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AUSTRAL ARCHAEOLOGY

YIRIBANA LOGISTICS ESTATE WEST 771-797 MAMRE ROAD KEMPS CREEK, YIRIBANA WEST NEW SOUTH WALES

ABORIGINAL CULTURAL HERITAGE ASSESSMENT

FINAL REPORT

GPT GROUP

14 April 2023

The GPT Group

DOCUMENT INFORMATION

Project:	Yiribana Logistics Estate West: 771-797 Mamre Road Kemps Creek, NSW ACHA
Services required:	ACHA
Client:	GPT Group
Prepared by:	Taylor Foster, Declan Coman, Dominique Bezzina
Project number:	22040

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EXECUTIVE SUMMARY

This report has been prepared for GPT Group and details the Aboriginal Cultural Heritage Assessment (ACHA) of land situated at 771-797 Mamre Road, Kemps Creek, New South Wales (NSW) [the study area], within the Penrith Local Government Areas (LGAs), and the parish of Melville in the county of Cumberland.

The study area is defined by the boundary of Lot 23 and Lot 24/ DP 258414. The study area is located in the suburb of Kemps Creek. It is bounded to the east by Mamre Road, to the south by is the township of Kemps Creek and to the west by South Creek.

This ACHA was undertaken to assess the archaeological potential for Aboriginal material as part of a Development Application (DA) being prepared under Part 4 of the *Environmental Planning and Assessment Act 1979*, before the proposed subdivision and development of the study area. The ACHA has been undertaken in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment Climate Change and Water NSW 2010).

A search of the Heritage NSW AHIMS database was undertaken on 14 April 2022 (Client Service ID 675711, 675713, 675716, 675717 and 675718). The results from the AHIMS search identified 395 previously recorded sites within a 10-kilometre radius of the study area. The search indicates that artefacts are the predominant site type with just over 95% of known sites containing this feature. While their occurrence in the local archaeological record is minimal, modified trees and grinding grooves have been known to occur within the Kemps Creek region and as such may occur within the study area. No previously recorded AHIMS sites were located within the study area.

No new Aboriginal cultural heritage objects were identified during the survey; however, five areas of PAD were identified within the designated lots. Only one area of PAD is within the impact footprint. Archaeological testing was not completed for areas of PADs that are not proposed to be impacted by the proposed activity, however, some PADs may be tested to ensure that they do not extend into proposed works areas or impacts may be mitigated following the completion of the testing program through alterations to the proposed works.

PAD	Description	No. test pits*
PAD 4	PAD 4 is located within an elevated flat landform approximately 600 metres east of South Creek and directly south of an unnamed tributary.	144

Based upon the results of the archaeological survey, Austral completed archaeological test excavations within PAD 4, an area of moderate archaeological potential located in the southern central portion of the study area. The test excavation program in PAD 4 comprised 10 transects with a total of 126 test pits and 12 expansion shovel test pits. One Aboriginal site was identified during the testing program, which comprised a high-density subsurface artefact deposit.

The Aboriginal sites identified during this ACHA are described, along with their significance in the table below:

Site / AHIMS	Aboriginal cultural heritage values
Yiribana AS 1/ AHIMS # 45-5-5678	Yiribana AS 1 (AHIMS # 45-5-5678) is an Artefact Scatter which contains a range of stone artefacts, including artefacts manufactured from silcrete, fine-grained siliceous material, chert, quartz and quartzite. The site contained a total of 547 artefacts, 546 of these being stone artefacts. The stone artefacts included flakes, flaked pieces, longitudinal split flakes, cores, flaked fragments and distal flakes. The site is located on an undulating flat approximately 500 metres east of South Creek, 500 metres northeast of Kemps Creek and directly south on an unnamed tributary. Yiribana AS 1 (AHIMS # 45-5-5678) has been assessed to have research and, social or spiritual significance.

Site / AHIMS	Aboriginal cultural heritage values
Yiribana PAD 1 / AHIMS # 45-5-5675	Yiribana PAD 1 (AHIMS # 45-5-5675) is a potential archaeological deposit with high potential located adjacent to an unnamed second order stream, approximately 485 metres west of Mamre Road. The site is within a flat on an undulating plain landform. The land use in the area is subject to pastoral/grazing. Yiribana PAD 1 (AHIMS # 45-5-5675) has indeterminate significance.
Yiribana PAD 2 / AHIMS # 45-5-5676	Yiribana PAD 2 (AHIMS # 45-5-5676) is a potential archaeological deposit with moderate potential located east-adjacent South Creek. The site is located on a flat on an undulating plain landform approximately 990 metres west of Mamre Road. The land use in the area is subject to pastoral/grazing. Yiribana PAD 2 (AHIMS # 45-5-5676) has indeterminate significance.
Yiribana PAD 3 / AHIMS # 45-5-5677	Yiribana PAD 3 (AHIMS # 45-5-5677) is a potential archaeological deposit with moderate potential located near South Creek and a second order stream. The site is located on a flat on an undulating plain landform approximately 730 metres west of Mamre Road. The land use in the area is subject to pastoral/grazing. Yiribana PAD 3 (AHIMS # 45-5-5677) has indeterminate significance.

ABORIGINAL COMMUNITY CONSULTATION

Consultation with Aboriginal stakeholders has been completed in accordance with the Consultation Requirements (DECCW 2010a). A summary of this process is included below.

Stage	Component	Commenced	Completed
Stage 1	Letters to agencies	01/04/22	N/A
	Registration of stakeholders	12/04/22	26/04/22
Stage 2	Project information	8/05/22	N/A
Stage 3	Review of project methodology	8/05/22	5/06/22
Stage 4	Review of ACHA by Aboriginal stakeholders	09/03/2023	06/04/2023

Further information on the consultation completed for the project can be found in Section 2 and Volume 2 of this report.

IMPACT ASSESSMENT

The proposed activity consists of the construction of a pump station, three warehouses, their associated carparks and access roads. Two seal roads are to be constructed, one running along the north boundary cutting across the centre of the site heading south, and one running north to south. This project will disturb and alter the surface conditions of the study area, some of which has previous disturbance due to the demolishing of the previous dwelling. No culturally modified vegetation will be impacted by the proposed works.

The development is proposed to be undertaken across two stages with two separate development applications.

STAGE 1 WORKS

Stage 1 includes the development of two warehouses in the east of the development, along with the north-south road and associated infrastructure. This will be associated with the first Development Application.

STAGE 2 WORKS

Stage 2 includes the development of the warehouse in the centre of the development, along with the northern road and associated infrastructure. This will be associated with the second Development Application.

This ACHA has included a programme of investigations that have characterised the nature, extent and significance of Aboriginal sites within the study area.

The proposed Stage 1 works have no foreseeable impact on known archaeological values.

The proposed Stage 2 works will impact one known archaeological site, Yiribana AS1 / AHIMS # 45-5-5678, through the excavation and construction the proposed centre warehouse, northern road and associated infrastructure.

An evaluation of harm to the Aboriginal sites identified as part of the ACHA is summarised below:

Site name / AHIMS No.	Type of harm	Degree of harm	Consequence of harm
Yiribana AS 1/ AHIMS # 45-5-5678	Direct	Total	Total loss of value
Yiribana PAD 1 / AHIMS # 45-5-5675	None	None	No loss of value
Yiribana PAD 2 / AHIMS # 45-5-5676	None	None	No loss of value
Yiribana PAD 3 / AHIMS # 45-5-5677	None	None	No loss of value

RECOMMENDATIONS

The following recommendations are derived from the findings described in this ACHA. The recommendations have been developed after considering the archaeological context, environmental information, consultation with the local Aboriginal community, and the findings of the test excavation and the predicted impact of the planning proposal on archaeological resources.

It is recommended that:

1. No further investigation is required before the commencement of the Stage 1 works. Exclusion fencing and barriers should be placed around the designated Stage 2 works area during Stage 1 construction and this area must be identified on all construction plans as a no-go area.
2. If unexpected finds occur during any activity within the Stage 1 works study area, all works in the vicinity must cease immediately. The find must be left in place and protected from any further harm. Depending on the nature of the find, the following processes must be followed:
    1. If, while undertaking the activity, an Aboriginal object is identified, it is a legal requirement under Section 89A of the NPW Act to notify Heritage NSW, as soon as possible. Further investigations and an AHIP may be required prior to certain activities recommencing.
    2. If, human skeletal remains are encountered, all work must cease immediately and NSW Police must be contacted, they will then notify the Coroner's Office. Following this, if the remains are believed to be of Aboriginal origin, then the Aboriginal stakeholders and Heritage NSW must be notified.
3. Before the Stage 2 works occur, GPT Group are to apply to Heritage NSW for an Aboriginal Heritage Impact Permit (AHIP) to salvage Yiribana AS 1 (AHIMS # 45-5-5678). This site is protected under Section 90 of the *NSW National Parks and Wildlife Act 1974* (NPW Act). It is recommended that the following mitigation measures are implemented as part of the AHIP:
    1. Salvage of Yiribana AS 1 (AHIMS # 45-5-5678).
    2. Exclusion fencing and barriers should be placed around Yiribana PAD 1 (AHIMS #45-5-56-75), Yiribana PAD 2 (AHIMS # 52-5-5676) and Yiribana PAD 3 (AHIMS # 52-5-5677) during construction and these sites must be identified on all construction plans as no-go areas.
    3. All Aboriginal objects collected during the archaeological testing and anticipated salvage works (under the approved AHIP) will be reburied onsite at the nominated location to be determined during stage 4 of consultation with the registered stakeholders.
4. It is recommended that GPT Group continues to inform the Aboriginal stakeholders about the management of Aboriginal cultural heritage within the study area throughout the completion of the project. The consultation outlined as part of this ACHA is valid for six

months and must be maintained by the proponent for it to remain continuous. If a gap of more than six months occurs, then the consultation will not be suitable to support an AHIP for the project.

5. A copy of this report should be forwarded to all Aboriginal stakeholder groups who have registered an interest in the project.

CONTENTS

FIGURES

TABLES

1 INTRODUCTION

Austral Archaeology Pty Ltd (Austral) has been commissioned by GPT Group (the proponent) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) for the property at 771-797 Mamre Road Kemps Creek, Yiribana West, New South Wales (NSW) [the study area]. The location of the study area is shown in Figure 1.1, Figure 1.2 and Figure 1.3.

1.1 THE STUDY AREA

The study area consists of the entirety of 771-797 Mamre Road Kemps Creek, Yiribana West, New South Wales, NSW (Lots 23 and 24 DP258414), located approximately 6.8 kilometres from the township of Kemps Creek, within the Penrith Local Government Areas (LGA), and the parish of Melville in the county of Cumberland. It is also within the boundaries of the Deerubbin Local Aboriginal Council (DLALC). It is bounded to the east by Mamre Road, to the south by the township of Kemps Creek and to the west by South Creek.

1.2 PURPOSE OF THE ACHA

The ACHA was undertaken to assess the potential harm that may occur to Aboriginal cultural heritage values as part of a Development Application under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), for the development of the study area.

The project involves the construction of a pump station, three warehouses, their associated carparks and access roads. Two sealed roads are to be constructed, one running along the northern boundary cutting across the centre of the site heading south, and one running north to south.

This project will disturb and alter the surface conditions of the study area which has previous disturbance due to the demolishment of the previous dwelling, no culturally modified vegetation will be impacted by the proposed works. As the project area is situated within a region of high sensitivity for the presence of Aboriginal sites and involves the movement of heavy vehicles for the completion of the proposed works, an ACHA will be required to conduct the archaeological assessments of the study area.

1.3 ASSESSMENT OBJECTIVES

The scope of this ACHA report is based on the legal requirements, guidelines and policies of the Heritage NSW, formerly the Office of Environment and Heritage (OEH), formerly, the Department of Environment, Climate Change and Water (DECCW), Department of Environment and Climate Change (DECC) and Department of Environment and Climate (DEC).

The guiding document for this assessment is the *Code of Practice for the Investigation of Aboriginal objects in NSW* (DECCW 2010b) [Code of Practice].

Information provided in this assessment includes, but is not limited to:

- The results of archaeological test excavation and surveys.
- An assessment of archaeological significance and management recommendations.
- A literary review of available data, including previous studies/investigations from within and adjacent to the study area.
- Adequate documentation to accompany an Aboriginal Heritage Impact Permit (AHIP) application.
- An assessment of harm posed to Aboriginal objects, places or values as part of the project.
- A description of practical measures that have been used to protect, conserve, avoid or mitigate harm to Aboriginal objects, places and values.

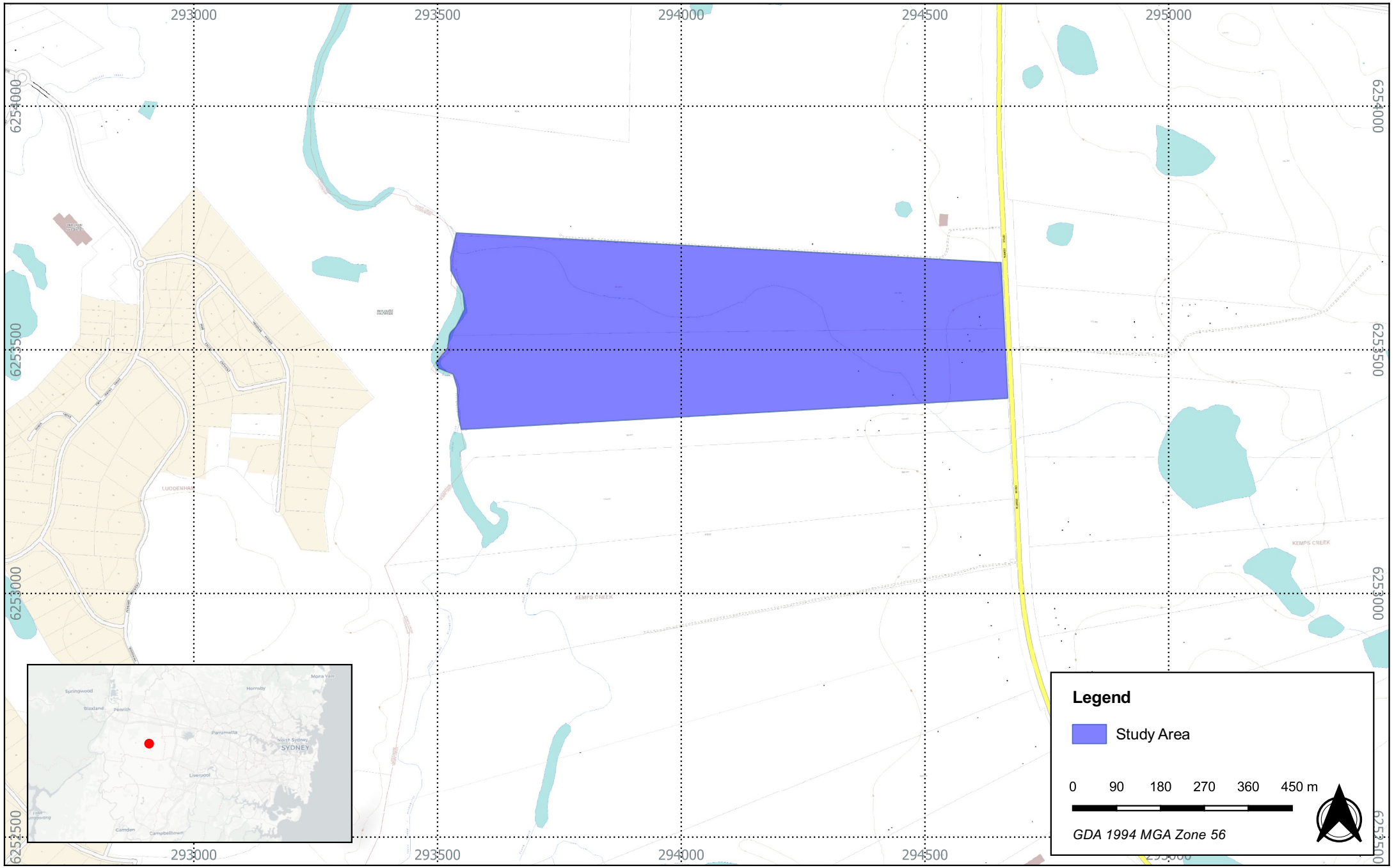

Figure 1.1 Location of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Basemap, CartoDB Positron *Drawn by: ARH Date: 2022-04-06*

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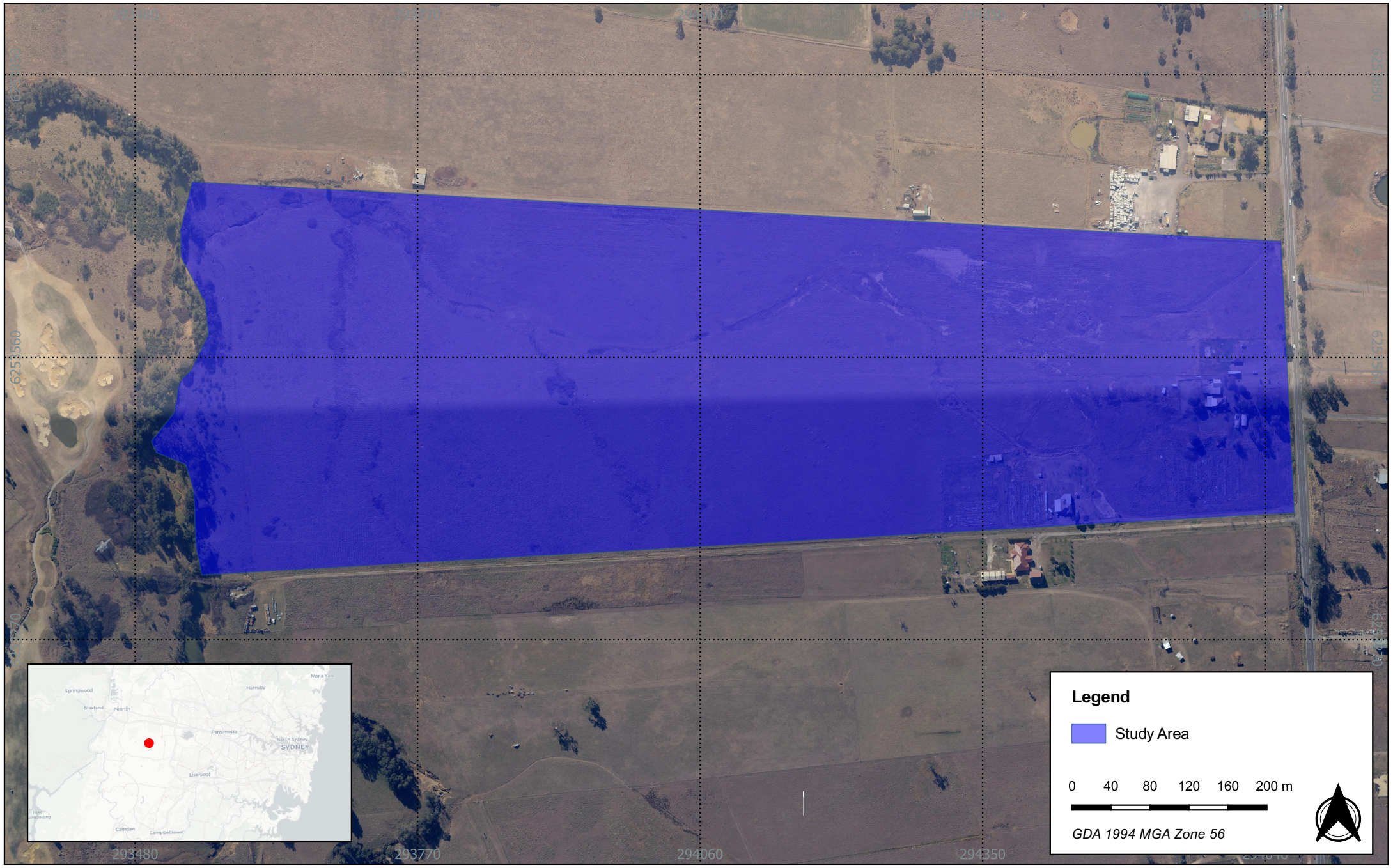

Figure 1.2 Detailed aerial of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPIAerial, CartoDB Positron *Drawn by: ARH Date: 2022-04-06*

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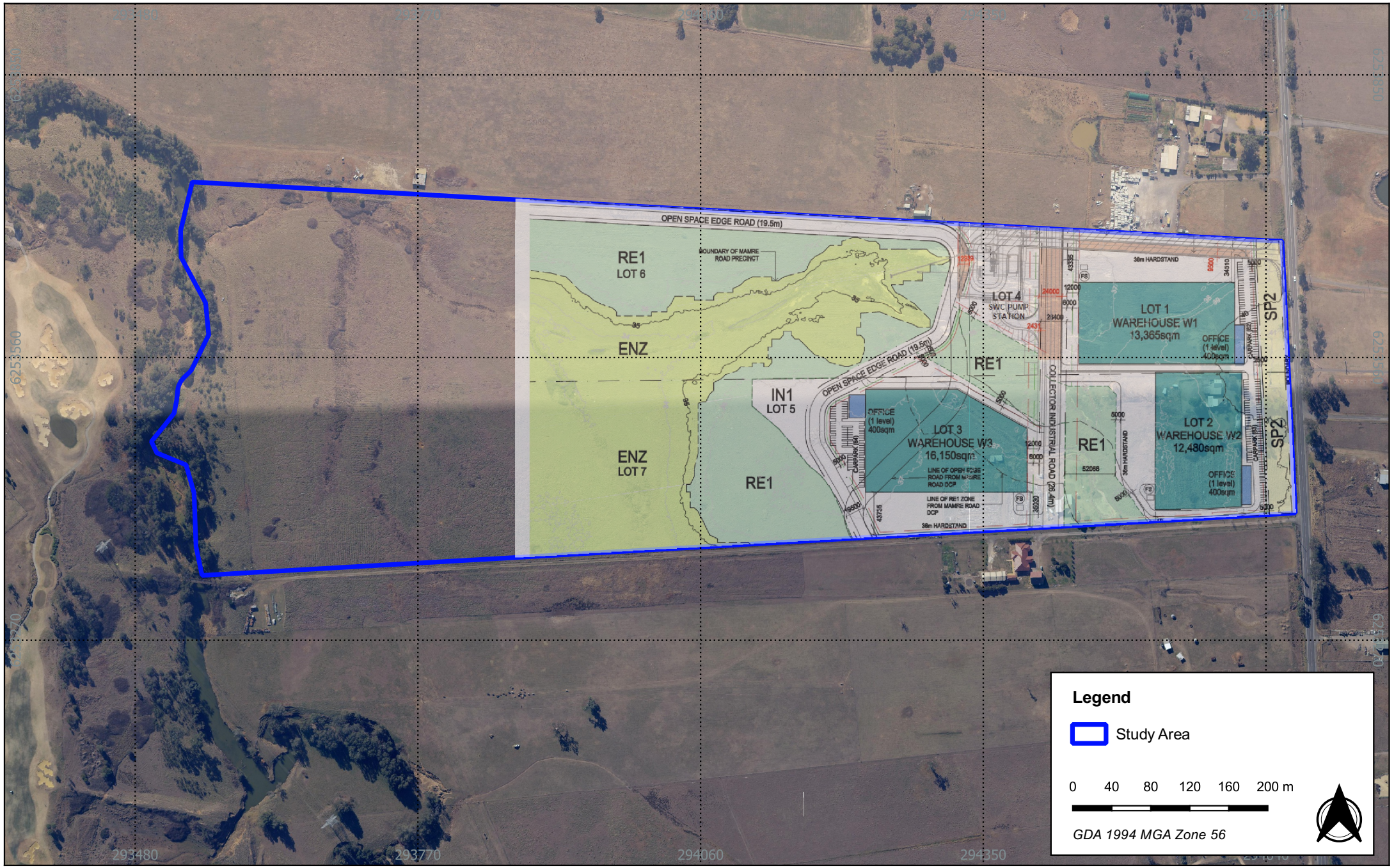

Figure 1.3 Proposed Development of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPIAerial

Drawn by: ARH Date: 2022-04-06

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1.4 SUMMARY OF LEGISLATIVE PROCESS

Aboriginal archaeological and cultural heritage assessments in NSW are carried out under the auspices of a range of State and Federal Acts, Regulations and Guidelines. The Acts and Regulations allow for the management and protection of Aboriginal places and objects, and the Guidelines set out best practice for community consultation in accordance with the requirements of the Acts.

This section outlines the Australian acts and guidelines that are applicable or have the potential to be triggered with regards to the proposed development are detailed in Table 1.1 to Table 1.4.

Table 1.1 Federal acts

Federal Acts:	Applicability and implications
Environment Protection and Biodiversity Conservation Act 1999	This act has not been triggered and so does not apply, as: • No sites listed on the National Heritage List (NHL) are present or in close proximity to the study area. • No sites listed on the Commonwealth Heritage List (CHL) are present or in close proximity to the study area.
Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987	Applies, due to: This Act provides blanket protection for Aboriginal heritage in circumstances where such protection is not available at the state level. This Act may also override state and territory provisions.

Table 1.2 State acts

State Acts:	Applicability and implications
National Parks and Wildlife Act 1974 (NPW Act 1974)	Applies, due to: • Section 86 – Prohibits both knowingly and unknowingly, causing harm or desecration to any Aboriginal object or place without either an AHIP or other suitable defence from the Act. • Section 87 – Allows for activities carried out under an AHIP or following due diligence to be a defence against the harm of an Aboriginal object. • Section 89A – Requires that the Heritage NSW must be notified of any Aboriginal objects discovered, within a reasonable time. • Section 90 – Requires an application for an AHIP in the case of destruction of a site through development or relocation.
NPW Regulation 2019	Applies, due to: • Section 80A – States minimum standards of due diligence to have been carried out. • Section 80C – Requires Aboriginal community consultation process to be undertaken before applying for an AHIP. • Section 80D – Requires production of a cultural heritage assessment report to accompany AHIP applications.
The Environmental Planning and Assessment Act 1979 (EP&A Act 1979)	Applies, due to: • This project is being assessed under Part 4 of the EP&A Act 1979. • Sections 86, 87, 89A and 90 of the NP&W Act 1974 will apply.
NSW Heritage Act 1977	There are no sites listed on the State Heritage Register associated with the study area, and therefore Section 57 of this act does not apply.

Table 1.3 State and local planning instruments

Planning Instruments	Applicability and implications
Local Environmental Plans (LEP)	The following LEP is applicable: • Penrith LEP 2010
Development Control Plans (DCP)	The following DCP is applicable: • Penrith DCP 2014

Table 1.4 Aboriginal community consultation guidelines

Guidelines	Applicability and implications
Consultation Requirements	The development is to be conducted in accordance with Part 4 of the EP&A Act. As the project is to be assessed under Part 6 of the NP&W Act, approvals under Section 90 of the NP&W Act 1974 as amended 2010 will be required, S89A of the Act will apply, and the Part 4 Guidelines will apply.

1.5 PROJECT TEAM AND QUALIFICATIONS

The personnel responsible for the preparation of this report are detailed in Table 1.5.

Table 1.5 Personnel involved in the preparation of this ACHA.

Name	Qualifications	Title	Responsibilities
Amanda Hansford	BA (Arch/Paleo) Grad Dip Arch	Director	Technical review
Taylor Foster	BA (Hons) Archaeology and English	Senior Archaeologist	Primary author, project manager, test excavations
Declan Coman	BA Archaeology	Archaeologist	Report writing, survey
Dominique Bezzina	BA Archaeology	Archaeologist	Report writing, survey
Carmen Baulch	Studying Bachelor of Arts/Bachelor of Science (Archaeology and Zoology)	Undergraduate Archaeologist	Report writing, test excavations
Brody Saccoccia	BA (Hons) Archaeology	Graduate Archaeologist	Test excavations
Jake Allen	Bachelor Communications Media, BA (French); Master of Maritime Archaeology (in progress)	Archaeologist	Test excavations
Peta Rice	BA History, Archaeology and Ancient History	Archaeologist	Test excavations
Crystal Wooding	Master of Archaeology and Cultural Heritage (in progress)	Student Archaeologist	Test excavations

1.6 ABBREVIATIONS

The following are common abbreviations that are used within this report:

Burra Charter	Burra Charter: Australia ICOMOS Charter for Places of Cultural Significance 2013
CBD	Central Business District
CHL	Commonwealth Heritage List

DCP	Development Control Plan
EPA Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environmental Protection and Biodiversity Act 1999
EPI	Environmental Planning Instrument
Heritage Act	NSW Heritage Act 1977
ICOMOS	International Council on Monuments and Sites
IHO	Interim Heritage Order
LEP	Local Environmental Plan
LGA	Local Government Area
NHL	National Heritage List
NPW Act	National Parks and Wildlife Act 1974
The Proponent	The GPT Group
RNE	Register of the National Estate
Study Area	771-779 Mamre Road, Kemps Creek, NSW
Penrith DCP	Penrith Development Control Plan 2014
Penrith LEP	Penrith Local Environmental Plan 2010

Refer also to the document Heritage Terms and Abbreviations, published by the Heritage Office and available on the website: http://www.environment.nsw.gov.au/heritage/index.htm.

2 CONSULTATION PROCESS

This section outlines the consultation process that has been followed as part of the preparation of this ACHA.

2.1 INTRODUCTION

Stakeholder consultation for this project commenced in line with the Consultation Requirements (DECCW 2010a). Heritage NSW (2010a, p.iii) recognises that:

- Aboriginal people should have the right to maintain their culture.
- Aboriginal people should have the right to participate in matters that may affect their heritage directly.
- Aboriginal people are the primary determinants of the cultural significance of their heritage.

The Consultation Requirements outline a four-stage consultation process which includes:

- Stage 1 – Notification of the project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about cultural significance.
- Stage 4 – Review of the draft cultural heritage assessment report.

Volume 2 of this ACHA contains a consultation log and evidence of all correspondences that were sent and received as part of the consultation process.

2.2 STAGE 1: NOTIFICATION AND REGISTRATION OF INTEREST

The following section outlines the tasks that were undertaken as part of Stage 1 of the Consultation Requirements.

2.2.1 IDENTIFICATION OF RELEVANT ABORIGINAL STAKEHOLDERS

In accordance with the Consultation Requirements the following bodies were notified as part of the project proposal:

- A response was received from Heritage NSW with a list of stakeholders who may have an interest in the proposed development.
- The DLALC did not respond with a list of stakeholders but registered interest for the project.
- The Greater Sydney Local Land Services replied that they had no list of stakeholders who may have an interest in the proposed development.
- The Penrith City Council replied with a list of stakeholders who may have an interest in the proposed development.
- The National Native Title Tribunal did not respond with a list of stakeholders.

A geospatial search conducted by the National Native Title Tribunal, *Native Title Act 1993* listed no Aboriginal stakeholders for the land within the study area. A copy of these letters and searches are included in Volume 2, Appendix A of this ACHA.

2.2.2 PUBLIC NOTICE

An advert was placed in the Western Weekender, to run on 8 April 2022, requesting the registration of cultural knowledge holders relevant to the project area. A copy of this advert is included in Volume 2, Appendix A of this ACHA.

2.2.3 INVITATION TO REGISTER

Letters were also written to the relevant agencies suggested in Section 4.1.2 of the Consultation Requirements (DECCW 2010a) on 1 April 2022 and a search was made of the Native Title Tribunal on the same day.

The letters to the relevant agencies were sent via email and Australia Post. Additional phone calls were received providing further information, and three late registrations were noted.

As a result of the consultation procedure, the following groups shown in Table 2.1 registered as Aboriginal stakeholders with an interest in this project:

Table 2.1 Registered Aboriginal stakeholders

Organisation	Contact person
Deerubbin Local Aboriginal Land Council	Kevin Cavanagh
Darug Custodian Aboriginal Corporation	Justine Coplin
Gunjeewong Cultural Heritage Aboriginal Corporation	Shayne Dickson
Corroboree Aboriginal Corporation	Marilyn Carroll-Johnson
Kamilaroi Yankuntjatjara Working Group	Phil Khan
A1 Indigenous Services	Carolyn Hickey
Widescope Indigenous Group	Steven Hickey, Donna Hickey
Didge Ngunawal Clan	Lillie Carroll, Paul Boyd
Wailwan Aboriginal Group	Philip Boney
B.H. Heritage Consultants	Ralph Hampton, Nola Hampton
Waawaar Awaa Aboriginal Corporation	Rodney Gunther, Barry Gunther
Mundawari Heritage Consultants	Dean Delponte
Julia Narayan	Julia Narayan
Gunya Aboriginal Cultural Heritage Services PTY LTD	Adam Gunther
Woka Aboriginal Corporation	Steven Johnson

2.3 STAGE 2: PRESENTATION OF INFORMATION

All registered Aboriginal stakeholders were provided with information outlining the proposed works, including information relating to proposed impacts as well as the project's methodology on 5 August 2022.

Copies of all correspondence relating to the provision of project information to registered Aboriginal stakeholders are included in Appendix A of this report.

2.4 STAGE 3: GATHERING INFORMATION ABOUT CULTURAL SIGNIFICANCE

2.4.1 REVIEW OF DRAFT METHODOLOGY

On 5 August 2022, Austral provided each Aboriginal stakeholder with a copy of the project methodology. The methodology outlined the proposed assessment process that would be used in the completion of the project. Aboriginal stakeholders were provided with 28 days to review and provide feedback on the methodology.

A phone call with a member of the Widescope Indigenous Group was carried out on 9 August 2022. Austral was informed that Widescope Indigenous Group agreed with the project's methodology. Gunjeewong Cultural Heritage Aboriginal Corporation also agreed with the methodology on 9 August 2022. Phillip Boney of the Wailwan Aboriginal Group agreed with the methodology via email on 9 August 2022.

Copies of all correspondence relating to the draft methodology from Aboriginal stakeholders are included in Volume 2, Appendix A of this ACHA.

2.5 STAGE 4: REVIEW OF DRAFT ACHA REPORT

On 9 March 2023, Austral provided each Aboriginal stakeholder with a copy of the draft ACHA. Aboriginal stakeholders were provided with 28 days to review and provide feedback on the ACHA. One response was received during this period from Woka Aboriginal Corporation stating that they agreed with the draft. No further responses were received.

3 LANDSCAPE CONTEXT

3.1 ENVIRONMENTAL CONTEXT

The environmental context first and foremost forms the basis for local ecosystems which in turn influence the range and diversity of the resource base that would have been available for past inhabitants of an area. Mobility and subsistence strategies employed by past humans would have responded to factors such as the availability and distribution of plant, animal and riverine resources and the accessibility of raw materials suitable for the manufacture of stone tools.

Additionally, environmental characteristics, such as local landforms, soil types and depths and the underlying geology, influence the potential for finding subsurface archaeological deposits. Soil characteristics, for instance, influence artefact preservation, the integrity of stratigraphic deposits and the degree of post-depositional movement of artefacts (e.g., with higher artefact movement likely within sandy compared to compact clayey deposits) and the ability to identify archaeological sites and deposits in the first place (e.g., because of higher visibility due to high exposure relating to erosion).

The following section discusses the study area in relation to its landscape, environmental and Aboriginal landscape resources. This environmental context has been prepared in accordance with Requirement 2 of The Code (DECCW 2011, pp.8–9).

3.1.1 TOPOGRAPHY AND HYDROLOGY

The study area is located within the Cumberland Plain which sits on Triassic Wianamatta group shales and sandstone. The area is characterised by the low rolling hills and open valleys that lead to the foot of the Blue Mountains to the west as well as swamps and lagoon areas across the floodplains of the Nepean River. Landforms identified within the study area consist of ridge lines/ crests and adjacent slopes associated with the drainage line that runs through the study area between the north-western corner of the property and the south-east portion of the property. Most of the study area forms part of one of the highest ridgelines in the area, which runs north to south providing a good view of the surrounding Cumberland Plain. The topography consists of low rolling to steep low hills with a local relief of 50-120 meters. Moderately inclined slopes of 10-15% represent the dominant landform elements.

The raised topography of the study area is likely to have kept the area well-drained, with overland flow being directed to the south and west where the existing drainage channel is located. The study area therefore contains multiple landforms that have been shown to be likely to contain Aboriginal cultural heritage in the nearby area. The crest of the ridgeline, for example, may preserve evidence of past Aboriginal occupation and use as flat, elevated, well-drained locations above creek lines are known to have been favoured as location for occupation and camping. The ridge itself and the adjoining slopes may also preserve evidence of Aboriginal material having potentially been used by past Aboriginal groups as transitory routes allowing movement through the landscape.

The study area is associated with a series of non-perennial drainage lines man-made drainage ponds and dams. South Creek which is a fifth-order creek and is fed by both Kemps Creek and Badgerys Creek. There is a second order unnamed stream that runs through the site starting at the eastern end of the southern boundary and joining South Creek at the northern end of the western boundary. The ability to exploit freshwater resources associated with these creeks would have encouraged Aboriginal occupation of the area. The close proximity of the study area to more permanent water sources such as South Creek means that the area would have provided past Aboriginal groups with a more permanent reliable source of fresh water and associated resources. Previous work done in the Cumberland Plain suggests that the meeting points of larger order streams are often a focus of activity. With the confluence of Kemps Creek and South Creek located to the southwest of the Study Area, there was likely a lot of Aboriginal activity within this region in the past.

The landforms and hydrology identified within the study area is illustrated in Figure 3.1 and Figure 3.2.

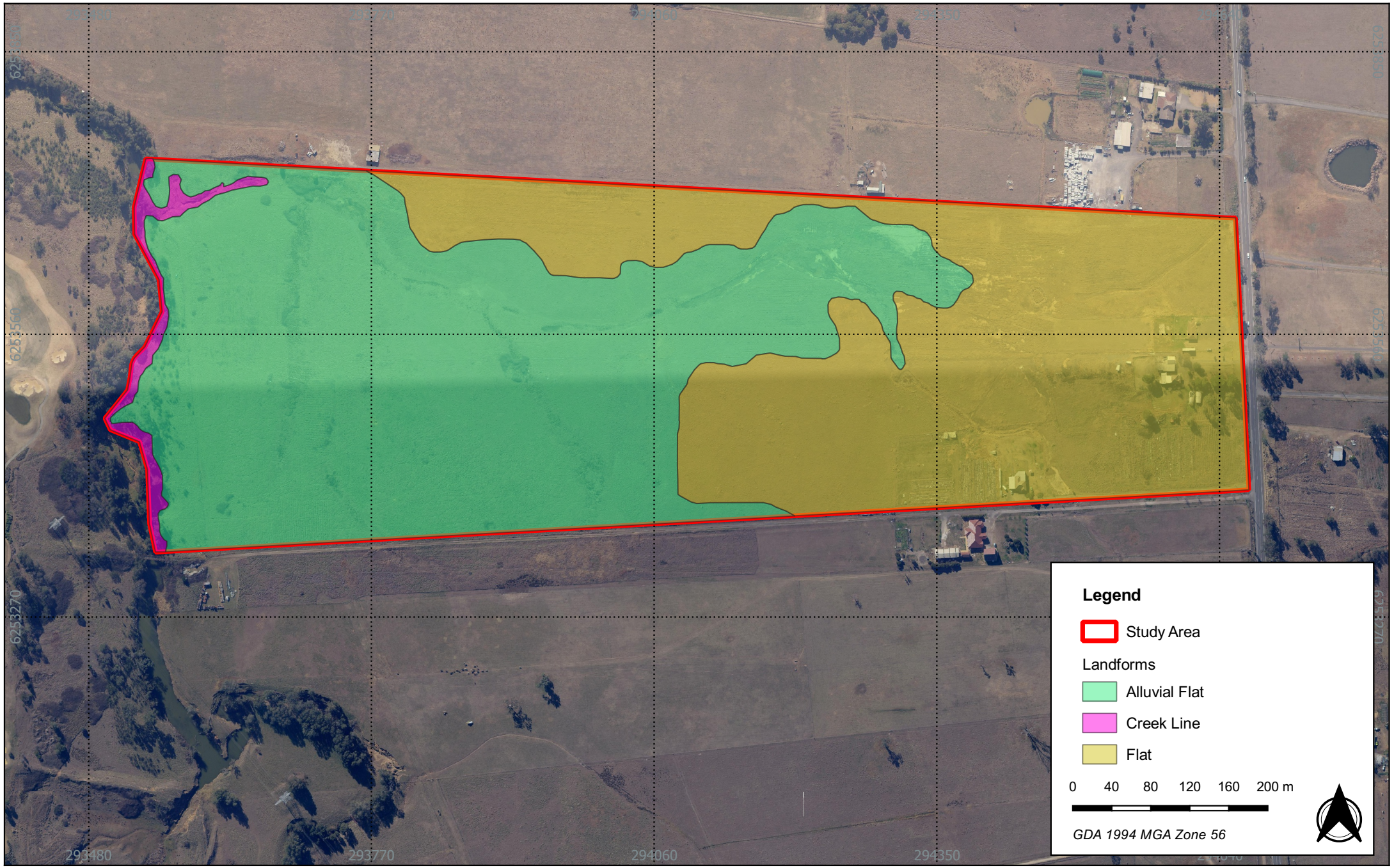

Figure 3.1 Landforms within the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2022-11-29

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3.1.2 GEOLOGY AND SOILS

Geological units are used to predict the presence and/or absence of certain Aboriginal site types including rock shelters, grinding grooves or quarries in addition to providing an insight into the range of raw material types that may have been available to past Aboriginal groups for tool making. The study area falls completely within the Bringelly Shale geological unit which forms part of the Wiannamatta Group, which covers most of the Sydney Basin. This unit is made up of mostly shale, carbonaceous claystone, laminite, lithic sandstone and rare coal seams (Colquhoun et al. 2019). Whilst the Bringelly Shale unit can have outcrops of sandstone, there are no deep incised drainage channels that are necessary for the natural creation of rock shelters.

The underlying geology of the study area and surrounding region would have provided a range of stone material types suitable for the production of flaked stone artefacts. Silcrete is the most common raw material type associated with stone tool manufacture based on assemblages recovered from archaeological sites across the Cumberland Plain and the Cumberland Lowlands. Known silcrete sources in the wider region include the St Marys Formation and Rickabys Creek gravels and terraces along the Nepean River. No known stone sources, however, are located within the study area.

The geological units identified within the study area are identified in Figure 3.2.

The study area contains the South Creek (sc) soil landscape which occupies approximately ¾ of land to the west. Landscapes and landforms typically associated with this landscape include floodplains, valley flats, and drainage depressions. The Department of Planning, Industry and Environment (2020) indicates that this landscape is prone to flooding, seasonal waterlogging, water erosion, surface movement, and is associated with permanently high water tables.

The Blacktown (bt) soil landscape is located within the remainder of the study area. It is characterised by gently undulating rises on Wianamatta Group shales with local relief of 30m. Blacktown (bt) soils are moderately erodible, with topsoils (bt1 and bt2) being generally hard setting with significant fine sand and silt contents, offset by moderate amounts of organic matter (Department of Planning, Industry and Environment 2020).

It is considered that areas within the Blacktown (bt) soil landscape have the potential for subsurface artefacts to be identified, as the soil profile is suitable for the retention of deposited objects.

The soil landscapes identified within the study area are identified in Figure 3.3 and Table 3.1

Table 3.1 Soil landscapes identified as being within study area

Soil landscape	Description
South Creek	Whilst this Soil Landscape does not enter the study area, its proximity to the Study Area suggests that the soil profile may extend into the Study Area, even though it is not mapped there. The South Creek Soil Landscape is characterised by floodplains, valley flats and drainage depressions on the Cumberland Plain. The dominant soil materials are: • **sc1** – Brown sandy loam to sandy clay loam - A horizon (ranges from 5YR4/3 to 10YR4/3). pH varies from 4.5 to 6.5. Small gravels may occur, but charcoal and other inclusions do not occur. • **sc2** – Hard setting dull brown clay loam to fine sandy loam – A horizon (7.5YR 5/4 but can range from 5YR 4/2 to 10YR 5/6). pH 5.5 to 7.0. Stones and inclusions do not occur. • **sc3** – Bright brown light to medium clay - B horizon (ranges from 5YR 4/8 to 10YR 5/1) Mottles occur and are yellow or grey. pH from 3.0 to 7.0. No charcoal but small gravels may occur. Near creeks, the soil strata are generally 30 - 50 centimetres of friable to lose sandy loam (sc1) overlying 15 centimetres of massive clay loam (sc2) and 70 centimetres of light-medium clay (sc3). On low terraces, the soil strata are generally 2 - 50 centimetres of sandy clay loam (sc1) overlying 15 centimetres of massive clay loam (sc2) and 60 - 85 centimetres of medium to heavy clay (sc3) (Bannerman & Hazelton 2011, pp. 92-95).

Soil landscape	Description
Blacktown	The Blacktown Soil Landscape is characterised by gently undulating rises, round crests and ridges with gently inclined slopes. The landscape is usually made up of cleared Eucalypt woodland and tall open forest. The dominant soil materials are: • **bt1** – Friable blackish-brown loam A horizon (10YR 2/2 can range from 5YR 3/2 to 10YR 3/4). pH from 5.5 to 7.0. Ironstone, shale fragments and charcoal are sometimes present. • **bt2** – Hard setting dark brown clay loam A2 horizon (7.5YR 4/3 can range from 2.5YR 3/3 to 10YR 3/3). pH from 5.5 to 7.0. Ironstone and shale gravel are common. • **bt3** - Strongly pedal, mottled brown light clay subsoil B horizon (7.5YR 4/6 can range from 2.5YR 4/6 to 10YR 4/6). Frequent red, yellow or grey mottles occur. pH 4.5 to 6.5. Shale gravel is common in stratified bands. • **bt4** - Light grey plastic mottled clay B3 or C horizon (10YR 7/1 or 2.5YR 6/2). pH 4.0 to 5.5. Ironstone is common, charcoal rare. On lower side slopes present in the Study Area, up to 30 centimetres of bt1 overlies 10 - 30 centimetres of bt2 and 40-100cm of bt3. Below bt3 there is usually more than 100 centimetres of bt4. The boundaries between the soil material are usually clear (Bannerman & Hazelton 2011, pp. 35-38).

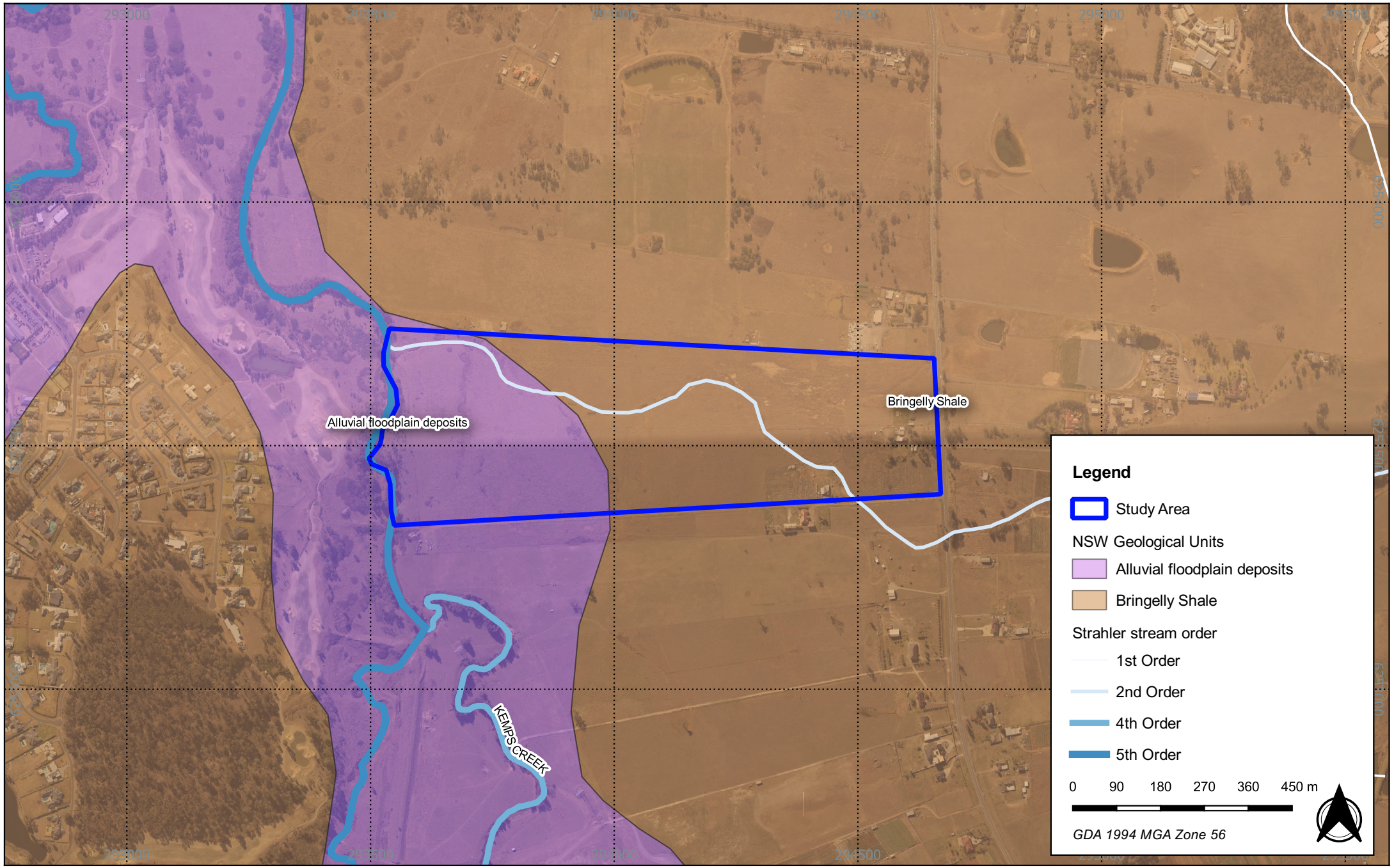


Figure 3.2 Geology and Hydrology of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial,NSW Geological Units *Drawn by: ARH Date: 2022-04-06*

AUSTRAL ARCHAEOLOGY

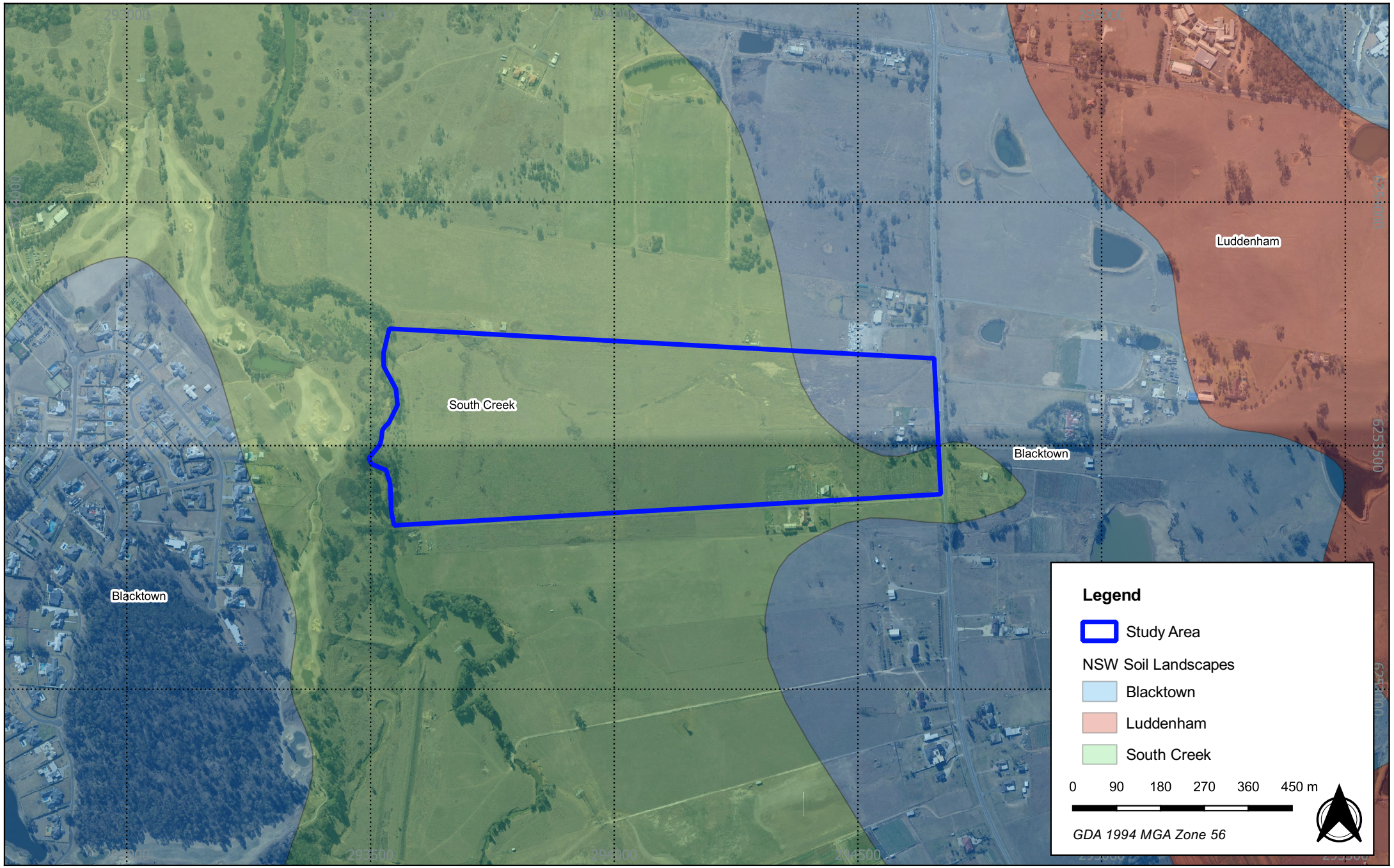


Figure 3.3 Soil landscapes of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial,NSW Soils Landscape *Drawn by: ARH Date: 2022-04-06*

AUSTRAL ARCHAEOLOGY

3.1.3 CLIMATE AND VEGETATION

The study area's environmental context is defined by its place within the Sydney Basin bioregion. Based on climate data from the Badgerys Creek Automatic Weather Station [site number: 067108], located approximately five kilometres from the study area, the local region is characterised by generally hot wet summers and cool to cold dry winters. The summer mean average temperatures reach highs of 30.3ºC and lows of 17.3ºC (BOM 2021). During winter, mean average temperatures reach highs of 17.5ºC and lows of 4.1ºC (Bureau of Meteorology 2021). The highest mean rainfall is recorded during February with 108.5mm, and the lowest mean rainfall is recorded in July with 24.8mm (BOM 2021).

The study area has undergone extensive stages of land clearance except for a few small stands of remnant vegetation. Remnant vegetation within the study area is likely to include a mixture of native flora associated with the South Creek and Blacktown soil landscapes and introduced species.

Prior to European land clearing, the landscape associated with the South Creek soil landscape included *Angophora subvelutina* (broad-leaved apple), *Eucalyptus amplifolia* (cabbage gum), *Casuarina glauca* (swamp oak). *Eleocharis sphacelata* (tall spike rush), *Juncus usitatus* and *Polygonum spp* are noted to occur within silted channels and *Melaleuca spp*. (paperbarks) and *Leptospermum spp*. (tea trees) may occur within elevated stream banks. Clearing of the study area has led to a dominance of *Rubus vulgaris* (blackberry) and other weeds throughout this soil landscape (Department of Planning, Industry and Environment 2020).

Blacktown soil landscape units comprise almost entirely of open forest (*dry sclerophyll forest*) with original woodland containing *Eucalyptus tereticornis* (forest red gum), *E. crebra* (narrow-leaved ironbark), *E. moluccana* (grey box) and *E. maculata* (spotted gum). In the locality of the study area the dominant species are *E. globoidea* (white stringybark) and *E. fibrosa* (broad-leaved ironbark), with *E. longifolia* (woollybutt) as an understorey species (Department of Planning, Industry and Environment 2020).

3.1.4 LANDSCAPE RESOURCES

The study area lies in a landscape that would have been rich in biological and ecological diversity prior to European clearing practices. The landscape would have typically supported a wide variety of flora and fauna, which coupled with proximity to watercourses, would have provided abundant natural resources for past Aboriginal people utilising the area. The elevated position of the study area is considered to have been a suitable travel route, which is reasonably well drained and would have provided a useful vantage point to areas of richer resources in closer proximity to more reliable water sources such as South Creek situated immediately west of the study area. South Creek is a large perennial watercourse that would have provided traditional Aboriginal communities with water and a large range of exploitable resources for food and tool making. The ridgeline within the study area would have provided traditional Aboriginal communities in the area with a means for getting from the top of the ridgeline to the plains below quickly and with minimal effort. As such, the study area was likely used as an access way to areas that were used more frequently, rather than a place of settlement.

3.2 PAST LAND USE PRACTICES

The study area has been previously cleared of vegetation, likely during the days of early European settlement when logging and clearance for agricultural activities were undertaken. Past agricultural practices, extensive land clearance, animal grazing, the construction of buildings, fences and vehicle tracks, tree harvesting, installation of overhead power lines and ongoing encroachment of residential development surrounding the study area have contributed to the removal of the original native vegetation. The study area is now covered in dense native and introduced grasses with planted gardens of native vegetation and introduced species. Land clearance would have resulted in soil disturbance and topsoil movement and loss that, coupled with erosion on slopes across the majority of the study area, might account for widespread artefact displacement but not the complete destruction of Aboriginal sites.

4 ARCHAEOLOGICAL CONTEXT

The range of environments and landscapes within the western Sydney region had a profound influence on the lives of the Aboriginal people who lived there. As hunters and gatherers, Aboriginal people were reliant on their surroundings to provide food. Their transitory lifestyle affected population size, social interactions, and degree of mobility, which can be confirmed in the archaeological record.

4.1 ETHNOHISTORY

While the earliest dates for Aboriginal occupation in Australia reach back to at least 65,000 years (Clarkson et al. 2017), the earliest known occupational site associated with the Cumberland Plain is located north of Pitt Town, on the southern bank of the Hawkesbury River where cultural deposits were dated by optically stimulated luminescence (OSL) to 36,000+/-3000 BP (Williams et al. 2012). A Pleistocene date of 14,700 BP has been established from Shaws Creek Rockshelter K2, located to the north of Penrith (Attenbrow 2003) while relatively early dates were also obtained for artefact bearing deposits at Open Site RS1 (AHIMS #45-5-0982) on Mulgoa Creek, Regentville (McDonald 1995). Most sites in the Sydney region, however, date to within the last 3,000 years to 5,000 years, as many researchers have proposed that occupation intensity increased from this period (Kohen 1986). While Aboriginal occupation of the Greater Sydney regions extends well into the Pleistocene, most archaeological sites are expected to date to the Holocene period coincident with more favourable environmental conditions following the Last Glacial Maximum (LGM).

Population estimates at the time of contact are notoriously problematic as Aboriginal groups avoided early European settlers and were highly mobile. Another factor that complicates an accurate estimation is the effect of European diseases such as influenza and smallpox, which decimated Aboriginal populations soon after contact. Governor Philip estimated the number of Aboriginal people in coastal Sydney to be in the order of 1,000 individuals prior to 1792. However, it is unlikely that the early European explorers were able to successfully grasp the traditional population size. More recent estimates of the contact period population of the greater Sydney region place the number between five and eight thousand, although other estimates are much lower (Turbet 2001). For the western Cumberland Plain, Kohen has estimated a pre-contact population of 500 to 1,000 people, or a minimum overall density of about 0.5 persons per kilometre^2 (Attenbrow 2003).

Early writers recorded several named Aboriginal groups as occupying the Sydney region after the First Fleet arrived in 1788. Many of the colonists' reports included the names of groups that were associated with certain areas of land (Attenbrow 2003).

At the time of European contact, the land surrounding the study area was inhabited by a clan of the Darug-speaking people. Judge-advocate David Collins noted in his records in 1798 that the Gahbrogal lived "away from the coast, but near saltwater/brackish conditions since they ate estuarine teredo worms called cah-bro" (Attenbrow 2003). It was only after the 1870s that names such as the Darug came into use to describe Aboriginal language groups (Attenbrow 2003, p.31). In the second half of the 19th century, Reverend William Ridley recorded the language that he said was spoken at "George's River, Cow pasture and Appin...from the mouth of the George's River, Botany Bay, and for about 50 miles [80 kilometres] to the south-west" (Attenbrow 2003).

At the beginning of the 20th century, anthropologist/linguist RH Mathews discussed a dialect that he referred to as Dharruk, Dhar'rook or Dharook (Attenbrow 2002:32). Mathews stated that:

> *The Dharruk speaking people adjoined the Thurrawal on the north, extending along the coast to the Hawkesbury River, and inland to what are now Windsor, Penrith, Campbelltown, and intervening towns. The Dhar-rook dialect, very closely resembling the Gundungarra, was spoken at Campbelltown, Liverpool, Camden, Penrith, and possibly as far east as Sydney, where it merged into the Thurrawal (Mathews & Everitt 1900).*

By the late 1960s, linguist Arthur Capell was able to work with information recorded by Reverend. Edward Threlkeld in approximately 1824 to confirm the currently accepted language groups Darug, Dharawal, Darginung, Gundungurra and Awaba in the addition to the separate language of Guringai (Attenbrow 2003).

In the 1970s, archaeologists and anthropologists in the Sydney region adopted names for linguistic groups as specified by Capell (Attenbrow 2003). Although the exact language boundaries are still open for debate and mapped boundaries can only ever be indicative, Attenbrow (2003) states that two of the four language groups spoken in Sydney were Darug (coastal dialect/s) and Darug (hinterland dialect). The mapped boundaries for Darug (hinterland dialect) include the Cumberland Plain from Appin in the south to the Hawkesbury River in the north, west of the Georges River, Parramatta, the Lane Cove River, and Berowra Creek.

However, traditional Aboriginal communities established a dynamic culture which encouraged movement throughout the landscape to assist in the ceremonial and functional practicalities of daily life. As such, defined borders for tribal groups need to be recognised as an artificial constraint designed by anthropologists (Organ 1990). Furthermore, all ethnohistory should be employed with caution and Hiscock (2008) has argued that even very early historical accounts may not be a suitable basis for analogy with past cultural practices of Aboriginal people.

As Aboriginal groups had to change their economic, cultural, and political practices in order to cope with the social impacts of disease arising from European contact in the historic period, Hiscock argues that it is likely that similar drastic changes happened in the past in response to “altered cultural and environmental circumstances” prior the arrival of Europeans.

By 1816, serious conflict had ended and, with dwindling natural resources due to the continued expansion of farmland and an influx of European settlers, local Aboriginal people came to rely increasingly on the settlers for basic necessities such as food, clothing and shelter (Kohen 1985).

In an attempt to ‘civilize’ Aboriginals, Governor Macquarie established a Native Institution and settlement in Blacktown (originally known as ‘Blacks Town’) in 1823 to teach Aboriginal families European farming techniques and ways of life. In 1833, the building was closed and the settlement was deemed a failure (Kohen 1985).

By 1820, the Cumberland Plain had been heavily occupied by over 24,000 European colonists (Attenbrow 2010, p.15). Introduced disease, beginning with the smallpox epidemic of 1789 – 1790, and resource pressure imposed on Darug groups by a steady stream of colonists ensured that populations and traditional activities were affected almost immediately. Early resistance to colonial incursions on tribal lands, like those that were led by the Bediagal man Pemulwuy, quickly gave way to a pattern of avoidance and the pursuit of traditional lifeways away from centres of European activity.

MATERIAL CULTURE

The material culture of the Aboriginal people of the Sydney basin at the time of European contact was diverse, with materials derived from a variety of plants, birds, and animals as well as stone. Below provides a short summary of the types of material known to have been used by the Aboriginal people of the Cumberland Plain.

Wood was used to produce a variety of useful tools and weapons, including throwing sticks, clubs, shields, spears, spear-throwers, digging sticks and containers, and ‘boomerang' is itself believed to be a Darug word (Kohen 1985, Turbet 2001, Attenbrow 2003). Spears were usually made of a grasstree spike (for the shaft) with a hardwood point with stone, bone, shell or wood sometimes used as barbs (Turbet 2001). Thin and straight spear-throwers were made from wattle (Turbet 2001). Fishing spears were usually tipped with four hardwood prongs with bone points (Attenbrow 2003, Turbet 2001). Fish were also caught by means of shell or bird talon fish hooks (Attenbrow 2003, Turbet 2001). Various types of bark were also used for making such diverse items as wrappings for new-born babies, shelters, canoes, paddles, shields, netting and torches (Attenbrow 2003, Turbet 2001). Resin from the grasstree was used as an adhesive for tool and weapon making (Attenbrow 2003, Turbet 2001).

Stone artefacts or evidence of their use, including scarred trees and grinding grooves on stone outcrops, are often the only physical indication of Aboriginal use of an area. The presence of stone artefacts can indicate one of three things; where stone was initially quarried, campsites where it was knapped to create tools or locations where it was discarded once used, or occasionally a combination of all three. The knapping of stone creates a large amount of stone debris in a very short amount of time. Stone was commonly used for tools and is the most common material found

in archaeological sites of the Sydney region. Stone was used as the preferred material for axe heads, spear barbs and as woodworking tools, amongst many other uses.

Archaeological investigation has resulted in the recognition of changes in the types of stone tools used by Aboriginal people through time. A sequence of changes in stone tool types in eastern NSW was identified by archaeologist FD McCarthy who named it the 'Eastern Regional Sequence' (McCarthy 1976). McCarthy identified 'Capertian,' 'Bondaian' and 'Eloueran' phases of the sequence, which together appear to span the last 15,000 years in the Sydney region.

However, McCarthy's sequence has since been disputed and/or modified, with Stockton and Holland (Stockton & Holland 1974), for example, modifying his theory by proposing four phases of the Eastern Regional Sequence. After Capertian, they described the 'Early Bondaian' and 'Middle Bondaian' phases, where Bondi points and other small tools become apparent in assemblages in Eastern NSW. Late Bondaian in Stockton and Holland's sequence referred to McCarthy's Eloueran phase. Stockton and Holland's terms continue to be used on the east coast of Australia today (Attenbrow 2003).

Broadly speaking, Capertian assemblages contain tools which are generally larger in size than later assemblages but also contain smaller tools, such as thumbnail scrapers and dentated saws. In the late Holocene (from approximately 5,000 years ago), backed artefacts such as Bondi points, Elouera and geometric microliths appear in archaeological assemblages in the Sydney Basin and these tools are characteristically much smaller than those of earlier phases. Edge ground implements appear in regional assemblages for the first time at about 4,500 to 4,000 years ago.

From about 1,600 years ago, Bondi points and geometric microliths began to drop out of use in the coastal parts of the Sydney region, although the Elouera continued to be used. This is known as the Late Bondaian phase. On the Cumberland Plains, however, dated archaeological sites suggest that backed artefact types continued to be used "until at least 650-500 years ago, although probably not [as late as the time of] British colonisation" (Attenbrow 2003, p.156). In coastal areas, and possibly throughout the Sydney Basin, the use of both quartz and of the bipolar flaking technique increased through time, although this tendency is less marked on the western Cumberland Plain (Attenbrow 2003, p.159, Corkill 1999, p.135).

FOOD

Both estuarine and terrestrial resources were exploited by Aboriginal hunter-gathers in the Cumberland Plain. Land mammals that were hunted for food included kangaroos, possums, sugar gliders, wombats and echidnas as well as native rats and mice (Attenbrow 2003, p.70). Birds, such as the mutton bird and brush turkey, were also eaten and it is recorded that eggs were a favourite food (Attenbrow 2003, pp.75–76). Evidence of yam harvesting has also been recorded on the Hawkesbury River and fish traps are known to have been used in the Nepean River (Kohen 1985). Kohen also notes that in 1810, the diet of the Gundungurra people was described as consisting of a variety of foods including "possums, eels, snakes, blue-tongued lizards, freshwater mussels and a variety of birds" (Kohen 1985).

Attenbrow has noted that "Sydney vegetation communities include over 200 species that have edible parts, such as seeds, fruits, tubers/roots/rhizomes, leaves, flowers and nectar (Attenbrow 2003, p.76). Observations from the earliest European settlers describe Aboriginal people in the Sydney region roasting fern-roots, eating small fruits the size of a cherry as well as a type of nut and the root of "a species of the orchid" amongst other types of plant food. As Attenbrow points out, however, the settlers' lack of knowledge of the local plant species make exact identification of the various plants used difficult (Attenbrow 2003, pp.76–79).

In summary, the Cumberland Plains and the Western Sydney environment provided a wide variety of plants and animals which were used by the local Aboriginal populations for artefact manufacture, medicinal purposes, ceremonial items, and food.

4.2 PREVIOUS ARCHAEOLOGICAL WORK

The material evidence of Aboriginal land-use has been compiled based upon a review of previous archaeological studies at a regional and local level, heritage database searches and field investigations.

4.2.1 REGIONAL ARCHAEOLOGICAL CONTEXT

Kohen (1986) study predicted site occurrence, chronology and function for the region. The chronological component of his model posits that the Aboriginal occupation of the Cumberland Plain primarily occurred during the mid to late Holocene (approximately 4,500 BP) and was related to an increase in Aboriginal population in the area and the introduction of a new stone tool technology, the 'small tool tradition'. Prior to the mid Holocene, Kohen (1986) argues that Aboriginal occupation of the area was concentrated on and around the Nepean River and the coast surrounding Sydney.

Similarly, Smith's (1989) work represented the first stage of a National Parks and Wildlife Service (NPWS) Planning Study for the Cumberland Plain. At the time, Smith calculated that less than 0.5% of the Cumberland Plain had been surveyed and/or studied systematically and noted that only 17 sites had so far been excavated. A number of surveys were conducted as part of Smith's investigation and in the 1,600m^2 assessment area she surveyed in the Rickabys Creek and Londonderry area, four sites and one isolated find were located. A predictive site location model was developed by Smith for the southern Cumberland Plain based the results of her study. This included the theory that sites would be most commonly found along permanent creeks and around swamp margins. Creek flats and banks were considered to be focal topographical features for site location (Smith 1989).

As a direct consequence of numerous archaeological investigations being undertaken due to rapid development across the Cumberland Plain, an increasing number of Aboriginal sites have been identified and recorded in the last 15 to 20 years. Access to a greater volume of data allowed McDonald (1997a, b) to undertake a more detailed analysis of site types and their distribution over the Cumberland Plain. Although McDonald noted that lack of archaeological visibility was a significant issue, she found Open Artefact Scatters and Open Camp Sites to be the dominant site type (89% of all sites recorded), followed by Isolated Finds and a combination of open or other site types (3.5%), and Scarred Trees (2.1%). Open Sites were found in all landscape units but McDonald determined the high proportion of sites located on creek banks appeared to be a reflection of surface visibility and taphonomy rather than being indicative of patterns of discard (McDonald 1997a). She also revealed that virtually none of the sites that had been excavated on the Cumberland Plain could be characterised on the basis of surface evidence alone due to an obvious disparity between the number of surface and sub-surface artefacts (McDonald 1996).

After extensive salvage and test excavations carried out for the Rouse Hill Test Excavation Programme (McDonald, Rich and Barton 1994) and the Rouse Hill (Stage 2) Infrastructure Project (McDonald 1996), several important characteristics relating to the Cumberland Plain were noted:

- *Most areas, even those with sparse or no surface manifestations, contain sub-surface archaeological deposits.*
- *Where open sites are found in aggrading and stable landscapes, some are intact and have the potential for subsurface structural integrity. Sites in alluvium possess the potential for stratification.*
- *While ploughing occurs in many areas of the Cumberland Plain, this only affects the deposit up to 30 centimetres deep, and even then, ploughed knapping floors have been located which are still relatively intact and depths of between 700 to 900 millimetres from the surface.*
- *Contrary to earlier models for open sites, many sites contain extremely high artefact densities with variability appearing to depend on the range of activity areas and site types that are present.*
- *The complexity of the archaeological record is also far greater than was previously identified on the basis of surface recording and limited test excavation. Intact knapping floors, backed blade manufacturing sites, heat treatment locations, several apparently specialised tool types and generalised camp sites were all found following more detailed investigations.*
- *Two Early Bondaian dates (between 5,000 and 3,000 BP) from Rouse Hill provide a context for backed blade manufacture.*

- *Overall site patterning is identifiable on the basis of environmental factors, where sites on permanent water are more complex (i.e., they represent foci for larger groups or are used repeatedly by smaller groups over a long period of time) than sites on ephemeral or temporary water lines (McDonald 1996:115).*

McDonald, Mitchell, and Barton (1994) also argued that environmental factors, such as stream order, were integral to developing a predictive model for the Cumberland Plain. Stream order modelling as a predictive tool can be utilised to anticipate the potential for Aboriginal camp site locations in the landscape based on the order of water permanence. McDonald (1997a, 1997b, 1999) in particular has drawn on stream order modelling to forecast the potential nature and complexity of sites in the Cumberland Plain. These models can also be used to predict the possible range of activities carried out at a particular site and the frequency and/or duration of occupation.

Analysing stream order can assist researchers in locating areas of past water permanence, which would have been vital for traditional Aboriginal communities. Abundant food and other resources are more likely to occur in areas of water permanence which would in turn attract Aboriginal occupation. McDonald's excavations of Open Artefact Scatter sites at the ADI site in St Marys provided evidence of such a correlation (McDonald 1997b, p.133).

According to McDonald, the range of lithic activities and the complexity of the resulting stone assemblage observed at a location of permanent water differ depending on stream order. Overall, Artefact Scatters in the vicinity of a higher order ranking streams reflect a greater range of activities (e.g., tool use, manufacture and maintenance, food processing and quarrying) than those located on lower order streams. Temporary or casual occupation of a site, reflected by an isolated knapping floor or tool discard, are more likely to occur on smaller, more temporary water courses (McDonald 1997a).

It is therefore possible, McDonald concluded, that stream order modelling could be utilised to make general predictions about the location and nature of Aboriginal sites on the Cumberland Plain. Water permanence (i.e., stream order), landscape unit (i.e. hill top, creek flat) as well as the proximity to artefact raw materials can result in variations in the density and complexity of an Aboriginal archaeological feature (McDonald 1997a). Site location and duration of occupation predictions therefore relate to stream order in the following ways:

- *In the headwaters of upper tributaries (i.e., first order creeks) archaeological evidence will be sparse and represent little more than a background scatter.*
- *In the middle reaches of minor tributaries (second order creeks) archaeological evidence will be sparse but indicate focussed activity (e.g., one-off camp locations, single episode knapping floors).*
- *In the lower reaches of tributary creeks (third order creeks) will be archaeological evidence for more frequent occupation. This will include repeated occupation by small groups, knapping floors (perhaps used and re-used), and evidence of more concentrated activities.*
- *On major creek lines and rivers (fourth order) archaeological evidence will indicate more permanent or repeated occupation. Sites will be complex, with a range of lithic activities represented, and may even be stratified.*
- *Creek junctions may provide foci for site activity; the size of the confluence (in terms of stream ranking nodes) could be expected to influence the size of the site.*
- *Ridge top locations between drainage lines will usually contain limited archaeological evidence although isolated knapping floors or other forms of one-off occupation may be in evidence in such a location (McDonald 2000:19).*

A synthesis by ENSR (2008, pp.35–38) of sites excavated in the Blacktown region over the last 30 years yielded the following conclusions regarding the types of sites and artefacts that can be extrapolated more broadly for the Western Sydney region and the archaeological patterning that can be expected in the Study Area:

- *Silcrete outcroppings and natural concentrations are common on ridgelines and hilltops and have been extracted and used by Aboriginal people in the past giving these landforms a high likelihood of quarry or extraction sites being present.*

- *Rock shelters are not present in the Blacktown region as the underlying geology is not suitable.*
- *Open camp sites or artefact scatters are the most common site type in the region. Isolated artefacts, scarred trees and Potential Archaeological Deposits (PADs) also present.*
- *Most areas with artefacts present on the surface also contain subsurface deposits. Additionally, many landforms which have no evidence of Aboriginal cultural heritage on the surface may still retain subsurface deposits.*
- *Subsurface deposits are normally found in alluvium, river terraces, lower slopes, and other remnant soils (with less than 700 millimetres of topsoil). Based on research at Second Ponds Creek, lower slopes and river terraces have the potential to retain the highest concentration of artefactual material (40,909 lithics within lower slopes and 32,786 lithics within RH/SP 12, a river terrace). These areas also often retain good structural and stratigraphical archaeological integrity.*
- *A greater complexity of Aboriginal sites is broadly correlated with the permanence of water, with the larger tributaries containing more complex archaeological sites. The likelihood of a site being present is also often drastically reduced when the distance to a water source is greater than 150 metres.*
- *A large range of raw materials were utilised by Aboriginal people in the region, including silcrete (which is often the dominate material), indurated mudstone, chert, tuff, quartz, basalt, and quartzite. Silcrete artefacts can also often be heat treated.*
- *Modern human activities can cause dramatic disturbance and can affect archaeological resources and their stratigraphic integrity. In particular, agricultural and horticultural activities near creeks often modify creek lines and river terraces, destroying the archaeological resource.*

Based on the results of subsurface testing at the Rouse Hill development on the northern Cumberland Plains, an updated predictive model was created by White and McDonald (2010). Their predictive model identified four main factors which determined artefact density and distribution. These were:

1) *Stream order, with higher order streams tending to have higher artefact densities and more continuous distributions than lower order streams.*
2) *Landform, with higher densities occurring on terraces and lower slopes, and with sparse discontinuous scatters on upper slopes.*
3) *Aspect on lower slopes associated with larger streams, with higher artefact densities occurring on landscapes facing north and northeast; and*
4) *Distance from water, with higher artefact densities occurring 51-100 metres from 4th order streams, and within 50 metres of 2nd order streams (White and McDonald 2010:36).*

These results are directly transferable to other parts of the Cumberland Plains.

In 2016 Biosis developed a predictive model relevant to the study area for the Mamre West Precinct at Orchard Hills located three kilometres north of the current study area. This model (Biosis 2016:30) suggests that:

- Artefact Scatters are the most frequent site type identified in soil landscapes, landforms and underlying geological formations within the local area, and are commonly found within 161 metres of permanent water sources and 266 metres of ephemeral water sources.
- Potential Archaeological Deposits (PADs) are often found within 189 metres of ephemeral water sources.
- Modified Trees are found in areas of old vegetation growth, often preserved as riparian corridors, and located approximately 193 metres from permanent water sources.
- Shell Middens, Art Sites and Stone Quarries are not recorded in the local region.
- Burial Sites, Rock Shelters and Grinding Grooves are unlikely to occur in the Study Area due to the lack of suitable soil profiles and the absence of underlying geology suitable for the creation of these site types.

- There are no known Aboriginal Ceremony or Dreaming Sites or Post-Contact Sites in the local region and thus these site types are expected to be rare.

4.2.2 HERITAGE DATABASE SEARCH

A search of the Heritage NSW AHIMS database was undertaken on 14 April 2022 (Client Service ID 675711, 675713, 675716, 675717 and 675718). The results from the AHIMS search identified 267 previously recorded sites within a 5-kilometre radius of the study area. The search indicates that Artefacts are the predominant site type with just over 95% of known sites containing this feature. While their occurrence in the local archaeological record is minimal, modified trees and grinding grooves have been known to occur within the Kemps Creek region and as such may occur within the study area (Figure 4.1, Table 4.1 and Table 5.1).

MOST SITES ARE LOCATED WITHIN FLATS AND ARE IN PROXIMITY TO THE PERENNIAL SOUTH CREEK AND ITS ASSOCIATED TRIBUTARIES AHIMS SITE 45-5-5190

MSP-04 (AHIMS #45-5-5190) is georeferenced as occurring within the study area. However, the description of MSP-04 in the site card shows that it is located within Lot 22 DP 258414, approximately 50 metres north of the extent of the study area.

Sites also commonly occur on footslopes, slopes, shoulders, and ridges. While they do occur within spurs, summits, and valleys AHIMS data within the area indicates this is infrequent. Refer to section 5 for further details on site occurrences.

It should be noted that upon requesting site cards, Heritage NSW indicated that some site cards were missing from the AHIMS system, in this instance AHIMS # 45-5-2568. Where this information is missing from the record, Austral has relied on information provided via the extensive search to inform of site predictions that may occur within and adjacent to the study area.

Table 4.1 Summary of sites recorded within 5-kilometres of the study area

Site type	Occurrence	Frequency (%)
Artefact	345	87.57%
Artefact, PAD	29	7.36%
PAD	17	4.32%
Artefact, Modified Tree	1	0.25%
Grinding Groove	1	0.25%
Modified Tree	1	0.25%
Grand Total	**394**	**100.00%**

FOR THE PURPOSE OF AHIMS SITE 45-5-5190

MSP-04 (AHIMS #45-5-5190) is georeferenced as occurring within the study area. However, the description of MSP-04 in the site card shows that it is located within Lot 22 DP 258414, approximately 50 metres north of the extent of the study area.

For the purpose of and Figure 4.2 and Table 4.2, it is assumed that the correct coordinate system has been registered for each site.

Table 4.2 Summary of sites recorded within the study area and adjacent.

Name	AHIMS No.	Type	Location Landform	Cadastral Boundary
MSP-02	45-5-5188	Artefact	Plain	Lot 22 DP 258414
MSP-03	45-5-5189	Artefact	Plain	Lot 22 DP 258414
MSP-04	45-5-5190	Artefact	Plain	Lot 23 DP 258414
EPTA10	45-5-3032	Artefact	Ridge slope	Lot 22 DP 258414
EPTA11	45-5-3033	Artefact	Spur-line crest	Lot 22 DP 258414
LEC10	45-6-1777	Open artefact scatter	Hill Slope	Lot 47 DP 270417

AHIMS SITE 45-5-5190

MSP-04 (AHIMS #45-5-5190) is georeferenced as occurring within the study area. However, the description of MSP-04 in the site card shows that it is located within Lot 22 DP 258414, approximately 50 metres north of the extent of the study area.

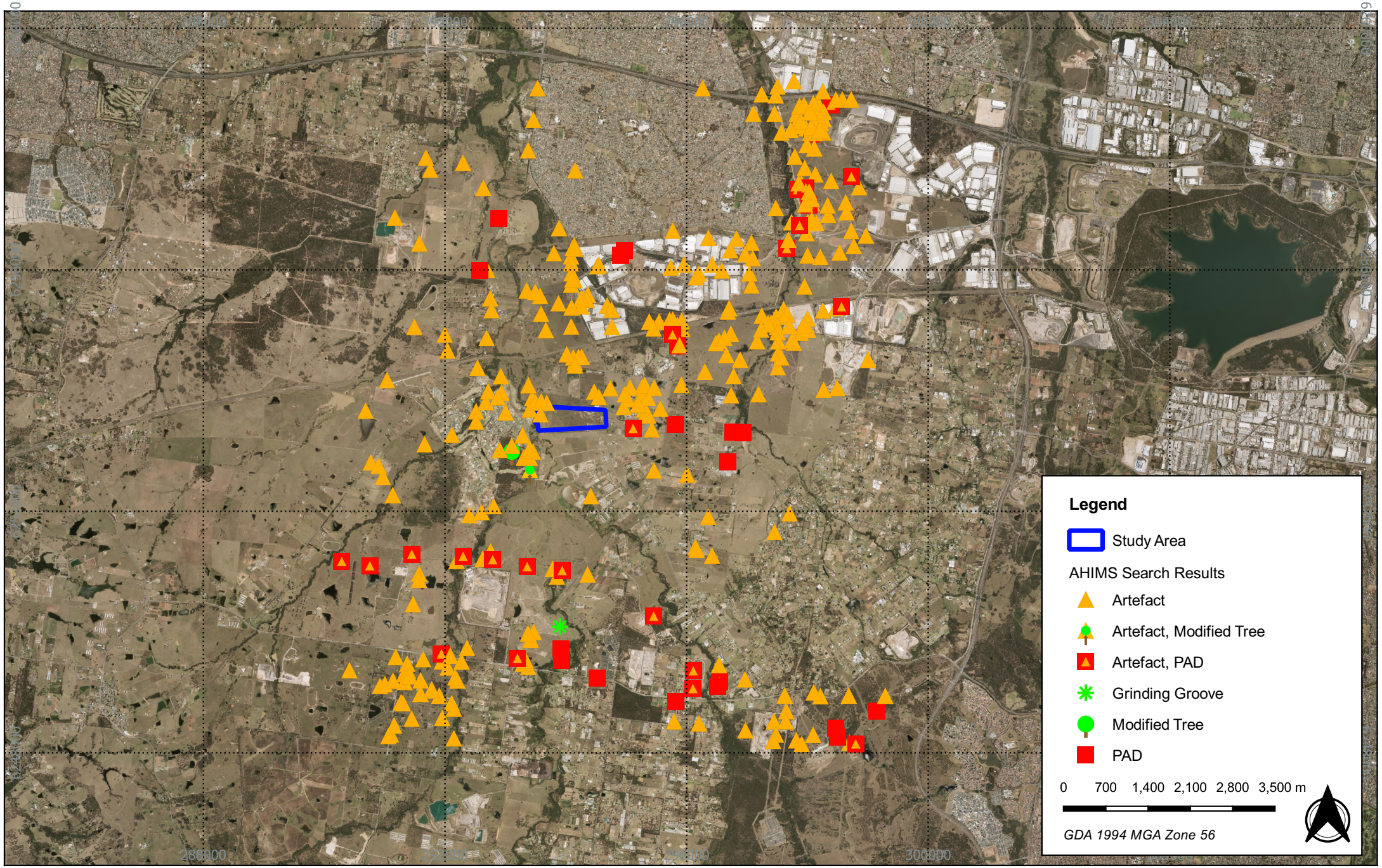


Figure 4.1 AHIMS Search results within 5km of the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPIAerial *Drawn by: ARH Date: 2022-04-28*

AUSTRAL ARCHAEOLOGY

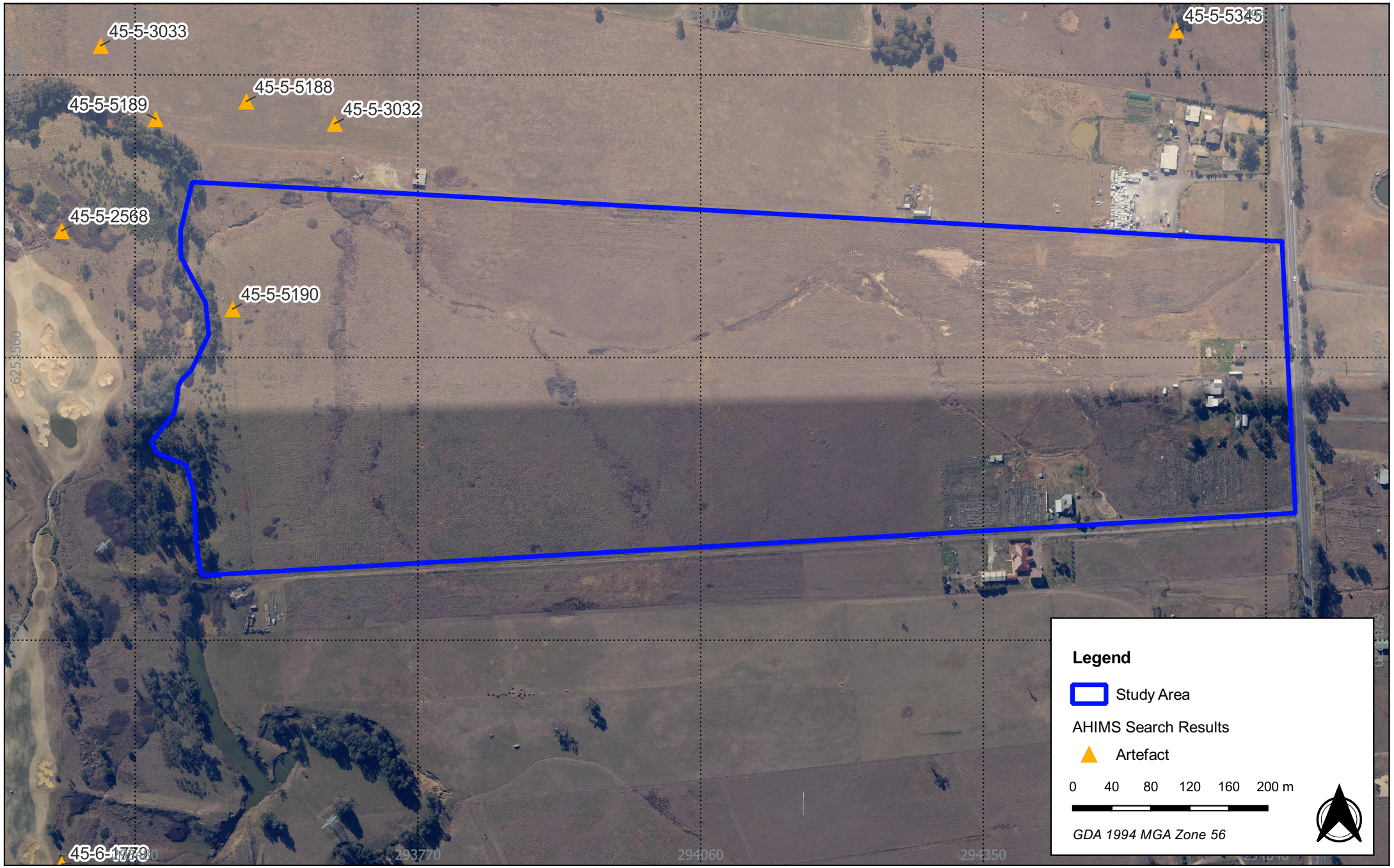


Figure 4.2 AHIMS Search results within the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPIAerial

Drawn by: ARH Date: 2022-04-28

AUSTRAL ARCHAEOLOGY

4.2.3 LOCAL ARCHAEOLOGICAL CONTEXT

Archaeological investigations of Penrith, and in particular the suburb of Kemps Creek, have been conducted in response to the spread of urban development as well as within the framework of academic enquiries. The limited ethnographic accounts of early settlers and explorers were once considered the primary source for archaeological enquiry. However, with the recent spread of urban development within the Kemps Creek environs, archaeological investigations have increased accordingly.

A large volume of studies have been completed in the region, as such, this section presents a synopsis of selected archaeological investigations of direct relevance to the study area. These reports have been selected based on their landform context, proximity to the study area and in particular, relationship to the Kemps Creek locality and South Creek catchment. The reports that have been reviewed are detailed in Table 4.3.

Table 4.3 Reports selected for review as part of local archaeological context.

Author	Relevance to Study Area	Type of assessment
Dallas (1988) and Appendix C	Luddenham Equestrian Centre, Luddenham Road, Erskine Park. Preliminary Archaeological Study. Current study area falls within this study area.	Survey and test excavation (appendix c)
Dominic Steele Consulting Archaeology (1999)	Land Between Luddenham and Mamre Roads, Luddenham, NSW. Survey Report. Current study area falls within this study area.	Survey
Jo McDonald Cultural Heritage Management Pty Ltd (2000)	"Austral Site", Mamre Road, Erskine Park, NSW. Approximately 1kilometres north-east of the study area.	Survey
Dominic Steele Consulting Archaeology (2001)	Land Between Luddenham and Mamre Roads, Luddenham, NSW. Preliminary Archaeological Test Excavation Project. Current study area falls within this study area	Test excavations
NSW Government (2018)	Aboriginal heritage assessment for the M12 Motorway, western Sydney. Approximately 8.5 kilometres south-west of the study area	Test excavations
Artefact Heritage Services Pty Ltd (2020)	Lots 54-58 Mamre Road, Kemps Creek Aboriginal Cultural Heritage Assessment Report. Located approximately 2.4 kilometres to the south of the current study area.	Survey and test excavation
EMM Consulting Pty Ltd (2020)	Mamre Road Precinct, Aboriginal Heritage Study. The eastern section of the current assessment area was included in this study.	Survey and desktop assessment
Niche Environment and Heritage (2020)	Lots 54-58 Mamre Road, Kemps Creek. Aboriginal Cultural Heritage Assessment. Assessment was approximately 700 metres south the assessment area.	Survey and test excavation
Biosis (2020)	657-769 Mamre Road, Kemps Creek, NSW. Assessment was approximately 1 kilometre to the north-east of the current study area.	Archaeological report
Biosis Pty Ltd (2020)	706-754 Mamre Road, Kemps Creek: Archaeological Report. Assessment was approximately 178 metres north-east of the assessment area.	Survey and test excavation

LOTS 54-58 MAMRE ROAD, KEMPS CREEK. ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Niche (2020) was commissioned by Mirvac to undertake an ACHA for 864 – 882 Mamre Road, Kemps Creek. An initial heritage assessment undertaken by Artefact Heritage who identified one Artefact Scatter previously unregistered on AHIMS within Niche's assessment area (AHIMS #45-5-5186) and one area of archaeological potential. Further investigations were recommended, and these were undertaken by Niche.

An archaeological survey was undertaken which identified further artefacts associated with AHIMS #45-5-5186 and revised the area of the PAD identified in the previous assessment. The survey identified five concentrations of artefacts ranging from 15 artefacts to three artefacts with six isolated artefacts uncovered as well.

Cores and longitudinal flakes were present suggesting artefact creation. The area was identified as having archaeological potential on the basis that it was situated on a ridgeline slope landform within 200 metres of water. However, as the site was located on a lower slope of the ridgeline, the artefacts were thought to have been washed down from the ridgeline crest above. Based on the number of surface artefacts identified, subsurface testing was recommended.

A total of 47 test pits were excavated, which uncovered a total of 25 additional artefacts, and one area of artefact concentration. It was concluded that MAM AS 1901 (AHIMS #45-5-5186) is a low-density artefact assemblage with six isolated surface artefacts, four surface artefact concentrations and one subsurface artefact concentration, with moderate archaeological significance. It was concluded that the site was an opportunistic artefact manufacture location, and a salvage excavation was recommended. This report is of relevant to the current assessment as it contributes to the predictive model for the region.

706-754 MAMRE ROAD, KEMPS CREEK. ABORIGINAL CULTURAL HERITAGE ASSESSMENT.

Biosis Pty Ltd. (2020) was commissioned by Aliro Group on behalf of ISPT Pty Ltd to undertake an ACHA for 706-754 Mamre Road, Kemps Creek. The assessed area is located on the east side of Mamre Road.

The topography for this assessed area includes a gently sloping alluvial flat and two crest landforms. Sparse and widely spaced shallow to deep alluvial stream channels form an integrated network running in a single direction. In times of flooding, the streams flood out of the channels and over the floodplain. The assessed area is located within 1.3 kilometres west of South Creek, a sixth order perennial stream, and has a first order non-perennial tributary of South Creek crossing the north-east portion of the assessment area. The western portion contains a series of dams which are likely modified first order drainage lines associated with the development. There are two soil landscape described within the assessed area, with the majority made up of Luddenham and the rest Blacktown soil landscape.

An archaeological survey was conducted and deemed to have a low efficiency due to thick vegetation limiting the ground surface visibility (GSV) thus limiting the ability to identify surface Aboriginal sites. Although no Aboriginal sites were located, several PADs were identified, and four months later, test excavations were carried out.

Test excavations were carried out on four different landforms (gentle slope, mid slope, steep slope, and crest). A total of 197 50 by 50-millimetre test pits were excavated by hand at intervals of 40 metres. The test pits were excavated at 100 millimetres split with the exception of the first test pit in each PAD which was excavated in 50-millimetre splits. Pits were excavated until the B-horizon (bedrock) was reached.

As a result of the testing programme, six Aboriginal sites and seven artefacts were located (Table 4.4).

Table 4.4 Testing Results from Biosis Pty Ltd (2020)

Landform	Area Tested (m^2)	Total Test Pits	Number of Sites	Number of Artefacts	Depth (mm)
Gentle Slope	27	108	2	3	0 to 200
Mid Slope	17.25	69	4	4	0 to 300
Steep Slope	3.75	15	0	0	
Crest	1.25	5	0	0	
Total	**49.25**	**197**	**6**	**7**	

A total of 108 test pits spaced at 40 metres intervals were excavated across the gentle slope landform revealing a total of three artefacts across two pits.

A total of 60 test pits spaced at 40 metre intervals were excavated across the gentle slope landform revealing a total of four artefacts with in four pits.

A total of 15 test pits spaced at 40 metre intervals were excavated across the steep slope landform. No artefacts were located.

A total of 5 test pits spaced at 40 metre intervals were excavated across the steep slope landform. No artefacts were located.

The test excavation revealed an artefact density of 0.01 artefact per square metre with the highest density being two artefacts located in a single test pit.

The majority of artefacts were angular fragments (three artefacts) two distal flakes, one complete flake and a multidirectional core. The artefact material was made up of one chert and six silcrete artefacts, silcrete being the common material type for the area. Biosis concluded that due to the low density of artefacts recovered it would suggest the area did not have long or short-term occupation but was likely used for temporary occupation and resource gathering.

MAMRE ROAD PRECINCT, ABORIGINAL HERITAGE STUDY

EMM Consulting Pty Ltd (2020) was commissioned by the Department of Planning, Industry and Environment to prepare an Aboriginal Heritage Study for the Mamre Road Precinct. The assessed area includes the eastern section of the current assessment area.

The topography of the area is characterised by the undulation Cumberland plain which is characterised by low rolling hills and wide valleys. There are two prominent ridgelines in the north of the assessed area. The ridgelines are broad with gentle slopes to the valley floor, this area is subject to flooding. The soil landscape for the assessed area consists of Blacktown soil, Luddenham soil and South Creek soil.

The assessed area is bounded by three major tributaries, South Creek (6^{th} order stream) running north to south along the western boundary, Kemps Creek (4^{th} order stream) running south-west before joining South Creek and Ropes Creek (3^{rd} order stream) forming the easter boundary. The assessed area has several smaller creeks and drainage lines criss-crossing the area. The assessed area has been highly disturbed over the last 200 years due to agricultural and pastoral activities including the modification of waterways including Kemps Creek to form dams.

Surveys were performed on targeted areas that had been previously identified by predictive modelling and areas of ground surface visibility. A total of 31 properties were investigated during the survey. Pedestrian surveys were conducted on 11 of the properties, the remaining 20 properties were inspected visually from the nearest public land vantage point.

The distance survey confirmed that the north and south-north landscape is dominated by prominent ridgelines receding to South Creek in the south-east, Kemps Creek in the west and Ropes Creek to the north-east. Ground visibility was extremely low but surface materials was generally limited to shale, with a low density of poor-quality quartz and silcrete also noted.

The survey was able to re-locate eleven previously recorded sites and identify two previously unrecorded sites. These were all low density with <10 artefacts and or isolated artefacts. The two unrecorded sites were both located on a stream bank. One site contained two artefacts and the other contained three.

The survey concluded that the assessed area had a range of moderate to high ground disturbance resulting from modern activities. Areas of significant archaeological potential were identified and included the ridgelines to the north and south-east of the assessed area, the confluence of South Creek and Kemps Creek and northern portion of South Creek and Ropes Creek.

LOT 54-58 MAMRE ROAD, KEMPS CREEK ABORIGINAL CULTURAL HERITAGE ASSESSMENT REPORT

Artefact Heritage Services Pty Ltd (2020) [Artefact] was commissioned by Mirvac to prepare an Aboriginal Cultural Heritage Report for lots 54-58 Mamre Road Kemps Creek.

The assessed area topography consists of a ridge crest, slope, and undulating landform. A small 1st orders unnamed tributary of Kemps Creek runs east-west through the northern part of lot 58 and Kemps Creek is located 940m west of the assessed area. The underlying geology is part of the Wianamatta group with a soil landscape consisting of Blacktown soil, Luddenham soil and South Creek soil. A significant silcrete source at Plumpton Ridge is located 12.8 kilometres northeast of the assessed area.

Artefact performed a pedestrian survey and test excavations of the assessed area. Ground surface visibility (GSV) across the assessed area was low with slightly higher GSV around dams due to higher levels of erosion. The pedestrian survey identified 24 surface artefacts some of which were eroding out of the ground surface around the artificial dams. The assessed area contained two artefact scatters, scatter one had 15 artefacts with scatter two comprising 3 artefacts. The area also contained 6 isolated artefacts. The surface assemblage comprised of 17 complete flakes (41.94%), a geometric microlith, three formed tools, a tula and a ground edged axe.

A total of 47 500mm x 500mm test pits spaced at 30m intervals were excavated. Test pits were hand excavated, with the first test pit excavated in 50mm splits and remaining test pits excavated in 100mm splits. Two of the test pits were expanded to open an area of 9 500mm x 500mm test pits due to the high density of artefacts. All test pits were excavated to the archaeological sterile layer.

A total area of 15.5 m^2 was excavated resulting in the recovery of 25 artefacts equalling an artefact density of 1.61 artefacts per m^2. The assemblage comprised of primarily fragmented artefacts and raw materials indicating that the area was potentially used for later stage artefact manufacture.

LUDDENHAM EQUESTRIAN CENTRE, LUDDENHAM ROAD, ERSKINE PARK. PRELIMINARY ARCHAEOLOGICAL STUDY

Dallas (1988) was commissioned by The Signature Corporation Australia Ltd. to prepare a Preliminary Archaeological Report for Luddenham Equestrian Centre, Luddenham Road, Erskine Park. The reported area comprises of land between Luddenham Road and Mamre Road.

The assessed area topography is characteries largely by low lying flood prone pastural land with a north-south ridgeline. The area is bounded by South Creek to the east and Cosgrove Creek to the west.

GSV of the surveyed area was generally low due to thick grass, areas of exposure along the creek lines were giving closer attention. The survey identified 12 open camp sites within the surveyed area, all 12 sites and 671 artefacts were located along the creek lines (Table 4.5).

Table 4.5 Survey Results from Dallas (1988)

Site	Type	Landform	Number of Artefacts	Material	Density (Per 1 m^2)
1	Open Artefact Scatter	Creek Bank	19	Pink, Red and Grey Silcrete	2
2	Open Artefact Scatter	Eroded Drainage Channel	3	Yellow and Pink Silcrete and Cream Chert.	1
3	Open Artefact Scatter	Creek Bank	5	Yellow and Red Silcrete and Cream Chert	1
4	Open Artefact Scatter	Creek	6 (Plus worked floor)	Yellow and Red Silcrete and Grey Chert	3 (14 on worked floor)
5	Open Artefact Scatter	Creek Bank	25	Red Silcrete, Quartz and Grey Chert	15
6	Open Artefact Scatter	Creek Drainage Channel/ Floodplain Flat	34	Pink, Red and Grey Silcrete and Cream Chert	2
7	Open Artefact Scatter	Floodplain Flat	3	Red Silcrete	1
8	Open Artefact Scatter	Creek Drainage Channel/ Floodplain Flat	9	Grey, Red and Yellow Silcrete. Yellow Mudstone and Grey Quartzite	4
9	Test Excavation	Creek Bank	20	Red Silcrete	5
10	Test Excavation	Gentle Hill Slope	7	Red, Pink Silcrete	2
11	Open Artefact Scatter	Creek Bank/Ford	7	Quartz Crystal, White Chert, Red and Yellow Silcrete	2
12	Test Excavation	Exposer From Dam Wall	567	Red, Yellow, Pink, and Grey Silcrete, Quartz and Chert	30

Eleven of the 12 sites are located on or close to Creek banks or watercourse, one site is located on a gentle hill slope. All sites are open artefact scatter and silcrete is the predominant material which is present in all 12 sites. Other material includes chert present in 7 sites, quartz present in 3 sites and quartzite and mudstone in 1 site.

Test excavations were carried out to identify the extent of site 9 and 12 and their relationship with site 10. Thirteen 200x500mm test trenches were excavated in 50mm and occasionally 100mm splits. The removed dirt was wet sieved through 5mm and 2mm sieves. Ten out of the 13 trenches held artefacts with a total of 104 artefacts and one piece of ochre were recovered. Silcrete was the dominant material with 99% and the other 1% was made up of 10 mudstone, 3 quarts and 1 chert. All artefacts were identified as debitage consisting of flakes and flake pieces.

LAND BETWEEN LUDDENHAM AND MAMRE ROADS, LUDDENHAM NSW. SURVEY REPORT.

Dominic Steele Consulting Archaeology (1999) was commissioned by Camelot Grange Pty LTD to conduct and report on a survey of the land between Luddenham and Mamre Road. The survey was conduct in the same area as the survey conducted by Dallas (1988).

During the survey a total of five previously unrecorded open camp sites, one isolated find and a possible scarred tree were identified. The finds were primarily located along South Creek and the adjacent dam. The survey also reidentified 5 of the 12 sites located by Dallas (1988).

LAND BETWEEN LUDDENHAM AND MAMRE ROADS, LUDDENHAM NSW. TEST EXCAVATIONS.

Dominic Steele Consulting Archaeology (2001) was commissioned by Camelot Grange Pty LTD to conduct a test excavation of the land between Luddenham and Mamre Road.

Twenty-three test pits were dug in 100 mm splits close to Congroves Creek, revealing a very low artefact density. Four test pits were also excavated to reinvestigate Site 10 previously inspected by (Dallas 1988). These test pits revealed a very low artefact density. Test pits opened on the spur revealed a low to medium artefact density that indicated a knapping area. Two scrapers and a single notched flake was also identified. Silcrete comprised the dominant material in the assemblage, making up 93.8% of the finds.

ARCHOLOGICAL SURVEY FOR ABORIGINAL SITES: PROPOSED LIGHT INDUSTRIAL SUBDIVISON "AUSTRAL SITE" MAMRE ROAD, ERSKINE PARK.

Jo McDonald Cultural Heritage Management Pty Ltd (2000) was commissioned by Gunninah Environmental Consultants on behalf of Austral Brick Company care of Handover Property Group to conduct an archaeological survey on 63.7 ha of land adjacent to Mamre Road.

The assessed area topography can be divided into four landscapes, a gentle sloping lower hillslope the dominant feature, a floodplain, 1st orders stream bank and a 2nd order stream bank both tributaries of South Creek located 1.5 kilometres to the west.

A pedestrian survey identified 39 artefacts across five open artefact scatters and 3 isolated artefacts within the boundary of the assessed area and 1 open artefact scatter was located to the north in an area of road reserve (Table 4.6.). A low GSV was reported across the site due to thick ground coverage, with small areas of moderate to high visibility around vehicle tracks, areas of animal grazing and animal tracks.

Table 4.6 Survey Results from Jo McDonald Cultural Heritage Management Pty Ltd (2000)

Site	Site Type	Landform	Number of Artefacts	Artefact	Density
1	Open Artefact Scatter	Lower Hillslope	2	A silcrete flake piece and indurated mudstone cone-spit broken flake	1 per 225m^2
2	Open Artefact Scatter	Lower Hillslope	2	A silcrete flake piece and a silcrete multiplatform core	1 per 270m^2
3	Open Artefact Scatter	Lower Hillslope	1	Silcrete Blade	1
4	Open Artefact Scatter	Lower Hillslope	3	Two silcrete flakes and an indurated mudstone flake fragment	1 per 23m^2
5	Isolated Artefact	Lower Hillslope	1	Indurated mudstone	1
6	Open Artefact Scatter	Lower Hillslope	14	Backed artefacts, two cores, a flake tool with use wear and debitage. 72% silcrete, 14% quartz, 14% mudstone	1 per 21m^2
7	Open Artefact Scatter	Creek Bank	12	Silcrete multiplatform core, cobble with possible use wear, a bipolar flake and debitage,	1 per 15m^2

Site	Site Type	Landform	Number of Artefacts	Artefact	Density
8	Open Artefact Scatter	Lower Hillslope	3	A silcrete flake and two indurated mudstone heat shatters	3
9	Isolated Artefact	Lower Hillslope/ Creek Bank.	1	Silcrete flake fragment	1
Total			**39**		

Sites were generally identified in areas of moderate to high ground surface visibility around vehicle tracks, areas of animal grazing and animal tracks. Many of the sites were located on the lower hillslopes and within vicinity (less than 300m) of one of the two streams within the surveyed area, with the dominant artefact material being silicate which is common for this area.

657-769 MAMRE ROAD, KEMPS CREEK. ABORIGINAL CULTURAL HERITAGE ASSESSMENT.

Biosis (2020) was commissioned by Altis Property Partners and Frasers Property Industrial Constructions to undertake an Aboriginal archaeological assessment at 657-769 Mamre Road, Kemps Creek. The study area was approximately 1 kilometre to the north-east of the current study area. The assessment was conducted to supplement an application for a State Significant Development (SSD) approval.

The study area was composed of two landforms: gentle slope and floodplain. South Creek, a 6th order creek, was in close proximity to the study area. This suggested that the archaeological potential of the study area could be high. The study area was also located within the Cumberland Lowlands and the Wianamatta Group. Similar to the current study area, the major soil landscapes within 657-769 Mamre Road were Blacktown 1 and Blacktown 2.

Biosis performed a pedestrian survey in January 2019 which revealed no new Aboriginal sites or areas of high archaeological potential. Constraints to the archaeological survey included the presence of large dams, dense grass cover and thick corn crops.

Test excavations were performed in four separate open areas named OA1, OA2, OA3 (north), and OA3 (south-east). A total of 274 50 x 50-centimetre test pits were excavated at 20-metre intervals across 37 transects. 16 artefacts were recovered from OA1, 9 artefacts were recovered from OA2, and 668 artefacts were recovered from OA3 (north) and OA3 (south-east). These artefacts included complete flakes, broken hammerstones, angular fragments, proximal flakes, bipolar flakes, distal flakes, and Bondi point fragments. Three previously recorded archaeological sites were encountered during the test excavations: MSP-01, MSP-02 and MSP-03. Six new archaeological sites were discovered during the test excavations. These were MSP-05, MSP-06, MSP-07, MSP-08, MSP-09, and MSP-10.

It was recommended that surface salvages be performed on MSP-01, MSP-02, MSP-07 and MSP-08, and a salvage excavation be performed on MSP-02.

5 PREDICTIVE MODEL

Austral has used the information produced as part of the archaeological and environmental context sections to formulate a broad predictive model that identifies the type and character of Aboriginal cultural heritage sites that may be present within the study area.

The predictive model is based on the analysis of the following key variables:

- Relationship between site types and their spatial distribution within the landscape.
- Raw site types, raw material types and site densities and their relationship to salient environmental features.
- Information in ethnohistorical sources may indicate important natural resources or landscape features that may have been exploited.
- Potential chronological and spatial relationships between sites

A predictive model has been developed based on the consideration of the variables outlined above that indicates the lively site types that will be encountered during the archaeological survey and archaeological testing.

5.1 ANALYSIS OF KEY VARIABLES

The AHIMS search that has been completed for this project has identified similar trends in Aboriginal site types within the region. The most recorded site type in the area is artefact sites, comprising 94.9% of site types in the local area (inclusive of artefact sites associated with areas of PAD). Areas of PAD are the second most recorded site type in the area comprising 11.6% of site types (inclusive of areas of PAD associated with artefacts). The only other site types identified in the local area are modified trees and grinding grooves, however, these site types are comparatively rare.

It should be noted that any analysis using AHIMS data will be prone to biases as it relates to sites that have been recorded over the past 40 years. During this time, varying methodologies have been used to identify sites and a large portion of the surrounding landscape may have been subject to limited or no assessment. Therefore, site distribution is likely to be reflective of survey methods and patterns and should not be considered a comprehensive list of all Aboriginal sites within a given region.

A summary of Aboriginal heritage sites within 10 kilometres of the study area is included in Table 5.1.

Table 5.1 Summary of sites recorded within a 10 kilometres radius of the study area.

Feature Type	Total	%
Artefact	346	87.6
Artefact, PAD	29	7.3
PAD	17	4.3
Artefact, Modified Tree	1	0.3
Grinding Groove	1	0.3
Modified Tree	1	0.3
TOTAL	**395**	**100**

5.1.1 SOIL LANDSCAPE

Much of the study area is within the South Creek soil landscape, though the northeast portion of the study area is within the Blacktown soil landscape. 102 (25.8%) of the identified AHIMS sites fall within South Creek landscape unit. The majority of AHIMS sites (n=254, 64.3%) are comparatively found within the Blacktown soil landscape. Within the South Creek landscape unit,

most recorded sites are artefact sites (92.2%) however, modified trees, grinding grooves and areas of PAD are all present within this soil landscape. Comparatively, 97.6% of sites in the Blacktown soil landscape are artefact sites, with the only other sites being present comprising areas of PAD. Chart 5.1 depicts the number of known local sites associated with the soil landscapes present in the area.

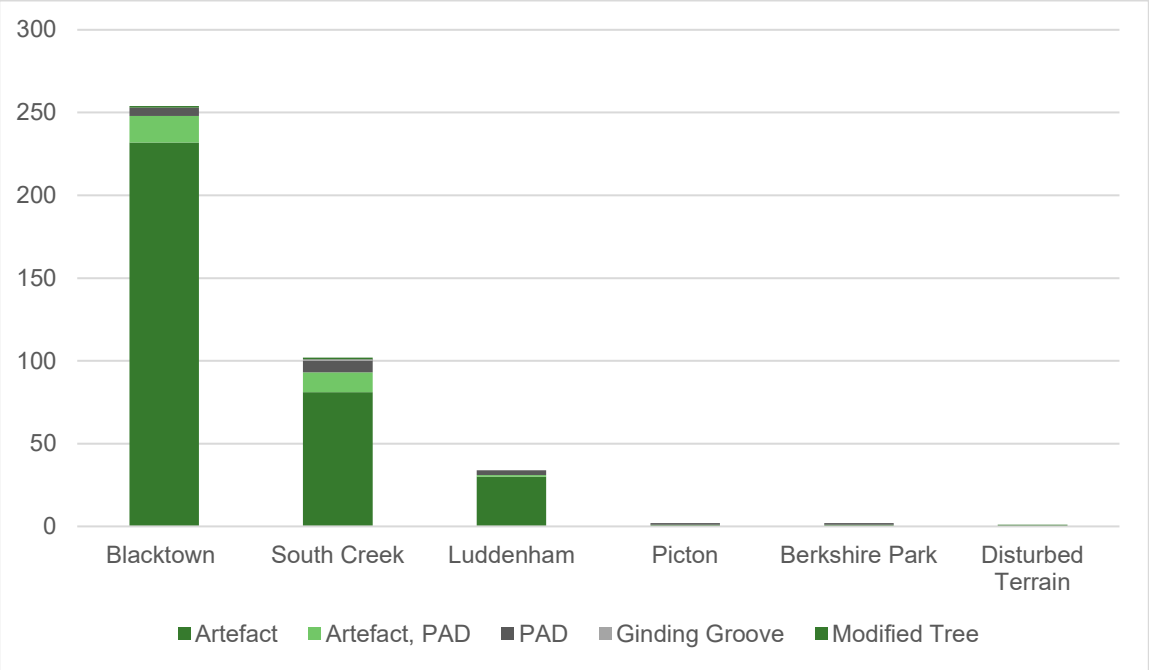


Chart 5.1 Site types in relation to soil landscapes

5.1.2 GEOLOGY

Within the greater local area, most sites are located within a Bringelly Shale geological unit (n=327, 82.8%), with the second highest number of sites located within an Alluvial Floodplain Deposit. This may be indicative of the presence of raw materials suitable for artefact manufacture, and therefore the quantity of tangible sites identified within these units. The Bringelly Shale unit can have outcrops of sandstone, and as a result of this grinding grooves have been identified in the local area.

The underlying geology of the study area and surrounding region would have provided a range of stone material types suitable for the production of flaked stone artefacts. Silcrete is the most common raw material type associated with stone tool manufacture based on assemblages recovered from archaeological sites across the region. Known silcrete sources in the wider region include the St Marys Formation and Rickabys Creek gravels and terraces along the Nepean River. A red silcrete quarry site is located approximately 2 kilometres from the study area. No known stone sources, however, are located within the study area, though large densities of silcrete artefacts have been found in proximity to the study area, both surface and subsurface.

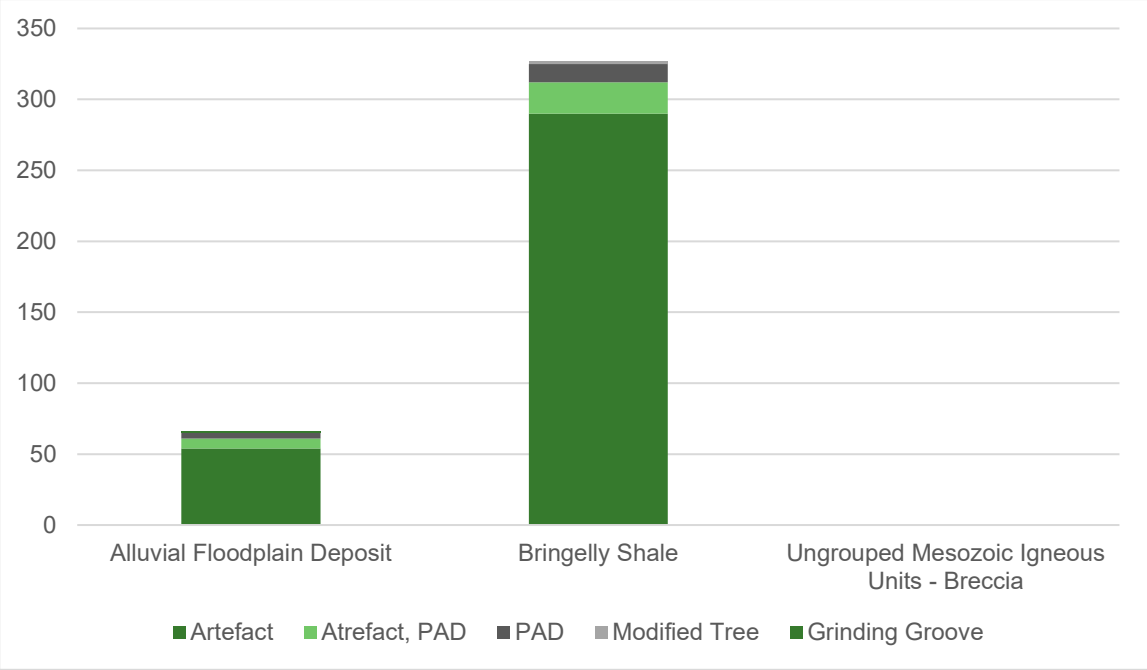


Chart 5.2 Site types in relation to geological units

5.1.3 TOPOGRAHY AND HYDROLOGY

The study area is located on a gentle slope that runs west from Mamre Road to South Creek. An alluvial plain extends along the western portion of the study area, immediately adjacent to the bank of South Creek. Levees and terraces are present above the banks of South Creek's stream channel. A small riparian corridor along the creek is also present (**Figure 4**). Most sites (51.95%) are located within a flat landform. However, sites in the local area have been identified in a vast majority of landforms at varying frequencies and this can be seen depicted below.

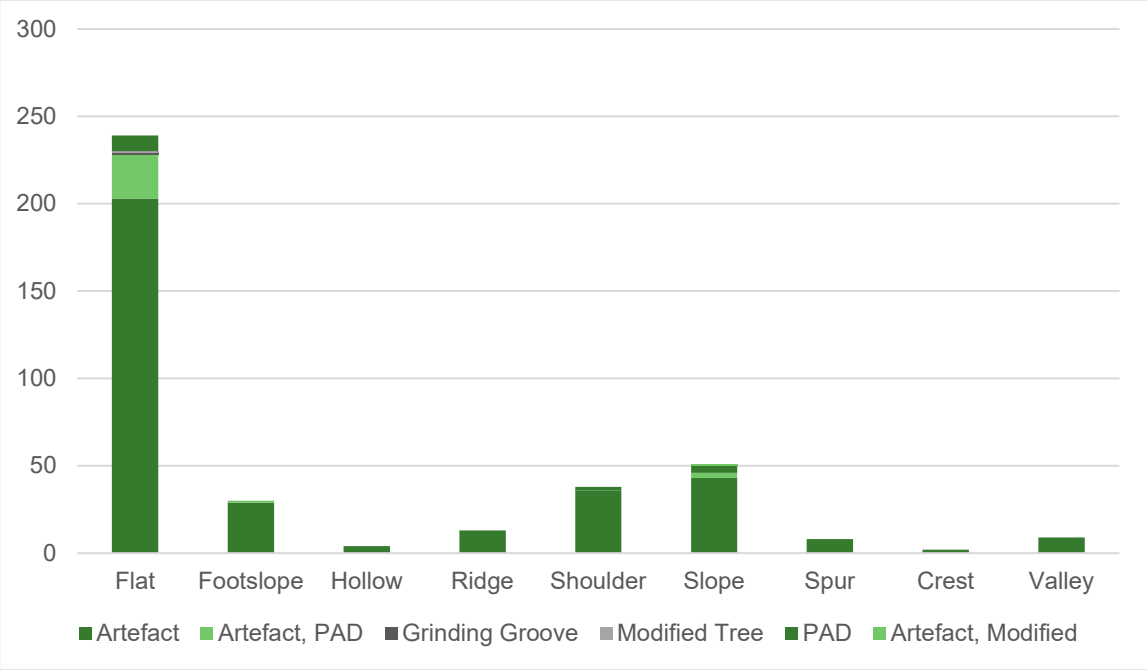


Chart 5.3 Site types in relation to topographical units

According to Speight (2009, p.59) alluvial plains comprise a landform characterised as having very low relief. Shallow-to-deep alluvial stream channels are typically sparse to widely spaced, forming a unidirectional, integrated network. There is often active erosion and aggradation by channelled

and overbank stream flow, or the landforms can be relicts from these processes. Typical landform elements associated with alluvial plain landforms presented within the study area include stream channels, levees, terraces, and channel fill. Levees are very long, low, narrow, nearly level, sinuous ridges immediately adjacent to a stream channel built up by overbank flow, often present on both sides of the stream channel as a result of periodic flooding and depositional events. During large floods the stream flows out of the channel and over the floodplain, resulting in both erosion and burial of cultural material.

There are several watercourses within or adjacent to the study area. South Creek flows north to south along the western boundary of the study area, a sixth order perennial water source. A second order tributary of South Creek flows west to east adjacent to the northern boundary of the study area through a low-lying plain that extends south through the study area. Two first order streams running approximately north-south join the second order stream in the western half of the study area.

Investigation into sites in the 10-km AHIMS search radius showed the highest number of sites are associated with 1st (28.5%) and 2nd (28.3%) order streams. Most other sites are associated with 4th (19.3%) and 5th (23.5%) order streams. As stream order increases, so does the likelihood that the stream would be a perennial source of water. Consequently, the proximity of South Creek, a 6th order perennial water source, to the study area suggests a high potential for Aboriginal occupation in this location. Predictive modelling for the Cumberland Plains region suggests that artefact density and site complexity decreases in relation to decreasing Strahler order. Therefore, the artefact density and complexity of potential archaeological deposits will likely decrease with increasing distance from high Strahler order water sources, and subsequently with decreasing Strahler order (Jo McDonald Cultural Heritage Management 1997, Jo McDonald Cultural Heritage Management 2006, Dominic Steele Consulting Archaeology 2003, White & McDonald 2010).

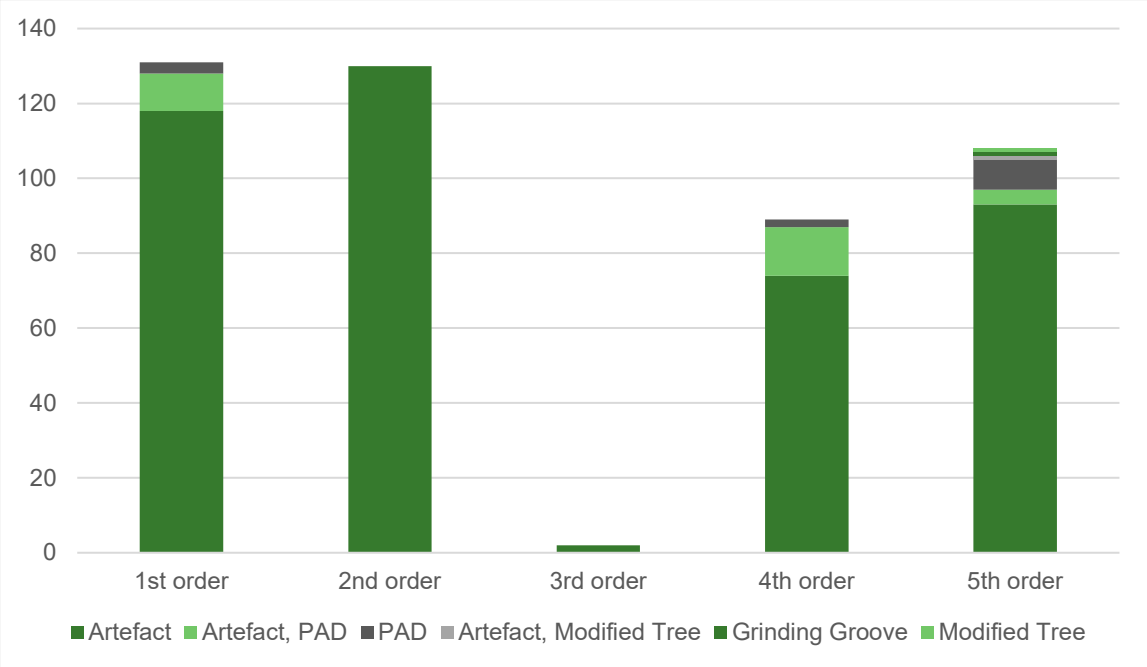


Chart 5.4 Site types in relation to stream order

5.1.4 ANALYSIS OF THE KNOWN SITES IN THE LOCALITY

Austral has undertaken an analysis of excavated sites in proximity to the study area to provide a detailed breakdown of the anticipated density and composition of lithic assemblages in the locality. Given the density of excavations within the vicinity of the study area, sites from within approximately 5 kilometres of the study area have been subject to this analysis. This identified 8 sites that had been subject to archaeological excavation. Details from these excavations are summarised in Table 5.2.

Table 5.2 Composition and density of local lithic assemblages

Site name	No. test pits	Test pits w/ artefacts	Total ex. (m^2)	Total artefacts	Max artefact density	Average artefact density	Raw Materials
Artefact – Lots 54-58 Mamre Road, Kemps Creek							
Mamre Road Artefact Scatter 1901 (AHIMS #45-5-5186)	47	-	11.75 m^2	60 (25 found during test excavation)	8.67 artefacts/ m^2	0.53 artefacts per test pit	Silcrete flakes, mudstone flakes, quartzite flakes, chert flakes
Biosis – 657-769 Mamre Road, Kemps Creek							
MSP-02 (AHIMS #45-5-5189)	127	-	31.75 m^2	668	137 artefacts per pit	5.26 artefacts per test pit	Silcrete and quartzite
MSP-05	4	4	1 m^2	5	2 artefacts per test pit	1.25 artefacts per test pit	-
MSP-06	2	2	0.5 m^2	2	1 artefact per test pit	1 artefact per test pit	Silcrete
MSP-09	3	3	0.75 m^2	7	3 artefacts per test pit	2.33 artefacts per test pit	-
MSP-10	3	3	0.75 m^2	9	6 artefacts per test pit	3 artefacts per test pit	-
Biosis – 705-754 Mamre Road, Kemps Creek							
BakersLn PAD4 (AHIMS #45-5-5566)	1	1	0.25 m^2	2	1 artefact per test pit	2 artefacts per test pit	Silcrete
BakersLn PAD5 (AHIMS #45-5-5567)	4	1	1 m^2	2	1 artefact per test pit	0.5 artefacts per test pit	Silcrete and chert

Average artefact densities in proximity to the study area are 0 and 9 artefacts per test pit, averaging between 0 and 9 artefacts/ m^2. However, the maximum artefact density per square metre located in the local area is 548 artefacts/ m^2. Common raw material types in sites excavated within the vicinity of the study area are silcrete, indurated mudstone tuff, chert, quartz, siltstone, mudstone, quartzite, and tuff. Silcrete is the dominant material present in the area, unsurprisingly, as there are frequencies of natural silcrete outcrops in proximity to the study area.

5.2 PREDICTIVE STATEMENTS

Based on the analysis presented in Section 5.1, the following predictive statements can be made:

- The known sites within the region are dominated by isolated artefacts, artefact scatters, and subsurface deposits, with higher densities occurring adjacent to perennial fresh water sources. These are predicted to be the most likely site type in the study area.
- Most artefacts are manufactured from silcrete, and this is expected to be the most prominent raw material in the study area. Other raw materials encountered in assemblages in the local area include indurated mudstone, chert, quartz, quartzite, glass, and petrified wood in lower numbers and these may be present within the study area.
- Most sites are located on raised areas close to higher order perennial streams, such as South Creek. Sites are also located on alluvial flood plains and lower slopes. Isolated artefacts have been found on all landforms across the area. It is predicted that subsurface artefacts in the area will be located on alluvial flat landforms in proximity to the watercourses present.
- Maximum artefacts densities of up to 548 artefacts per metre² have been encountered within approximately 10-kilometres of the study area. In general, average densities have been between 0 and 9 artefacts per metre². It is likely the study area will contain at least low densities of artefacts, with higher subsurface deposits possible in proximity to watercourses.
- Angular fragments comprise the most common artefact type recorded in the local area, although formal tools such as backed artefacts (geometric microliths, Bondi points, backed flake fragments) are also common within assemblages. It is predicted subsurface assemblages may comprise these features.

6 FIELD METHODS

A site specific investigation methodology has been developed for the project that complies with the Requirements of the Code of Practice (DECCW 2011).

6.1 SURVEY METHODOLOGY

The survey was conducted on 11th May 2022 by Declan Coman (Archaeologist, Austral) and Dominique Bezzina (Archaeologist, Austral). Steve Randall (Site Officer, Deerrubbin LALC) was in attendance.

6.1.1 SURVEY OBJECTIVES

The objectives of the survey were to:

- Complete a systematic survey that targets areas that have been identified as having the potential to contain Aboriginal heritage values.
- Identify and record Aboriginal archaeological sites visible on the ground surface and areas of PAD.
- Confirm that the previously recorded Aboriginal archaeological sites (AHIMS #45-5-5190) have been incorrectly georeferenced and is not located within the study area.

6.1.2 SAMPLING STRATEGY

The survey methodology was designed to optimise the investigation of areas where archaeological materials may be present and visible, as well as the investigation of the broader archaeological potential of all landform elements present within the study area, which included:

- Upper and lower gentle slope
- Floodplain
- Levee/terrace
- Riparian corridor
- Streambanks.

The specific survey methodology developed for this assessment was guided by the survey requirements as set out in Requirements 5 to 10 of the Code of Practice (DECCW 2011) and based upon consideration of the overall landform pattern within the study area, known landform elements (after Speight 2009) and the location of the previously identified sites. The survey targeted portions of the study area where previously recorded sites were located, to ascertain if they were still visible and if so the condition of these sites. The north of the study area is dominated by a raised alluvial floodplain which slopes gently down to the west, terminating at South Creek. This portion of the study area flanks an east-west running second order water course which runs into South Creek. In this area, the survey focused on elevated portions of the floodplain adjacent to the second order water course. Two minor water courses run north-south within the study area; the survey also examined elevated portions of land close to these. Finally, the survey also targeted the levee/terraces and riparian corridor alongside South Creek, along with visible portions of the streambank.

6.1.3 SURVEY METHODS

The archaeological survey consisted of pedestrian traverses completed by 2 team members. A key survey variable is ground surface visibility (GSV), which considers the amount of ground surface which is not covered by any vegetation; and exposure, which defines areas where dispersed surface soils and vegetative matter afford a clear assessment of the ground, were assessed across the study area and within each landform element. Overall survey coverage and calculated survey effectiveness was recorded. Note that the effectiveness of the field survey was largely dependent on the degree of GSV. Where surface visibility was restricted by dense vegetation cover, the potential for PADs was assessed, particularly in association with those landforms identified within the predictive model as more likely to contain Aboriginal archaeological sites. The potential of these

areas and all landform elements within the study area was considered against available evidence of land disturbance.

Photographs were taken of all survey units and landforms as well as representative surface visibility, and where present, surface exposures, soil profiles and disturbances relevant to the interpretation of the stratigraphic conditions and archaeological potential within each survey unit.

6.2 TEST EXCAVATION METHODOLOGY

The test excavation was conducted from 4 October 2022 through to 15 November 2022. The excavations were led by Taylor Foster (Senior Archaeologist, Austral) with assistance from:

- Dominique Bezzina Archaeologist, Austral
- Peta Rice Archaeologist, Austral
- Maria Maniatis Casual Archaeologist, Austral
- Tiffany Jones Casual Archaeologist, Austral
- Brody Saccoccia Graduate Archaeologist, Austral
- Jake Allen Graduate Archaeologist, Austral
- Madelaine Firth Graduate Archaeologist, Austral
- Carmen Baulch Student Archaeologist, Austral
- Crystal Wooding Student Archaeologist, Austral
- Belinda Jackson Kamilaroi Yankuntjatjara Working Group
- Jamie Currell Kamilaroi Yankuntjatjara Working Group
- Tyrone Pal Kamilaroi Yankuntjatjara Working Group
- Justine Coplin Darug Custodian Aboriginal Corporation
- Dominic Wilkens Darug Custodian Aboriginal Corporation
- Rodney Gunther Waawaar Awaa Aboriginal Corporation
- Adam Gunther Waawaar Awaa Aboriginal Corporation

The test excavation was completed in accordance with the notification and sampling strategy that was submitted to Heritage NSW on 27 September 2022. A copy of this notification is included in Volume 2.

6.2.1 TEST EXCAVATION OBJECTIVES

The objectives of the test excavation were to characterise the nature, extent and archaeological significance of Aboriginal objects associated with areas of high and moderate potential within the study area.

6.2.2 TEST EXCAVATION METHODOLOGY

The test excavation programme was undertaken according to the prescribed methodology of Requirement 14 to 20 and 23 to 26 of the Code of Practice (DECCW 2011). Specifically, Requirement 15b of the Code of Practice, stipulates that a sampling strategy must be developed for all test excavations which take place prior to work commencing (DECCW 2011, p.25). In summary, test pits must be placed on a systematic grid designed to target both areas likely to contain PADs and the location of proposed impacts. Test pits must be located a minimum of 5 metres apart.

Each test pit was excavated following Requirement 16a of the Code of Practice using mattocks, shovels and trowels (DECCW 2011, p.26). Sample units measured 500 millimetres^2, with the first test pit excavated in 50-millimetre spits to act as a geomorphologic example and the remaining test pits were excavated in 100-millimetre spits. The excavation was undertaken until the B-horizon was reached and then continued for another 100 millimetres to confirm that the following spit was

culturally sterile. In general, the decision to stop excavating was made, when the top of the C horizon; when a higher percentage of clay was evident, or coffee rock was encountered.

The objectives of the test excavation were to characterise the nature, extent and archaeological significance of Aboriginal objects associated with areas of high and moderate potential (PADs) within the study area. The survey identified five areas of PAD within the designated lots, however, only one area of PAD is within the impact footprint. Archaeological testing was not completed for areas of PADs that are not proposed to be impacted by the proposed activity, however some PADs may be tested to ensure that they do not extend into proposed works areas or impacts may be mitigated following the completion of the testing program through alterations to the proposed works. The survey identified one area of PAD within the proposed impact locations.

Table 6.1 Location of test pits within the study area

PAD	Description	No. test pits*
PAD 4	PAD 4 is located within an elevated flat landform approximately 600-metres east of South Creek and directly south of an unnamed tributary. The test excavations will consist of 144 test pits placed at 10m intervals along 10 transects. Each transect will be placed 20m apart and positioned to target areas of identified sensitivity within the scope of the proposed works.	144

It was stated test pits may be expanded to better understand the extent or characteristics of the archaeological resource present or if deep soil deposits necessitate expansion to reach a basal layer. Triggers for expansion may comprise, but are not confined to:

- high relative artefact density
- variation in raw material
- unusual artefact types
- evidence of a knapping event or different activities
- presence of hearths or other features that could be dated to provide a chronology.

Expansion as a result of higher relative artefact densities would be conducted by either expanding the initial test pit up to 1 square metre or by placing pits up to 5-metre intervals from the target test pit. Should a feature be identified, and the extent or characteristic of the feature need to be determined, test pits would be placed directly adjacent the feature as required to determine the archaeological resource. Expansion of the test pits would total no more than 0.5% of the surface area of the study area as is specified in Requirement 16a of the Code of Practice (DECCW 2010, p.26). Expansion would cease upon discussions between the archaeologists and RAPs present when it has been deemed that the extent or characteristics of the site or feature have been defined.

6.2.3 SIEVING

On site processing of excavated soils and artefact retrieval was undertaken via a combination of dry sieving through both a 5-millimetre and 3-millimetre nested sieve or solely through a 3-millimetre sieve, dependent on the nature of the material. Artefacts were collected from the sieves and placed in bags according to test pit provenance. Buckets containing material from the same spit were kept together and separate from other spits. All test pits were backfilled with the available material retrieved from the sieving location upon completion of the recording.

6.2.4 RECORDING

Detailed recording of all pits was undertaken, requiring the completion of an excavation recording form for each spit excavated. The form necessitated detailed descriptions of the soil profile, any evidence of disturbance and/or features, as well as depth of excavation and the number of artefacts and inclusions present. For each artefact a separate plastic bag was annotated with the project name, transect number, test pits number, spit number, date, and recorder's initials.

Photographic recording occurred at the completion of each pit or when an archaeological feature was uncovered. A photographic record was taken of at least one wall section in each test pit.

Together with a section drawing and stratigraphic photogrammetry from each pit, the photographs allowed for a detailed record of the strata present at the site.

6.2.5 ANALYSIS OF EXCAVATED MATERIAL

A lithic analysis was conducted by Doug Williams (Austral subcontractor). The lithics analysis was aimed at primarily identifying the presence of culturally modified lithic material within the archaeological record, with a secondary goal of identifying material, tool types and any indicators of *in situ* reduction that informs depositional integrity. All the artefacts recovered were taken to temporary storage at the Austral Archaeology office in the Albion Park and are to be reburied within the study area. In 2023 Austral is relocating to Yallah, at this point the artefacts may be moved to be stored within the Yallah office before reburial. Aboriginal stakeholders are to be consulted as to an appropriate area to relocate these artefacts. A new AHIMS site card for the location where the artefacts are to be relocated is to be created and lodged with the AHIMS registrar.

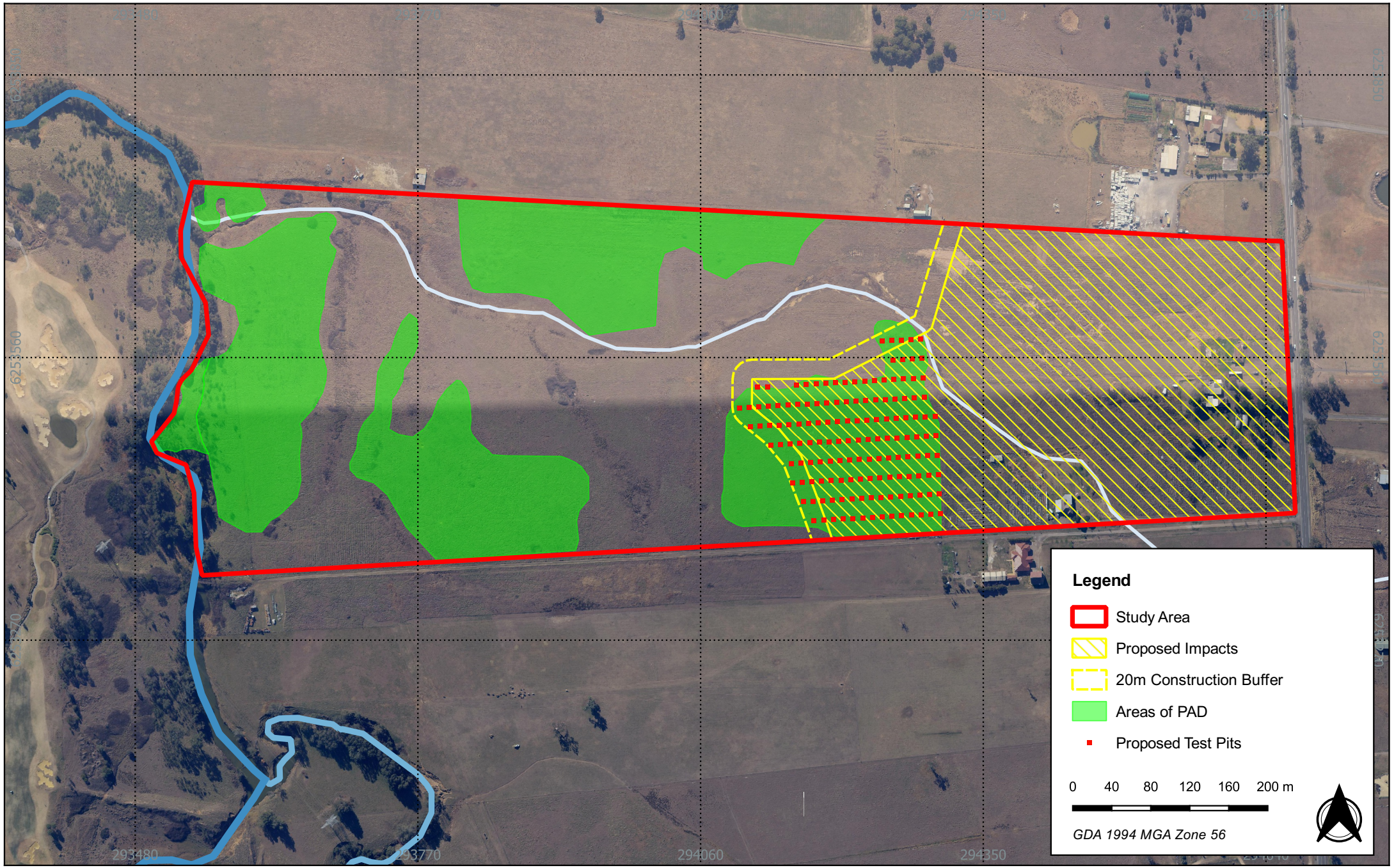


Figure 6.1 Proposed test pit locations

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPIAerial

Drawn by: ARH Date: 2022-08-05

AUSTRAL ARCHAEOLOGY

7 ARCHAEOLOGICAL RESULTS

The following section outlines the results of the archaeological investigations conducted within the study area.

7.1 ARCHAEOLOGICAL SURVEY RESULTS

7.1.1 VISIBILITY

In most archaeological reports and guidelines visibility refers to GSV, and is usually a percentage estimate of the ground surface that is visible and allows for the detection of (usually stone) artefacts that may be present on the ground surface (DECCW 2011). GSV within the study area varied from 0% to 20%, with the majority of the site possessing low visibility due to thick, tall grass cover (Figure 7.1) and discrete areas of visibility in areas of disturbance (Figure 7.2), and waterlogged gullies (Figure 7.3).

7.1.2 EXPOSURE

Exposure refers to those parts of the surveyed landforms whose topsoil has visibly been removed due to naturally occurring erosion or man-made disturbances. Usually expressed as a percentage of the total land surface, it is a theory predicting the nature of geomorphological change (DECCW 2011).

Overall, the study area displayed areas of exposure around formal and informal tracks such as driveways and pathways, erosion scours, and naturally clear areas on streambanks. Overall exposure in the study area was less than 10%, which hindered the overall effectiveness of the survey for identifying surface sites such as stone artefact scatters. The highest areas of exposure were present in the banks of the ephemeral streams in the west of the study area (Figure 7.4), and in the banks of South Creek (Figure 7.5).

7.1.3 DISCUSSION OF RESULTS

The most significant disturbance in the study area, comprises the clearing of land for agricultural and residential purposes, the establishment of vehicle tracks and other informal tracks across the study area. The south-eastern corner of the study areas has been subject to disturbances from residential buildings, sheds, market gardens and landscaping.

No new Aboriginal cultural heritage sites or objects were identified during the survey. Overall, the survey effort was hampered by thick grass coverage, poor visibility and areas of standing water. GSV across the study area was deemed to be approximately 0% to 10%. Area of exposure were limited to vehicle tracks, fence lines, erosion scours and the stream banks of South Creek. Four areas of PAD were identified during the survey, comprising one area of high subsurface archaeological potential in the north-western portion of the study area and three areas of moderate archaeological potential in the west and central-southern sections. Only PAD 4 is situated within the footprint of the proposed works area. Areas of PAD are shown on Figure 7.11.

PAD 1 is located in the northern-central part of the study area, located on a raised area adjacent to an unnamed second order water course. PAD 1 has been assessed as having high archaeological potential. PAD 2 comprises a raised flat directly adjacent to South Creek and bounded in the east by an unnamed first order water course. PAD 2 has been assessed as having moderate subsurface archaeological potential.

PAD 3 is situated to the east of PAD 2 in the central portion of the study area. PAD 3 is located on a flat / gentle slope between two first order water courses that run roughly north-south. PAD 3 has been assessed as having moderate subsurface archaeological potential. Finally, PAD 4 was recorded in the southern-central portion of the study area on a raised area within a flat / gentle slope. PAD 4 is abutted in the east by a disturbed area of former market garden and in the south by the lot boundary. PAD 4 has been assessed as having moderate subsurface archaeological potential.

Three landforms are present within the study area, these consist of low gullies following the ephemeral water courses running through the study area (Figure 7.6), slopes leading up to low

flats in the south of the study area (Figure 7.7), and slopes leading to elevated flats /terraces in the north of the study area (Figure 7.8, Figure 7.9 and Figure 7.10).

A description of these results, as they relate to the survey units and observed landforms within the study area can be seen in Figure 7.11 and Table 7.2.

Table 7.1 Survey coverage

Survey unit	Landform	Survey unit area (m²)	Visibility (%)	Exposure (%)	Effective coverage area (m²)	Effective coverage (%)
1	Alluvial Flat / terrace	~180 000	0	0	0	0
2	Flat	~170 000	0	0	0	0
3	Creek Line	~6400	10	5	32	0.5

Table 7.2 Landform summary

Landform	Landform area (m²)	Area effectively surveyed (m²)	% of landform effectively surveyed	No. sites	No. artefacts / features
Alluvial Flat	~180 000	0	0	**0**	3 x PAD
Flat	~170 000	0	0	**0**	1 x PAD
Creek Line	~6400	32	0.5	**0**	1 x PAD

The archaeological survey did not identify any new Aboriginal cultural heritage sites or objects; however, 4 areas of PAD were recorded. One area of PAD was deemed to have high subsurface archaeological potential, with the other PADs assess as having moderate archaeological potential. The survey was undertaken on landforms such as raised areas within floodplains and gentle slopes adjacent to water courses where previous studies in the area (i.e. Biosis 2020a) had identified archaeological material. In addition, the survey also targeted areas of exposure on vehicle tracks, erosion scours and the streambanks of South Creek. Areas in the northern part of the study area were accessed by informal tracks and, transects were walked out from these to examine different landforms. In general, the survey effort was hampered by thick grass coverage, poor visibility, and areas of standing water. As discussed in Section 4.2.2, above, one previous site, MSP-04 (AHIMS #45-5-5190), was erroneously recorded in the study area due a georeferencing issue. The description of MSP-04 (AHIMS #45-5-5190) on the site card was checked and determined to be located on Lot 22 DP 258414, outside of the current study area.

Figure 7.1 Visibility across majority of site.

Figure 7.2 Areas of disturbance in east of study area

Figure 7.3 Waterlogged gully

Figure 7.4 Exposure in bank of stream running through study area.

Figure 7.5 Exposures in banks of South Creek

Figure 7.6 Gully running through study area.

Figure 7.7 Low flat areas in south of study area

Figure 7.8 Slopes along north of stream

Figure 7.9 Elevated flat in north of study area.

Figure 7.10 Elevated flat / terrace on South Creek in west of study area.

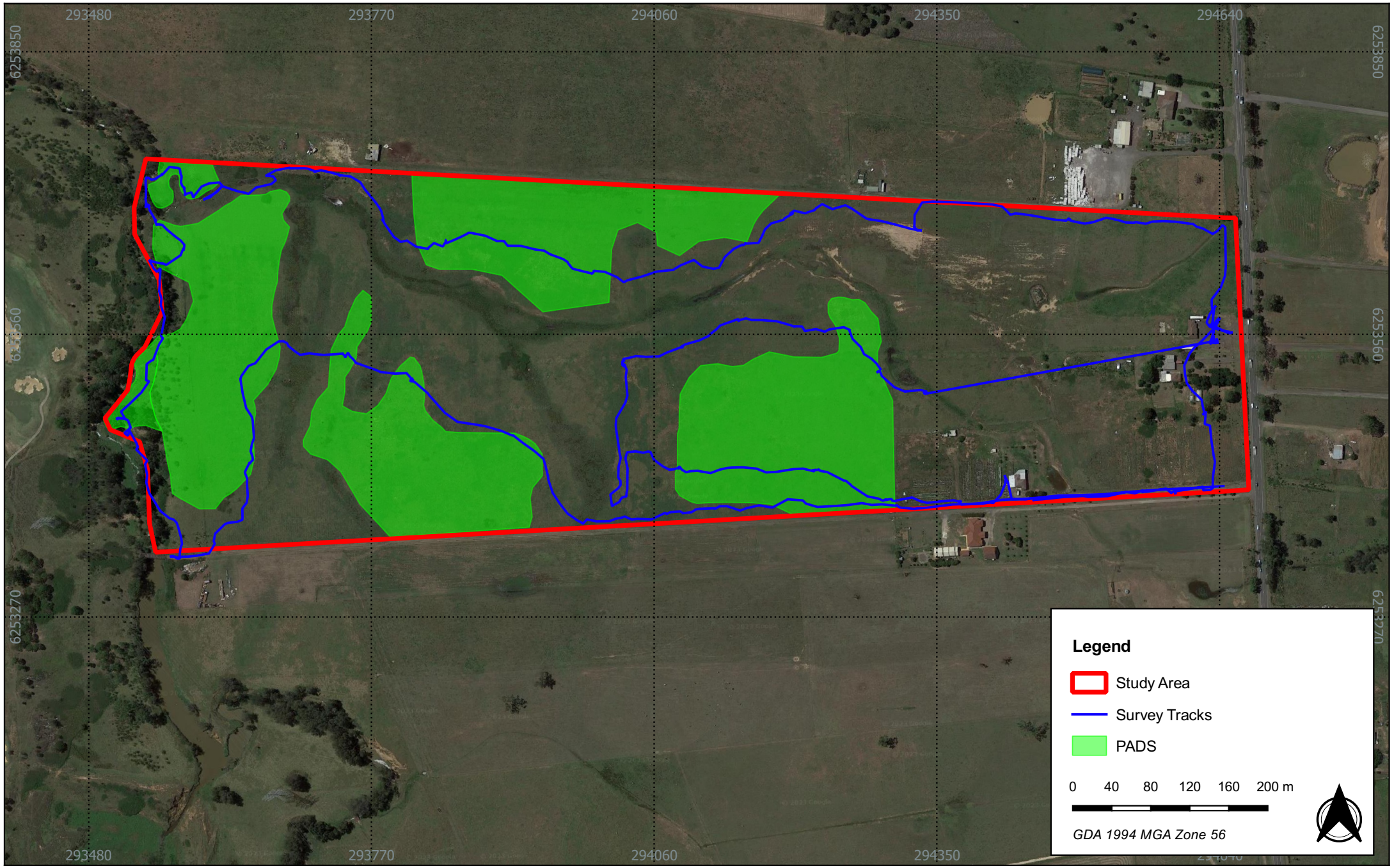


Figure 7.11 Results from the archaeological survey

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2023-02-02

AUSTRAL ARCHAEOLOGY

7.2 TEST EXCAVATION RESULTS

Based upon the results of the archaeological survey, Austral completed archaeological test excavations within the study area within PAD 4, an area of moderate archaeological potential located in the southern central portion of the study area. The test excavation program in PAD 4 comprised 10 transects with a total of 126 test pits and 12 expansion shovel test pits. The results of the testing program in PAD 4 are summarised in the following section.

PADs identified as numbers 1, 2 and 3 were not tested during this program, as no development of these areas is planned. Should the development plan be amended at a later stage, PADs 1, 2 and 3 will require subsurface testing.

7.2.1 PAD 4 TESTING AREA

This testing location consisted of 126 test pits distributed 10 metres apart across 10 transects, with an additional 12 test pits distributed around two test pits which yielded high artefact densities. Transects A to J were located within a gentle midslope/elevated flat landform. All transects ran east-west, beginning on the higher (eastern) slope landform and going west directly across the elevated flat.

LANDFORM

Transects A to J were located within a gentle midslope/elevated flat landform. All transects ran east to west, beginning within the higher (eastern) slope landform and proceeding west across the elevated flat. The slope was heavily covered with grass and had low to zero GSV.

SOILS, DISTURBANCE AND FEATURES

Soils across the PAD 4 were generally comprised of a dark brown silty sand topsoil layer (A1 Horizon), that overlayed a yellowish-brown compact clay base layer (B Horizon). The average depth was between 200 and 300 millimetres.

A summary of soil characteristics across the Study Area is provided Table 7.3.

Table 7.3 Summary of soil characters within the study area

Soil Horizon	Soil Characteristics
A1 Horizon	Depth: 0-200 mm Munsell: 10YR 3/4 PH: 5 Description: Dark brown silty sand topsoil layer, moderately compact with >2% to 5% root inclusions.
B Horizon	Depth: 200 – 300 mm Munsell: 10 YR 4/4 PH: 6 Description: Yellowish-brown compact clay with >1% root inclusions.

ARTEFACT ASSEMBLAGE

Yiribana AS 1 consisted of a total assemblage of 546 artefacts at an overall mean density of 15.6 / m^2. There were eight raw material types present of which silcrete comprised 84.98%. A total of 50 flakes (51%) were in this assemblage with a minimum number of individuals (MNI) of 35. Debitage, 20% (n=19) and three cores (3%) completed the assemblage. The presence of some cortex (n=7) suggests this area was utilised in the early stages of reduction, however, with only two of these pieces having 50% cortex this is likely to be stage two reduction. The relatively high frequency of tools at 16% (n=24) strongly suggests that stage three and four of the reduction also occurred at this site.

The soil profile of the north section of test pit C12 is shown in Figure 7.12 and Figure 7.13.

The soil profile of the south section of test pit D8 is shown in Figure 7.14 and Figure 7.15.

The soil profile of the north section of test pit F9 is shown in Figure 7.16 and Figure 7.17.

Figure 7.12 North section of test pit C12 showing soil profile.

Figure 7.13 Drawing of the north section of test pit C12.

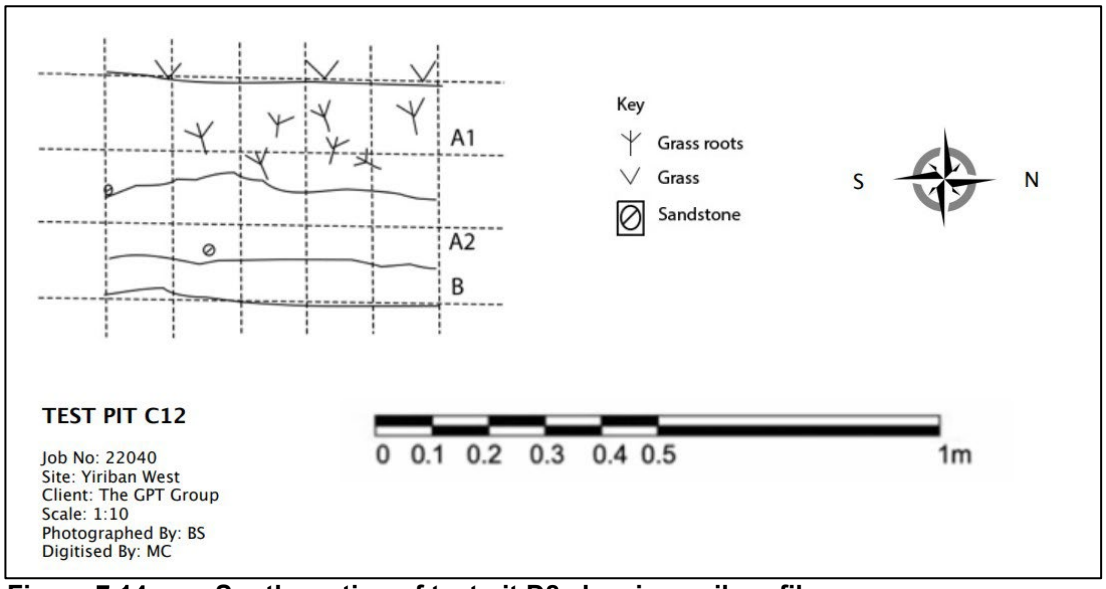


Figure 7.14 South section of test pit D8 showing soil profile.

Figure 7.15 Drawing of the south section of test pit D8.

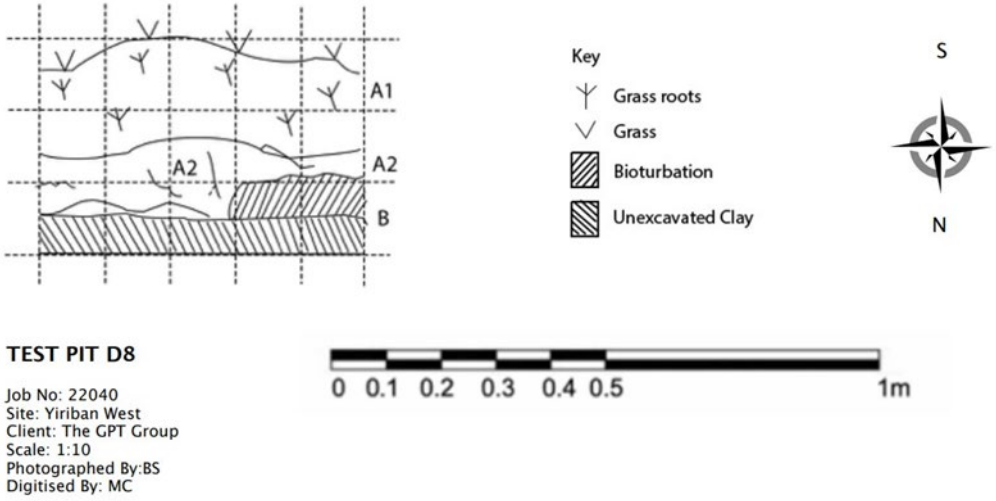
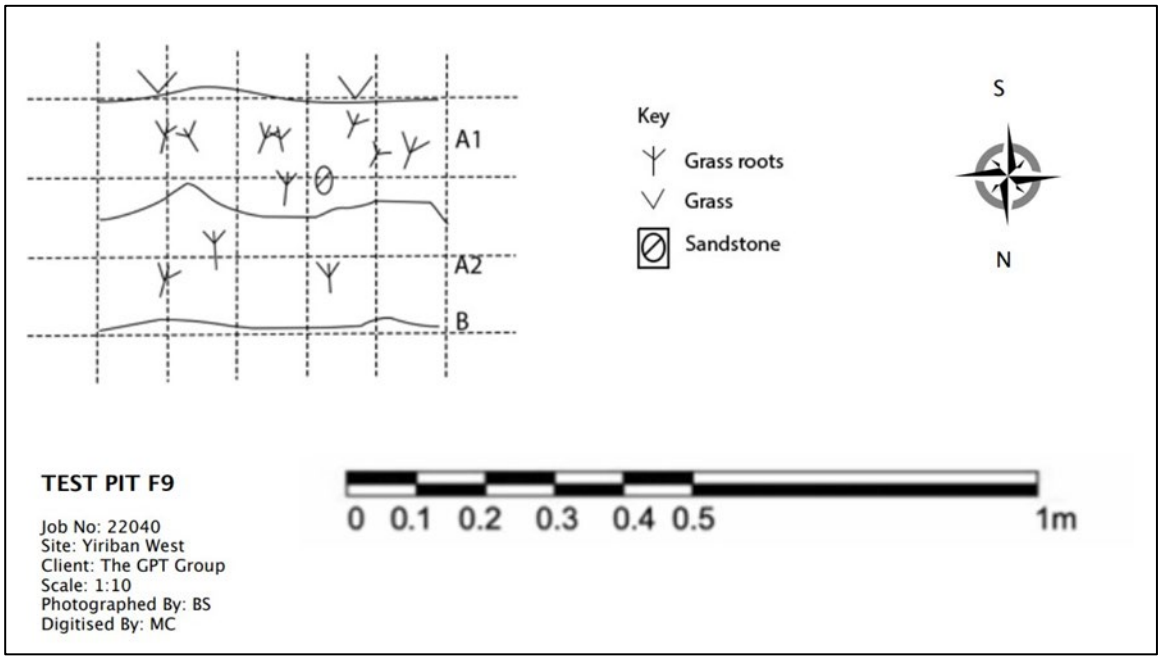


Figure 7.16 North section of test pit F9 showing soil profile.

Figure 7.17 Drawing of the north section of test pit F9.



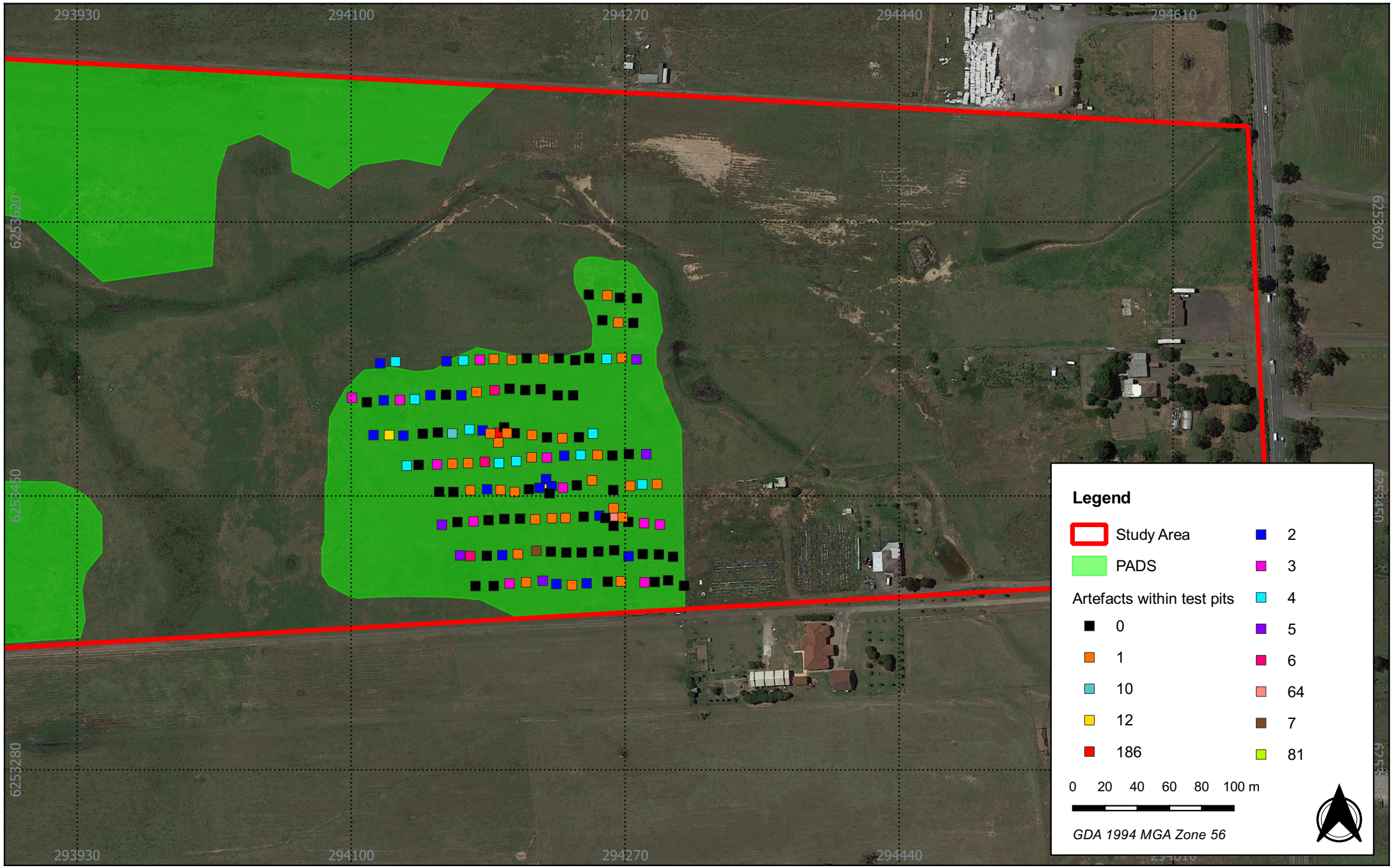


Figure 7.20 Location of test pits and artefact distribution in relation to the study area

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2023-02-02

AUSTRAL ARCHAEOLOGY

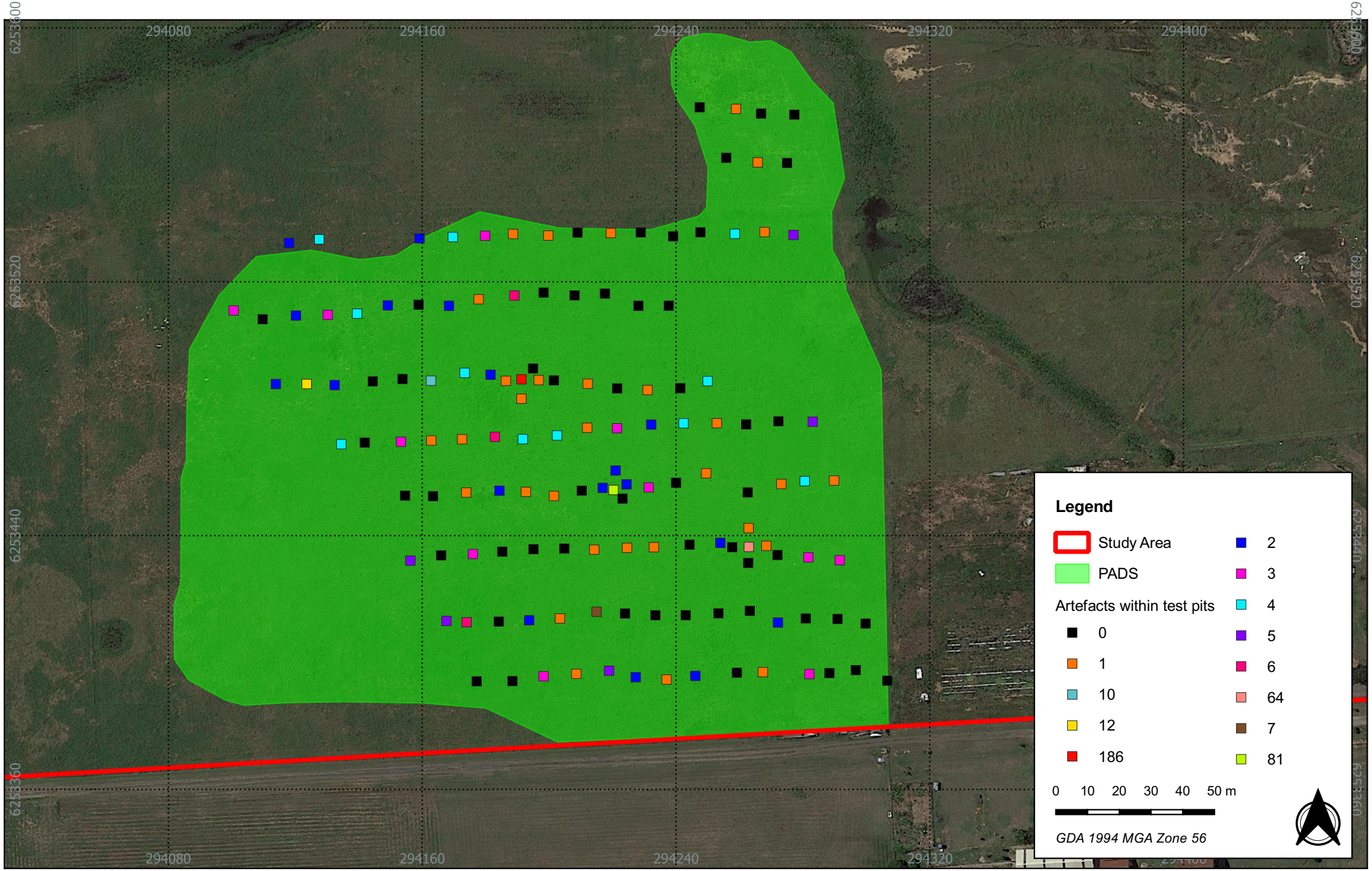


Figure 7.19 Location of test pits and artefact distribution within PAD 4

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2023-02-02

AUSTRAL ARCHAEOLOGY

7.3 LITHICS ANALYSIS

This lithic analysis aims to provide details of the stone material identified during the test excavation using standard terminology for artefact analysis taken from Holdaway & Stern (2013) and McCarthy (1976). Detailed artefact analysis entailed recording several characteristics for each artefact. Stone artefact raw materials were examined through a hand lens (x 10 magnification). Each artefact was recorded in database form, suitable for comparative analysis on a local and regional basis. The terminology used in the analysis is defined in Table 7.4

Table 7.4 Terminology used in the identification of stone tools.

Analytical Terms	Definition
Flaked Piece	A piece of debris exhibiting evidence of knapping but lacking key diagnostic traits (e.g., platform, termination, bulb of percussion, ventral surface).
Flake	An artefact with a striking platform, positive flake scars and fracture termination features.
Bipolar Flake	A flake with distinctive crushing to proximal and distal ends, the result of a resting a core on an anvil and striking directly from above rather than at an oblique angle.
Retouched Flake	A flake that has been reshaped subsequent to it being struck from the core
Backing Flake	A small, distinctive flake, the result of backing retouch – often exhibiting bipolar characteristics.
Core Rotation Flake	A flake with dorsal scars indicating it is the first flake struck following rotating a core to commence a new striking platform.
Eraillure Flake	A flake produced inadvertently, removed from the bulb of percussion during flaking.
Longitudinal Split Flake	One half of a flake split along its percussion axis
Proximal Flake Fragment	A flake exhibiting striking platform and/or initiation but missing its termination
Medial Flake Fragment	The mid-section of a flake, identifiable by ventral and dorsal surfaces, but missing initiation and termination
Distal Flake Fragment	An artefact that has features of a flake termination, but no initiation
Flake Fragment	An artefact with an identifiable ventral and dorsal surface, but without any complete defining margins or features.
Pot lid Flake	A flake produced inadvertently as a spall through heat
Retouched Piece	An artefact exhibiting secondary flaking, but not having the characteristics of a flake.
Core	An artefact that exhibits at least one complete negative scar and no positive scars
Core Fragment	An artefact exhibiting only incomplete negative scars, including at least one proximal negative scar.
Symmetric Backed Artefact	A backed artefact shaped to have a point at each end.
Asymmetric Backed Artefact	A backed artefact with a point at one end and blunted by backing retouch at the other
Hammer Fragment	Part of a hammerstone, identifiable by distinctive hammer use damage.

7.3.1 RESULTS OF THE ANALYSIS

The artefacts recovered during the test excavation program within the study area underwent a detailed lithics analysis by Doug Williams (Archaeologist, Access Archaeology). All stone artefacts identified in this project were classified using technological criteria and an assessment of the stone material from which they were made. Identification was made magnification using a stereomicroscope with 10-90X magnification. Measurements were made using digital callipers and

rounded to the nearest whole millimetre. Mass was measured using digital scales accurate to 0.01g and recorded to that accuracy. The technological attributes recorded were selected to provide:

- Baseline characterisation of the assemblage,
- Information on the kinds of activities being undertaken in the study area,
- Attributes that may allow comparison with other nearby sites.
- Attributes that may contribute to an assessment of significance (research potential)
    - Assemblage density
    - Spatial structure
    - Assemblage diversity
    - Specialist manufacture

The assemblage of complete artefacts was relatively large, so all artefacts were subject to a record of maximum dimension and mass, beyond that they were subject to a level of recording commensurate with their ability to provide meaningful data. Broken or non-diagnostic artefacts were not recorded to the same detail as complete specimens (see artefact records in Volume 2: Appendix). For example, proximal flake fragments had striking platform and initiation features recorded but were not measured for percussion length or any other attribute that required examination of the entire dorsal surface. The level of recording applied to each technological category is evident in Appendix Volume 2)

The test excavation program recovered 546 stone artefacts from the 140 test pits at an overall mean density of 15.6 / m2 although this mean is heavily skewed by the results of three test pits that collectively yielded 331 artefacts (60.6%) of the assemblage (Table 7.5). Disregarding the results from these three dense pits, the mean artefact density is 1.6/m2.

The distribution of subsurface artefacts is relatively continuous, although there were areas where the test pits spaced at 10m apart yielded no artefacts. The densest pits (C12, D8 and F9) are all associated with a low, wide rise in the centre of the study area, and occur in an approximately linear arrangement in a northwest-south east oriented alignment (Table 7.5.). In addition to the high degree of clustering in these three pits there are ten additional locations that exhibit moderate densities per square metre (as arbitrarily defined by 20-50 artefacts/m2 or more) and may indicate the presence of a denser location in close proximity. These are:

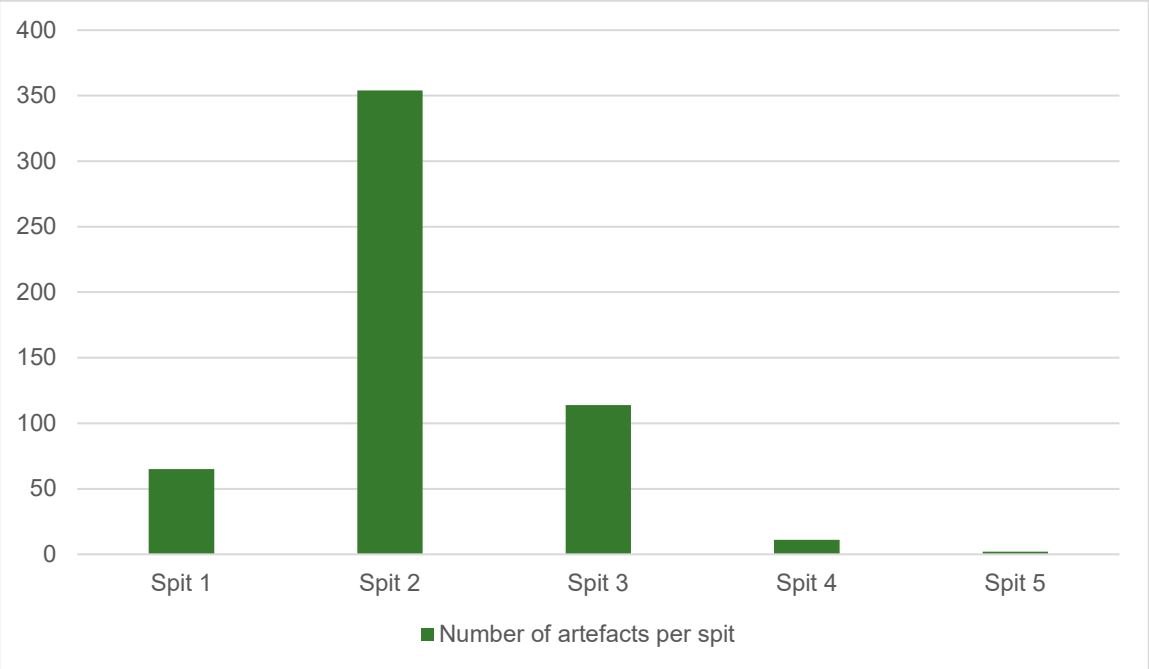
- Transect A Pit 5 (5 artefacts, 20/m2).
- Transect B Pit 1 (5 artefacts, 20/m2), Pit 2 (6 artefacts, 24/m2), Pit 6 (7 artefacts, 28/m2).
- Transect C Pit 1 (5 artefacts, 20/m2).
- Transect E, Pit 17 (5 artefacts, 20/m2).
- Transect F Pit 2 (12 artefacts, 48/m2), Pit 6 (10 artefacts, 40/m2).
- Transect G Pit 10 (6 artefacts, 24/m2).
- Transect H Pit 15 (5 artefacts, 20/m2).

The cluster of artefacts at Transect F Pit 2 is particularly noteworthy, not only for exhibiting 48 artefacts / m2, but also as two volcanic flakes were observed to conjoin – the only conjoins found thus far in the assemblage (see below).

The particularly high density of artefacts in C12 (n=64), D8 (n=81) and F9 (n=186) are made more striking due to the lack of artefacts in surrounding pits 5 metres away on cardinal points. These ‘expansion pits’ were excavated at 5 m intervals (north, southeast, and west) around the original pit. At C12 two out of four expansion pits had artefacts, for a total of three across the four pits. At D8 two out of four expansion pits had artefacts, for a total of four across the four pits. At F12 three out of four expansion pits had artefacts, for a total of three across the four pits.

Artefacts were strongly clustered in spits two (100-200mm) and three (200-300mm), these levels comprising 85.5% of the assemblage (Chart 7.1).

Chart 7.1 Number of artefacts per spit



The distribution of artefacts within the test pits is presented in Table 7.5.

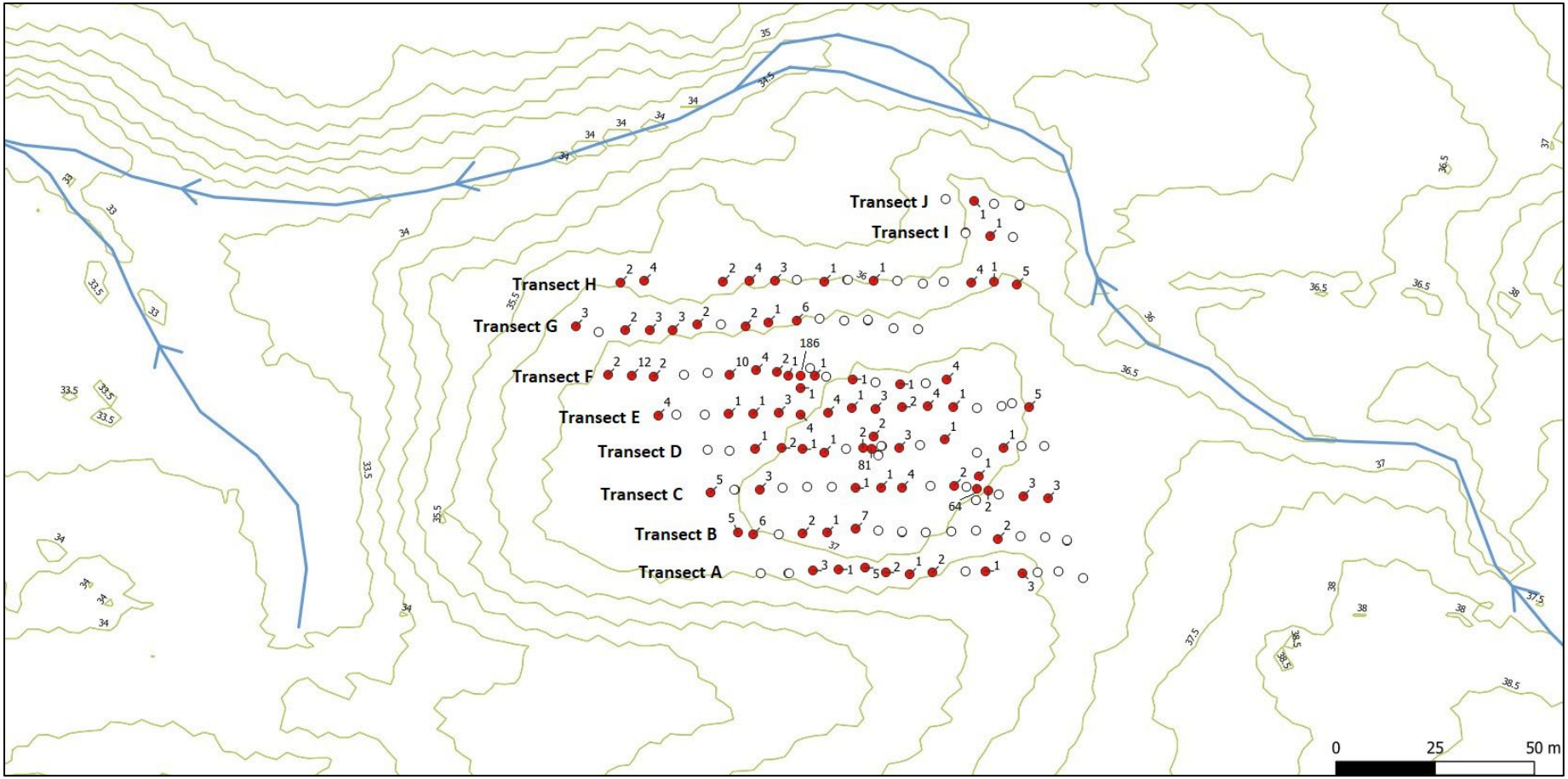
Table 7.5 Distribution of artefacts within test pits

Pit No.	Number of artefacts	Percentage of the total assemblage
Transect A		
3	3	0.55%
4	1	0.18%
5	5	0.91%
6	2	0.37%
7	1	0.18%
8	2	0.37%
10	1	0.18%
11	3	0.55%
Transect B		
1	5	0.91%
2	6	1.10%
4	2	0.37%
5	1	0.18%
6	7	1.28%
12	2	0.37%
Transect C		
1	5	0.91%
3	3	0.55%
7	1	0.18%

Pit No.	Number of artefacts	Percentage of the total assemblage
8	1	0.18%
9	4	0.73%
11	2	0.37%
12	64	11.70%
12 ExpA	1	0.18%
12 ExpB	1	0.18%
14	3	0.55%
15	3	0.55%
Transect D		
3	1	0.18%
4	2	0.37%
5	1	0.18%
6	1	0.18%
8	81	14.81%
8 ExpA	2	0.37%
8 ExpB	2	0.37%
8 ExpD	2	0.37%
9	3	0.55%
11	1	0.18%
13	1	0.18%
14	4	0.73%
15	1	0.18%
Transect E		
1	4	0.73%
3	3	0.55%
4	1	0.18%
5	1	0.18%
6	3	0.55%
7	4	0.73%
8	4	0.73%
9	1	0.18%
10	3	0.55%
11	2	0.37%
12	4	0.73%
13	1	0.18%
16	5	0.91%
Transect F		
1	2	0.37%
2	12	2.19%

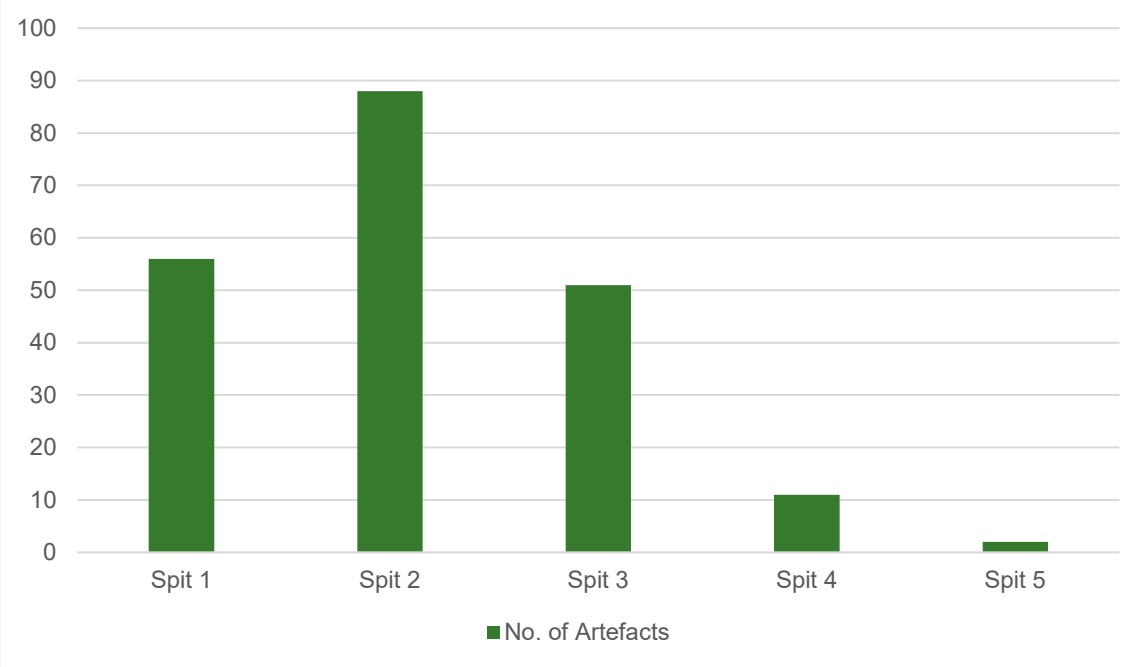
Pit No.	Number of artefacts	Percentage of the total assemblage
3	2	0.37%
6	10	1.83%
7	4	0.73%
8	2	0.37%
9	186	34.00%
9 ExpB	1	0.18%
9 ExpC	1	0.18%
9 ExpD	1	0.18%
11	1	0.18%
13	1	0.18%
15	4	0.73%
Transect G		
1	3	0.55%
3	2	0.37%
4	3	0.55%
5	4	0.73%
6	2	0.37%
8	2	0.37%
9	1	0.18%
10	6	1.10%
Transect H		
1	2	0.37%
2	4	0.73%
3	2	0.37%
4	4	0.73%
5	3	0.55%
6	1	0.18%
7	1	0.18%
9	1	0.18%
13	4	0.73%
14	1	0.18%
15	5	0.91%
Transect I		
2	1	0.18%
Transect J		
2	1	0.18%
Total	**547**	**100%**

Figure 7.20 Artefact Distribution



The observations of trends in artefact depth below surface are highly influenced by the results of C12, D8 and F9, although removing these pits from the analysis shows a similar pattern albeit with reduced dominance of Spit 2 (Chart 7.2).

Chart 7.2 Number of artefacts per spit



7.3.2 RAW MATERIALS

The assemblage comprised eight stone materials (Table 7.6, Table 7.6Table 7.7), of which Silcrete comprised the majority (84.98%). Silcrete artefacts were recorded in a range of colours and several different grain sizes and textures were observed, so it is probable that within the 'silcrete' category there is represented material from several sources. Nonetheless, colour alone is a poor indicator of whether silcrete came from separate sources. The most common form of silcrete observed was a reddish-brown medium grained silcrete, although this material also graded into tan. Red/brown/tan silcrete is highly likely to be from the same or similar relatively local sources. Dark brown silcrete exhibited a distinctly glossy texture and is likely to be from a separate source.

Table 7.6 The total number of artefacts per raw material

Category	Silcrete	FGS	Quartzite	Chert	Quartz	Petrified Wood	Sandstone	Volcanic	Total
Flake	208	16	2	8	3			3	**240**
Retouched Flake	6				1				**7**
Backing Flake	5								**5**
Core Rotation Flake	5			1					**6**
Eraillure Flake	2								**2**
Longitudinal Split Flake	17	1						1	**19**
Proximal Flake Fragment	19	2			1			1	**23**

Category	Silcrete	FGS	Quartzite	Chert	Quartz	Petrified Wood	Sandstone	Volcanic	Total
Medial Flake Fragment	6								**6**
Distal Flake Fragment	36	2				1			**39**
Flake Fragment	38	3	1	2					**44**
Pot lid Flake		1							**1**
Retouched Piece	2	1							**3**
Core	7		1						**8**
Core Fragment	16	4							**20**
Symmetric Backed Artefact	2	1							**3**
Asymmetric Backed Artefact	3	1							**4**
Hammer Fragment			1						**1**
Flaked Piece	92	17		4	1		1		**115**
Total	464	49	5	15	6	1	1	5	**546**

Table 7.7 The total number of artefacts by raw material type and spit number

Raw material	Spits					
	1	**2**	**3**	**4**	**5**	**Total**
Silcrete	44	318	93	7	2	464
FGS	9	23	16	1	-	49
Chert	4	4	4	2	-	14
Quartz	2	3	1	-	-	6
Quartzite	-	5	-	-	-	5
Volcanic rock	5	-	-	-	-	5
Banded chert	-	-	-	1	-	1
Glass	1	-	-	-	-	1
Petrified wood	-	-	1	-	-	1
Sandstone	-	1	-	-	-	1
Total	**65**	**354**	**115**	**11**	**2**	**547**

7.3.3 ARTEFACT TYPES AND FLAKING TECHNOLOGIES

Eighteen separate technological/fragmentation categories were present, with complete flakes the most numerous individual technological categories, being so in all individual stone materials. Assemblage fragmentation is low with 18.1% of artefacts being suggestive of post deposition breakage. This is represented by the proportion of proximal, medial, and distal flake fragments, and amorphous flake fragments. This calculation excludes artefacts that would have fragmented during reduction as these do not assist in making inferences regarding post deposition disturbance

(for example, longitudinally split flakes, core fragments, flaked pieces). Only 8 complete cores were recorded. Retouched pieces and implements form a low proportion of the assemblage 2.4% with symmetric and asymmetric forms being approximately equally represented. Complete flakes (n=258) form the largest single component of diagnostic artefacts in the assemblage, with 17 longitudinally split flakes also contributing to the data on flake length.

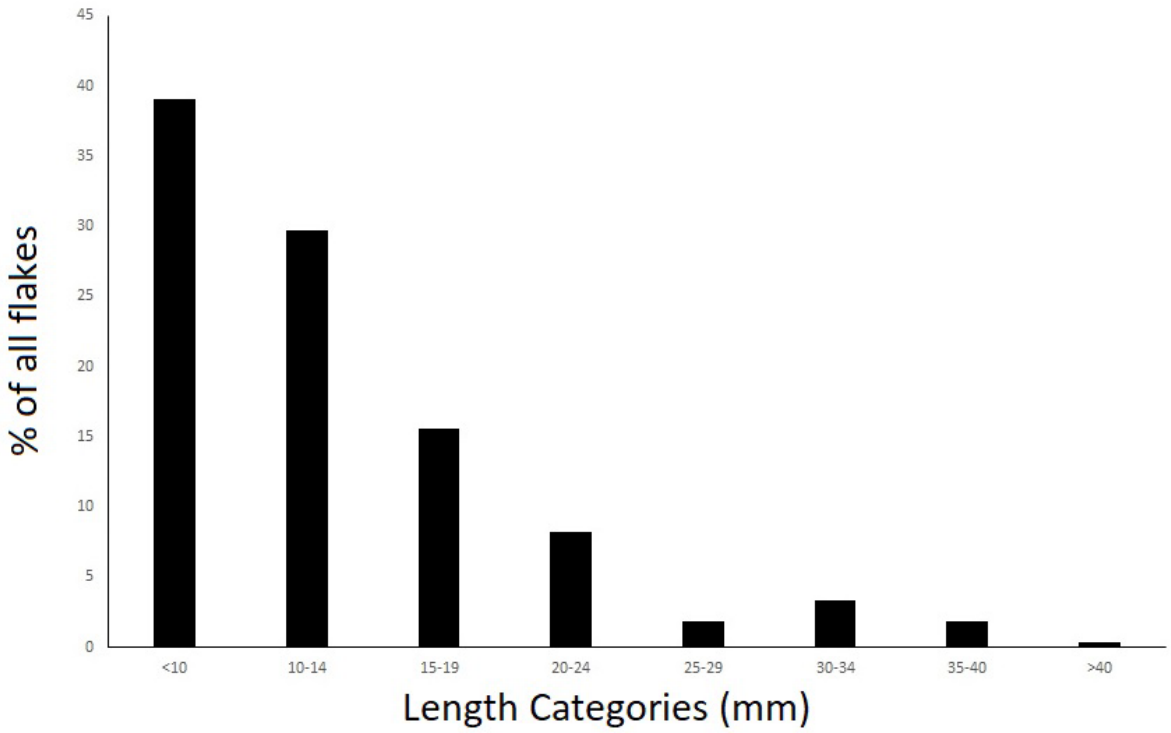
Table 7.8 Flake Length Summary (mm)

Material	n	Smallest	Largest	Mean	Median	Mode
Chert	8	3	33	13.1	11	N/A
FGS	17	5	38	17.4	14	22
Quartz	4	8	13	10.3	10	8
Silcrete	236	4	41	12.7	11	8
Volcanic	4	11	13	12	12	12
All	271	3	41	13	12	13

*Omits quartzite flakes as an individual category as there were only two recorded. Quartzite flakes included in 'All' category.

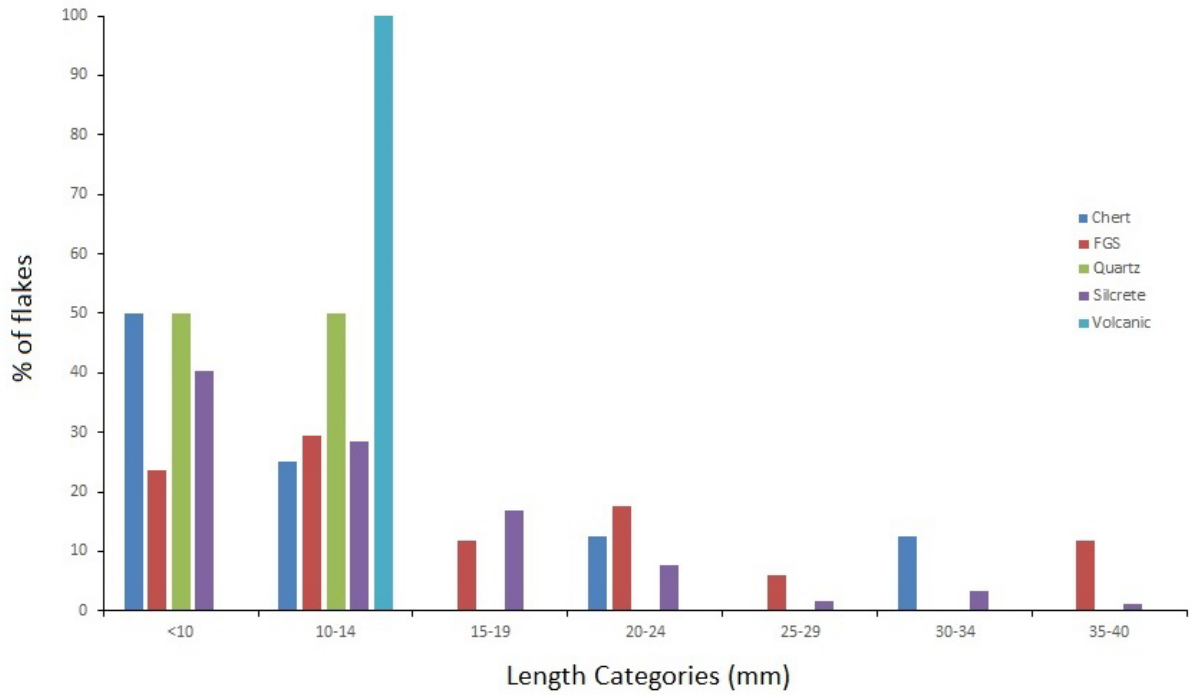
The main pattern to be observed in the data presented in Table 7.2 is that flakes were generally small, and the predominance of small flakes is illustrated in Chart 7.3. With 84.39% of all flakes less than 20 mm in length and flakes <10 mm being the modal class the flake assemblage is particularly small.

Chart 7.3 Flake Length - All Flakes, 5mm length classes.



Splitting the results of flake length into stone material categories it can be observed that the dominance of very small flakes is common across all materials, with the modal class of all materials being <15mm (Chart 7.4).

Chart 7.4 Flake Length – Stone Material Categories, 5mm Length classes.



Flake elongation is a measure of the extent to which flakes are wide in comparison to their percussion length. It is a feature of many analyses to determine the extent of 'blade' manufacture, and thus arrive at some indication of the economy of flaking trying to be achieved and, further, whether or not people were attempting to produce flakes for further transformation into backed artefacts. For the purposes of stone tool analysis, a blade is defined as a flake the length of which is twice as long (or greater) as its width, and which has approximately parallel lateral margins (Bar-Yosef and Kuhn 1999:323, Odell 2003: 45, Andrefsky 2007:253). Our analysis of elongation uses a population of 217 complete flakes and excludes those with step and hinge terminations.

Elongation is generally determined by dividing flake length by width to arrive at an index (EI). In this manner a flake with an index of 2 is a blade, and index of 1 is equally as long as wide, and 0.5 is twice as wide as long. In this study three measurements of flake width were taken – proximal width, midpoint width and distal width. Flakes that terminated in a point were given a default distal width of 1mm. This analysis uses 217 complete flakes, but omitting those with step or hinge terminations as these flakes are generally regarded as the result of flaws in the core or flaking errors. Midpoint width has been used to calculate the elongation index. Table 7.9 shows the mean elongation of flakes of different raw materials, breaking them into percussion length categories.

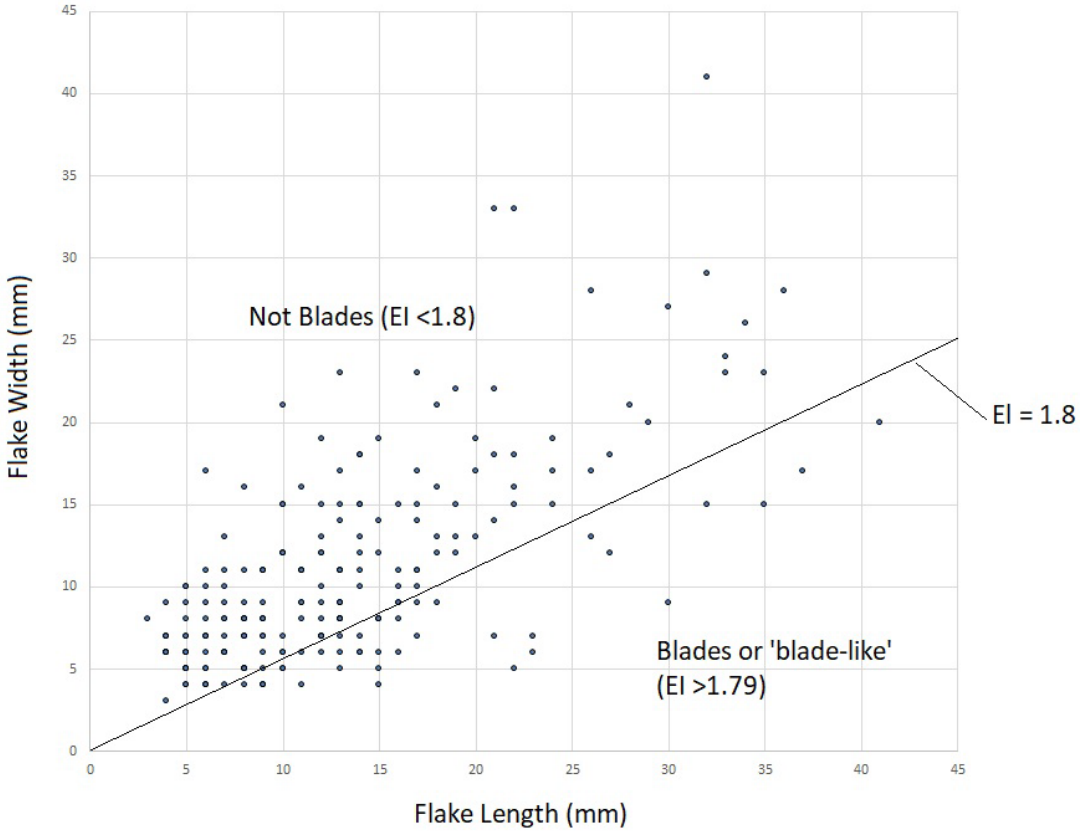
Table 7.9 Mean Elongation Index Values of Length Categories and Stone Materials

	Sample No.	Overall	<10	10-14	15-19	20-24	25-29	<30
Chert	10	0.95	0.83	0.93		0.64		1.34
FGS	10	1.08	0.96	1.17		0.94	1.45	1.29
Quartz	4	1.13	1.00	1.26				
Quartzite	2	1.08	0.82				1.33	
Silcrete	189	1.36	1.04	1.36	1.63	1.93	1.64	1.80
Volcanic	3	1.39		1.39				

This indicates that overall, the assemblage is not particularly elongated, with most flakes around as long as they were wide. Volcanic flakes were the most elongated across their whole assemblage, although that population comprised only three flakes. The only class of flakes that approached being blades across their class were silcrete flakes 20-24mm in length (1.93) and

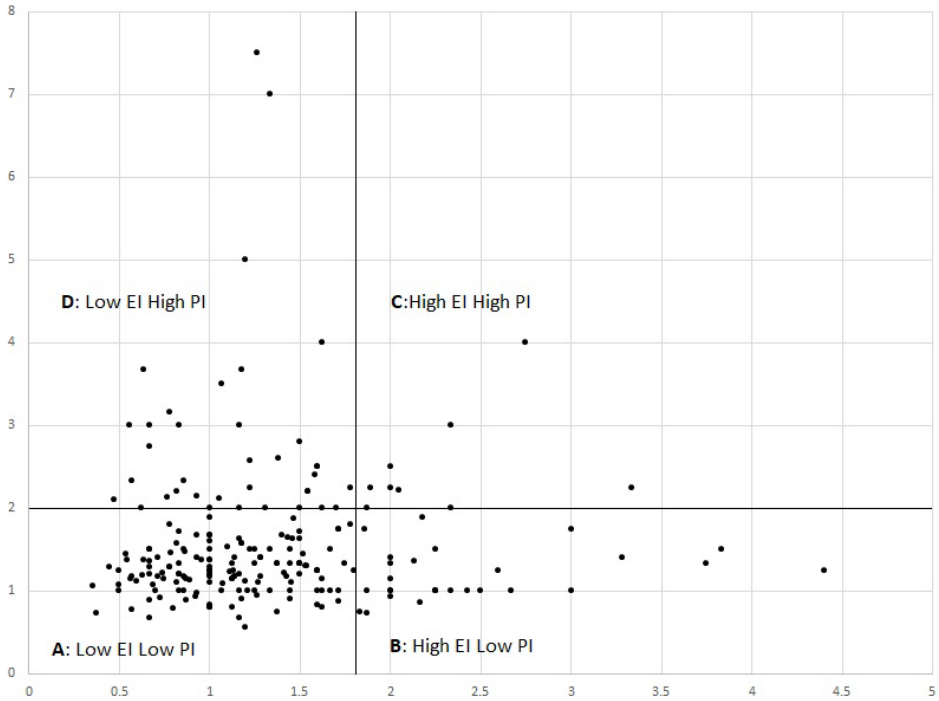
<30mm long (1.8). Of the 217 flakes able to be used to analyse elongation, 38 (17.5%) were blades or blade like as defined by an elongation index of 1.8 or greater (Chart 7.5).

Chart 7.5 Flake Elongation – All Flakes. EI=Elongation Index.



Regarding the requirement for parallel margins, a parallel index (PI) can be calculated by dividing the width of the flake mid-point by the width of the striking platform (Davidson 2003). In this index a high value represents a large difference between the platform width and width at midpoint, indicating that margins are not parallel. A low value represents a small or no difference between the platform width and midpoint width indicating more parallel margins. The EI and PI can be plotted against each other to illustrate the proportion of blade like flakes.

Chart 7.6 Bladiness of Assemblage (after Davidson 2003)



Flake striking platforms were measured for width and thickness and recorded according to their category and the nature of their surface (Table 7.10). In this analysis complete flakes and proximal flake fragments were used (n=276).

Table 7.10 Striking Platforms

Platform Type	Chert	FGS	Quartz	Quartzite	Silcrete	Volcanic	Total
Broad Cortical		1			2	2	**5**
Broad 1 Scar	1		1		19		**21**
Broad 2 Scars					21		**21**
Broad 3 Scars					5		**5**
Broad >3 scars	1				1		**2**
Broad Facetted					4		**4**
Focal Cortical					4	1	**5**
Focal 1 Scar	5	10	1	1	112		**129**
Focal 2 Scars		4	1		21		**26**
Broad 3 Scars					4		**4**
Focal >3 scars							**0**
Focal Facetted		1			10		**11**
Focal Crushed	1	2	2	1	36	1	**43**
Total	**8**	**18**	**5**	**2**	**239**	**4**	**276**

The majority of flakes (54.35%) exhibited a plain flaked surface (Andrefsky's 'flat' platform – Andrefsky 2007:96), 68.8% of all flakes exhibited a surface that had 1 or two flake scars. Focal platforms with minimal preparation evident were most common, although the presence of facetted

platforms is evidence of a degree of careful preparation prior to flake removal. The predominance of focal platforms and 15.6% of flakes having crushed platforms is evidence of economy flaking being practised with thin flakes and blades being the desired result of knapping. Cortical platforms are uncommon comprising only 3.6% of all flake platforms.

One indicator of blade production, accuracy and economy of flaking is the presence of a ridge on the dorsal surface of a flake, termed the dorsal ridge. The consistent presence of dorsal ridges is an indicator of the consistency of placement of the application of force to remove the flake and to prepare the core for the removal of another similarly configured flake.

Table 7.11 Dorsal Ridges

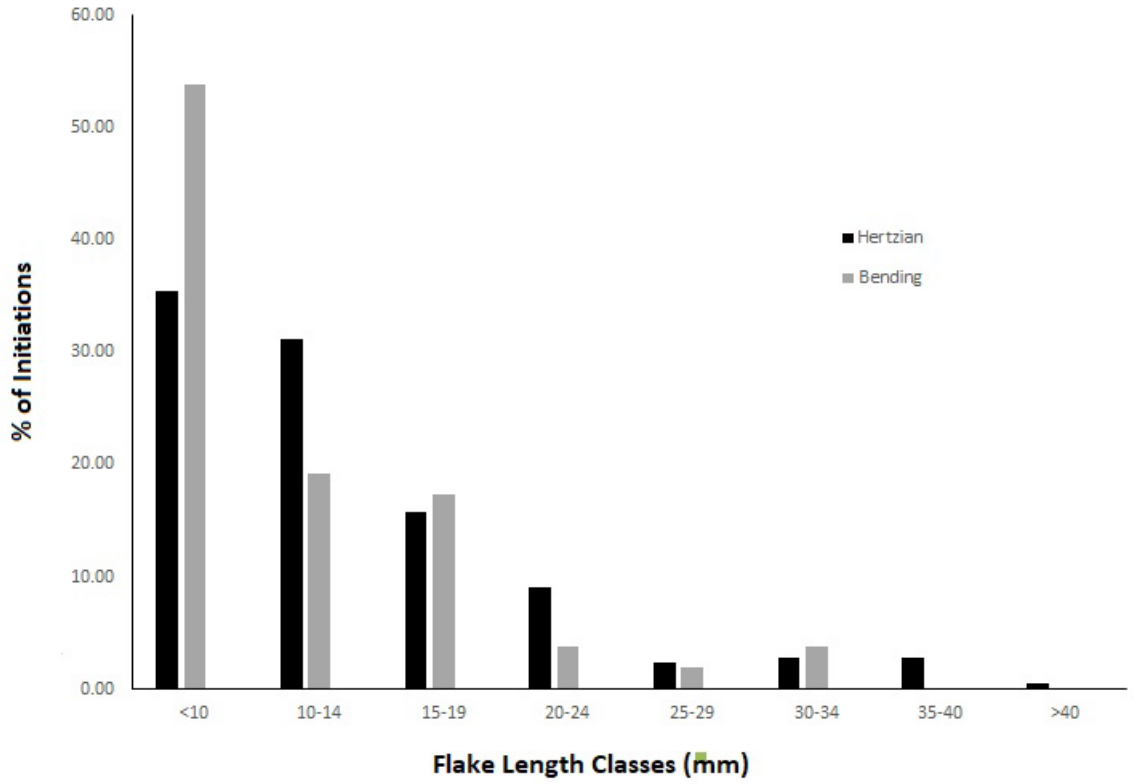
Elongation Index	Dorsal Ridge Yes	Dorsal Ridge No
>1.8	20.74	79.26
<1.8	63.41	36.59

63.41% of flakes with an elongation index of 1.8 or greater exhibited a dorsal ridge, whereas only 20.74% of flakes with a lesser elongation had dorsal ridges. This is almost certainly a function of the preponderance of very small flakes that were not intended to be blades but rather were retouch or core preparation flakes.

An analysis of flake initiation was able to be undertaken on a sample of 287 artefacts comprising complete flakes, proximal flake fragments and longitudinally split flake fragments. Hertzian initiations were dominant comprising 79.5% (n=228) of all recorded flake initiations, followed by bending initiations (18.1%, n=52) and wedging initiations (2.4%, n=7).

In a smaller sample comprising complete flakes and longitudinally split flakes that could be examined with reference to percussion length (n=267), flakes with bending initiations are more heavily proportionally represented in the smaller flake classes. This is consistent with bending initiations being associated with trimming or thinning.

Chart 7.7 Proportion of Flake Initiations in Flake Length Classes



There are several ways a flake can terminate in its fracture from the core. It is generally theorised that feather terminations are most desirable because they enable continuation of flaking from the platform, whereas other termination forms can hasten the point where a core face becomes unusable, and the core must be rotated. Feather terminations also ensure a thin sharp edge around more of the flake's margin, potentially making more flakes useable cutting implements (Odell 2003:57). Consistent feather termination is taken to indicate an amount of control and precision, in applying a generally outward direction of the application for force to the core, and the application of the correct amount of force (Hiscock 1986). Axial terminations occur when the flake fracture continues through the base of the core (Cotterell and Kamminga 1986, 1990, Odell 2003) and therefore can act as approximations of core length. Crushed terminations occur when the core is in contact with a hard anvil, particularly when force is applied at a right angle to the platform, as opposed to an oblique blow (Dickson 1977).

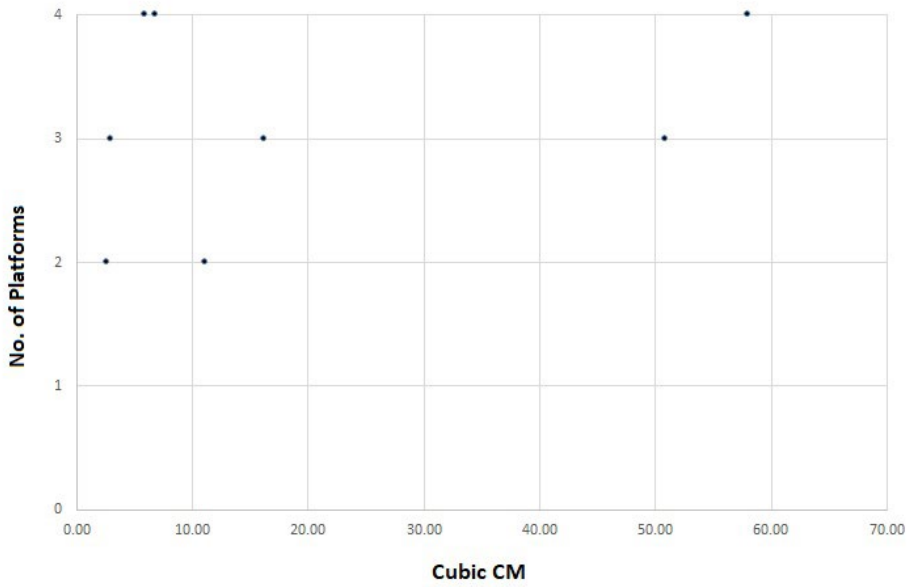
Table 7.12 Flake Terminations

Platform Type	Chert	FGS	Quartz	Quartzite	Silcrete	Volcanic	Petrified Wood	Total
Feather	6	10	4	2	199	4	1	**226**
Step		2			38			**40**
Plunging	1				7			**8**
Hinge	1	4			1			**6**
Crushed					8			**8**
Axial	1	2			24			**27**
Total	**9**	**18**	**4**	**2**	**277**	**4**		**314**

The analysis of flake termination was able to be undertaken across the categories of complete flakes, distal flake fragments and longitudinally split flakes (n=314). Table 7.12 shows an overwhelming predominance of feather terminations across the flakes of all raw material categories. Across the entire assemblage 72% of terminations were feather terminations, with variation in the detail of individual categories. That there is a low proportion of flakes terminated in sub-optimal way across an assemblage of small artefacts suggests both application of a high degree of knapping skill and use of high quality, predictable stone materials.

Despite the size of the assemblage only eight complete cores were recovered (Table 7.12, Chart 7.8). This is in addition to 20 core fragments which are undiagnostic for the purposes of core analysis. The cores were mainly quite small and all exhibited rotation, with up to 4 flaking directions recorded on some specimens. Two particularly small specimens exhibited evidence of being anvil rested (as opposed to being 'bipolar') showing they had been reduced beyond the inertia threshold for handheld percussion flaking. In comparison to the number of struck flakes (n=287: flakes + retouched flakes + core rotation flakes + long split flake fragments + proximal flake fragments+(distal flake fragments-proximal flake fragments)) the presence of 8 complete cores gives a ratio of 35.9 flakes per core. This is a high ratio of flakes to cores and suggests cores were removed from the area following flaking.

Chart 7.8 Core Volume and Number of Platforms



Axial terminated flakes, by definition, also approximate core length so examination of those flakes can add dimension to an analysis of core size. Chart 7.9 illustrates the distribution of axial terminated flakes with reference to the population of cores from the assemblage. As with the overall flake population there is a preponderance of small flakes <15mm in length, it is probable these flakes are the result of retouching activities as opposed to the production of flakes for use or core shaping/preparation. The remainder of the distribution shows most cores being worked were in the 20-40mm length range, all of which would likely have required anvil support to achieve flake removal. Retouched artefacts included four asymmetric backed artefacts, three symmetric backed artefacts, seven retouched flakes and three amorphous pieces. Of the six backed artefacts for which chord length could be recorded, asymmetric backed artefacts had a mean length of 20mm and symmetric backed artefacts were particularly small with a mean length of 12.7mm. Retouched flakes were also mainly very small with only one specimen greater then 35mm in length, and the remainder having a mean length of 13.3mm

Chart 7.9 Length of Cores

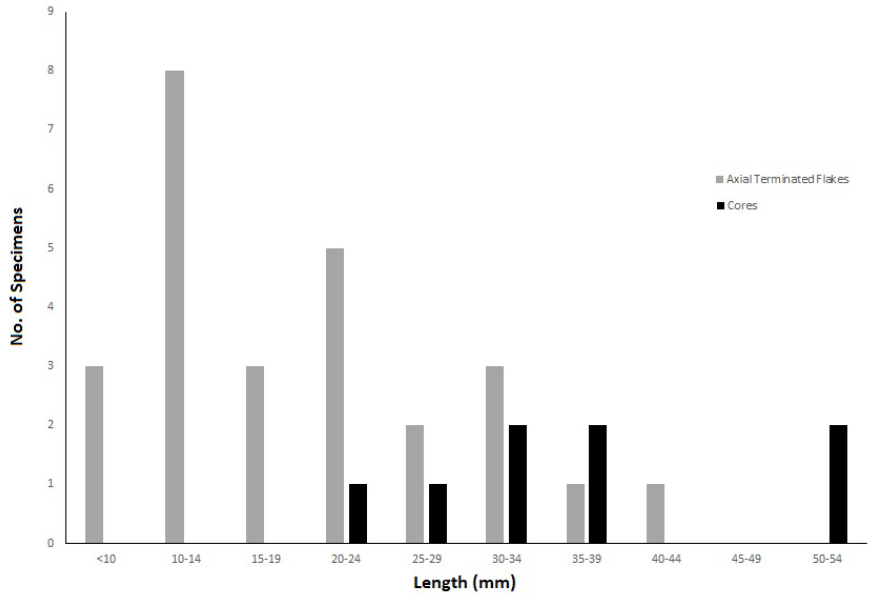


Figure 7.21 Selection of cores from Yiribana AS1

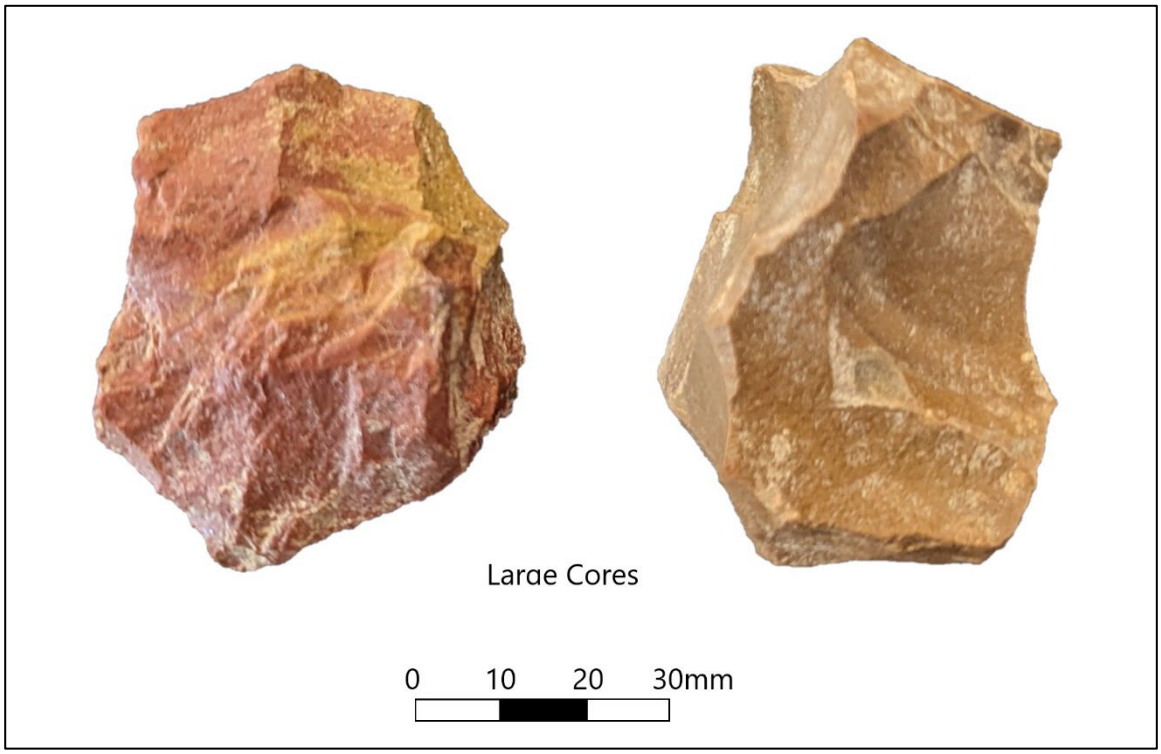


Figure 7.22 Selection of cores from Yiribana AS1

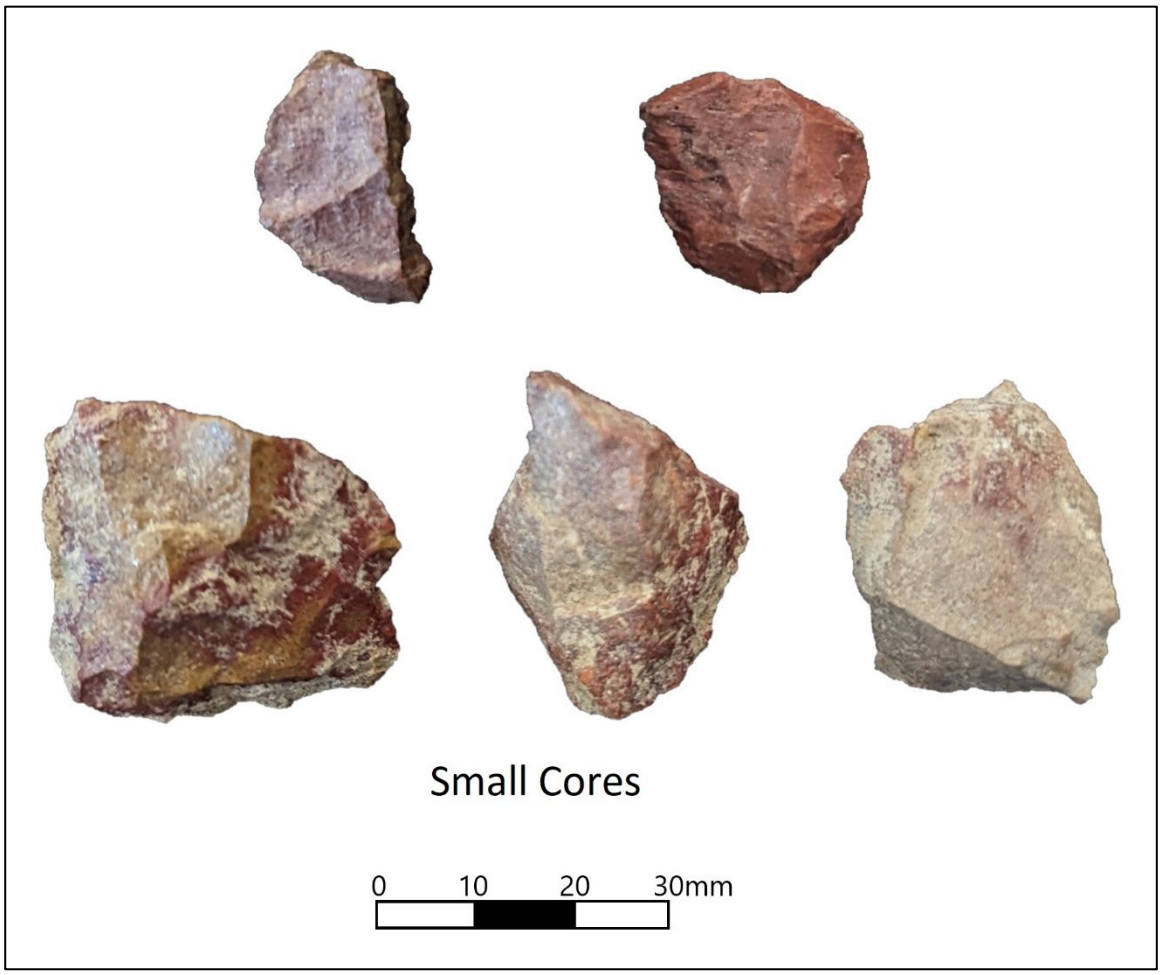
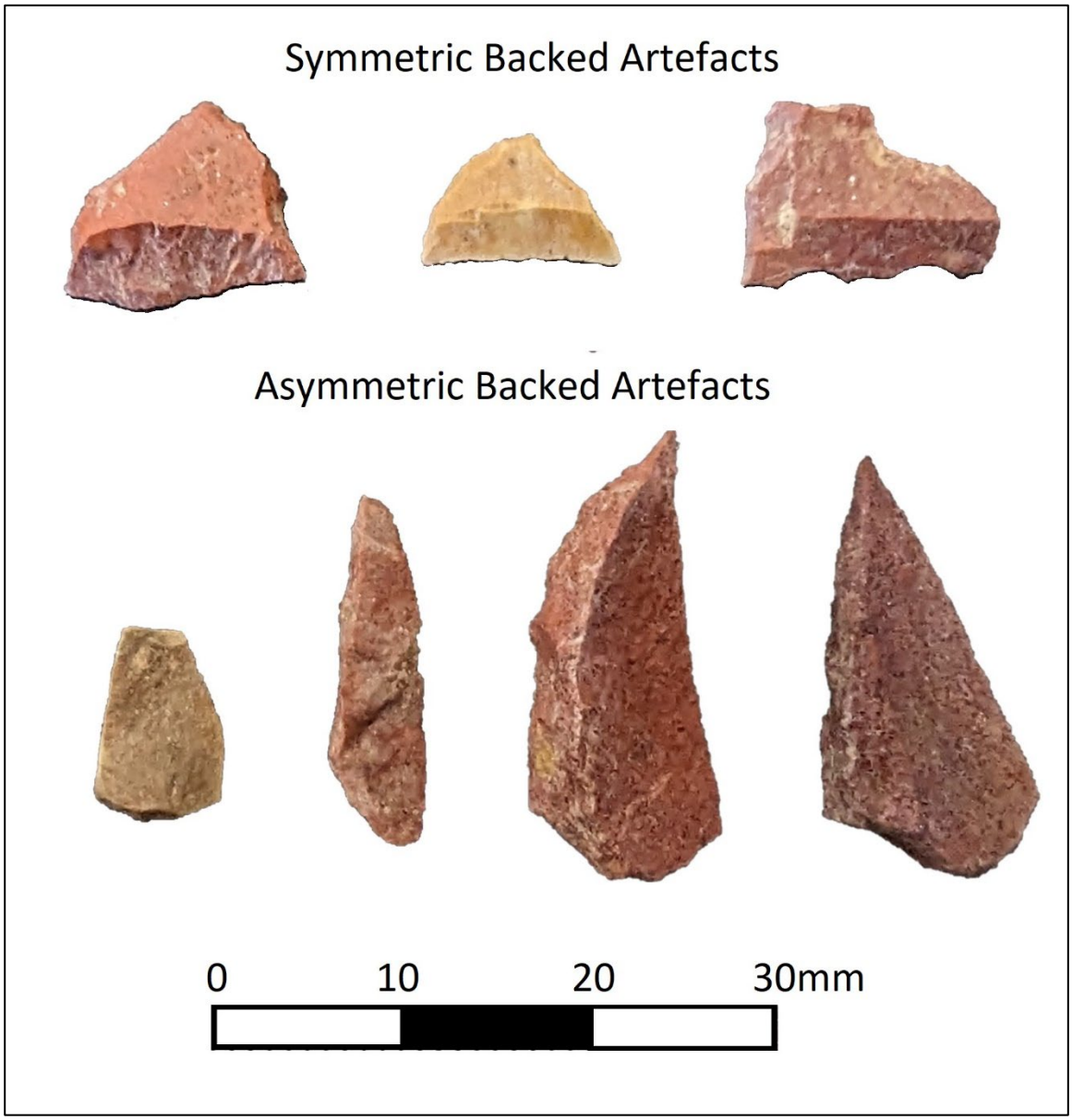


Figure 7.23 Selection of backed artefacts from Yiribana AS1



7.4 IDENTIFIED ABORIGINAL SITES

One Aboriginal site and three areas of PAD were identified as part of the archaeological survey and testing program.

An archaeological survey of the study area was completed on 11th May 2022 and archaeological test excavations were completed between 4 October 2022 through to 15 November 2022. The sites identified as part of this investigation are outlined in Table 7.13.

Table 7.13 Test areas / survey units and identified sites

AHIMS No.	Site name	Feature(s)	Testing area / Survey Unit	Landform
45-5-5678	Yiribana AS 1	Artefact scatter	PAD 1	Undulating flat
45-5-5675	Yiribana PAD 1	Potential archaeological deposit	PAD 2	Undulating flat
45-5-5676	Yiribana PAD 2	Potential archaeological deposit	PAD 3	Undulating flat
45-5-5677	Yiribana PAD 3	Potential archaeological deposit	PAD 4	Undulating flat

YIRIBANA AS 1 (AHIMS # 45-5-5678)

Site type	Artefact Scatter
Centroid	GDA 94 Zone 56 294196 m E and 6253460 m N
Site Extent	225 m X 220 m

Yiribana AS 1 (AHIMS # 45-5-5678) is an Artefact Scatter, which contains a range of stone artefacts, including artefacts manufactured from silcrete, fine-grained siliceous material, chert, quartz, and quartzite. The site contained a total of 547 artefacts, 546 of these being stone artefacts. The stone artefacts included flakes, flaked pieces, longitudinal split flakes, cores, flaked fragments and distal flakes. The site is located on an undulating flat approximately 500 metres east of South Creek, 500 metres northeast of Kemps Creek and directly south on an unnamed tributary.

Figure 7.24 and Figure 7.25 contain representative images indicating the landscape context and cultural material identified within Yiribana AS 1 (AHIMS # 45-5-5678).

Figure 7.24 Northwest view of Yiribana AS 1 (AHIMS # 45-5-5678)

Figure 7.25 Selection of artefacts from Yiribana AS 1 (AHIMS # 45-5-5678)

YIRIBANA PAD 1 (AHIMS # 45-5-5675)

Site type	Artefact Scatter
Centroid	GDA 94 Zone 56 296341 m E and 6253844 m N
Site Extent	355 m X 130 m

Yiribana PAD 1 (AHIMS # 45-5-5675) is a potential archaeological deposit with high potential located adjacent to an unnamed second order stream, approximately 485 metres west of Mamre Road. The site is within a flat on an undulating plain landform. The land use in the area is subject to pastoral/grazing.

Figure 7.26 contains a representative image indicating the landscape context within Yiribana PAD 1 (AHIMS # 45-5-5675).

Figure 7.26 North view of Yiribana PAD 1 (AHIMS # 45-5-5675)

YIRIBANA PAD 2 (AHIMS # 45-5-5676)

Site type	Artefact Scatter
Centroid	GDA 94 Zone 56 293621 m E and 6253570 m N
Site Extent	325 m X 115 m

Yiribana PAD 2 (AHIMS # 45-5-5676) is a potential archaeological deposit with moderate potential located east-adjacent South Creek. The site is located on a flat on an undulating plain landform approximately 990 metres west of Mamre Road. The land use in the area is subject to pastoral/grazing.

Figure 7.27 contains a representative image indicating the landscape context identified within Yiribana PAD 2 (AHIMS # 45-5-5676).

Figure 7.27 West view of Yiribana PAD 2 (AHIMS # 45-5-5676)

YIRIBANA PAD 3 (AHIMS # 45-5-5677)

Site type	Artefact Scatter
Centroid	GDA 94 Zone 56 293819 m E and 6253423 m N
Site Extent	250 m X 246 m

Yiribana PAD 3 (AHIMS # 45-5-5677) is a potential archaeological deposit with moderate potential located near South Creek and a second order stream. The site is located on a flat on an undulating plain landform approximately 730 metres west of Mamre Road. The land use in the area is subject to pastoral/grazing.

Figure 7.28 contains a representative image indicating the landscape context identified within Yiribana PAD 3 (AHIMS # 45-5-5677).

Figure 7.28 Northwest view of Yiribana PAD 3 (AHIMS # 45-5-5677)

8 ANALYSIS AND DISCUSSION

The following section presents an analysis and discussion of the results of the archaeological investigation, with an emphasis on the archaeological testing program.

8.1 SITE INTEGRITY AND EXTENT

The archaeological material from the study area displays a high degree of variation in density over the 140 test pits, with three displaying very high density (256-744 artefacts / metre^2). The high-density concentrations are spatially contained is demonstrated through results from 'expansion' pits excavated at 4 points around the original at approximately cardinal directions at 5 metres distance. All of the pits excavated for the purposes of attempting to define the extent of high-density pits exhibited either no artefacts or low-density results. There were eight additional pits displaying moderate to high density (20-48 artefacts / metre^2) and it is considered probable these pits indicate the presence of higher density locations in close proximity – within 1-3 metres of the test pit, based on the results of expansion it's around the very high-density pits. These moderate and high-density pits are interspersed with pits that had no archaeological material or low to moderate density.

The dominance of artefacts in the band 100mm-200mm below surface is also evidence of a relatively low level of post European disturbance (Table 8.1). Had the soil profile undergone significant disturbance, a more even distribution through the soil profile might be expected. It is possible that a stronger concentration around 200-250mm is present, but excavation techniques were too coarse to detect such a pattern.

This overall pattern is that which would be expected in an area with a low level of disturbance and suggests that whatever land use the study area has experienced since European occupation it has not had a fully deleterious effect on the spatial integrity of the archaeology. Adding to this result is the presence of two conjoining artefacts from one pit, which again suggests the spatial integrity of the assemblage is high. It is highly likely that with limited excavation the products of isolated knapping events can be retrieved either in their substantial entirety or a large sample. Areas with such spatial arrangements are uncommon and the research potential of such assemblages is consequently high.

Table 8.1 Analysis of artefacts per site by spit

Site / AHIMS No.	Spit Number					Total
	1	2	3	4	5	
Yiribana AS1 / 45-5-5678	65	354	144	11	2	546

8.2 THE ARTEACT ASSEMBLAGE

The dominance of silcrete in the assemblage is the result of three silcrete knapping events comprising the majority of the assemblage, although silcrete-dominated assemblages are common in the area (Roads and Maritime Services (RMS) 2019). The presence of eight stone materials shows a moderate level of assemblage diversity (Table 8.2). The presence of 17 separate technological categories of artefacts including three types of retouched implements shows that a range of technological activities was being undertaken in the study area.

Table 8.2 Analysis of raw material types per site

Site / AHIMS No.	Raw Materials								Total
	Silcrete	FGS	Quartzite	Chert	Quartz	Petrified Wood	Sandstone	Volcanic	
Yiribana AS1 / 45-5-5678	464	49	5	15	6	1	1	5	546

Table 8.3 Artefact density per site

Site / AHIMS No.	Total artefacts	Total area (m^2)	Highest No. artefacts per pit	Highest No. artefacts per m^2	Average Artefact density (per m^2)
Yiribana AS1 / 45-5-5678	546	34.5	186	744	15.6

Table 8.4 Analysis of artefact type by site

Artefact Type	Total at Yiribana AS1
Flake	240
Retouched Flake	7
Backing Flake	5
Core Rotation Flake	6
Eraillure Flake	2
Longitudinal Split Flake	19
Proximal Flake Fragment	23
Medial Flake Fragment	6
Distal Flake Fragment	39
Flake Fragment	44
Pot lid Flake	1
Retouched Piece	3
Core	8
Core Fragment	20
Symmetric Backed Artefact	3
Asymmetric Backed Artefact	4
Hammer Fragment	1
Flaked Piece	115
Total	**546**

The strongest pattern observed is the overall small size of the flaked artefacts, with those <10mm the modal class. While this is an unusual pattern compared to other excavated assemblages across southeast Australia there are notable parallels within a few kilometres of the study area (RMS 2019:115). This suggests the assemblage retrieved from the study area is part of a reduction strategy commonly employed in the local area, which was geared towards the production of blade-like flakes which at 17.5% of the assemblage is a relatively high proportion. Many of the unmodified flakes not fitting in to the blade category would have been part of the core preparation strategy necessary to remove blades. Precision flaking is indicated by the high proportion of focal platforms on small flakes and blades.

All cores were small, with the largest being only 53mm long, with the remainder <35mm and exhibiting a high degree of rotation (Table 8.3 and Table 8.4). This suggests a high degree of core curation was being practised at this site with only cores that were quite exhausted discarded at the locality. With a flake to core ratio of ~36 : 1 it would appear cores were being preferentially removed from the study area for further reduction elsewhere as opposed to being discarded on site or stored there for future use.

Backed artefacts, both symmetric and asymmetric were being produced in the study area and evidenced by incomplete specimens and the presence of 'backing flakes' in the assemblage (Table 8.4). Backed pieces or evidence of their production form only 2% of the whole assemblage but given the tight spatial arrangement it might be predicted that a greater proportion may be found in close adjacent positions to the current excavations. Further as it is highly probable the production of blades (17.5%) was related to the creation of pieces that might be converted to backed artefacts, nearly 20% of the assemblage was directly related to backed artefact production.

8.3 ARCHAEOLOGICAL ANALYSIS

The presence of dense clusters of small artefacts geared towards blade and backed artefact production, in addition to the relative absence of cores is indicative of the area being used in a relatively transitory, mobile fashion. This is opposed to being a semi-permanent base camp where a greater range of stone materials and larger artefacts might be predicted, as well as a wider range of activities such as grinding or chopping tools.

8.4 DISCUSSION

Based on the results of the test excavation, the following statements can be made about the areas of archaeological sensitivity identified during the archaeological survey:

- Yiribana AS1 (AHIMS # 45-5-5678)
    - Test excavations at Yiribana AS1 (AHIMS # 45-5-5678) identified a subsurface scatter with varying densities over the site area. Three clusters contained very high-density artefact deposits and eight additional pits contained moderate-high artefact densities. These moderate and high-density pits are interspersed with pits that had no archaeological material or low to moderate density.
    - Artefacts were dominant in the band 100mm-200mm below surface – this is believed to be evidence of a relatively low level of post European disturbance.
    - Yiribana AS1 is believed to display the overall pattern that would be expected in an area with a low level of disturbance. The data suggests that whatever land use the study area has experienced since European occupation it has not had a fully deleterious effect on the spatial integrity of the archaeology.
    - The presence of two conjoining artefacts from one pit also suggests the spatial integrity of the assemblage is high. It is highly likely that with limited excavation the products of isolated knapping events can be retrieved either in their substantial entirety or a large sample.
    - Areas with such spatial arrangements are uncommon and the research potential of such assemblages is consequently high.
- Yiribana PAD 1 (AHIMS # 45-5-5675)
    - Yiribana PAD 1 was not subject to test excavations as it was outside of the disturbance footprint. Due to this it is still considered an area of high archaeological potential.
- Yiribana PAD 2 (AHIMS # 45-5-5676)
    - Yiribana PAD 2 was not subject to test excavations as it was outside of the disturbance footprint. Due to this it is still considered an area of high archaeological potential.
- Yiribana PAD 3 (AHIMS # 45-5-5677)
    - Yiribana PAD 3 was not subject to test excavations as it was outside of the disturbance footprint. Due to this it is still considered an area of high archaeological potential.

A reassessment of archaeological sensitivity is outlined in Figure 8.1.

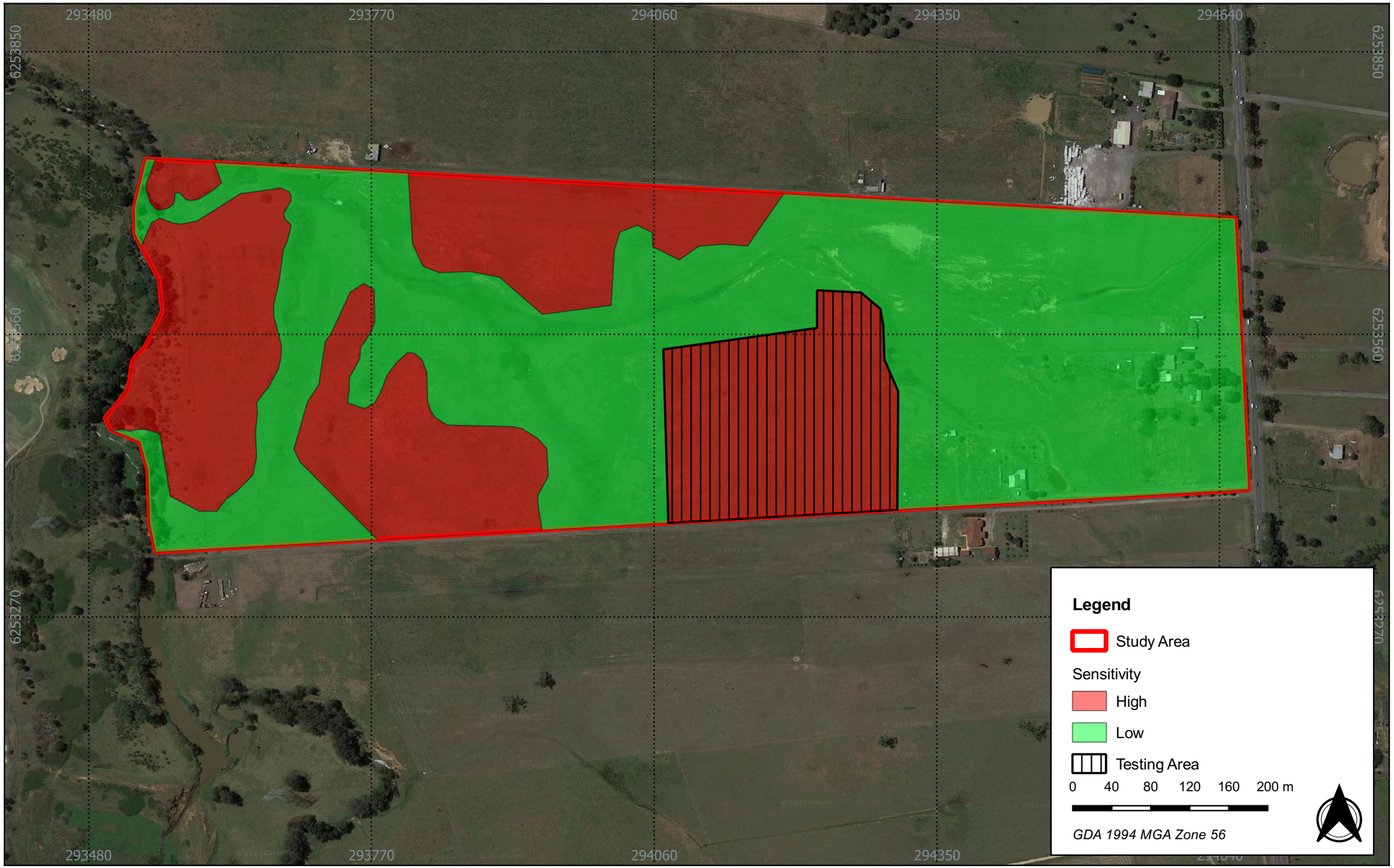


Figure 8.1 Revised archaeological sensitivity mapping

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial

Drawn by: ARH Date: 2023-02-02

AUSTRAL ARCHAEOLOGY

9 CULTURAL HEIRTAGE VALUES

An assessment of significance seeks to determine and establish the importance or value that a place, site or item may have to the community at large. The concept of cultural significance is intrinsically connected to the physical fabric of the item or place, its location, setting and relationship with other items in its surrounds. The assessment of cultural significance is ideally a holistic approach that draws upon the response these factors evoke from the community.

9.1 BASIS FOR THE ASSESSMENT

The significance values provided in the Australia ICOMOS *Charter for the Conservation of Places of Cultural Significance* (the Burra Charter) are considered to be the best practice heritage management guidelines in Australia (Australia ICOMOS 2013a). The Burra Charter defines cultural significance as:

> *"…aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups." (Australia ICOMOS 2013a, p.2)*

The Burra Charter significance values outlined in Table 9.1; these are frequently adopted by cultural heritage managers and government agencies as a framework for a more holistic assessment of significance.

Table 9.1 Definitions of Burra Charter significance values (Australia ICOMOS 2013b)

Value	Definition
Aesthetic	Refers to the sensory and perceptual experience of a place. That is how a person responds to visual and non-visual aspects such as sounds, smells and other factors having a strong impact on human thoughts, feelings and attitudes. Aesthetic qualities may include the concept of beauty and formal aesthetic ideals. Expressions of aesthetics are culturally influenced.
Historic	Refers to all aspects of history. For example, the history of aesthetics, art and architecture, science, spirituality, and society. It therefore often underlies other values. A place may have historic value because it has influenced, or has been influenced by, an historic event, phase, movement or activity, person, or group of people. It may be the site of an important event. For any place the significance will be greater where the evidence of the association or event survives at the place, or where the setting is substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of such change or absence of evidence.
Scientific	Refers to the information content of a place and its ability to reveal more about an aspect of the past through examination or investigation of the place, including the use of archaeological techniques. The relative scientific value of a place is likely to depend on the importance of the information or data involved, on its rarity, quality or representativeness, and its potential to contribute further important information about the place itself or a type or class of place or to address important research questions.
Social	Refers to the associations that a place has for a particular community or cultural group and the social or cultural meanings that it holds for them.

Value	Definition
Spiritual	Refers to the intangible values and meanings embodied in or evoked by a place which give it importance in the spiritual identity, or the traditional knowledge, art and practices of a cultural group. Spiritual value may also be reflected in the intensity of aesthetic and emotional responses or community associations and be expressed through cultural practices and related places. The qualities of the place may inspire a strong and/or spontaneous emotional or metaphysical response in people, expanding their understanding of their place, purpose and obligations in the world, particularly in relation to the spiritual realm. The term spiritual value was recognised as a separate value in the Burra Charter, 1999. It is still included in the definition of social value in the Commonwealth and most state jurisdictions. Spiritual values may be interdependent on the social values and physical properties of a place.

In addition to the Burra Charter significance values, other criteria's and guidelines have been formulated by other government agencies and bodies in NSW to assess the significance of heritage places in NSW. Of particular relevance to this assessment are the guidelines prepared by the Australian Heritage Council and the Department of the Environment, Water, Heritage and the Arts (DEWHA), and Heritage NSW (Australian Heritage Council & DEWHA 2009, DECCW 2011, OEH 2011, NSW Heritage Office 2001).

The Guide (OEH 2011, p.10) states that the following criteria from the NSW Heritage Office (2001, p.9) should be considered:

- **Social value:** Does the subject area have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons?
- **Historic value:** Is the subject area important to the cultural or natural history of the local area and/or region and/or state?
- **Scientific value:** Does the subject area have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state?
- **Aesthetic value:** Is the subject area important in demonstrating aesthetic characteristics in the local area and/or region and/or state?

OEH (2011, p.10) states that when considering the Burra Charter criteria, a grading system must be employed. Austral will use the following grading system to assess the cultural values of the study area and its constituent features. These are outlined in Table 9.2.

Table 9.2 Gradings used to assess the cultural values of the study area

Grading	Definition
Exceptional	The study area is considered to have rare or outstanding significance values against this criterion. The significance values are likely to be relevant at a state or national level.
High	The study area is considered to possess considerable significant values against this criterion. The significance values are likely to be very important at a local or state level.
Moderate	The study area is considered to have significance values against this criterion; these are likely to have limited heritage value but may contribute to broader significance values at a local or State level.
Little	The study area is considered to have little or no significance values against this criterion.

9.2 ASSESSMENT OF SIGNIFICANCE

The following section addresses the Burra Charter significance values with reference to the overall study area.

9.2.1 AESTHETIC SIGNIFICANCE VALUES

Aesthetic values refer to the sensory, scenic, architectural, and creative aspects of the place. These values may be related to the landscape and are often closely associated with social and cultural values.

The study area is within an area of constant artificial change. While the land within the study area is currently a cleared field, and the view to south creek offers some aesthetic appeal, the surrounding developments and continuous urbanisation of Mamre Road offer low aesthetic values.

Based on this assessment, the study area is considered to have **low** aesthetic significance values.

9.2.2 HISTORIC SIGNIFICANCE VALUES

The assessment of historic values refers to associations with particular places associated with Aboriginal history. Historic values may not be limited to physical values but may relate to intangible elements that relate to memories, stories or experiences.

There is no evidence of historic values being present within or associated with the study area.

Based on this assessment, the study area is considered to have **no** historic significance values.

9.2.3 SCIENTIFIC SIGNIFICANCE VALUES

Scientific significance generally relates to the ability of archaeological objects or sites to answer research questions that are important to the understanding of the past lifeways of Aboriginal people. Australia ICOMOS (2013b, p.5) suggests that to appreciate scientific value, that the following question is asked: "*Would further investigation of the place have the potential to reveal substantial new information and new understandings about people, places, processes or practices which are not available from other sources?*".

In addition to the above criteria, The Guide (OEH 2011, p.10) also suggests that consideration is given to the Australian Heritage Council and DEWHA (2009) criteria, which are particularly useful when considering scientific potential:

- **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?

An assessment of the scientific significance of the Aboriginal sites located within the study area is outlined in Table 9.3

Table 9.3 Scientific significance of Aboriginal sites in the study area

Site name	AHIMS No.	Assessment of significance	Grading
Yiribana AS 1	45-5-5678	Yiribana AS1 (AHIMS # 45-5-5678) identified a subsurface scatter with varying densities over the site area. Three clusters contained very high-density artefact deposits and eight additional pits contained moderate-high artefact densities. These moderate and high-density pits are interspersed with pits that had no archaeological material or low to moderate density. Yiribana AS1 is believed to display the overall pattern that would be expected in an area with a low level of disturbance. The data suggests that whatever land use the study area has experienced since European occupation it has not had a fully deleterious effect on the spatial integrity of the archaeology. It is highly likely that the products of isolated knapping events can be retrieved either in their substantial entirety or a large sample. Areas with such spatial arrangements are uncommon and as such the archaeological significance and the research potential of the assemblage is considered high.	High

Site name	AHIMS No.	Assessment of significance	Grading
Yiribana PAD 1	45-5-5675	Yiribana PAD 1 has indeterminate significance.	N/A
Yiribana PAD 2	45-5-5676	Yiribana PAD 2 has indeterminate significance.	N/A
Yiribana PAD 3	45-5-5677	Yiribana PAD 3 has indeterminate significance.	N/A

9.2.4 SOCIAL AND SPIRITUAL SIGNIFICANCE VALUES

As social and spiritual significance are interdependent, Austral has undertaken a combined assessment of these values. The Consultation Requirements specify that the social or cultural values of a place can only be identified through consultation with Aboriginal people.

No submissions were received from RAPs during stage 4 consultation regarding social and spiritual significance of the site, however, all Aboriginal sites hold high significance to the local Aboriginal community.

Based on this assessment, the study area is considered to have **high** social and spiritual significance values.

9.3 STATEMENT OF SIGNIFICANCE

Statements of significance for identified Aboriginal sites within the study area are presented in Table 9.4. The statements of significance have been formulated using the Burra Charter significance values and relevant NSW guidelines (DECCW 2011, OEH 2011, Australia ICOMOS 2013a).

Table 9.4 Statements of significance for Aboriginal sites in the study area

Site name	Statement of significance
Yiribana AS 1	Yiribana AS1 (AHIMS # 45-5-5678) identified a subsurface scatter with moderate and high-density clusters interspersed with areas of no archaeological material or low to moderate density. The site is believed to display the overall pattern that would be expected in an area with a low level of disturbance, and it is highly likely that the products of isolated knapping events can be retrieved either in their substantial entirety or a large sample. Areas with such spatial arrangements are uncommon and as such the archaeological significance of Yiribana AS1 is considered high.
Yiribana PAD 1	Yiribana PAD 1 has indeterminate significance.
Yiribana PAD 2	Yiribana PAD 2 has indeterminate significance.
Yiribana PAD 3	Yiribana PAD 3 has indeterminate significance.

Heritage NSW specifies the importance of considering cultural landscapes when determining and assessing Aboriginal cultural values. The principle behind this is that '*For Aboriginal people, the significance of individual features is derived from their inter-relatedness within the cultural landscape. This means features cannot be assessed in isolation and any assessment must consider the feature and its associations in a holistic manner"* (DECCW 2010c).

The study area is situated within multiple areas of high archaeological potential, with a high-density artefact site identified with an undisturbed landform. While the aesthetic and historic significance of the site is considered low, the archaeological significance of Yiribana AS1 is high, and it is believed that 3 remaining areas of low disturbance have the high potential to reveal subsurface deposits. However, the eastern portion of the study area is highly disturbed and is believed to contain no archaeological potential.

10 IMPACT ASSESSMENT

This section outlines, according to Heritage NSW guidelines, the potential harm that the proposed activity may have on identified Aboriginal objects and places within the study area (DECCW 2011, OEH 2011).

10.1 LAND USE HISTORY

The study area is found within an area under constant artificial change. The study area has been previously cleared of vegetation, likely during the days of early European settlement when logging and clearance for agricultural activities were undertaken. Vegetation clearance has occurred throughout most of the Study Area. Past agricultural practices, extensive land clearance, animal grazing, the construction of buildings, fences and vehicle tracks, tree harvesting, installation of overhead power lines and ongoing encroachment of residential development surrounding the Study Area have contributed to the removal of the original native vegetation. The Study Area is now covered in dense native and introduced grasses with planted gardens of native vegetation and introduced species.

Table 10.1 Summary of past land use within the study area, and the potential impacts on archaeological resources

Past land uses	Potential impacts on archaeological resources
Land Clearance	Land clearance would have resulted in soil disturbance and topsoil movement and loss that, coupled with erosion on slopes across the majority of the Study Area, might account for widespread artefact displacement but not the complete destruction of Aboriginal sites
Development	The construction of buildings, fences and vehicle tracks has completely disturbed sections of the study area through excavation and removed archaeological potential in these direct impact areas.

10.2 PROPOSED ACTIVITY

The proposed activity consists of the construction of a pump station, three warehouses, their associated carparks and access roads. Two seal roads are to be constructed, one running along the north boundary cutting across the centre of the site heading south, and one running north to south. This project will disturb and alter the surface conditions of the study area, some of which has previous disturbance due to the demolishing of the previous dwelling. No culturally modified vegetation will be impacted by the proposed works.

The development is proposed to be undertaken across two stages with two separate development applications.

STAGE 1 WORKS

Stage 1 includes the development of two warehouses in the east of the development, along with the north-south road and associated infrastructure. This will be associated with the first Development Application.

STAGE 2 WORKS

Stage 2 includes the development of the warehouse in the centre of the development, along with the northern road and associated infrastructure. This will be associated with the second Development Application.

10.3 ASSESSING HARM

This section outlines the assessment process for addressing potential harm to Aboriginal objects and/or places within the study area, as outlined by Heritage NSW (OEH 2011, p.12).

10.3.1 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

An objective of the NPW Act, under Section 2A(1)(b)(i) is to conserve "*places, objects and features of significance to Aboriginal people*" through applying the principles of ecologically sustainable development (ESD) (Section 2A(2)). ESD is defined in Section 6(2) of the *Protection of the Environment Administration Act 1991* (NSW) as "…*the effective integration of social, economic and environmental considerations in decision-making processes".* ESD can be achieved with regards to Aboriginal cultural heritage, by applying principle of inter-generational equity, and the precautionary principle to the nature of the proposed activity, with the aim of achieving beneficial outcomes for both the development, and Aboriginal cultural heritage.

INTERGENERATIONAL EQUITY

The principle of intergenerational equity is where the present generation ensure the health, diversity, and productivity of the environment for the benefit of future generations. The Department of Environment and Climate Change (DECC), now Heritage NSW, states that in terms of Aboriginal cultural heritage "*intergenerational equity can be considered in terms of the cumulative impacts to Aboriginal objects and places in a region. If few Aboriginal objects and places remain in a region (for example, because of impacts under previous AHIPs), fewer opportunities remain for future generations of Aboriginal people to enjoy the cultural benefits of those Aboriginal objects and places.*" (DECC 2009, p.26).

The assessment of intergenerational equity and understanding of cumulative impacts should consider information about the integrity, rarity or representativeness of the Aboriginal objects and/or places that may be harmed and how they illustrate the occupation and use of the land by Aboriginal people across the locality (DECC 2009, p.26).

Where there is uncertainty over whether the principle of intergenerational equity can be followed, the precautionary principle should be applied.

PRECAUTIONARY PRINCIPLE

Heritage NSW defines the Precautionary Principle as "*if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation*" (DECC 2009, p.26).

The application of the precautionary principle should be guided through:

- A careful evaluation to avoid, wherever practicable, serious, or irreversible damage to the environment.
- An assessment of the risk—weighted consequences of various options.

DECC (2009, p.26) states that the precautionary principle is relevant to the consideration of potential impacts to Aboriginal cultural heritage, where:

- The proposal involves a risk of serious or irreversible damage to Aboriginal objects and/or places or to the value of those objects and/or places.
- There is uncertainty about the Aboriginal cultural heritage values, scientific, or archaeological values, including in relation to the integrity, rarity or representativeness of the Aboriginal objects or places proposed to be impacted.

Where either of the above is likely, a precautionary approach should be taken, and all effective measures implemented to prevent or reduce harm to Aboriginal cultural heritage values.

10.3.2 TYPES OF HARM

When considering the nature of harm to Aboriginal objects and/or places, it is necessary to quantify direct and indirect harm. The types of harm, as defined in the Guide (OEH 2011, p.12), and are summarised in Table 10.2. These definitions will be used to quantify the nature of harm to identified Aboriginal objects and/or places that have been identified as part of this assessment. The Code states that the degree of harm can be either total or partial (DECCW 2010b, p.21).

Table 10.2 Definition of types of harm

Type of harm	Definition
Direct harm	May occur as the result of any activity which disturbs the ground including, but not limited to, site preparation activities, installation of services and infrastructure, roadworks, excavating detention ponds and other drainage or flood mitigation measures, and changes in water flows affecting the value of a cultural site.
Indirect harm	May affect sites or features located immediately beyond, or within, the area of the proposed activity. Examples of indirect impacts include, but are not limited to, increased impact on art in a shelter site from increased visitation, destruction from increased erosion and changes in access to wild food resources.

10.4 IMPACT ASSESSMENT

This ACHA has included a programme of investigations that have characterised the nature, extent, and significance of Aboriginal sites within the study area.

The proposed Stage 1 works have no foreseeable impact on known archaeological values.

The proposed Stage 2 works will impact one known archaeological site, Yiribana AS1 / AHIMS # 45-5-5678, through the excavation and construction the proposed centre warehouse, northern road, and associated infrastructure.

An evaluation of harm to the Aboriginal sites identified as part of the ACHA is summarised in Table 10.3. Details of the proposed activity and their relationship to identified Aboriginal sites is outlined in Table 10.3.

Table 10.3 Assessment of harm to identified Aboriginal sites.

Site name / AHIMS No.	Type of harm	Degree of harm	Consequence of harm
Yiribana AS 1/ AHIMS # 45-5-5678	Direct	Total	Total loss of value
Yiribana PAD 1 / AHIMS # 45-5-5675	None	None	No loss of value
Yiribana PAD 2 / AHIMS # 45-5-5676	None	None	No loss of value
Yiribana PAD 3 / AHIMS # 45-5-5677	None	None	No loss of value

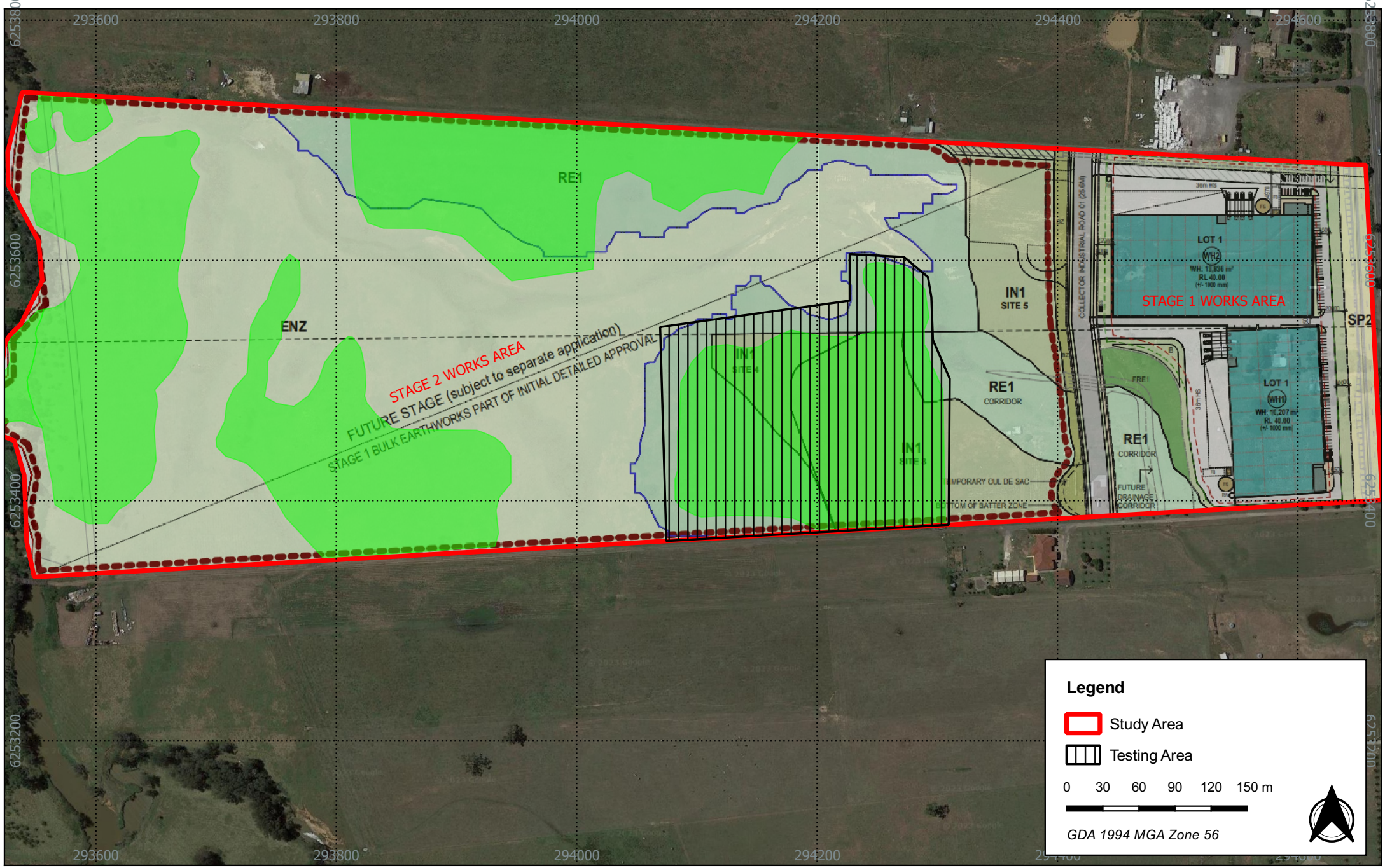


Figure 10.1 Details of the proposed activity in relation to identified Aboriginal sites

22040 - 771-797 Mamre Road, Kemps Creek - ACHA

Source: NSW LPI Aerial *Drawn by: ARH Date: 2023-02-02*

AUSTRAL ARCHAEOLOGY

11 AVOIDING AND MINIMISING HARM

The Burra Charter, advocates a cautious approach to change: "*do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained*" (Australia ICOMOS 2013a, p.1). Based on this principle, this section identifies the measures that have been taken to avoid harm and what conservation outcomes have been achieved through the preparation of this ACHA.

11.1 DEVELOPMENT OF PRACTICAL MEASURES TO AVOID HARM

The assessment resulted in the recovery of a high-density artefact assemblage recovered from one Aboriginal heritage site within the study area that is considered to have high archaeological significance. The site depicts Aboriginal use of the landscape surrounding South Creek and its associated tributaries.

Impacts to heritage values in the study area have been reduced by concentrating the works in the east portion of the study area, away from the creek. Three of the four PAD areas were not disturbed and will not be within the development area. The sub-surface testing program completed as part of this assessment has resulted in the collection of a small but representative sample of stone artefacts associated with the sites and the broader study area. As would the results of further salvage. The data catalogue produced from the analysis of this material, and provided in Volume 2, is therefore available for future reference and use. Despite its limited research value, the data nevertheless is important for contributing to current understandings of the past Aboriginal land use practices in the local region and provides support for the predictive model.

11.2 APPLICATION OF PRINCIPLES OF ESD AND CUMULATIVE IMPACTS

The Guide to Reporting requires this ACHA to consider the effects of cumulative impacts under the principles of ESD. In essence, this requires the acknowledgement that while a single development might have a minimal impact, it forms part of a slow urbanisation process which results in the widespread loss of environmental and cultural resources.

The sites located within the study area that will be impacted by the proposed development are representative of a common site type (i.e., Artefacts sites including low density artefact scatters and isolated artefacts) in association with a range of landform types that are well represented across the region. The lack of diversity in artefact types and raw materials means that their overall scientific/archaeological and educational value is assessed as being low. Although all Aboriginal sites are of cultural significance to the Aboriginal community.

Western Sydney is a region that is subject to progressive urbanisation and expansion, which places pressure on the archaeological resources within the region. To qualify whether the proposed impacts from the project will have a broader impact on the cultural resources of the region, Austral undertaken an analysis of AHIMS sites in relation to their current or future zoned use. The purpose behind this analysis is to determine the volume of AHIMS sites that are located within zonings that have or are likely to be subject to progressive development. This assumes that sites that are located within land zoned for residential (R1 - R5), business (B1 – B5) and industrial (IN1 – IN4) purposes are more likely to have been harmed or may be under thread of harm. Conversely, sites that are zoned for environmental (E1 – E5), recreational (RE1 – RE2) and rural (RU1 – RU6) purposes are more likely to be subject to conservation.

This analysis indicates that the majority of AHIMS sites (n=257, 65.1%) are located within zonings that are likely to be subject to harm through progressive urbanisation and other developments, while only 34.9% (n=138) of sites are within zonings likely to facilitate conservation outcomes and minimal threat to the conservation of sites. Unsurprisingly, the greatest threat to Aboriginal sites is general industrial development, with 42.8% of sites (n=169) located within an industrial zoning.

Table 11.1 Analysis of AHIMS sites in relation to land zoning

Land zones	Number of sites	% of sites
Business development	2	0.5

Land zones	Number of sites	% of sites
Enterprise	25	6.3
Environment and recreation	17	4.3
Environmental conservation	50	12.7
Environmental Living	6	1.5
General industrial	169	42.8
Infrastructure	48	12.2
Low density residential	1	0.3
Primary production small lots	12	3
Private recreation	9	2.3
Public recreation	15	3.8
Rural landscape	23	5.8
Waterways	18	4.6
Total	**395**	**100**

A review of the frequency of one or more AHIP's listed against AHIMS sites indicates some slightly differing trends. Despite the high frequency of sites within areas unlikely to facilitate conservation, a comparatively small number of sites have had AHIPs granted against them. Current data indicates that 89.4% of sites have not had one or more AHIPs listed against them (Table 11.2). Additionally, the only sites that have had AHIPs listed against them are artefact sites and areas of PAD, indicating that more diverse site types are being conserved, rather than destroyed.

Table 11.2 Analysis of AHIMS sites with AHIP's issued

Site types	No. Sites	No. sites with AHIPs	% Sites with AHIPS
Artefact	346	39	11.3
Artefact, PAD	29	3	10.3
PAD	17	0	0
Artefact, Modified Tree	1	0	0
Grinding Groove	1	0	0
Modified Tree	1	0	0
Total	**395**	**42**	**10.6**

This analysis does indicate that 11.3% of artefact and 10.3% of artefact, PAD sites have had AHIPs issued against them, indicating that these sites have been subject to cumulative impacts from successive approvals. However, this analysis does appear to indicate that locally, a higher proportion of AHIMS sites, specifically 353 (89.4%) are ether being conserved rather than destroyed.

11.3 STRATEGIES TO MINIMISE HARM

The progressive urbanisation of the Kemps Creek area, specifically along Mamre Road, has contributed to the cumulative destruction of Aboriginal heritage sites in the area. In order to facilitate higher conservation outcomes, the current development avoids the majority of areas of subsurface potential, and these areas were excluded from the testing program to limit impacts. Furthermore, to minimize harm to Aboriginal objects, salvage of the site within the impact footprint and reburial of the material retrieved is recommended.

12 RECOMMENDATIONS

The following recommendations are derived from the findings described in this ACHA. The recommendations have been developed after considering the archaeological context, environmental information, consultation with the local Aboriginal community, and the findings of the test excavation and the predicted impact of the planning proposal on archaeological resources.

It is recommended that:

1. No further investigation is required before the commencement of the Stage 1 works. Exclusion fencing and barriers should be placed around the designated Stage 2 works area during Stage 1 construction and this area must be identified on all construction plans as a no-go area.
2. If unexpected finds occur during any activity within the Stage 1 works study area, all works in the vicinity must cease immediately. The find must be left in place and protected from any further harm. Depending on the nature of the find, the following processes must be followed:
    1. If, while undertaking the activity, an Aboriginal object is identified, it is a legal requirement under Section 89A of the NPW Act to notify Heritage NSW, as soon as possible. Further investigations and an AHIP may be required prior to certain activities recommencing.
    2. If, human skeletal remains are encountered, all work must cease immediately and NSW Police must be contacted, they will then notify the Coroner's Office. Following this, if the remains are believed to be of Aboriginal origin, then the Aboriginal stakeholders and Heritage NSW must be notified.
3. Before the Stage 2 works occur, GPT Group are to apply to Heritage NSW for an Aboriginal Heritage Impact Permit (AHIP) to salvage Yiribana AS 1 (AHIMS # 45-5-5678). This site is protected under Section 90 of the *NSW National Parks and Wildlife Act 1974* (NPW Act). It is recommended that the following mitigation measures are implemented as part of the AHIP:
    1. Salvage of Yiribana AS 1 (AHIMS # 45-5-5678).
    2. Exclusion fencing and barriers should be placed around Yiribana PAD 1 (AHIMS #45-5-56-75), Yiribana PAD 2 (AHIMS # 52-5-5676) and Yiribana PAD 3 (AHIMS # 52-5-5677) during construction and these sites must be identified on all construction plans as no-go areas.
    3. All Aboriginal objects collected during the archaeological testing and anticipated salvage works (under the approved AHIP) will be reburied onsite at the nominated location to be determined during stage 4 of consultation with the registered stakeholders.
4. It is recommended that GPT Group continues to inform the Aboriginal stakeholders about the management of Aboriginal cultural heritage within the study area throughout the completion of the project. The consultation outlined as part of this ACHA is valid for six months and must be maintained by the proponent for it to remain continuous. If a gap of more than six months occurs, then the consultation will not be suitable to support an AHIP for the project.
5. A copy of this report should be forwarded to all Aboriginal stakeholder groups who have registered an interest in the project.

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14 APPENDICES

SEE VOLUME 2