New high school for Schofields and Tallawong

Archaeological Report

Prepared for NSW Department of Education

Final Report

31 July 2025

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- TSA Riley: Maria Soerensen
- NSW Department of Education: Duncan Jones, Alyce Haast & Josh Malin

Biosis staff involved in this project were:

- Mathew Smith (assistance in the field)
- Azka Abid (mapping)

Biosis acknowledges the Aboriginal and Torres Strait Islander peoples as Traditional Custodians of the land on which we live and work.

We pay our respects to the Traditional Custodians and Elders past and present and honour their connection to Country and ongoing contribution to society.

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Summary

Biosis Pty Ltd (Biosis) was commissioned by NSW Department of Education (DoE) to undertake an Aboriginal Cultural Heritage Assessment (ACHA) for a proposed future activity of the new high school for Schofields and Tallawong at part of 201 Guntawong Road, Tallawong, New South Wales (NSW) (the study area). The study area is located within Lot 1 DP 1283186 and located approximately 46 kilometres north-east of the Sydney central business district (CBD).

This Archaeological Report (AR) has been prepared to support a Review of Environmental Factors (REF) for the DoE for the construction and operation of the new high school for Schofields and Tallawong (the activity). The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority under Part 5 of *Environmental Planning and Assessment Act 1979* (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

This AR documents the findings of the archaeological investigations conducted as part of the ACHA. As required under Section 2.3 of *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010b) (the Code), the AR provides evidence about the material traces of Aboriginal land use to support the conclusions and management recommendations in the ACHA. DoE is the determining authority and will assess the REF to help them determine if the proposed development is likely to have a significant effect on the environment, including Aboriginal cultural heritage.

The proposed activity is for the construction and operation of a new high school for Schofields and Tallawong. The new high school will accommodate up to 1,000 students. The school will provide 49 permanent teaching spaces (PTS), and three support teaching spaces (STS) across three buildings.

The buildings will be three-storey in height and will include teaching spaces, specialist learning hubs, a library, administrative areas and a staff hub. Additional core facilities are also proposed including a standalone school hall, a carpark, as pick up and drop off zone along Nirmal Street, two sports courts and a sports field.

Specifically, the proposal involves the following:

- Three learning hubs (three-storeys in height) accommodating 49 general teaching spaces and three support learning units (SLUs).
- Other core facilities including amenities, library, staff hub and administrative areas.
- Standalone school hall.
- Separate carpark with 72 spaces.
- Kiss and drop zone along Nirmal Street.
- Open play space including sports courts and sports field.
- Public domain works.

The proposed site access arrangements are as follows:

- Main pedestrian entrance to be located off Nirmal Street.
- Kiss and drop zone proposed along Nirmal Street.

- Onsite parking access via Nirmal Street.

There are 83 Aboriginal cultural heritage sites registered with the Aboriginal Heritage Information Management System (AHIMS) register, both within the study area as well as in the vicinity. There are three registered sites within the study area AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1. The study area is also part of a wider site, known as *Nangamay Ngurra* a proposed Aboriginal Place which consists of a complex of archaeological sites.

The survey was conducted on 23 October 2024 by Mathew Smith (Biosis, Senior Heritage Consultant), Alyce Haast (DoE) and Justine Coplin (Cultural Sites Officer, Dharug Custodian Aboriginal Corporation). The overall effectiveness of the survey for examining the ground for Aboriginal sites was deemed low. This was attributed to vegetation cover restricting ground surface visibility (GSV) combined with a low exposure. One previously unrecorded Aboriginal cultural heritage site was identified during the field investigation, AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1. The site consists of one hammerstone artefact located upon an existing dirt track within the study area. There is high potential for development activities to impact Aboriginal sites and the identified sites within the study area and for direct impact to *Nangamay Ngurra* Aboriginal Place nomination.

A Ground Penetrating Radar (GPR) survey was undertaken on 10 April 2025 by MALA GPR Australia (MALA GPR). The GPR survey was undertaken to determine if there were burials present within the central portion of the study area. The depth of resolution from the survey was considered "unsatisfactory" likely due to recent rainfall and the presence of clay deposits. The GPR survey returned results that were inconclusive in the determination of archaeological artefacts or burials.

Strategies have been developed based on the archaeological significance of cultural heritage relevant to the study area. The strategies also take into consideration:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practice, widely considered to include:
  - The ethos of the Australia — International Council on Monuments and Sites (ICOMOS) Burra Charter.
  - the Code.

The recommendations that resulted from the consultation process are provided below.

Management recommendations

Prior to any development impacts occurring within the study area, the following is recommended.

Recommendation 1: Continued consultation with the registered Aboriginal parties

It is recommended that DoE continue to inform these groups about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project. This recommendation is in keeping with the consultation requirements.

Recommendation 2: Application for an AHIP to impact AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1

If avoidance through redesign is unable to occur, it is recommended that that DoE apply to Heritage NSW, NSW Department of Climate change, Energy, the Environment and Water (Heritage NSW) for an AHIP to destroy AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 and to partially impact AHIMS 45-5-5766/Guntawong Road 2 which are currently protected under the NPW Act. The AHIP should be for a term of two years.

A small portion of AHIMS 45-5-5766/Guntawong Road 2 will be impacted by the proposed activity. Due to the low to moderate density of artefacts, no further works is advised. The majority of AHIMS 45-5-5766/Guntawong Road 2 will not be impacted and will be conserved (refer to Recommendation 3).

It is recommended that the surface stone artefacts associated with AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 is collected prior to construction.

Recommendation 3: Fencing of AHIMS 45-5-5766/Guntawong Road 2

Prior to any works taking place, the majority of AHIMS 45-5-5766/Guntawong Road 2 and the area of moderate archaeological potential which will not be impacted are to be conserved and should be clearly fenced to ensure they will not be harmed by the proposed activity. Fencing must remain in place over the lifespan of the construction phase.

Recommendation 4: No further archaeological work required in the area of low potential once AHIP obtained from Heritage NSW

No further archaeological work is required in the area of low potential except in the event that unexpected human remains are unearthed during any phase of the project (refer to Recommendation 7).

Recommendation 5: Discovery of unanticipated Aboriginal objects

All Aboriginal objects and Places are protected under the NPW Act. It is an offence to disturb an Aboriginal site without a consent permit issued by Heritage NSW. Should any unanticipated Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders.

Recommendation 6: Discovery of unanticipated historical relics

Relics are historical archaeological resources of local or State significance and are protected in NSW under the *Heritage Act 1977*. Relics cannot be disturbed except with a permit or exception/exemption notification. Should unanticipated relics be discovered during the course of the project, work in the vicinity must cease and an archaeologist contacted to make a preliminary assessment of the find. The Heritage Council will require notification if the find is assessed as a relic.

Recommendation 7: Discovery of human remains

If any suspected human remains are discovered during any activity you must:

1. Immediately cease all work at that location and not further move or disturb the remains.
2. Notify the NSW Police and Heritage NSW Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location.

3. Not recommence work at that location unless authorised in writing by Heritage NSW.

Recommendation 8: Development of an Aboriginal Cultural Heritage Management Plan

It is recommended an Aboriginal Cultural Heritage Management Plan (ACHMP) be developed to appropriately manage Aboriginal cultural heritage identified within the study area. An ACHMP sets out specific guidelines and protocols for the management of Aboriginal heritage across the life of the project inclusive of construction and operational use. This should be inclusive of unanticipated finds protocols, the requirement for heritage inductions to be undertaken by the site personnel prior to works, and long-term care and control of Aboriginal archaeological materials. The ACHMP must be prepared by a suitably qualified archaeologist in consultation with the RAPs for the project.

Recommendation 9: Heritage Interpretation plan

Given the significance of the region to Aboriginal people, there is an opportunity for heritage interpretation as part of the design. Heritage interpretation is an innovative way to integrate culture into design and can not only honour the deep-rooted connection to the land but also ensure that Aboriginal cultural heritage remains present in the daily operations of the proposed high school. As such, it is recommended that a Heritage Interpretation Plan be prepared by a suitably qualified heritage consultant following the NSW Heritage Council's *Interpreting Heritage Places and Items Guidelines*.

Biosis understands that this recommendation has been captured within the Connecting with Country program undertaken by DoE.

Definitions

ACHA	Aboriginal Cultural Heritage Assessment
ACHMP	Aboriginal Cultural Heritage Management Plan
ADDA	Aboriginal Due Diligence Assessment
AECG	Aboriginal Education Consultative Group
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AR	Archaeological Report
Biosis	Biosis Pty Ltd
BP	Before Present
CBD	Central Business District
Consultation requirements	*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*
Cth DCCEEW	Australian Commonwealth Department of Climate Change, Energy, the Environment and Water
DECCW	Department of Environment, Climate Change and Water (now Heritage NSW)
DP	Deposited Plan
DoE	NSW Department of Education
EP&A Act	*Environmental Planning and Assessment Act 1979*
ESD	Ecological Sustainable Development
GDA	Geocentric Datum of Australia
GPS	Global Positioning System
GPR	Ground Penetrating Radar
GSV	Ground Surface Visibility
Heritage NSW	Heritage NSW, NSW Department of Climate Change, Energy, the Environment and Water
ICOMOS	International Council on Monuments and Sites
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
MALA GPR	MALA GPR Australia
MGA	Map Grid of Australia
NHL	National Heritage List
NNTT	National Native Title Tribunal
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NSW	New South Wales

NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
NTSCORP	Native Title Services Corporation
PAD	Potential Archaeological Deposit
PTS	Permanent Teaching Spaces
RAPs	Registered Aboriginal Parties
REF	Review of Environmental Factors
SLUs	Support Learning Units
STS	Support Teaching Spaces
The Code	*Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW*
The study area	Part of 201 Guntawong Road, Tallawong NSW (Lot 1 DP1283186)
T&I SEPP	State Environmental Planning Policy (Transport and Infrastructure) 2021

1 Introduction

1.1 Project background

Biosis was commissioned by DoE to undertake an ACHA of the proposed future development of the new high school for Schofields and Tallawong at part of 201 Guntawong Road, Tallawong (Lot 1 DP 1283186) NSW (study area) (Figure 1 and Figure 2). This AR documents the findings of the archaeological investigations conducted as part of the ACHA. The AR provides evidence about the material traces of Aboriginal land use to support the conclusions and management recommendations in the ACHA.

The future development of the site will involve ground disturbing works that will have the potential to impact known and unknown Aboriginal heritage constraints that may be present within the study area. The project is to be assessed as REF under Part 5.1 of the EP&A Act.

This investigation has been carried out under Part 6 of the NPW Act and in accordance with the Code. The Code has been developed to support the process of investigating and assessing Aboriginal cultural heritage by specifying the minimum standards for archaeological investigation undertaken in NSW under the NPW Act.

It is stated in Section 1.2 of the Code that where the ACHA report concludes that the proposed activity will result in harm to Aboriginal objects or declared Aboriginal Places, an application for an AHIP will be required. This application must be supported by an ACHA report.

The EP&A Act includes provisions for local government authorities to consider environmental impacts in land-use planning and decision making. Each Local Government Area (LGA) is required to create and maintain a Local Environmental Plan (LEP) that includes Aboriginal and historical heritage items. Local Councils identify items that are of significance within their LGA, and these items are listed on heritage schedules in the local LEP and are protected under the EP&A Act and the Heritage Act.

1.2 Study area

The site is known as 201 Guntawong Road, Tallawong and is legally described as part of Lot 1 DP 1283186 (Figure 2). The site is located at the corner of Guntawong Road and Clarke Street, Tallawong and is approximately 4 hectares. The site has an approximately 100-metre-long frontage to Guntawong Road along its northern boundary. Nirmal Street provided a partial frontage along the eastern boundary of the site with plans to extend Nirmal Street to provide a future connection to Guntawong Road.

The site is predominantly cleared land and consists of grassland with several patches of remnant native vegetation particularly within the northern portion of the site. As a result of precinct wide rezonings, the surrounding located is currently transitioning from a semi-rural residential area to a highly urbanised area with new low to medium density residential development with supporting services. The site is located approximately 1.5 kilometres to the north-west of Tallawong Metro Station and is also serviced by an existing bus stop along Guntawong Road.

1.3 Planning approvals

The proposed development will be assessed against Part 5.1 of the EP&A Act. Other relevant legislation and planning instruments that will inform this assessment include:

- NPW Act.

- *National Parks and Wildlife Amendment Act 2010* (NSW).
- *State Environmental Planning Policy (Transport and Infrastructure) 2021*.
- *State Environmental Planning Policy (Industry and Employment) 2021*.
- *Environmental Planning and Assessment Regulation 2021*.
- *Blacktown LEP 2015*.
- *Blacktown Development Control Plan 2015*.

1.4 Objectives of the investigation

The objectives of the investigation can be summarised as follows:

- To identify and consult with any registered Aboriginal stakeholders and the Deerubbin Local Aboriginal Land Council.
- To conduct additional background research in order to recognise any identifiable trends in site distribution and location.
- To search statutory and non-statutory registers and planning instruments to identify listed Aboriginal cultural heritage sites within the study area.
- To highlight environmental information considered relevant to past Aboriginal occupation of the locality and associated land use and the identification and integrity/preservation of Aboriginal sites.
- To summarise past Aboriginal occupation in the locality of the study area using ethnohistory and the archaeological record.
- To formulate a model to broadly predict the type and character of Aboriginal sites likely to exist throughout the study area, their location, frequency and integrity.
- To conduct a field survey of the study area to locate unrecorded or previously recorded Aboriginal sites and to further assess the archaeological potential of the study area.
- To assess the significance of any known Aboriginal sites in consultation with the Aboriginal community.
- To identify the impacts of the proposed development on any known or potential Aboriginal sites within the study area.
- To recommend strategies for the management of Aboriginal cultural heritage within the context of the proposed development.

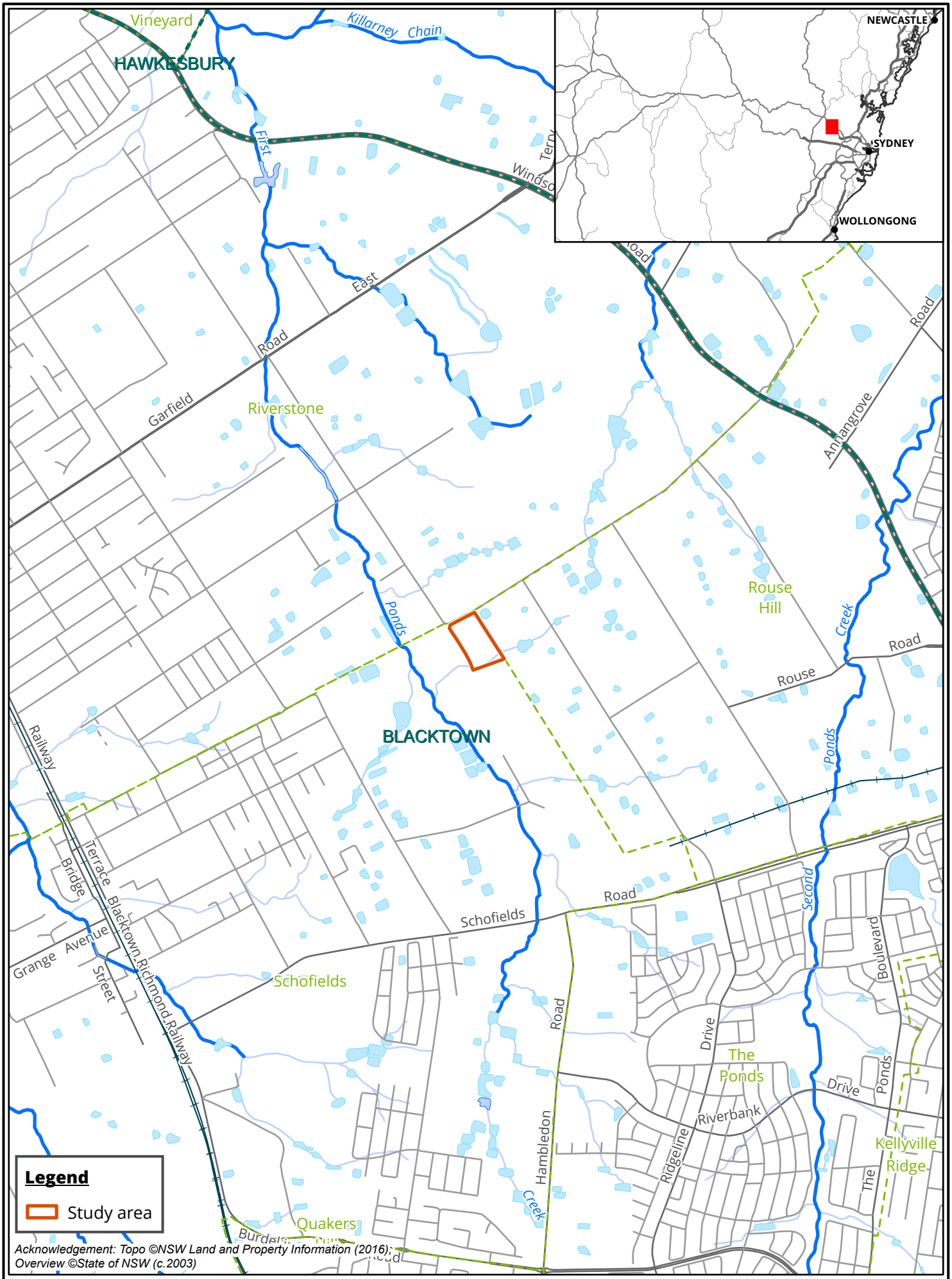
1.5 Investigators and contributors

The roles, previous experience and qualifications of the Biosis project team involved in the preparation of this AR are described below in Table 1.

Table 1 Investigators and contributors

Name and qualifications	Experience summary	Project role
Samantha Keats	Samantha is the NSW Heritage Manager with Biosis Wollongong office and has over eight years of experience as an	• Project Director

Name and qualifications	Experience summary	Project role
BA (Hons)	archaeologist. Samantha has had experience working as an archaeologist and project manager on a number of Aboriginal and European heritage projects across NSW, including water infrastructure and linear projects, residential development projects, renewable energy projects, and telecommunications projects. As part of these project Samantha has interacted with a diverse client base including Local Government, National Parks and Wildlife Service, Department of Primary Industry and Water, resource companies, architectural firms, engineering firms, and private developers.	
Maggie Butcher BSc/BA (Hons)	Maggie is one of the NSW Team Leaders, Senior Associate Heritage Consultant and Excavation Director with the Biosis Sydney office. Maggie has over eight years' experience as an archaeologist and has experience in conducting desktop assessments, archaeological survey and Aboriginal and historical excavation as well as consulting with Traditional Owners. She has also successfully managed a number of ACHAs to completion since her commencement at Biosis.	• Quality Assurance
Anthea Vella B.Arch, M.AHM	Anthea is a one of the NSW Team Leaders and Senior Heritage Consultant with over six years' experience. Anthea has experience in conducting Aboriginal and historical heritage assessments, surveys, archaeological test excavations and salvage excavations for a variety of projects including Aboriginal Due Diligence Assessments, ACHAs, Historical Heritage Assessments, Statements of Heritage Impact, Constraints Assessments, Aboriginal and Non-Aboriginal Heritage Management Plans, and Heritage Impact Assessments and permits for Aboriginal archaeology throughout NSW. Anthea possesses specialist skills in analysing Ground Penetrating Radar data. Anthea also possesses skills in desktop research, artefact analysis, project management, and reporting.	• Quality Assurance • Client communications • Technical advice
Mathew Smith BA/BSc (Hons)	Mathew is a Senior Heritage Consultant with over eight years' experience in the consulting industry. Mathew has extensive experience consulting with Aboriginal communities across NSW as well as completing Aborignal due diligence assessments, Aboriginal cultural heritage assessments, heritage management plans and Aboriginal heritage Impact Permits, including both archaeological survey, excavation and monitoring field works. Mathew is a full member of the Australian Association of Consulting Archaeologists Inc. and is also recognised as a specialist in the recording and analysis of Aboriginal artefacts.	• Technical advice • Field investigation • Community consultation
Molly Crissell BA	Molly joined the Heritage team in the Biosis Newcastle office in 2021 and has over four years of experience as Heritage Consultant. Molly has had experience working as an archaeologist and project management on several Aboriginal projects across NSW and Western Australia. Since joining Biosis, Molly has gained experience in project management, Aboriginal community consultation, field survey, test excavations, salvage excavations, and report preparation throughout the Sydney, Illawarra and Hunter regions.	• Project management • Background research • Community consultation • Reporting
Bronte Baonza BA Arts	Bronte joined Biosis in 2023 as a Graduate Heritage Consultant with the Sydney Heritage team. During her time with Biosis, she has supported project managers in conducting archaeological surveys, test excavations, Aboriginal consultation, and background research.	• Community consultation



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APEM Group

Figure 1 Location of the study area

Matter: 40105, Date: 15 October 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA
Layout: 40105_AR_F1_Locality

0 200 400 600 800 1,000
Metres
Scale 1:25,000@ A4, GDA2020 MGA Zone 56

N

Figure 2 Study area detail

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Matter: 40105, Date: 15 October 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F2_StudyArea

2 Proposed activity

The proposed activity is for the construction and operation of a new high school known for Schofields and Tallawong. The new high school will accommodate up to 1,000 students. The school will provide 49 PTS, and three STS across three buildings.

The buildings will be three-storey in height and will include teaching spaces, specialist learning hubs, a library, administrative areas and a staff hub. Additional core facilities are also proposed including a standalone school hall, a carpark, as pick up and drop off zone along Nirmal Street, two sports courts and a sports field.

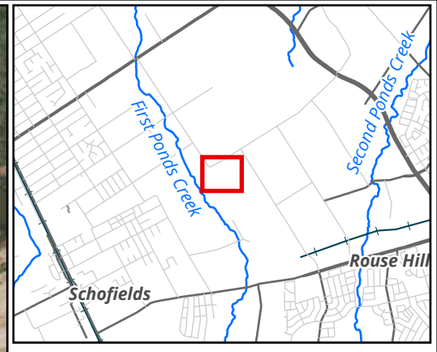
Specifically, the proposal involves the following:

- Three learning hubs (three-storeys in height) accommodating 49 general teaching spaces and three SLUs.
- Other core facilities including amenities, library, staff hub and administrative areas.
- Standalone school hall.
- Separate carpark with 72 spaces.
- Kiss and drop zone along Nirmal Street.
- Open play space including sports courts and sports field.
- Public domain works.
- A proposed future Aboriginal education shared learning hub (subject to future development consent as required).

The proposed site access arrangements are as follows:

- Main pedestrian entrance to be located off Nirmal Street.
- Kiss and drop zone proposed along Nirmal Street.
- Onsite parking access via Nirmal Street.

Figure 3 provides an extract of the proposed site plan.



Legend

Study area

Figure 3 Proposed activity

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

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Matter: 40105, Date: 18 December 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
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3 Desktop assessment

The desktop assessment involves researching and reviewing existing archaeological studies and reports relevant to the study area and surrounding region. This information is combined to develop an Aboriginal site prediction model for the study area, and to identify known Aboriginal sites and/or places recorded in the study area. This desktop assessment has been prepared in accordance with Requirements 1 to 4 of the Code.

3.1 Landscape context

It is important to consider the local environment of the study area any heritage assessment. The local environmental characteristics can influence human occupation and associated land use and consequently the distribution and character of cultural material. Environmental characteristics and geomorphological processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly, landscape features can contribute to the cultural significance that places can have for people.

3.1.1 Topography and hydrology

The study area is located within the Cumberland Plain, which is a broad and shallow basin that stretches westwards from Parramatta to the Hawkesbury-Nepean River and southwards from Windsor to Thirlmere (S. M. Bannerman & Hazelton 1990). The study area is contained within the Wianamatta Group geological formation, specifically the Ashfield Shale, Bringelly Shale, and Minchinbury Sandstone geological units.(Figure 4) (S. M. Bannerman & Hazelton 1990, p.2). The Bringelly Shale formation is primarily composed of shale, with occasional calcareous claystone, laminate, and coal (S. M. Bannerman & Hazelton 1990, p.28). Topographically the study area is situated within a ridge landform, surrounded by gently sloping landscapes (Figure 5).

Stream order is recognised as a factor which assists in the development of predictive modelling in Sydney Basin Aboriginal archaeology, and has seen extensive use in the Sydney region, most notably by Jo McDonald Cultura l Heritage Management (Jo McDonald Cultural Heritage Management 2000, Jo McDonald Cultural Heritage Management 2005, JMCHM 2005, Jo McDonald Cultural Heritage Management 2006, Jo McDonald Cultural Heritage Management 2008). Predictive models, which have been developed for the region, have a tendency to favour higher order streams as having a higher potential for campsites as these types of streams would have been more likely to provide a stable source of water and by extension, other resources which would have been used by Aboriginal groups.

The stream order system used for this assessment was originally developed by Strahler (1952). It functions by adding two streams of equal order at their confluence to form a higher order stream, as shown in Photo 1. As stream order increases, so does the likelihood that the stream would be a perennial source of water.

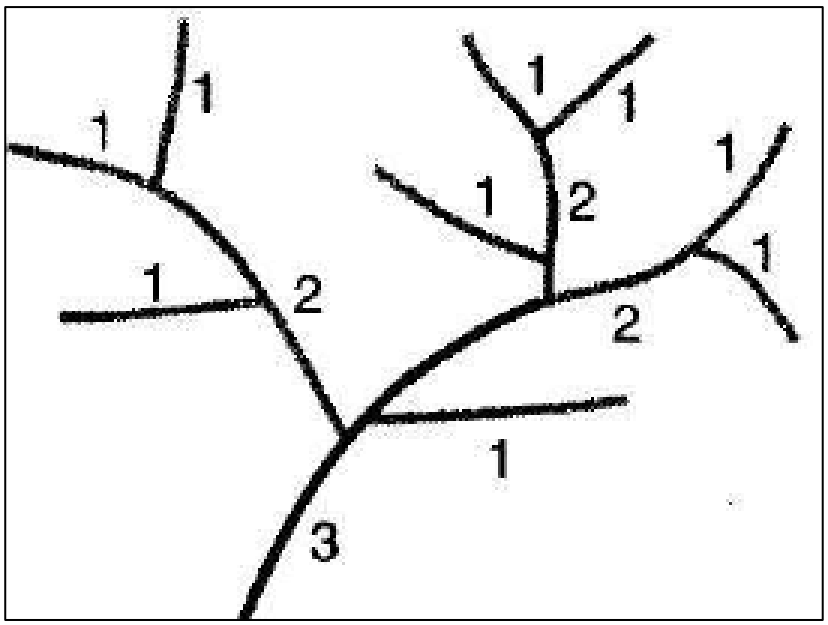


Photo 1 Diagram showing Strahler stream order (Ritter et al. 1995, p.151)

Several permanent fresh water sources are located within close proximity to the study area. A first order non perennial water source is located in the southern portion of the study area which flows easterly. This water course is a tributary of First Ponds Creek, a third order perennial water course located 240 metres to the west of the study area. Another first order non perennial water course is located 275 metres north of the study area, which also flows easterly from First Ponds Creek (Figure 5).

3.1.2 Soil landscapes

The study area is occupied by the Blacktown soil landscape (Figure 6). This landscape is a residual soil landscape and consists of gently undulating rises, broad rounded crests and gently inclined slopes with a gradient of less than 5%. Local relief within the Blacktown soil landscape is up to 30 metres and rocky outcropping is absent. Dominant soils consist of shallow to moderately deep (<100 centimetres) red and brown podzols on crests and in well drained topographies, and deep (150-300 centimetres) yellow podzolic soils and soloths on lower slopes and drainage lines (S.M. Bannerman & Hazelton 1990, p.28). The soil characteristics of this landscape are described in Table 2 and Photo 2.

Due to their age and slow accumulation, residual soil landscapes have reasonable potential to contain archaeological deposits in an open context, such as stone artefacts derived from occupation sites. Other occupational evidence might include scarred trees where remnant vegetation occurs. However, the slow accumulation and high impact of extensive land clearing (usually associated with pastoral and civic development) often results in poor preservation of archaeological material.

Subsurface artefacts in the Blacktown soil landscape are typically located in the A horizon topsoil. It is likely that any subsurface artefacts would be identified in the upper two stratigraphic profiles (*bt1* and *bt2*). The soils described in Table 2 align closely with profiles described in nearby excavations at the Rouse Hill Anglican College, on the northern side of Rouse Road, approximately 900 metres south-east of the study area (Stephanie Garling Archaeological Consulting (SGAC) 2000, p.45). The descriptions given by Stephanie Garling Archaeological Consulting (2000) suggest that the *bt1* profile had largely eroded away from the assessment area, and that the majority of the artefacts identified came from the *bt2* profile. Should these profiles remain intact within the study area, there is potential that artefact will be located within it.

Table 2 Blacktown soil landscape characteristics (S. M. Bannerman & Hazelton 1990, pp.29–30)

Soil material	Description
bt1—Friable brownish black loam	This is a friable brownish black loam to clay loam with moderately pedal subangular blocky (2 – 20 mm) structure and rough-faced porous ped fabric. This material occurs as topsoil (A horizon). Colour is brownish black (10YR 2/2) but can range from dark reddish brown (5YR 3/2) to dark yellowish brown (10YR 3/4). Rounded iron indurated fine gravel-sized shale fragments and charcoal fragments are sometimes present. Roots are common.
Bt2—Hardsetting brown clay loam	This is a brown clay loam to silty clay loam which is hardsetting on exposure or when completely dried out. It occurs as an A2 horizon. This material is water repellent when extremely dry. Colour is dark brown (7.5YR 4/3) but can range from dark reddish brown (2.5YR 3/3) to dark brown (10YR 3/3). Platy, iron indurated gravel-sized shale fragments are common. Charcoal fragments and roots are rarely present.
Bt3—Strongly pedal, mottled brown light clay	This is a brown light to medium clay with strongly pedal polyhedral or sub-angular to blocky structure and smooth-faced dense ped fabric. This material usually occurs as subsoil (B horizon). Colour is brown (7.5YR 4/6) but may range from reddish brown (2.5YR 4/6) to brown (10YR 4/6). Frequent red, yellow or grey mottles occur often becoming more numerous with depth. Fine to coarse gravel-sized shale fragments are common and often occur in stratified bands. Both roots and charcoal fragments are rare.
Bt4—Light grey plastic mottled clay	This is a plastic light grey silty clay to heavy clay with moderately pedal polyhedral to subangular blocky structure and smooth faced dense ped fabric. This material usually occurs as deep subsoil above shale bedrock (B3 or C horizon). Colour is usually light grey (10YR 7/1) or, less commonly, greyish yellow (2.5YR 6/2). Red, yellow or grey mottles are common. Strongly weathered ironstone concretions and rock fragments are common. Gravel-sized shale fragments and roots are occasionally present. Charcoal fragments are rare.

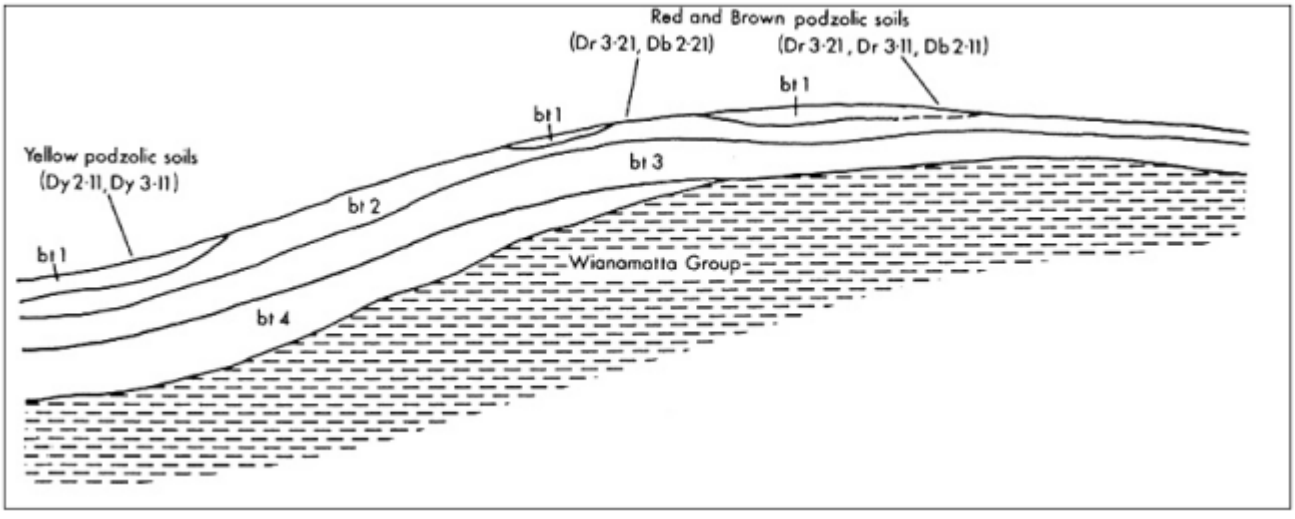


Photo 2 Schematic cross-section of Blacktown soil landscape illustrating the occurrence and relationship of the dominant soil materials (Source: S. M. Bannerman & Hazelton 1990, pp. 29–30).

3.1.3 Landscape resources

The original woodland and open-forest supported by the Blacktown soil landscape were dominated by Forest Red Gum *Eucalyptus tereticornis*, Narrow-leaved Iron·Bark *E. crebra*, Grey Box *E. moluccana* and Spotted Gum *E. rnaculala* with Woollybutt *r. longifolia* as understorey (S. M. Bannerman & Hazelton 1990, p.29).

Plant resources were used in a variety of ways. Fibres were twisted into string which was used for many purposes including the weaving of nets, baskets and fishing lines. String was also used for personal adornment. Bark from eucalypts was used in the provision of shelter; a large sheet of bark being propped against a stick to form a gunyah (Attenbrow 2002). Swamp oak bark could be used for the making of canoes, and smooth-barked apple for the making of baskets and bowls.

Common fauna in the area include Common Ringtail Possum *Pseudocheirus peregrinus*, Common Brushtail Possum *Trichosurus vulpecula*, Gould's Wattled Bat *Chalinolobus gouldii,* Southern Myotis *Myotis Macropus,* Australian Raven *Corvus coronoides,* Noisy Miner *Manorina (Myzantha) melanocephala,* Magpie-lark *Grallina cyanoleuca,* and Australian Magpie *Gymnorhina tibicen* (Atlas of Living Australia 2021).

As well as being important food sources, animal products were also used for tool making and fashioning a myriad of utilitarian and ceremonial items. For example, tail sinews are known to have been used to make fastening cord, while 'bone points', which would have functioned as awls or piercers, are often part of the archaeological record. Animals such as Brushtailed Possums were highly prized for their fur, with possum skin cloaks worn fastened over one shoulder and under the other (Attenbrow 2002).

Raw material sources in the vicinity of the study area include silcrete quarries at Riverstone and Plumpton Ridge, which are located approximately 5 kilometres to the west (Archaeological & Heritage Management Solutions 2015, p.18).

While the diverse natural environment would have provided vast and plentiful floral and faunal resources and the temperate climate would have made the area suitable for year-round occupation, the distance of the study area from permanent water sources would have detracted from its appeal as a long-term occupation site.

3.1.4 Land use history

The land within the study area was originally granted Richard Rouse, a public servant and settler of 450 acres on 8 October 1816. The land was utilised for grazing and agricultural purposes. Historical aerial imagery allows for modern developments and land use to be identified within the study area. An aerial dated to 1947 (Photo 3) displays the study area and the vicinity as relatively undisturbed, except for minor vegetation clearance. The study area remained undeveloped until the 1950s, which shows the development of roads in the vicinity of the study area. By the 1960s (Photo 4), a residential structure can be observed within the western portion of the study area, with a track leading from the structure towards the south. Minimal change is observed from the 1965 (Photo 4) to the 1970 (Photo 5) aerial. In 1986 (Photo 6), a residential property can be observed in the western portion of the study area with a driveway running south from the property. A track running east from the property can also be observed. From 1986 to 2005 (Photo 7), no changes can be observed within the study area. In the most recent aerial, the residential property is no longer within the western portion and the study area is vacant (Photo 8).

Photo 3 **Aerial imagery dated to 1947 with the study area outlined in orange (Source: NSW Spatial Services)**

Photo 4 **Aerial imagery dated to 1965 with the study area outlined in orange (Source: NSW Spatial Services)**

Photo 5 **Aerial imagery dated to 1970 with the study area outlined in orange (Source: NSW Spatial Services)**

Photo 6 **Aerial imagery dated to 1986 with the study area outlined in orange (Source: NSW Spatial Services)**

Photo 7 **Historical aerial dated to 2005 with the study area outlined in orange (Source: NSW Spatial Services)**

Photo 8 **Present day historical aerial with the study area outline in orange (Source: NSW Spatial Services)**

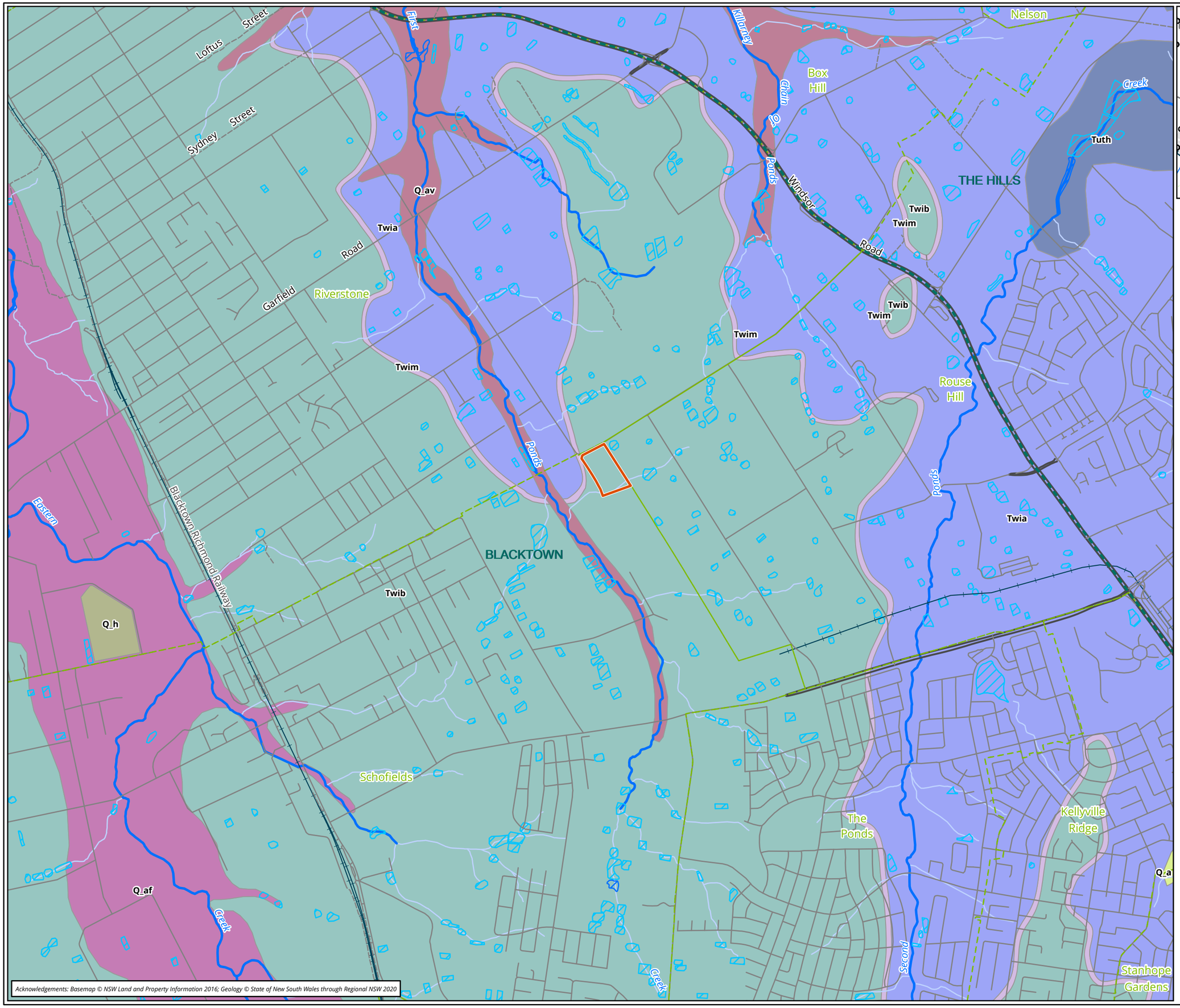


Figure 4 Geological units in the vicinity of the study area

Matter: 40105, Date: 15 October 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F4_Geology

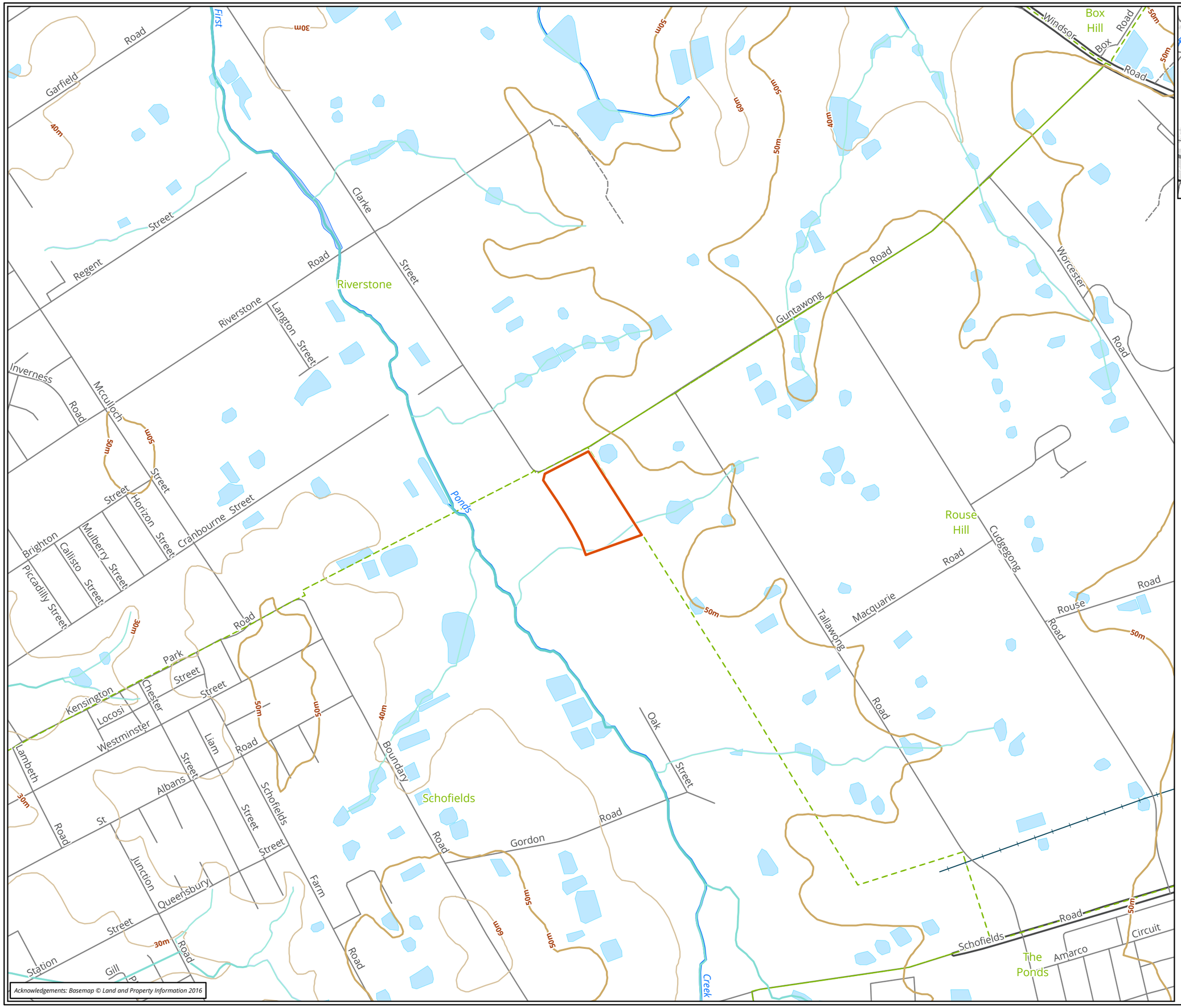
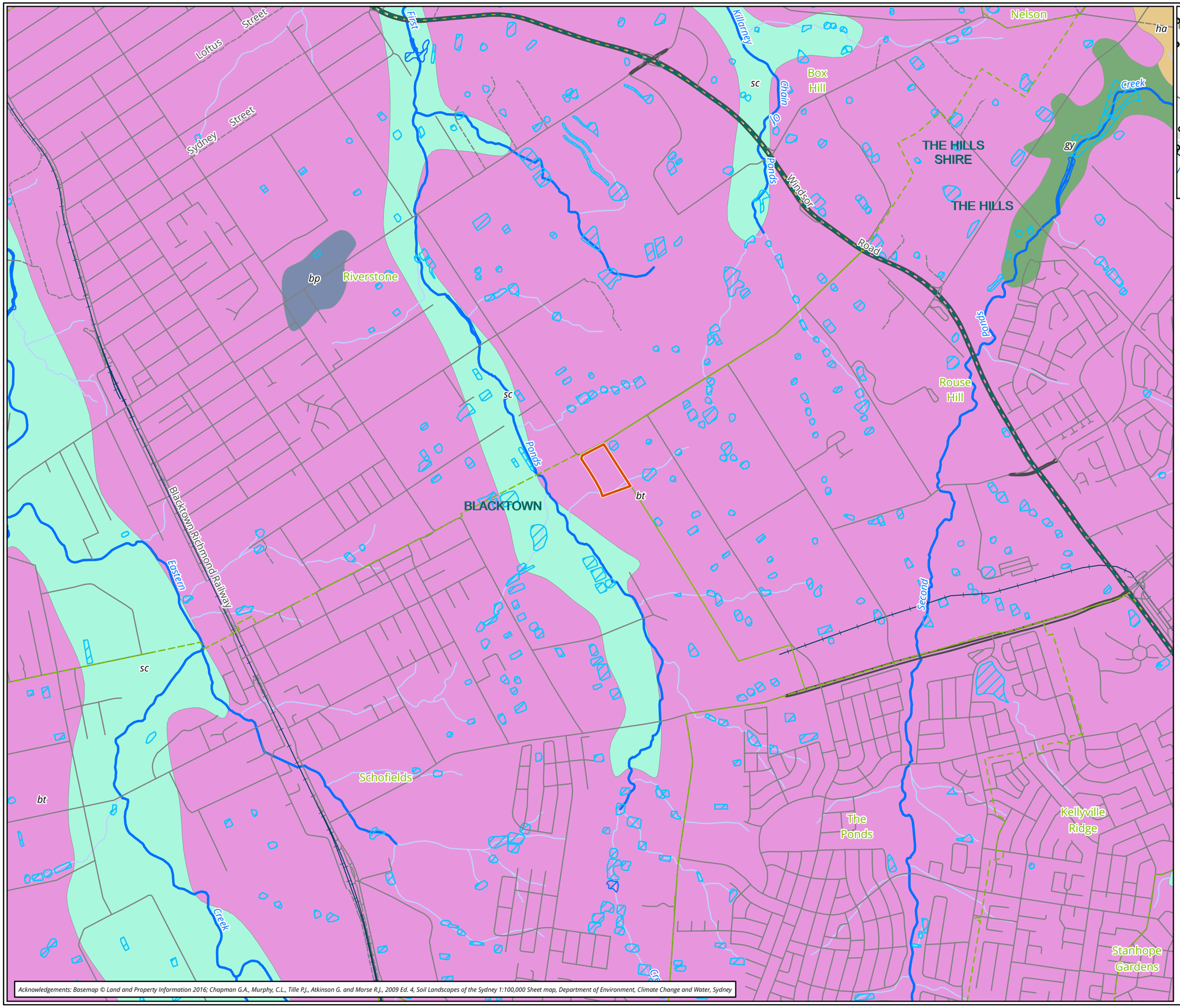


Figure 5 Hydrology and topography in the vicinity of the study area

Acknowledgements: Basemap © Land and Property Information 2016

Matter: 40105, Date: 15 October 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\,
40105_Tallawong_ACHA,
Layout: 40105_AR_F5_Hydrology



Legend

Study area

Soil landscape units

- bp - BERKSHIRE PARK
- bt - BLACKTOWN
- gy - GYMEA
- ha - HAWKESBURY
- sc - SOUTH CREEK

Figure 6 Soil landscapes in the vicinity of the study area

0 200 400 600 800 1,000

Metres

Scale: 1:20,000 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis APEM Group

Matter: 40105, Date: 15 October 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F6_Soils

3.2 Previous archaeological work

A large number of cultural heritage surface (surveys) and sub-surface (excavations) investigations have been conducted throughout the region of NSW in the past 40 years. There has been an increasing focus on cultural heritage assessments in NSW due to ever increasing development, along with the legislative requirements for this work and greater cultural awareness of Aboriginal cultural heritage.

3.2.1 Regional overview

Dominic Steele Consulting Archaeology (2003) undertook test excavations at Wallgrove Road, Eastern Creek; approximately 13.5 kilometres south of the current study area. The predictive modelling employed by Steele is of relevance to the Cumberland Plain generally and draws on assessments made by JMCHM and AMBS in the Rouse Hill Area. The assessment built on a number of previous surveys conducted between 1980 and 2002 within the assessment area. Steele noted a JMCHM study from 1997, which had stated that surface artefacts were not an effective way to characterise archaeological sites, and that at the time of writing:

- 17 out of the 61 excavated sites on the Cumberland Plain had no artefacts present on the surface prior to excavation. However, most areas with sparse or no surface manifestations contained considerable archaeological deposits.
- The ratio of recorded surface to excavated artefacts is 1:25 across the Plain.
- None of the excavated sites could be properly characterised on the basis of their surface artefacts alone.
- Open campsites are located in all landscapes on the Cumberland Plain. The predominance of sites recorded along creek banks is likely to be indicative of surface visibility conditions and taphonomic factors, rather than the human distribution of artefacts across the landscape (DSCA 2003, pp.19–20).

This statement notes a number of issues with predictive models that base their assessment of subsurface potential based entirely on the presence or absence of surface artefacts. There may be a correlation between artefact density and site function.

A total of 20, 1 metre squared pits were excavated using a backhoe, and sieved through nested 5 and 2.5 millimetre sieves. The deposit encountered tended to be relatively shallow, with most pits not exceeding 20 centimetres. A total of 38 artefacts were identified by surface survey and excavation, with a density characterised by Steele as extremely low, and the area was interpreted as being visited sporadically, and not the site of any sort of knapping or camping, but rather a general background scatter.

The deposit consisted primarily of silcrete, with quartz, tuff, and volcanic rock present in much lesser quantity. The vast majority of the deposit was identified as manuport, with some flake and core fragments present, and one potential broken axe.

Biosis (2010) conducted test excavations approximately 16 kilometres south-west of the current study area in advance of the construction of a link road between Erskine Park Road and Old Wallgrove Road, Erskine Park. A total of 113, 1 square metre pits were excavated across four sites. Two of these sites were the locations of surface finds, while the other two were identified potential archaeological deposits (PADs).

- AHIMS 45-5-3843/RCIF 1 was originally recorded as an isolated artefact site, as one silcrete artefact was found on the edge of a dam during field survey. During test excavations, 16 pits were excavated in a U shape around the dam, recovering eight artefacts from four of the pits. It was noted that the land had undergone some disturbance as a result of past land use activities.

- AHIMS 45-5-3842/EPLR 1 was originally recorded as a low density artefact scatter consisting of two silcrete artefacts located on the northern and southern bank of a shallow tributary creek line. A total of 19 pits were excavated at this site, recovering three artefacts across two pits. Again, the land had seen disturbance from ploughing, stock movement, vehicle movement and fence construction.
- AHIMS 45-5-3062/EP Potential Archaeological Deposit (PAD) 1 east was the portion of AHIMS 45-5-3062/EP PAD 1 located on the east side of Ropes Creek. Sub-surface testing was carried out on the floodplain and a slight rise overlooking the floodplain. 27 test pits were excavated in this area, and a total of 52 artefacts were recovered from 10 pits. As with the other excavation units, it had seen disturbance from past land use activities such as grazing and vehicle movement.
- AHIMS 45-5-3062/EP PAD 1 west was the portion of AHIMS 45-5-3062/EP PAD 1 located on the west side of Ropes Creek, on the banks and floodplain of the creek. 51 test pits were excavated, with a total of 289 artefacts were found in 29 pits, almost all within the top 20 centimetres. Two pits contained artefacts between 20 and 30 centimetres.

A total of 352 artefacts were recovered during excavations, with the majority being comprised of silcrete, along with a number of quartz artefacts. It was noted during excavation that sources of silcrete are naturally occurring within 3 kilometres of the assessment area.

3.2.2 Local overview

A number of Aboriginal cultural heritage investigations have been conducted within the region (within approximately 10 kilometres of the study area). Most of these investigations were undertaken as part of development applications and included surface and sub-surface investigations. These investigations are summarised below.

McDonald (1986) undertook a preliminary archaeological assessment of the proposed Regional Waste Disposal Depot at Schofields, located approximately 4.6 kilometres west of the study area. The assessment area was located nearby Plumpton ridge, which previous studies have identified to be used as a silcrete source for stone tool manufacture. Five, 50 by 50 centimetre test pits were excavated on ridges and gullies located within the assessment area. It was identified that surface scatters of artefacts were located across the entire area, concentrated towards the ridge top, reducing density with distance from the ridge. Disturbance from ploughing was also identified. Raw material types included predominantly silcrete with some quartz, mudstone, volcanic and petrified wood in the form of blade cores, backed artefacts, flakes and grinding stones. Further investigation was recommended.

Australian Museum Business Service (AMBS 2000) undertook salvage excavations at Mungerie Park located approximately 3.4 kilometre south-east of the study area. These excavations followed a previous 1998 survey that located numerous sites, including: rock shelters, grinding grooves and rock art sites. Two new sites were also identified during the survey: a group of grinding grooves and artefact scatter. Excavations undertaken in 2000 totalled of 211 square metres in a mixture of transects, patterned test pit areas, and open excavations. From this sample, a total of 5,504 artefacts were recovered, giving an average artefact density of 26.1 artefacts per metre squared.

The results of this excavation led to the characterisation of three zones of complexity. These are areas where activities took place which are located in relation to environmental focal points, in this case, grinding groove sites and Caddies Creek (Australian Museum Business Service 2000):

- A “complex zone”, where overlapping knapping floors and high density concentrations are present due to the repeated occupation and use of the area with closest access to resources and facilities.

- A "dispersed zone", where knapping floors and/or activity areas are spatially discrete due to less frequent occupation of those areas, or the positioning of activities requiring a measure of separation from a main camp.

A "sparse zone" comprising a consistently low density distribution of artefacts likely to have resulted from discard in the context of use (or loss) rather than manufacture.

Stephanie Garling Archaeological Consulting (SGAC 2000) completed test excavations in two areas of potential (AHIMS 45-5-2573/RHAC2 and AHIMS 45-5-2574/RHAC3) located approximately 1 kilometre south-east of the study area. Testing was completed in advance of the construction of the Rouse Hill Anglican College. The program of testing was completed following an archaeological survey which identified one stone artefact and two PADs. These areas were assessed as having moderate to high potential based on:

- Close proximity to food and water sources in the form of Second Ponds Creek.
- Gentle hillslopes in the area, which formed a potentially suitable camping location.
- The presence of previously excavated sites in the vicinity, which had contained significant deposits.
- Predictive modelling, which suggested that higher densities of artefactual material may be present within the study area.
- A lack of disturbance identified within the study area.
- The presence of the study area on Shale Lowlands, which had previously been assessed as a threatened landscape on the Cumberland Plain in terms of disturbance.

Stephanie Garling Archaeological Consulting also brought together background research from various sources relating to sources of raw artefact material in relation to the assessment area Table 3. Test excavations at both sites identified subsurface deposits, with the results summarised in Table 4.

Table 3 Distance to known sources of raw material for artefacts from SGAC assessment area

Nearest sources of surface stone	Silcrete	Silicified tuff	Petrified wood	Quartz	Quartzite	Igneous
Hawkesbury sandstone	-	-	-	12	-	-
Scheyville	10	10	-	-	10	-
South Windsor	-	11	-	-	11	-
Nepean River Agnes Banks	-	21	-	21	21	21
Riverstone	3	-	4	4	-	-
Echo vale	8	8	8	-	8	8
Sirius Place	-	12	-	12	12	-
Marsden Park	6.5	-	6.5	-	6.5	-
Plumpton Ridge	6	-	6	-	-	-
Bells Creek 2	8	-	-	-	-	-
ADI Dunheved (St Marys)	13	13	13	-	13	-
Plumpton Park	9.5	-	-	-	-	-
Blacktown 1	9	-	-	-	-	-

Table 4 Results of the subsurface test excavations

Site	Extent of excavations	Number of artefacts recovered	Density (artefact/metres squared)
AHIMS 45-5-2573/RHAC2	32 metres squared Six 1 x 1 metre test pits Two open areas	942	29.44
AHIMS 45-5-2574/RHAC3	15 metres squared Fifteen 1 x 1metre test pits	7	0.47

Within AHIMS 45-5-2573/RHAC2, localised knapping floors were identified, with the largest containing 812 artefacts. Excavations in this area identified a relatively intact knapping floor with a central area of high density and a lower density peripheral area. It was noted that a high number of backed artefacts (47) were identified in the assemblage, and that the primary raw material was silcrete. The site was assessed as having moderate significance, as while a large number of artefacts were recovered, it was considered that the deposit was relatively unstratified, and as such as unable to provide a chronology for Aboriginal occupation in the area (Stephanie Garling Archaeological Consulting (SGAC) 2000, p.80).

The low density of artefacts identified at AHIMS 45-5-2574/RHAC3 led to it being classed as 'background scatter' with it being considered unlikely that camping or knapping took place at this site. It was suggested that local Aboriginal groups may have favoured the lower hillslope closer to Second Ponds Creek. This site was classed as having low potential.

Jo McDonald Cultural Heritage Management Pty Ltd (2002) undertook an assessment of Areas 2, 5, 20, 22, and 24b of the Rouse Hill Infrastructure Project in the Second Ponds Creek Area, which contains the study area. This survey incorporated the current study area, which forms a part of Area 20. The initial sections of the assessment identified the majority of Area 20 as being in a zone of 'lesser' disturbance (JMCHM 2002, p.14). The regional predictive modelling used for this study was based on work undertaken throughout the 1990s and early 2000s in the Cumberland Plain, predominantly throughout the Rouse Hill area. It was stated that:

"It is predicted that the size (density and complexity) of archaeological features will vary according to the permanence of water (i.e. ascending stream order), landscape unit and proximity to lithic resources in the following way:

- *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) will be archaeological evidence for sparse but 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 reused), and evidence of more concentrated activities.*
- *On major creek lines, such as the lower reaches of Second Ponds (third order) and Caddies Creeks (fourth order), there will be archaeological evidence for more permanent or repeated occupation. Sites will be complex 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.*
- *Ridgetop locations between drainage lines will usually contain limited archaeological evidence, although isolated knapping floors or other forms of one-off occupation may be in evidence in such a location.*

- *Naturally outcropping silcrete will have been exploited and evidence for extraction activities (decortication, testing and limited knapping) would be found in such locations.*
- *Sites in close proximity to an identified stone source would cover a range of size and cortex characteristics. As one moves away from the resource, the general size of artefacts in the assemblage should decrease, as should the percentage of cortex. The increasing number of new (in particular) silcrete sources has made the testing of the distance decay model (Dallas & Witter 1983) more difficult, and suggests that this model is a poor mechanism for explaining raw material preferences around the Plain."* (JMCHM 2002, pp.15–16).

This predictive model, and variations upon it, has formed the base standard for predictive modelling in the Cumberland Plain region for the past decade, with a large number of reports drawing on it to develop their own predictions of sites that will be present in a given area. Stream order is given preference as an indicator of permanent, reliable water courses, which in the Cumberland Plain occurs at the confluence of two second or third order creeks (JMCHM 2002, p.12).

The local predictive model stated that surface artefacts (predominantly silcrete) were likely to occur in open locations on shale bedrock but were unlikely to be present in large numbers unless in a disturbed context. Areas of PAD should be marked based on low disturbance caused by previous land use. Shelter sites would not be found, but open grinding grooves may be found in sandstone or shale/sandstone transition areas. There was some potential for scarred trees to occur in areas of original vegetation.

The survey identified four new sites within the assessment area, as well as 18 previously recorded sites and nine PADs (which were not recorded as sites win the AHIMS register). Of these sites, four were isolated finds, seven were open camp sites, 10 were open camp sites with PADs, and one was an open camp site with grinding groove. The majority of these sites were located in the Ashfield Shale, or Quaternary Alluvium geological formations. The majority of artefacts identified by survey were made of silcrete.

One site (RH/SP17) was identified adjacent to the study area by this survey, designated as an open site with PAD. The site consisted of six silcrete artefacts and one 'other' artefact associated with vehicle track exposure to the south of the corner of Rouse Road and Terry Road. The area of PAD was defined by road and property boundaries in the area. The site was assessed as having mixed but good potential (JMCHM 2002, p.67). Recommendations for sites of this level of potential in areas threatened by development included test excavation to establish their actual level of significance. This site was further investigated by KNC (2010).

AECOM (2010) undertook an Aboriginal heritage assessment for the Alex Avenue and Riverstone Growth Centre Precincts for ENSR Australia Pty Ltd. The study involved the assessment of two proposed growth precincts identified as Riverstone and Alex Avenue. During the field investigation 37 Aboriginal sites were identified adjacent to First Ponds Creek and upon the large ridgeline which transects through the centre of the two assessment areas. The assessment identified six sites with high archaeological significance, four sites with moderate archaeological significance and 27 sites of low archaeological significance. Two sites were identified of high cultural significance.

The investigation identified the AHIMS 45-5-4311/A7 Archaeological Complex which is located to the west of the current study area. The site consists of an artefact scatter and archaeological deposit located on lower slopes and flats adjacent to First Ponds Creek. The site is approximately 300 metres by 150 metres and consists of several artefact scatters including, RV27, RV28 and A6. The assessment also identified the A8 Archaeological Complex which is a continuation of AHIMS 45-5-4311/ A7 Archaeological Complex which was disrupted due to market gardening activities.

Kelleher Nightingale Consulting (KNC) (2010) undertook an Aboriginal heritage assessment of the Area 20 precinct of the North West growth centre for the NSW Department of Planning. The study involved broad

assessment and survey of the area to inform precinct planning, zoning, and layout. Based on the results of previous assessments in the vicinity, KNC developed a predictive model which stated the following (p.18):

- Stone artefacts are likely to occur across the entire assessment area.
- The highest artefact numbers and densities will be associated with the margins of Second Ponds Creek.
- Artefact densities are likely to be quite low on the higher upper slope and crest landforms within Area 20. Although artefacts may not be observed on the surface during field survey, they are likely to be present in a subsurface context.
- The subsurface archaeological context across Area 20 would not necessarily have been heavily disturbed by ploughing and/or vegetation clearance.

This model was based on the findings of (AMBS 2000), (JMCHM 2002), and a number of other surface and subsurface investigations that have taken place in the vicinity of Area 20. It noted that the results of multiple excavations had indicated that low artefact densities were consistently recorded on upper slopes and crests in the area (Kelleher Nightingale Consulting 2010, p.17). It was also noted by KNC that previous predictive models had placed a large emphasis on the idea that more complex sites would be identified in close proximity to streams. However, the works undertaken by Therin (2004), demonstrated that artefacts occurred in a range of landforms. Both assessments agreed that the highest artefact densities were located in the margins of Second Ponds Creek.

During the survey to test the modelling, it was identified that the majority of sites were located on lower and mid slopes, with some being present on upper slopes and crests as well as one on a creek flat. A total of 19 artefact sites and seven PADs were identified during the survey.

The results of the survey largely confirm the predictive statements made in the predictive model. Stone artefacts formed the majority of identified sites, and were located across a variety of landforms, as well as being well distributed throughout the assessment area. The majority of sites were located away from upper slopes and crests, and those that were located on these landforms were low density scatters and isolated finds (although it is noted that all scatters were of low density). The sites with the largest artefact counts were located within 150 metres of Second Ponds Creek. As the assessment did not involve subsurface investigations, it is not possible to judge the accuracy of that portion of the predictive model.

White & McDonald (2010) undertook a review of previous work in the Rouse Hill development area, including the study area, discussing lithic artefact distribution from previous excavations. The study considered a number of factors including stream order, distance from water, landform, aspect, and distance to silcrete sources. As a result of the assessment, the following statements were made:

- Stream Order: water supply was a significant factor influencing Aboriginal land use and habitation in the area. There was a correlation between increasing stream order and larger numbers and higher densities of artefacts (from a comparison of first, second, and fourth order streams).
- Distance from water: the results showed that an assumption that sites would be clustered within 50 metres of water sources was not entirely correct from the data available. In first order stream landscapes, there was no significant correlation between artefact distribution and distance to water. In second order landscapes, artefact density was highest within 50 metres of water, and then declined with increasing distance. In fourth order landscapes, density was highest between 51-100 metres from water.

- Landform: Artefact density was considered to be lowest on upper slopes and ridgetops, with density increasing on mid and lower slopes. Density was highest in terrace landforms, and lower on creek flats, likely due to repeated flooding events and the erosion the caused.
- Distance to silcrete sources: the results of the study showed no significant difference between sites located closer to or further away from silcrete sources. However, 6 kilometres was the maximum tested distance from silcrete sources, so the sample is only representative of a limited area.
- Aspect: this only appeared to have an influence on sites in the lower parts of valleys, which may have been sited to take advantage of steady factors such as the rising/setting sun and wind direction. Sites in higher parts of valleys may have been influenced by weather and other factors.

GML and JMHCM (2012) completed an Aboriginal heritage assessment as part of the north-west rail link for the NSW Government, now known as the Sydney Metro. The railway sought to connect Epping and Rouse Hill with a stabling yard constructed at Tallawong. The route of the railway is 1.5 kilometres metres south of the study area.

The railway was first surveyed by JMCHM in 2006, this survey identified 14 sites and PADs. This assessment found the Rouse Hill area had a higher potential for artefact scatters and PAD (GML Heritage & Jo McDonald Cultural Heritage Management 2012, p.15). Further survey undertaken by GML focused on 17 construction areas along the NWRL route. Broadly, large artefact densities and PADs were identified in areas that weren't disturbed (GML Heritage & Jo McDonald Cultural Heritage Management 2012). However, most of these sites were found to be heavily disturbed based on modern developments. On average, ground visibility was 30% guided by exposures under trees and on pedestrian walkways. Few areas of moderate potential were identified where dense vegetated areas weren't found to be disturbed. In total, seven sites were identified.

Table 5 Sites identified during the NWRL survey (GML Heritage & Jo McDonald Cultural Heritage Management 2012, p.66)

Site	Site description	Distance to study area
14 Cumbelege Lane	Artefact scatter and PAD associated with driveway bank. 18 stone artefacts are located on the surface made of silcrete, quartz and chert.	4.9 km south-east
Corner Taggert Way and Balmoral Road	Isolated silcrete core in a disturbed area.	3.7 km south-east
87 Schofields Road	Five silcrete artefacts in disturbed context.	100 metres west
69 Schofields Road	Two silcrete artefact and one chert flake	800 metres west
65 Schofields Road	One silcrete core and one silcrete flaked piece on vehicle track	850 metres west
59 Schofields Road	Six artefacts comprised of silcrete, chert, mudstone located within a market garden on a rise landform overlooking Second Pounds Creek.	1.3 km west
28 Tallawong Road	One silcrete flake located in a market garden.	900 metres north-west

Artefact Heritage (Artefact Heritage 2013) undertook an Aboriginal heritage assessment of the Tallawong Stabling Yard as part of the NWRL project located approximately 1.2 kilometres west of the study area. Prior to assessment, a predictive model was established for the assessment area. Artefact Heritage suggested that open stone artefact types were most likely. These surface deposits would also be representative of sub-surface potential. Likewise, models for the Cumberland Plain suggest lower artefact densities on upper slopes

and crests. Higher densities exist on terrace landforms (Artefact Heritage 2013, p.23,24). The assessment consisted of transect survey of half of the assessment area as the northern portion was inaccessible. No previously unidentified Aboriginal sites were located during the survey. Attempts were made to relocate three AHIMS sites during the survey:

- Recorded by GML (2012) and was reported to contain an artefact scatter. Significant grass cover and furrowing within the site's reported location was found. The artefacts associated with this site could not be relocated.
- AHIMS 45-5-4766/65 Schofields Road: Reported to contain an isolated artefact adjacent to a dirt service road. The area was significantly disturbed by grass coverage and no artefacts were identified.
- AHIMS 45-5-4112/69 Schofields Road: Recorded by GML in 2011 (in Artefact Heritage 2013, p.30). No archaeological material was relocated. Previous test pits were identified. The area was also demonstrated to be disturbed.

The high levels of disturbance identified during the survey and within the previously recorded sites led to an assessment of low archaeological potential.

KNC (2013) provided an Aboriginal heritage salvage methodology of the west zone of the NWRL project, located 600 metres north-east of the study area at its nearest point. KNC undertook salvage excavations at sites previously identified by GML (2012). These sites consisted of a mixture of artefact scatters and disturbed landforms that were thought to contain archaeological potential. The location information within the methodology is heavily redacted so their accurate location could not be determined in relation to the assessment area. However, many were located in the vicinity of Schofields Road, adjacent to the NWRL route and assessment area.

Biosis Pty Ltd (2016) conducted test excavations along Rouse Road, 980 metres south of the study area. A 2015 survey identified that previously identified Aboriginal sites would be impacted by the proposed road development and confirmed that AHIMS 45–5–3108/PAD RH/SP had high archaeological potential. Test excavations were conducted within areas of high and moderate archaeological potential. A total of 66 test pits were excavated and a total of 188 artefacts were recovered. The test excavations resulted in the identification of three new Aboriginal sites, AHIMS 45-5-473/9RR-AD1, AHIMS 45-5-4740/RR-AD2 and AHIMS 45-5-4738/ RR-AD3 and redefined the extent of Aboriginal sites 45-5-3108/RH/SP 17 and AHIMS 45-5-3926/ RH/A20P 11.

Comber (2016) conducted an Aboriginal Due Diligence Assessment (ADDA) at 132 Tallawong Road, Rouse Hill, located approximately 600 metres south-west of the study area. Background research identified the site to have archaeological potential due to its location between two second order creeks and 3 kilometres from a third order creek. Expected site types were predicted to be artefact scatters and isolated finds. The survey of the site did not locate any Aboriginal objects due to poor visibility. Further investigation of the site through test excavations were recommended.

Biosis (2019) conducted an ADDA at 22 Worcester Road, Rouse Hill, and located approximately 1 kilometre south-east of the study area. Background research and predictive modelling identified a high potential for artefact scatters and PAD. The field investigation was restricted by poor GSV, and no sites were identified. However, due to the proximity of the assessment area to Second Ponds Creek and the identification of moderate and high levels of archaeological potential, further assessment was recommended.

KNC (2019) completed an Aboriginal heritage impact assessment at Bella Vista, approximately 5 kilometres south-east of the study area. Predictive modelling demonstrated a higher archaeological potential on landforms in proximity to creek lines while areas of low and moderate potential were identified on ridge, crest and slope landforms. The assessment identified the area to have some archaeological potential because of its location adjacent to Elizabeth McArthur Creek. Low density artefact scatters and PAD were identified in the

background research. Subsequent test excavations, adjacent to but outside of their assessment area, found that archaeological sites were located on elevated landforms adjacent to Elizabeth McArthur Creek. These sites contained flakes, tools and cores, the majority of which were made of silcrete. Several radio-carbon dates taken from charcoal samples returned dates between 4,385 years and 570 years.

Biosis (2020) undertook an ADDA at Schofields, located approximately 3 kilometres south-west of the study area. Background research identified one AHIMS site to be located within the assessment area and previous archaeological assessments deemed the area of low potential. A survey of the assessment area could not relocate the AHIMS site and no previously unrecorded sites were identified, confirming the results of previous assessments. No further assessment was recommended.

Extent (2020) undertook an ADDA for 201 Guntawong Road as part of initial development planning for the study area. This assessment undertook background research and a field survey. Extent noted that the eastern portion of 201 Guntawong Road, which the current study area is located, contained areas of disturbance located across slopes and hill crests. Extent determined that these areas of disturbance were unlikely to contain intact soil profiles and the likelihood of archaeological sites was low. Areas adjacent to First Ponds Creek associated with the *Nangamay Ngurra* Aboriginal Place nominationto the west of the current study area displayed lower evidence of disturbance and were assessed with high potential to contain intact archaeological deposits. Areas of moderate potential were also identified around the tributaries feeding into First Ponds Creek, with Extent noting that areas within 200 metres of these water courses, and which displayed low-moderate levels of disturbance, had potential to contain sub-surface deposits. Additional investigation in the form of an ACHA was recommended.

KNC (2024) undertook an ACHA for 201 Guntawong Road for Landcom as part of an application for civil and infrastructure subdivision works following on from Extent (2020). Their assessment included the current study area in its entirety. KNC identified five previously recorded Aboriginal sites within their assessment area none of which occur within the current study area. They undertook test excavations in areas of moderate potential identified by Extent (2020) as being within 200 metres of water course with low evidence of minimal disturbances present.

The results of KNC's excavations supported the predictions of Extent (2020). An additional three Aboriginal sites, AHIMS 45-5-5765/ Guntawong Road 1, AHIMS 45-5-5766/Guntawong Road 2, and AHIMS 45-5-5821/Guntawong Road 4 in proximity to the tributaries of First Ponds Creek were identified. AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4 are both within the current study area. AHIMS 45-5-5766/Guntawong Road 2 was located across a lower slope landform adjacent to a tributary of First Ponds Creek. The site was found to contain 15 artefacts across six test pits resulting in a density of 10 artefacts per square metre. AHIMS 45-5-5821/Guntawong Road 4 was located on mid slopes running adjacent to Guntawong Road. Two artefacts were identified across five test pits giving a density of 1.6 artefacts per square metre. The remainder of the current study area displayed evidence of historical disturbances and was of low potential. KNC recommended that an AHIP be sought for impacts to AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4, with salvage of a sample of AHIMS 45-5-5766/Guntawong Road 2 proposed due to the higher density of artefacts detected.

3.2.3 AHIMS site analysis

A search of the AHIMS database (Client Service ID: 934369) identified 83 Aboriginal archaeological sites within a 1.25 x 1.25 kilometre search area, centred on the study area (Figure 7). Two of these registered sites are located within the study area. AHIMS search results are provided in Appendix 1. The mapping coordinates recorded for these sites were checked for consistency with their descriptions and location on maps from

Aboriginal heritage reports where available. These descriptions and maps were relied upon where there were notable discrepancies.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic, archaeological survey; hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area. Some recorded sites consist of more than one element, for example artefacts and a modified tree, however for the purposes of this breakdown and the predictive modelling, all individual site types will be studied and compared. This explains why there are **93** results presented here, compared to the **83** sites identified in AHIMS. It should be noted, within the 83 sites identified in the AHIMS search, four were identified as "Not a Site", this has been taken into consideration within the table below.

Table 6 AHIMS site type frequency

Site type	Number of occurrences	Frequency (%)
Artefact	76	81.72
PAD	11	11.82
Not a site	4	4.32
Modified tree	1	1.07
Ochre quarry	1	1.07
Total	**93**	**100**

3.2.4 Aboriginal sites within the study area

The desktop assessment has identified two Aboriginal sites located within the study area. A description of the sites is provided below.

AHIMS 45-5-5766/Guntawong Road 2

AHIMS 45-5-5766/Guntawong Road 2 is a low to moderate density subsurface artefact scatter which was recorded by KNC in 2024. The site is located across the lower slope of a spur running west from the ridgeline between Second Ponds and First Ponds Creek. A total of 15 artefacts were recovered from 1.5 metres squared , which is a mean artefact density of 10 artefacts per square metre.. The artefact assemblage consists of flake and flake fragments made of silcrete and IMT with two cores and one back blade fragment.

Photo 9 Silcrete artefacts from AHIMS 45-5-5766/Guntawong Road 2 (Source: Kelleher Nightingale Consulting 2024)

AHIMS 45-5-5821/Guntawong Road 4

AHIMS 45-5-5821/Guntawong Road 4 is a low-density subsurface artefact scatter which was previously recorded by KNC in 2024. The site consists of two silcrete flakes and is located within the mid slope of a spurline running along Guntawong Road. The site is approximately 190 metres each of the first order drainage tributary and 350 metres east of First Ponds Creek.

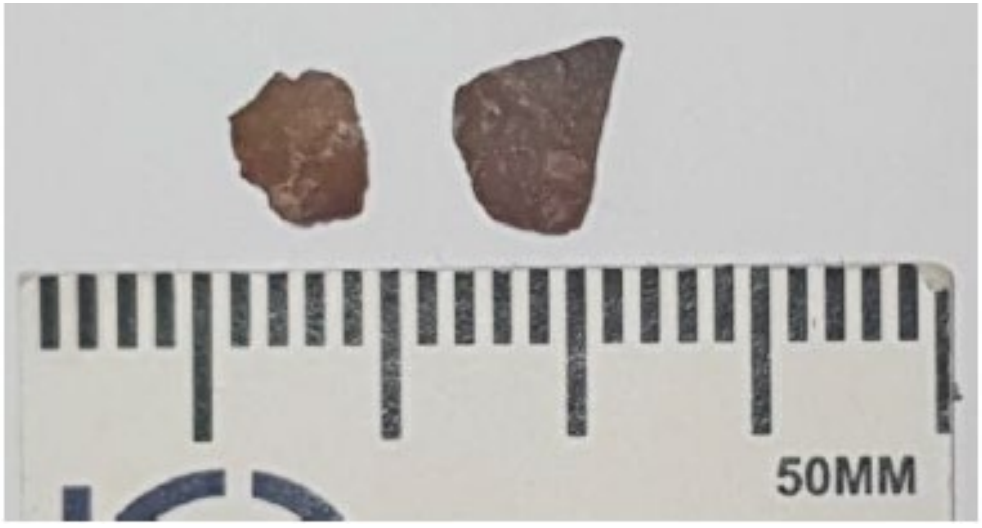


Photo 10 Silcrete flakes from AHMS 45-5-5821/Guntawong Road 4 (Source: Kelleher Nightingale Consulting 2024)

Nangamay Ngurra Aboriginal Place nomination

The study area is part of a wider Aboriginal Place nomination known as Nangamay Ngurra. The nominated Aboriginal place consists of the following lots:

- Lot 9 Section Q DP712
- Lot 1-3, 22-26 DP 1447
- Lot 33 DP 39341
- Lot 4, 5, 43, 44, 46, 47 DP 1239068
- Lot 20-21 DP 1246798
- Lots 4 (part), 5, 6 (part), 8 DP 1252397
- Lot 1 DP 1283186
- Cranbourne Street (part)
- Keogh Street (part)
- Orticelli Street (part)
- Skinner Street (part)

Photo 11 *Nangamay Ngurra* Aboriginal Place nomination with current study area outlined in red (Kelleher Nightingale Consulting 2024)

Nangamay Ngurra includes a ceremonial and men's site, and a burial place. *Nangamay Ngurra* has high cultural significance, the area would have been utilised by all clans of Dharug whom would travel to meet within this area. *Nangamay Ngurra* includes a complex of archaeological sites which provide tangible evidence of the Dharug occupation within the study area and vicinity. The known archaeological sites within the *Nangamay Ngurra* Aboriginal Place nomination include:

- AHIMS 45-5-4311/A7 Archaeological Complex. This includes sites A6, A8, RV27 AND RV26. The sites include surface scatters, isolated finds, sub-surface archaeological deposits and possible culturally modified trees within the vicinity of the study area.

- AHIMS 45-5-4955/First Ponds 1
- AHIMS 45-5-5418/Guntawong IF1
- AHIMS 45-5-5419/Guntawong AS2
- AHIMS 45-5-5420/Clarke Guntawong AS1
- AHIMS 45-5-5421/Clarke AS1
- AHIMS 45-5-5422/Clarke AS2
- AHIMS 45-5-5425/Guntawong AS1
- AHIMS 45-5-5765/Guntawong Road 1
- AHIMS 45-5-5766/Guntawong Road 2
- AHIMS 45-5-5821/Guntawong Road 4
- AHIMS 45-5-5018/ CS-AD-01

Archaeological sites associated with the nominated Aboriginal Place which overlap with the proposed activity area are AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4.

NOT TO BE MADE PUBLIC

Figure 7.1 Aboriginal sites within the vicinity of the study area

0 100 200 300 400 500

Metres

Scale: 1:13,000 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 18 December 2024,
Prepared for: BB, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F7.1_AHIMS

NOT TO BE MADE PUBLIC

Figure 7.2 AHIMS within the vicinity of the study area

0 20 40 60 80 100

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 07 January 2025,
Prepared for: MC, Prepared by: AA, Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F7.2_AHIMS

3.3 Discussion

The study area is located with a flat and slope landform underlaid by Bringelly Shale formation. The deep residual soil of the Blacktown soil landscape covers the extent of the study area. A first order non perennial water source is located in the southern portion of the study area which flows easterly. This water course is a tributary of First Ponds Creek, a third order perennial water course located 240 metres to the west of the study area. These landforms and proximity to water sources would have provided an abundance of natural food and material resources which would have been utilised by Aboriginal people within the local region. The study area is included within a high culturally significant nominated Aboriginal Place *Nanagamay Ngurra* which consists of multiple archaeological sites. This area would have been a meeting place for Dharug clans as a ceremonial site, men's site and burial place.

A simple analysis of the Aboriginal cultural heritage sites registered within 1.25 kilometre buffer of the study area and review of archaeological assessments within the local and wider region indicate that artefact sites are the most common site type and are likely to consist of either isolated finds or artefact scatters made predominantly of silcrete (KNC 2024).The Blacktown soil landscape contains deep soil profiles that develop over extensive periods of time. Previous studies display that if this soil landscape is left undisturbed, there is a high potential for archaeological deposits to remain (Stephanie Garling Archaeological Consulting (SGAC) 2000).

Within the study area, test excavations were undertaken by KNC (2024) which identified AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4. AHIMS 45-5-5766/Guntawong Road 2 was located across a lower slope landform adjacent to a tributary of First Ponds Creek. The site was found to contain 15 artefacts across six test pits resulting in a density of 10 artefacts per square metre. AHIMS 45-5-5821/Guntawong Road 4 was located on mid slopes running adjacent to Guntawong Road. Two artefacts were identified across five test pits giving a density of 1.6 artefacts per square metre. KNC recommended an AHIP be sought for impacts to AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4, with salvage of a sample of AHIMS 45-5-5766/Guntawong Road 2 proposed due to the higher density of artefacts detected.

3.3.1 Predictive model

A model has been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to have existed throughout the study area and where they are more likely to be located.

This model is based on:

- Site distribution in relation to landscape descriptions within the study area.
- Consideration of site type, raw material types and site densities likely to be present within the study area.
- Findings of the ethnohistorical research on the potential for material traces to present within the study area.
- Potential Aboriginal use of natural resources present or once present within the study area.
- Consideration of the temporal and spatial relationships of sites within the study area and surrounding region.

Table 7 indicates the site types most likely to be encountered across the present study area. The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the study area.

Table 7 Aboriginal site prediction statements

Site type	Site description	Potential
Flaked stone artefact scatters and isolated artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density 'background' scatters and isolated finds.	High: Stone artefact sites have been previously recorded in the region across a wide range of landforms including alluvial flats, and within the study area; they have the high potential to be present in undisturbed areas within the study area.
PADs	Potential sub surface deposits of cultural material.	High: PADs have been previously recorded in the region across a wide range of landforms including alluvial flats. They have the potential to be present in undisturbed landforms.
Aboriginal Places	Aboriginal Places may not contain any 'archaeological' indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	High: The study area is located within a wider landscape which is a nominated Aboriginal Place.
Modified trees	Trees with cultural modifications	Low-Medium: A small number of mature native trees have survived within the study area, due to extensive vegetation clearing from the 1800's onwards.
Burials	Aboriginal burial sites.	Low -Medium: Aboriginal burial sites are generally situated within deep, soft sediments, caves or hollow trees. Areas of deep sandy deposits will have the potential for Aboriginal burials. The soil profiles associated with the study area are not commonly associated with burials. However, burials are likely to exist within the A7 Archaeological Complex located east of the study area.
Ochre quarry	Ochre quarry sites where Aboriginal people gathered materials used for painting.	Low: There is only one record of an ochre quarry within the vicinity of the study area.
Shell middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	Low: Shell midden sites have not been recorded within the study area. No shell middens have been located in the vicinity of the study area. There is some potential for shell middens to be located in vicinity of permanent water sources which is not located within the study area. There is a low potential of Shell Middens being present within the study area.
Quarries	Raw stone material procurement sites.	Low: There is no record of any quarries being within or surrounding the study area.
Aboriginal ceremony and Dreaming Sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	Low: There are currently no recorded mythological stories for the study area.

Site type	Site description	Potential
Post-contact sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	Low: There are no post-contact sites previously recorded in the study area and historical sources do not identify one.
Axe grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	Very Low: The geology of the study area lacks suitable horizontal sandstone rock outcrops for axe-grinding grooves. Therefore, there is low potential for axe grinding grooves to occur in the study area.
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	Very Low: The sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist, which are not present in the study area.

4 Archaeological survey

A field survey of the study area was undertaken on 23 October 2024 by Mathew Smith (Biosis, Senior Heritage Consultant) and Alyce Haast (DoE). Justine Coplin (DCAC) attended the field survey to provide cultural information but did not undertake the survey with Mathew Smith due to the cultural sensitivity of the area. The field survey sampling strategy, methodology and a discussion of results are provided below.

4.1 Archaeological survey objectives

The objectives of the survey were to:

- Provide RAPs an opportunity to view the study area and to discuss previously identified Aboriginal object(s) and/or place(s) in or within close proximity to the study area.
- Attempt to re-identify Aboriginal archaeological sites previously identified in the study area.
- Undertake a systematic survey of the study area targeting all landforms in the study area
- Identify and record Aboriginal archaeological sites visible on the ground surface.
- Identify and record areas of PADs.

4.2 Archaeological survey methodology

The survey methods were intended to assess and understand the landforms and to determine whether any archaeological material from Aboriginal occupation or land use exists within the study area.

4.2.1 Sampling strategy

The survey effort targeted all landforms and previously recorded AHIMS site in the study area that will potentially be impacted by the development. It focused on areas with increased ground surface visibility (GSV) and exposure as this enabled Aboriginal objects to be identified on the ground surface.

4.2.2 Survey methods

The archaeological survey was conducted on foot with a field team of two members. Recording during the survey followed the archaeological survey requirements of the Code and industry best practice methodology. Information that recorded during the survey included:

- Aboriginal objects or sites present in the study area during the survey.
- Survey coverage.
- Any resources that may have been exploited by Aboriginal people.
- Landform.
- Photographs of the site indicating landform.
- Evidence of disturbance.
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the study area was undertaken. Photographs and recording techniques were incorporated into the survey including representative photographs of survey units, landform, vegetation coverage, GSV and the recording of soil information for each survey unit were possible.

Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal cultural heritage and points marking the boundary of the landform elements were recorded using a handheld Global Positioning System (GPS) and the Map Grid of Australia (94) coordinate system.

4.3 Archaeological survey results

A total of one transect was walked across two landforms with the two surveyors walking 2 metres apart (Figure 8). This follows the methodology set out in Burke & Smith (2004, p. 65), which states that a single person can only effectively visually survey an area of two linear metres. One new Aboriginal site was identified in the study area. The results from the field survey have been summarised in Table 8 below and full transect details are provided in Figure 8.

Table 8 Survey coverage

Survey unit	Landform	Survey unit area (m²)	Visibility (%)	Exposure (%)	Effective coverage area (m²)	Effective coverage (%)
1	Flat	1280	5	5	3.2	0.25
1	Slope	4160	5	5	10.4	0.25

Table 9 Landform summary

Landform	Landform area (m²)	Area effectively surveyed (m²)	Landform effectively surveyed (%)	No. of Aboriginal sites	No. of artefacts or features identified during survey
Flat	11173	3.2	0.029	2	0
Slope	31127	10.4	0.033	1	1

4.3.1 Constraints to the survey

With any archaeological survey there are several factors that influence the effectiveness (the likelihood of finding sites) of the survey. The factors that contributed most to the effectiveness of the survey were reduced visibility caused by extensive grass coverage.

4.3.2 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 allowing for the detection of (usually stone) artefacts that may be present on the ground surface (DECCW 2010).

GSV during the survey varied throughout the study area but was generally low (0–10%) with the average being approximately 5%. GSV was hindered by extensive grass coverage and tree litter (Photo 12 and Photo 13).

Photo 12 **Low GSV in the central portion of the study area on slope landform, facing north-east (1 metre scale)**

Photo 13 **Isolated area of higher GSV on the flat landform, facing south-east (1 metre scale)**

4.3.3 Exposure

Exposure refers to the geomorphic conditions of the local landform being surveyed and attempts to describe the relationship between those conditions and the likelihood the prevailing conditions provide for the exposure of (buried) archaeological materials. Whilst also usually expressed as a percentage estimate, exposure is different to visibility in that it is in part a summation of geomorphic processes, rather than a simple observation of the ground surface (Burke & Smith 2004, p.79, DECCW 2010).

Overall, the study area displayed very few areas of exposure, ranging between 0–10%, with an average of approximately 5% across the study area. Exposure was mainly seen around vehicle access areas and in areas where erosion was prevalent such as the walls of drainage channels (Photo 14 to Photo 15).

Photo 14 **Area of exposure in vehicle tire rut (1 metre scale)**

Photo 15 **Area of exposure on eroded wall of drainage line (0.5 metre scale)**

4.3.4 Disturbances

Disturbance levels within the study area were assessed during the visual inspection. Levels of disturbance were categorised through an inspection of the ground surface. Disturbance levels within the study area have been categorised according to the following criteria:

- High disturbance—the landform has been heavily disturbed and all natural soil horizons have been displaced or removed, these areas are unlikely to contain Aboriginal cultural material.
- Moderate disturbance—the landform has undergone disturbances to a certain degree, but the extent and nature of these disturbances cannot be fully quantified. Aboriginal cultural material may be present within these locations but is unlikely to be *in situ*.
- Low disturbance—the landform has not been significantly disturbed and is highly likely to contain intact soil horizons. Aboriginal cultural material if present is likely to be *in situ*.

Historic and recent aerials (Photo 3 to Photo 8) show that the study area has been subject to moderate levels of disturbance. This has occurred in the forms of vegetation clearance, livestock grazing and infrastructure associated with those activities.

Visible disturbance consisted of access tracks traversing portions of the study area and stockyards located in the eastern extent of the study area with associated areas of cut and fill earthworks adjacent. The remainder of the study area did not display further visible disturbances as a result of extensive grass cover.

A representation of the disturbances that were noted during the archaeological survey are shown in Photo 16 and Photo 17.

Photo 16 **Photo showing representative area of disturbance as a result of vehicle access track (1 metre scale)**

Photo 17 **Area of cut and fill disturbance with spoil heap in the background (1 metre scale)**

4.4 Discussion of archaeological survey results

The archaeological survey consisted of one meandering transect which targeted all landforms present in the study area. The results of the survey have been summarised below and transect locations are provided in Figure 8. Overall, the survey was hindered by low average GSV (5%), as a result of extensive grass coverage and dense vegetation. This affected the surveyor's abilities to identify Aboriginal sites upon the grounds surface, and prohibited surveyors from making further observations on levels of exposure and disturbance to subsurface deposits.

As noted above in Section 4.3.4, disturbance was observed in association with the historical uses of the study area for grazing and pastoral purposes. The areas of most significant disturbance were located on the highest portion of the slope landform within the eastern portion of the study area, with stock yards and areas of cut and fill earthworks present. The central portion of the study area displayed disturbances in historical aerial imagery associated with removal of the native Cumberland Plain woodland. The bulk earthworks and removal of Cumberland Plain woodland, which would have been dominated by Forest Red Gums in the study area, would have resulted in significant disturbances to A soil horizons and any potential subsurface deposits.

The field investigation did identify one Aboriginal object, a quartzite hammerstone located on the surface of a disturbed access track. The artefact was not found to be in-situ and displayed damage from vehicle use of the access track. AHIMS sites, AHIMS 45-5-5766/Guntawong Road 2 and AHIMS 45-5-5821/Guntawong Road 4 within the study area were investigated as part of the survey. Both of these sites consisted of subsurface artefact deposits and the survey did not identify any surface artefacts in association with these sites.

Based on the results of the field investigation and previous test excavations undertaken by KNC the study area displays sporadic, and isolated deposits of archaeological material. These areas of material are restricted to the areas of minimal disturbance such as at AHIMS 45-5-5821/Guntawong Road 4 on the northern boundary of the study area, and AHIMS 45-5-5766/Guntawong Road 2 in the western portion of the study area associated with the flat landform in close proximity to the drainage line. Disturbances in the eastern and central portions of the study area will have resulted in the removal of A horizon soils resulting in a low potential that intact sub-surface deposits are present in these areas.

New Aboriginal sites identified in the study area

AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 was identified during a field investigation by Biosis. The site consists of an isolated artefact located on the surface of an access track within the southern portion of the study area. The artefact consisted of a quartzite river cobble fragment with battering damage on the intact distal end consistent with use as a hammerstone. The artefact displayed some damage from vehicle use of an access track. The artefact was not in-situ and has been deposited in its location by non-cultural actions.

Photo 18 AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1

Photo 19 **AHIMS 450505913/201 Guntawong Rd Hammerstone 1, photo portraying the distal end with battering damage**

[redacted]

Figure 8 Survey results and coverage

0 10 20 30 40 50

Metres

Scale: 1:1,200 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 02 December 2024,
Prepared for: MC, Prepared by: AA, Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_AR_F8_SurveyResults

Figure 9 Landforms

0 10 20 30 40 50

Metres

Scale: 1:1,500 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 29 November 2024,
Prepared for: MC, Prepared by: AA, Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_ACHA_F9_Landforms

5 Ground Penetrating Radar Survey

A GPR survey of part the study area was undertaken on 10 April 2025 by James Meintjes (Senior Geophysicist MALA GPR) and Sam Rubino (Geophysicist, MALA GPR). DoE representative Sonia Mallos was also present during the GPR survey. The GPR survey strategy, methodology and a summary of results are provided below. MALA GPR's complete report is provided in Appendix 2.

5.1 GPR survey objectives

The objectives of the survey were to:

- Investigate approximately 1.2 hectares of subsurface area within the study area using geophysical methods.
- Identify and interpret any potential Aboriginal archaeological artefacts or burials visible in the subsurface.
- Deliver a report that supports DoE in developing next steps toward potential development of the study area.
- Deliver a .dxf file inclusive of all interpreted features.

5.2 GPR survey methodology

5.2.1 Survey strategy

The survey effort targeted maximum horizontal coverage of the scope area to be potentially impacted by the development, with data resolution estimated up to 2 metres of vertical depth.

5.2.2 Survey methods

A 3D array (utilising multiple transmitters and receivers) was mobilised using a John Deere Hydraulic Vehicle, with minimal impact on the surface. Data was acquired in one metre wide, slightly overlapping, parallel survey paths to ensure no gaps within the data. Specific obstacles that resulted in slight limitations to the survey coverage included trees, rocks, and debris.

The collected data was post-processed and interpreted with a focus on clusters of features as potential areas of interest. A .dxf file of all interpretations accompanies MALA GPR's report provided in Appendix 2.

5.3 GPR survey results

With obstructions to the coverage area minimal, GPR survey was achieved in line with the horizontal survey strategy outlined in 5.2.1. However, depth resolution was considered "unsatisfactory" likely due to recent rainfall and the presence of clay deposits (MALA GPR AUSTRALIA 2025, p. 18).

Multiple subsurface anomalies were identified as having archaeological potential due to their locations away from potential fill, proximity to a consistent stratigraphic layer across the site (approximately 0.6 metres), and clustered nature. However, interpretations conceded that the anomalies "ultimately do not differ to other subsurface features such as rocks, tree roots and fill features" (MALA GPR AUSTRALIA 2025, p. 19).

Considering the additional limitations in data resolution, the GPR results are therefore not conclusive. Nevertheless, MALA GPR consider the information to be supportive to any future informed decision.

6 Scientific values and significance assessment

The two main values addressed when assessing the significance of Aboriginal sites are cultural values to the Aboriginal community and archaeological (scientific) values. This report will assess scientific values while the ACHA report will detail the cultural values of Aboriginal sites in the study area.

6.1 Introduction to the assessment process

Heritage assessment criteria in NSW fall broadly within the significance values outlined in the Australia International Council on Monuments and Sites (ICOMOS) Burra Charter (Australia ICOMOS 2013). This approach to heritage has been adopted by cultural heritage managers and government agencies as the set of guidelines for best practice heritage management in Australia. These values are provided as background and include:

- **Historical significance** (evolution and association) refers to historic values and encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are 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 subsequent treatment.
- **Aesthetic significance** (Scenic/architectural qualities, creative accomplishment) refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.
- **Social significance** (contemporary community esteem) refers to the spiritual, traditional, historical or contemporary associations and attachment that the place or area has for the present-day community. Places of social significance have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be determined through consultative processes with local communities.
- **Scientific significance** (Archaeological, industrial, educational, research potential and scientific significance values) refers to the importance of a landscape, area, place or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or object and will consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

The cultural and archaeological significance of Aboriginal and historic sites and places is assessed on the basis of the significance values outlined above. As well as the ICOMOS Burra Charter significance values guidelines, various government agencies have developed formal criteria and guidelines that have application when assessing the significance of heritage places within NSW. Of primary interest are guidelines prepared by the Australian Commonwealth Department of Climate Change, Environment, Energy, and Water (Cth DCCEEW), Heritage NSW. The relevant sections of these guidelines are presented below.

These guidelines state that an area may contain evidence and associations which demonstrate one or any combination of the ICOMOS Burra Charter significance values outlined above in reference to Aboriginal heritage. Reference to each of the values should be made when evaluating archaeological and cultural significance for Aboriginal sites and places.

In addition to the previously outlined heritage values, the Heritage NSW Guidelines (Office of Environment and Heritage, Department of Premier and Cabinet 2011) also specify the importance of considering cultural landscapes when determining and assessing Aboriginal heritage values. The principle behind a cultural landscape is that 'the significance of individual features is derived from their inter-relatedness within the cultural landscape'. This means that sites or places cannot be 'assessed in isolation' but must be considered as parts of the wider cultural landscape. Hence the site or place will possibly have values derived from its association with other sites and places. By investigating the associations between sites, places, and (for example) natural resources in the cultural landscape the stories behind the features can be told. The context of the cultural landscape can unlock 'better understanding of the cultural meaning and importance' of sites and places.

Although other values may be considered — such as educational or tourism values — the two principal values that are likely to be addressed in a consideration of Aboriginal sites and places are the cultural/social significance to Aboriginal people and their archaeological or scientific significance to archaeologists. The determinations of archaeological and cultural significance for sites and places should then be expressed as statements of significance that preface a concise discussion of the contributing factors to Aboriginal cultural heritage significance.

6.2 Archaeological (scientific significance) values

Archaeological significance (also called scientific significance, as per the ICOMOS Burra Charter) refers to the value of archaeological objects or sites as they relate to research questions that are of importance to the archaeological community, including indigenous communities, heritage managers and academic archaeologists. Generally the value of this type of significance is determined on the basis of the potential for sites and objects to provide information regarding the past life-ways of people (Burke & Smith 2004, p.249, NPWS 1997, p.26).

For this reason, the NPWS summarises the situation as 'while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential' (NPWS 1997, p.26).

The NPWS criteria for archaeological significance assessment are based largely on the ICOMOS Burra Charter.

Research potential

Research potential is assessed by examining site content and site condition. Site content refers to all cultural materials and organic remains associated with human activity at a site. Site content also refers to the site structure – the size of the site, the patterning of cultural materials within the site, the presence of any stratified deposits and the rarity of particular artefact types.. Site condition refers to the degree of disturbance to the contents of a site at the time it was recorded.

Table 10 and Table 11 outline the site content and site condition rating used for archaeological sites.

Table 10 Site contents ratings used for archaeological sites

Rating	Description
0	No cultural material remaining.
1	Site contains a small number (e.g. 0–10 artefacts) or limited range of cultural materials with no evident stratification.
2	Site contains a larger number, but limited range of cultural materials; and/or some intact stratified deposit remains; and/or are or unusual example(s) of a particular artefact type.
3	Site contains a large number and diverse range of cultural materials; and/or largely intact stratified deposit; and/or surface spatial patterning of cultural materials that still reflect the way in which the cultural materials were deposited.

Table 11 Site condition ratings used for archaeological sites

Rating	Description
0	Site destroyed.
1	Site in a deteriorated condition with a high degree of disturbance; lack of stratified deposits; some cultural materials remaining.
2	Site in a fair to good condition, but with some disturbance.
3	Site in an excellent condition with little or no disturbance. For surface artefact scatters this may mean that the spatial patterning of cultural materials still reflects the way in which the cultural materials were laid down.

Pearson & Sullivan (1995, p. 149) note that Aboriginal archaeological sites are generally of high research potential because 'they are the major source of information about Aboriginal prehistory'. Indeed, the often great time depth of Aboriginal archaeological sites gives them research value from a global perspective, as they are an important record of humanity's history. Research potential can also refer to specific local circumstances in space and time — a site may have particular characteristics (well preserved samples for absolute dating, or a series of refitting artefacts, for example) that mean it can provide information about certain aspects of Aboriginal life in the past that other less or alternatively valuable sites may not (Burke & Smith 2004, pp.247–248). When determining research potential value particular emphasis has been placed on the potential for absolute dating of sites.

The following sections provide statements of significance for the Aboriginal archaeological sites recorded. The significance of each site follows the assessment process outlined above. This includes a statement of significance based on the categories defined in the Burra Charter. These categories include social, historic, scientific, aesthetic and cultural (in this case archaeological) landscape values. Nomination of the level of value — high, moderate, low or not applicable — for each relevant category is also proposed. Where suitable the determination of cultural (archaeological) landscape value is applied to both individual sites and places (to explore their associations) and also, to the study area as a whole. The nomination levels for the archaeological significance of each site are summarised below.

Representativeness

Representativeness refers to the regional distribution of a particular site type. Representativeness is assessed by whether the site is common, occasional, or rare in a given region. Assessments of representativeness are subjectively biased by current knowledge of the distribution and number of archaeological sites in a region. This varies from place to place depending on the extent of archaeological research. Consequently, a site that is assigned low significance values for contents and condition, but a high significance value for

representativeness, can only be regarded as significant in terms of knowledge of the regional archaeology. Any such site should be subject to re-assessment as more archaeological research is undertaken.

Assessment of representativeness also considers the contents and condition of a site. For example, in any region there may only be a limited number of sites of any type that have suffered minimal disturbance. Such sites would therefore be given a high significance rating for representativeness, although they may occur commonly within the region.

Table 12 outlines the site representativeness ratings used for archaeological sites.

Table 12 Site representativeness ratings used for archaeological sites

Rating	Description
1	Common occurrence
2	Occasional occurrence
3	Rare occurrence

Overall scientific significance ratings for sites, based on a cumulative score for site contents, site integrity and representativeness are provided in Table 13.

Table 13 Scientific significance ratings used for archaeological sites

Rating	Description
1–3	Low scientific significance
4–6	Moderate scientific significance
7–9	High scientific significance

Each site is given a score on the basis of these criteria. The overall scientific significance is determined by the cumulative score. This scoring procedure has been applied to the Aboriginal archaeological sites identified during the sub-surface testing. The results are provided in Table 16.

6.2.1 Statements of archaeological significance

The following archaeological significance assessment is based on Requirement 11 of the Code. Using the assessment criteria detailed in Scientific Values and Significance Assessment, an assessment of significance was determined and a rating for each site was determined. The results of the archaeological significance assessment are given in Table 14 below.

Table 14 Scientific significance assessment of archaeological sites recorded within the study area.

Site name	Site content	Site condition	Representativeness	Scientific significance
AHIMS 45-5-5821/ Guntawong Road 4	1	2	1	4 - Moderate
AHIMS 45-5-5766/ Guntawong Road 2	2	2	1	5 - Moderate
AHIMS 45-5-5913/ 201 Guntawong Rd Hammerstone 1	1	1	1	3 - Low

Site name	Site content	Site condition	Representativeness	Scientific significance
Nominated Aboriginal Place – *Nanagamay Ngurra*	TBC	TBC	TBC	TBC

Table 15 Statements of scientific significance for archaeological sites recorded within the study area.

Site name	Statement of significance
AHIMS 45-5-5821/ Guntawong Road 4	AHIMS 45-5-5821/Guntawong Road 4 is a low-density subsurface artefact scatter which was previously recorded by KNC in 2024. The site consists of two silcrete flakes and is located within the mid slope of a spurline running along Guntawong Road. The site is approximately 190 metres each of the first order drainage tributary and 350 metres east of First Ponds Creek. The archaeological assessment completed by KNC determined that AHIMS 45-5-5821/Guntawong Road 4 is a common site type and possess low potential for further information to be obtained which could contribute to our understanding of Aboriginal land use within the local region. AHIMS 45-5-5821/Guntawong Road 4 therefore possess low scientific potential.
AHIMS 45-5-5766/ Guntawong Road 2	AHIMS 45-5-5766/Guntawong Road 2 is a low to moderate density subsurface artefact scatter which was recorded by KNC in 2024. The site is located across the lower slope of a spur running west from the ridgeline between Second Ponds and First Ponds Creek. A total of 15 artefacts were recovered from 1.5m^2, which is a mean artefact density of 10 artefacts per m^2. The artefact assemblage consists of flake and flake fragments made of silcrete and IMT with two cores and one back blade fragment. The archaeological assessment completed by KNC determined that AHIMS 45-5-5766/Guntawong Road 2 is a common site type which possesses moderate potential for further information to be obtained which could contribute to our understanding of Aboriginal land use within the local region. KNC has recommended that AHIMS 45-5-5766/Guntawong Road 2 possess moderate scientific potential and further investigation in the form of a salvage excavation should be undertaken.
AHIMS 45-5-5913/ 201 Guntawong Rd Hammerstone 1	AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 was identified during a field investigation by Biosis. The site consists of an isolated artefact located on the surface of an access track within the southern portion of the study area. The artefact consisted of a quartzite river cobble fragment with battering damage on the intact distal end consistent with use as a hammerstone. The artefact displayed some damage from vehicle use of an access track. The artefact was not in-situ and has been deposited in its location by non-cultural actions. The archaeological assessment determined that AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 is a common site type and possess low potential for further information to be obtained which could contribute to our understanding of Aboriginal land use within the local region. AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 therefore possesses low scientific significance.
***Nangamay Ngurra* Aboriginal Place nomination**	*Nangamay Ngurra* includes a ceremonial and men's site, and a burial place. *Nangamay Ngurra* has high cultural significance, the area would have been utilised by all clans of Dharug whom would travel to meet within this area. *Nangamay Ngurra* includes a complex of archaeological sites which provide tangible evidence of the Dharug occupation within the study area and vicinity. The known archaeological site associated with the Nangamay Ngurra Aboriginal Place nomination located within the study area is AHIMS 45-5-5766/Guntawong Road 2.

7 Impact assessment

There are three recorded Aboriginal sites and one nominated Aboriginal Place that may be subject to harm within the study area. It is expected that potential harm to Aboriginal archaeological sites from the development in the study area is high. Strategies to avoid or minimise harm to Aboriginal heritage in the study area are discussed below.

7.1 Predicted physical impacts

As previously outlined, the proposed works involve the development of a new high school, which will comprise of the following works:

- Three learning hubs (three-storey in heigh) accommodating 49 general teaching spaces and three SLUs.
- Other core facilities including amenities, library, staff hub and administrative areas.
- Standalone school hall.
- Separate carpark with 72 spaces.
- Kiss and drop zone along Nirmal Street.
- Open play space including sports courts and sports field.
- Public domain works.
- A proposed future Aboriginal education shared learning hub (subject to future development consent as required).

The proposed site access arrangements are as follows:

- Main pedestrian entrance to be located off Nirmal Street.
- Kiss and drop zone proposed along Nirmal Street.
- Onsite parking access via Nirmal Street.

Left unmitigated, these activities have the potential to completely remove or disturb AHIMS 45-5-5821/Guntawong Road 4, AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 and nominated Aboriginal Place *Nanagamay Ngurra.* Harm to AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 cannot be avoided with the current design plan. Harm to AHIMS 45-5-5766/Guntawong Road 2 has been avoided through redesign. A summary of impacts is provided below in Table 16.

Table 16 Summary of potential archaeological impacts

AHIMS site no.	Site name	Scientific Significance	Type of harm	Degree of harm	Mitigation measures
AHIMS 45-5-5821	Guntawong Road 4	Low	Direct	Total loss of value	Avoidance of site, heritage induction and development of an ACHMP. If avoidance is not possible and AHIP to impact should be obtained.

AHIMS site no.	Site name	Scientific Significance	Type of harm	Degree of harm	Mitigation measures
AHIMS 45-5-5766	Guntawong Road 2	Moderate	Direct	Total loss of value	Fencing, heritage induction and development of an ACHMP. If site cannot be avoided, an AHIP to impact and salvage should be obtained.
AHIMS 45-5-5913	201 Guntawong Rd Hammerstone 1	Low	Direct	Total loss of value	Avoidance of site, heritage induction and development of an ACHMP. AHIP to impact should be obtained.
***Nangamay Ngurra* Aboriginal Place nomination**	*Nangamay Ngurra* Aboriginal Place nomination	TBC	Direct	Partial loss of value	Avoidance of site, heritage induction and development of an ACHMP. Where avoidance is not possible, and if the nominated is approved by Heritage NSW an AHIP to impact should be obtained.

7.2 Ecologically Sustainable Development

One of the primary aims of the NP&W Act is the 'conservation of objects places and features … of cultural value within the landscape, including … places, objects and features of significance to Aboriginal people …' ((s.2A(1)(b)(i)). The *Operational Policy: Protecting Aboriginal Cultural Heritage (Version 2)* (DECC NSW 2011) provides guidance to proponents in term of 1.1 Ecologically Sustainable Development (ESD).

ESD has been defined in Part 3, 6. (2) Objective of the Authority of the *Protection of the Environment Administration Act 1991* (NSW). This outlines that the ESD requires the integration of economic and environmental considerations (including cultural heritage) in the decision-making process. In regard to Aboriginal cultural heritage, ESD can be achieved by applying the principle of intergenerational equity and the precautionary principle.

> ***Intergenerational equity***
>
> *The principle of intergenerational equity states that the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – for the benefit of future generations.*
>
> *In terms of Aboriginal cultural heritage, intergenerational equity can be considered in terms of the 'cumulative impacts' of any proposal to Aboriginal objects and places. For example, if few Aboriginal objects and places remain in a region (because of harm authorised under previous AHIPs), fewer opportunities remain for future generations of Aboriginal people to enjoy the cultural benefits of those Aboriginal objects and places.*
>
> *Information about the significance of Aboriginal cultural heritage values associated with the Aboriginal objects and places proposed to be harmed will be relevant to the consideration of intergenerational equity and an understanding of the cumulative impacts of a proposal.*
>
> *Where there is uncertainty, the precautionary principle should also be followed (see below).*

The precautionary principle

The precautionary principle states that the lack of full scientific certainty about the threat of harm should not be used as a reason for not taking measures to prevent harm from occurring.

In applying the precautionary principle, decisions should be guided by:

- *a careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment (which includes cultural heritage)*
- *an assessment of the risk-weighted consequences of various options. The precautionary principle is relevant to OEH consideration of potential harm to Aboriginal cultural heritage where:*
- *the proposal involves a risk of serious or irreversible harm to Aboriginal objects or places or to the value of those objects or places, and*
- *there is a lot of uncertainty about the significance of Aboriginal cultural heritage values of the Aboriginal objects or places proposed to be harmed.*

Where this is the case, a precautionary approach should be taken and all cost-effective measures implemented to prevent or reduce harm to the Aboriginal objects/place.

7.3 Management and mitigation measures

Ideally, heritage management involves conservation of sites through the preservation and conservation of fabric and context within a framework of 'doing as much as necessary, as little as possible' (Marquis-Kyle & Walker 1994, p.13). In cases where conservation is not practical, several options for management are available. For sites, management often involves the salvage of features or artefacts, retrieval of information through excavation or collection (especially where impact cannot be avoided) and interpretation.

Avoidance of impact to archaeological and cultural heritage sites through design of the development is the primary mitigation and management strategy and should be implemented where practicable. Due to the design and the level of bulk earthworks required to make it suitable for development, it is not possible to avoid impacts to Aboriginal sites in the study area.

A conclusion from community consultation is that a new site location for the proposed works should be considered in order to avoid impacts to the highly culturally significant Aboriginal Place within the study area and wider landscape. An outcome from community consultation is that the proposed school should not be built within the study area, due to the culturally significant Aboriginal Place. A new site location for the proposed works should be established in order to avoid impacts to the highly culturally significant Aboriginal Place within the study area and wider landscape.

Impacts to AHIMS 45-5-5821/Guntawong Road 4, AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 are unable to be avoided through redesign an AHIP will need to be obtained for direct impact. The AHIP will also need to allow for community collection of AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 for collection prior to any construction works.

7.3.1 Avoidance through redesign

As per the outcomes of community consultation, it was recommended that DoE should investigate another study area for the development of the new high school in order to avoid impact to the nominated Aboriginal Place *Nanagamay Ngurra*.

DoE assessed three potential sites to develop the Schofields-Tallawong High School to meet current and future demand for public high-school tuition in the area. Optioneering was limited to these three sites based on the high forecasted demographic growth and the limited number of land parcels available for acquisition within the area of service need.

DoE also confirms that based on the Aboriginal cultural heritage investigations, impacts to archaeological site AHIMS 45-5-5766/Guntawong Road 2 have been reduced through redesign. The majority of the AHIMS 45-5-5766/Guntawong Road 2 site within the high school area will now not be impacted and will be conserved and protected from harm as an area of natural drainage overflow. As minor impacts to AHIMS 45-5-5766/Guntawong Road 2 will occur, an AHIP to impact will need to be obtained, a no harm area for the remainder of the site will be fenced to ensure the area is protected.

The proposed future Aboriginal education shared learning hub will be sited to ensure no additional impacts to AHIMS 45-5-5766/ Guntawong Road 2.

7.3.2 Continue Aboriginal community consultation

As per the consultation requirements it is recommended that a copy of this report is provided to RAPs. It is also recommended that the proponent should continue to inform RAPs about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project.

7.3.3 Apply for an AHIP to impact AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1

If impacts to AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 cannot be avoided through redesign, it is recommended that an AHIP covering the development footprint be obtained from Heritage NSW prior to impacts occurring. An AHIP is required for any activities likely to have an impact on Aboriginal objects or Places, or that cause land to be disturbed for the purposes of discovering an Aboriginal object. **The AHIP should be for a term of two (2) years.**

A small portion of AHIMS 45-5-5766/Guntawong Road 2 will be impacted by the proposed activity. Due to the low to moderate density of artefacts, no further works is advised. The majority of AHIMS 45-5-5766/Guntawong Road 2 will not be impacted and will be conserved.

The AHIP will allow for impacts to AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 to occur through the proposed development and community collection of 45-5-5913/201 Guntawong Rd Hammerstone 1.

Advice preparing AHIPs

An AHIP is required for any activities likely to have an impact on Aboriginal objects or Places or cause land to be disturbed for the purposes of discovering an Aboriginal object. Heritage NSW issues AHIPs under Part 6 of the NPW Act.

AHIPs should be prepared by a qualified archaeologist and lodged with Heritage NSW. Once the application is lodged processing time can take between 8-12 weeks. It should be noted that there will be an application fee levied by the Heritage NSW for the processing of AHIPs, which is dependent on the estimated total cost of the development project.

7.3.4 Community surface collection of AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1

AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 should be salvaged through community surface collection as part of the AHIP to impact. This ensures that the most information possible is obtained from the sites prior to their destruction. This not only increases current understanding of the site but increases our knowledge of Aboriginal occupation in the wider Blacktown region and ensures that any scientific and cultural information that we obtain can be accessed and used by future generations.

7.3.5 Fencing of AHIMS 45-5-5766/Guntawong Road 2 and area of moderate archaeological potential

Prior to any construction works taking place, the majority of AHIMS 45-5-5766/Guntawong Road 2 and the area of moderate archaeological potential which will not be impacted should be conserved and fenced off and secured, to ensure it will not be harmed by the proposed works. Fencing must remain in place over the over the lifespan of construction phase. Should future development work propose to impact AHIMS 45-5-5766/Guntawong Road 2, then an AHIP will need to be obtained from Heritage NSW. Further archaeological investigation in the form test excavations is not recommended for AHIMS 45-5-5766/Guntawong Road 2 as the site will be avoided through redesign.

7.3.6 Aboriginal Cultural Heritage Management Plan

It is recommended an ACHMP be developed to appropriately manage Aboriginal cultural heritage identified within the study area. An ACHMP sets out specific guidelines and protocols for the management of Aboriginal heritage across the life of the project inclusive of construction and operational use. This should be inclusive of unanticipated finds protocols, the requirement for heritage inductions to be undertaken by the site personnel prior to works, and long-term care and control of Aboriginal archaeological materials. The ACHMP must be prepared by a suitably qualified archaeologist in consultation with the RAPs for the project.

7.3.7 Heritage Interpretation Plan

Given the significance of the region to Aboriginal people, there is an opportunity for heritage interpretation as part of the design. Heritage interpretation is an innovative way to integrate culture into design and can not only honour the deep-rooted connection to the land but also ensure that Aboriginal cultural heritage remains present in the daily operations of the proposed high school. As such, it is recommended that a Heritage Interpretation Plan be prepared by a suitably qualified heritage consultant following the NSW Heritage Council's *Interpreting Heritage Places and Items Guidelines*.

Figure 10.1 Impact assessment

0 40 80 120 160 200

Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 20 December 2024,
Prepared for: MC, Prepared by: AA., Last edited by: aabid
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_ACHA_F10.1_ImpactAssessment

Figure 10.2 Impact assessment

0 20 40 60 80 100

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA2020 MGA Zone 56

N

biosis

APEM Group

Matter: 40105, Date: 20 December 2024,
Prepared for: MC, Prepared by: AA., Last edited by: owilliams
Location: P:\40100s\40105\Mapping\
40105_Tallawong_ACHA,
Layout: 40105_ACHA_F10.2_ImpactAssessment

8 Recommendations

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the study area and influenced by:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practise, widely considered to include:
  - Ethos of the Australia ICOMOS Burra Charter.
  - The Code.

Prior to any impacts occurring within the study area, the following is recommended.

Recommendation 1: Continued consultation with the registered Aboriginal parties

It is recommended that DoE continue to inform these groups about the management of Aboriginal cultural heritage sites within the study area throughout the life of the project. This recommendation is in keeping with the consultation requirements.

Recommendation 2: Application for an AHIP to impact AHIMS 45-5-5766/Guntawong Road 2, AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1

If avoidance through redesign is unable to occur, it is recommended that that DoE apply to Heritage NSW, NSW Department of Climate change, Energy, the Environment and Water (Heritage NSW) for an AHIP to destroy AHIMS 45-5-5821/Guntawong Road 4 and AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 and to partially impact AHIMS 45-5-5766/Guntawong Road 2 which are currently protected under the NPW Act. The AHIP should be for a term of two years.

A small portion of AHIMS 45-5-5766/Guntawong Road 2 will be impacted by the proposed activity. Due to the low to moderate density of artefacts, no further works is advised. The majority of AHIMS 45-5-5766/Guntawong Road 2 will not be impacted and will be conserved (refer to Recommendation 3).

It is recommended that the surface stone artefacts associated with AHIMS 45-5-5913/201 Guntawong Rd Hammerstone 1 is collected prior to construction.

Recommendation 3: Fencing of AHIMS 45-5-5766/Guntawong Road 2

Prior to any works taking place, the majority of AHIMS 45-5-5766/Guntawong Road 2 and the area of moderate archaeological potential which will not be impacted are to be conserved and should be clearly fenced to ensure they will not be harmed by the proposed activity. Fencing must remain in place over the lifespan of the construction phase.

Recommendation 4: No further archaeological work required in the area of low potential once AHIP obtained from Heritage NSW

No further archaeological work is required in the area of low potential except in the event that unexpected human remains are unearthed during any phase of the project (refer to Recommendation 7).

Recommendation 5: Discovery of unanticipated Aboriginal objects

All Aboriginal objects and Places are protected under the NPW Act. It is an offence to disturb an Aboriginal site without a consent permit issued by Heritage NSW. Should any unanticipated Aboriginal objects be encountered during works associated with this proposal, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the archaeologist will provide further recommendations. These may include notifying Heritage NSW and Aboriginal stakeholders.

Recommendation 6: Discovery of unanticipated historical relics

Relics are historical archaeological resources of local or State significance and are protected in NSW under the *Heritage Act 1977*. Relics cannot be disturbed except with a permit or exception/exemption notification. Should unanticipated relics be discovered during the course of the project, work in the vicinity must cease and an archaeologist contacted to make a preliminary assessment of the find. The Heritage Council will require notification if the find is assessed as a relic.

Recommendation 7: Discovery of human remains

If any suspected human remains are discovered during any activity you must:

1. Immediately cease all work at that location and not further move or disturb the remains.
2. Notify the NSW Police and Heritage NSW Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location.
3. Not recommence work at that location unless authorised in writing by Heritage NSW.

Recommendation 8: Development of an Aboriginal Cultural Heritage Management Plan

It is recommended an ACHMP be developed to appropriately manage Aboriginal cultural heritage identified within the study area. An ACHMP sets out specific guidelines and protocols for the management of Aboriginal heritage across the life of the project inclusive of construction and operational use. This should be inclusive of unanticipated finds protocols, the requirement for heritage inductions to be undertaken by the site personnel prior to works, and long-term care and control of Aboriginal archaeological materials. The ACHMP must be prepared by a suitably qualified archaeologist in consultation with the RAPs for the project.

Recommendation 9: Heritage Interpretation plan

Given the significance of the region to Aboriginal people, there is an opportunity for heritage interpretation as part of the design. Heritage interpretation is an innovative way to integrate culture into design and can not only honour the deep-rooted connection to the land but also ensure that Aboriginal cultural heritage remains present in the daily operations of the proposed high school. As such, it is recommended that a Heritage Interpretation Plan be prepared by a suitably qualified heritage consultant following the NSW Heritage Council's *Interpreting Heritage Places and Items Guidelines*.

Biosis understands that this recommendation has been captured within the Connecting with Country program undertaken by DoE.

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Appendices

Appendix 1 AHIMS results

This has been removed for public exhibition.

Appendix 2 Ground Penetrating Radar report

t/a MALA GPR AUSTRALIA
[redacted]

3D Ground Penetrating Radar Survey –
201 Guntawong Rd, Schofields

CLIENT COMPANY	NSW Department of Education
CLIENT CONTACT	Sonia Mallos
CLIENT PHONE	[redacted]
PROJECT SITE	201 Guntawong Rd, Schofields NSW 2762
JOB ID	GGA25113
SURVEY DATE	April 10, 2025
REPORT DATE	April 17, 2025
REVISION	1

COMPILED BY Sam Rubino

Geophysicist

REVIEWED BY James Meintjes

Senior Geophysicist

Table of Contents

1.0 Introduction

1.1 Background Information

MALA GPR Australia (MALA GPR) was contracted by the NSW Department of Education (DET) to utilise geophysical methods to investigate the subsurface within a dedicated area of 201 Guntawong Rd, Schofields NSW. DET reported to MALA GPR that prior to further works being completed in the area, the area must be scanned for any indication of archaeological artefacts or burials. The area of investigation was located inside 201 Guntawong rd and consisted mostly of bushland on an existing property (Figure 1).

The site mostly comprised of shin to knee height vegetation which was mowed by an external party to allow the 3D GPR to traverse the site. Obstructions such as surface holes, wooden posts, logs, stakes and outcropping rocks were present on site and limited complete coverage in certain areas. Trees were abundant on the northern and southern sections of the survey area, determining boundaries where 3D GPR acquisition was possible. The ground was found to be slightly undulated when a site visit was completed, however, post mowing revealed that the site contained harsh uneven ground in certain areas, particularly towards the southern sections of the site. A fence-line separated a section of the survey area, however, did not establish any issues regarding acquisition. As provided by DET, the site was claimed to be generally filled with brown silty/sandy clay and contains an underlain layering of clay/sandy clay. The total approximate area of the site is 4 hectares, however, the total area where 3D GPR could be utilised was 1.2 hectares.

Figure 1: Northeastern section of the survey area, depicting examples of debris and obstructions.

Figure 2: Example of wooden post obstructors. To the left of the posts is an example of uneven ground encountered throughout the survey area.

1.2 Scope

MALA GPR were to utilise 3D GPR using RTK GPS, to survey an approximate 1.2 hectare area within the property of 201 Guntawong Rd, Schofields (Figure 3). This included an area of bushland on an existing property, with harsh uneven grassy terrain.

Figure 3: Survey area under investigation (marked with an orange marker), requested by DET at 201 Guntawong Rd, Schofields, NSW.

The request for Ground Penetrating Radar (GPR) investigations aims to attempt to determine the potential presence of archaeological artefacts or burials. The findings aim to assist DET to inform the next steps towards future works in this area.

Upon completion of the data acquisition and interpretation, MALA GPR was to deliver the following:

- Geophysical report with findings outlined within report.
- A dxf file with all interpreted features

2.0 Methodology

2.1 Description of Geophysical Methods

Ground Penetrating Radar (GPR) is a geophysical method that uses radar pulses to image the subsurface. GPR uses transmitting and receiving antennas in which the transmitting antenna radiates short pulses of high-frequency radio waves into the ground/material. When the wave hits a subsurface object or a boundary with differing dielectric permeabilities, the receiving antenna records variations in the reflected return signal. The depth range of a certain frequency GPR is limited by the electrical conductivity of the ground. As ground conductivity increases, the signal penetration depth decreases. A 3D array (MALA MIRA utilising multiple transmitters and receivers) was used in this investigation to maximise area coverage and provide more data for interpretation.

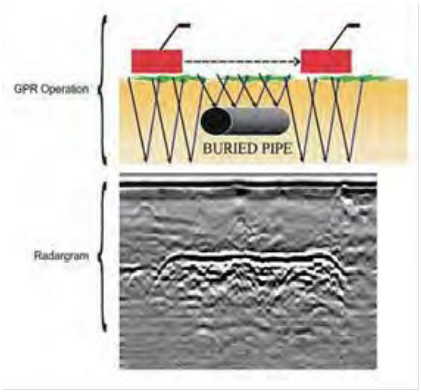

Figure 4: GPR radargram 2D cross section displaying anomaly across a buried pipe.

Figure 5: MALA MIRA 400MHz 3D GPR with RTK GPS mobilised with a John Deere Hydraulic Vehicle, used on site.

2.2 Data Acquisition

A 400MHz 3D GPR (MALA MIRA– Figure 5) was utilised in this survey to attempt to obtain suitable depth penetration (up to 2m depth) while maintaining data resolution. The 3D GPR array (16 channels) allows for maximum area coverage (1m wide swath) with minimal to no gaps between acquired profiles (swaths), unlike traditional 2D methods. Positioning for the 3D GPR survey was tracked using an Emlid RS2+ RTK GPS rover antenna, receiving AUSCORS GNSS satellite corrections. GPR Data output is imaged in plan view depth slices, allowing highlighted areas and locations of interests to be emphasised with increased clarity.

Data acquisition was performed by Geophysicists James Meintjes and Sam Rubino, of MALA GPR Australia on the 10th of April 2025. DET representative Sonia was notified of arrival on site and departure from site. Terry (Landscaper on site) was present during the day of acquisition and was utilised to mow some of the specified area for further vegetation reduction. The survey was conducted on a dry sunny day, following a days of rain the previous 3 days.

Table 1 below outlines the GPR collection parameters employed, using the 3D antenna.

Antenna	400 MHz 3D array
Number of channels	16
Antenna Separation	0.27 m
Time Window	62.37 ns
Trigger Distance Interval	0.04 m
Stacks	4

Table 1. GPR acquisition parameters.

The 3D GPR system was mounted and pushed using a John Deere Hydraulic Vehicle throughout the survey area. This enabled efficient data collection, having minimal impact on the grounds and surrounding area. The GPR survey aimed for maximum coverage within the survey scope area. GPR swaths were conducted in parallel collection directions with slight overlaps with aim to maintain no gaps within the data. Overall, GPR coverage was great, and in line with the survey scope area.

GPS Satellite exposure was great throughout the survey area, with no overhead obstructions causing dropouts. The designated survey area outlined by DET was covered with effective coverage. The western section of the survey area contained debris and infrastructure that limited complete coverage; however, this effect was minimal. Coverage of the GPR data in respect to the survey area is displayed in Figure 6.

Figure 6: GPR data swaths displaying coverage of the designated survey area.

2.3 Limitations

Limitations to the survey included the following:

- Coverage Limitations.

While the 3D GPR method aimed for maximum coverage, specific obstacles slightly limited the survey coverage and included (but were not limited to) trees, small outcropping rocks, debris, tree logs, surface holes and exposed wooden posts.

- Subsurface Conductivity Limitations.

Areas with medium to high subsurface conductivity will cause signal attenuation, limiting GPR depth penetration, and in turn, resolution. Such areas may include conductive fill or saturated surface and subsurface conditions.

- Subsurface Target Limitations

To obtain a satisfactory reflection from the GPR signal, the dielectric contrast between the target material (eg void) and host material (eg surrounding geology) must be significant. As a result, it is entirely possible that not all subsurface features will be detectable. Targets may also be indistinguishable as they will appear as similar features in the dataset (eg. Large rock, unknown object or potential artefact).

2.4 Data Processing

Data processing and geophysical report compilation was performed offsite by Sam Rubino.

The collected 3D GPR data was post processed and interpreted using Guideline Geo proprietary post processing software, MALA Vision Desktop v1.2504.09.

Upon import, 3D data was interpolated within swaths. Standard filters were applied to the dataset which included linear and exponential time gain. Background removal was toggled on/off throughout interpretation. FK Migration was used to determine signal velocities for respective time to depth conversions. 3D data was further interpolated within defined areas, with a cell size/grid spacing of 0.04m horizontal. This grid spacing value was kept close to the trace interval (0.04m) to aim for high resolution gridding. Absolute values were calculated, where calculations are made on the magnitude of the radar wave, ignoring the polarization (all negative values become positive). A depth slice thickness of 0.24m was applied to the 3D interpolation.

Interpretations of data were made in line with the survey scope by utilising markers in the interpretation software. Areas of clustered hyperbolae were focussed on as these features may relate to the targets of interest. All interpretations are exported to .dxf (accompanying this report), the format of the .dxf is UTM GDA2020 Zone 56.

3.0 Results

3.1 Presentation of Findings

The presentation of results from the data interpretation has been analysed below, with an interpretation of key anomalies found relating to targets of interest.

The below Figure 7 displays all interpretations made within the processing stage. All plan view maps are North orientated. The accompanying .dxf file will outline x.y,z positioning of all anomalies (with the exception of the anomalies from component A above).

Further, Section 3.2 will detail individual relevant interpretations, to provide a better understanding of the nature of the anomalies, and how they were interpreted.

Figure 7: GPR Coverage with indications of relevant subsurface anomalies. Red markers indicate indications of potential archaeological features.

3.2 Interpretation of the Data

The below figures (Figures 8-13) display processed and interpolated 3D GPR data (showing the interpreted area of interest), with addition of an associated 2D radargram to display the interpreted anomaly in 2D cross sectional view. Descriptions of the interpretations will accompany each figure and will be factual based on the data. Findings provide examples of data relating to potential targets found during acquisition. Correlation of the findings to potential subsurface features relevant with the survey scope will be discussed in Section 4.1 Analysis of Results.

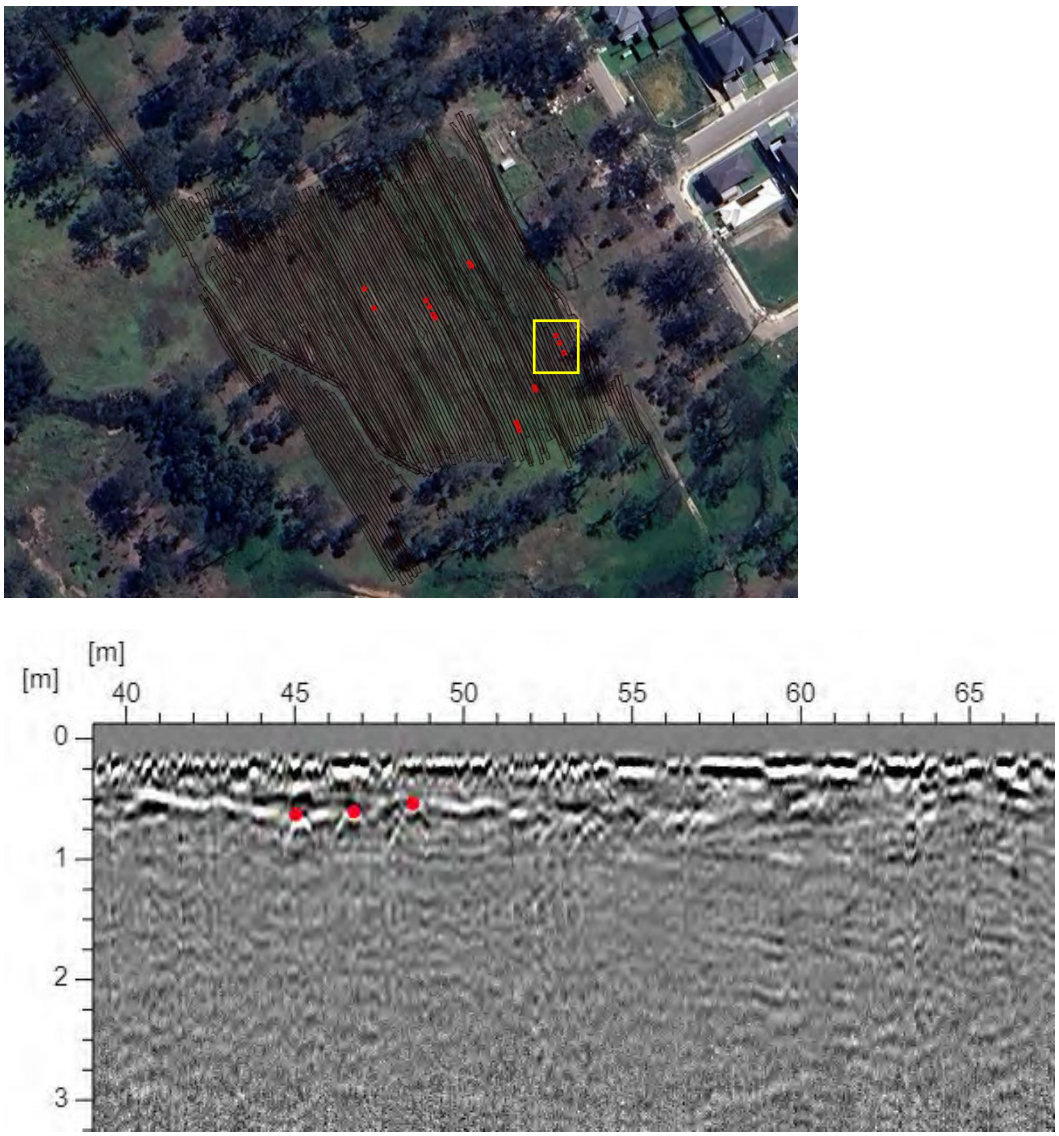

Figure 8: The above example depicts an anomaly that may indicate the presence of an archaeological feature. This feature appears as a series of hyperbolic anomalies and occurs at approximately 0.6m depth and appears to be situated in a stratigraphic layer. General radargram is attenuated, likely due to subsurface conditions. The mapped image (top image) shows a yellow polygon in reference to the location of the anomaly. A signal velocity of 112m/µs is applied to the dataset.

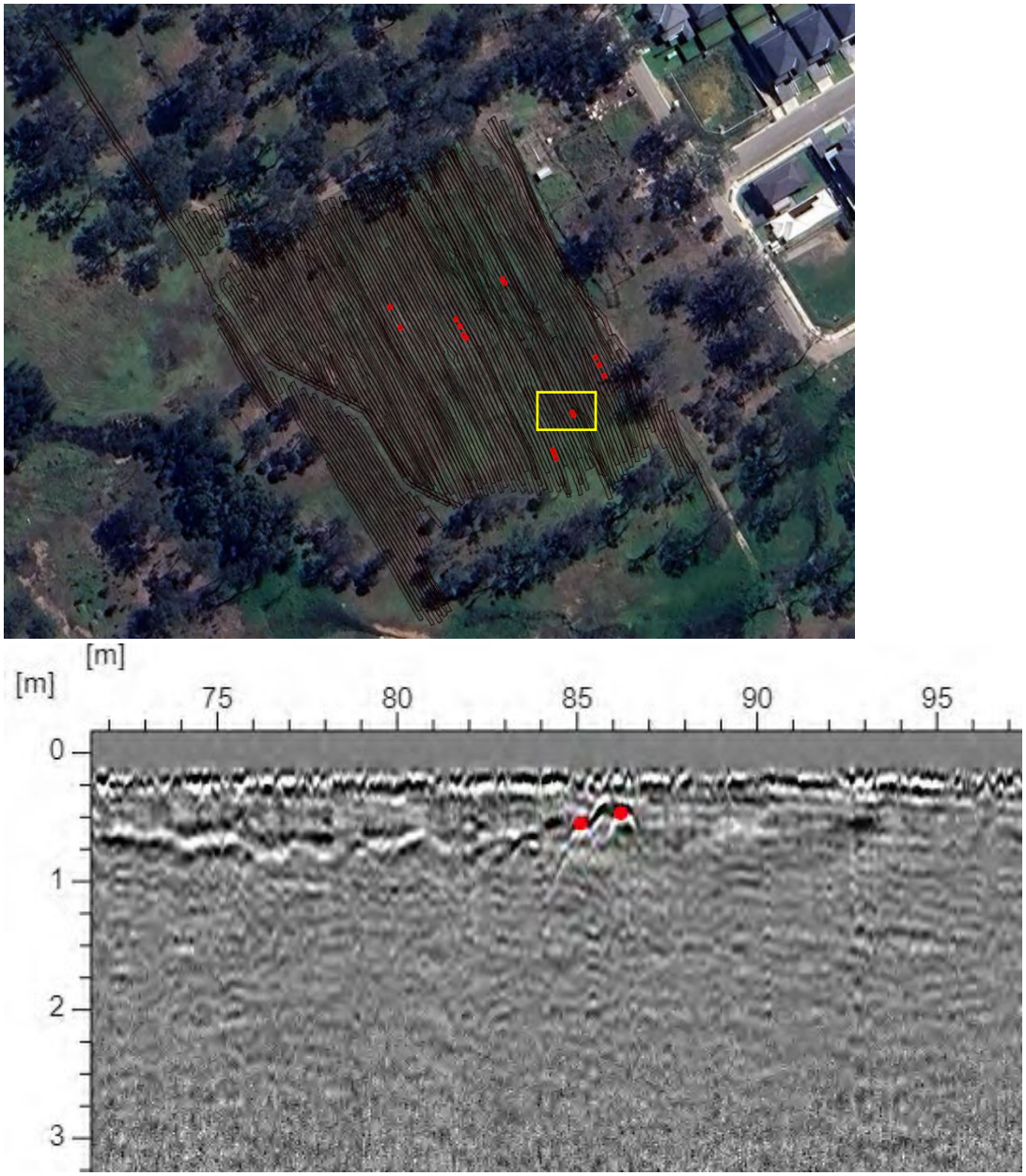

Figure 9: A series of hyperbolic anomalies are found at approximately 0.5m depth and location marked with a yellow polygon in the mapped image (top image). An associated 2D radargram (bottom image) displays the anomaly at depth and indicates an anomaly relating to a possible archaeological feature. Subsurface anomalies marked appear in what appears to be a stratigraphic layer, such as the feature marked in Figure 8. Data appears to be attenuated past a depth of 1m. A signal velocity of 112m/μs is applied to the dataset.

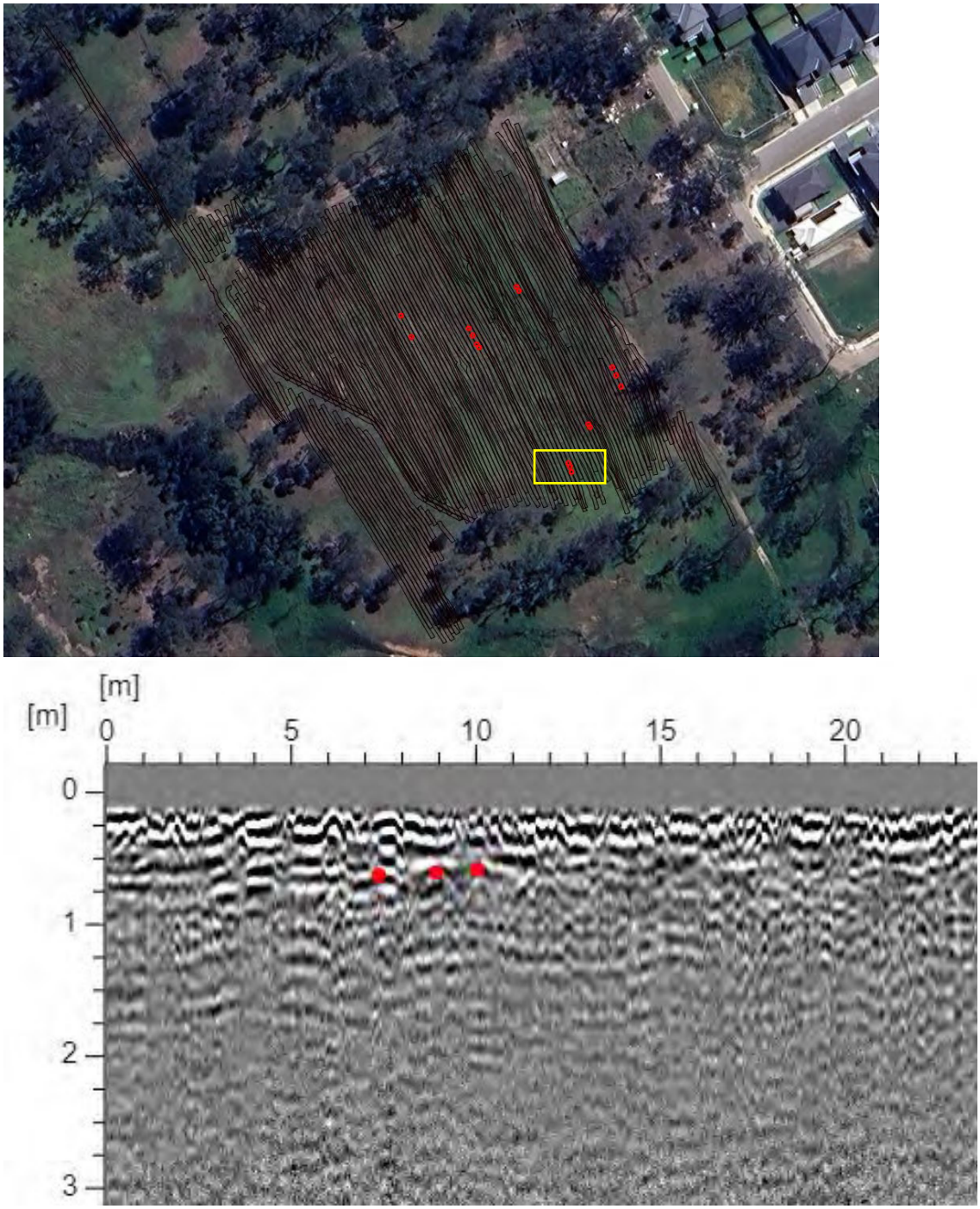

Figure 10: Example of a subsurface anomaly relating to a potential archaeological feature is found on the southern section of the survey area (top image), marked with a yellow polygon. An associated 2D radargram (bottom image) passing through the interpreted area, displays the feature at a depth of approximately 0.6m (marked with red markers) which spans from approximately 7m to 10m into the radargram. Signal attenuation is evident throughout the radargram. A signal velocity of 112m/μs is applied to the dataset.

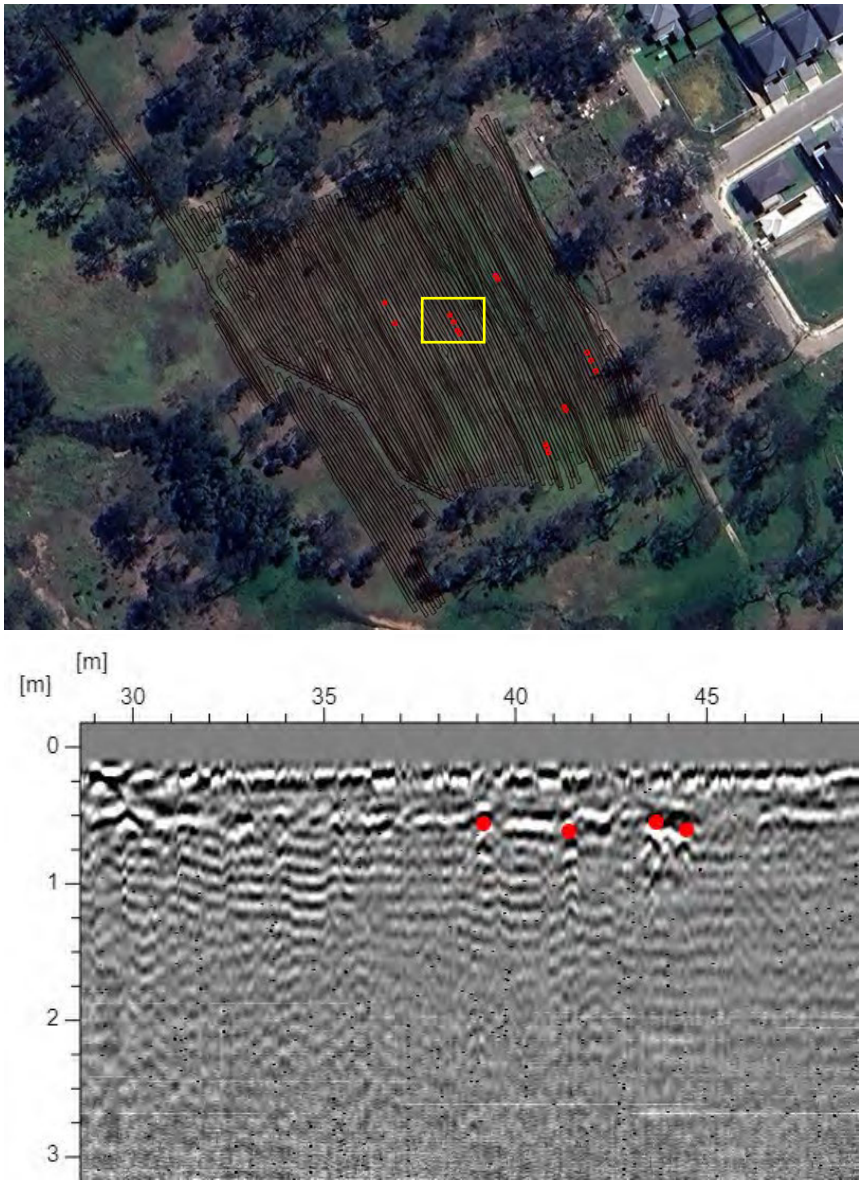

Figure 11. The above Figure 11 depicts a subsurface anomaly relating to a possible archaeological feature found in the central section of the survey area (top image), marked with a yellow polygon. An associated 2D radargram (bottom image) passing through the interpreted area, displays the feature at a depth of approximately 0.53m. The subsurface feature appears as a cluster of hyperbolae. Prior to this anomaly are two anomalies that could potentially relate to metallic features, located at a depth of approximately 0.5m. Signal attenuation continues to be apparent throughout the radargram and is especially noticeable at approximately 1m depth and below. A signal velocity of 112m/µs is applied to the dataset.

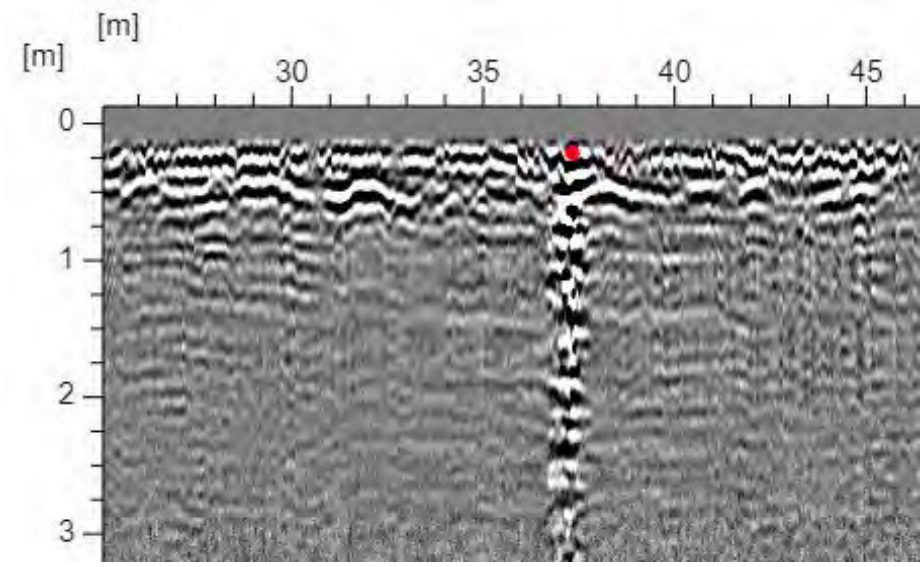

Figure 12. Radargram showing an example of a near surface anomaly found in the central section of the survey area. The marked anomaly could possibly relate to a metallic feature situated near the surface. Anomaly appears highly contrasted in comparison to the remainder of the radargram, indicating that the nature of the anomaly may be metallic. A signal velocity of 112m/µs is applied to the dataset.

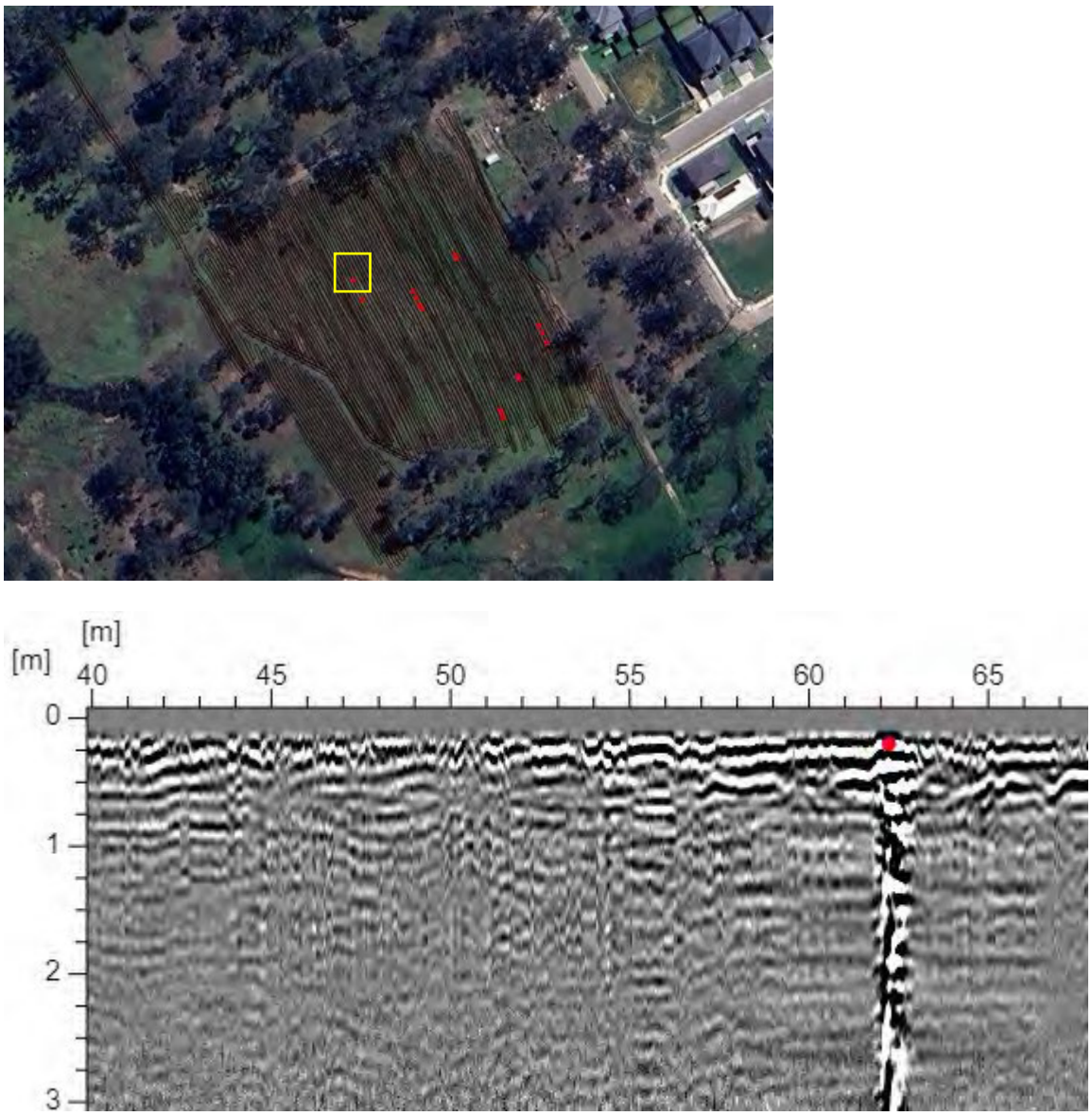

Figure 13. Anomaly found in the 2D radargram that may relate to a near-surface feature. This anomaly may indicate a metallic feature due to its high contrast in comparison to the remaining radargram horizons. Data continues to show heavy attenuation from approximately 0.5m depth, causing interpretations of anomalies to be difficult. A signal velocity of 112m/μs is applied to the dataset.

4.0 Discussion

4.1 Analysis of Results

Overall data acquisition was sufficient throughout the survey area. Total coverage of the survey area was in line with the scope and covered areas that were deemed surveyable during the site visit preceding the day of acquisition. Multiple subsurface anomalies were found that have the potential to be archaeological features.

Figure 8 portrays a series of hyperbolae found at approximately 0.6m depth. The subsurface feature seems to appear interlaced in a stratigraphic layer that is noticeably consistent throughout the area at approximately 0.5m depth. The subsurface anomaly found in Figure 8 was marked as a possible archaeological feature and appears isolated from other neighbouring features that could be associated with potential fill material. Signal attenuation is evident from approximately 1m depth throughout the radargram and is consistent throughout the swath acquired. Depth penetration is poor as a result, and depths greater than 1m are heavily attenuated, exhibiting unfavourable ground conditions for radar.

Figures 9 and 10 also exhibit similar characteristics to Figure 8's anomaly as they appear as a series of hyperbolae, being located at a similar depth as well as being situated in the locality of a stratigraphic layer. Signal attenuation throughout the northeastern and eastern area was poor and did not improve upon mobilising the radar in different sections of the area. Figure 9 portrays limited depth penetration at approximately 0.75m, the radargram in Figure 10 shows limited depths of approximately 1m. As these two anomalies are in the vicinity of one another, this would further reinforce altering subsurface conditions throughout the survey area. The anomaly portrayed in Figure 9 appears in higher contrast in comparison to the anomaly depicted in Figure 10, indicating that the anomaly in Figure 9 may be metallic in nature.

Figure 11 displays data that exhibits an indication of a potential archaeological feature and appears as a cluster of hyperbolae at approximately 0.53m depth. The feature appears isolated and is found towards the central section of the survey area. The anomaly appears to be situated beneath a stratigraphic layer, much like the features found in Figures 8-10, and also appears at a similar depth. Signal attenuation continues to be evident throughout the radargram from a depth of approximately 0.5m and continues to depict heavy attenuation much like the data acquired in the northeastern and eastern sections of the area. The anomaly appears in high contrast and appears situated in the vicinity of two other high contrast features, possible metallic features, at similar depths of approximately 0.5m. Signal attenuation in this area continues to be poor, with radar depth penetration being limited to approximately 1m.

Figures 12 and 13 portray marked near surface anomalies that appear in high contrast in comparison to the remainder of the radargram. These anomalies appear to have the potential to be metallic features (due to their very high contrast) and appear as large columns in the dataset. Signal attenuation continues to be poor in the central section of the survey area, with no noticeable features being interpretable apart from the near surface anomalies marked in Figures 12 and 13, with depth penetration being limited to approximately 0.5m. Data collected in the western and northern sections of the survey area also exhibited significant attenuation, with no evident anomalies indicating targets of interest marked, with depth penetration being limited to approximately 0.5m-1m in most in these sections.

The general signal velocity achieved throughout the site varied, where signal velocity is utilised to determine time to depth conversions of located anomalies. Signal velocities altered from 112m/µs in the main survey area, seeing increases towards the southwestern section of the survey area of 125m/µs. Signal velocity across the fence line showed increases of up to 140m/µs, indicating that subsurface conditions altered throughout the entirety of the survey area. Therefore, the provided depths are estimates only and may possibly vary from what has been provided. The overall resolution and depth penetration achieved in the survey area was unsatisfactory and was most likely a result of unfavourable, conductive subsurface conditions such as clay and possible saturation from previous days rainfall.

5.0 Conclusions

5.1 Summary of Key Findings

Notable and key findings from the GPR survey included:

- Multiple subsurface anomalies of unknown nature were marked throughout the site. These anomalies were located between the surface and approximately 0.6m.
- Near surface anomalies with a potential metallic nature were marked. These anomalies were found in the vicinity of the unknown natured anomalies towards the central survey area.
- Data was heavily attenuated throughout the survey area, alluding to unfavourable subsurface materials (conductive) that in turn diminish radar resolution and depth penetration with depth penetration being limited to a maximum of approximately 1m depth in most sections of the survey area. This may possibly be a result of saturated ground conditions due to rainfall occurring on prior days to acquisition.

5.2 Conclusions

Based on the detection and interpretation of the notable and key findings above, it can be concluded that the GPR survey returned results that were inconclusive in the determination of archaeological artefacts or burials.

The survey area coverage as per the survey scope was great, certain obstacles (trees, outcropping rocks, logs and surface holes) limited full coverage, however the areas affected by these obstructions were minimal. GPS exposure was excellent in the entirety of the survey area with no overhead obstructions causing interference or dropouts. GPR data was heavily attenuated throughout the entirety of the survey area. This is likely due to unfavourable conductive materials for radar, as well as the ground being slightly saturated and mixed with clays. Anomalies marked have potential to be of archaeological nature, however, ultimately do not differ to other subsurface features such as rocks, tree roots and fill features. Furthermore, as a significant dielectric contrast is required to image subsurface targets in greater accuracy and resolution, not all targets may have been imaged as a result. However, while the GPR results are not conclusive, they offer supportive information to make more informed decision making.

6.0 Disclaimer

It should be noted that the attached results are the result of an interpretation of the collected data. Whilst state-of-the-art instrumentation and qualified personnel have been utilised for this survey there are circumstances under which the interpreted result can differ from the actual sub surface strata.

The author accepts no responsibility for actions or decisions made on the basis of the presented result. The results are presented for the clients' review only and should not form the sole basis of any decision or action made in relation to this project.

This report has been prepared for the use of the client as listed on page 1 in accordance with general accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report.

This report was prepared on completion of the fieldwork/processing and is based on conditions encountered and reviewed at the time of preparation. MALA GPR Australia disclaims responsibility for any changes that might have occurred after this time.

This report should be read in full, no responsibility for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Only qualified legal practitioners can give legal advice.

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue; conditions on the site can change in a limited time. This should be borne in mind if the report is used after a protracted delay. As with any form of non-destructive testing, our opinions of results do not apply, we rely solely on date collection and criteria conformance.

If it is found that the actual results differ from the interpreted result the author should be contacted immediately.