cataloguing and analysis	• Bachelor of Arts (Hons) • Master of Museum Studies	Senior Heritage Consultant, Artefact Heritage	6 years
Julia McLachlan	• Supervision of test excavation	• Bachelor of Arts (Hons)	Heritage Consultant, Artefact Heritage	3 years
Jennifer Norfolk	• Production of section drawings	• Bachelor of Marine Science • Master of Science	Heritage Consultant, Artefact Heritage	4 years

1.6 Consultation

Consultation was conducted in accordance with the Office of Environment and Heritage (OEH) Consultation Requirements. The consultation process resulted in 19 registrations of interest from Aboriginal persons or organisations. Comprehensive consultation information is provided in the associated Aboriginal Cultural Heritage Assessment Reports (ACHAR) for this project (Artefact Heritage 2018b and c).

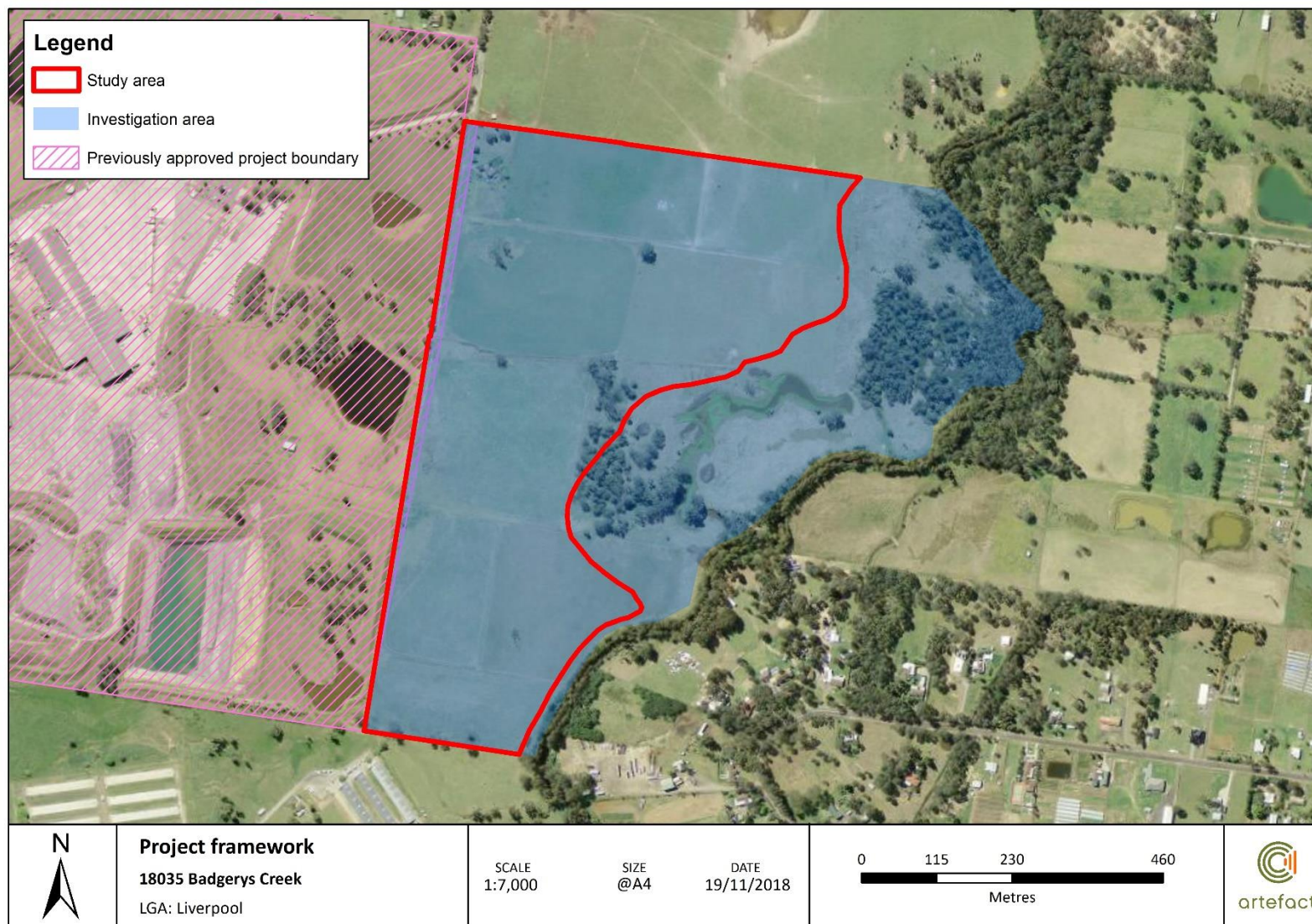
Section 3.0 provides a full list of those registered Aboriginal parties (RAPs) that participated in the test excavation program.

Figure 1.1: Location of the study area



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Figure 1.2: Project framework



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2.0 STATUTORY REQUIREMENTS

2.1 State legislation

2.1.1 *National Parks and Wildlife Act 1974*

The NPW Act, administered by the OEH provides statutory protection for all Aboriginal 'objects' (consisting of any material evidence of the Aboriginal occupation of NSW) under Section 90 of the Act, and for 'Aboriginal Places' (areas of cultural significance to the Aboriginal community) under Section 84.

The protection provided to Aboriginal objects applies irrespective of the level of their significance or issues of land tenure. However, areas are only gazetted as Aboriginal Places if the Minister is satisfied that sufficient evidence exists to demonstrate that the location was and/or is, of special significance to Aboriginal culture.

The NPW Act was amended in 2010 and as a result the legislative structure for seeking permission to impact on heritage items has changed. A Section 90 permit is now the only Aboriginal Heritage Impact Permit (AHIP) available and is granted by the OEH. Various factors are considered by OEH in the AHIP application process, such as site significance, Aboriginal consultation requirements, ESD principles, project justification and consideration of alternatives. The penalties and fines for damaging or defacing an Aboriginal object have also increased.

As this project is considered a State Significant Development (refer to section 2.1.4) permits issued under the NPW Act are not required.

2.1.2 *Native Title Act 1994*

The *Native Title Act 1994* was introduced to work in conjunction with the Commonwealth *Native Title Act 1993*. Native Title claims, registers and Indigenous Land Use Agreements are administered under the Act.

One registered Native Title claim has been identified during the consultation process for the Liverpool LGA (Table 2.1). The current study area is not located within the boundaries of the Native Title Claim (NC 2017/003).

Table 2.1: Schedule of Native Title Determination applications

Tribunal ID	Name	Date lodged	Registration status
NC2017/003	South Coast People	3 August 2017	Accepted for registration 31 January 2018

2.1.3 *Aboriginal Lands Right Act 1983*

The *Aboriginal Land Rights Act 1983* (ALR Act) established Aboriginal Land Councils (at State and Local levels). These bodies have a statutory obligation under the ALR Act to:

- (a) take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law, and
- (b) promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area.

The study area is within the boundary of the Gandangara LALC.

The *ALR Act* also provides for a LALC to claim certain unused Crown Land within its boundary. The study area is held under freehold title and therefore cannot be subject to a claim under *ALR Act*.

2.1.4 *Environmental Planning & Assessment Act 1979*

Part 3A was repealed by the *NSW Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act), which commenced on 1 October 2011. Under the Part 3A Repeal Act, projects deemed to be 'transitional Part 3A projects will continue to be subject to Part 3A of the EP&A Act (as in force immediately before the repeal and as modified by the Part 3A Repeal Act). Transitional Part 3A projects include certain projects that were the subject of an existing approval under Part 3A.

As the site has a Project Approval that was granted under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act), it is a transitional Part 3A project. The provisions of Part 3A (as in force immediately prior to its repeal) continue to be applicable to the Project. Therefore, the project is proposed to be assessed under s75W of the repealed Part 3A.

The transitional arrangements in the EP&A Act were repealed by the Environmental Planning and Assessment Bill 2017. This moved transitional Part 3A projects to the current State significant development and State significant infrastructure pathways, and applications to modify such projects will no longer be made under Section 75W. This modification application has been made within the transitional timeframe and is not affected by the above arrangements.

However, the test excavation methodology was guided by the Code of Practice. Previous archaeological test excavations, within the wider region, were completed under the Code of Practice. Therefore, it is an applicable framework to use for comparative analysis of archaeological findings within the current test excavation.

2.2 Commonwealth legislation

2.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment and Heritage Legislation Amendment Act (No.1) 2003* amends the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to include 'national heritage' as a matter of National Environmental Significance and protects listed places to the fullest extent under the Constitution. It also establishes the National Heritage List (NHL) and the Commonwealth Heritage List (CHL).

The *Australian Heritage Council Act 2003* (AHC Act) establishes a new heritage advisory body – the Australian Heritage Council (AHC), to the Minister for the Environment and Heritage and retains the Register of the National Estate (RNE).

The *Australian Heritage Council (Consequential and Transitional Provisions) Act 2003* repeals the *Australian Heritage Commission Act 1975*, amends various Acts as a consequence of this repeal and allows the transition to the current heritage system.

Together the above three Acts provide protection for Australia's natural, Indigenous and non-Indigenous heritage. The new features include:

- A new NHL of places of national heritage significance.
- A new CHL of heritage places owned or managed by the Commonwealth.

- The creation of the AHC, an independent expert body to advise the Minister on the listing and protection of heritage places.
- Continued management of the Register of the National Estate (RNE).

National Heritage List

The NHL is a list of places with outstanding heritage value to our nation, including places overseas. So important are the heritage values of these places that they are protected under the EPBC Act. This means that a person cannot take an action that has, will have, or is likely to have, a significant impact on the national heritage values of a national heritage place without the approval of the Australian Government Minister for the Environment and Heritage. It is a criminal offence not to comply with this law and there are significant penalties. There are no places listed on the NHL within the study area.

Commonwealth Heritage List

The CHL is a list of places managed or owned by the Australian Government. There are no places listed on the CHL within the study area.

Register of the National Estate

The RNE is an evolving record of Australia's natural, cultural and Aboriginal heritage places that are worth keeping for the future. The AHC compiles and maintains the RNE under the *Australian Heritage Council Act 2003*. Places on the RNE that are in Commonwealth areas, or subject to actions by the Australian Government, are protected under the EPBC Act by the same provisions that protect Commonwealth heritage places (see above).

Following amendments to the *Australian Heritage Council Act 2003*, the RNE was frozen on 19 February 2007, meaning no new places can be added, or removed. From 2012 all references to the RNE were removed from the EPBC Act and the AHC Act. The RNE is now maintained on a non-statutory basis as a publicly available archive. No Aboriginal sites were listed for Badgerys Creek on the RNE.

2.2.2 Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (ATSHP Act), deals with Aboriginal cultural property (intangible heritage) in a wider sense. Such intangible heritage includes any places, objects and folklore that 'are of particular significance to Aboriginals in accordance with Aboriginal tradition'. These values are not currently protected under the NPW Act.

There is no cut-off date and the ATSHIP Act may apply to contemporary Aboriginal cultural property as well as ancient sites. The ATSHIP Act takes precedence over state cultural heritage legislation where there is conflict. The Commonwealth Minister who is responsible for administering the ATSHIP Act can make declarations to protect these areas and objects from specific threats of injury or desecration. The responsible Minister may make a declaration under Section 10 of the Commonwealth Act in situations where state or territory laws do not provide adequate protection of intangible heritage.

Where an Aboriginal individual or organisation is concerned that intangible values within the proposal are not being adequately protected, they can apply to the Minister for a declaration over a place. No intangible places were identified during previous heritage assessments.

3.0 ABORIGINAL STAKEHOLDER CONSULTATION

Consultation for this ATR has been conducted by Artefact Heritage in line with the Consultation Requirements (DECCW 2010b). The full consultation details and records for the study area are provided in the ACHARs (Artefact Heritage 2018b and c).

3.1 Registration of Aboriginal parties

In accordance with step 4.1.2 of the Consultation Requirements, Artefact Heritage corresponded with the following organisations by letter and email on the 6 June 2018 requesting the details of Aboriginal people who may hold cultural knowledge relevant to determining the Aboriginal significance of Aboriginal objects and/or places within the local area:

- Greater Sydney Local Land Services
- Liverpool City Council
- Native Title Service Corporation
- Gandangara LALC
- Office of Environment and Heritage – Parramatta Office
- National Native Title Tribunal
- Office of the Registrar, *Aboriginal Land Rights Act 1983*

In addition to this, and in accordance with Step 4.1.3 of the Consultation Requirements, an advertisement was placed in Liverpool City Champion Advertisement on the 13 June 2018, inviting the participation of Aboriginal people who may hold cultural knowledge relevant to determining the Aboriginal significance of Aboriginal objects and/or places within the local area.

In accordance with Step 4.1.3 of the Consultation Requirements, on the 21 June 2018, emails or letters were sent to all Aboriginal persons or organisations identified through advertisement or through responses from agencies contacted as part of Step 4.1.2. In accordance with Step 4.2 the letters provided details about the location and nature of the proposal, as well as an invitation to register as an Aboriginal stakeholder.

Additional consultation details have been removed for public exhibition

4.0 ENVIRONMENTAL BACKGROUND

4.1 Geomorphology and geology

The study area is located within the central portion of the Cumberland Plain, a large low-lying and gently undulating landform in the Sydney Basin. The formation of the basin began between 300 to 250 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow (Pickett and Alder 1997). The oldest, Permian layers of the Sydney Basin consist of marine, alluvial and deltaic deposits that include shales and mudstone overlain by Coal Measures.

The geology of the study area is characterised by the Triassic Wianamatta group which consists of black to dark grey shale and laminate on top of medium to coarse-grained quartz sandstone, very minor shale and laminate. The landforms are a result of the weathering of local bedrock. The underlying geology is the Hawkesbury sandstone that was laid down as river sediments and is described as medium to coarse grained quartz sandstone, this is overlain by the finer sedimentary material caps of Ashfield Shale. Hawkesbury Sandstone weathers to form thin, sandy soils with low water-retaining qualities.

4.2 Soils

The western portion of the study area is comprised of the Blacktown Residual Soil Landscape which has shallow to moderately deep, hard setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines (Figure 4.1).

The eastern portion of the study area comprises the South Creek Soil Landscape, an alluvial environment characterised by floodplains, valley flats and drainage depressions. The soils are often very deep, layered sediments over bedrock or relic soils. Plastic clays or structured loams occur in and immediately adjacent to drainage lines. Red and yellow podzolic soils are most common on terraces with small areas of structured grey clays, leached clay and yellow solodic soils (Bannerman and Hazelton 1990).

4.3 Hydrology and landforms

The study area is located 900 m east of Badgerys Creek, a second order stream. South Creek is approximately 250 m to the east, with the south of the study area bordered by a small ephemeral drainage channel associated with South Creek. Portions of the study area are located above the probable maximum flood level, with the eastern part of the study area within the probable maximum flood level and the medium risk flood zone (Figure 4.2).

The study area incorporates two landform elements including a hill crest, and slope. The north western portion is the highest location within the study area, it forms part of the low undulating hill crests between the two major water courses. From this point, the study area generally slopes in a south easterly direction towards South Creek. The slope is gradual with the lowest area located at the south eastern portion of the study area. There is a gradual incline towards the creek line, indicating a previous lower slope formation.

4.4 Vegetation

The study area would have once been covered by Alluvial Woodland. This community was characterised by a canopy, composed of *Eucalyptus amplifolia* (Cabbage Gum) and *E. moluccana* (Grey Box). Beneath the canopy, the ground cover was dominated by a mix of exotic and native

species including *Microlaena stipoides* (Weeping Grass), *Sida rhombifolia** (Paddy's Lucerne), *Einadia trigonos* and *Paspalum dilatatum** (Paspalum). Within the study area, Alluvial Woodland occurs in a landscape modified by agricultural practices (i.e. grazing) and is in moderate condition. This condition class also occurs within the centre of the study area and south eastern margins. There is also a 'high' condition class in the north eastern margin along South Creek. This condition is relatively intact and forms the largest patch of vegetation within the study area. A total of 8.75 ha, comprising 17.5 per cent, of Alluvial Woodland occurs in the study area.

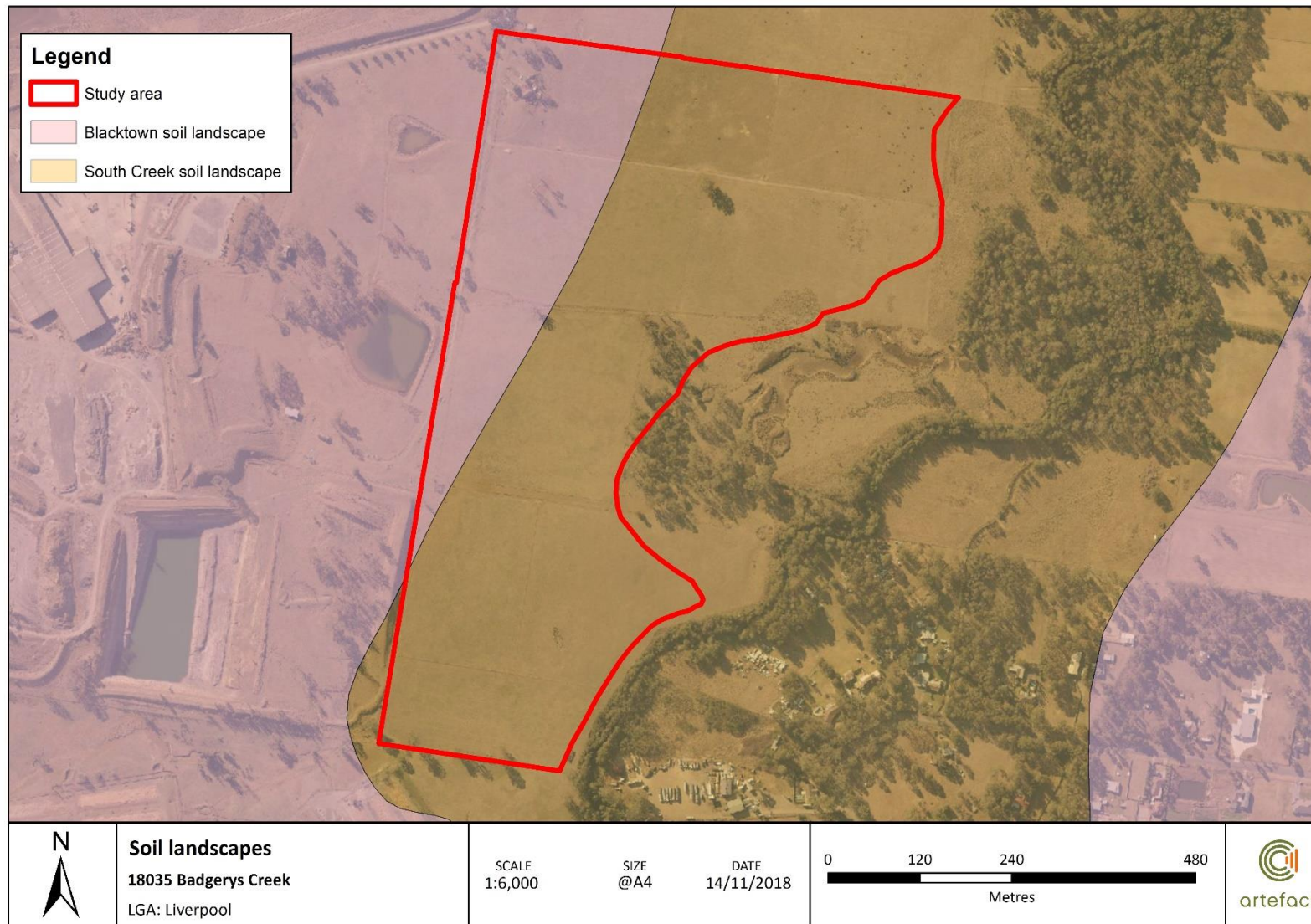
4.5 Land use

Exploration to the west of Sydney Cove began soon after initial colonisation, as it was found that the sandstone soils of coastal Sydney were unsuited for cultivation (Austral 2011). The Cumberland Plain, with its rich alluvial soils, offered better conditions for farming and land was cleared in the Cumberland Plain as early as the 1790s (Austral 2011).

The study area is located within a zone that has historically been characterised as rural in nature. The dominant activities within the vicinity from the nineteenth century onwards have been a mix of agricultural pursuits, including pastoralism, wheat and maize cropping and dairy farming. Ploughing works, associated with pastoralism, would typically impact the soil profile to a depth of approximately 300 mm.

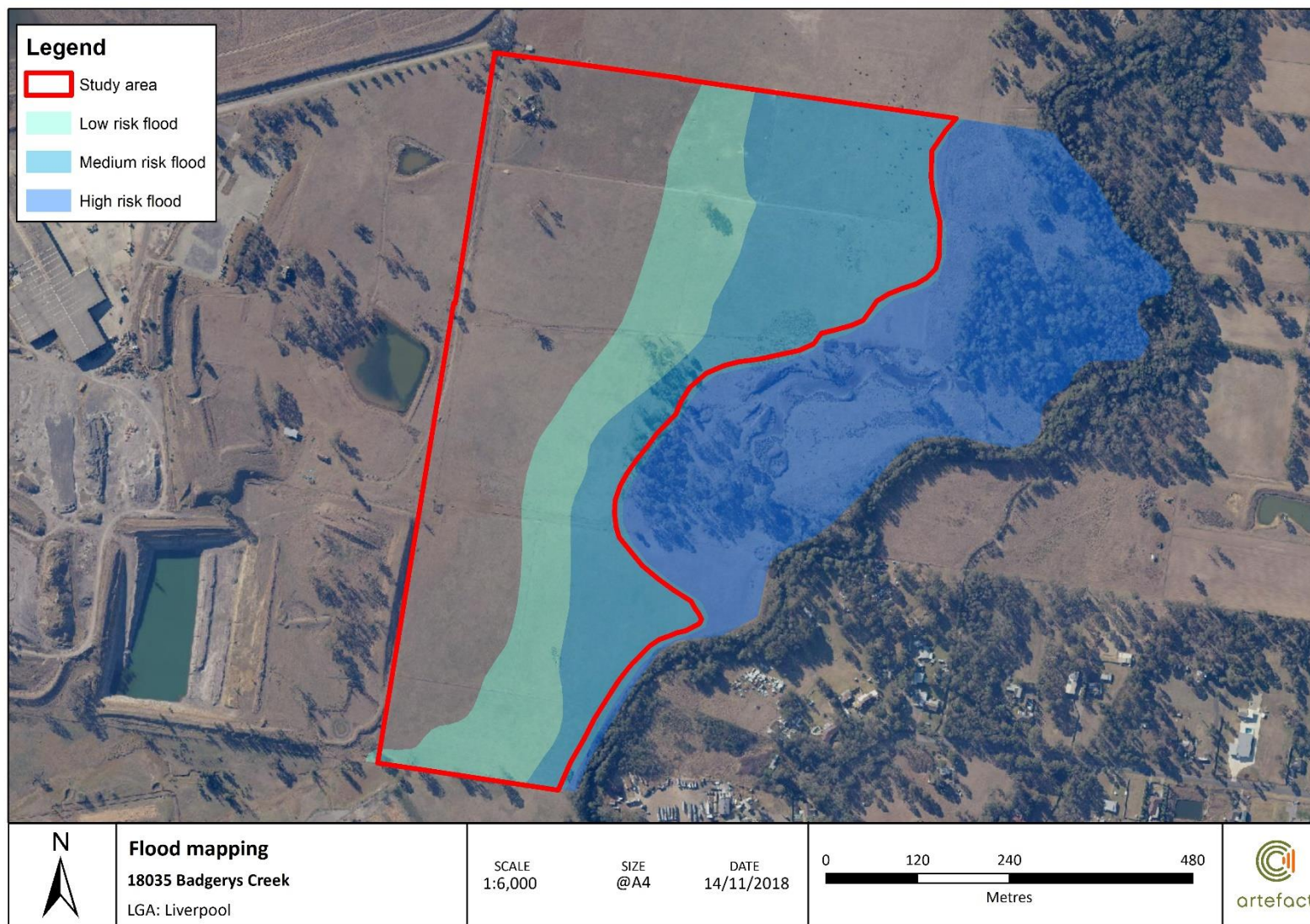
The north west section of the study area contains a brick residence with introduced species of willow and pine trees. Earthworks have occurred as the land has been built up and landscaping has occurred. The study area is generally cleared of native vegetation except for the remnant vegetation around the house and a small cropping of mature native gums in the centre of the study area. While there is evidence of extensive grazing practices the surface does not appear to have been ploughed but due to the lack of structural integrity provided by vegetation, the erosional prone soil of the slopes would have been affected by sheet wash and animal trampling over time.

Figure 4.1: Soil landscapes within the study area



Document Path: C:\Users\GIS\Desktop\GIS\GIS_Mapping\18035_Badgerys_Creek\MXD\181114\Soils.mxd

Figure 4.2: Flood mapping, study area outlined in red (Source: CSR)



Document Path: C:\Users\GIS\Desktop\GIS\GIS_Mapping\18035_Badgerys_Creek\MXD\181114\MOD4_flooding.mxd

5.0 ARCHAEOLOGICAL BACKGROUND

5.1 Ethnohistorical context

The study area is located near the boundaries of two Aboriginal language groups, Dharawal and Gundungurra (Tindale 1974). The Dharawal are placed in the area from the south side of Botany Bay and Port Hacking to north of the Shoalhaven River and inland to Campbelltown, Camden and Bargo. They are thought to have ranged further north into the Liverpool region, the boundaries defined today can only be used as indicative (Attenbrow 2010). The Gundungurra are described as occupying the southern rim of the Cumberland Plain, west of the Georges River, including a boundary area with the Dharawal in the Camden and Bargo locality.

As traditional territorial boundaries were fluid it is uncertain which group(s) occupied the study area (Peterson 1976). The current state of knowledge about the fluidity of tribal boundaries is based partly on studies of contemporary Aboriginal communities in northern and central Australia who were less affected by European colonisation, and partly on observations of tribal groups to the west and south-west of Sydney who had been severely affected by the disconnection from their lands cause by European colonisation (Thomson 1985).

There are also ethno-historical observations made by early explorers and settlers in the region, who first came into contact with the Aboriginal people of these areas in the 18th and 19th century. Wilson, during a 1798 expedition through the region, observed that people were wearing large skin cloaks. When James Backhouse travelled to the region in 1836, he noted that skin cloaks were still worn, but some European clothes and blankets were also used, and that ceremonies such as tooth avulsion were also practised (Koettig 1981).

In the early 1800s, relationships between the Aboriginal people of the area and the European settlers were in general amicable. Grace Karskens notes several examples of close relationships between land owners and local Aboriginal people, including John Kennedy who gave the Dharawal protection on Teston Farm at Appin in later, not so peaceful, times (Karskens 2010). Relations between Aboriginal people and colonists did not remain amicable. A sustained drought during 1814 and 1815, and continued disenfranchisement of Aboriginal people from the land lead to tensions between farmers and Aboriginal people who remained to the southwest of Sydney. Aboriginal people were accused of stealing corn and potatoes and spearing cattle. A number of farmers were killed on their properties. In a dispatch Governor Macquarie wrote that,

The Native Blacks of this country...have lately broken out in open hostility against the British Settlers residing on the banks of the River Nepean near the Cow Pastures.

Aboriginal people were targeted, and it was ordered that Aboriginal men be strung from trees when they were killed as an example (Turbet 2011: 234).

In 1816, the tensions culminated in the Appin massacre when Aboriginal people where pursued by a detachment led by Captain James Wallis. Fourteen Aboriginal people of the Dharawal nation were shot or driven over a cliff to their deaths by the soldiers. The bodies of two of the Aboriginal men were strung up at the site (Turbet 2011).

Overall the devastation of the Aboriginal culture did not come about through war with the British, but instead through disease and forced removal from traditional lands. It is thought that during the 1789 smallpox epidemic over half of the Aboriginal people of the Sydney region died. This loss of life meant that some of the Aboriginal groups who lived away from the coastal settlement of Sydney may have

disappeared entirely before Europeans could observe them or record their clan names (Karskens 2010: 452).

Into the nineteen and twentieth century's descendants of the Gundungurra and Dharawal groups continued to live across the southern margin of the Cumberland Plain along with Aboriginal people from other areas of NSW.

5.2 Regional context

The archaeological understanding of the early Aboriginal settlement of the Sydney Basin and surrounds is constantly expanding and developing. The oldest evidence of human occupation in the vicinity of the study area comes from Cranebrook Terrace, located 20 km north west of the study area (Attenbrow 2010: 18-20). Cranebrook Terrace has been dated to 41,700 years Before Present (yBP) (ANU-4016).

The existing archaeological record is limited to certain materials and objects that were able to withstand degradation and decay. As a result, the most common type of Aboriginal objects remaining in the archaeological record are stone artefacts. Archaeological analyses of these artefacts in their contexts have provided the basis for the interpretation of change in material culture over time. Technologies used for making tools changed, along with preference of raw material. Different types of tools appeared at certain times, for example ground stone hatchets are first observed in the archaeological record around 4,000 years Before Present (BP) in the Sydney region (Attenbrow 2010: 102). It is argued that these changes in material culture were an indication of changes in social organisation and behaviour.

The Eastern Regional Sequence was first developed by McCarthy in 1948 to explain the typological differences he was seeing in stone tool technology in different stratigraphic levels during excavations such as Lapstone Creek near the foot of the Blue Mountains (McCarthy 1948). The sequence had three phases that corresponded to different technologies and tool types (the Capertian, Bondaian and Eloueran). The categories have been refined through the interpretation of further excavation data and radiocarbon dates (Hiscock and Attenbrow 2005; JMCD CHM¹ 2005). It is now thought that prior to 8,500 years BP tool technology remained fairly static with a preference for silicified tuff, quartz and some unheated silcrete. Bipolar flaking was rare with unifacial flaking predominant. No backed artefacts have been found of this antiquity.

After 8,500 years BP silcrete was more dominant as a raw material, and bifacial flaking became the most common technique for tool manufacture. From about 4,000 years BP to 1,000 years BP backed artefacts appear more frequently. Tool manufacture techniques become more complex and bipolar flaking increases (JMCD CHM 2006). It has been argued that from 1,400 to 1,000 years before contact there is evidence of a decline in tool manufacture. This reduction may be the result of decreased tool making, an increase in the use of organic materials, changes in the way tools were made, or changes in what types of tools were preferred (Attenbrow 2010:102). The reduction in evidence coincides with the reduction in frequency of backed blades as a percentage of the assemblage.

After European colonisation Aboriginal people of the Cumberland Plain often continued to manufacture tools, sometimes with new materials such as bottle glass or ceramics. There are a number of sites in Western Sydney where flaked glass has been recorded, for example at Prospect (Ngara Consulting 2003) and Oran Park (JMCD CHM 2007).

¹ Jo McDonald Cultural Heritage Management

5.3 Previous archaeological investigations

A number of archaeological investigations have been carried out within and adjacent to the study area. These have generally been associated with large land releases and the development of infrastructure to service these precincts. The following summary of previous investigations focuses on previous studies within the current local context of the Badgerys Creek Bringelly area.

Western Sydney Airport (Navin Officer Heritage Consultants 2016)

An Aboriginal Cultural Heritage Assessment and test excavations were conducted on the land owned by the Australian Government situated on the west side of Badgerys Creek for the Western Sydney Airport. The archaeological assessment incorporated both a survey and test excavation in which 23 new Aboriginal sites were recorded. Nine sites were registered as surface artefacts and 14 were registered as a result of the subsurface testing. The predominant material of these artefacts was silcrete. The sites included isolated artefacts, artefact scatters, and grinding grooves. Artefacts were found across varying landforms including alluvial flats, slopes, crests, elevated rises, and spur crests.

Boral Badgerys Creek Aboriginal Heritage Assessment – Addendum (AECOM 2011)

AECOM was engaged by Boral to undertake a test excavation program following the Aboriginal heritage assessment carried out in 2010 (AECOM 2011). The location of the testing area is approximately 1.1 km west of the current study area. A total of 30 hand excavated pits were excavated in close proximity to the creek line of Badgerys Creek. Four artefacts were retrieved across three excavation units. These excavation units were within transect 3, located on a terrace landform approximately 50 m east of Badgerys Creek. The artefacts were recorded as BC-EX01-11 (AHIMS ID 45-5-4099) (Figure 5.1). All artefactual material retrieved consisted of silcrete. Other finds consisted of silcrete, mudstone, and quartz was not considered to be artefactual based on the absence of diagnostic features and it was concluded that this material had been deposited during fluvial events. Artefacts were only retrieved within the flat (alluvial) areas while testing on the slopes did not identify any archaeological deposit. The results of the test excavation indicated a low-density archaeological deposit associated with Badgerys Creek.

Boral Bricks Aboriginal Heritage Impact Assessment (AECOM 2010)

AECOM was engaged by Boral to undertake an Aboriginal Heritage Impact Assessment as part of the Environmental Assessment for the expansion and continued use of the quarrying and brick making operations at the Badgerys Creek Quarry Site. The assessment area is directly west of the current study area and limited to the continued use and expansion of several quarry pits including Pit 3, Pit 4, and Pit 5. One Aboriginal site was recorded within a disturbed context during the survey (within the Pit 5 area) which consisted of an indurated mudstone broken flake (AHIMS ID 45-5-4098) located within an exposure on a cattle track approximately 250 m east of Badgerys Creek (Figure 5.1). This prompted an additional survey of a section of the Badgerys Creek however, no additional sites were found. The report noted that further assessment was not recommended as the proposed development did not encroach towards the waterways however, it was noted that higher densities of Aboriginal cultural material are likely to be within these areas.

Environmental Impact Assessment for the Second Sydney Airport (Navin Officer Heritage Consultants 1997)

Navin Officer Heritage Consultants was engaged to conduct an Aboriginal cultural heritage study as part of the Environmental Impact Statement for the site options of the second Sydney airport. These two sites were located in Badgerys Creek and Holsworthy. The location of the Badgerys Creek site is located 1.1 km west of the study area. The study incorporated previous Aboriginal heritage studies within the local area, surface survey and oral cultural heritage information discussed with the various

groups. Given the large survey area and landscape variables, the study area was divided into local landform units and further subdivided into order of ridgeline and order of stream.

The study identified that most site types are likely to be located in close proximity to water (within 50 m). Sites located near permanent water sources are likely to yield high artefact densities comprised of complex assemblages. A total of 110 sites were recorded during this survey. It was found that crests contain the lowest density of sites and isolated artefacts per square kilometre. Disturbance levels can be directly correlated to low archaeological potential. Relatively higher densities have been defined for the major watershed ridgeline between the Nepean River and South Creek catchments. However, it was noted that the relative sample size within the landform may have skewed the results and further research should be required.

Elizabeth Drive Upgrade Archaeological Survey for Aboriginal Sites (Brayshaw 1995)

Brayshaw (1995) was engaged by Roads and Traffic Authority to investigate Aboriginal heritage for the Elizabeth Drive upgrade as part of the greater Sydney West Airport site. It was found that much of the Elizabeth Drive road easement had been disturbed as part of the previous road works. Several potential archaeological deposits (PADs) and two artefact scatters were identified north of Elizabeth Drive. These were generally associated with the downstream areas of waterbodies including Kemps Creek, Badgerys Creek, South Creek, and Cosgroves Creek.

The sites identified on this survey were found in disturbed context, however were associated with waterbodies. No sites were identified to the south of Elizabeth Drive within proximity to the current study area.

Archaeological Survey of Area Considered for Second Airport Southern Zone (Haglund 1978)

Haglund (1978) conducted an archaeological assessment for the environment impact survey for Major Airport Needs of Sydney. The full archaeological report is no longer available, and only a partial report was obtained. Several sites were registered as part of the large-scale survey. One site (AHIMS ID 45-5-0213) is recorded as being within the current study area however, given the discrepancies on the coordinate system and the directions provided on the Aboriginal Site Recording Form, is unlikely to be present within the current study area but east of South Creek.

5.4 Registered Aboriginal sites

The location of Aboriginal sites is considered culturally sensitive information. It is advised that this information, including the AHIMS data appearing on the heritage map for the proposal be removed from this report if it is to enter the public domain.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken on the 5 March 2018 for sites registered within the following coordinates:

GDA 1994 MGA 56	292250 -- 294250 E 6245998 -- 6247998 N
Buffer	1000 m
Number of sites	30
AHIMS Search ID	331827

The distribution of recorded sites within the AHIMS search area is shown in Figure 5.1. The search located 30 registered sites within the vicinity of the study area, and no sites within the study area.

The frequency of recorded site types is summarised in Table 5.1 below.

Table 5.1: Frequency of site features within the AHIMS extensive search results

Site Feature	Frequency	Per cent
Artefact	27	90
Modified Tree (Carved or Scarred)	2	6.6
Art (Pigment or Engraved)	1	3.33
Total	30	100

The most frequent site feature in the search area is artefact site (n=27, 90 per cent). There are no previously registered Aboriginal sites recorded within the study area. South Creek (AHIMS ID 45-5-0213), is located on the eastern edge of the study area.

South Creek (AHIMS ID 45-5-0213)

This site was recorded by Ms Laila Haglund in 1978 as 'artefacts' and was described to be located on a ploughed low-lying peninsula, at the loop formed by South Creek. Deep waterholes were also observed in the bends. Artefacts of flaked stone were scattered all over the ploughed area. The recorded coordinates place the site on the western bank of South Creek, however from the description it can be determined there is a coordinate error and that the probable real location is further east on the opposite bank of South Creek. The exact location was unable to be determined and as a result the site was not able to be relocated. Co-ordinate errors are common on the AHIMS database, particularly for sites recorded in AGD.

Figure 5.1: Previously recorded sites identified in AHIMS search (sites recorded during this study not mapped)

Map removed for public exhibition

Figure 5.2: Close up of previously recorded sites identified in AHIMS search (sites recorded during this study not mapped)

Map removed for public exhibition

5.5 Predictive modelling

Archaeological investigation across the Cumberland Plain has been comprehensive over the past 30 years, including survey, excavation and desktop analysis studies. This varied and intensive investigation has led to the development and continual refinement of a predictive model for Aboriginal occupation within the region.

The Cumberland Plain has been extensively studied due to the growth demand of the ever-increasing Sydney population. Regional studies have been done on the large Growth Centres of the North West and South West of the Cumberland Plain, west of Sydney Basin. White and McDonald (2010) have contributed to the debate over site prediction by discussing the nature of Aboriginal site distribution, interpreted through lithic analysis of excavated sites in the Rouse Hill Development Area (White and McDonald 2010). The Rouse Hill Development Area is located about 15 km north of the current study area, the watercourses in the development area (Caddies Creek and Second Ponds Creek) derive from the same source as South Creek, Hawkesbury River, and are of a similar stream order. The soil landscapes are also reflective of those in the current study are, South Creek Soil Landscape along the high order watercourses and associated remnant Blacktown Soil Landscape. The study gave rise to the commonly referred Stream Order Model which provides a sound basis for archaeological investigations in the Cumberland plain. The paper provides a spatial and distributive analysis of Aboriginal objects in relation to freshwater resources and along varying landform units. The findings of this study highlighted the relationship between proximity to freshwater and landscape with archaeological evidence of Aboriginal occupation. The study found that artefact densities were most likely to be greatest on terraces and lower slopes within 100 m of freshwater resources (White and McDonald 2010). The predictive model identified that ridgelines and crests located between drainage lines will contain archaeological evidence though usually representative of background scatter (White and McDonald 2010).

While White and McDonald's (2010) predictive model can be seen as an indicative model of the archaeology of the Cumberland Plain, a more recent study has been conducted by Godden Mackay and Logan (GML 2012) at the East Leppington Precinct. The study utilised the Stream Order Model developed by White and McDonald (2010) in their investigations and three different and complementary models to explain their findings. The Stream Order Model is a regional based model and doesn't consider the small-scale intra-landform variations that can affect the predictions of this model.

Owen and Cowie (2017) describe three other models that can be used to more accurately describe archaeological probability within the landscape. Economic Resource Model, Activity Overprinting Model and Domiciliary Spacing Model. The Economic Resource Model focuses on the resource zones, confluences of creeks are considered high resource zones due to the richness in flora and fauna. The model suggests that the evidence of Aboriginal activities will decrease with distance from these resource rich nodes. Activity Overprinting Model was used to explain the density of sites at increasing distances from the creek and Domiciliary Spacing Model was used to describe the features and spatial variation of a site.

In conjunction with these models, an understanding of the soil landscape and the nature and prevalence of cultural material within these contexts is important in the predictive model process. Deposits that contain cultural material are likely to exist within both Blacktown Soil Landscapes and South Creek Soil Landscapes however, these are generally not stratified. Blacktown soils retrieve cultural material in A Horizon deposits which generally extend approximately 300 mm below the ground surface. Stratified archaeological deposits are likely to be located within the South Creek Soil Landscape. These stratified deposits are most likely to exist within raised embankments where environmental forces, such as flash flooding, are less likely to have impacted Aboriginal cultural

material situated on the ground surface. The deposits may have a vertical distribution that parallels alluvial deposition over time. The NSW Soil and Land Information System produced a technical report outlining the results of a core sample taken approximately 1.3 km north of the current study area, along the alluvial flats of South Creek. The results show that the South Creek soils extends to a depth of two metres in this area and may parallel the depth of deposit within the study area.

Every predictive model has its limitations and constraints and should be used as a guiding factor for future investigation and be used as a bridging tool to further current understanding of the cultural environment.

Based on the AHIMS registered sites, previous studies and the environmental context, predictions can be made on the type of Aboriginal archaeological evidence potentially present within the current study area. This evidence could be found in the form of certain site types:

- Open artefact scatters or isolated finds – this was the most common site feature from the AHIMS search and is the most prevalent source of evidence of Aboriginal occupation that has influenced the predictive models for many studies. The visibility of these sites is dependent on surface visibility and exposure and are affected by the nature of the soil landscape. The erosional nature of the Blacktown soils within the study areas suggest that possible deposits are susceptible to erosion, yet the depositional nature of permanent watercourses such as the South Creek soils gives rise to the probability of intact occupational records in the deep stratigraphic layers. Using the Stream Order Model and Economic Resource model we can assume there is a high likelihood for sites.
- Culturally modified scar trees – while extensive clearing occurred post-European contact these sites may occur in any pockets of mature native trees.
- Grinding grooves – these sites occur on sandstone outcroppings usually along waterways, swamps or water pans. The presence of these sites will be dependent on the availability of suitable sandstone sources. The underlying geology of the Soil Landscapes in the study area is the Wianamatta Group which contains the Minchinbury Sandstone, a fine to medium grained quartz Sandstone. Grinding grooves have been found along South Creek and Badgerys Creek but are unlikely to be found in the study area.
- Sub-surface artefact sites – low density assemblies, primarily composed of silcrete will be associated with crest landforms.

6.0 ARCHAEOLOGICAL SURVEY

6.1 Background

A preliminary site inspection of the study area was undertaken by Anna Darby (Heritage Consultant, Artefact Heritage) and Jennifer Norfolk (Heritage Consultant, Artefact Heritage) on 6 March 2018 in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW 2010c). This inspection resulted in the assessment that the study area is likely to contain Aboriginal sites. Therefore, an archaeological survey with the RAPs was recommended.

6.2 Aims

The aims of the archaeological survey were as follows:

- cover a representative sample of the study area that will potentially be impacted by the proposed works
- record any Aboriginal objects observed during the survey
- to liaise with RAP representatives regarding the proposed works and the archaeological potential of the study area
- to verify test excavation, transect locations with the RAP representatives, as outlined in the methodology (Artefact Heritage 2018a).

6.3 Timing and personnel

The archaeological survey was conducted on 20 August 2018. Personnel and timing for the archaeological survey are presented in Table 6.1.

Table 6.1: Timing and personnel for the archaeological survey

Participant	Organisation	Role	Date of participation
Ryan Taddeucci	Artefact Heritage	Senior Heritage Consultant	20 August 2018
Julia McLachlan	Artefact Heritage	Heritage Consultant	20 August 2018
Cameron Mackay	Artefact Heritage	Archaeologist	20 August 2018
Paul Boyd	Didge Nguawal Clan	RAP	20 August 2018
Daniel Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	RAP	20 August 2018
Fred Trewlynn	Darug Land Observations	RAP	20 August 2018
Jeff Hickey	Kamilaroi-Yankuntatjara Working Group	RAP	20 August 2018

6.4 Survey strategy and methodology

The study area was divided into nine survey units (SUs), based on landform and access, these units were numbered SU1 – SU9 (Figure 6.27). The overall strategy was to complete a full coverage survey, where possible.

The survey units were traversed on foot, in accordance with the Code of Practice. A handheld Global Positioning System (GPS) was used to track the path of the survey team and record the coordinates of survey transects. The coordinate system projection used for all site recording was GDA94 MGA 56.

The survey was conducted with seven people traversing the area spaced 15 m apart. All ground exposures were examined for Aboriginal objects (stone artefacts, imported shell, or other traces of Aboriginal occupation). Old growth trees were examined for signs of cultural scarring and marking.

A photographic record was kept during the survey. Photographs were taken to record aspects of survey units including vegetation and disturbance. Scales were used for photographs where appropriate. Full details of each SU are provided in section 6.5.2 – section 6.5.4.

6.5 Survey coverage

6.5.1 Coverage

The survey covered two landform units within the study area. A summary of survey coverage is outlined in Table 6.2. Landform survey coverage is outlined in Table 6.3.

All visible surfaces were inspected, and old growth native trees were similarly targeted for evidence of cultural modification. Local landforms, evidence of land use history and previous research was used to inform assessments of archaeological potential. Full survey of SU1 was unachievable due to access restrictions to the property. Overall the visibility was low due to grass cover. Exposures were present in areas worn down by animal and livestock movement. Due to the dryness of the landscape dust was also a factor that contributed to the low visibility.

Table 6.2: Effective survey coverage

Survey unit	Landform	Survey unit area (sq m)	Visibility (%)	Exposure (%)	Effective coverage Area (sq m)	Effective coverage (%)
SU1	Crest, slope	8,568	10	50	428	5
SU2	Crest, slope	46,513	50	10	2325	5
SU3	Slope	22,685	80	1	181	0.8
SU4	Slope	49,382	80	1	395.06	0.8
SU5	Slope	62,050	80	1	496.4	0.8
SU6	Slope	66,284	80	10	5,302.72	8
SU7	Slope	73,299	80	1	586.39	0.8
SU8	Slope	30,378	80	1	243.2	0.8
SU9	Slope	14,694	80	1	117.55	0.8

Table 6.3: Landform survey coverage

Landform	Landform area (sq m)	Area effectively surveyed (sq m)	% of landform effectively surveyed	Number of surface sites	Total no. of sites
Slope	368,468	18,721.32	5.08	1	1
Crest	5,385	215	4	0	0

6.5.2 Survey Unit 1

Survey Unit 1 is located 1.15 km east of Badgerys Creek and 800 m west of South Creek, bordered by an unnamed private road. SU1 measures 140 m north-south and 60 m east-west with an area of 8,568 square metres. Due to access restriction to SU1 a full coverage survey was not practicable. SU1 was subject to a sample survey which involved a single transect following the perimeter of SU1.

Survey Unit 1 is predominantly comprised of a slope landform which inclines towards South Creek in the east. The mid-western portion of SU1 is comprised of a crest landform. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture, remnant vegetation includes sporadic juvenile and mature trees with occasional shrubberies. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure, associated with the driveway to the residential structure, was estimated to be 50 per cent.

A residential structure located in the centre of the SU has been built on top of ground that has been artificially elevated by fill.

Survey Unit 1 was assessed as having low archaeological potential due to the high level of disturbance associated with the construction of the residential structure and the modification of the landscape. No Aboriginal objects were identified within SU1. In consultation with the RAPs, it was determined that SU1 was not an area of PAD due to high disturbance. Therefore, SU1 was not subject to test excavations during the subsequent phase of investigations.

**Figure 6.1: View north east of SU1
(Photographed by A Darby, 6 May 2018)**



**Figure 6.2: View north west of SU1
(Photographed by J McLachlan, 20 August 2018)**



6.5.3 Survey Unit 2

Survey Unit 2 was located 1.26 km east of Badgerys Creek and 620 m west of South Creek, bordered by Martin Road in the northwest. SU2 measures 330 m north-south and 220 m east-west with an area of 46,513 square metres. SU2 was subject to a full coverage survey, conducted through 14, north-south oriented transects spaced 15 m apart.

Survey Unit 2 was predominantly comprised of a slope landform which drops down towards South Creek in the east. The western edge of the SU encompasses an unnamed and unsealed private road. A crest landform is located where the private road meets Martin Road. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture, remnant vegetation was limited to a small cluster of mature trees located in the middle of SU2. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure, associated with vehicle tracks, was estimated to be 10 per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences, the establishment of an underground gas pipeline, and a concrete platform in the mid-west.

Survey Unit 2 was assessed as having moderate archaeological potential due to the low level of disturbance, landform and proximity to South Creek. In consultation with the RAPs, it was determined that the planned location of test excavation within SU2, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU2.

No Aboriginal objects were identified within SU2.

Figure 6.3: View south east of survey unit 2 (Photographed by J McLachlan, 20 August 2018)



Figure 6.5: view north of survey unit 2 (Photographed by J McLachlan, 20 August 2018)



Figure 6.4: View east of survey unit 2 (Photographed by J McLachlan, 20 August 2018)



Figure 6.6: View east of survey unit 2 (Photographed by J McLachlan, 20 August 2018)



6.5.4 Survey Unit 3

SU3 was located 1.16 km east of Badgerys Creek and 600 m west of South Creek, on an upper slope landform. SU3 measures 150 m north-south and 130 m east-west with an area of 22,685 square metres. The SU was bordered to the north, west and south by a barbed wired fence and associated fence posts. A residential structure on an artificially created earthworks platform was located immediately west of the SU. SU3 was subject to a full coverage survey, conducted through seven, east-west oriented transects spaced 15 m apart.

SU3 was comprised of a slope landform which descends towards South Creek in the east. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. At the time of the survey SU3 was being utilised as pastoral land for two horses. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be one per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

SU3 was assessed as having moderate archaeological potential due to the low level of disturbance, landform and proximity to South Creek. In consultation with the RAPs, it was determined that the planned test excavation within SU3 should proceed. However, during the survey waterlogged soils, including visible pools of water, were observed along the northern boundary of the SU, and the test area stipulated by the test excavation methodology (Artefact Heritage 2018a) was moved further north at the request of D. Chalker (Site Officer, Cubbitch Barta).

No Aboriginal objects were identified within SU3.

**Figure 6.7: View west of survey unit 3
(Photographed by J McLachlan, 20 August 2018)**



**Figure 6.8 View south of survey unit 3
(Photographed by J McLachlan, 20 August 2018)**



Figure 6.9: Ground Cover (J McLachlan, 20 August 2018)



6.5.1 Survey Unit 4

Survey Unit 4 is located 1.27 km east of Badgerys Creek and 314 m west of South Creek, bordered to the north by 230 Martin Road. SU4 measures 135 m north-south and 350 m east-west with an area of 49,382 square metres. SU4 was subject to full survey coverage, conducted through seven, east-west oriented transects spaced 15 m apart.

SU4 comprised a slope landform which inclines towards South Creek in the east. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. At the time of the survey SU4 was being utilised as pastoral land for two horses. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be one per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

Survey Unit 4 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned test excavation within SU4 should proceed. However, during the survey waterlogged soils, including visible pools of water, were observed along the northern boundary of the SU, and the test area stipulated by the test excavation methodology (Artefact Heritage 2018a) was moved further north at the request of the D. Chalker (Site Officer, Cubbitch Barta).

No Aboriginal objects were identified within SU4.

Figure 6.10: View north of SU4 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.11: View east west of SU4 (Photographed by R. Taddeucci, 20 August 2018)



6.5.2 Survey Unit 5

Survey Unit 5 was located 1.43 km east of Badgerys Creek and 260 m west of South Creek, bordered to the north, west and south by a barbed wire fence. SU5 measures 185 m north-south and 350 m east-west with an area of 62,050 square metres. SU5 was subject to a full survey coverage, conducted through 20, north-south oriented transects spaced 15 m apart.

Survey Unit 5 was comprised of a slope landform which drops down towards South Creek in the east. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be one per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

Survey Unit 5 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned location of test excavation within SU5, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU5.

No Aboriginal objects were identified within SU5.

Figure 6.12: View east of SU5 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.13: View northeast of SU5 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.14: View north of SU5 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.15: View south of SU5 (Photographed by R. Taddeucci, 20 August 2018)



6.5.3 Survey Unit 6

Survey Unit 6 was located 1.42 km east of Badgerys Creek and 300 m west of South Creek, bordered by Martin Road in the northwest. SU6 measures 260 m north-south and 260 m east-west with an area of 66,284 square metres. SU6 was subject to a full survey coverage, conducted through 14, north-south oriented transects spaced 15 m apart.

Survey Unit 6 was comprised of a mid-slope landform which drops down towards South Creek in the east. The western edge of the SU encompasses an unnamed and unsealed private road. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be 10 per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences and vehicle tracks.

Survey Unit 6 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned location of test excavation within SU5, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU6.

One Aboriginal object was identified within SU6 and was recorded as BCBW18 IF 01 (AHIMS ID 45-5-5165), see section 6.6 for a full description.

Figure 6.16: View north of SU6 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.17 View east of SU6 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.18: View west of SU6 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.9: Ground cover (Photographed by R. Taddeucci, 20 August 2018)



6.5.4 Survey Unit 7

Survey Unit 7 was located 1.5 km east of Badgerys Creek and 30 m west of South Creek, on a middle slope landform. SU7 measures 225 m north-south and 380 m east-west with an area of 73,299 square metres. The SU was bordered to the north, west and south by a barbed wired fence and associated fence posts. SU7 was subject to a full coverage survey, conducted through 21, north-south oriented transects spaced 15 m apart.

Survey Unit 7 was comprised of a slope landform which drops down towards South Creek in the east. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be one per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

Survey Unit 7 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned location of test excavation within SU5, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU7.

No Aboriginal objects were identified within SU7.

Figure 6.19: View east of SU7 (Photographed by R Taddeucci, 20 August 2018)



Figure 6.20 View west of SU7 (Photographed by R Taddeucci, 20 August 2018)



Figure 6.21: Ground cover (Photographed by R. Taddeucci, 20 August 2018)



6.5.5 Survey Unit 8

Survey Unit 8 was located 1.67 km east of Badgerys Creek and 15 m west of South Creek, bordered to the north, west and south by a barbed wire fence. SU8 measures 116.3 m north-south and 256 m east-west with an area of 30,378 square metres. SU8 was subject to a full survey coverage, conducted through 14, north-south oriented transects spaced 15 m apart.

Survey Unit 8 was comprised of a slope landform which drops down towards South Creek in the east. The majority of the SU has been cleared of native vegetation and is currently comprised of open pasture. The SU was dominated by manicured grass, restricting surface exposure. Ground exposure was limited to areas surrounding fence posts and was estimated to be one per cent.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

Survey Unit 8 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned location of test

excavation within SU8, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU8.

No Aboriginal objects were identified within SU8.

Figure 6.22: View east of SU8 (Photographed by R. Taddeucci, 20 August 2018)



Figure 6.23 View south of SU8 (Photographed by R. Taddeucci, 20 August 2018)



6.5.6 Survey Unit 9

Survey Unit 9 was located 1.65 km east of Badgerys Creek and 230 m west of South Creek, on a lower slope landform. SU9 measures 190 m north-south and 90 m east-west with an area of 14,694 square metres. The SU was bordered to the north and west by a barbed wired fence and associated fence posts. Due to dense vegetation coverage, SU9 was subject to a sample survey coverage which involved two transects beginning at the northwest corner, one extending to the east and the other to the south.

Survey Unit 9 was comprised of a lower slope landform which drops down towards South Creek in the east. The majority of the SU (approximately 60 per cent) was covered in a moderately dense woodland, with the remainder covered in manicured grass. As a result, exposure was low, approximately 10 per cent, and was limited to areas surrounding tree roots.

Minor disturbance across the SU was observed, associated with the construction of barbed wire fences.

No Aboriginal objects were identified within SU9. An uprooted tree with fused branches was located in SU9. One cultural site, an uprooted modified tree, was identified (Figure 6.26). Full details regarding the cultural site will be provided in the ACHARs (Artefact Heritage 2018b and c).

Survey Unit 9 was assessed as having moderate archaeological potential due to the low level of disturbance. In consultation with the RAPs, it was determined that the planned location of test excavation within SU9, as per the test excavation methodology (Artefact Heritage 2018a), was suitable for SU8.

**Figure 6.24: View northeast of SU9
(Photographed by A. Darby, 22 August 2018)**



**Figure 6.25 View east of SU9 (Photographed
by A. Darby, 22 August 2018)**



**Figure 6.26: View southwest with potential
culturally modified tree in foreground
(Photographed by J McLachlan, 20 August
2018)**



Figure 6.27: Survey units within MOD3



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6.6 Survey results

One new archaeological site was identified during the survey. A cultural site was also identified and is discussed in more detail in the MOD4 ACHAR (Artefact Heritage 2018c). The survey resulted in the confirmation that the entirety of the study area is of moderate archaeological potential. This was due to the study area demonstrating a low level of disturbance, being located on an archaeological sensitive landform and within close proximity to South Creek.

6.6.1 BCBW18 IF 01 (AHIMS ID 45-5-5165)

Site type: Isolated Find
Centroid: Removed for public exhibition
Site Extent: 3 metres x 3 metres

The site is comprised of a single complete flake of silcrete with three scars on the dorsal surface.

Figure 6.28: Dorsal side of BCBW18 IF 01 (Photographed by J McLachlan, 24 August 2018)



Figure 6.29: BCBW18 IF 01 (Photographed by J McLachlan, 24 August 2018)



Figure 6.30: Location of Aboriginal archaeological and cultural sites identified through the survey

Map removed for public exhibition

7.0 ARCHAEOLOGICAL TEST EXCAVATION

Part 3A was repealed by the NSW *Environmental Planning and Assessment Amendment (Part 3A Repeal) Act 2011* (Part 3A Repeal Act), which commenced on 1 October 2011. Under the Part 3A Repeal Act, projects deemed to be 'transitional Part 3A projects will continue to be subject to Part 3A of the EP&A Act (as in force immediately before the repeal and as modified by the Part 3A Repeal Act). Transitional Part 3A projects include certain projects that were the subject of an existing approval under Part 3A.

As the CSR Advanced Manufacturing Hub has a Project Approval that was granted under Part 3A of the EP&A Act, it is a transitional Part 3A project. The provisions of Part 3A (as in force immediately prior to its repeal) continue to be applicable to the Project. Therefore, the project is proposed to be assessed under s75W of the repealed Part 3A.

The transitional arrangements in the EP&A Act were repealed by the Environmental Planning and Assessment Bill 2017. This moved transitional Part 3A projects to the current State significant development and State significant infrastructure pathways, and applications to modify such projects will no longer be made under Section 75W. This modification application has been made within the transitional timeframe and is not affected by the above arrangements.

Furthermore, under SSD approval it is not a requirement that test excavation be conducted in accordance with the Code of Practice.

However, the test excavation methodology was guided by the Code of Practice. Previous archaeological test excavations, within the wider region, were completed under the Code of Practice. Therefore, it is an applicable framework to use for comparative analysis of archaeological findings within the current test excavation.

7.1 Aims

The aims of the archaeological test excavation are:

- Adequately identify the nature of any subsurface archaeological deposits, including preliminary comparisons with results of other subsurface archaeological investigations in the area.
- Assess the scientific significance of any archaeological deposits identified during the excavation, following the assessment of test excavation results.
- Provide an opportunity for registered Aboriginal stakeholders to comment on the Aboriginal cultural heritage values of the study area
- Provide the proponent with recommendations on opportunities to avoid impact and future requirements for further archaeological investigation where required.

7.2 Timing and personnel

The test excavation program was carried out across five days from the 20 August to 24 August 2018. Test excavation was directed by Vanessa Edmonds (Principal, Artefact Heritage), supervised by Julia McLachlan (Heritage Consultant, Artefact Heritage) and Ryan Taddeucci (Senior Heritage Consultant, Artefact Heritage). Table 7.1 lists all participants in the test excavation and their dates of participation.

Table 7.1: Participants in the test excavation program

Name	Organisation	Role	Date
Vanessa Edmonds	Artefact Heritage	Principal	23 August 2018
Ryan Taddeucci	Artefact Heritage	Excavation supervisor	20 August – 24 August
Julia McLachlan	Artefact Heritage	Excavation supervisor	20 August – 24 August
Anna Darby	Artefact Heritage	Excavation assistant	20 August – 24 August
John Sokalik	Artefact Heritage	Archaeologist	20 August – 24 August
Amad Ghareb	Artefact Heritage	Archaeologist	20 August – 24 August
Cameron MacKay	Artefact Heritage	Archaeologist	20 August – 24 August
Paul Boyd	Didge Ngunawal Clan (DNC)	Site officer	20 August 2018
Adam King	Didge Ngunawal Clan (DNC)	Site officer	21 August – 24 August
Fred Trewlynn	Darug Land Observations (DLO)	Site officer	20 August – 24 August
Jeff Hickey	Kamilaroi-Yankuntatjara Working Group	Site officer	20 August – 24 August
Daniel Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	Site officer	20 August – 22 August
Ebony Chalker	Cubbitch Barta Native Title Claimants Aboriginal Corporation	Site officer	23 August – 24 August

7.3 Constraints

There were several constraints which impacted the test excavation program. A series of barbed wired fences were located across the study area, which limited the location of excavation units and restricted movement of the excavation team across the study area. Two horses occupied a paddock in which test excavation was scheduled to occur in, this created a restriction on the timing and management of excavation areas. Excavation in the horse paddock could not occur until the last day of excavation so that the excavated area could be backfilled immediately after completion.

At the request of the property tenants, disturbance of the study area was to be kept to a minimum. Therefore, the location of the wet sieving station was restricted to the centre of the study area. Excavated material had to be carried from the excavation area to the sieving area.

A gas pipeline was located along the western boundary of the study area, which limited the areas where transects could be placed. Dense vegetation was also a major constraint to the placement of the baseline. While there was no rainfall during the excavation period, there were a few days with a high wind factor.

Despite these constraints, all proposed test pits were excavated down to an archaeologically sterile deposit and the proposed sampling of the study area was achieved.

7.4 Sampling strategy

The study area was comprised of a 37.4 ha area and therefore required the development of a sampling strategy. The aim of the sampling strategy was to test the various landforms within the study area to produce predictive statements regarding the likely archaeological sensitivity and potential across the study area that would facilitate management and mitigation measures related to Aboriginal cultural heritage.

Previous archaeological investigation in the area has identified Aboriginal cultural material in close proximity to the creek line, both Badgerys Creek (AECOM 2010) and South Creek (Haglund 1978). Landform observations, predictive models and comments made by the RAPs during the survey were used to inform the locations of the testing program.

The areas that were tested incorporated different landforms at varying distances to South Creek to test the integrity of subsurface deposits within these contrasting contexts and provide more information on Aboriginal land use patterns.

A total of eight, east-west oriented transects were placed to sample the study area at various distances and elevations from South Creek (Figure 7.1).

The transects were plotted at intervals of approximately 200 m, with some variation due to constraints from fences and vegetation. Transect 8 was plotted at the end of the excavation between transect 2 and 3, due to the higher density of artefactual material obtained from those two transects. Transect 5 was placed 10 m from the northern boundary of the study area at the request of the RAPs. Transect 6 was placed in the southern portion of the study area along a slope, while transect 7 was placed 10 m from the northern boundary of the study area at the request of the RAPs.

Figure 7.1: Excavation transects within the study area



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7.5 Methodology

7.5.1 Test excavation layout

The start and end points of each transect were plotted in a handheld, non-differential GPS unit. These points were marked on the ground with flags and a magnetic compass was used to confirm the orientation. A baseline was strung from the start point to the end point, and the northwest corner of each excavation unit (hereafter referred to as test pit) was plotted at 25 m intervals along each transect. The location of each test pit (TP) was marked with a handheld, non-differential GPS. All TPs were labelled according to an alpha numeric system, according to the corresponding transect and position. The number of TPs per transect is summarised in Table 7.2. All TPs were spaced 25 m apart, with the exception of TP4L, which was spaced 30 m from TP4K to capture the terrace. All TPs were aligned so that the northern edge followed the alignment of the associated transect.

Table 7.2: Transects and test pit counts

Transect	Test pit count
1	10
2	12
3	10
4	12
5	9
6	7
7	6
8	11
Total	77

7.5.2 Excavation procedure

Test excavation involved hand excavation of 500 mm x 500 mm TPs down to an archaeological sterile depth. The first TP in each transect was excavated in arbitrary spits of 50 mm with each subsequent TP excavated in arbitrary spits of 100 mm. Where archaeological features were encountered excavation of the feature occurred as a single unit. Where unusual deposits were encountered TPs were expanded.

A context sheet for each test pit was completed in the field. Details recorded included date of excavation, name of excavators, depth, number of buckets and soil description. A photographic record was made for each section wall and base for all TPs. Additionally, a scale drawing of a representation section, pH and Munsell soil colour was determined on a representative sample at each transect.

Where unusual archaeological features were encountered, the TPs were expanded. At TP8G a hearth with clay heat retainers was identified in the northwest corner. As a result, TP8G was expanded in a clockwise direction, beginning in the west. The subsequent TPs were labelled TP8G2-3. TP1H was expanded to the north to determine the full extent of a high concentration of artefacts

that was identified *in-situ*. Two charcoal samples were retrieved from the hearth feature, they were individually wrapped in aluminium foil, to prevent crushing, and placed in labelled bags. The bags were left open, to dry the samples and prevent the growth of mould. The position of each sample in three dimensional space was recorded.

All retrieved deposit from each test pit was placed in buckets and transported to a sieve area. All retrieved deposit was wet sieved using 3 mm sieves.

All test pits were back-filled by hand with the clean fill using shovels.

7.5.3 Aboriginal objects

All Aboriginal objects retrieved during the course of test excavation were placed in re-sealable bags for further analysis and recording. Once test excavation was completed, the artefact assemblage was recorded and stored. This included recording key attributes of material, artefact type, platform type, and dimensions, as well as a photographic record of representative artefacts (Table 7.3). All recorded information was entered into a Microsoft Excel table with detail linked to the provenance of each artefact. Once entered into the Excel table (Appendix 3), the data can be readily supplied with the test excavation report.

All artefacts were stored in double re-sealable snap lock bags. A permanent marker was used to record the provenance of the artefacts in each bag in writing on the outside of the bag and on an archival grade tag such as Dupont™ Tyvek® paper.

An Aboriginal Site Recording Form will be completed for newly identified sites and submitted to the AHIMS registrar as soon as practicable.

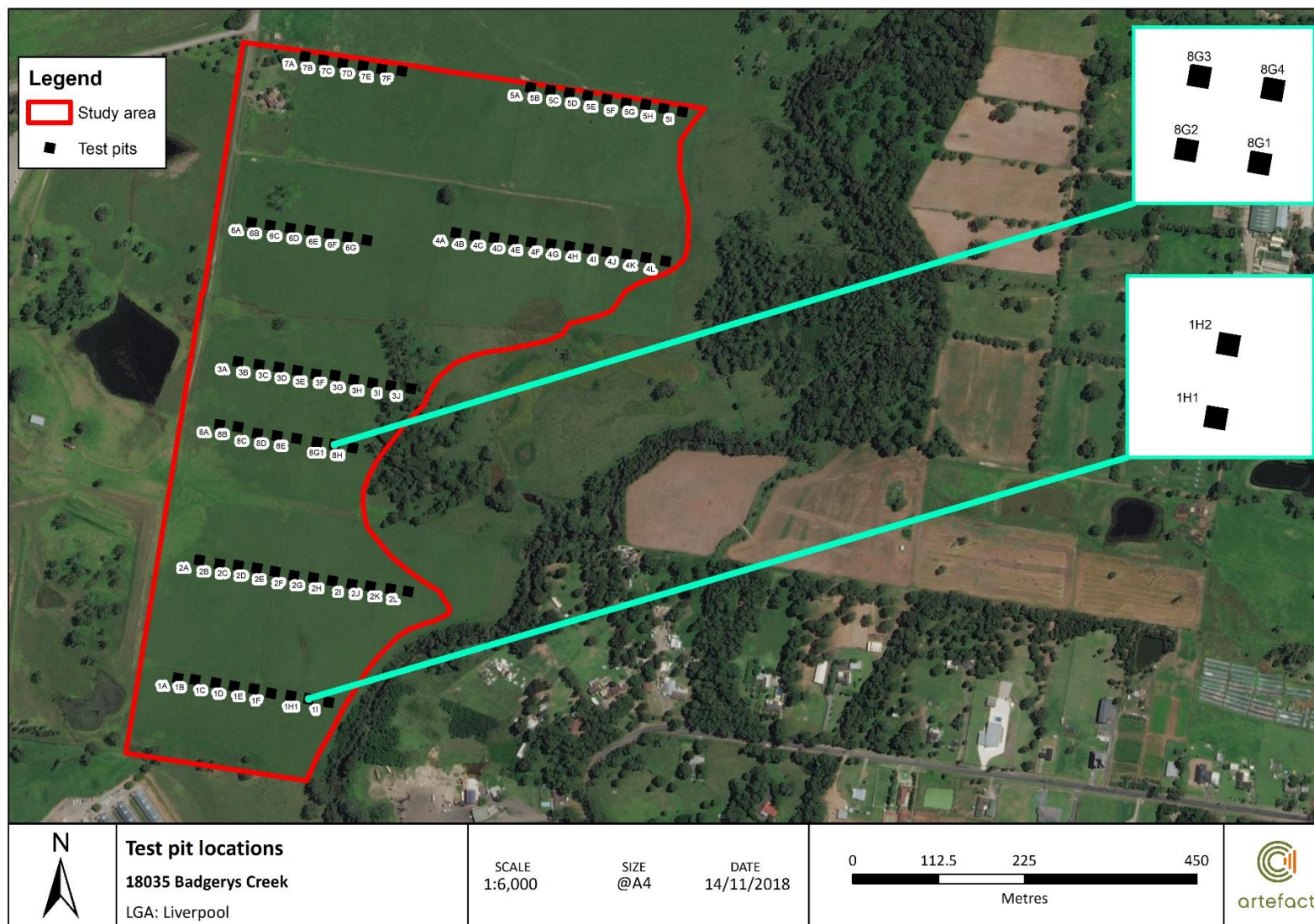
Long-term care and management of the retrieved archaeological assemblage was discussed with RAPs through the methodology review process and during fieldwork. The items are temporarily stored in a secure cabinet at the Artefact Heritage head office, Pyrmont. Long-term management of the excavated artefacts will involve reburial at a location specified in the ACHARs (Artefact Heritage 2018b and c).

Table 7.3: Recorded artefact attributes

Artefact attributes	Recorded details
Site details	Site name
Test pit	Location of the northwest corner of the test pit on the X Y grid
Spit	Spit number
Raw material	Raw material type and colour. Raw material types included: basalt, chalcedony, chert, dolerite, ironstone, mudstone, quartz, quartzite, silcrete
Typological class/ reduction type	Debris, complete flake, flake fragment marginal, transverse fragments, longitudinal fragments, multiple platform core (MPC), single platform core (SPC), core fragment, muller, Other.
Formal tool type (if applicable)	Backed, blade, tula adze, burren adze, burin, scraper, retouched, geometric microlith
Dimensions	Orientated length, width and thickness of complete flakes
Cortex	Cortex coverage of whole artefact.

Artefact attributes	Recorded details
Weight	Measured to the 0.1 gram (gm). Artefacts less than 0.05 gm were rounded up to 0.05 gm, whilst artefacts greater than 0.05 gm were rounded up to 0.1 gm

Figure 7.2: Excavation transects within the study area



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7.6 Test excavation results

Based on the landform and artefact distribution from the excavation area, three new artefact scatters have been identified across the study area (Figure 7.13).

7.6.1 BCBW18 AS 01 (AHIMS ID 45-5-5162)

Site type: Artefact Scatter
Centroid: Removed for public exhibition
Site Extent: 10 metres x 10 metres

Badgerys Creek Brick Works 18 Artefact Scatter (BCBW18 AS) 01 (AHIMS ID Pending) is a low-density artefact scatter situated on an upper slope, 756 m west of South Creek (Figure 7.13). The assemblage is comprised of two artefacts, one complete flake of mudstone and one proximal flake fragment of silcrete. Both artefacts were obtained from the upper two spits of the deposit (0-200 mm). The site is part of a larger archaeological complex which includes BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163).

Figure 7.3: Proximal flake fragment of silcrete retrieved from spit 1 (Photographed by A Darby, 3 September 2018)



Figure 7.5: View north of BCBW18 AS 01 (AHIMS ID 45-5-5162) (Photographed by A Darby, 21 August 2018)

Image removed for public exhibition

Figure 7.4: Complete flake of mudstone retrieved from spit 2 (Photographed by A Darby, 3 September 2018)



Figure 7.6: View west of BCBW18 AS 01 (AHIMS ID 45-5-5162) (Photographed by A Darby, 21 August 2018)

Image removed for public exhibition

7.6.2 BCBW18 AS 02 (AHIMS ID 45-5-5164)

Site type: Artefact Scatter and Hearth
Centroid: Removed for public exhibition
Site Extent: 930 metres x 144 metres

BCBW18 AS 02 (AHIMS ID 45-5-5164) is located in the low-medium level flood zone, 50 m above sea level on a lower slope, 20 m west of South Creek. Test excavations revealed that the subsurface deposit is *in situ*.

The subsurface assemblage consists of 21 stone artefacts. The assemblage features five raw materials (Figure 7.7), with silcrete being the dominant raw material type (n=15, 71.43 per cent). Four artefact types (transverse flake fragments, complete flakes, a multiple platform core, and a piece of debris) were present in the assemblage. Debris and cores are indicative of on-site artefact manufacturing. All cultural material was retrieved from the upper two spits (0-200 mm).

A hearth comprising burnt clay heat retainers was located in the centre of the site (Figure 7.13). The hearth was associated with one transverse fragment of chert (Figure 7.12). No signs of heat treatment were present on the fragment.

Table 7.4: Summary of artefact raw materials

Raw material	Count	Per cent
Chert	2	9.52
Mudstone	1	4.76
Quartz	2	9.52
Quartzite	1	4.76
Silcrete	15	71.43
Total	21	100

Table 7.5: Summary of artefact types

Type	Count	Per cent
Debris	1	4.76
Complete Flake	13	61.90
Flake Fragment Proximal	2	9.52
Flake Fragment Distal	1	4.76
Flake Fragment Marginal	3	14.29
<i>Total Transverse fragments</i>	6	28.57
Core - MPC	1	4.76

Type	Count	Per cent
Total	21	100.00

Figure 7.7: Remnants of the *in situ* hearth, TPG1-4 (Photographed by A Darby, 24 August 2018)



Figure 7.9: Burnt clay heat retainers from TP8G1, spit 3 (Photographed by A Darby, 3 September 2018)



Figure 7.8: Flake fragment from TP8G4, spit 1 (Photographed by A Darby, 3 September 2018)



Figure 7.10: View north from TP8E (Photographed by A Darby, 24 August 2018)

Image removed for public exhibition

7.6.3 BCBW18 AS 03 (AHIMS ID 45-5-5163)

Site type: Artefact Scatter
Centroid: Removed for public exhibition
Site Extent: 10 metres x 10 metres

BCBW18 AS 03 (AHIMS ID 45-5-5163) is located within the medium flood zone 200 m west of South Creek on a lower slope. Test excavations revealed that the subsurface deposit has not been disturbed. However, the site is located within the medium flood risk area (Figure 4.2) and it is very likely that the archaeological integrity of the deposit has been compromised by frequent inundation.

Nine subsurface artefacts were retrieved from a 500 mm x 500 mm area. The site only featured two raw materials within the assemblage (mudstone and silcrete). The assemblage contained three artefact types (complete flakes, transverse flake fragments, and a multiple platform core). No debris or longitudinal fragments were identified. Therefore, it is unlikely that the site was the place of artefact manufacturing.

Table 7.6: Summary of artefact raw materials

Raw material	Count	Per cent
Mudstone	3	33.33
Silcrete	6	66.67
Total	9	100

Table 7.7: Summary of artefact types

Type	Count	Per cent
Complete Flake	5	55.56
Flake Fragment Proximal	1	11.11
Flake Fragment Distal	1	11.11
Flake Fragment Marginal	1	11.11
<i>Total Transverse fragments</i>	3	33.33
Core - MPC	1	11.11
Total	9	100.00

Figure 7.11: Artefacts from TP5H, spit 3
(Photographed by A Darby, 3 September 2018)



Figure 7.12: View west across BCBW18 AS 03
(AHIMS ID 45-5-5163) (Photographed by J McLachlan, 24 August 2018)



Figure 7.13: Newly identified sites

Map removed for public exhibition

8.0 ANALYSIS AND DISCUSSION

8.1 Soils, disturbance and features

Soils across study area were generally comprised of a light brown, silt sediment with an average test pit depth of 250 mm. Soil disturbance was limited to minor bioturbation from grass rootlets. A summary of soil characteristics across the study area is provided in Table 8.1.

See Figure 8.1 for a photograph of a representative soil profile for the study area and Figure 8.2: Technical drawing of T5H northern profile

for a representative technical drawing of the deposit.

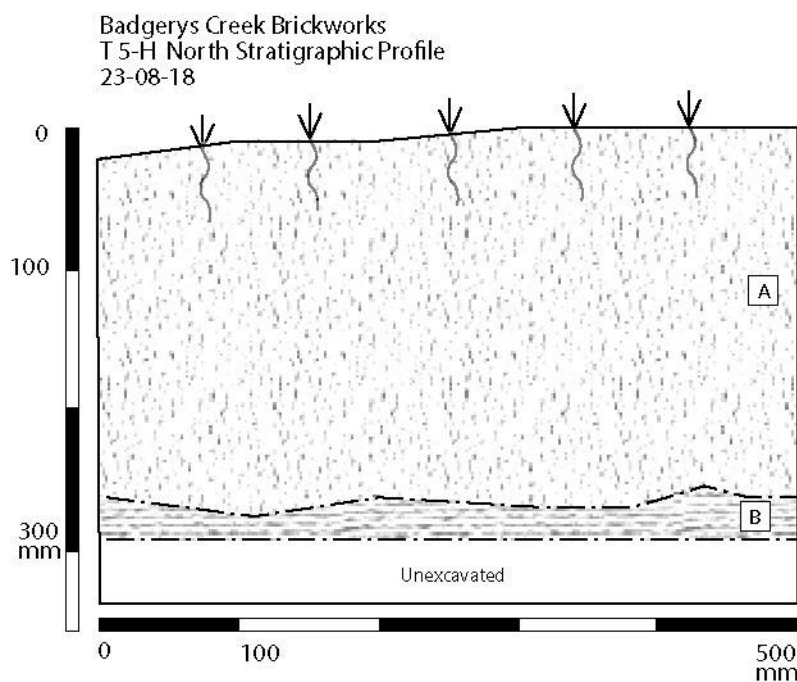
Table 8.1: Summary of the soil characteristics

Layer	Description
A Horizon:	Depth: 0-200 mm
	pH: 6
	Munsell: 10 YR 4/2 Dark greyish brown
	Description: Compact, light brown silt with frequent bioturbation from grass rootlets
B Horizon:	Depth: 200-300 mm
	pH: 6.5
	Munsell: 10 YR 4/3 Brown
	Description: Compact, brown silt coming down on a compact red-brown clay.

Figure 8.1: North profile of TP5H (Photographed by A Darby, 24 August 2018)



Figure 8.2: Technical drawing of T5H northern profile



TP4J, TP4K and TP4L were anomalous to the remainder of the study area, as the deposit was much deeper and featured a slight transition in the A horizon, interpreted as A1 and A2. The greater depth of deposit can be attributed to the TPs being located closer to the flood plain than the remainder of the TPs across the study area. The deposit was intact but was much more compact than the other deposit encountered across the study area. TP4J also featured frequent inclusions of charcoal. As a result, it was interpreted that a burning event had occurred at some point during the soil deposition. See Table 8.2 for a summary of the soil characteristics.

See Figure 8.3 for a photograph of a representative soil profile for the study area and Figure 8.4 for a representative technical drawing of the deposit.

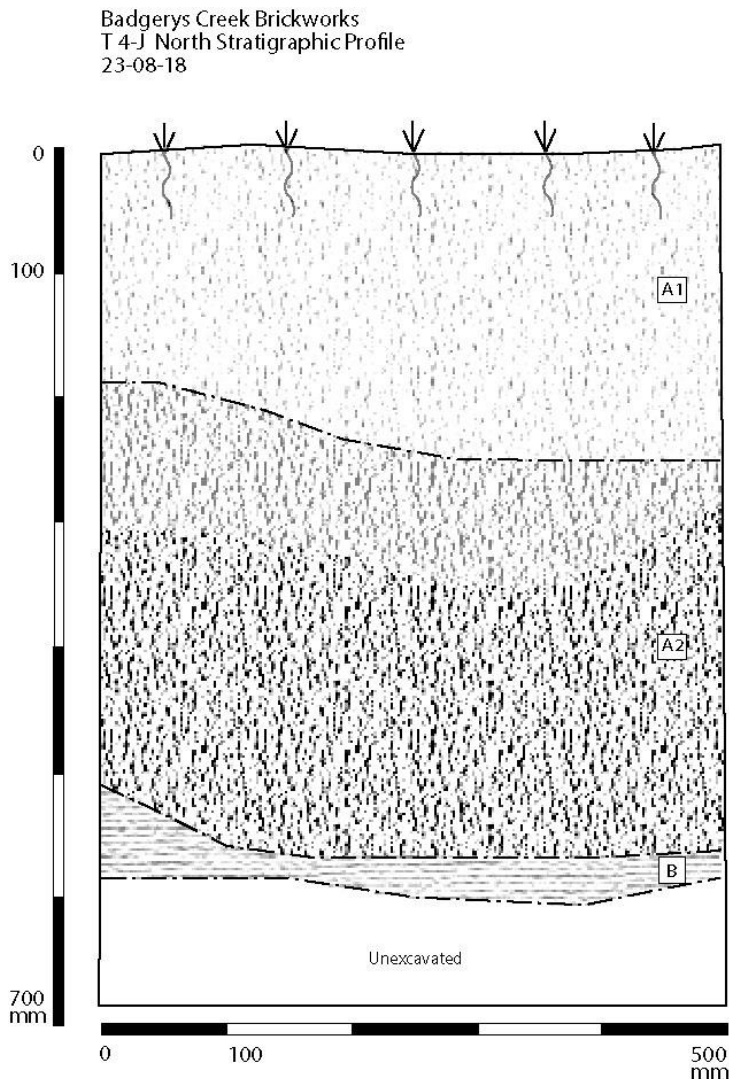
Table 8.2: Summary of the study area soil characteristics for TP4J

Layer	Description
A1 Horizon:	Depth: 0-200 mm
	pH: 6
	Munsell: 10 YR 4/2 Dark greyish brown
	Description: Compact, light brown silt with frequent bioturbation from grass rootlets
A2 Horizon:	Depth: 200-500 mm
	pH: 6
	Munsell: 10 YR 5/3 Brown
B Horizon:	Description: Compact, brown silt with charcoal inclusions
	Depth: 500-600 mm
	pH: 6.5
	Munsell: 10 YR 4/3 Brown
	Description: Compact, brown silt coming down on a compact red-brown clay.

Figure 8.3: North profile of TP4J (Photographed by A Darby, 23 August 2018)



Figure 8.4: Technical drawing of T4J northern profile



8.2 Artefact assemblage

To interpret artefact scatters with a limited chrono-stratigraphic control, a behavioural-assemblage matrix has been developed (Table 8.3). This matrix describes assumed relationships between varying residential and logistical mobility configurations, group size and stages of artefact reduction. It relies on the sampling of artefacts in adjoining assemblages, assuming synchronicity.

The aim of this matrix is to create interpretive windows into assemblage variability that can inform on the likely size of resident groups, their mobility, their duration of site occupancy and the intensity of both tool and core reduction.

The interpretations of the behavioural matrix rely heavily on the establishment of reduction stages. Table 8.4 provides a description of each level of reduction.

To interpret the assemblage within the context of the matrix the following attributes have been measured:

- degree of cortex

- platform preparation
- degree of retouch
- shape of flakes
- core rotation
- number of dorsal scars on flakes
- proportion of formal implements
- size of the assemblage.

For the purposes of the following analysis, only subsurface artefacts have been considered as they are subject to less dynamic taphonomic processes that would comprise the spatial integrity of the assemblage.

Table 8.3: Site occupation category characteristics

	High residential mobility / Low logistical mobility	Moderate residential mobility / moderate logistical mobility	Low residential mobility / High logistical mobility
Characteristics	Generally small in size	Generally small-medium to medium in size	Larger in size
	Generally low number of artefacts	Increased assemblage size	High assemblage size
	Assemblage orientated towards earlier stages of reduction	Multiple artefact concentrations	Multiple concentrations
	Generally limited range of reduction	Early and mid-stages of reduction	Multiple features (reduction area, artefact scatter etc)
	Limited lithological/typological diversity	Increased lithological/typological diversity	Increased lithological/typological diversity
	Less tertiary reduction	Rise in number of grinding/formal implements such as blades and adzes.	Mid to late stage reduction
	Fewer formal tools		Rise in number of grinding/formal implements such as blades and adzes.
Associated with	Small groups of people during periods of higher mobility	Repeat visits of small groups or small aggregations.	Larger groups and periods of lower mobility
	Limited number of visitations (one or two)	Limited number of visitations	Many visitations
Numbers of people (as per Binford 2001: Table 8.01)	<16 people, mean of 11	21 - 50 People, mean 31	130 - 350 people, mean 245

Table 8.4: Characteristics of each stage of artefact reduction

Early stages	Mid stages	Late stages
Higher proportion of flakes with cortex	Lower proportion of flakes with cortex	Lower proportion of flakes with cortex - relatively few primary pieces (<10%)
Higher proportion of cortex on flakes	Possibly lower proportion of cortex on flakes	Possibly lower proportion of cortex on flakes
Larger artefacts	Some large artefacts but some smaller ones appearing	Increase in number of exhausted cores
Flakes larger and squarer	Increase in number of artefacts with retouch /OHR	Some large artefacts but more smaller ones appearing
If core preservation not a feature, then expect more single platform cores	Flakes becoming more uniform in shape	Increase in number of artefacts with retouch /OHR and in the proportion of retouch to artefact length
Minimal platform preparation	Flakes will start to tend away from square towards longer shapes *	Flakes becoming more uniform in shape
Fewer number of dorsal scars on complete flakes	Increase in use of cores means increase in ratio of MPC to SPC	Flakes will start to tend away from square towards longer shapes
Higher proportions of debris	Some micro flakes	Increase in use of cores means increase in ratio of MPC to SPC
		More micro flakes
		Rise in number of dorsal scars

8.2.1 Distribution and density

Of the 77 test pits excavated only 18 test pits yielded artefacts with 32 artefacts retrieved in total. The average density of subsurface artefacts across the study area is 1.66 artefacts per square metre. TP5H contained nine artefacts which was the highest artefact count from the study area. TP5H had an average density of 36 artefacts per square metre. TP5H was not mapped inside the extent of BCBW18 AS 02 (AHIMS ID 45-5-5164) as it was not located on the same landform and featured a much higher artefact density.

Table 8.5: Spit counts

Spit	Count	Per cent	Weight	Average artefact weight
1	11	34.38	14.11	1.28
2	12	37.50	20.63	1.72
3	9	28.13	32.91	3.66
4	0	0.00	0	0
Total	32	100.00	67.65	2.11

Table 8.6: Summary of artefact counts from the study area

Pit	Count	Per cent	Weight	Average
1E	1	3.13	1.53	1.53
1F	1	3.13	0.16	0.16
1G	3	9.38	0.45	0.15
1H1	2	6.25	0.4	0.20
1H2	1	3.13	0.06	0.06
1I	3	9.38	4.66	1.55
2F	1	3.13	0.36	0.36
2G	1	3.13	2.52	2.52
2H	1	3.13	1.3	1.30
2I	1	3.13	0.82	0.82
2J	1	3.13	2.95	2.95
3D	1	3.13	1.52	1.52
3I	1	3.13	0.57	0.57
4C	1	3.13	0.34	0.34

Pit	Count	Per cent	Weight	Average
5H	9	28.13	32.91	3.66
6C	2	6.25	1.23	0.62
8E	1	3.13	10.18	10.18
8G	1	3.13	5.69	5.69
Total	32	100.00	67.65	2.11

Figure 8.5: Location of test pits

Map removed for public exhibition

8.2.2 BCBW18 AS 01 (AHIMS ID 45-5-5162)

TP6C contained a proximal flake fragment from spit 1 (0 – 100 mm) and a complete flake of mudstone from spit 2 (100 – 200 mm).

Meaningful interpretations relating to artefact size cannot be made from fragmented artefacts, as it is difficult to determine the full metrics of an artefact that is incomplete. Artefacts which are the product of early stage reduction tend to be short and wide while artefacts that are products of later stage reduction tend to be long and thin. The only complete flake in the assemblage measured 14.22 mm in length by 10.91 mm in width. With a length/width ratio of 1.3 the artefact is indicative of later stage reduction.

No cortex was noted on either of the artefacts in the assemblage, also indicative of later stage reduction.

8.2.3 BCBW18 AS 02 (AHIMS ID 45-5-5164)

8.2.3.1 Raw material

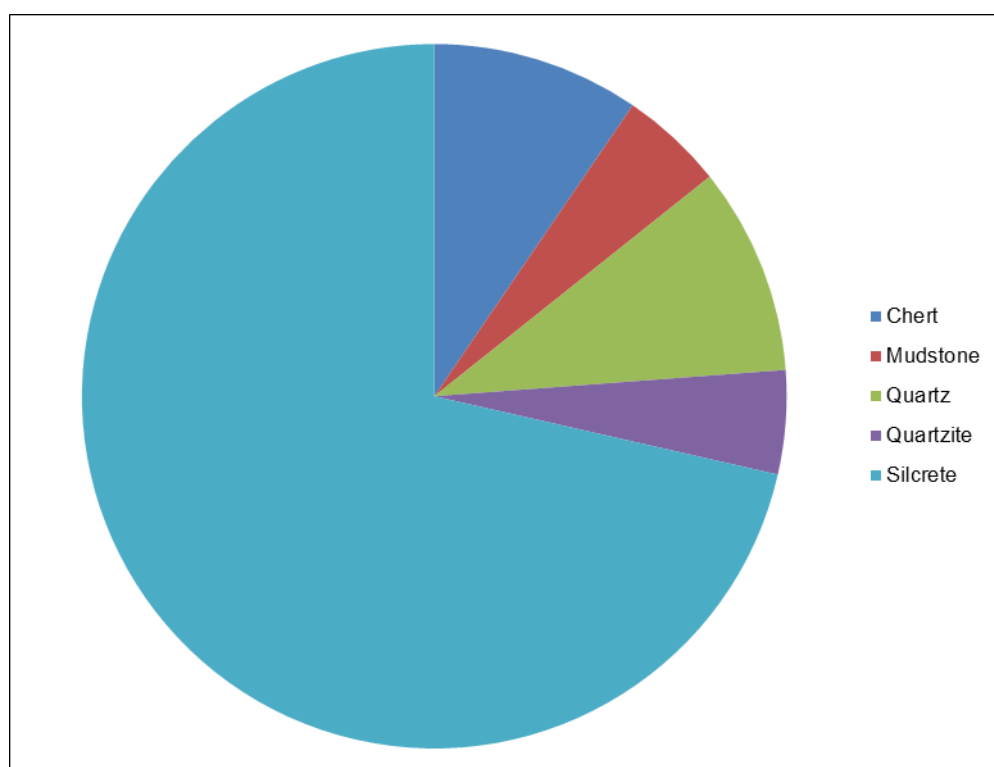
Five raw material types were identified within the assemblage of BCBW18 AS 02 (AHIMS ID 45-5-5164), with silcrete being the dominant raw material (n=15, 71.43 per cent). Lesser proportions of chert (n=2, 9.52 per cent), quartz (n=2, 9.52 per cent), mudstone (n=1, 4.76 per cent), and quartzite (n=1, 4.76 per cent). The range of raw material types within the assemblage is characterised of medium range material variation. This type of assemblage is indicative of smaller groups of people engaging in repeated occupation of the land.

A summary of the raw material types recovered from each test area is included in Table 8.7 and Figure 8.6.

Table 8.7: Summary of artefact raw materials

Raw material	Count	Per cent
Chert	2	9.52
Mudstone	1	4.76
Quartz	2	9.52
Quartzite	1	4.76
Silcrete	15	71.43
Total	21	100

Figure 8.6: Raw materials as proportions (per cent)



8.2.3.2 Artefact types

The artefact assemblage consisted primarily of complete flakes (n=13, 61.9 per cent) and transverse flake fragments (n=6, 28.57 per cent). The assemblage also included a single multiple platform core (n=1, 4.76 per cent) and a single piece of debris (n=1, 4.76 per cent). A summary of artefact types is located in Table 8.8 and Figure 8.7. The appearance of a multiple platform core (MPC) in the assemblage at a higher portion than single platform cores (SPCs) is characteristic of smaller groups which engage in repeated occupation of the land.

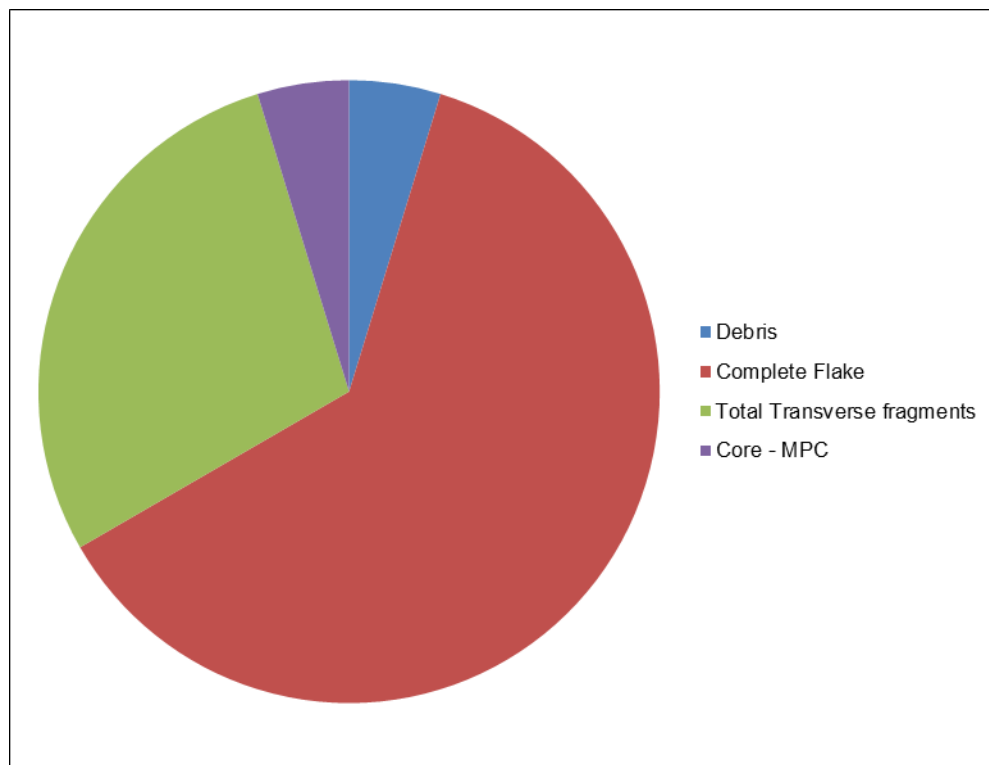
The high proportions of transverse flake fragments indicate that the site has been subject to post depositional disturbance. However, as the proportion of transverse flake fragments is low, the integrity of the site is high.

Table 8.8: Summary of artefact types

Type	Count	Per cent
Debris	1	4.76
Complete Flake	13	61.90
Flake Fragment Proximal	2	9.52
Flake Fragment Distal	1	4.76
Flake Fragment Marginal	3	14.29
<i>Total Transverse fragments</i>	6	28.57
Core - MPC	1	4.76

Type	Count	Per cent
Total	21	100.00

Figure 8.7: Distribution by percentage of artefact types



8.2.3.3 Size

The average weight of the artefacts within the assemblage was 1.6 grams (g). On average the chert artefacts were the heaviest, weighing 3.61 g with quartzite having the lowest average weight of 0.34 g. The multiple platform core had the highest average weight (10.18 g) with the complete flakes having the lowest average weight of 0.85 g. See Figure 8.8 and Figure 8.9 for a visual representation of the average weights for each raw material and artefact type.

Overall, the average size of the artefacts within the assemblage is medium range, which is indicative of smaller groups which engage in repeated occupation of the land.

Figure 8.8: Average weight by raw material type

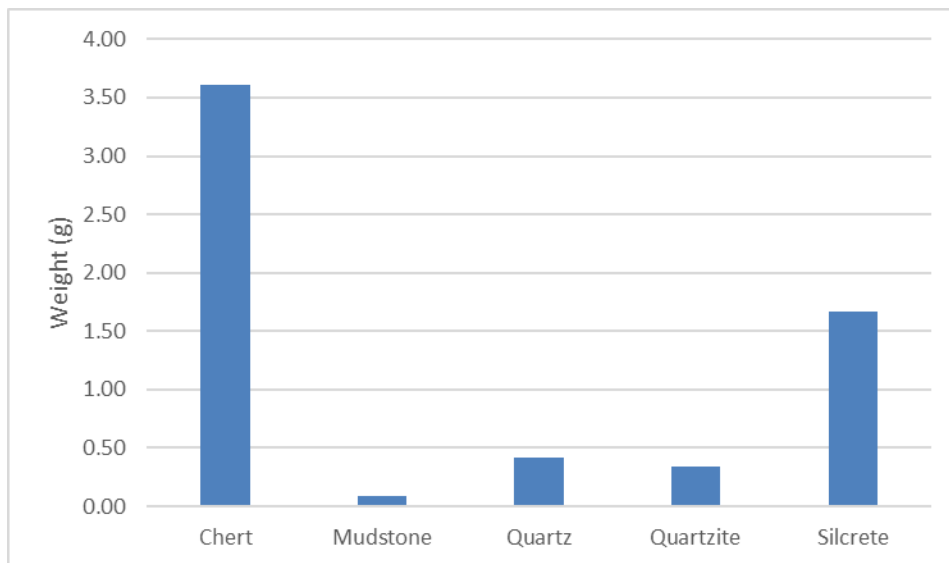
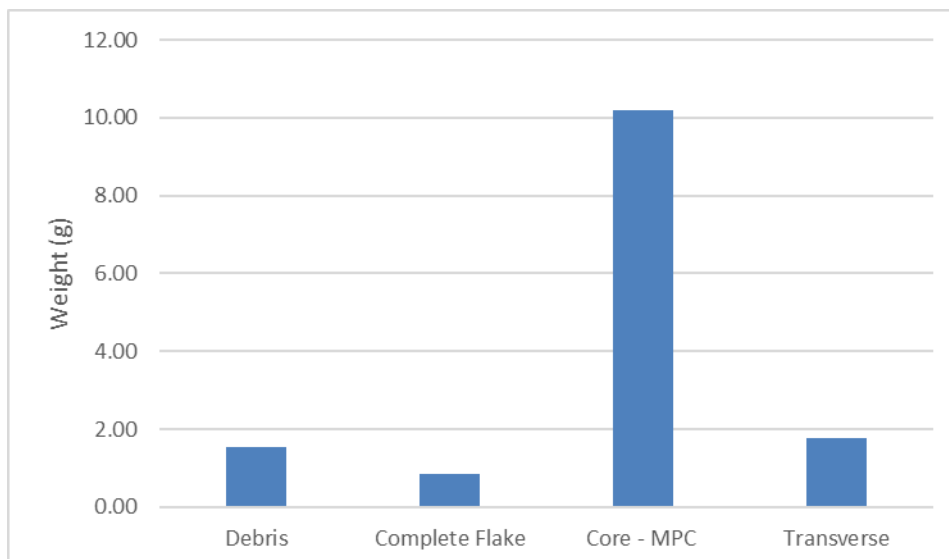


Figure 8.9: Average weight by artefact type



8.2.3.4 Cortex

A total of three artefacts were identified as possessing remnant terrestrial cortex, which accounts for 16.67 per cent of the assemblage. The mean remnant cortex was 53.33 per cent.

Table 8.9: Summary of artefact cortex

	Number	Max%	Min%	Mean %	SD
All artefacts with cortex	3	80	40	53.33	23.09

8.2.3.5 Reduction stages

A total of two artefacts featured markers of intentional secondary stage reduction, as they featured less than 100 per cent cortex of the dorsal side and at least one scar. One artefact was identified to be the product of tertiary stage reduction, as it featured retouch.

Meaningful interpretations relating to artefact size cannot be made from fragmented artefacts, as it is difficult to determine the full metrics of an artefact that is incomplete. Artefacts which are the product of early stage reduction tend to be short and wide while artefacts that are products of later stage reduction tend to be long and thin. Across the BCBW18 AS 02 (AHIMS ID 45-5-5164), the mean length for the complete flakes was 11.32 mm and the mean width was 11.32 mm. When the length/width ratio of complete flakes is greater than 1, an artefact is likely the product of latter stage reduction; ratios below 1 are likely the result of early stage reduction. The average length/width ratio across the site is 1.08. This indicates that artefacts across the site tend to be the product of later stages of reduction. See Table 8.10 for a summary of the dimensions of complete flakes within the assemblage.

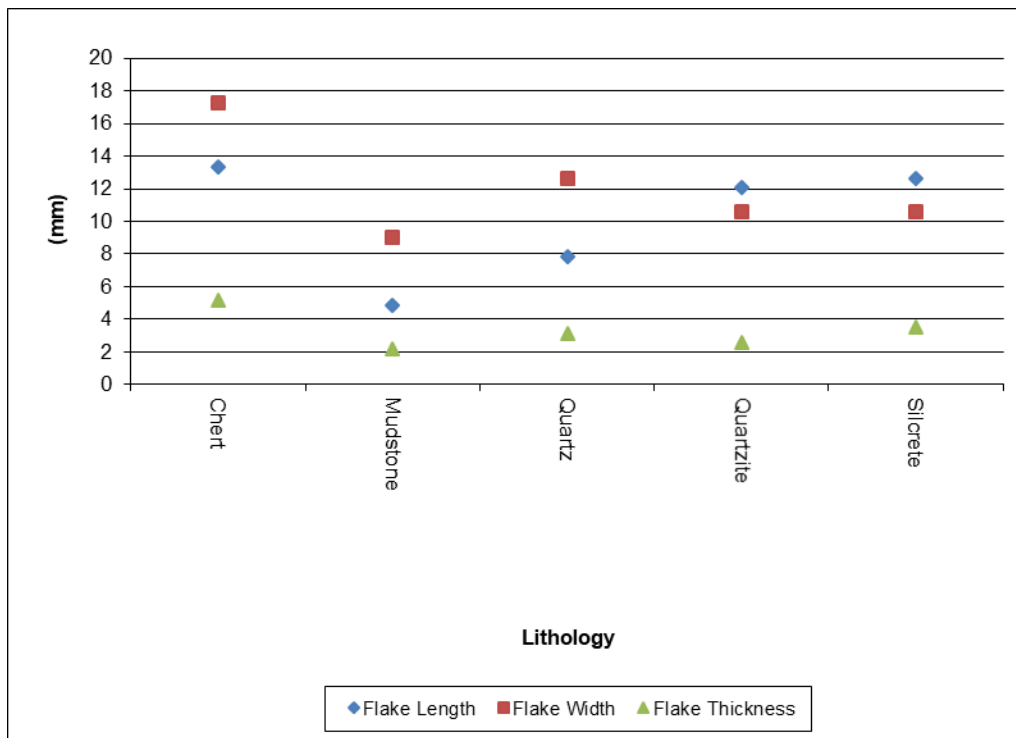
Across the site the complete flakes comprised of quartzite and silcrete tended to have a length greater than their width, indicative of later stage reduction. While complete flakes comprised of chert, mudstone and quartz tended to have a width greater than their length, indicative of early stage reduction. See Figure 8.10 for a visual representation of the dimensions for each raw material type.

Overall, the artefacts within the assemblage are characteristic of medium level reduction, indicative of smaller groups that engage in repeated occupation of the land.

Table 8.10: Summary of artefact dimensions

	Number	Mean	Max	Min	SD
Complete Flake Length	13	11.32	26.25	4.89	6.06
Complete Flake Width	13	11.32	25.41	5.53	5.50
Complete Flake Thickness	13	3.43	9.79	1.23	2.36
Complete Flake Length/Width Ratio		1.08	2.49	0.49	0.52

Figure 8.10: Average dimensions of complete flakes across the study area



8.2.3.6 Aboriginal hearth

TP8G1 exposed a feature of burnt clay heat retainers in the northwest corner at a depth of 200 mm, extending down to a depth of 350 mm. The clay base of the deposit had been baked and the deposit contained small fleckings of charcoal. The entirety of the hearth was not excavated, and the full extent is unknown. The soils which surrounded the hearth were consistent with those identified across the study area, see Table 8.11 and Figure 8.11 for full details.

Hearths were used by Aboriginal people for cooking. Dating of previously identified hearths found that these features were used over the last 1,000 years, and that before this time Aboriginal people cooked using different techniques (GML 2016).

Studies from outside of Sydney have found that many groups of Aboriginal people used hearths to cook rhizomes, which were used as a primary source of food (GML 2016). However, a recent study from East Leppington, 10.5 km northwest of the study area, found that hearths with clay heat retainers were used to cook meat, or plants outside their flowering season (GML 2016). This evidence has been interpreted as heat retainers are used to roast foods.

Two charcoal samples retrieved from the hearth, were submitted to the University of Waikato for Accelerator Mass Spectrometry (AMS) radiocarbon dating. One of the samples was found to be unsuitable for the AMS dating process. However, the other sample yielded a result of 2,056±20 BP (Wk-48125).

Table 8.11: Summary of the soil characteristics for the hearth

Layer	Description
A Horizon:	Depth: 0-200 mm pH: 6

Layer	Description
	Munsell: 10 YR 4/2 Dark greyish brown
	Description: Compact, light brown silt with frequent bioturbation from grass rootlets
	Depth: 200-300 mm
	pH: 6.5
B Horizon:	Munsell: 10 YR 4/3 Brown
	Description: Compact, brown silt coming down on a compact red-brown clay.

Figure 8.11: Western profile

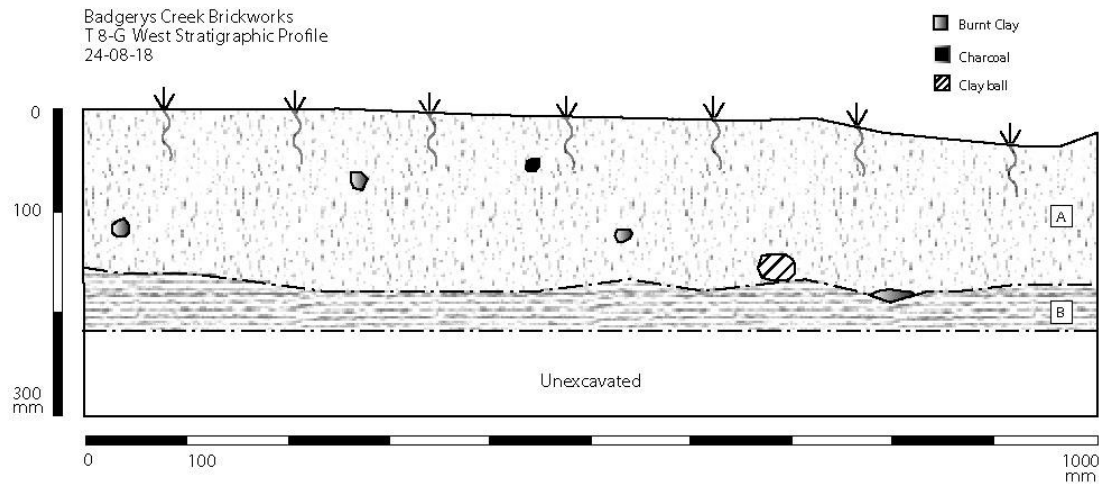
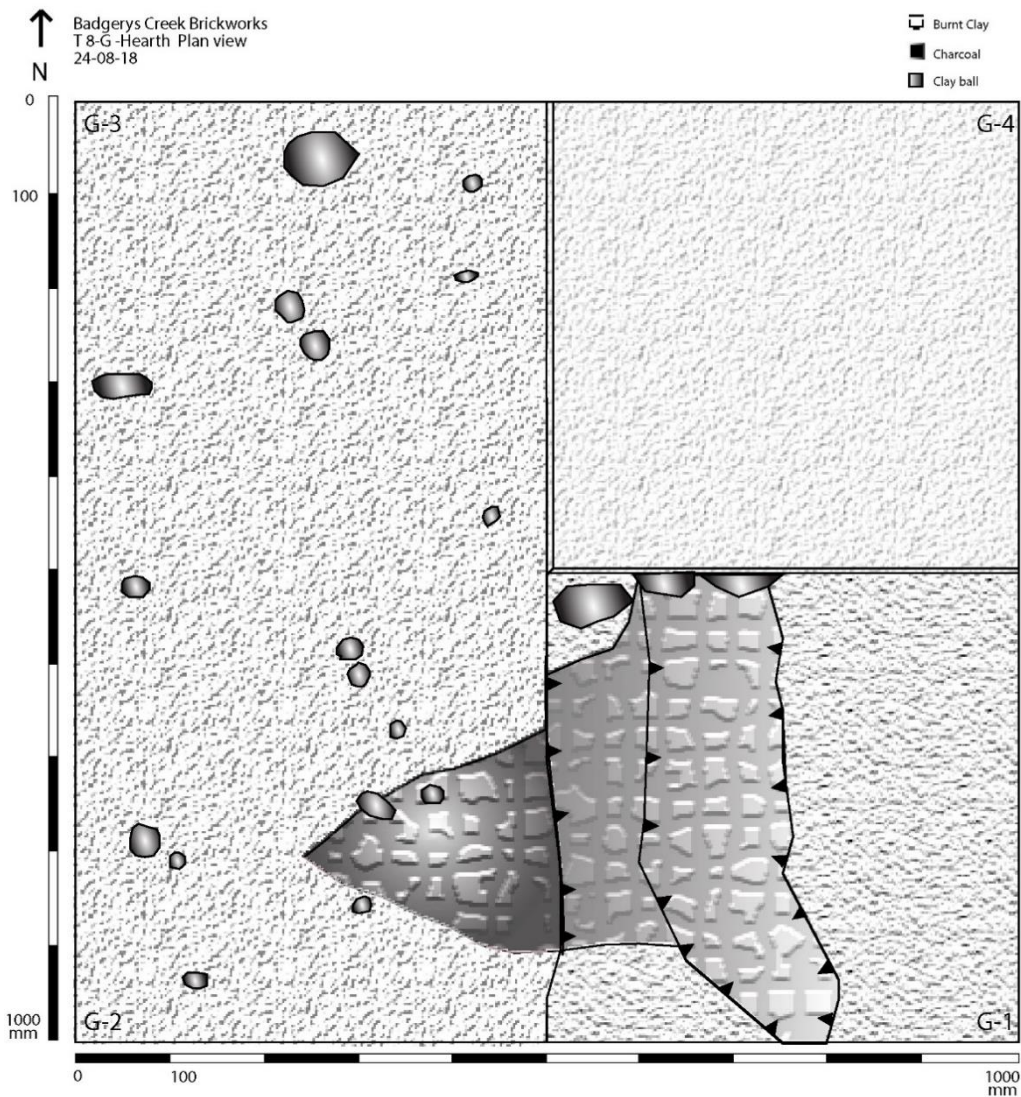


Figure 8.12: Plan drawing of the hearth feature



8.2.4 BCBW18 AS 03 (AHIMS ID 45-5-5163)

8.2.4.1 Raw material

Two raw material types were identified within the assemblage of BCBW18 AS 03 (AHIMS ID 45-5-5163), with silcrete being the dominant raw material ($n=6$, 66.67 per cent). The range of raw material types within the assemblage is characterised of low range material variation.

A summary of the raw material types recovered from each test area is included in Table 8.7 and Figure 8.6.

Table 8.12: Summary of artefact raw materials

Raw material	Count	Per cent
Mudstone	3	33.33
Silcrete	6	66.67

Raw material	Count	Per cent
Total	9	100

8.2.4.2 Artefact types

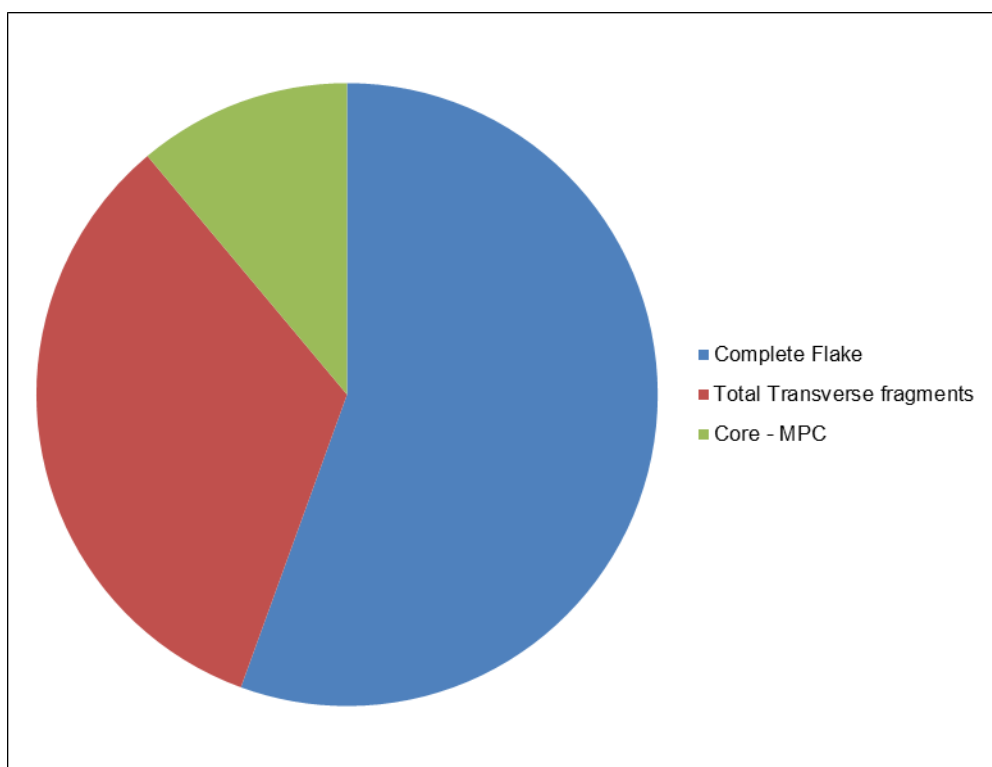
The artefact assemblage consisted primarily of complete flakes (n=5, 55.56 per cent) and transverse flake fragments (n=3, 33.33 per cent). The assemblage also included a multiple platform core (n=1, 11.11 per cent). A summary of artefact types is located in Table 8.8 and Figure 8.7. The appearance of a multiple platform core (MPC) in the assemblage at a higher portion than single platform cores (SPCs) is characteristic of smaller groups which engage in repeated occupation of the land.

The high proportions of transverse flake fragments indicate that the site has been subject to post depositional disturbance. However, as the proportion of transverse flake fragments is low, the integrity of the site is high.

Table 8.13: Summary of artefact types

Type	Count	Per cent
Complete Flake	5	55.56
Flake Fragment Proximal	1	11.11
Flake Fragment Medial	1	11.11
Flake Fragment Marginal	1	11.11
<i>Total Transverse fragments</i>	3	33.33
Core - MPC	1	11.11
Total	9	100.00

Figure 8.13: Distribution by percentage of artefact types



8.2.4.3 Size

The average weight of the artefacts within the assemblage was 3.66 grams (g). On average the silcrete artefacts were the heaviest, weighing 5.16 g while the mudstone featured an average weight of 0.66 g. The multiple platform core had the highest average weight of 29.54 g with the complete flakes having the lowest average weight of 0.35 g. See Figure 8.8 and Figure 8.9 for a visual representation of the average weights for each raw material and artefact type.

Overall, the average size of the artefacts within the assemblage is medium range, which is indicative of smaller groups which engage in repeated occupation of the land.

Figure 8.14: Average weight by raw material type

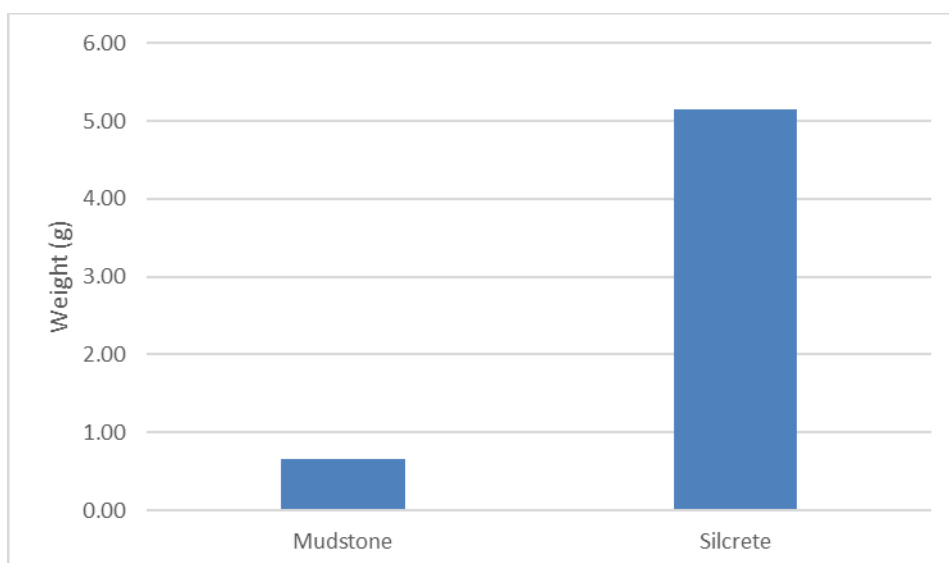
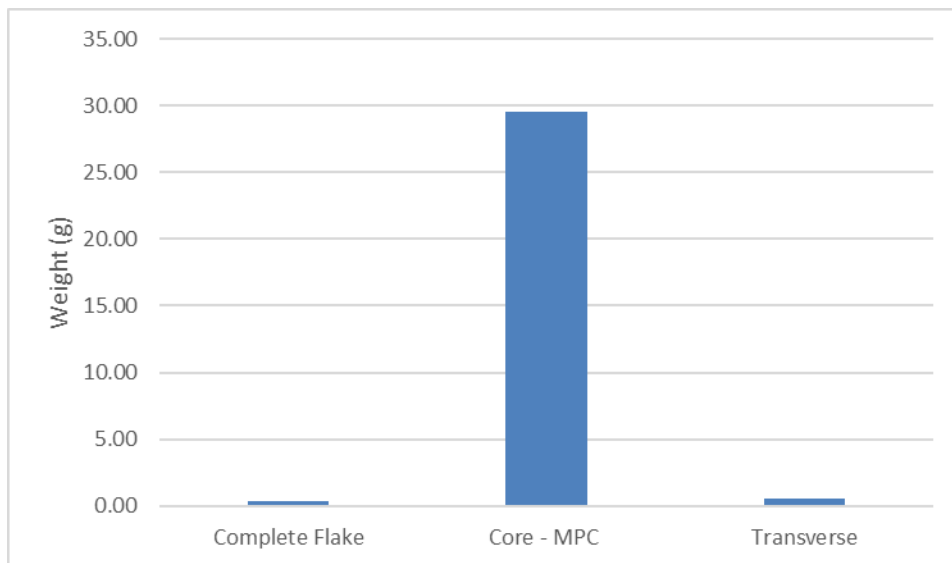


Figure 8.15: Average weight by artefact type



8.2.4.4 Cortex

A total of two artefacts were identified as possessing remnant terrestrial cortex, which accounts for 22.22 per cent of the assemblage. The mean remnant cortex was 57.5 per cent, although the average cortex for complete flakes was 100 per cent while the multiple platform core only featured an average of 15 per cent remnant cortex.

Table 8.14: Summary of artefact cortex

	Number	Max%	Min%	Mean %	SD
All artefacts with cortex	2	100	15	57.5	60.1040764
Complete Flakes with cortex	1	100	100	100	0
MPCs with Cortex	1	15	15	15	0

8.2.4.5 Reduction stages

One complete flake was identified as the product of primary stage reduction, as 100 per cent of the dorsal surface was covered in remnant cortex. A total of two artefacts featured markers of intentional, secondary stage reduction, as they featured less than 100 per cent cortex of the dorsal side and at least one scar. One artefact was identified to be the product of tertiary stage reduction, as it featured retouch.

Meaningful interpretations relating to artefact size cannot be made from fragmented artefacts, as it is difficult to determine the full metrics of an artefact that is incomplete. Artefacts which are the product of early stage reduction tend to be short and wide while artefacts that are products of later stage reduction tend to be long and thin. Across BCBW18 AS 03 (AHIMS ID 45-5-5163), the mean length for the complete flakes was 9.35 mm and the mean width was 11.08 mm. When the length/width ratio of complete flakes is greater than 1, an artefact is likely the product of latter stage reduction; ratios below 1 are likely the result of early stage reduction. The average length/width ratio across the site is

0.87. This indicates that artefacts across the site tend to be the product of early stages of reduction. See Table 8.10 for a summary of the dimensions of complete flakes within the assemblage.

Table 8.15: Summary of artefact dimensions

	Number	Mean	Max	Min	SD
Complete Flake Length	5	9.35	15.28	4.49	4.12
Complete Flake Width	5	11.08	18.52	5.59	5.14
Complete Flake Thickness	5	2.20	3.37	1.36	0.85
Complete Flake Length/Width Ratio		0.87	1.19	0.60	0.22

8.3 Site integrity

Across the study area deposits were generally comprised of a thin humic layer overlaying a 200 -300 mm layer of undisturbed silt, coming down on compact clay interpreted as degraded bedrock. Open areas are subjected to dynamic post depositional processes which significantly compromise the archaeological integrity of the deposit.

No evidence of disturbance to the deposit was noted during the excavation and flood mapping indicates that BCBW18 AS 01 (AHIMS ID 45-5-5162) is located outside the flood zone. Therefore, BCBW18 AS 01 (AHIMS ID 45-5-5162) is considered to be of high archaeological integrity. However, flood mapping has indicated that BCBW18 AS 03 (AHIMS ID 45-5-5163) is located in the medium risk flood zone, with BCBW18 AS 02 (AHIMS ID 45-5-5164) located predominantly across the low risk flood zone. Periodic inundation of the sites would compromise the archaeological integrity of the sites by impacting the spatial distribution of the artefacts within the assemblage.

8.4 Comparative analysis

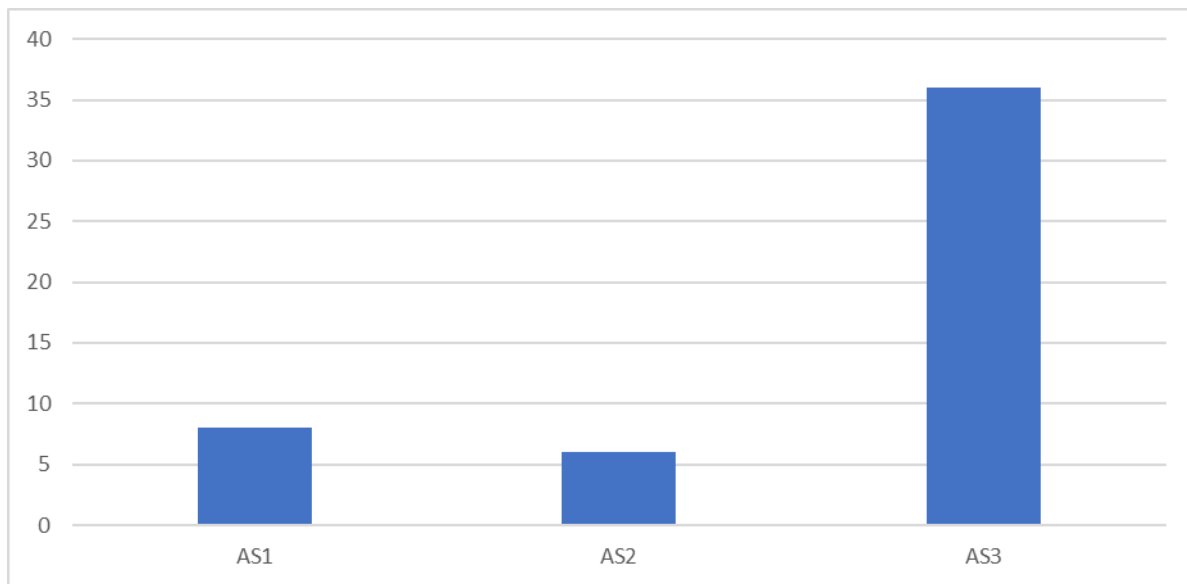
Table 8.16 and Figure 8.16 provides an overview of artefact density for all three sites identified across the study area.

Across the three sites the area was likely a place of repeated occupation by a small, mobile group.

Table 8.16: Comparative artefact density between subsurface assemblages within the study area

Site	Artefact count	Mean artefact density
BCBW18 AS 01 (MOD3)	2	8
BCBW18 AS 02 (MOD4)	21	6
BCBW18 AS 03 (MOD4)	9	36

Figure 8.16: Artefact density across the study area



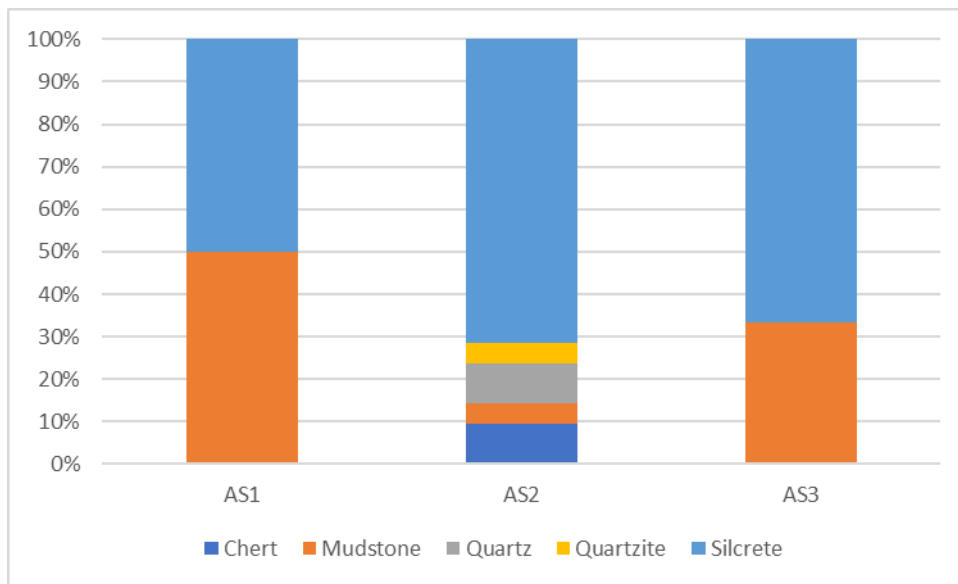
8.4.1 Raw materials

Across the three sites, a total of five raw materials were identified (chert, mudstone, quartz, quartzite and, silcrete). It was found that BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 03 (AHIMS ID 45-5-5163) featured only mudstone and chert, in similar proportions (Table 8.17). BCBW18 AS 02 (AHIMS ID 45-5-5164) contained all five raw materials with silcrete appearing in similar proportions to BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 03 (AHIMS ID 45-5-5163).

The proportions of mudstone within BCBW18 AS 02 (AHIMS ID 45-5-5164) were much lower to accommodate equal proportions of mudstone, chert, quartz, and quartzite. Quartzite and quartz are very hard raw material types with aesthetic values. Chert is a softer material than quartz and quartzite but is valued for its aesthetics.

Based on the raw material types, it is likely that BCBW18 AS 02 (AHIMS ID 45-5-5164) was a place of more permanent occupation. The people who utilised the area engaged in greater logistical mobility to obtain a greater variety of raw materials. The lower variation of raw materials in the BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 03 (AHIMS ID 45-5-5163) assemblage is indicative of ephemeral use of the landscape by a small group of high mobile individuals. However, within the context of all three sites, BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 03 (AHIMS ID 45-5-5163) are likely the result of logistical movement out from BCBW18 AS 02 (AHIMS ID 45-5-5164).

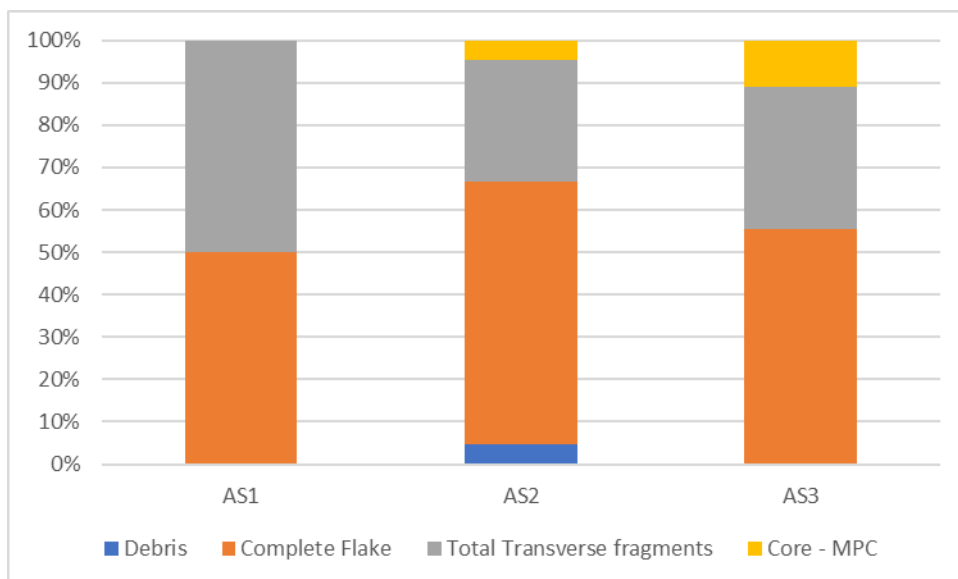
Table 8.17: Comparative percentage raw materials across the study area



8.4.2 Artefact types

Across the three sites, four artefact types were identified (debris, complete flakes, transverse flake fragments, and multiple platform cores). It was found that BCBW18 AS 02 (AHIMS ID 45-5-5164) featured all four artefact types. The presence of debitage and cores are indicative of on-site artefact manufacturing. While BCBW18 AS 03 (AHIMS ID 45-5-5163) also features a multiple platform core there is no direct evidence to indicate that artefact manufacturing occurred there, or if it was just a place that an exhausted core was discarded. BCBW18 AS 01 (AHIMS ID 45-5-5162) only featured two artefact types. Low variation of artefact types in an assemblage are indicative of ephemeral use of the landscape by a small group of high mobile individuals.

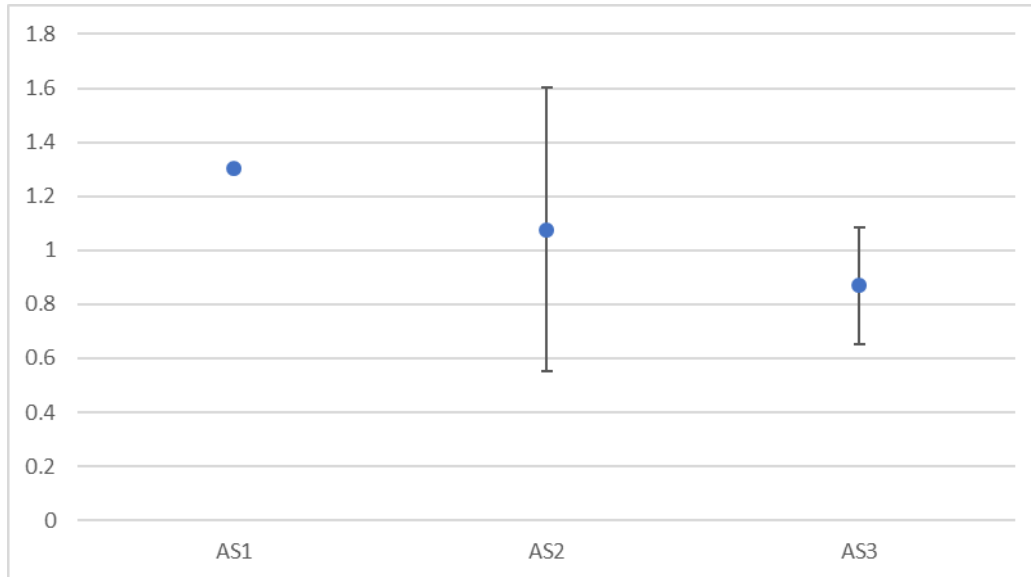
Figure 8.17: Comparative percentage of artefact types across the study area



8.4.3 Size

Comparatively, it was found that BCBW18 AS 01 (AHIMS ID 45-5-5162) and BCBW18 AS 02 (AHIMS ID 45-5-5164) were indicative of later stage reduction, while BCBW18 AS 03 (AHIMS ID 45-5-5163) was indicative of early stage reduction. Figure 8.18 below illustrates the length width ratios across the sites, with standard deviation.

Figure 8.18: Length/width ratio across the study area



8.5 Aboriginal settlement history

8.5.1 Local

The results of the test excavation demonstrate that the study area holds a significant aspect of wider land use activities in the region. BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163) are part of a larger archaeological complex which incorporates BCBW18 AS 01 (AHIMS ID 45-5-5162). The assemblage retrieved from across the complex is indicative of small groups engaging in repeated occupation of the area. Archaeological evidence from across the complex has indicated that the people who occupied the land engaged in artefact manufacturing practices and activities associated with a heat retainer hearth (i.e. heat treatment of artefacts, food preparation). Based on the Eastern Regional Sequence the sites were predicted to date from the early Holocene. However, the results of the radiocarbon dating found that the area was occupied as recently as $2,056 \pm 20$ BP (Wk-48125).

8.5.2 Regional

Mills points 14

Mills points 14 (AHIMS ID 52-2-1108) located 25 km south east of the BCBW18 AS 02 (AHIMS ID 45-5-5164), was dated at $2,160 \pm 80$ BP (Beta-27197). Mills points 14 (AHIMS ID 52-2-1108) is an open campsite featuring a hearth associated with the bipolar knapping of quartz. No bipolar knapping was observed across the study area, and quartz was only present in low concentrations.

Boat Harbour 1

Boat Harbour 1, located 43.7 km south of the study area, involved the excavation of a disturbed midden on the Kurnell Peninsula to further explore the presence of fish hooks in this area. Excavation occurred on an exposed vertical face and identified a 1 m deep interspersed shell midden deposits and sterile sand beneath 1 m of modern sand. The midden was dominated by *Ninella* sp and *Cymatillesta* sp. shell in the upper units and pipi and cockles in the lower unit. Bird, mammal and fish bone were also present. Several fish hooks and fish hook files were recovered from the upper layers and bi-points/bone points from the lower units. Stone artefacts were only found in small numbers and dominated by quartz.

Curracurrang

At Curracurrang, 42.5 km south east of the study area, charcoal samples were dated to 1,930±80 BP (2CU5/-). The deposit was associated with backed blades, edge-ground implements, and 'fabricators' of Bondaian industry.

Jamisons Creek

The closest, dated site to the study area is Jamisons Creek (JC/A3a-12), 18 km north west of the study area. The site is dated at 1,590±130 BP (SUA-1232). Excavations were undertaken of a large body of sand adjacent to Jameson creek. A total of 867 artefacts were recovered from 5.3 square metres and resulted in the identification of two broad phases, Bondaian and Capertian. Bondi points, bipolar pieces and retouched flakes were all only found in the upper phase. Bone and freshwater mussel were also found, as well as worked piece of cockle shell. Artefacts were dominated by chert (70 per cent) with lesser proportions of silcrete (<10 per cent), quartz, basalt and quartzite. Occupation appeared to occur until the 19th century. Excavations reached depths of 1.4 m.

Conclusion

BCBW18 AS 02 (AHIMS ID 45-5-5164) is uncharacteristic of other assemblages dating from approximately 2,000 BP. The majority of assemblages from this period feature bi-polar flaking, backing, lower portions of silcrete, high portions of quartz, and complex formal tools.

9.0 SIGNIFICANCE ASSESSMENT

9.1 Assessment criteria

This significance assessment has been undertaken in accordance with the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in New South Wales (OEH 2011).

Archaeological significance refers to the archaeological or scientific importance of a landscape or area. This is characterised by using archaeological criteria such as archaeological research potential, representativeness and rarity of the archaeological resource and potential for educational values. These are outlined below:

- Research potential: does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state's natural and cultural history?
- Representativeness: how much variability (outside and/or inside the subject area) exists, what is already conserved, how much connectivity is there?
- Rarity: is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practised? Is it in danger of being lost or of exceptional interest?
- Education potential: does the subject area contain teaching sites or sites that might have teaching potential?

Cultural values and significance of the study area are discussed in the ACHARs (Artefact Heritage 2018b and c).

9.2 Archaeological significance assessment

The archaeological test excavation program within the study area identified four new sites. Assessment of the scientific significance of the artefact site locations considers the following aspects of the test excavation results:

- Presence of a variety of artefact types and raw material types
- Potential for artefact assemblages to answer questions about raw material sourcing and site use
- The portions of the study area that have been tested have been assessed to have moderate archaeological sensitivity
- Landforms with steep gradients are unlikely to yield artefacts
- The remainder of the site showed a low-density scatter across the study area with isolated areas of concentrated artefact densities

A summary of the archaeological significance of sites identified during test excavation is presented in Table 9.1.

Table 9.1: Significance assessment

Site name (AHIMS ID)	Research potential	Representativeness	Rarity	Education potential	Overall significance assessment
BCBW18 AS 01 (AHIMS ID 45-5-5162)	Low	Low	Low	Low	Low
BCBW18 AS 02 (AHIMS ID 45-5-5164)	High	Moderate	High	High	High
BCBW18 AS 03 (AHIMS ID 45-5-5163)	Low	Low	Low	Low	Low
BCBW18 IF 01 (AHIMS ID 45-5-5165)	Low	Low	Low	Low	Low

9.2.1 BCBW18 AS 01 (AHIMS ID 45-5-5162)

BCBW18 AS 01 (AHIMS ID 45-5-5162) is a low-density artefact scatter. The assemblage did not feature any especially representative or rare artefact types or raw materials. Therefore, the site is considered to be of low archaeological significance.

9.2.2 BCBW18 AS 02 (AHIMS ID 45-5-5164)

BCBW18 AS 02 (AHIMS ID 45-5-5164) is a low-density subsurface artefact scatter located on an intact landform. The site features a clay heat retainer hearth, which is extremely rare within the regional context. The intact nature of the deposit presents an opportunity to use the obtained carbon dates to contribute towards a regional sequence of artefact assemblages. Due to the high research potential and rarity of the site, BCBW18 AS 02 (AHIMS ID 45-5-5164) is considered to be of high scientific significance. However, the remainder of the site is considered to be of low significance and potential.

9.2.3 BCBW18 AS 03 (AHIMS ID 45-5-5163)

BCBW18 AS 03 (AHIMS ID 45-5-5163) is a high density subsurface artefact scatter located on an intact landform. The site does not feature any especially significant artefact types or raw materials but is unusual due to the high concentration of artefacts in a small area. The presence of a multiple platform core indicates that the site could be a reduction area, however no debris was identified to support this conclusion. The site is also significant due to its association with BCBW18 AS 02 (AHIMS ID 45-5-5164) and its associated hearth feature. However, as the site is located in a medium risk flood area, the archaeological integrity of the site has been impacted and the spatial distribution of artefacts compromised. Therefore, the BCBW18 AS 03 (AHIMS ID 45-5-5163) is considered to be of low significance.

9.2.4 BCBW18 IF 01 (AHIMS ID 45-5-5165)

BCBW18 IF 01 (AHIMS ID 45-5-5165) is an isolated surface artefact located in a moderately disturbed context. Due to the lack of archaeological integrity the site is considered to be of low scientific significance.

10.0 IMPACT ASSESSMENT

10.1 Proposed works

CSR are proposing various changes to the approved project. Some of these changes are located within the approved project boundary on land that was previously assessed and approved for disturbance. Other changes are located on CSR owned land, outside and immediately east of the approved project boundary, in the area defined as the 'study area' in Section 1.2. It is these changes that require further ground disturbance that was not assessed under the approved project, that need to be assessed for Aboriginal heritage values as part of the proposed MOD3 and MOD4. Works proposed in the study area under MOD3 include construction of the roof products manufacturing facility.

MOD3 will include the construction and operation of a roof products manufacturing facility. The new roof products manufacturing facility and associated infrastructure would cover a total site area of 68,000 square metres which would include:

- Approximately 5810 square metres factory for housing the roof products manufacturing plant
- The future Monier expansion area covers approximately 2.3 ha
- Approximately 42,890 square metres concrete hardstand area for the storage of finished products
- Yard/batten storage shed footprint of approximately 1,000 square metres
- Guardhouse of approximately 75 square metres
- Storage Shed and Drivers Amenities of approximately 1,000 square metres
- Wind tunnel of approximately 100 square metres
- Three 100,000 litre rainwater tanks
- 46 light vehicle car parking spaces in a 1,174 square metres bitumen sealed carpark
- Weighbridge
- Stormwater basin
- Access road (1,821 square metres bitumen sealed).

Under MOD4, CSR propose to construct a grid connected solar farm within the study area. This will allow energy security through a more diverse energy mix, initiate a clean renewable energy source on-site, reduce the greenhouse gas emissions that contribute to global warming and improve the land utilisation on the eastern flank, outside of the approved project boundary. Details are unavailable for the design of the solar farm but it is likely to comprise solar panels on poles with a concrete pad at the base.

10.2 Impacts of the proposed works

The current test excavation program has provided evidence for the presence of Aboriginal objects within the study area. A summary of the impacts to sites identified during test excavation and additional survey is provided in Table 10.1. This assessment is based on the impact area, which includes the areas required for construction of the proposed manufacturing facility, sediment basin, and future expansion.

CSR has indicated a preference towards conserving portions of BCBW18 AS 02 (AHIMS ID 45-5-5164) for artefact reburial. This impact assessment is based on the understanding that a 10 m exclusion zone will be established around the hearth in BCBW18 AS 02 (AHIMS ID 45-5-5164).

Further information regarding impact to the Aboriginal archaeological sites identified within the study area is located within the ACHARs (Artefact Heritage 2018b and c).

Table 10.1: Impact assessment

Site name (AHIMS ID)	Type of harm	Degree of harm	Consequence of harm
BCBW18 AS 01 (AHIMS ID 45-5-5162)	Direct	Total	Total loss of value
BCBW18 AS 02 (AHIMS ID 45-5-5164)	Direct	Partial	Partial loss of value
BCBW18 AS 03 (AHIMS ID 45-5-5163)	None	None	No loss of value
BCBW18 IF 01 (AHIMS ID 45-5-5165)	Direct	Total	Partial loss of value

Figure 10.1: Location of sites in relation to impact area

Map removed for public exhibition

11.0 MITIGATION AND MANAGEMENT

11.1 Guiding principles

The overall guiding principle for cultural heritage management is that where possible Aboriginal sites should be conserved. If conservation is not practicable, measures should be taken to mitigate against impacts to Aboriginal sites.

The nature of the mitigation measures recommended is based on the assessed significance of the sites. The final recommendations would also be informed by cultural significance, which will be discussed by the Aboriginal community in their responses during the next stage of consultation, outlined in the ACHARs (Artefact Heritage 2018b and c).

11.2 Conservation

BCBW18 AS 02 (AHIMS ID 45-5-5164) has been assessed as demonstrating high archaeological significance due to presence of a clay heat retainer hearth. CSR have stated that a 10 m buffer will be established around the hearth feature and have proposed that all artefacts retrieved during survey and subsurface test excavation for be reburied within the exclusion zone for the hearth.

11.3 Surface collection

To mitigate against the destruction of identified Aboriginal cultural heritage objects, it is recommended that the RAPs are provided with the opportunity to conduct a surface collection of BCBW18 IF 01 (AHIMS ID 45-5-5165) concurrently with the reburial.

11.4 Salvage excavations

BCBW18 AS 01 (AHIMS ID 45-5-5162) has been assessed as demonstrating low scientific significance due to the extremely low density. It is highly likely that the majority of the assemblage in the site area has been removed through the test excavation and therefore, salvage is not recommended.

The majority of BCBW18 AS 02 (AHIMS ID 45-5-5164) will not be impacted by the proposed works. The most significant portion of BCBW18 AS 02 (AHIMS ID 45-5-5164), is the hearth feature, which will not be impacted by the proposed work and will be protected by a 10 m buffer under the MOD4 works. The impact area has been comprehensively tested through the test excavation program, which found that the highest concentrations of artefacts are located nearest the creekline. Therefore, it is unlikely that significant archaeological materials will be retrieved from salvage excavations within the impact area. No salvage excavations are recommended for the portions of BCBW18 AS 02 (AHIMS ID 45-5-5164), impacted by the works.

BCBW18 AS 03 (AHIMS ID 45-5-5163) will not be impacted by the proposed works and therefore, salvage is not recommended.

11.5 Long term management of test excavation artefact assemblage

Consultation with the RAPs as part of this assessment has indicated that appropriate long-term management strategy for the artefacts retrieved from the test excavation is that, all retrieved material be reburied on site at a location that has been reserved for no future impact. Further information

regarding the consultation process and the location of the reburial is included in the ACHARs (Artefact Heritage 2018b and c).

CSR has amended design plans to conserve the entire extent of the hearth feature within BCBW18 AS 02 (AHIMS ID 45-5-5164) with a 10 m buffer. CSR have proposed that all artefacts retrieved during the survey and subsurface test excavation for both MOD3 and MOD4 be reburied within the hearth's exclusion zone.

11.6 Heritage Interpretation Strategy

Impacts can be further mitigated through interpretation that acknowledges the Aboriginal occupation and utilisation of the study area. In consultation with RAPs, a Heritage Interpretation Strategy must be prepared, and implemented, which addresses the cultural significance of this location within the Dharawal landscape and the archaeological finds from the study area. Methods of incorporating identified Aboriginal heritage values into the design process could include interpretive displays and artistic elements within the new premises, and external elements such as paving components and plantings, providing information on Aboriginal land-use and life-ways within the study area and surrounds. Samples or reconstructions of the archaeological finds could be considered for incorporation into the internal interpretive elements.

Any strategy for interpretation must be developed in consultation with the RAPs.

12.0 RECOMMENDATIONS

The following recommendations are based on consideration of:

- Statutory requirements under the *National Parks and Wildlife Act 1974* as amended
- The results of this archaeological technical report
- The interests of the Aboriginal stakeholder groups
- The likely impacts of the proposed development.

It was found that:

- Three new subsurface sites (BCBW18 AS 01 (AHIMS ID 45-5-5162), BCBW18 AS 02 (AHIMS ID 45-5-5164) and BCBW18 AS 03 (AHIMS ID 45-5-5163)) were identified during subsurface testing:
 - BCBW18 AS 01 (AHIMS ID 45-5-5162) is a low-density artefact scatter and was assessed as being of low scientific significance
 - BCBW18 AS 02 (AHIMS ID 45-5-5164) is a low-density artefact scatter with a heat retainer hearth feature. This site type is considered rare and of high research potential.
 - BCBW18 AS 03 (AHIMS ID 45-5-5163) is a high-density artefact scatter that is considered to be of low scientific significance.
- One newly recorded surface site (BCBW18 IF 01 (AHIMS ID 45-5-5165)) was identified during the survey

It is therefore recommended that:

- An Aboriginal Cultural Heritage Assessment Report (ACHAR) must be prepared in compliance with the Aboriginal heritage requirements of PA10_0014.
- Collection of surface artefacts across BCBW18 IF 01 (AHIMS ID 45-5-5165) must be conducted prior to the commencement of the proposed works
- A conservation area with a 10 m buffer be placed around the hearth feature portion of BCBW18 AS 02 (AHIMS ID 45-5-5164)
- Long term arrangements for the management of excavated artefacts, involve reburial within the location specified in the ACHARs (Artefact Heritage 2018b and c).

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14.0 APPENDICES

APPENDIX 1 - 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 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 stakeholders: Members of a local Aboriginal land council, Aboriginal groups or other Aboriginal people who have registered their interest with the RTA to be consulted about a proposed RTA project or activity

AHIMS: Acronym for 'Aboriginal heritage information management system'. AHIMS is a register that contains information about NSW Aboriginal heritage, and it is maintained by DECCW.

Alluvium: A deposit left by the flow of water. It can include sediments of gravel, mud or sand.

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).

Archaeology: The scientific study of human history, with focus on material remains and ethnographic evidence.

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: An item of cultural material created by humans.

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

Backed blade/ artefact: Bladelets that have one edge blunted by steep retouch to form a back.

Basalt: A common volcanic rock. It is fine grained (approximately 45-50 per cent silica) and rich in iron and magnesium.

Baseline: A line that is the base for measurement or for construction

Bedrock: A consolidated rock that is unbroken and un-weathered, located beneath soil or rock fragments.

Bifacial flaking: The removal of flakes from two faces of a single platform.

Bipolar: A method of flaking stone, especially quartz, where cores are rested upon an anvil during flaking.

Bipolar core: A core used to create bipolar flakes.

Blade: A stone flake that is at least twice as long as it is wide.

Bioturbation: Disturbance in soil profiles caused by living organisms, such as ants and roots.

Bora ground: These are usually identified as flat, mounded earth rings that were used for Aboriginal ceremonial activities.

Bulb of percussion: A partial cone of force produced when a flake is struck off a core. The cone occurs on the ventral (inside surface) of the flake.

Burials: Burial sites may be composed of a single burial, isolated individuals in a general area, or cemeteries containing many individuals.

Carved/ modified trees: Carved trees exhibit evidence of purposeful removal of bark but differ from scarred trees in that geometric patterns and figures are cut into the tree. The motifs of the mid-north coast region are mostly linear geometric patterns (Craib and Bonhomme 1995: 27).

Chalcedony: A mineral with high silica content that has a microcrystalline structure. It is often described as 'waxy' and can be translucent. It is found in a variety of colours such as white, grey, greyish-blue or brown.

Chert: A fine grained rock composed of cryptocrystalline silica. It exhibits a range of textures and colours including red, green or black. Chert is easy to work and retains a sharp edge for an extensive period of time before resharpening is required. It has a low to medium fracture toughness.

Clast: A broken fragment of rock or crystal particle that was created either through erosion or weathering.

Clay: A type of sediment with particles less than 4 microns in size and that is composed of clay minerals (Keary 2001: 49).

Conglomerate: Is a geological term used to describe clasts that are cemented in a fine-grained matrix. It is a sedimentary rock.

Core: A stone piece from which a flake has been removed by percussion (striking it) or by pressure. It is identified by the presence of flake scars showing the negative attributes of flakes, from where flakes have been removed.

Cortical platform: This term is used to describe a platform that has cortex present and may indicate that the core's surface (where the flake was struck) was previously un-worked.

Cortex: The outer weathered surface of stone; if smooth, it can indicate the source of stone was a pebble.

Crushed platform: This term is used to describe a flake that has a damaged platform and where the platform's attributes cannot be recorded as a result.

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

Debitage: Small, unmodified flakes produced as part of the flaking process, but discarded unused.

Distal: Term of view used to describe the lower portion of a flake in respect to where the striking force terminates.

Distal flake: A broken flake with the presence of a termination and the absence of a platform or impact point.

Dorsal: The side of a flake that was originally part of the core's outer surface (often referred to as the 'dorsal surface').

Easting: This is a measurement used to determine location. The easting is the x-coordinate and relates to the vertical lines on a map, which divide east to west. It increases in size when moving further east.

Edge damage: Where the edge of a tool has been used, resulting in microscopic fractures along the surface.

Exposure: The level of ground exposure is based on whether the landform is eroding, aggrading or stable.

Faceted platform: A faceted platform has three or more flake scars present on its surface.

Feather termination: A feather termination has a 'minimal thickness at the distal end and an acute angle between the dorsal and ventral surfaces' (Holdaway and Stern 2008: 129). In appearance, a feather termination becomes gradually thinner towards the end of the flake.

Fine grained siliceous material: A rock that has a high content of silica and that is fine grained in appearance without any further identifying characteristics.

Flake: A stone piece removed from a core by percussion (striking it) or by pressure. It is identified by the presence of a striking platform and bulb of percussion, not usually found on a naturally shattered stone.

Flake scar: Often called a 'negative flake scar', it is the remnant of a previous flake that was struck from the core. This appears on the dorsal surface of a flake.

Flaked fragment: This is a chipped stone artefact which cannot be classed as a flake, core or retouched flake, the reason being that the defining attributes are missing. This often happens when a core contains a number of incipient fracture planes. Artefacts that are heavily weathered or which have been shattered in a fire are also difficult to categorise.

Flaked platform: This term is used to describe a platform that has been worked previously; one or more flakes were removed prior.

Floodplain: The area covered by water during a major flood and/or the area of alluvium deposits laid down during past floods.

Fluvial: Pertaining to or produced from a river.

Focalised platform: A small platform that is intentionally prepared for percussion by overhang removal.

Footprint: The scale, extent or mark that a development makes on the land in relation to its surroundings.

Geometric microliths: Backed at one end, the other end or both, these tools are made on geometric shaped flakes, <80 mm maximum dimension.

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

Hammerstone: A piece of stone used to knock flakes from a core. Evidence of pitting or bashing can usually be seen along some part of the margins of this artefact.

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.

Holocene: The Holocene epoch forms part of the late Quaternary period and extends from about 11,000 years ago to the present day.

Humic: Soil that contains organic matter (from 'humus').

Igneous: After magma or lava cools and solidifies, it forms igneous rock. This can happen in volcanic and plutonic (under the surface of the earth) scenarios. An example of this is basalt.

In situ: A description of any cultural material that lies undisturbed in its original point of deposition.

Ironstone: A type of sedimentary rock that contains iron.

Knapping: The removal of flakes and flaked pieces from a stone core by the use of percussion.

Layer: In stratigraphy, it is used to describe a horizon (soil, rock, charcoal) that is distinct from its surrounds.

Landform: Description for an area of land based on an assessment of a series of environmental characteristics including geology, geomorphology, soils and vegetation.

Loam: Soil that contains roughly equal concentrations of silt, sand and clay.

Longitudinally split flake: This is a flake that is broken (split) from the point of percussion (the strike) through to the termination.

Manuport: An unmodified piece of stone transported to a site by humans.

Medial: Term of view referring to the intermediate section or middle section of a broken flake.

Medial flake: Absence of proximal and distal margins, but with an identifiable ventral surface.

Metamorphism: The process where an existing rock (which can be sedimentary or igneous) is transformed into another mineral through the application of temperature and pressure. An example of this is hornfels.

Mudstone: A sedimentary rock formed from mud/clay.

Muller: A large stone artefact which differs in construction depending on the environment. These were used as an aide for processing seeds and other low return plant material or ochre.

Multiple platform core: Is a core with more than one identifiable platform.

Munsell colour: This is a colour code chart used to standardise colour specifications.

Non-diagnostic: An amorphous piece of stone that is neither a flake, flaked fragment, core or retouched flake.

Northing: This is a measurement used to determine location. The northing is the y-coordinate and relates to the horizontal lines on a map, which divide north to south. It increases in size when moving further north.

Notched tool: Flakes that exhibit a small area of retouch, forming a concave edge on lateral or distal margin.

Oriented length: This is a measurement taken from the point of impact through to the termination.

Oriented thickness: This is a measurement taken from where the oriented width and oriented length intersect.

Oriented width: This is a measurement taken across the middle of a flake (halfway between the point of impact and the termination).

Overhang removal: This occurs when a platform is prepared for striking; small flakes are struck before a flake is detached, leaving visible scars behind.

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.

pH: A measure of the acidity or alkalinity of the soil. Neutral is indicated by a pH of 7, with strongly acidic being 0 and strongly basic (alkaline) being 14. The 'pH' is said to stand for 'potential of hydrogen'.

Platform: On a flake, this is a core remnant from where the flake was struck off the core.

Platform width: This is a measurement taken across the width of a platform between the two lateral margins of a flake.

Platform thickness: This is a measurement taken from the ventral to dorsal surfaces of a flake (beginning at the point of impact/percussion).

Plunge termination: This occurs when the ventral surface 'curves markedly away from the face of a core...and continues directly into the core, removing the base of the core' (Holdaway and Stern 2008: 132). This can present as a 'J' shape when holding the flake in profile.

Proximal: Term of view used to describe the upper portion of a flake in respect from where it was initially struck off a core.

Proximal flake: A broken flake with the presence of a platform, but the absence of a termination.

Pot-lidded: The damage caused by exposure to extreme heat, resulting in a circular depression on the surface of a stone artefact.

Pressure flaking: A process to remove a flake from a core by applying pressure (from a piece of wood or bone) along the core's edge.

Quarry: In this report, 'quarry' can refer to a native source of stone that was mined by Aboriginal people in the past. Rock from these sites could be used to make artefacts.

Quartz: A mineral composed of silica with an irregular fracture pattern. The quartz used in artefact manufacture is generally semi-translucent, although it varies from milky white to glassy. Glassy quartz can be used for conchoidal flaking, but poorer quality material is more commonly used for block fracturing techniques. Quartz can be derived from water worn pebbles, crystalline or vein (terrestrial) sources.

Quartzite: A form of metamorphosed sandstone. It is often white or grey in colour but can occur in other shades due to mineral impurities.

Reduction: the process of fashioning stone from its natural state into tools or weapons by removing some parts.

Refit: Knapping is a reductive technology. As such, it is possible to 'refit' tools back together after breakage or knapping (i.e. refitting a proximal and distal flake back together or refitting a flake back to the core it was knapped from).

Resource area: An area of the landscape or part of the environment that provides a resource (be it food or material items such as a source of stone for making artefacts) for Aboriginal people. Swamps are good examples of rich resource zones.

Retouch: A flake, flaked piece or core with intentional secondary flaking along one or more edges.

Sand: A material composed of small grains (0.625-2.0 mm) (Keary 2001: 233). Sand is formed from a variety of minerals and rocks, but commonly contains silica, such as quartz.

Sandstone: Is a sedimentary rock formed from sand-sized grains.

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.

Sediment: Is a mineral that has undergone erosion or weathering and that is then deposited via aeolian, glacial or fluvial means.

Sedimentary: Sedimentary rock is formed through the accumulation of sediment deposits that are then consolidated. An example of this is mudstone.

Shale: A sedimentary rock of well-defined layers comprised of small particles (less than 4 microns in size) (Keary 2001: 16) sourced from weathered or eroded materials.

Significant ground disturbance: Means disturbance of (a) the topsoil or surface rock layer of the ground; or (b) a waterway, by machinery in the course of grading, excavating, digging, dredging or deep ripping, but does not include ploughing other than deep ripping.

Silt: A sediment with grains ranging from 4.0-62.5 microns in size (Keary 2001: 245). It can be found as a soil or in water.

Single platform core: Is a core with one identifiable platform.

Scraper: A stone tool, usually with steep retouch along its edges that was ethnographically used to make wooden implements or process foods and other resources.

Silcrete: Soil, clay or sand sediments that have silicified under basalt through groundwater percolation. It ranges in texture from very fine grained to coarse grained. At one extreme it is cryptocrystalline with very few clasts. It generally has characteristic yellow streaks of titanium oxide that occur within a grey and less commonly reddish background. Used for flaked stone artefacts.

Spit: Refers to an arbitrarily defined strata of soil removed during excavation (often 50 millimetres to 100 millimetres in depth).

Step termination: This occurs when a 'flake terminates abruptly in a right-angle break' (Holdaway and Stern 2008: 130).

Stratification: The way in which soil forms in layers.

Stratigraphy: The study of soil stratification (layers) and deposition.

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.

Survey: In archaeological terms, this refers to walking over a surface while studying the location of artefacts and landmarks. These are then recorded and photographed.

Termination: Refers to the shape of the distal end of a flake.

Tool: A stone flake that has undergone secondary flaking or retouch.

Usewear: A pattern of wear that is left on a stone artefact due to utilisation.

Ventral: The side of a flake that was originally attached to the core (often called the 'ventral surface'). Features such as the bulb of percussion are found on this surface of a flake.

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 2 – SECRETARY’S ENVIRONMENTAL ASSESSMENT REQUIREMENTS MP10_ 0014 MOD3

Removed for public exhibition

APPENDIX 3 – ARTEFACT CATALOGUE

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APPENDIX 4 – AHIMS DATA

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APPENDIX 4 – AHIMS SITE CARDS

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APPENDIX 5 – AHIMS SEARCH DATA

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APPENDIX 6 – SECRETARY’S ENVIRONMENTAL ASSESSMENT REQUIREMENTS MP10_ 0014 MOD3

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