



Orange Abattoir Archaeological Survey Report

Prepared for Geolyse

22 January 2016

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Biosis

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Abbreviations

ACHA	Aboriginal Cultural Heritage Assessment
AHIMS	Aboriginal Heritage Information Management System
DECCW	former Department of Environment, Climate Change and Water now OEH
EPA Act	Environment Planning and Assessment Act 1979
EPBC	Environmental Protection and Biodiversity Conservation
ICOMOS	International Council on Monuments and Sites
LALC	Local Aboriginal Land Council
LGA	Local Government Area
NISP	Number of Individual Species Present
NPW	National Parks and Wildlife
NPWS	National Parks and Wildlife Service
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAD	Potential Archaeological Deposit
SLNSW	State Library of New South Wales

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Summary

Biosis Pty Ltd has been commissioned by Geolyse to undertake an Archaeological Assessment to accompany their lodgement of a Planning Proposal for the proposed rezoning of lots from industrial and primary production lots to large lot residential.

An assessment in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) 'the due diligence code' has been undertaken for the Project Area in order to inform responsibilities with regards to Aboriginal cultural heritage in the area. In addition to the basic tasks required for a due diligence assessment, an extended background review, as well as an archaeological survey in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b)* was conducted, in order adequately map areas of high, moderate and low archaeological sensitivity.

Consultation with the Aboriginal community is not a formal requirement of the Due Diligence process and has not been undertaken as part of this assessment. Any further cultural heritage works at this site will require Aboriginal community consultation. The survey located a total of 20 Aboriginal heritage sites; if these sites will be impacted during the proposed development then Aboriginal heritage stakeholder consultation must be undertaken as outlined in the *Aboriginal cultural heritage consultation requirements for proponents (DECCW 2010c)*.

Archaeological survey was conducted from 4 January to 8 January 2015 with a field team of two Biosis archaeologists. A total of 24 transects were undertaken throughout the different landforms with the walking transects being undertaken approximately two metres apart. The archaeological survey identified 20 Aboriginal heritage sites in the Project Area.

The following management recommendations have been developed relevant to the Project 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 of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010).

Prior to any impacts occurring within the Project Area, the following is recommended:

Recommendation 1: Further archaeological assessment

Areas identified as having a Potential Archaeological Deposit (PAD) (OA03, OA04, OA05, OA06, OA11, OA12, OA13, PAD 01, PAD 02, PAD03, PAD 04, PAD05 and PAD 06) should be avoided wherever possible. If impact to these areas cannot be avoided subsurface investigations (test excavations), undertaken in accordance with the code, will be required prior to the commencement of works. Consultation with Aboriginal stakeholders according to the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010) ('the consultation requirements') will be required for the development to proceed.

Recommendation 2: Application for an Aboriginal Heritage Impact Permit (AHIP) for the entire Project Area

If the proposed works cannot avoid harm to OA01, OA02, OA03, OA04, OA05, OA06, OA07, OA08, OA09, OA10, OA11, OA12, OA13, OA14, PAD 01, PAD 02, PAD03, PAD 04, PAD05 and PAD 06 it is recommended that an application be made to the Office of Environment and Heritage (OEH) for an area based Aboriginal Heritage Impact Permit (AHIP) for the entirety of the Project Area. The AHIP should include the following conditions:

- Impact can occur to the Aboriginal cultural heritage sites OA01, OA02, OA03, OA04, OA05, OA06, OA07, OA08, OA09, OA10, OA11, OA12, OA13, OA14, PAD 01, PAD 02, PAD03, PAD 04, PAD05 and PAD 06. All of the sites occur within the proposed works area.
- The isolated artefacts (Sites OA01, OA02, OA07, OA09 and OA10) should be relocated prior to ground disturbance and moved outside of the impact area, but within their original landscape context.
- At sites OA03, OA04, OA05, OA06, OA11, OA12, OA13 and OA14, the surface artefacts should be relocated prior to ground disturbance and moved outside of the impact area, but within their original landscape context. Any subsurface archaeological material located within the impact area, with the exception of human remains, can be destroyed.
- Impact within the limits of the area based destruction AHIP for any further Aboriginal objects encountered during construction unless human remains are involved.

For information about AHIPs and their preparation, see below.

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. The OEH issues AHIPs under Part 6 of *the National Parks and Wildlife Act 1974* (NPW Act).

AHIPs should be prepared by a qualified archaeologist and lodged with the OEH. 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 OEH for the processing of AHIPs, which is dependent on the estimated total cost of the development project.

Where there are multiple sites within one project area an application for an AHIP to cover the entire project area is recommended.

Recommendation 3: Discovery of Aboriginal ancestral remains

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity you must:

- Immediately cease all work in the vicinity and not further move or disturb the remains.
- Notify the Coroners Office and NSW Police immediately. Following this, contact OEH's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location. The find must also be reported to the Aboriginal parties.
- Not recommence work at that location unless authorised in writing by OEH.

Recommendation 4: 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.

□□ Introduction

1.1 Project background

Biosis Pty Ltd has been commissioned by Geolyse to undertake an Archaeological Assessment to accompany their lodgement of a Planning Proposal for the proposed rezoning of lots from industrial and primary production to large lot residential.

An assessment in accordance with the 'due diligence code' has been undertaken for the Project Area in order to inform responsibilities with regards to Aboriginal cultural heritage in the area. In addition to the basic tasks required for a due diligence assessment, an extended background review, as well as an archaeological survey in accordance with the code was conducted, in order to adequately map areas of high, moderate and low archaeological sensitivity.

This report is intended to inform decisions relating to the management of Aboriginal cultural heritage and if required to form the basis for further approvals required under Part 6 of the NPW Act.

1.2 Project Area

The Project Area covers an area of approximately 290 hectares and is located within Orange City Council, Parish of Orange, County of Wellington (see Figure 1). The Project Area consists of;

- Lot 15 DP6694
- Lot 3 DP255983
- Lot 2 DP255983
- Lot 14 DP6694
- Lot 25 DP6694

The Project Area is also bounded by Clergate Road and the main western railway on the west and Pearce Lane in the north (Figure 2).

1.3 Project Development

The Project development will involve the rezoning Lot 15 from industrial purposes and Lot 3, 2, 14 and 25 from primary production purposes to large residential lots (see Figure 1).

1.4 Planning approvals

The planning proposal will be considered against Part 3 of the *Environmental Planning and Assessment Act 1979* NSW. Other relevant legislation and planning instruments that will inform this assessment include:

- *Environmental Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979* (NSW)
- *National Parks and Wildlife Act 1974* (NSW)
- *National Parks and Wildlife Amendment Act 2010* (NSW)
- *Infrastructure SEPP 2007*

- *Orange Local Environmental Plan 2011*

1.5 Assessment objectives

The following is a summary of the major objectives of the assessment:

- Conduct extensive 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 Project 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 Project Area using ethnohistory and the archaeological record.
- To formulate a model to predict the type and character of Aboriginal sites likely to exist throughout the Project Area, their location, frequency and integrity.
- To conduct a field survey of the Project Area to locate unrecorded or previously recorded Aboriginal sites and to further assess the archaeological potential of the Project 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 Project Area
- To recommend strategies for the management of Aboriginal cultural heritage within the context of the proposed development.

1.1 Aboriginal consultation

Consultation with the Aboriginal community is not a formal requirement of the Due Diligence process and has not been undertaken as part of this assessment. Any further cultural heritage assessment works at this site will require Aboriginal community consultation. If Aboriginal heritage items are located during construction and will be impacted by the construction then Aboriginal heritage stakeholder consultation must be undertaken as outlined in the consultation guidelines.

Figure 1 Location of the Project Area

Figure 2 Project Area

□□ Investigators and contributors

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

Table 1 Investigators and contributors

Name	Qualifications	Experience
Amanda Atkinson	Ba (Arch/Paleo), Grad Dip. Arch	9 years
Amanda Atkinson is a consultant archaeologist with Biosis Pty Ltd Wollongong office. Amanda has nine years archaeological consulting experience across south-eastern and western Australia. She is experienced in all aspects of heritage consulting with specialisation in Aboriginal archaeology. Amanda has extensive experience in the successful completion of Aboriginal and Historical assessments, archaeological surveys, excavations, permits and management plans. She is accomplished in obtaining approvals under the <i>NSW National Parks and Wildlife Act 1974</i>. Amanda has extensive experience in the successful completion of Aboriginal and Historical assessments, archaeological surveys, excavations, permits and management plans. Amanda is a diligent and highly experienced heritage consultant with extensive experience in project management. She is easily able to develop excellent working relationships with project stakeholders and manage and negotiate the relationship between Aboriginal stakeholders, government regulators and clients.		Project Roles • Lead cultural heritage advisor • Field survey • Project management • Development of recommendations • Preparation of the report
Shannon Smith	BA, Grad Dip Arch	5 years
Shannon Smith is a field archaeologist with Biosis Pty Ltd Wollongong office. Shannon has five years archaeological consulting experience and has conducted over 70 heritage projects across South Australia and Western Australia. She is experienced in all aspects of heritage consulting and has extensive experience in archaeological surveys and excavations, reporting, permit application, grant applications and analysis of cultural material. Shannon specialises in Aboriginal archaeology, with particular research interests in open air-artefacts scatters and shell middens. Shannon has primarily undertaken projects in the Pilbara region of Western Australia and has operated as the heritage consultant within large multidisciplinary teams tasked with managing heritage values. Shannon is a diligent and highly experience heritage consultant with extensive experience in project management. During her career she has worked in collaboration with a number Aboriginal Corporations, Aboriginal stakeholders, development proponents, mining companies and government regulators.		Project Roles • Field survey • Preparation of the report • Development of recommendations

Name	Qualifications	Experience
Ashleigh Pritchard	Diploma of Spatial Information Services (GIS)	5 years
Ashleigh is a GIS Operator with the Wollongong office of Biosis Pty Ltd. She has five years experience in the field of mapping and has contributed to over 400 consultant reports in both the Natural and Cultural heritage teams across New South Wales, Victoria and Queensland for a diverse range of clients. Ashleigh has utilised the functionality of GIS to undertake spatial analysis projects such as calculations of habitat loss as well as georeferencing and digitising. She has extensive experience in spatial data management and map production for large, ongoing impact monitoring projects in New South Wales Ashleigh has experience in the use of GIS in assessing and preparing high quality maps to support information for biodiversity offset requirements, including mapping of vegetation at a regional scale, assessment of 100 hectare and 1000 hectare assessment circles, connectivity assessment, calculation of vegetation cover pre- and post-development and development of assessment tools using remote sensing and handheld computers (tablets). Ashleigh has utilised a variety of software packages to create map products throughout her career including ArcMap, AutoCad and MapInfo Professional		Project Roles • Mapping
James Shepherd	Ba of Arts Informatics (Hons)	9 years experience
James Shepherd is a Senior GIS Officer working with Biosis Pty Ltd since February 2011, with over nine years professional experience in the use and application of GIS to various disciplines, particularly within the environmental and heritage consulting sectors. James is experienced in map production, spatial analysis and spatial data management and has worked with numerous clients across Australia from a range of business sectors. James is a qualified esri trainer in a number of official esri ArcGIS Desktop courses from beginner to advanced level. James has previously worked as an archaeological and heritage consultant including assisting with heritage and archaeological assessments and management plans for a number of large sites across NSW and Victoria. James has contributed to over 100 consultant reports in both the Natural and Cultural heritage teams in the form of figure production, field data preparation and management, spatial analysis, landscape interpretation and quantitative impact analysis (e.g. vegetation impacts calculations). James possesses strong analytical and problem solving skills.		Project Roles • Mapping

□□ Previous archaeological assessments

A number of Aboriginal cultural heritage investigations have been conducted within the local area around the Project Area. These investigations, briefly summarised below, include the following:

Pearson (1979) undertook a survey targeting two creek valleys north of the Mitchell Hwy between Lucknow and Bathurst. Forty-two sites were recorded, with artefacts numbering between one and 92 at each site.

Pearson (1981) analysed the patterns of Aboriginal and early European settlement within the Upper Macquarie Region. This study included three shelters excavated, providing occupation dates of around 7,000 BP.

Kelton (1994) undertook a heritage assessment at Moulder Hill, 15 kilometres north of Orange. During the survey a scarred tree and an isolated artefact were located. Both sites were recorded close to an ephemeral drainage line.

Kelton (1996) undertook a heritage assessment of the 560 hectares at Ophir Reserve, north east of Orange. During this survey one previously recorded site was relocated (44-2-20) and three additional scarred trees. These sites were situated on an elevated area overlooking a creek line

Hughes and Johnston (1995) was commissioned to undertake an aboriginal assessment of the proposed routes for an access road, water pipeline and 132 kilovolt (kV) transmission line. During this assessment a total of seven Aboriginal sites, all open artefact scatters were recorded. Six sites were located within the proposed 132 kV transmission route and the others were stated within the proposed road access route to the mine site. No sites were recorded along the water pipeline route.

Oakley (2002) undertook an Aboriginal assessment of the Suma Park and Spring Creek Reservoirs, located near Orange. During this assessment a total of seven artefact scatters were recorded. The sites were located along the low gradient spurs. The artefact analysis recorded that the primary raw material was quartz with artefacts of basalt and chert also recorded. The majority of artefacts were flakes and broken flakes, with several cores also recorded.

Heritage Concepts (2003) were commissioned by Parsons Brinckerhoff to complete an Aboriginal and Historic Archaeological and Cultural Assessment. The survey investigated 632 hectares of land. A total of two sites were identified along with a number of areas highlighted as PADS.

OzArk (2009) undertook survey of 212 hectares between Leeds Parade and the Ophir Road Orange. The project surveyed hilly country interspersed with ephemeral and permanent creeks again. The survey recorded nine Indigenous sites and one PAD (Ozark 2009).

Appleton (2005) undertook an Aboriginal cultural assessment over the Euchareena Road Resource Recovery Centre, known as 'the hub site'. During the survey a scar tree (44-1-0080) and an open site comprising of a grinding stone and hand axe (44-1-0081) were recorded. It was noted that the find spot of the items is considered to be secondary and that the artefacts were not originally from that location. The proposed project did not affect the Aboriginal sites. In 2009 Ozark was commissioned by R.W.Corkery & Co. Pty Limited on behalf of Orange City Council to provide management recommendations for the identified Aboriginal heritage sites by Appleton in 2005. Ozark recommended that an Aboriginal Heritage Management Plan be written.

NTSCORP (2012) was engaged by Orange City Council to undertake an Aboriginal Heritage Study of land within the Orange City Council boundary. The purpose of the investigation was to consult with the Orange Aboriginal community, prepare a thematic history, identify and assess sites of significance and provide management recommendations. An archaeological survey was not conducted as part of the investigation;

instead information was gathered from the AHIMS data base maintained by OEH. A search of the on-line facility in July 2011 showed that 40 sites have been recorded since 2002. Most sites have been recorded as part of commercial and residential developments. The investigation revealed that there are no dates for Aboriginal sites in the Orange district. The oldest dates obtained from a site in the wider area is from two rock shelters at the Granites approximately 60 kilometres to the south-east of Wellington. Occupation began at this site in 7150 BP.

Hanson (2012) was engaged by R W Corkery & Co Pty Ltd to create an Aboriginal Cultural Heritage Management Plan for the East Guyong Quarry. The Quarry is located approximately 22 kilometres southeast of Orange. No Aboriginal sites were identified.

Pardoe (2013) was engaged by Barrick to prepare an Aboriginal Cultural Heritage Assessment for the Cowal Gold Mine Extension Modifications. The Cowal Gold Mine is located approximately 38 kilometres north-east of West Wyalong. The field survey of the proposed disturbance areas associated with the Modification were carried out over a period of four days. Based on the results from previous surveys, three registered Aboriginal heritage sites, all artefact scatters (43-4-0021, 43-4-0022 and 43-4-0024) and the Wamboyne Back Plains Site 1 (43-4-0044) were located. Other objects have also been previously recorded and collected from within the area during previous cultural heritage assessments and surveys, however these objects represent a component of the regional background distribution rather than individual sites.

Ozark (2014a) were commissioned by Peter Basha Planning and Development to undertake an archaeological assessment of Lot 99 DP 756869 and Lot 43 DP1154795 located at Silverdown Way and Dean Drive. The project proposed to develop the areas into a Residential subdivision. During the survey no new sites were recorded and no archaeologically sensitive landforms were identified. Areas identified as areas of 'Aboriginal Archaeological Potential', as identified by **Heritage Concepts (2003)** were reassessed. It was concluded that those landforms were not archaeologically sensitive, nor likely to contain unidentified archaeological deposits.

Ozark (2014b) was commissioned by Fenlor Group Pty Ltd, on behalf of Landorange Partnership to undertake an Aboriginal heritage assessment of the rezoning on a portion of land approximately 5 kilometres north-east of Orange. No new Aboriginal sites were identified within the Survey Area, although two pieces of rhyolite were noted, but there was not sufficient information to classify them as stone artefacts.

Williams (2014b) was engaged by Geolyse to undertake an Aboriginal Heritage Due Diligence Assessment of the Orange Southern Feeder Road Stage 1 area. The area had been previously surveyed by the Orange LALC who had identified three potential scarred trees and one stone artefact. These locations were inspected during this assessment and it was determined that they were not sites. The results from the assessment was that the development could proceed with causation and no further archaeological assessment was required.

NSW Archaeology (2015) was engaged by Geolyse to conduct an Aboriginal heritage assessment of Summer Hill Estate, north of Orange. A field inspection was conducted and eleven sites were located and recorded within the survey area. All eleven sites consisted of isolated stone artefacts. The artefacts were recorded in generally disturbed areas and it was argued that they did not possess an archaeological potential deposit. The final recommendations were that an Aboriginal Cultural Heritage Assessment Report and formal Aboriginal Consultation be undertaken prior to work commencing. An AHIP would also be needed for all eleven sites.

Access Archaeology & Heritage (Williams 2015) was commissioned by Geolyse Pty Ltd to undertake an Aboriginal Cultural Assessment of a proposed pip line installation intended to service the South Orange Urban Release Area. This assessment followed an Aboriginal Heritage Due Diligence study (**Williams 2014a**) that recorded one scatter of two stone artefacts on the surface of Hawkes Lane. During the assessment Aboriginal community consultation was undertaken. The proposed development would impact on both sites

and a final recommendation of the assessment was that an AHIP was needed for both sites. Williams concluded that due to the fact that these sites were located in poor visibility, there was potential for more widespread archaeological remains within the survey area.

3.1.1 AHIMS site analyses

A search of the NSW OEH Aboriginal Information Management System (AHIMS) database was conducted on 11 December 2016. The search identified 6 Aboriginal archaeological sites within a 10 kilometre search area, centred on the proposed Project Area (see Table 2). None of these registered sites are located *within* the Project Area (see Figure 4). 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 on but notable discrepancies occurred.

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.

Table 2 AHIMS search results.

AHIMS site no	Site name	Site status	Site type
44-2-0094	Moulder Hill ST-1;MH/ST-1	Valid	Modified Tree (Carved or Scarred) : -
44-2-0202	MPA PASA2	Valid	Potential Archaeological Deposit (PAD) : 1
44-2-0184	MPA2	Valid	Artefact : 1
44-2-0185	MPA3	Partially Destroyed	Artefact : 1, Potential Archaeological Deposit (PAD) : 1
44-2-0186	MPA4	Destroyed	Artefact : 1
44-2-0144	Burrendong 1	Valid	Artefact : -

Table 3 AHIMS results, site types and frequencies

Site type	Number of occurrences	Frequency (%)
Artefact	3	50
Artefact and PAD	1	17
PAD	1	17
Modified tree (Carved or Scarred)	1	17
TOTAL	6	100

Figure 3 AHIMS search results

□□ Project Area context

A desktop assessment has been undertaken to review existing archaeological studies for the Project Area and surrounding region. This information has synthesised to develop an Aboriginal site prediction model for the Project Area and identify known Aboriginal sites and/or Places recorded in the Project Area. This Desktop Assessment has been prepared in accordance with requirements 1 to 4 of the code.

4.1 Landscape context

It is important to consider the local environment of the Project Area in 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.

4.1.1 Topography and geology

The Project Area is located within the South Eastern Highlands Bioregion, which occupies approximately 6.11 percent of NSW. This bioregion is located inland from the coastal bioregion of the Sydney Basin. This bioregion includes most of the ACT into Victoria.

The topography of this bioregion includes the dissected ranges and plateau of the Great Dividing Range. It extends to the Great Escarpment in the east and to the western slopes of the inland drainage basins. The landscape includes undulating to rolling low hills north of Orange ranging from 750-900 metres above sea level. In parts steep and rocky, with slopes 6 -10 percent. Slopes are from 50 - 100 metres long, averaging 450 metres. Local relief average 40 metres, ranging from 20-60 metres. The drainage channels are fixed and widely spaced from 650-1000 metres apart. The Mullions Range is located within the north-east of the Project Area and reaches a height of approximately 900 metres above sea level.

The Project Area is located within the Oakdale geological formation (Oco), which is dominated by Mafic volcanic sandstone, basalt, siltstone, black shale, chert, breccia and conglomerate (see Figure 4). It is important to understand the geological formation of the area in order to understand the raw materials that would have been available for the production of stone tool. If raw materials are recorded within an area that are not characteristic of the local geological formation, this gives a good insight into local trade of raw material within the wider area.

4.1.2 Soil landscapes

The main soil landscape within the Project Area is North Orange (see Figure 5). There is also four other soil landscapes in the wider region that are associated with Summer Hill Creek, which is the main creek east of the Project Area. A summary of the North Orange soils is provided in Table 4.

Table 4 Soil landscapes within the Project Area (Kovac, Murphy & Lawrie 1989)

Soil landscape	Description
North Orange (no)	Red Earths (Gn2.11 and Gn2.14) on upper slopes and shallow lithosols on crests and sideslopes. Yellow earths (Gn2.34 and Gn2.24) appear on lower slopes with brown Solodic and yellow Solodic soils (Db1.42, Db2.22, Dy3.41 and Dy3.42) in drainage depressions. Other soils include Non-calcic Brown soils (Dr.2.22 and Dr1.22), Red and Brown Podzolic Soils (Dr2.21, Dr2.11 AND Db1.41), gravely earths (Gn2.14, Dn2.4 and Gn2.7) and yellow Solonetzic soils (Dy3.43).

4.1.3 Hydrology

The Project area is also located within the Macquarie – Castlereagh catchment area, which covers an area of 91,985 kilometres squared. The Macquarie–Castlereagh region varies from steep terrain in the east to open plains in the west where the Ramsar-listed (An area that has been designated under Article 2 of the Ramsar Convention under the EPBC Act) Macquarie Marshes are located. Within this catchment area there are several distributary rivers and creeks that enter the Macquarie River, including Turner River and Summer Hill Creek. Summer Hill Creek is located east of the Project Area and is a tributary of the Macquarie River. A number of wetlands in the bioregion are regarded as nationally important and listed in the Directory of Important Wetlands in Australia.

Within the Project Area itself there are a number of drainage lines and a large drainage area, which all feed into a main creek line within the centre of the Project Area. The main creek line also feeds east into Summer Hill Creek.

4.1.4 Rainfall

Within the South Eastern Highlands Bioregion the mean annual rainfall is 460 – 1883 millimetres, with a minimum monthly average of 23 – 98 millimetres. The closest active weather station to the Project Area is the Orange Agricultural Institute (station 063254, established 1966). Orange has a maximum mean rainfall of 95.6 millimetres and a minimum mean of 53.1 millimetres (BOM 2015). This information can help us assess the likelihood of water in the area, which will affect the location and type of cultural material. During the fieldwork both dry and wet weather was experienced during the survey.

4.1.5 Temperature and weather conditions

This bioregion is dominated by a temperate climate characterised by warm summers and no dry season. Significant areas in the north and south of the bioregion are at higher elevations in a montane climate zone, where summers are much milder.

The township of Orange (station 063254), has an annual average maximum temperature of 26.4°C and an average minimum temperature of 1.5°C (BOM 2015). Temperature and weather condition in the areas allow a better understanding the natural environmental conditions and how these would have effect on previous Aboriginal subsistence patterns.

4.1.6 Vegetation

The area surrounding the Project Area supports natural and modified vegetation communities. The term *modified* is used to describe land where the original natural vegetation cover has been cleared and replaced with agricultural land uses. The state of vegetation in these modified areas varies considerably from recently cropped areas to regenerating native vegetation. Although significant areas of natural vegetation cover the Project Area, most plant communities have been disturbed or degraded as a result of altered water regimes, physical disturbance from earthworks, livestock and pest animal grazing, weed invasion and forestry activities. Despite extensive land clearance in the region since the 1830s, environments containing important plant communities remain throughout the Central West. By looking at these environments on a regional scale it can give some indication of the landscapes of the Central West as they appeared and the ways in which they have changed since then (Kass 2003).

Within the wider bioregion there are a number of different vegetation communities which have been summarised in Table 5. The Project Area also has some initial vegetation mapping, which shows that there are pockets of Blakely's red gum (*Eucalyptus blakelyi*) and Yellow box (*Eucalyptus melliodora*) open woodlands of the tablelands. Vegetation was also an important resource for hunting and foraging as well as for constructing tools and other utilities.

Table 5 Vegetation within the bioregion

Landscape	Vegetation
Lower areas	Yellow box <i>Eucalyptus melliodora</i> , Red box <i>Eucalyptus polyanthemos</i> and Blakely's red gum <i>Eucalyptus blakelyi</i> , with areas of white box <i>Eucalyptus albens</i> . Grey gum <i>Eucalyptus punctata</i> and Blaxland's stringybark <i>Eucalyptus blaxlandii</i> .
Associations dominate hills in the west of the bioregion	Red stringybark <i>Eucalyptus macrorhyncha</i> , broad-leaved peppermint <i>Eucalyptus dives</i> and white gum <i>Eucalyptus rossii</i> .
Main streams	River oak <i>Casuarina cunninghamiana</i> .
Higher areas	Brown barrel, mountain gum <i>Eucalyptus dalrympleana</i> , narrow-leaved peppermint <i>Eucalyptus radiata</i> and ribbon gum <i>Eucalyptus viminalis</i> .
Rocky outcrop	Patches of black cypress pine <i>Callitris endlicheri</i> .
Cold plateaus	Pen woodlands of snow gum and black sallee <i>Eucalyptus stellulata</i> .

4.1.7 Landscape resources

Resources in the vicinity of the Project Area would have provided adequate sources of nutrition for subsistence activities; however these resources would be largely tied to seasonal variations and the flow of the nearby rivers. The Wiradjuri people relied on staple food resources provided by the major rivers in their country – the Macquarie, Lachlan and Murrumbidgee Rivers. In the dry season the food from the rivers was supplemented with meat (kangaroo and emus) and vegetables – fruit, nuts, yam daisies, wattle seeds and orchid tubers (Niche 2014).

A selection of resources has been compiled into Table 6 to give an indication of the resources available to local Aboriginal groups. Notably, the majority of the food sources mentioned in Table 6 are located within or in close proximity to rivers and lakes. This has partially to do with the greater availability of resources in these environments, particularly in the summer months, but it is also tied to early ethnographic observations made by explorers and surveyors.

Table 6 Landscape resources available to local Aboriginal groups

Plant / Animal	Aboriginal use
Emus / emu eggs	Food source (Allen 1974; Mitchell 1835)
Kangaroo	Food source (Mitchell 1835)
Fish species	Food source, fat from these animals could also be used in medicine (Martin 2010). Fish and crayfish were taken from the rivers from September to May.
Freshwater snail	Food source (Martin 2010)
Marsh clubrush	Food source (Martin 2010)
Possum	Possums and larger grazing animals were hunted throughout the year. (Mitchell 1835)
Red / grey kangaroo	Food source, also used to make bags to hold seeds or water (Allen 1974), bone was used for bone points, and the teeth for fish hooks (Martin 2010)
River mussel/ Lake mussel	Food source (Martin 2010; Mitchell 1835)
Snakes and lizards	Food source (Martin 2010)
Wattle seeds fruit, nuts, yam daises, wattle seeds and orchid tubers	Food source (Niche 2014).
Waterfowl / other aquatic birds	Food source available in summer months in Riverine environments (Allen 1974)
Bracken fern	Food source (NTSCORP 2012)
Yabbies	Food source (NTSCORP 2012)

Figure 4 Geology

Figure 5 Soil Landscape

Figure 6 Hydrology

4.1.8 Post settlement land use and history

Ethnohistory

The Project Area falls within an area identified by Tindale (1974) as being within the boundaries of the Wiradjuri linguistic group. The Wiradjuri linguistic group covers a large portion of the central west. It was closely related to the Ngiyampaa language to the west and Gamilaraay to the north. Linguists refer to the three languages as the Wiradjuri group. A distinctive feature of the group was that they began with the term for “no” (“wira”) and concluded with the term for “having” (“djuri”). The Wiradjuri language was the predominate language spoken in the areas around Dubbo and Mudgee in the north, close to Albury in the south, from Bathurst in the east and as far west as Hay. It is not known if Wiradjuri was always the superordinate language name in the area or whether it had come to be used predominantly during the early period of European settlement. Tindale (1974) suggests that the Jeithi dialect of the south-west Wiradjuri may have been displaced to the area during this time. The language is no longer fluently spoken.

Owing to the disturbance of Aboriginal culture by the arrival and colonisation of Australia by Europeans in the 18th and 19th centuries, the actual boundaries of these groups are difficult to identify with great confidence. Martin (2006) studied ethnographic sources from early European observers in an attempt to define these boundaries.

The spiritual beliefs of the Wiradjuri were organised around sacred sites associated with mythical *jín*, which could be associated with a particular animal or plant. A person's *jín* was inherited from their mother, along with the responsibility of maintain the sacred sites associated within it. Individuals learn the stories and songs associated with their *jín* and were not allowed to eat or damage them. There are also other stories connected to specific *jíns* movements in the landscape as well as other mythological figures included Biarni, his emu wife Goobeorangelnaba and the giant serpent Kurree (NTSCORP 2012).

An analysis of the early ethnographic literature for the Orange district suggests that day to day, small groups of approximately 20-40 closely related people occupied local creeks and river valleys. They would move around in these small groups, using the river flats, open land and waterways with some regularity through the seasons, as indicated by the archaeological material that has accumulated in these areas. Traditionally, Wiradjuri people travelled to the alpine regions of the South Eastern Highlands and Australian Alps for the annual summer feast of bogong moths (Flood 1980).

The first explorers to enter the region also documented the Wiradjuri people. John Oxley expedition left Bathurst on 20 April 1817 and headed west, following the major waterways. Oxley described the environmental conditions as

'... the flats covered with acacia pendula; the last three miles were rather more elevated: the soil in general a loose, red, sandy loam, with small cypress, box, and acacia trees; a few acres in patches had been burned, occasionally relieving to the eye from the otherwise barren scrubby appearance of the country. We passed through two or three small eucalyptus scrubs, and upon getting out of one, having gone thirteen miles and a quarter, we fortunately happened to fall in a native well, containing a few gallons of water sufficient for our own supply; whilst the open level land which the scrub led to having been burnt, we hoped would afford succulent herbage sufficient for the horses, and prevent them from suffering from want of water...' (Oxley 1817).

Oxley's party encountered Aboriginal people in the Trundle area, north-west of Orange:

'... the country became more open; the grass had been burnt, and marks of the mogo or stone hatchet on the trees, made by the wandering natives of these deserts in search of food, gave us renewed hopes of soon coming to water.' *'...several transitory encampments of the natives were found, but none that had been inhabited within*

these four or six months; by all of them found abundance of the pearl muscle-shell so common on the Lachlan."
(Oxley 1917)

Sir Thomas Mitchell was another explorer who followed Oxley's path into the central west in the 1835. In Goobang Valley Mitchell encountered a number of local Aboriginal people, which was described as follows;

'...at length the sound of natives' hatches was heard, and one came forward to meet me. We learned from him we were on BURANBILL Creek, and that its course was SW towards Clare, or Lachlan River...' (Mitchell 1935).

Mitchel also encountered a chief, possibly in ceremonial dressing, and described his dress in his diary as;

'...emu feathers being mixed with the wild locks of his hair... One large feather decked the brow of the chief, which with his nose, was tinged with yellow ochre... to this personage the others paid the greatest deference and it is worthy to remark that they always refused to tell his names, or that of several others...' (Mitchell 1935).

Mitchell also described in his diary the diet and fishing practices of the Aboriginal people:

'... the principle food of these various tribes consisted of opossum, kangaroo and emu. Fishing was left entirely to the 'gins', was effectually, yet simply preformed by a moveable dame of long twisted dry grass, through which water only could pass... The 'gins' further used to gather fresh water muscles by lifting the shell out of the mud with their toes...' (Mitchell 1935).

A distinctive feature of Wiradjuri country was clusters of carved trees, which marked burials and initiation sites. The trees were decorated with geometric and figurative designs. One example is at Yuranigh's grave (Yuranigh's was a guide for Sir Thomas Mitchell) on Gamboola Station near Molong, which was marked by five carved trees (NTSCORP 2012) (see Plate 1).



Plate 1 Example of carved tree (SLNSW: SPF/1150)

Distinctive ceremonies were conducted for the burial of important individuals. William Govett, surveyor, observed an Aboriginal funeral near Goulburn in 1836. He wrote:

'...I was struck with the peculiarity of the noise... I soon perceived before me three native black women, and rode up to them. They were sitting around a mound of earth, with their heads depressed and nearly touching one another... They were each of them striking their heads with a tomahawk, holding the instrument in the right hand, and wounding particularly the upper part of the back of the head... They weep this way, wailing and cutting their heads, until they become perfectly exhausted, and can shed tears no longer... The trees all round the tomb were marked in various peculiar ways, some with zigzags and stripes, and pieces of bark otherwise cut...' (Briggs and Jackson 2011: 8.)

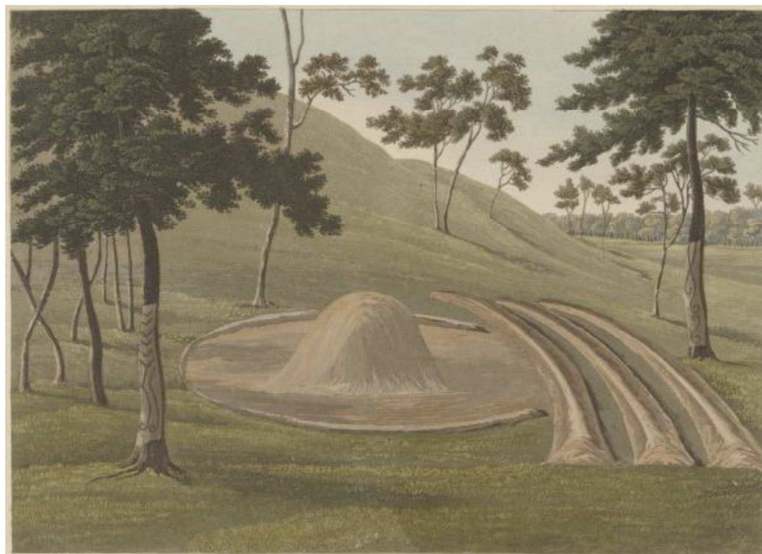


Plate 2 Example of mound burial (National Library of Australia: nla.pic-an8955101)

The initial relations between Aboriginal and European settlers were initially peaceful until paternalism expanded and damaged the local environment. From 1822, the Wiradjuri, led by a man named Windradyne, attacked a number of pastoral stations in an attempt to gain control of the area. Martial law was subsequently declared by Governor Brisbane in May of 1823 (Read 1988: 8-11). Following the period of martial law the earliest distribution of blankets to Aboriginal people in Bathurst is recorded in 1826. In all, 40 Aboriginal people were given blankets, 28 from "Binjung" and 12 from "Boohgan" (Aborigines, Returns of Aborigines, 1833-36, SRANSW 4/6666B.3.).

The Aboriginal population of Orange was also devastated by a smallpox outbreak in 1830 and 1831. The Wiradjuri in the district blamed the disease on Captain Sturt who has recently passed through the Wellington Valley. The impact of smallpox, which the Wellington and Lachlan River Wiradjuri called the "Thunna Thunna", was devastating and it has been estimated by doctors at that time to have killed between one in three and one in six of all Aboriginal people in the areas to which it spread.

Traditional Aboriginal life in the bioregion is considered to have ended by 1850 (HO and DUAP 1996). The *Sydney Morning Herald* reported in 1856 that the Aboriginal people in the south of the bioregion were extinct but the census indicated 166 Aborigines (likely to have been Ngarigo) around Cooma and 319 near Bombala (most probably Bidawal) (Pearson 1984: 63-68; Grant and Rudder 2005; Howitt 1904: 108. Mathews 1895, 1897 & 1898; NTSCORP, 2012).

Post settlement history

The European settlement of the Central West reflects the broader movement of people throughout NSW. In 1813 Surveyor George Evans crossed the Blue Mountains and entered the Central Tablelands, which began an era of official exploration. Two years later, Governor Macquarie proclaimed a Government Stock Established, staffed by soldiers and convicts, at the present site of Bathurst (Griffin 2004).

A number of commercial industries contributed in the increase in settlement in the region. The identification and mining of earth materials has been an important industry within the Central West since the 1840s. Settlers were attracted to the area by mining during both the nineteenth and early twentieth centuries. Within Australia the mineral Copper was first mined in NSW and in 1845 a number of copper mines were in operation in the Central West. Copper was discovered in Carcoar in the 1840s and in 1851 gold was discovered in Bathurst.

Gold was discovered in 1851 in Orange at the junction of Lewis Ponds and Summer Hill Creek. By the end of the month there were several hundred people panning for gold at Ophir along Summer Hill Creek. This was the beginning of a gold rush. This had the effect of tripling the population of Orange in a matter of months.

Agriculture was also a large industry that increased settlement in the region, with farmers from east NSW, Victoria and South Australia moving into the area. This industry also brought in a seasonal migration with works associated with the yearly harvest, planting or searing. There are the number of heritage listed farming homesteads and planting throughout the region.

The earliest public enterprise in the Central West was the building of a road over the Blue Mountains, to assist in the movement of settlers. In many areas of NSW the settlement of an area predates the building of major roadways. However, for the Central West the settlement could only occur once this infrastructure was built. The railway line reached Bathurst on the 4 April 1876. The construction of the railway altered settlement patterns.

A review of the contextual history in conjunction with the Thematic History of the Central West has identified a number of historical themes which relates to the occupational history of the Project Area. This is summarised in Table 7.

Table 7 Identified historical themes for the Project Area (Kass 2003)

Australian Theme	New South Wales Theme
Peopling Australia	- Migration - Convict
Developing local, regional and national economies	- Agriculture - Commerce - Environment - Exploration - Forestry - Health - Mining - Transport
Educating	- Education
Governing	- Defence - Government and Administration - Law and order
Developing Australia's Cultural Life	- Domestic life - Leisure - Religion - Sport
Marking the phases of life	- Birth and Death

Predictive model

A model has been formulated to predict the type and character of Aboriginal cultural heritage sites likely to exist(ed) throughout the Project Area and where they are more likely to be located.

This model is based on the regional and local distribution of sites as recorded in the AHIMS register and regional and local studies focused on site distribution. The key factors required to build the predictive model include:

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

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the survey and subsequent sub-surface investigations across the present Project Area (Table 11).

The concept of site prediction is certainly not new; the more it is possible to explain what processes took place to create a site, the more this knowledge can be used to say where other sites are likely to occur. Witter argues that 'sites are near water' approach is not prediction in a scientific sense but should be referred to as forecasting (Witter 1992: 279). A predictive model generalises the distribution of Aboriginal heritage sites by looking at the environmental elements, vegetation, physiographic features and soils. These factors influence the human interaction with the environment. It is also important to assess biasing factors (Witter 1992:258).

5.1 Wider region

In 2012 NTSCORP undertook a review of the registered AHIMS Aboriginal sites within the wider Orange area (see Chart 1). The review determined that Open camp sites, consisting of stone artefacts and hearths, were the most common site type found in the area. These site types are most commonly located in close proximity to reliable water sources and were found along ridges and slopes overlooking the creek, but not on the flat. These sites were believed not to have been located on the flats due to the poor drainage and cold temperatures in the low lying region. The second most common site types in the area were carved or scarred trees. As mentioned above, a distinctive feature of the Wiradjuri country was clusters of carved trees which marked burials of important people and initiations sites. The trees were richly decorated with geometric and figurative designs.

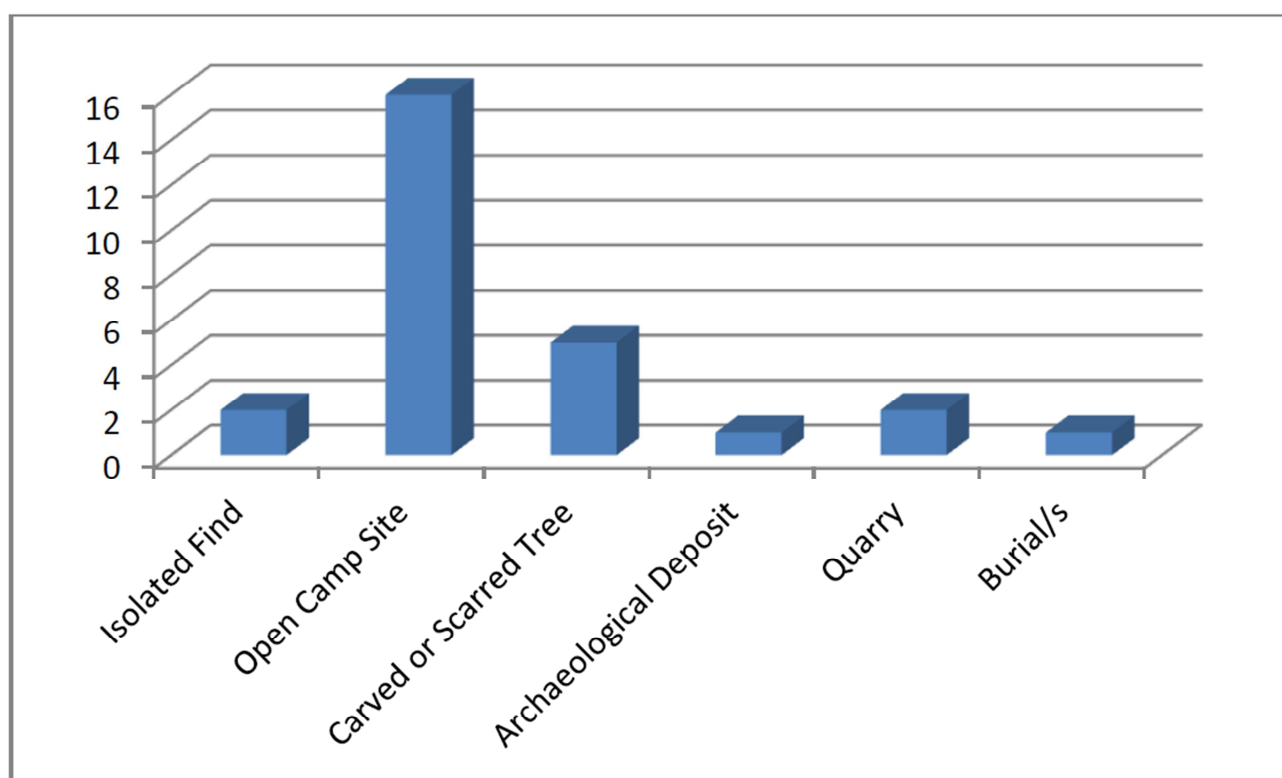


Chart 1 AHIMS site types in the wider Orange region (NTSCORP, 2012)

5.2 Local region

5.2.1 Analysis of Aboriginal occupation

AHIMS

A total of 6 previously recorded AHIMS sites are located in close proximity to the Project Area.

Table 8 Summary of the AHIMS site types recorded within the local area

Site types	Number of sites	Percentage (%)
Artefact scatters	4	67
PAD	2	33.3
Modified tree	1	17
Total	6	100

5.2.2 Local soils

There are a number of different soil landscapes within the local area. Three of these have previously recorded AHIMS sites. The highest number of sites has been recorded within the Mookerwa soil landscape, which is associated with low rolling hills, with some steep rocky slopes. Both artefact scatters and a PAD have been recorded in this landscape. The North Orange soil landscape, which is within the Project Area, contains the second highest number of sites, a modified tree and an artefact scatter. This landscape is also associated with low rolling hills. The third landscape to record sites was the Macquarie landscape, which is associated with alluvial plains and terraces. This landscape is surrounding the Summer Hill Creek and the site is recorded as a PAD (see Chart 2).

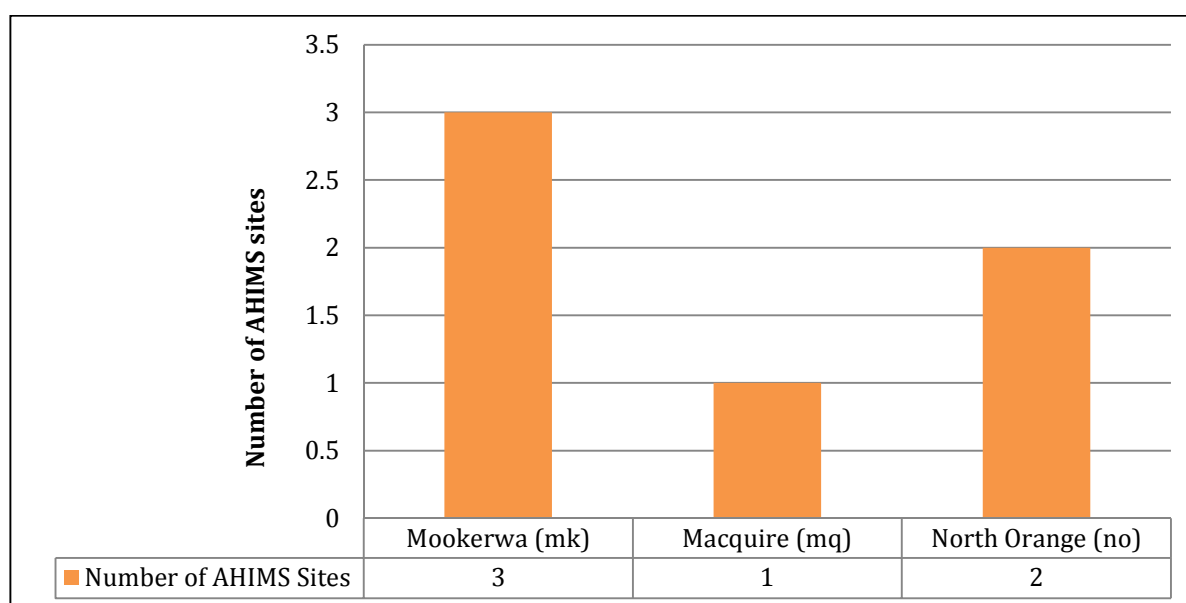


Chart 2 Figure displaying the number of recorded AHIMS sites within the soil landscape in the local region.

5.2.3 Local geology

There are two main geological formations within the local area, which are the Mullions Range Volcanics (Smu) and Oakdale formation (Oco). The Project Area is located within the Oco formation. The Smu formation is characterised by Rhyolite, tuffaceous mudstone, rhyolite breccia, volcanic conglomerate, dacite and limestone. The Oco formation is characterised by Mafic volcanic sandstone, basalt, siltstone, black shale, chert, breccia and conglomerate.

There have been an equal number of previously recorded sites in these two geological formations. The main site types recorded within the Smu formation have been artefact scatters and PAD, and within the Oco artefact scatters, PADs and modified trees (Chart 2).

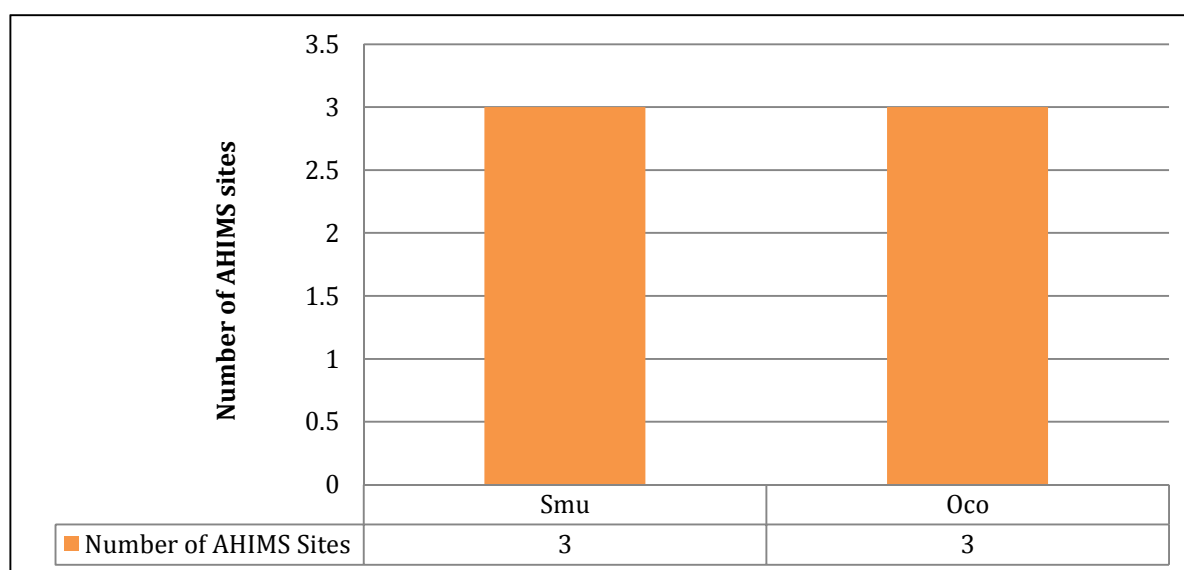


Chart 3 Figure displaying the number of recorded AHIMS sites located within the geological formation in the local region.

5.2.4 Local hydrology

Distance to water

Within the local area the average distance that sites are recorded from permanent water sources is approximately 1 kilometre to 1.5 kilometres. The average to ephemeral water source is approximately 400 metres to 500 metres. From this data it is evident that PADs have been previously recorded in areas close to both permanent and ephemeral water sources. Most site types are generally closer to ephemeral waters sources, except modified trees. This data could be affected by the possible underrepresentation of certain site types in the local area (see Table 9).

Table 9: Summary of the site types and their associated distances to water

Site type	Permanent water source (m)			Ephemeral water source (m)		
	Max	Min	Average	Max	Min	Average
Artefact Scatter (4)	1719	447	1056	1000	242	595
PAD (2)	714	250	1607	664	242	453
Modified Tree (1)	180			756		

5.3 Aboriginal site prediction statements

The definition of the grading of potential is described in Table 10 followed by an assessment using this grading system based upon the above analysis of regional and local site distribution and density. From this assessment a prediction of site types which may occur in the Project Area can be made. The results of the predictive model are presented in Table 11.

Table 10 Definitions of the predictive model

Potential rating	Description
High	Those aboriginal sites types give this rating have been recorded in both the regional and local landscape. However, there numbers are not as numerous. This being said the landscape conditions within the focus area will be aligned with those generally associated with this site type. Although it may be unlikely to locate this site type, due to their overall moderated numbers, this location would be where you would ultimately find them.
Medium	Sites are known to occur in the regional and local landscape but not in high numbers. The landscape conditions are not precisely aligned however the site may infrequently occur in certain conditions.
Low	The site types given this rating have been recorded regionally, but not locally and not in substantial numbers. The site is generally considered unlikely to occur within the landform conditions present.

Table 11 Aboriginal site prediction statements

Site type	Site description	Potential
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: This site type is the most common site (67 %) recorded within the local area and the wider area. This site type has been recorded within both the Mookerwa and North Orange soil landscapes associated with low rolling hills. The North Orange soil landscape is located within the Project Area. On average this site type will be recorded approximately 1 kilometre from a permanent water source and 595 metres from an ephemeral water source. This site type has a high percentage of being recorded in association with one other site types.
Potential Archaeological Deposits (PADs)	Potential sub surface deposits of cultural material.	High: This site type is also the second most common site (33.3 %) recorded within the local area. This site type has been recorded within both the Mookerwa and Macquarie Landscapes, which are associated with low rolling hills and the alluvial plains and terrace of Summer Hill Creek. On average this site type will be recorded approximately 1.6 kilometres from a permanent water source and 453 metres from an ephemeral water source.
Modified trees	Trees with cultural modifications.	Medium: Modified trees have been recorded in wider area, although only one has been noted in the local area. This modified tree is located within the North Orange soil landscape, which is also located within the Project Area. It was also recorded closer to a permanent water source, compared to an ephemeral.

Site type	Site description	Potential
Stone quarries	Raw stone material procurement sites.	Medium: The geology within the Project Area could produce an outcrop, which could have been quarried.
Aboriginal resource and gathering locations	Areas of high natural resource density which Aboriginal people may have collected resource. Areas may contain medicinal plants etc.	Medium: The Project Area contains many natural resources used by Aboriginal people so it is possible that Aboriginal people may consider areas within the Project Area as resource and gathering locations.
Burials	Aboriginal burial sites.	Low: 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 Project Area are not commonly associated with burials.
Axe grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	Low: The geology of the Project Area lacks suitable horizontal rock outcrops for axe-grinding grooves. Therefore there is low potential for axe grinding grooves to occur in the Project Area.
Shell middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	Low: This site type is not often recorded within the local 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.	Low: The sites will only occur where suitable sandstone exposures or overhangs possessing sufficient sheltered space exist, which are not present in the Project Area.
Earth mounds	Earth mounds are large mounds (or scatters if deflated) of material associated with cooking. They may contain heat retainers, shell, bone, artefacts and human remains.	Low: This site type is not often recorded within the local 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 Project 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 Project Area and historical sources do not identify any.
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.	Low: There are currently no recorded Aboriginal historical associations for the Project Area.

□□ Field survey

A field survey of the Project Area was undertaken from 5 January to 8 January, 2015. The field survey sampling strategy, methodology and a discussion of results are provided below.

6.1 Archaeological survey aims

The principle aims of the survey were:

- To undertake a systematic survey of the Project Area targeting areas with the potential for Aboriginal heritage.
- Identify and record Aboriginal archaeological sites visible on the ground surface.
- Identify and record areas of potential archaeological deposits (PADs).

6.2 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 Project Area. These are detailed below.

6.2.1 Sampling strategy

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 (DECCW 2010) and industry best practice methodology.

The 290 hectare Project Area was targeted during the survey. All landforms present within the Project Area, including ridgelines and their associated slopes, were targeted, including each occurrence of a specific landform type that will potentially be impacted. Those areas with a higher potential for Aboriginal heritage, including areas around permanent and ephemeral water sources, were also targeted. This included areas along the unnamed main creek line in the centre of the Project Area

Recording during the survey followed the archaeological survey requirements of the Code and industry best practice methodology. Information that was recorded during the survey includes:

- Aboriginal objects or sites present within the Project Area during the survey.
- Landform elements, distinguishable areas of land approximately 40 metres across or with 20 metre radius (Speight 1998).
- Ground surface visibility (GSV) and areas of exposure.
- Survey coverage.
- Any resources that may have potentially have been exploited by Aboriginal people.
- Photographs of the site indicating landform.
- Observable past and present disturbances to the landscape from human or animal activities.
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the Project Area was undertaken. Photography and recording techniques were incorporated into the survey including representative photographs of the survey unit, landform, vegetation cover, ground surface visibility, disturbances and the recording of soil information where possible. Any potential Aboriginal objects observed during the survey were documented and photographed. Survey transects, the location of Aboriginal cultural heritage and relevant points of interest were recorded using a hand-held Global Positioning System (GPS) and the Map Grid of Australia (94) coordinate system.

6.3 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 factor that contributed most to the effectiveness of the survey within the Project Area was the poor ground surface visibility.

6.4 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 (NSW NPWS 1997).

Within the disturbed areas associated with the fence lines, dams and the eroding creek bank there was a good level of visibility, approximately 50 percent. The majority of the Project Area, however, had a lower level of visibility, approximately ten percent, due to the low-lying vegetation (Plate 3).

Overall the GSV within the Project Area was considered poor.

6.5 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. 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 and Smith 2004: 79, NSW NPWS 1997).

Overall, the Project Area displayed areas of exposure that were investigated. The exposure areas were associated with fence lines and gate, modern dams, drainage lines and the main creek line. Often these exposures were the result of water erosion or where livestock has congregated (Plate 4, Plate 5 and Plate 6).

6.6 Disturbance

Disturbance in the Project Area is associated with natural and human agents. Natural agents generally affect small areas and include the burrowing and scratching in soil by animals, such as wombats, foxes, rabbits and wallabies. The Project Area is currently being used to hold live stock, and as mentioned above, there is substantial disturbance to the soils. Disturbances associated with recent human activities are also prevalent in the Project Area. The area has been subject to activities related to farming practices including vegetation clearance, large scale earth works associated with the creation of the dams, and the construction of the current fencing and stock grazing. The alteration of the natural water flow within the Project Area has resulted in large areas of erosion, particularly in relation to the main creek lines banks. There are also areas

throughout the Project Area where modern rubbish has also been dumped or buried and Environment Protection Authority monitoring stations have been dug (see Plate 7)



Plate 3 Example of poor visibility throughout the Project Area (scale = 2 metres)



Plate 4 Example of exposed area near a fence line and gate (scale = 2 metres)



Plate 5 Example of exposed area near a dam (scale = 2 metres)



Plate 6 Example of exposed area within a drainage line (scale = 2 metres)



Plate 7 Example of disturbance within the Project Area (scale = 2 metres)

