

APPENDIX F

Aboriginal Cultural Heritage Assessment Report

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Aboriginal Cultural Heritage Assessment Report
Appin Mine Ventilation and Access Project
Menangle, NSW

Wollondilly LGA

Prepared for South32 Illawarra Metallurgical Coal

Prepared by Niche Environment and Heritage | 26 May 2021



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Executive summary

Project outline

Niche Environment and Heritage (Niche) was engaged by South32 Illawarra Metallurgical Coal (IMC) (hereafter referred to as 'the Proponent'), to conduct an Aboriginal Cultural Heritage Assessment (ACHA) for the proposed Appin Mine Ventilation and Access Project including project construction, operation and closure (here on referred to as 'the Project') located within the Wollondilly Local Government Area, at Lot 20A DP 4450, at 345 Menangle Road, Menangle, NSW (hereafter referred to as 'the Subject Area'). This ACHA is required to accompany a proposed modification application to Project Approval 08_0150, under section 4.55 of the *Environmental Planning and Assessment Act 1979*.

Consultation was undertaken with twenty-one (21) Aboriginal stakeholders (including groups and individuals) who identified themselves as Registered Aboriginal Parties (RAPs) through the consultation process following the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010b). Consultation with these parties has been ongoing through the development of this ACHA report.

In addition to a survey of the Subject Area, this ACHA includes a review of previous surveys and assessments from within the Subject Area and surrounds.

The Subject Area has been previously investigated within the wider Bulli Seam Operations Cultural Heritage Assessment (Biosis Research 2009). The survey undertaken for that assessment identified one isolated artefact site within the Subject Area; Bulli Site 7 (AHIMS ID#52-2-3687) (Biosis Research 2009: 94). The assessment also identified areas of Potential Archaeological Deposit (PAD) within the Menangle Region that are likely to contain subsurface archaeological deposits. It was concluded that PADs within the Menangle area are generally located adjacent to watercourses in depositional soil landscapes (Biosis Research 2009: 29). The predictive model developed in the Bulli Seam Operations Assessment indicates that the eastern edge of the Subject Area along Foot Onslow Creek, has the potential to contain subsurface Aboriginal objects.

A cultural heritage survey and archaeological test excavation of the Subject Area identified that Bulli Site 7 (AHIMS ID#52-2-3687) is a low-density open camp site that extends to the south of the originally recorded location and across to the eastern bank of Foot Onslow Creek. Part of Bulli Site 7 (AHIMS ID#52-2-3687) falls within the proposed Ventilation Shaft footprint and will be directly impacted as a result of the works program. The site is assessed to hold low scientific (archaeological) significance. The Registered Aboriginal Parties (RAPs) have advised that all sites have cultural significance.

Detailed avoidance, mitigation and management measures have been developed to reduce potential impacts on Aboriginal heritage. These are outlined in Section 13 of this report.

Summary of potential impacts

This assessment has determined that the Project would partially impact a single Aboriginal cultural heritage site (AHIMS ID 52-2-3687, see Figure 4) registered on Aboriginal Heritage Management System (AHIMS).

Table 1: AHIMS registered site within the Subject Area

AHIMS ID#	Site name	Site type
52-2-3687	Bulli Site 7	Isolated artefact

The following recommendations have been made in consultation with the RAPs:

Table 2: Recommendations

Recommendations	
1.	An Aboriginal Cultural Heritage Management Plan (AHMP) should be developed for the Project that details and schedules (for the life of the Project) the mitigation and management measures presented in the report. The AHMP should be developed in consultation with the RAPs and relevant regulatory authorities and in compliance with the requirements of the BSO HMP 2017. The AHMP should include the following: • Protocols for the involvement of the RAPs in cultural heritage works conducted under the AHMP. This protocol should focus on members of the RAPS identified during this ACHA's consultation process. • A communications protocol that describes clear methods of communication, including expectations of suitable notification and response time, between the proponent and the RAPs. • A protocol for the discovery and management of Unexpected Finds, including stop work provisions and notification protocols. • A protocol for the discovery and management of human remains, including stop work provisions and notification protocols, as per Recommendation 7. • Procedures for the management and reporting of previously unknown Aboriginal heritage sites that may be identified during the life of the Project. • Protocols for heritage awareness training to be incorporated into the Project site inductions for both employees and sub-contractors who may be conducting works that have the potential to impact on any Aboriginal heritage sites. Consideration should be given to involving the RAPs in the development and presentation of the cultural awareness training. • A regular review process for the AHMP (in accordance with Condition 5 of Schedule 6 of the Appin Mine Approval, or every three years unless otherwise stipulated). • AHIMS Site impact forms to be submitted for any sites subject to impact. • Copies of the final report should be made available to each RAP, the Department of Planning, Industry and Environment and Heritage NSW.
2.	A surface collection of the isolated surface artefact at Bulli Site 7 (AHIMS ID#52-2-3687) be undertaken in consultation with the Project RAPs under the above AHMP.
3.	A Care and Control Agreement be developed for the long-term management of recovered artefacts.
4.	The five artefacts recovered during the test excavation, and the surface artefact to be collected as per Recommendation 2 be reburied on site outside of the area of impact. The reburial to be conducted under the AHMP and in accordance with the Care and Control Agreement.
5.	All site personnel should be inducted into the Subject Area, so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* as to their responsibilities in the conservation of Aboriginal Heritage.
6.	Site Card information for Bulli Site 7 (AHIMS ID#52-2-3687) should be updated in the AHIMS database with revised site descriptions (i.e. Aboriginal Site Impact Form (ASIFs).
7.	In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately and: • The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. • The remains must be left in place and protected from harm or damage. • The NSW Police and Coroners Office must be contacted immediately. • No further action is to be undertaken until the NSW Police confirm the origin of the remains as non-human and provide a case number for South32's records. • If the skeletal remains are identified as Aboriginal, South 32 or their agent must contact: ▪ the Heritage NSW's Enviroline on 131 555; and representatives of the RAPs.

Recommendations	
	▪ No works are to continue until the Heritage NSW provides written notification to the Proponent or their Agent.

Glossary and list of abbreviations

Term or abbreviation	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present-day Aboriginal communities.
ACHA	Aboriginal Cultural Heritage Assessment.
Aboriginal object(s)	The legal definition for material Aboriginal cultural heritage under the NSW *National Parks and Wildlife Act 1974.*
Aboriginal stakeholders	Members of a local Aboriginal land council, registered holders of Native Title, Aboriginal groups or other Aboriginal people who may have an interest in the Project.
AHIMS	Aboriginal Heritage Information Management System.
AHIP	Aboriginal Heritage Impact Permit.
AR	Archaeological Report.
Archaeology	The scientific study of material traces of human history, particularly the relics and cultural remains of past human activities.
Archaeological deposit	A layer of soil material containing archaeological objects and/or human remains.
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.
Archaeological site	An area that contains surface or sub-surface material evidence of past human activity in which material evidence (artefacts) of past activity is preserved.
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	A group of artefacts found in close association with one another Any group of items designated for analysis that exist in spatial and/or vertical context – without any assumptions of chronological or spatial relatedness.
Avoidance	A management strategy which protects Aboriginal sites within an impact area by avoiding them totally in development.
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Code of Practice	*Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.*
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
DECCW	The Department of Conservation, Climate Change and Water, replaced by the Biodiversity and Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE) and now Heritage NSW of the Department of Premier and Cabinet (DPC).
DG	Director General.
DPC	Department of Premier and Cabinet.
DPIE	The Department of Planning, Industry and Environment.

Term or abbreviation	Definition
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979.*
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Harm	With regard to Aboriginal objects this has the same meaning as the NSW *National Parks and Wildlife Act 1974*.
HMP	Heritage Management Plan.
Heritage NSW	Aboriginal cultural heritage regulator in the Department of Premier and Cabinet. Responsible for the management of Aboriginal Cultural Heritage (ACH) regulation functions under the National Parks and Wildlife Act 1974. Formerly BCD of DPIE.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Impact area	An area that requires archaeological investigation and management assessment.
In situ	Latin words meaning 'on the spot, undisturbed'.
Isolated artefact / find	A single artefact found in an isolated context.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Land unit	An area of common landform, and frequently with common geology, soils and vegetation types, occurring repeatedly at similar points in the landscape over a defined region. It is a constituent part of a land system.
Landform	Any one of the various features that make up the surface of the earth.
LALC	Local Aboriginal Land Council.
LEP	Local Environmental Plan.
LGA	Local Government Area.
Management plans	Conservation plans which identify short and long term management strategies for all known sites recorded within a (usually approved) Subject Area.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
NPW Act	National Parks and Wildlife Act 1974.
NPW Regulation	National Parks and Wildlife Regulation 2009.
OEH	Office of Environment and Heritage, replaced by the Biodiversity and Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE) and now Heritage NSW of the Department of Premier and Cabinet.
Open camp site	An archaeological site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill, etc.).
PAD	Potential Archaeological Deposit. A location considered to have a potential for subsurface archaeological material.
Palimpsest	Having diverse layers or aspects
RAP	Registered Aboriginal Party.

Term or abbreviation	Definition
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	A place where past human activity is identifiable.
Spit	A unit of archaeological excavation with an arbitrary assigned measurement of depth and extent.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.

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1. Introduction

This report presents the findings of an ACHA undertaken for the proposed Appin Mine Ventilation and Access Project) located at Lot 20A DP 4450, at 345 Menangle Road, Menangle, NSW Menangle, NSW (Figure 1 and Figure 2).

The Appin Mine (the Mine) is an existing underground coal mine situated in the Southern Coalfield of NSW approximately 25 kilometres north-west of Wollongong. The Mine is owned and operated by Endeavour Coal Pty Ltd, a subsidiary of Illawarra Coal Holdings Pty Ltd, which is a wholly owned subsidiary of South32 Limited. Appin Mine, Cordeaux Colliery and Dendrobium Mine (and associated facilities) collectively operate as South32 Illawarra Metallurgical Coal IMC.

IMC received Project Approval 08_0150 (the Appin Mine approval) from the Planning Assessment Commission of NSW under delegation of the Minister for Planning and Infrastructure on 22 December 2011 for current and proposed mining of the Bulli Seam Operations (BSO). The Appin Mine approval was gazetted as a State Significant Development (SSD) for the purposes of future modifications on 23 November 2018.

IMC is seeking to modify the existing Appin Mine approval, pursuant to Section 4.55(2) of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act), to incorporate the construction and operation of infrastructure critical to the ongoing viability of the Mine referred to as the Appin Mine Ventilation and Access Project (hereafter referred to as the Project).

The Subject Area has been previously investigated within the wider Bulli Seam Operations Cultural Heritage Assessment (Biosis Research 2009). The survey undertaken for the Bulli Seam Operations ACHA identified one isolated artefact site within the Subject Area; Bulli Site 7 (AHIMS ID#52-2-3687) on a highly disturbed dam edge (Biosis Research 2009: 94).

The Bulli Seam Operations ACHA found that the Menangle region contains areas of PAD that are likely to contain subsurface archaeological deposits. PADs within the Menangle area are generally located adjacent to watercourses in depositional soil landscapes (Biosis Research 2009: 29). The predictive model developed in the Bulli Seam Operations ACHA indicates that the eastern edge of the Subject Area situated along Foot Onslow Creek has the potential to contain subsurface Aboriginal objects.

Figure 4 depicts the location of Bulli Site 7 (AHIMS ID#52-2-3687) in relation to the proposed works.

Table 3: Aboriginal cultural heritage site within the Subject Area

AHIMS ID	Site Name	Site Description
52-2-3687	Bulli Site 7	Open camp site

1.1 Scope and Objectives

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by IMC to prepare an ACHA to inform the development process and to manage and mitigate harm to Aboriginal objects and cultural heritage values of the Project.

1.2 Statutory and regulatory framework

The EP&A Act, administered by the NSW Department of Planning, Industry and Environment (DPIE), provides planning controls and requirements for environmental assessment in the development approval process. It also establishes the framework for formal assessment of Aboriginal cultural heritage values in

land-use planning and development consent processes. Developments that require development consent (from a council or the Minister for Planning and Infrastructure) are assessed under Part 4 of the EP&A Act. Part 4 developments are not exempt from the Aboriginal cultural heritage provisions and offences of the *National Parks and Wildlife Act 1974* (NPW Act).

As noted above, the Project is a modification of the approved Appin Mine works for the current Appin Mine approval (SSD) (08_0150).

In compliance with the Appin Mine approval, a Heritage Management Plan (HMP) has been developed for the Project, which includes the current Subject Area. Section 9.2 of the HMP outlines that additional heritage investigations are to be undertaken to address any knowledge gaps including supplementary surveys to identify new and relocate previously recorded sites. Therefore, in accordance with the management plan, an ACHA has been undertaken to address the proposed Project and the potential impacts on known and unknown Aboriginal cultural heritage sites within the Subject Area. This report aims to mitigate and manage said impacts in consultation with the Aboriginal community.

All archaeological assessments and reporting for this project have been undertaken in accordance with the following regulatory and advisory documents and guidelines:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH, 2011).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010a) [hereafter referred to as the 'Code of Practice'].
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Part 6 National Parks and Wildlife Act, 1974) (DECCW, 2010b) [hereafter referred to as the 'Consultation Requirements'].
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS], 1999).
- *Bulli Seam Operations Heritage Management Plan* (Biosis 2020).

2. Site Location and Investigation Area

The Subject Area is approximately 35 km northwest of Wollongong and 8 km northwest of Appin (Figure 1). The township of Menangle is located approximately 1.3 km to the northeast of the Subject Area. The Subject Area is located on land owned by IMC, within the BSO Project Longwall Mining Area and within the South Campbelltown Mine Subsidence District in the Southern Coalfield of NSW. The Project is located within the Cumberland Plain biogeographic region, with the Razorback Range to the north-west. The major river system of the Nepean Gorge is situated nearby to the Project in the east, with an associated tributary Foot Onslow Creek located within the Subject Area.

The Subject Area will incorporate Ventilation Shaft 7, Ventilation Shaft 8, mine access facilities and additional areas for associated works and infrastructure, such as the construction site access and the provision of services to the Site. The boundary of the Subject Area and the extent of the Subject Area are shown on (Figure 2). The 'Project Area' referenced in the figures in this assessment is considered to include everything within the Construction Footprint, as designated by the Proponent. For the purpose of this assessment, 'Subject Area' and 'Project Area' are synonymous.

Infrastructure that will be developed within the Subject Area will be positioned to align with the approved layout of the underground workings for Appin Area 7, to be proximal to required services and to minimise the potential impacts on the environment and/or communities of Menangle and Douglas Park

For the initial stages of this assessment, including the development of the Project Methodology and field survey, the Subject Area included a strip of land to the east of Foot Onslow Creek and a small hill along the southern boundary (Plate 1). This Subject Area was refined by IMC in December 2020 to exclude the eastern bank of Foot Onslow Creek and the hill (Plate 2). The test excavation methodology and conclusions and recommendations of this assessment are related to the amended Subject Area only (Figure 2 and Plate 2).



Plate 1: Initial Subject Area included in the initial stages of assessment and Project Methodology. The entirety of this Subject Area was surveyed (Source: Niche, IMC and LPI).

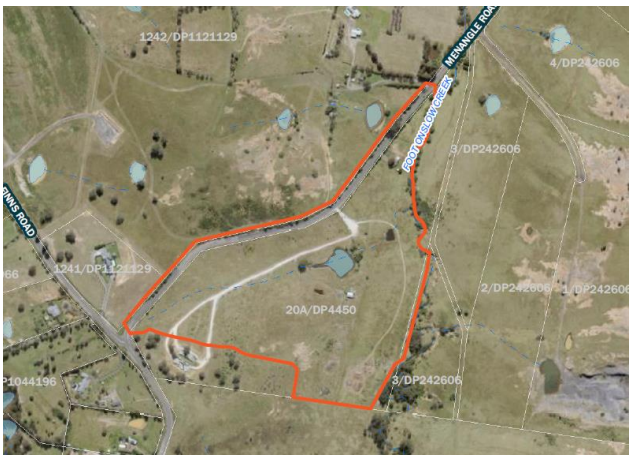
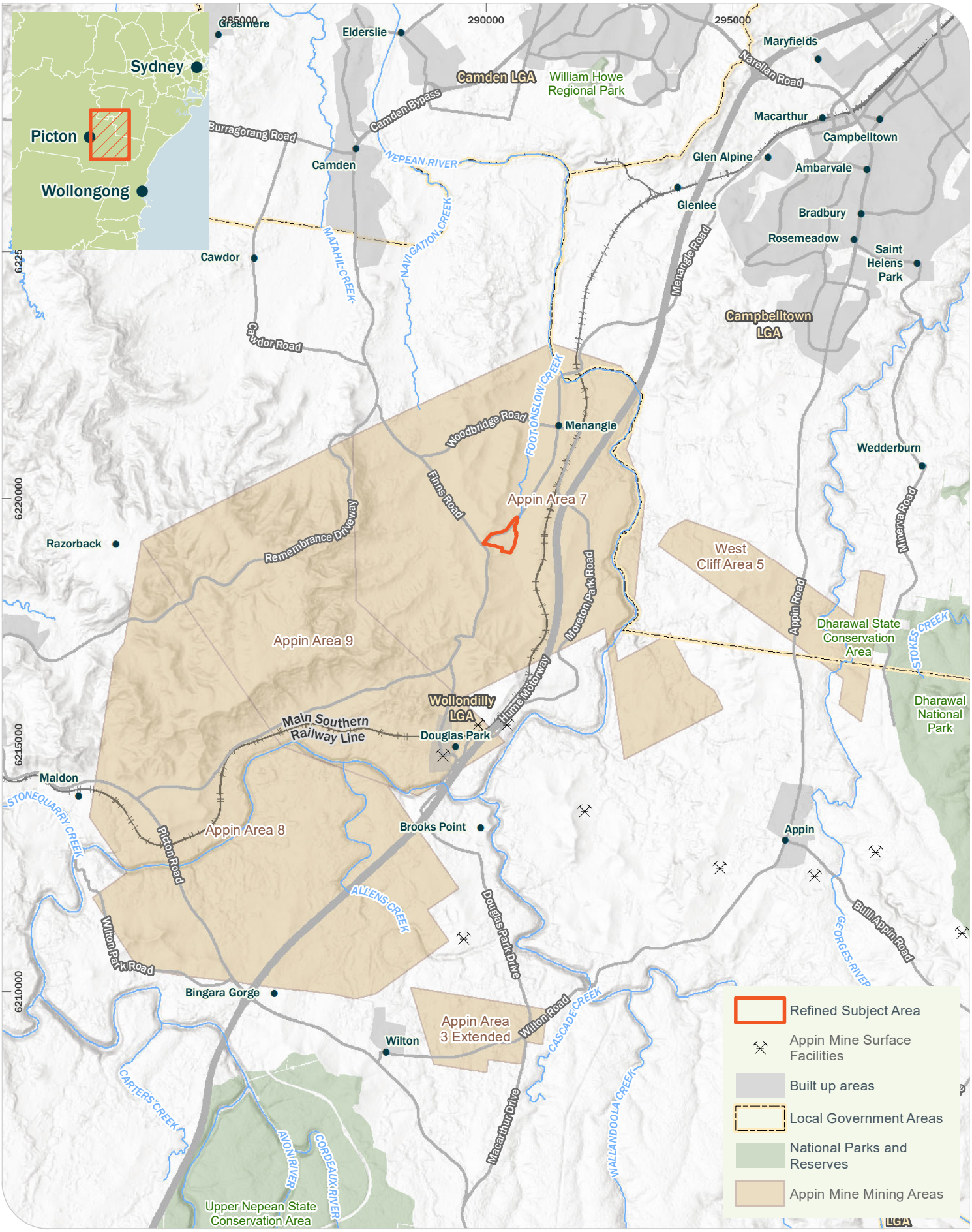


Plate 2: Refined Subject Area, as amended by IMC in December 2020 following the field survey. The test excavation and conclusions and recommendations of this assessment are in relation to this amended Subject Area.

The Subject Area for this ACHA includes approximately 25.5 ha of land that was considered during this assessment as potential locations for the proposed Ventilation Shaft site that may be impacted by the

Project (Figure 2). The Subject Area extends from some moderately sloping hills in the west, across pastoral flats and toward Foot Onslow Creek in the north.



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km
GDA 1994 MGA Zone 56

Regional Location

Appin Mine Ventilation and Access Project ACHA

Niche PM: Matt Richardson
Niche Proj. #: 5948
Client: South32

Figure 1

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

v2.0



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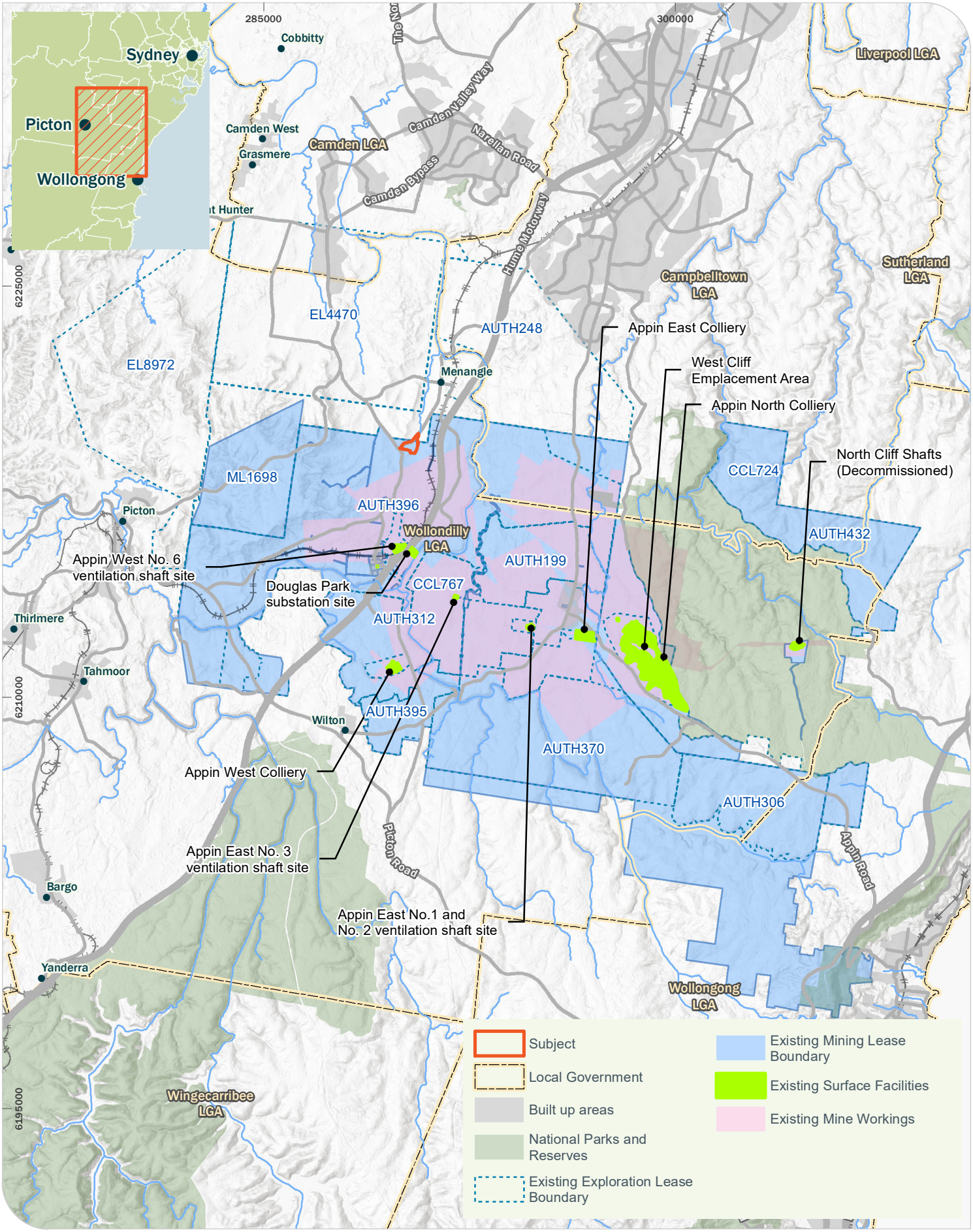
Niche PM: Matt Richardson
Niche Proj. #: 5948
Client: South32

Refined Subject Area

Appin Mine Ventilation and Access Project ACHA

Figure 2

public/NSW_Imagery: © Department of Customer Service 2020



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Bulli Seam Operations Project Overview

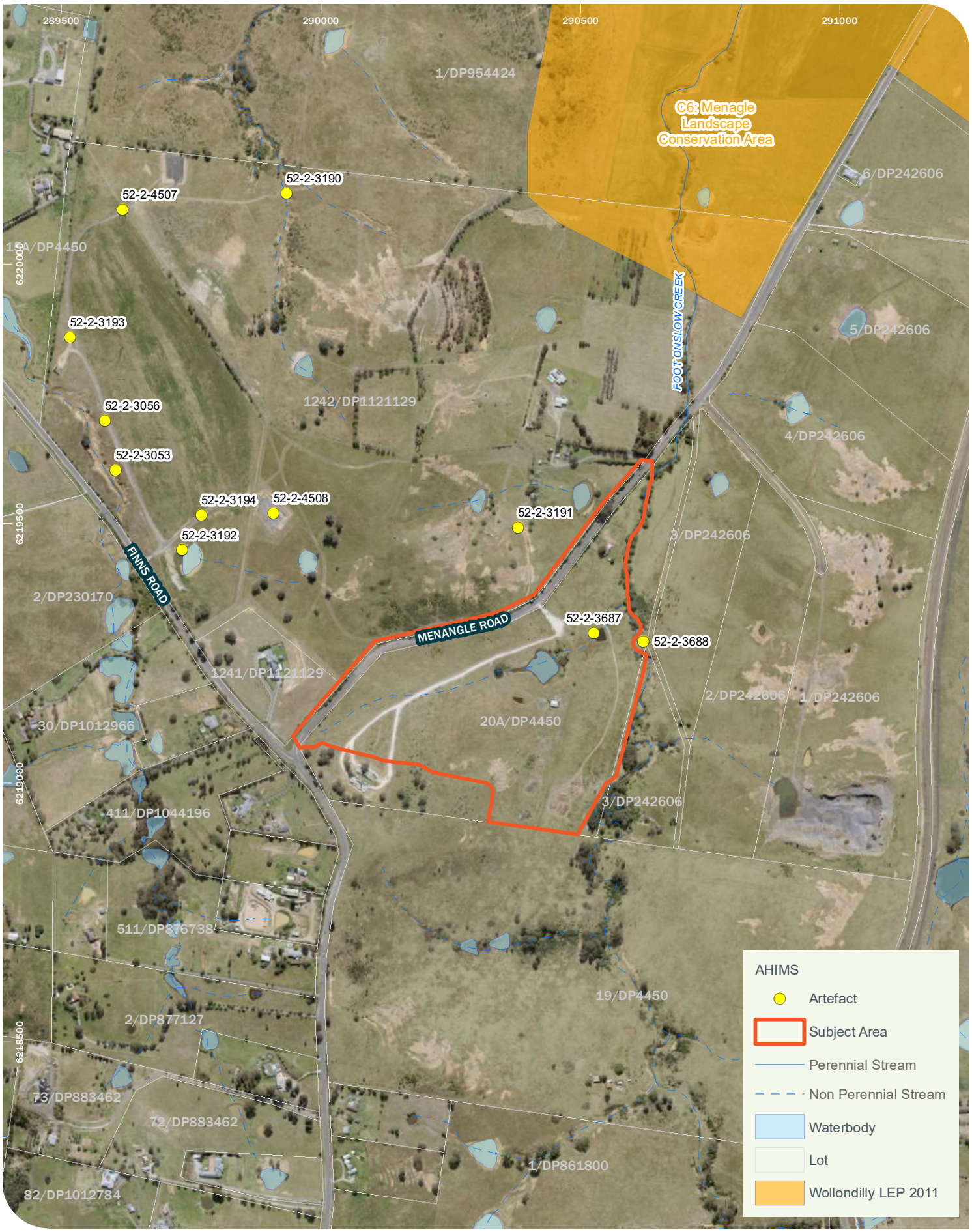
Appin Mine Ventilation and Access Project ACHA

Niche PM: Matt Richardson
Niche Proj. #: 5948
Client: South32

Figure 3

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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GDA 1994 MGA Zone 56

Subject Area with AHIMS and Heritage Items

Appin Mine Access and Ventilation Project ACHA

Niche PM: Sarah McGuinness
Niche Proj. #: 6152
Client: South32

Figure 4

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Australia latest: @Metrop Map

3. Description of the Development Proposal

3.1 Proposed Activities

An integral requirement of underground mining is adequate ventilation infrastructure and mine access facilities to ensure a safe and efficient underground working environment. Appin Mine operations are progressing further away from the existing surface infrastructure located in the Appin and Douglas Park areas, and additional infrastructure is required to support the ongoing operations.

The Project involves the construction and operation of a downcast ventilation shaft (Ventilation Shaft 7), an upcast ventilation shaft (Ventilation Shaft 8), three (3) extraction fans, ducting and evases and associated ancillary infrastructure. Based on the current mining schedule, the additional ventilation shafts are required to be operational prior to 2025 to maintain continuity of safe underground operations.

The Project also involves the development of mine access facilities including a headframe and personnel and materials winder (within Ventilation Shaft 7) and surface facilities consisting of offices, stores, bathhouse facilities and car parking areas. The establishment of these facilities would provide access for personnel and consumable materials to the Mine and will increase the safety and efficiency of transporting personnel and consumable materials underground.

To support the key infrastructure noted above, the Project will also include the following activities:

- installation of temporary and permanent site access arrangements, including upgrade or improvement to the Menangle Road intersection, internal roadways, associated hardstand and car parking areas.
- site preparation, including clearing of vegetation, demolition of existing structures and earthworks.
- installation of appropriate security (e.g. fencing) to prevent unauthorised access to the site.
- installation of a power supply and transmission and associated electrical switch rooms, transformers and ancillary infrastructure.
- shaft material/spoil handling and emplacement activities. Associated revegetation and landscaping activities to minimise visual impact of the site.
- installation of personnel amenities such as bathhouses (e.g. changerooms), administration facilities and mines rescue facilities.
- installation of diesel storage tanks and associated pipelines.
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure including fire protection and sewerage treatment facilities.
- installation of bulk materials storage facilities and warehouses.
- installation of communications equipment including fibre optic cable and wireless infrastructure.
- installation of a service borehole to provide underground services.
- controlled release of excess water and/or re-use or water where practicable.
- progressive revegetation of disturbed areas post construction.
- installation of erosion and sediment control infrastructure, where required; and
- other associated minor infrastructure, plant, equipment and activities.

The Project would be similar to previously approved ventilation and mine access infrastructure of the Appin Mine and will not increase the volume of coal produced. Coal handling infrastructure is not proposed as part of the Project.

The shafts would be constructed from the surface down to the underground workings using conventional shaft sinking methods (mechanical excavation and controlled blasting) with material from the excavation being removed from the top of the shaft. The excavated material resulting from the construction of the shafts would be used as engineered fill and for construction of earth screening bunds and sediment dams. Where practicable, excess material would be stockpiled on-site, revegetated and used for future rehabilitation of the shaft site upon decommissioning. The two shafts would be constructed simultaneously and lined progressively during excavation.

The Project will comprise two main phases; the construction phase and the operational phase. Once the shaft sinking is complete and the ventilation infrastructure is installed, the operational phase for the ventilation shafts will immediately commence. The construction of the mine access facilities would occur subsequent to the ventilation infrastructure, due to the priority requirement for mine ventilation air supply.

Activities associated with sinking the shafts would occur 24 hours per day, seven days per week. The remainder of construction activities associated with the facility (e.g. installation of surface infrastructure) would generally be limited to daytime construction hours. Once operational, the site would be required to operate 24 hours per day, seven days per week, consistent with other similar facilities of the Mine.

This ACHA assesses the additional disturbance areas associated with the proposed activities of the Project that have the potential to harm Aboriginal heritage sites.

3.2 Project Phasing

The Project is proposed to commence as soon as practicable after all the necessary approvals have been obtained and any prerequisite conditions fulfilled.

4. Aboriginal Community Consultation Process

In administering its statutory functions under Part 6 of the NPW Act, Heritage NSW requires that proponents consult with Aboriginal people about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and/or places within any given development area, in accordance with Clause 80c of *NSW National Parks and Wildlife Regulation 2009*.

Heritage NSW maintains that the objective of consultation with Aboriginal communities about the cultural heritage values of Aboriginal objects and places is to ensure that Aboriginal people have the opportunity to improve ACHA outcomes (DECCW 2010b). This is ensured by:

- Providing relevant information about the cultural significance and values of Aboriginal objects and/or places.
- Informing the design of the methodology to assess cultural and significance of Aboriginal objects and/or places.
- Actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal objects and/or places within the proposed Subject Area.
- Commenting on draft assessment reports before they are submitted by the Proponent to Heritage NSW.

Consultation, in the form outlined in the Consultation Requirements (DECCW 2010b), is a formal requirement in cases where a proponent is aware that their development activity has the potential to harm Aboriginal objects or places. Heritage NSW also recommends that these requirements be used when the certainty of harm is not yet established but a proponent has, through some formal development mechanism, been required to undertake a cultural heritage assessment to establish the potential harm their proposal may have on Aboriginal objects and/or places.

The Consultation Requirements outline a four-stage consultation process that includes detailed step-by-step guidance as to the aim of the stage, how it should be proceed, and what actions are necessary for it to be considered successfully completed. The four stages are:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about the cultural significance of the project area.
- Stage 4 – Review of the draft Aboriginal Cultural Heritage Assessment report.

The Consultation Requirements also outline the roles and responsibilities of Heritage NSW, RAPs including Local and State Aboriginal Land Councils, and proponents throughout the consultation process.

To meet the requirements of consultation it is expected that the proponent will:

- Bring the RAPs (or their nominated representatives) together and be responsible for ensuring appropriate administration and management of the consultation process.
- Consider the cultural perspectives, views, knowledge and advice of the RAPs involved in the consultation process when they assess cultural significance and work together to develop any heritage management outcomes for Aboriginal abject(s) and/or place(s).
- Provide evidence to Heritage NSW of consultation by including information such as cultural perspectives, views, knowledge and advice provided by the RAPs.

- Accurately record and clearly articulate all consultation findings in the final cultural heritage assessment report.
- Provide copies of their final cultural heritage assessment report to the RAPs who have been consulted.

The consultation process undertaken to seek active involvement from appropriate Aboriginal representatives for the project followed the current NSW statutory guidelines – the Consultation Requirements. Section 1.3 of the Consultation Requirements describes the guiding principles of the document, which have been derived directly from the Principles section of the Australian Heritage Commission's *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission, 2002). Both documents share the aim of creating a system where advice can be sought from the Aboriginal community.

The following sections outline the process and results of the consultation conducted during this assessment to ascertain and reflect the Aboriginal cultural heritage values of the Subject Area. Further detail regarding the Aboriginal community consultation process is outlined in Appendix 1.

4.1 Stage 1 – Notification of project proposal and registration of interest

4.1.1 Notification of agencies

Notification was initiated on 30 September 2020 to all relevant organisations named under Section 4.1.2 of the Consultation Requirements. This was done to identify Aboriginal people who may have cultural knowledge relevant to the Subject Area and whom may have an interest in the proposed Project. The list of the contacted organisations is provided in Table 4 below and a copy of the notification letter is provided in Appendix 1.

Table 4: List of contacted organisations

Name of Organisation	Date of notification sent	Date of response received
Heritage NSW / DPIE	30 September 2020	30 September 2020
Tharawal LALC	30 September 2020	No response received
Office of the Registrar	30 September 2020	No response received
National Native Title Tribunal	30 September 2020	30 September 2020
NTS Corp	30 September 2020	No response received
Wollondilly Shire Council	30 September 2020	No response received
Greater Sydney Local Land Services	30 September 2020	No response received

4.1.2 Advertisement

In accordance with Section 4.1.3 of the Consultation Requirements, a newspaper advertisement was placed in Wollondilly Advertiser on Wednesday 14 October 2020 with a close date of 5 pm on the 28 October 2020 (14 days) to provide additional opportunity for Aboriginal people who may be interested in the project to come forwards. A copy of the advertisement is included in Appendix B.

4.1.3 Notification of potential stakeholders

A list of potential cultural knowledge holders was compiled from submissions and information collected during the notification and registration periods. A list of the potential stakeholders is provided in Table 5 below.

Table 5: List of potential Aboriginal stakeholders

Potential Aboriginal stakeholders	
A1 Indigenous Services	Garrara Aboriginal Corporation
Amanda Hickey Cultural Services	Ginninderra Aboriginal Corporation
Aragung Aboriginal Cultural Heritage Site Assessments	Goodradigbee Cultural & Heritage Aboriginal Corporation,
B.H. Heritage Consultants	Guntawang Aboriginal Resources Incorporated
Barking Owl Aboriginal Corporation	Jarmbi Aboriginal Cultural Heritage
Barraby Cultural Services	Kamilaroi Yankuntjatjara Working Group
Butucarbin Aboriginal Corporation	Mura Indigenous Corporation,
Confidential	Murra Bidgee Mullangari Aboriginal Corporation
Confidential	Ngambaa Cultural Connections
Cubbitch Barta	South Coast People
D'harawal Mens Aboriginal Corporation	Tharawal Local Aboriginal Land Council
Darug Booroobergongal Elders Aboriginal Corporation	Thoorga Nura
Darug Land Observations	Waawaar Awaa
Didge Ngunawal Clan	Wori Wooilywa
Freeman&marx PtyLtd	Wurrumay Pty Ltd
Galamaay Cultural Consultants	Yulay Cultural Services
	Yurrandaali

A copy of the notification letter that was sent to the above organisations and individuals on 14 October 2020 is included in Appendix B.

4.1.4 Registered Aboriginal Parties

As a result of the Stage 1 enquiries, the following twenty one (21) organisations and/or individuals became RAPs for this project (see Table 6), and a consultation log of all correspondence included in Appendix 1.

Table 6: RAP organisations and contacts

Organisation	Contact Name
A1 Indigenous Services	Ms Carolyn Hickey
Amanda Hickey Cultural Services	Ms Amanda Hickey
Aragung Aboriginal Cultural Heritage Site Assessments	Mr Jamie Eastwood
Barking Owl Aboriginal Corporation	Ms Jody Kulakowski
Barraby Cultural Services	Ms Lee Field
Butucarbin Aboriginal Corporation	Ms Jennifer Beale
Confidential	Confidential
Confidential	Confidential
Cubbitch Barta Native Title Claimants	Ms Glenda Chalker
Didge Ngunawal Clan	Ms Lillie Carroll and Mr Paul Boyd

Organisation	Contact Name
Freeman&marx PtyLtd	Mr Clive Freeman
Ginninderra Aboriginal Corporation	Mr Steven Johnson and Ms Krystle Carroll
Guntawang Aboriginal Resources Incorporated	Ms Wendy Morgan
Kamilaroi Yankuntjatjara Working Group	Mr Phil Khan
Ngambaa Cultural Connections	Ms Kaarina Slater
Tharawal Local Aboriginal Land Council	Ms Rebecca Jarvis
Waawaar Awaa	Mr Rodney Gunther
Wori Wooilywa	Mr Daniel Chalker
Wurrumay Pty Ltd	Ms Vicky Slater
Yulay Cultural Services	Ms Arika Jalomaki
Yurrandaali	Mr Bo Field

4.1.5 Notification of OEH and LALC

Notification of RAPS to Heritage NSW and the Local Aboriginal Land Council, as per Section 4.1.6 of the Consultation Requirements (DECCW 2010a) was sent initially on the 29 October 2020 with an updated version sent on the 23 November 2020.

4.2 Stage 2 and 3 – Presentation of project information, assessment methodology and gathering information about the cultural significance of the Subject Area

4.2.1 Project information and assessment methodology

The RAPs were provided with a letter outlining information about the project and an assessment methodology in accordance with the Consultation Requirements (DECCW 2010a) and the Code of Practice (DECCW, 2010b). The project information was provided on 28 October 2020.

The purpose of the provided documents was to:

- Describe the project, outline the project scope, time frame and proposed works.
- Describe the environment of the Subject Area and information relevant to the ACHA process.
- Provide an opportunity for the RAPs to understand the process and comment on the proposed methodology.
- Set a time frame for providing feedback and comments on the methodology and project information.

The draft methodology was submitted to the RAPs on 28 October 2020 and the closing date for comments was at 5 pm, 26 November 2020 (to meet the minimum 28 days review period). A copy of the cover letter and methodology is included in Appendix 1.

A number of RAPs provided feedback on the project information and assessment methodology. Their comments and/or review are outlined in Table 7, and copies of all submissions made are included in Appendix 1.

4.2.2 Test Excavation and assessment methodology

The RAPs were provided with a letter outlining the test excavation methodology in accordance with the Consultation Requirements and the Code of Practice. The test excavation methodology was provided on 22 December 2020.

The purpose of the provided documents was to:

- Describe the test excavation process.
- Provide an indication of the proposed test pit locations.
- Provide an opportunity for the RAPs to understand the process and comment on the proposed test excavation methodology.
- Set a time frame for providing feedback and comments on the methodology and project information.

The draft methodology was submitted to the RAPs on 22 December 2020 and the closing date for comments was at 5 pm, 28 January 2021 (to meet the minimum 28 days review period). A copy of the cover letter and methodology is included in Appendix 1.

A number of RAPs provided feedback on the project information and assessment methodology. Their comments and/or review are outlined in Table 8, and copies of all submissions made are included in Appendix 1.

Table 7: Details of RAP feedback on the project information and assessment methodology

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
Aragung Aboriginal Cultural Heritage Site Assessments	Jamie Eastwood	*Thank you for your recent email concerning Appin Mine Ventilation and Access Project ACHA Project Information and Methodology. ARAGUNG Aboriginal Cultural Heritage Site Assessments has review the above documentation, and supports and agrees with all methodology project information put fourth. As an organisation we would like to be involved in all aspects of this project, and would like to add further cultural information orally upon a Archaeological Field survey.*	Thank you for your email and feedback. In addition, if you would like to be involved with fieldwork please ensure that you send through a copy of your certificate of currency and workers compensation insurance.
Amanda Hickey Cultural Services	Amanda DeZwart	*I have reviewed the document and support the project information and Methodology. Thank you*	Thank you for your feedback. In addition, if you would like to participate in fieldwork please ensure that you send through a copy of your certificate of currency and workers compensation insurance.
A1 Indigenous Services	Carolyn Hickey	*I have reviewed the information and support the alteration to the Subject Area.*	Thank you for your feedback and insurance information. We will be in touch regarding upcoming work soon.
Barraby Cultural Services	Lee Field	*I on behalf of Barraby have read and agrees with the methodology for this project. I have attached my insurances as I would like to be considered for the upcoming field work.*	Thank you for your feedback and insurance information. We will be in touch regarding upcoming work soon.
Cubbitch Barta Native Title Claimants	Glenda Chalker	*Thank you for the opportunity of commenting on the proposed project on Menangle Road, Menangle. There have been two identified and recorded sites along the creek line, and a previous excavation further downstream identified artefact bearing deposits, despite no surface visible artefacts. Therefore the potential for there to be subsurface material is very high. If the project can completely avoid any impacts to the surrounding areas of the creek line then there should be no other real issues.*	Thank you for your response. We have noted your feedback regarding sub-surface potential across the Subject Area.
Yurrandaali Pty Ltd	Bo Field	*I Bo Field of Yurrandaali Pty Ltd, agrees with the methodology associated with this project. I would like to express my interest in participating in the upcoming field work. Please see our insurances attached.*	Thank you for your feedback and insurance information. We will be in touch regarding upcoming work soon.

Table 8: Rap feedback on Test Excavation Methodology

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
Aragung Aboriginal Cultural Heritage Site Assessments	Jamie Eastwood	*Thank you for supplying Aragung Aboriginal Cultural Heritage Site Assessments with a draft copy of the project information and methodology RE: Appin Mine Ventilation and Access Project Menangle NSW Archaeological Test Excavation Methodology .* *Aragung has review the before mention project information , and agrees and supports all information stated in the draft copy of the Test Excavation Methodology and method for assessing heritage significance of the project area.* *Aragung Aboriginal cultural heritage Site assessments would like to be involved in all future aspects of this project including Archaeological field work - meeting etc. should one of our experience Aboriginal Site Officers (RAP) be required to participate in on site field work please find attach to this email up to date insurance details and pay rate*	Thank you for your feedback. We are looking forward to working with you on site.
Cubbitch Barta Native Title Claimants	Glenda Chalker	*In my opinion the proposed methodology for the test excavation should be changed to sieving through 3 mm instead of 5 mm. Any artefacts should be reburied within the proposed conservation area.*	Thankyou Glenda. We have noted your concerns and will consider the applicability of the 3 mm during the excavations.
DNC	Lilly Carroll	*DNC Agrees to the methodology/ Test excavation for the Appin mineshaft ventilation project.*	Thank you for your feedback. We are looking forward to working with you on site.
Freeman & Marx	Clive Freeman	*We would like to support the methodology. It is great that it has included some of the recommendations spoken about on the initial site visit.* *We look forward to assisting in the excavation tests.*	Thank you for your feedback. We are looking forward to working with you on site.
KYWG	Phil Kahn	*Thank you for your report, we agree and support you test excavation methodology regarding Appin Mine Shaft Ventilation Project.*	Thankyou Phil. We will be in touch shortly with logistics for the project.

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
Yulay Cultural Services	Arika Jalomaki	*I have read and agree with the methodology for upcoming test excavations and look forward to working with you.*	Thankyou Arika, we look forward to working with you on site.

4.2.3 Aboriginal Cultural Heritage Assessment Survey

4.2.3.1 Survey Engagement Application Process

Due to a high volume of potential participants, six RAPs were invited to participate in the field survey. The invitation described the requirements that the Proponent needed applicants to satisfy for engagement in regard to fitness for work, drugs and alcohol policy, and personal insurance and protective equipment.

4.2.3.2 Aboriginal Cultural Heritage Survey

An Aboriginal cultural heritage survey was conducted over one day, 7 December 2020. Table 9 summarises the representatives of the RAPs who attended the survey. Table 10 details the feedback of RAPs during the survey.

Table 9: Aboriginal cultural heritage survey attendance

Representative	Registered Aboriginal Party
7 December 2020	
Nick DeZwart	A1 Indigenous Services
Phil Boney	Barraby Cultural Services
Rebecca Chalker	Cubbitch Barta Native Title Claimants
Joanne Smith	Didge Ngunawal Clan
Clive Freeman	Freeman& Marx Pty Ltd
Adam Gunther	Kamilaroi Yankuntjatjara Working Group

Table 10: Details of RAP feedback during the Aboriginal heritage survey

Registered Aboriginal Party	RAP	Comment made	Response from Niche
All RAP groups involved in the field assessment	RAPs involved in the field assessment	RAPs involved survey noted the sub-surface potential of both sides of Foot Onslow Creek. The poor visibility of the Subject Area was also noted.	This was noted and considered during this assessment. The Test Excavation Methodology developed for the Subject Area considered the discussions regarding sub-surface potential, with test pits located accordingly.
Cubbitch Barta and Freeman & Marx	Rebecca Chalker and Clive Freeman	A discussion between Rebecca, Clive and Sarah McGuinness (Niche) identified the often-over-looked sub-surface potential of hill tops and ridge lines, as situated in the original Subject Area.	This was noted and considered during this assessment. The southern hilltop was excluded from the revised Subject Area and thus will not be impacted by the proposed works.

4.2.4 Archaeological Test Excavation

4.2.4.1 Test Excavation Engagement Process

Due to a high volume of potential participants, 11 RAPs were invited to participate in the test excavation. The invitation described the requirements that the Proponent needed applicants to satisfy for engagement in regard to fitness for work, drugs and alcohol policy, and personal insurance and protective equipment.

4.2.4.2 Archaeological Test Excavation

The archaeological test excavation was undertaken over 10 days, between 1 and 12 February 2021. Table 11 summarises the representative of RAPs who attended during the course of the test excavation. Table 12 details the RAP feedback over the course of the test excavation.

Table 11: Archaeological test excavation participants

Participant	Organisation
Nick De Zwart	A1 Cultural Services
Wayne Kennedy	A1 Cultural Services
Jayden Reid	Aragung
Lee Field	Barraby Cultural Services
Kirsty-Lee Chalker	Cubbitch Barta Native Title Claimants
Glenda Chalker	Cubbitch Barta Native Title Claimants
Rebecca Chalker	Cubbitch Barta Native Title Claimants
Kiarni Chalker	Cubbitch Barta Native Title Claimants
Peter Markovic	Freeman & Marx
Jamie Currell	KYWG
Kaarina Slater	Ngambaa CC
Hannah Matagia	Wurrumay
Bree Slater	Yulay Cultural Services
Arika Jalomaki	Yulay Cultural Services
Bo Field	Yurrandaali

Table 12: RAP feedback during the test excavation

Registered Aboriginal Party	RAP	Comment made	Response from Niche
RAP groups involved in the field assessment	RAPs involved in the field assessment	RAPs involved in the test excavation were surprised at the low density of artefacts recovered during the excavation. The erosion and agricultural disturbances within the Subject Area were noted.	This was noted and considered during this assessment.
Cubbitch Barta	Glenda Chalker	Glenda reiterated her comments from the field survey and requested that the 3 mm sieve be used for wet sieving and additional pits be excavated around the artefact bearing pits.	Glenda's recommendation from the field survey was considered and employed during the test excavation. All sieving was conducted on the 3 mm sieve and an additional 6 pits were excavated around the artefact bearing pits.

4.3 Stage 4 – Review of draft Aboriginal cultural heritage assessment report

A draft of this report was provided to the RAPs for their review and comment on 26 March 2021 in accordance with the Consultation Requirements (DECCW 2010b). A statutory timeframe of a minimum of 28 days for responses was provided to all RAPs, with a request for comments to be provided by 5 pm 27 April 2021.

The responses in Table 13 detail the comments made by the RAPs, as well as Niche's response, and copies of all submissions made and received are included in Appendix 1.

Table 13: Details of RAP feedback on the draft ACHA

Registered Aboriginal Party	RAP	Comment made	Response from Niche
Aragung	Jamie Eastwood	Thank you for your email and invitation to provide comment on the Aboriginal Cultural Heritage Assessment Report Apin Mine Ventilation and access project. Aragung Aboriginal Cultural Heritage Site Assessments has review the above mention report which has been papered by NICHE and agrees to and Supports all information stated in the reports presentation of information and methodology use in archaeological investigations. Aragung Considers archaeological investigations such as the Apin project to be exceedingly important for First Nations Darug and Tharawal People, as such investigations provides direct tangible evidence to our ancestral heritage and also allows our people to continue our cultural practice of caring for country and our Aboriginal places of significance. Aragung also considers such archaeological investigations as exceedingly important to the wider existing community , and future residing residence of the Apin area Tharawal Country , as such investigation provide a important bridging tool to reconciliation and education in the informing to these local communities of Indigenous and Australian local histories. Having work as a Aboriginal cultural Site officer on Tharawal and Darug lands for many years , as a Indigenous person who has traditional connections to the project area - through trade , ceremony , marriage and song line - and as a known member of the greater Sydney Aboriginal Community I have obtain a deep understanding of cultural knowledge to the country in which the report was prepared for . Should you require any more assistance in future or ongoing archaeological investigation I would only be to happy to impart my cultural knowledge towards country and country associated to Darug Tharawal lands, via email phone conversation or onsite meetings.	Thank you for your response and for your assistance on the project to date.

Registered Aboriginal Party	RAP	Comment made	Response from Niche
		should Aragung Aboriginal Cultural Heritage Site Assessments be considered for future involvements or field works towards the Apin Mine ventilation and Access project please do not hesitate to enquirer about the availability of myself or one of our three experience Aboriginal Site Officer . Copies of all up to date insurance certificates can be found attach to this email.	
Guntawang Aboriginal Resources Incorporated	Wendy Morgan	Thanks for providing the ACHA for the Appin Mine Ventilation and Access Project. Guntawang has nothing more to offer at the moment. We look forward to working with you in the near future.	Thank you for your response and for your assistance on the project to date.
KYWG	Kadibulla Khan	Thank you for your ACHA regarding Appin Mine Ventilation and Access Project. A long time ago before the Europeans arrived, the land would have been very different from today. The flora and fauna would have been thriving, there would have been many water ways flowing, today they have been used for drainage. Aboriginal people would have used their environment to their advantage, utilising what they needed and never wasting or taking too much. This was a part of our lore looking after mother nature as she provides for us Aboriginal people and we give back to her. Hunting and gathering would have taken place along with camping and ceremonial practices. There is always the potential for Aboriginal sites or PADs, even in the historic fill layers. I would like to mention Aboriginal interpretation within the development as it is just as important to recognise the Aboriginal people. This can be achieved through native gardens, artwork, signage, 3D replicas of artefacts on display and an app could be created. We look forward to working with you on this project further.	Many thanks for your reply detailing how the landscape would have been used by Aboriginal people and emphasising the symbiotic relationship they maintained with their environment. We look forward to working with you further on this project as well.
DNC	Lilly Carroll	DNC has reviewed the documents and is Happy from our end.	Thank you for your response and for your assistance on the project to date.

4.4 Stage 5 – Care and Control Agreement

Due to the collection of the five Aboriginal objects during the test excavation program, and the recommended collection of the surface artefact located at Bulli Site 7 (AHIMS ID#52-2-3687), the long term management of the six Aboriginal objects is required. Under section 85A(1)I of the NPW Act, the Director General of the Department of Premier and Cabinet may transfer control of Aboriginal objects to a person or persons for safekeeping.

Initial discussions on site with the RAPs during the test excavation indicate a preference for the Aboriginal objects to be reburied on site, outside of the proposed area of impact. Following RAP review of the draft ACHA, reburial of artefacts on site is identified as the preferred option.

As such, reburial on site under a Care and Control Agreement is recommended as per Recommendations 3 and 4. Details of RAP consultation regarding the long-term management of the Aboriginal objects is outlined in Table 14 below.

Table 14: Details of care and control consultation

Registered Aboriginal Party	Stakeholder	Preference of location for long term care	Method of Contact
Cubbitch Barta Native Title Claimants	Glenda Chalker	Reburial on site in area of excavated trenches outside of impact area.	Phone

5. Investigator and Contributors

5.1 Research and Reporting

This investigation was managed by Sarah McGuinness (BA). The Aboriginal community consultation, research, field assessment and report writing was undertaken by Sarah McGuinness, Wade Goldwyer (BA - Hons) and Yolanda Pavincich (BArch GradDip CHM). GIS for this investigation was undertaken by Greg Tobin and Yin Hua (Niche).

The ACHA was reviewed internally by Niche Aboriginal Heritage Team Leader Renée Regal (BA Hons).

5.2 Fieldwork

In addition to the representatives of the RAPs listed in Table 9 and the test excavation participants listed in Table 20, the individuals listed in Table 15 attended and/or supported the surveys and assessment in various capacities.

Table 15: Aboriginal cultural heritage surveys and assessment – other participants or support personnel

Name	Representing	Role
Nick DeZwart	A1 Indigenous Services	RAP
Wayne Kennedy	A1 Indigenous Services	RAP
Jayden Reid	Aragung	RAP
Lee Field	Barraby Cultural Services	RAP
Phil Boney	Barraby Cultural Services	RAP
Kirsty-Lee Chalker	Cubbitch Barta Native Title Claimants	RAP
Glenda Chalker	Cubbitch Barta Native Title Claimants	RAP
Kiarni Chalker	Cubbitch Barta Native Title Claimants	RAP
Rebecca Chalker	Cubbitch Barta Native Title Claimants	RAP
Joanne Smith	Didge Ngunawal Clan	RAP
Peter Markovic	Freeman & Marx Pty Ltd	RAP
Clive Freeman	Freeman & Marx Pty Ltd	RAP
Jamie Currell	Kamilaroi Yankuntjatjara Working Group	RAP
Adam Gunther	Kamilaroi Yankuntjatjara Working Group	RAP
Nicola Curtis	IMC	Principal Mining Approvals
Steve Groen	IMC	Lead Studies - Illawarra Metallurgical Coal
Tracy Connolly	IMC	Exploration Field Assistant
Jerom Fox	IMC	Project Manager of Pre-feasibility Assessment
Marika Low	Niche	Artefact Analysis
Sarah McGuinness	Niche	Site Director
Sam Ward	Niche	Field Assistant

Name	Representing	Role
Wade Goldwyer	Niche	Field Assistant
Kosta Contas	Niche	Field Assistant
Chelsea Freeman	Niche	Field Assistant
John Gillen	Niche	Field Assistant
Matthew Richardson	Niche	Company Director
Kaarina Slater	Ngambaa CC	RAP
Hannah Matagia	Wurrumay	RAP
Bree Slater	Yulay Cultural Services	RAP
Arika Jalomaki	Yulay Cultural Services	RAP
Bo Field	Yurrandaali	RAP

6. Landscape Context

6.1 Overview

Understanding the past and present environmental contexts of an area is requisite in any Aboriginal archaeological and cultural heritage investigation (DECCW 2010a). The nature and distribution of Aboriginal archaeological sites are closely related to the environmental context. This section provides a broad overview of the environmental setting of the Subject Area, before describing each of the soil landscapes that are contained within it. Soil landscapes, when considered with the levels of past land use and modification, are a useful tool in identifying environmental proxies for the likely preservation and burial of Aboriginal objects in a landscape and resources that may have been available to Aboriginal people in the past; such as the presence of rock outcrops to provide surfaces for art or to sharpen and prepare implements, stone for the manufacture of stone tools and plant species.

6.2 The Landscape

The Subject Area is located on the southern margins of the Cumberland Plain, which is characterised by low lying, gently undulating plains and hills (Hazelton and Tille 1990). The Subject Area is also located on the peripheries of the Woronora Plateau, as defined by the gorges and sandstone plateaus found to the east and the incised Nepean Gorge.

There are two soil landscapes present within the Subject Area which are defined by Hazelton and Tille (1990) as the Blacktown and Theresa Park soil landscapes. The Blacktown Soil Landscape makes up 10% of the Subject Area (Figure 5 and Plate 3) is characterised by gently undulating hills, with relief up to 30m and slopes of usually less than 5% gradient. Crests of hills and ridges are broad and rounded, with convex upper slopes. Lower slopes of this soil landscape are generally concave with broad drainages lines and valley flows. The dominant vegetation of this soil landscape prior to historic clearing would have been open-forest and woodland with denser vegetation in the riparian zone. Small pockets of residual Cumberland Plain Woodland are located within the Subject Area. Pastoral grasses now dominate the areas of cleared vegetation. The underlying geology within the Blacktown Soil Landscape is Wianamatta Shale, with overlying, generally shallow podzolic loam soils and clay. The Blacktown soils have formed in situ through weathering of the shale geology, and as such have the potential to preserve Aboriginal objects wherever they occur.

The Theresa Park soil landscape comprises approximately 90% of the Subject Area. This soil landscape is formed from fluvial processes associated with the Foot Onslow Creek and the Nepean River (Figure 5 and Plate 4). It is characterised by its undulating slopes, floodplains and terraces with local relief up to 60m and slope gradients <5%, except on edges of terraces where gradients exceed 10%. Prior to historic clearing, the dominant vegetation of the Theresa Park soil landscape would have been tall open wet-sclerophyll forest, which would have contained cabbage gum and broad-leaved apple. The portion of the Subject Area where the Theresa Park soil landscape occurs has been cleared of all native vegetation, with some regrowth occurring on the banks of the Foot Onslow Creek. Soils within this landscape are generally podzolic on the terraces with Prairie Soils within current floodplains. The soil profile is relatively deep (>250cm) consisting of sandy loams overlying sandy clay, within landforms associated with floodplains and terrace edges. This profile is moderately deep (>150cm) towards drainage lines and consisting predominately of sandy clay deposits. The Theresa Park soils are often subject to post depositional movement as a result to the seasonal waterlogging/ flooding as well as soil erosion as such, Aboriginal objects may not be preserved in their original archaeological context.



Plate 3: Example of the Blacktown Soil Landscape within the Subject Area.



Plate 4: Example of the Theresa Park Soil Landscape within the Subject Area, with the low rolling hills of the Blacktown Soil landscape in the rear of the photo.

The Subject Area can be further divided into various landform units that can be used to inform predictive models for the potential occurrence of Aboriginal objects. The landforms within the Subject Area are defined as flat, lower slope and upper slopes and crests. The characteristics of these landforms and their location within the Subject Area are summarised below.

Flat

The northern part of the Subject Area near Foot Onslow Creek is situated within the flat landform unit (Plate 5). This unit is covered with pastoral grasses with regrowth vegetation and weeds along the watercourse. This landform sits within the Theresa Park soil landscape and is intersected by low drainage lines associated with Foot Onslow Creek. Modern vehicle tracks, vegetation clearance and stockpiled material along with a single storey dwelling and shed have all impacted upon this landform unit.



Plate 5: An example of flat landforms within the Subject Area with Foot Onslow Creek in the mid ground; facing south-west.

Lower slopes

The lower slope landform unit is characterised within the Subject Area by gentle hill slopes leading into cleared pasture and ultimately draining into Foot Onslow Creek (Plate 6). This landform has been

extensively cleared of native vegetation. This soil landscape unit is part of the Theresa Park soil landscape. Aboriginal site Bulli Site 7 (AHIMS ID# 52-2-3687) is situated within this landform unit.



Plate 6: An example of lower slope landform unit within the Subject Area; facing north-west.

Upper slopes and crests

The upper slope and crest landform unit is characterised within the Subject Area by partially cleared, heavily grassed steep slopes with some remnant Cumberland Plain Woodland vegetation (Plate 7 and Plate 8). This unit is situated around the southern and western end of the Subject Area and is located within both the Blacktown and Theresa Park soil landscapes. The upper slope and crest landform unit is particularly susceptible to erosion and soil slumping due to vegetation clearance and soil exposure.



Plate 7: An example of upper slope and crest landform, within the Subject Area; facing south.



Plate 8: An example of upper slope and crest landform with remnant Cumberland Plain Woodland along the rear crest; facing south.

6.3 Hydrology

The primary hydrological feature of the Subject Area is Foot Onslow Creek, a small drainage tributary of the Nepean River that intersections the Subject Area at the northern end, running north- south through the boundary of the Subject Area (Figure 5). Foot Onslow Creek would have been a reliable water source,

particularly following rains where water would have pooled in the channel and ponds. The Nepean River itself is fed by a large catchment area and would have been a reliable, year-round source of fresh water.

6.4 Disturbance and Modification

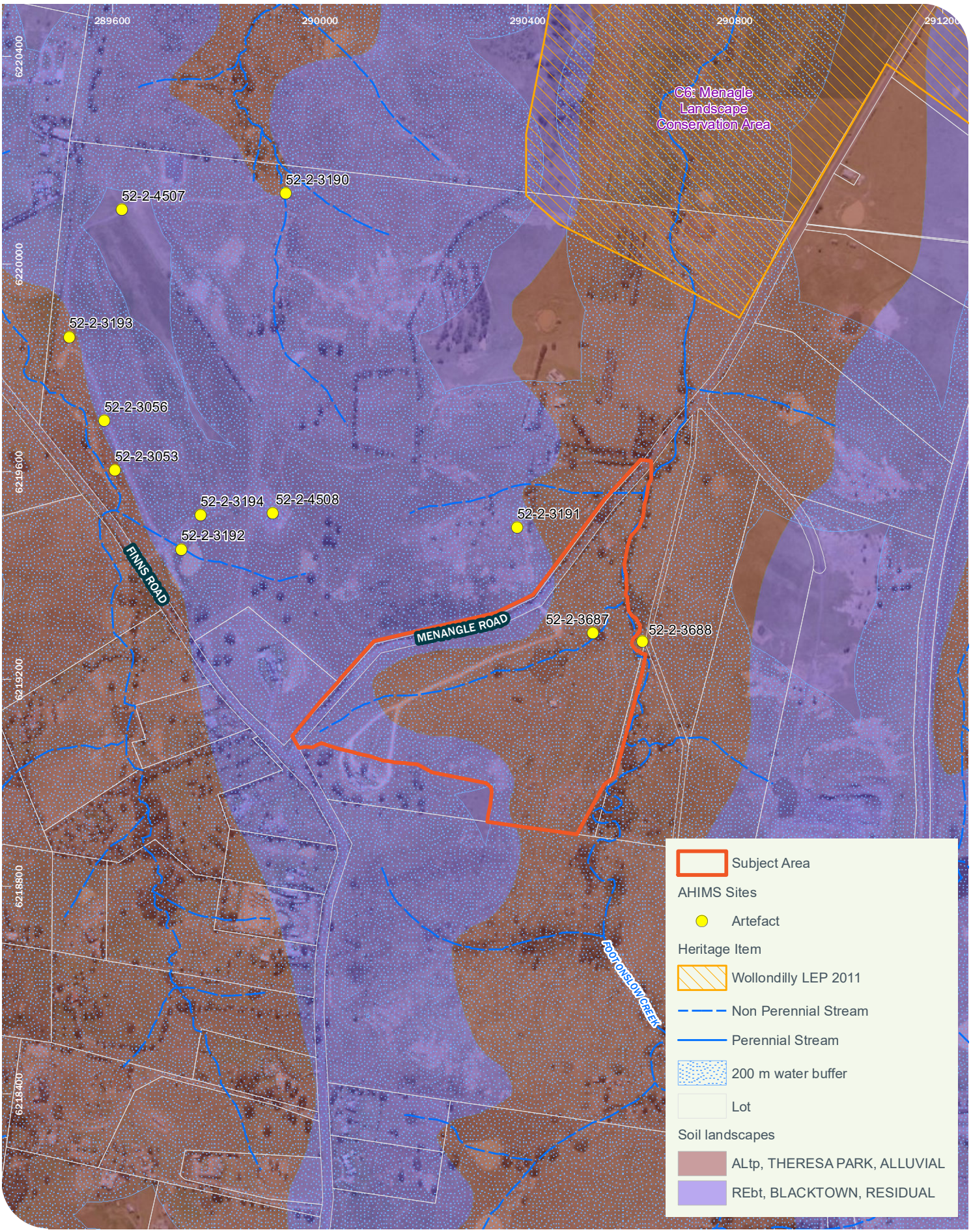
The Subject Area is located in the south west region of Sydney where the general use of the land is characterised by small rural holdings, light industrial, commercial premises and local road networks. The first land grants in the district were issued between 1810 and 1820 and in the following decades the district established an agricultural and pastoral industry, including wheat and maize crops, and dairying (Whitaker 2005). The district has maintained its rural roots through to the present day, and mining has become an important regional industry. More recently the establishment of the southern suburbs of the Sydney urban area has begun to encroach further into the area, as former farmland is transformed into residential housing.

The Subject Area is currently zoned as RU2 – Rural landscape comprising of undeveloped land. There is a single-story dwelling located towards the northeast side of the property fronting Menangle Road, as well as a large shed situated towards the centre of the property. Unsealed tracks connect the property.

The landforms within the Subject Area have been subject to significant land uses that may impact upon the preservation and visibility of the archaeological record of the Subject Area. These include widespread clearing of native vegetation and subsequent erosion, as well as major pastoral and agricultural utilisation. The impacts of earthworks associated with the construction of dams and vehicle tracks as well as, cattle grazing can be seen across the Subject Area.

6.5 Summary

The Subject Area generally consists of low lying and gently undulating plains, with areas in the west of the Subject Area comprising steeper hills of greater local relief. Vegetation has been largely cleared across the wider area, with introduced pastoral grasses the current dominant vegetation, with isolated pockets of residual Cumberland Plain Woodland. The soil landscapes of the Subject Area are moderately deep and have the potential to contain Aboriginal objects in situ. The Subject Area is also in close proximity of reliable water sources, making it a suitable location for year-round occupation by Aboriginal people.



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Soil landscapes and hydrology in the local area

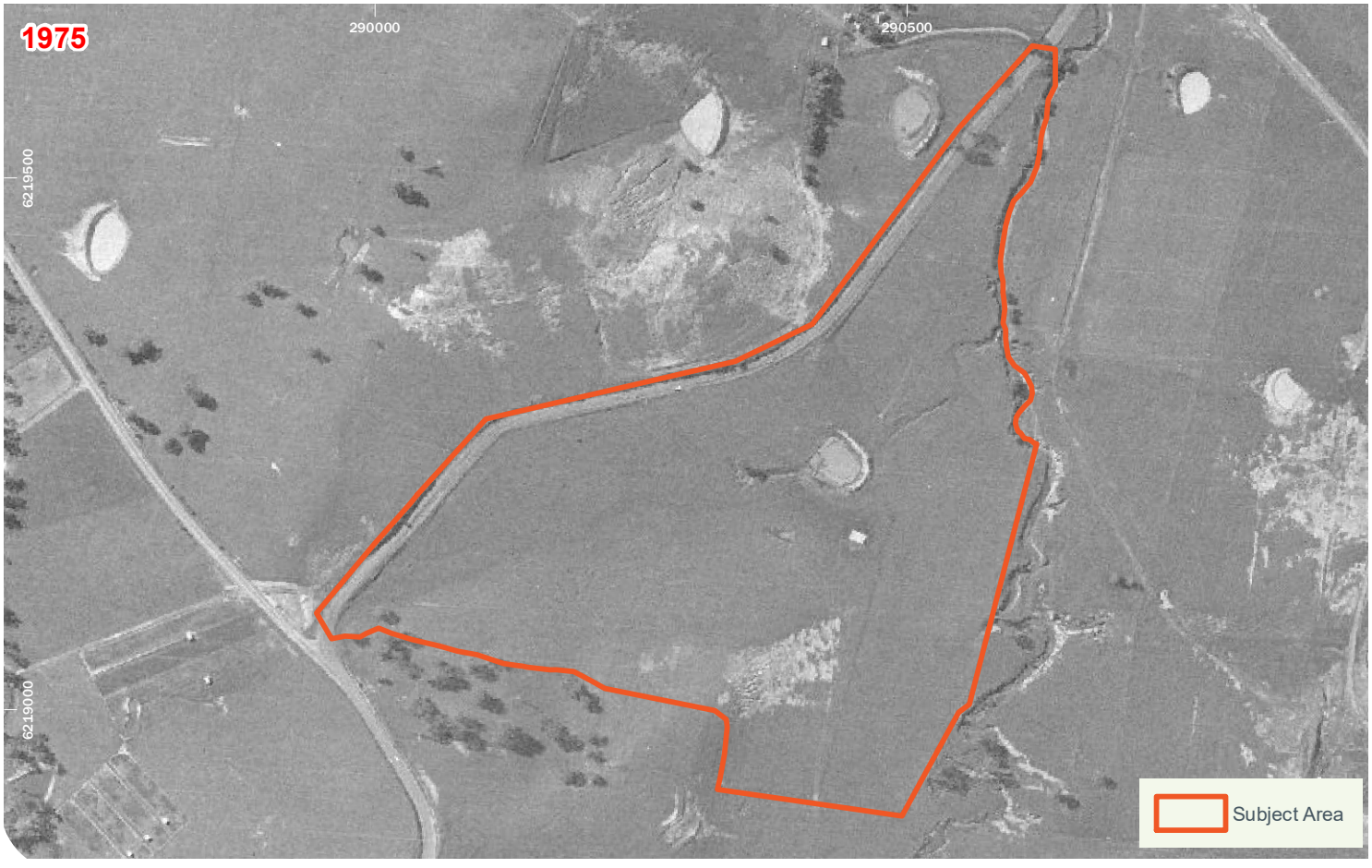
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Niche Proj. #: 6272
Client: South32 Illawarra Coal

Figure 5

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Historical aerial photographs
Appin Mine Access and Ventilation Project ACHA

Niche PM: Sarah McGuinness
Niche Proj. #: 6152
Client: South32

Figure 6

public/NSW_Imagery: © Department of Customer Service 2020 @Metro Map

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7. Aboriginal Archaeological Context

The Subject Area is located in the Cumberland Plain, a physiographic region of western Sydney characterised by its open undulating hilly landscape with alluvium rich soil underlain by the sedimentary geology. While the region is characterised by a rich Aboriginal archaeological record, the reconstruction of past land use of Aboriginal people in the Cumberland Plain and the structure of their society is an extremely difficult task often relying on biased historical documents and archaeological evidence resulting from environmental impact assessments rather than research-driven projects (see AMBS 1997 for more detailed discussion of current limitations). Despite these inherent limitations, archaeologists have built up a picture of Aboriginal settlement patterns for the region, establishing a foundation for the testing of predictive models and the refinement of knowledge. The past Aboriginal land use indicated by the results of previous archaeological work in the region (reviewed in Subsection 7.3 of this Section) suggests that certain areas nearby major creeks were used as locations for the intensive manufacture of silcrete and quartz artefacts (as suggested by the high-density artefacts recovered in association with knapping floors) as well as locations of artefact processing, use and/or maintenance.

7.1 Ethnography and History

The Menangle area is the traditional country of the Tharawal people. Tindale (1974) identified the Tharawal boundaries as being from the south side of Botany Bay to north of the Shoalhaven River, and running inland to the Campbelltown and Camden area (Attenbrow 2010: 34, SA Museum 2010). RAP Glenda Chalker describes the Appin and Douglas Park area as being 'Gundungurra and Tharawal tribal country' as the area is a transitional boundary between the Tharawal and their westerly neighbours, the Gundungara (Attenbrow 2010: 23, DEC 2007: 7). Attenbrow (2010:35) points out that such boundary mapping, undertaken as it was in the nineteenth century is indicative at best, however there appears to be reasonably strong agreement between those who have mapped language boundaries that the Douglas Park area is indeed a transitional boundary between the Tharawal and Gundangara.

The records and histories of the Tharawal and their country at the time of contact with Europeans are subject to bias and are generally fragmented, providing nothing like a complete picture of the way Aboriginal people were living prior to European interference. Nevertheless, we know the Tharawal regularly communicated, moved, traded and participated in ceremonies between their country and neighbouring areas. It is most likely family groups or clans would 'intermingle and interact along both physical and social boundaries' rather than be strictly confined to the 'tribal' borders that were to be artificially imposed by European anthropologists (Organ 1990: xliii).

The arrival of the First Fleet in Sydney Cove in 1788 was followed the next year by a smallpox epidemic, which spread to the neighbouring regions and, although the exact effects are not known, killed over half the Aboriginal population of the areas effected (Organ 1990: 5).

Early in the nineteenth century European graziers began taking land in the south of the Cumberland Plain and the coastal plains around Wollongong, with cedar getting being conducted in the narrower northern coastal plain and rainforest areas of the escarpment (DEC 2005b). Access to traditional and everyday resources (such as water) and clearing the land of trees would have had a major impact on the ways in which Aboriginal people would have been living, and also caused significant social disruption between Aboriginal groups, and pressure between Aboriginal people and the ever increasing European population. This period was a time of drought, and the competition for resources between the Europeans and the Tharawal, who were adapting to the massive changes that were so quickly upon them, led to several years of conflict. Organ (1990) documents the various skirmishes, killings and reprisals between Europeans and

the Tharawal during the 1814 – 1815 period in the Cowpastures, Camden and Appin districts. Eventually this sporadic bloodshed would lead to larger scale conflict, with Governor Macquarie implementing a sustained punitive action against the Aboriginal population in the district. This resulted in the Appin Massacre of 17 April 1816, in which Aboriginal people were shot and driven over the steep cliffs (probably near Broughtons Pass) to their death during a surprise attack by a detachment of the 46th Regiment, in the middle of the night.

Despite the massive changes that were so quickly brought to the Aboriginal people of the region, they maintained a sense of community, traditional customs and practices, cultural knowledge and continued to care for significant sites and the land in general. The Tharawal continue as custodians of the land, and many continue to live in the Gundungara and Tharawal tribal country today.

7.2 Heritage Register Searches

7.2.1 AHIMS Register

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted of the Subject Area on 13 August 2020 (AHIMS Search ID# 527254); results listed in Table 16. There were 11 previously recorded Aboriginal cultural heritage sites in and around the Subject Area. Of these Aboriginal cultural heritage sites, one is situated within the Subject Area boundary (Bulli Site 7 AHIMS ID# 52-2-3687).

The Aboriginal cultural heritage sites recorded within 4km of the Subject Area were found to be comprised of open sites containing either isolated finds or an open camp site (Table 16).

Table 16: Details the AHIMS sites that are within 4km of the Subject Area

AHIMS ID	Site Name	Site Features
52-2-3190	WG1	Isolated Find
52-2-3191	WG6, Wandinong	Isolated Find
52-2-3192	WG5, Wandinong	Open camp site
52-2-3053	WG4 Wandingong (Unavailable)	Isolated Find
52-2-3194	Wandinong 5	Isolated Find
52-2-3056	WG4 AFT	Open camp site
52-2-3193	Wandinong 6	Open camp site
52-2-3687	Bulli Site 7	Isolated Find
52-2-3688	Bulli Site 8	Open camp site
52-2-4507	WG7	Isolated Find
52-2-4508	WG8	Isolated Find

7.2.2 Other Registers

In addition to AHIMS, searches of the World Heritage Database, the Commonwealth Heritage List, National Heritage List, State Heritage Register, State Heritage Inventory, the Wollondilly LEP (2011) and the Wollondilly Development Control Plan (DCP) (2016) were conducted on the 30 October 2020. Clause 5.10 of the Wollondilly LEP (2011) outlines the controls for heritage conservation including the conservation of Aboriginal objects and Aboriginal Places of heritage significance.

Table 17: Listed heritage items in proximity to the Subject Area

Heritage Register	Items in the Activity Area	Items within wider region of the Activity Area
World Heritage Database	• N/A	• N/A
Commonwealth Heritage List	• N/A	• N/A
National Heritage List	• N/A	• N/A
State Heritage Register	• N/A	• Upper Nepean Scheme – Upper Canal (SHL ID # 4580004)
Schedule 5 of LEP	• N/A	• Menangle Landscape Conservation Area (ID# C6) • Slab Hut (ID#I79) • Old Razorback Road (ID# A1) • Mount Hercules Homestead (ID #A12) • Upper Nepean Scheme – Upper Canal (ID #I16) • Cawdor Dairy (ID #I85)
DCP	• N/A	• An Aboriginal Heritage assessment must be completed if there is a proposed impact or disturbance to, or within the immediate vicinity (100 metres) of an Aboriginal Object, Aboriginal Place of significance, an existing or former ceremonial ground, a burial ground or cemetery, a story place or mythological site, a former Aboriginal reserve or historic encampment, or an archaeological site of high significance.

7.3 Local Archaeological Assessments

Archaeological studies provide material evidence of Aboriginal use of the landscape at times both before and after written history and complements the oral histories and cultural knowledge held by the Aboriginal community. A number of archaeological assessments have been undertaken in the Subject Area, including the following:

- Biosis (2009) Bulli Seam Operations Aboriginal Cultural Heritage Assessment. An unpublished report prepared for BHP Billiton Illawarra Coal.
- Biosis Research (2012) Appin Mine Heritage Management Plan. An unpublished report for South32 Illawarra Metallurgical Coal.
- Niche Environment and Heritage (2020) Menangle Road Geotechnical Investigations Aboriginal Objects Due Diligence Assessment. An unpublished report prepared for South32 Illawarra Metallurgical Coal.

7.3.1 Summary of Local Archaeological Assessments

A summary of local archaeological assessments undertaken in the vicinity of the Subject Area is provided in Table 18.

Table 18: Summary of Archaeological Assessments within and in close proximity to the Subject Area

Assessment and date	Summary of findings
AHMS (2015) Greater Macarthur Investigation Area: Aboriginal and	AHMS undertook an investigation for the wider Macarthur region to assess the potential for development in the growth areas, encompassing the Subject Area. The assessment identified a high likelihood of extensive and/or significant Aboriginal sites

Assessment and date	Summary of findings
Historic Heritage- Gap Analysis and Future Direction	occurring along the large river systems and their riparian corridors. In particular, the tributaries of the Nepean River were identified as key area of high potential, with Aboriginal sites likely to be clustered around the upper reaches of tributaries where sandstone shelters begin to form. This investigation is of relevance as it contributes to the archaeological record of the region and assists in establishing a predictive model for the nature and distribute of Aboriginal sites for the region.
Biosis Research (2006b) Douglas Area 7 Project Environmental Impact Statement Appendix H: Impacts on Indigenous and Historical Archaeology- Revised report	This assessment was undertaken to characterise the cultural heritage resources in the predicted subsidence area of Appin Colliery Longwalls 701 to 704. This project assessed a large area of land approximately three kilometres to the south of the Subject Area, in a similar landscape of creek flats and gentle slopes. Biosis Research's survey took in sandstone environments that flanked the Nepean River and some of its westerly tributaries, but crucially this survey also investigated the cleared landscapes of the Cumberland Lowlands in the Douglas Park area. It was one of the first surveys to do so, and discovered eight (8) previously unknown stone artefact sites in the area, including on the Mountbatten property (Mountbatten 1 AHIMS ID # 52-2-3674, Harris Creek Scar Tree and Harris Creek 2). Biosis Research noted that stone artefact sites in the local area were generally under-represented in AHIMS records due to a lack of previous survey effort to find them (with most previous survey focusing on finding sandstone shelters). The report concluded that the landform with the most archaeological sensitivity in the region were tributaries and gullies, as these contained sandstone shelter sites with rock art and archaeological deposit; in addition stone artefacts were likely to occur in all parts of the undulating hills of the lowlands (the discontinuous "background scatter" of stone artefacts) as has been documented elsewhere on the Cumberland Plain
Biosis Research 2009 **Bulli Seam Operations (BSO) Aboriginal Cultural Heritage Assessment**	Biosis were commissioned to conduct an Aboriginal Cultural Heritage Assessment of the Bulli Seam Operations including Appin Mine and the Subject Area. A total of 632 known sites were recorded within the study area including an additional 44 as a result of the assessment. The majority of these sites were found to consist of sandstone shelters and platforms followed by stone artefacts and Potential Archaeological Deposits (PADs), which were found to predominately occur on the Blacktown soil landscape, within paddock grasses and open woodland vegetation across the Cumberland lowlands. These finds are associated with upper hill slopes, ridgelines and in close proximity to water sources including swamps and water lines. This report is of relevance as it contributes to the archaeological record of the region and assists in establishing a predictive model for the nature and distribute of Aboriginal sites for the region.
Jo McDonald Cultural Heritage Management Pty Ltd 2009 **Test Excavation Report Howes Creek Menangle Park**	Jo McDonald Cultural Heritage Management Pty Ltd were commissioned to undertake an archaeological test excavation of an area of high archaeological potential on the southern bank of Howe's Creek, situated approximately 6km north of the Subject Area. This is the only excavation that has occurred in the local area. The excavation identified that proximity of the test pits to Howe's Creek was an important factor to artefact density and that pits with pale sandy soil were generally found to have a higher density of artefacts to pits with dark loamy soil. A total of 113 artefacts were recovered during the test excavation, with an additional 70 artefacts recovered during a targeted excavation of an area of high potential within 200m south of Howe's Creek.
Jo McDonald Cultural Heritage Management Pty Ltd 2010	Jo McDonald Cultural Heritage Management Pty Ltd were commissioned by Landcom and Campbelltown City Council to prepare an assessment of Indigenous heritage values in the Menangle Park area, approximately 1 km north of the Subject Area. The assessment identified 22 open surface Aboriginal cultural heritage sites and a number

Assessment and date	Summary of findings
Assessment of Indigenous heritage values Menangle Park	of areas of PAD through survey and sensitivity mapping. The assessment identified first order tributary creek lines as one of three high value landscapes with the potential to contain sub-surface archaeological objects. The assessment noted the limited archaeological investigations in the Menangle area, and recommended investigation and salvage for zones identified to be of high Indigenous sensitivity prior to development.
Kelleher Nightingale 2012	Kelleher Nightingale were commissioned to conduct a Due Diligence assessment to inform a Review of Environmental Factors for the Douglas Park Environmental Waste Water Scheme, situated approximately 3km south of the Subject Area. This report is of relevance as it contributes to the archaeological record of the region and assists in establishing a predictive model for the nature and distribute of Aboriginal sites for the region.
Niche 2020	Niche were commissioned to undertake a Due Diligence assessment for geotechnical investigations within the Subject Area. The assessment concluded that further investigation was warranted due to the presence of known and potential unknown Aboriginal cultural heritage sites. The assessment identified high archaeological potential along the terraces either side of Foot Onslow Creek.

7.4 Regional Archaeological Studies

The local archaeological studies detailed above fit broadly into the wider Cumberland Plain area, which encompasses the entire Subject Area. The antiquity of Aboriginal occupation in the region is demonstrated through a number of archaeological excavations that have been undertaken across the Cumberland Plain.

It is now proposed that Aboriginal occupation of Australia dates back at least 65,000 years based on results from Madjedbebe, a rockshelter located in northern Australia (Clarkson et al. 2017). The greater Sydney region has been inhabited by Aboriginal people for at least 35,000 years. The earliest known occupational site of the Cumberland Plain and generally in the Sydney Basin is located north of Pitt Town, south of the Hawkesbury and the cultural deposits have been dated by optically stimulated luminescence (OSL) to 36,000+/-3000 BP (Williams et al. 2012). While there is early evidence that the Sydney region has been occupied for over 35,000 years (Williams et al. 2012), archaeological research indicates the earliest evidence for occupation in the eastern Blue Mountains to the west of the Sydney Basin is 12,000 years Before Present (BP) from Walls cave, Lyre Bird dell and Kings Table. The earliest date recorded at King Table of 22,000 years BP (Stockton and Holland 1974) has been rejected due to a lack of clarity on associated taphonomic processes (Johnson 1979). The late Holocene (5,000-0 years BP) sees extensive increased occupation of the Cumberland Plain with the vast majority of the 12,000 or so sites recorded from this period. The result of this extensive and continued occupation has left a vast amount of accumulated depositional evidence.

7.5 Synthesis and Predictive Model

On the Cumberland Plain at Rouse Hill, west of Sydney, White and McDonald (2010) have analysed the distribution of stone artefacts across the Rouse Hill Development Area, which measures around 5 km x 5 km. This is the first such peer reviewed and published analysis and predictive model. White and McDonald analysed several landscape variables against the results of sub-surface investigations (a database containing 4429 stone artefacts) and concluded that the stream order (the size of a drainage line) and landform were the most important factors in determining artefact density and distribution. In summary they conclude that factors influencing artefact density include:

1. stream order, with higher order streams tending to have higher artefact densities and more continuous distributions than lower order streams.
2. landform, with higher densities occurring on terraces and lower slopes, and with sparse discontinuous scatters on upper slopes.
3. aspect on lower slopes associated with larger streams, with higher artefact densities occurring on landscapes facing north and northeast.
4. distance from water, with higher artefact densities occurring 51–100m from 4th order streams, and within 50m of 2nd order streams (White and McDonald 2010: 36).

Although the Menangle area is one of greater relief than Rouse Hill, White and McDonald's observation about the importance of landform is noteworthy and aptly describes the known distribution of stone artefact sites in the Menangle area. Jo McDonald Cultural Heritage Management also undertook a study of Indigenous heritage values at Menangle Park, just north of the Subject Area (JMCHM 2010). This study identified three high value landscapes with the potential to contain sub-surface Aboriginal objects, including creek terraces like that of Foot Onslow Creek.

Using data from regional and local archaeological studies, as well as environmental contexts such as geography, topography, hydrology and proximity to resources- a predictive model can be developed to make an informed calculation about the likelihood of specific site types, raw material occurrence and site distribution within the Subject Area.

The Subject Area is located on mostly cleared flats and low to steep hills. There are no landforms within the Subject Area which will produce rock shelters. The Subject Area contains no previously documented or known evidence of use by the Aboriginal community in the times since European contact. The types of Aboriginal archaeological site which were considered likely to occur within the Subject Area are open stone artefact sites. The Subject Area is on the low hills and gentle slopes of the Blacktown Soil Landscape as well as the floodplain and terraces of Theresa Park Soil landscape (Hazelton and Tille 1990). The Blacktown Soil Landscape has the potential to preserve traces of past Aboriginal land use wherever they occurred on the landscape. The Theresa Park Soil Landscape also has the potential to contain Aboriginal objects and/or features due to its moderately deep soil profile, increasing the likelihood to preserve artefacts at depth.

Considering the characteristics of the Cumberland Plain in general, and the specific results of previous investigations in the Subject Area and the surrounding Menangle area the following predictive statements can be made:

- Open Camp Sites (consisting of surface artefact scatters and/or isolated artefacts) are the most likely Aboriginal site types to occur, being commonly found in water-related landforms and gentle slopes <200 m from waterways. This includes flats, lower slopes and hill crests. High density artefact sites are usually located within 50 m – 100 m proximity to upper reaches of larger drainage lines.
- Potential Archaeological Deposits (PADs) are likely to occur where intact soil profiles are present in association with well drained flats and lower slopes. The occurrence of sub-surface material does not necessarily correlate with Aboriginal objects found upon the surface.
- Modified trees (scarred or carved) are unlikely to occur within the Subject Area due to historic clearing of vegetation and the fact that the practice of utilising wood and bark from trees by Aboriginal people decreased after European contact.
- Rockshelters, art (pigment and engraved), middens, quarries, stone arrangements and axe grinding grooves will not be located within the Subject Area due to the absence of suitable food water resources (shells and molluscs) and/or suitable geology (i.e. sandstone formations and outcrops).

- Aboriginal burials are unlikely to be present within the landscape due to the shallow soil profile. These sites tend to occur within deep, sandy and/or soft soil contexts within sand dune formations, often in association with midden materials.
- Aboriginal places are places of cultural significance to Aboriginal people. No Aboriginal places have been declared within the Subject Area (November 2020) or listed on AHIMS (http://www.environment.nsw.gov.au/conservation/AboriginalPlacesNSW.htm).

The predictive statements are limited to the open stone artefact and scarred tree site types, as these are the only site types with a predictable likelihood to occur in the Subject Area.

8. Field Methods

8.1 General Information

The following methods were used to identify archaeological resources, heritage values and significant cultural themes for the Subject Area:

- Aboriginal community input- this was sought throughout the project via the consultation process, participation in archaeological fieldwork and other correspondence.
- Archaeological research- this included landscape characterisation, analysis of previous archaeological works in the region and field survey.
- Archaeological test excavation.

A proposed methodology for the Project ACHA was developed by Niche. A copy of the proposed methodology is available in Appendix 5. The proposed methodology follows the:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (DEC 2005).*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010a).*
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010b); and*
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011).*

8.2 Cultural Heritage Survey

The cultural heritage survey covered all of the initial Subject Area (Plate 1) for the proposed Project, including the land along the eastern bank of Foot Onslow Creek. A brief discussion of the results of the survey in the excluded Subject Area is included below.

The cultural heritage survey was undertaken on Monday 7 December 2020. The list of fieldwork participants is provided in Table 19 below.

Table 19: Cultural Survey Participants

Representative	Registered Aboriginal Party
7 December 2020	
Nick DeZwart	A1 Indigenous Services
Phil Boney	Barraby Cultural Services
Rebecca Chalker	Cubbitch Barta Native Title Claimants
Joanne Smith	Didge Ngunawal Clan
Clive Freeman	Freeman & Marx Pty Ltd
Adam Gunther	Kamilaroi Yankuntjatjara Working Group
Sarah McGuinness	Niche
Yolanda Pavincich	Niche
Nicola Curtis	IMC

Previously registered AHIMS sites that fall within the Subject Area were relocated.

The survey was conducted through a systematic meander across the Subject Area, with survey participants walked a series of transects generally spaced between 10 m and 20 m apart. Areas of greater visibility and

higher potential (exposures, ridgelines, terraced flats etc) were targeted during the survey. Sites were recorded using pre-prepared forms and handheld GPS with an average accuracy of ± 7 m.

The results of the survey are presented in Section 9.

8.3 Archaeological Test Excavation

The purpose of the archaeological test excavation was to increase visibility of deposits and provide further information on the Aboriginal cultural heritage values of the Subject Area. The data gathered contributed to our understanding of site characteristics and local and regional prehistory. The results assisted the formalisation of appropriate management recommendations for the proposed works and any archaeological material recovered.

Test excavation was completed under the BSO Aboriginal Cultural Heritage Management Plan (South32, 2012) and in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010a) and was undertaken by Niche along with representatives from the RAP groups. The methodology for the test excavation was provided to the RAPs as part of the Stage 2 consultation process outlined in the Consultation Requirements.

The archaeological test excavation was carried out between Monday 1 and Friday 12 February 2021. The list of fieldwork participants is provided in Table 20 below. The test excavation was undertaken in accordance with the sampling methodology outlined below.

Table 20: List of fieldwork participants, organisation and dates

Participant	Organisation	Dates
Nick De Zwart	A1	8 February 2021
Wayne Kennedy	A1	9 February 2021
Jayden Reid	Aragung	8 -12 February 2021
Lee Field	Barraby Cultural Services	1 – 4 February 2021
Kirsty-Lee Chalker	Cubbitch Barta Native Title Claimants	2 and 4 February 2021
Glenda Chalker	Cubbitch Barta Native Title Claimants	3 and 12 February 2021
Rebecca Chalker	Cubbitch Barta Native Title Claimants	1 February 2021
Kiarni Chalker	Cubbitch Barta Native Title Claimants	11 and 12 February
Peter Markovic	Freeman & Marx	4, 8, 9 and 12 February 2021
Jamie Currell	KYWG	1, 2, 3 and 5 February 2021
Kaarina Slater	Ngambaa CC	5, 9 and 10 February 2021
Hannah Matagia	Wurrumay	5, 9, 10, 11 and 12 February 2021
Bree Slater	Yulay Cultural Services	5, 10, 11 and 12 February 2021
Arika Jalomaki	Yulay Cultural Services	8 February 2021
Bo Field	Yurrandaali	1 – 4 February 2021
Sarah McGuinness	Niche	1- 12 February 2021
Sam Ward	Niche	1- 12 February 2021

Wade Goldwyer	Niche	1- 12 February 2021
Kosta Contas	Niche	2, 3, 4, 8, 9, 19 and 11 February 2021
Chelsea Freeman	Niche	1, 5 and 12 February 2021
John Gillen	Niche	1 February 2021
Matthew Richardson	Niche	5 and 12 February 2021
Nicola Curtis	South32 IMC	1, 3, 4, 8, 11 and 12 February 2021
Steve Groen	South32 IMC	1, 5 and 12 February 2021

It is important to note that the first priority in test excavations, and recording Aboriginal objects, must always be to avoid or minimise, as far as practicable, the risk of harm to the objects under investigation. This means due care must be taken when excavation and collecting objects.

The test excavation was located in the area associated with a known registered Aboriginal site; (AHIMS ID# 52-2-3687) (Figure 4). The aim of the test excavation was to:

1. Test the area surrounding the registered Aboriginal cultural heritage site.
2. Increase ground surface visibility in the Subject Area.
3. Provide further information on the nature, significance and extent of any sub-surface archaeological deposit within the Subject Area.
4. Test the nature, significance and extent of any sub-surface archaeological deposit in relation to archaeologically sensitive landforms within the Subject Area (i.e. with distance from water).

A total of 52 test pits were excavated, including the 46 pits proposed in the Project Methodology and an additional six test pits (Table 23).

The original 46 pits were aligned along three transects following the contours of Foot Onslow Creek (Figure 7).

- **Transect 1** - This transect was located approximately 20m west of the Foot Onslow Creek bank. A total of 17 test pits were proposed along Transect 1.
- **Transect 2** - This transect was located approximately 30m west of Transect 1, and 50m west of the Foot Onslow Creek bank. A total of 16 test pits were proposed along Transect 2.
- **Transect 3** - This transect was located approximately 30m west of Transect 2, and 80m west of the Foot Onslow Creek bank. A total of 13 test pits were proposed along Transect 3.

Following completion of the original 46 test pits, an additional six test pits were excavated in the central portion of the site. The location of the additional test pits was decided in consultation with RAPs on site and were placed in proximity to artefact bearing test pits TP9, TP26, TP29 and TP38 (Figure 7).

The addition of extra test pits assisted in determining the extent of subsurface archaeological deposits.

8.3.1 Test Excavation Methods

The high pastoral grasses were machine slashed prior to excavation.

The test pits were excavated according to Requirements 16 and 17 of the Code of Practice.

- Test excavation pits measured 50 cm x 50 cm.
- The excavation pits were hand excavated.
- Test pits were be excavated using 5 cm spits for the first test pit within each transect, and 10 cm spits for each test pit thereafter to:
  - the base of artefact bearing layers.
  - a viable B horizon indicating a base of artefact layer.
  - rock, should this occur in the absence of B horizon or base of artefact layer.
  - groundwater, where present.
  - where it would be considered that digging any deeper would be unsafe.
  - where sufficient information has been recovered to understand the extent, nature and significance of the archaeological deposits; or
  - a depth of 100 cm (for safety compliance).

8.4 Recording and Photography

The location of each excavation pit was recorded using a non-differential GPS. Excavation was recorded on spit sheets for each pit and diagnostic and/or representative archaeological features were sketched and photographed. Upon completion, the stratigraphy of all test pits were scale drawn and photographed.

8.5 Sieving

All excavated material was wet sieved through 3 mm aperture wire mesh.

8.6 Artefact Collection

All artefacts recovered during test excavations are temporarily held by Niche in a locked cupboard located at Niche's office on 2/19 Ralph Black Drive, North Wollongong.

Following completion of the test excavation, a full record and catalogue of the artefacts was prepared in accordance with Requirement 26 of the Code of Practice and described below in Section 9.2.3.

8.7 Long-term management of artefacts

The long-term management of artefacts will be determined following consultation with RAPs following Project approval. Discussion on site with RAPs indicates that the preferred long-term deposition of the artefacts recovered during the test excavation is their reburial on site, outside of the impact footprint.

8.8 Artefact Analysis and Cataloguing

The analysis, recording and cataloguing of artefacts was completed by Niche Heritage Consultant Marika Low in accordance with Requirement 19 of the Code of Practice and as per the methods described in Section 9.

8.9 Sensitive Cultural Information- Management Protocol

During the consultation process the proponent and Niche provided the opportunity for the RAPs to provide cultural information, including a statement of the value of identified sites and other matters. The input points were listed within the survey methodology that has been included in Appendix 5, information will be accepted at any point during the project prior to the finalisation of the ACHA.

RAPs were made aware that the Proponent and Niche staff would seek cultural information and supporting evidence in regard to matters of cultural value.

In the event that a stakeholder had sensitive or restricted public access information it was proposed that the proponent and Niche would manage this information (if provided by the Aboriginal community) in accordance with a sensitive cultural information management protocol. It is anticipated that the protocol will include making note of and managing the material in accordance with the following key limitations as advised by Aboriginal people at the time of the information being provided:

- Any restrictions on access to the material.
- Any restrictions on communication of the material (confidentiality).
- Any restrictions on the location/storage of the material.
- Any cultural recommendations on handling the material.
- Any names and contact details of persons authorised within the relevant Aboriginal stakeholder to make decisions concerning the Aboriginal material and the degree of authorisation.
- Any details of any consent given in accordance with customary law.
- Any access and use by the RAPs of the cultural information in the material.

There was sensitive material provided by the RAPs to Niche, and accordingly any restricted information is marked as *confidential* in this report.

9. Results

9.1 Cultural Heritage Survey

The survey area consisted primarily of flat to gentle sloping landforms, with some areas of steep slope and ridgeline. The survey covered the entire original Subject Area, including the later excluded section. For the purpose of Section 9.1, Subject Area refers to the initial unrefined size (Plate 1).

A summary of survey coverage by landform categories across the Subject Area is provided in Table 21 and Table 22.

Table 21: Survey coverage across Subject Area by landform category

Landform category	Landform area (sq. m)	Visibility	Exposure	Effective coverage area (sq. m)	Effective coverage %
Creek terrace	70000	10%	10%	700	1
Gentle slope	100000	10%	10%	1000	1
Steep slope	39500	10%	10%	395	1
Upper slope and crest	15500	20%	20%	620	4

Table 22: Landform summary

Landform category	Landform area (sq.m)	Area effectively surveyed (sq.m)	% of landform effectively surveyed	Number of sites	Number of artefact features
Creek terrace	7000	700	1	2	6
Gentle slope	100000	1000	1	0	0
Steep slope	39500	395	1	0	0
Upper slope and crest	15500	620	4	0	0

The Subject Area is currently characterised by high, dense grass cover, with scattered areas of low regrowth vegetation (Plate 9 Plate 10 and Plate 11). Visibility was generally poor across the Subject Area. Areas of exposure are scattered and generally consist of vehicle tracks, areas of erosion and dam banks (Plate 14).

Areas of disturbance were noted in the form of:

- General land clearance across the Subject Area.
- Prolonged agricultural and pastoral use.
- Significant earthwork construction of two dams.
- Well used vehicle tracks.
- Compaction and erosion of soils in the southern half of the Subject Area where heavy machinery had been used and stored.
- Soil and rubbish stockpiling (Plate 12); and
- Natural erosion and weathering of the banks of Foot Onslow Creek (Plate 13).



Plate 9: General photo of the Subject Area facing south-west.



Plate 10: General photo of the Subject Area facing south.



Plate 11: General photo of the Subject Area facing north showing high dense grass cover and poor visibility.



Plate 12: General photo of the Subject Area showing disturbances of soil and rubbish stockpiling.



Plate 13: General photo of the Subject Area facing west showing disturbance through dam construction.



Plate 14: General photo of the Subject Area showing soil erosion along bank of Foot Onslow Creek.

9.1.1 Previously recorded sites within the Subject Area

Two previously recorded sites were located within or immediately adjacent to the Subject Area; two were registered on AHIMS; Bulli Site 7 (AHIMS ID # 52-2-3687) and Bulli Site 8 (AHIMS ID# 52-2-3688). Details of these sites are listed below;

9.1.1.1 AHIMS ID# 52-2-3687 (Bulli Site 7)

Previously recorded isolated artefact site AHIMS ID#52-2-3687 was not relocated during the initial cultural heritage survey. The site is located on an area of exposure adjacent to the northern dam in the property, within the paddock between Foot Onslow Creek and Menangle Road (Plate 15 and Figure 4).

This site is likely to have been subject to significant disturbance through land clearing, cattle grazing, vehicular movement, rubbish dumping and natural disturbances of erosion and soil slumping.



Plate 15: Location of Bulli Site 7 (AHIMS ID #52-2-3687), facing east.

Site identification during Test Excavation

While Bulli Site 7 (AHIMS ID#52-2-3687) was not able to be reidentified during the original field survey in December 2020, a secondary inspection of the site during the test excavation program identified an artefact on the northern dam wall (Plate 15). The artefact is unlikely to be in situ, with the bank of the dam artificially constructed as clearly identified in nearby TP 24.

The red silcrete flake (Plate 16 and Plate 17) was eroding from an area of exposure that had been subject to additional disturbances of erosion and bioturbation caused by cattle accessing the dam water.





Plate 16: Red silcrete flake identified at Bulli Site 7 (AHIMS ID#52-2-3687) during the test excavation.

Plate 17: location of flake eroding from dam bank.

9.1.1.2 AHIMS ID# 52-2-3688 (Bulli Site 8)

Previously recorded open camp site, Bulli Site 8 (AHIMS ID#52-2-3688), was relocated during the cultural heritage survey, and was found to extend north of the original recorded boundary (Figure 8). The site is located on the eastern side of Foot Onslow Creek and extends approximately 100 m north along the fence line, in an area of eroding exposure. Eight artefacts were recorded along the exposure (Plate 18, Plate 22 and Plate 23). Consensus among the RAPs and Niche on site was that the scatter is likely to continue outside of the surveyed area to the east.

This site has been subject to significant disturbance through land clearing, cattle grazing, vehicular movement, construction of powerline easement, rubbish dumping and natural disturbances of erosion and soil slumping. Some of the identified artefacts were noted eroding from the bank (Plate 20).

Following the revision of the Subject Area (Section 2), this location is no longer within the boundary and will not be impacted by the proposed works.



Plate 18: Red silcrete core at Bulli Site 8 (AHIMS ID#52-2-3688).



Plate 19: Bulli Site 8 (AHIMS ID#52-2-3688) area of eroding exposure along fence line. Facing north.



Plate 20: Bulli Site 8 (AHIMS ID#52-2-3688) showing erosion of bank. Facing east.



Plate 21: Area of exposure along fence line at Bulli Site 8 (AHIMS ID#52-2-3688). Facing south.



Plate 22: Red silcrete flake at Bulli Site 8 (AHIMS ID#52-2-3688).

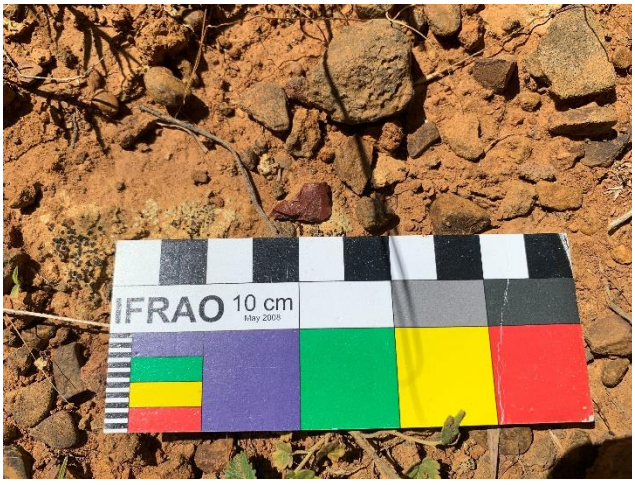


Plate 23: Red silcrete flake at Bulli Site 8 (AHIMS ID#52-2-3688).

9.2 Archaeological Test Excavation

9.2.1 Test Pit Locations

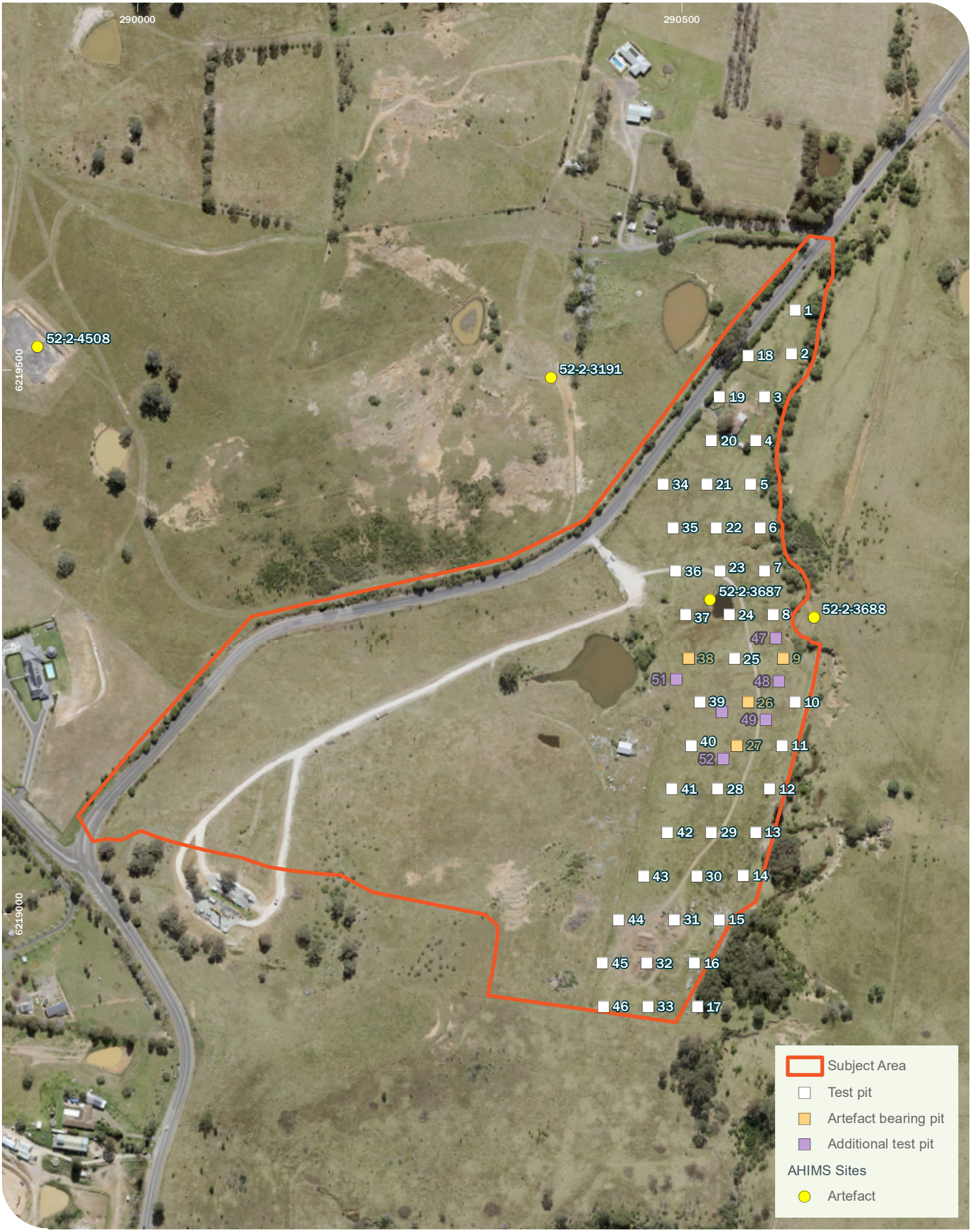
A total of 52 test pits were excavated over the ten-day excavation program (Figure 7). All of the 46 test pits proposed in the Excavation Methodology were positioned according to the projected transects, with the additional six test pits positioned in the central portion of the site, around artefact bearing pits (Table 23).

All test pits measured 50 by 50 cm. A summary of the excavated test pits is presented below in Table 23. Excavation records, section drawings and photographs of each individual test pit are provided in Annex 3, with an analysis and discussion of the test excavation results outlined in Section 10.

Table 23: Test Pit Summary

Test pit ID	Landform	Datum	Zone	Easting	Northing	Transect	Final depth (cm)	Aboriginal objects
TP01	Creek terrace	GDA	56	290603	6219555	1	65	
TP02	Creek terrace	GDA	56	290600	6219515	1	40	
TP03	Creek terrace	GDA	56	290575	6219475	1	60	
TP04	Creek terrace	GDA	56	290567	6219435	1	40	
TP05	Creek terrace	GDA	56	290563	6219395	1	50	
TP06	Creek terrace	GDA	56	290571	6219355	1	50	
TP07	Creek terrace	GDA	56	290575	6219315	1	50	
TP08	Creek terrace	GDA	56	290583	6219275	1	60	
TP09	Creek terrace	GDA	56	290593	6219235	1	60	1 X Spit 4
TP10	Creek terrace	GDA	56	290603	6219195	1	40	
TP11	Creek terrace	GDA	56	290592	6219155	1	60	
TP12	Creek terrace	GDA	56	290580	6219115	1	40	
TP13	Creek terrace	GDA	56	290567	6219075	1	40	
TP14	Creek terrace	GDA	56	290556	6219035	1	40	
TP15	Creek terrace	GDA	56	290534	6218995	1	50	
TP16	Creek terrace	GDA	56	290511	6218955	1	50	
TP17	Creek terrace	GDA	56	290514	6218915	1	40	
TP18	Gentle slope	GDA	56	290560	6219513	2	25	
TP19	Gentle slope	GDA	56	290534	6219475	2	60	
TP20	Creek terrace	GDA	56	290527	6219435	2	50	
TP21	Creek terrace	GDA	56	290522	6219395	2	50	
TP22	Creek terrace	GDA	56	290531	6219355	2	50	
TP23	Creek terrace	GDA	56	290534	6219315	2	40	
TP24	Creek terrace	GDA	56	290543	6219275	2	100	
TP25	Creek terrace	GDA	56	290547	6219235	2	30	
TP26	Creek terrace	GDA	56	290560	6219195	2	40	1 X Spit 1 1 X Spit 2

Test pit ID	Landform	Datum	Zone	Easting	Northing	Transect	Final depth (cm)	Aboriginal objects
TP27	Creek terrace	GDA	56	290550	6219155	2	60	1 X Spit 2
TP28	Creek terrace	GDA	56	290532	6219115	2	50	
TP29	Creek terrace	GDA	56	290527	6219075	2	70	
TP30	Creek terrace	GDA	56	290513	6219035	2	20	
TP31	Creek terrace	GDA	56	290493	6218995	2	40	
TP32	Creek terrace	GDA	56	290467	6218955	2	30	
TP33	Creek terrace	GDA	56	290469	6218915	2	40	
TP34	Gentle slope	GDA	56	290482	6219395	3	40	
TP35	Creek terrace	GDA	56	290491	6219355	3	50	
TP36	Creek terrace	GDA	56	290494	6219315	3	50	
TP37	Creek terrace	GDA	56	290503	6219275	3	50	
TP38	Creek terrace	GDA	56	290506	6219235	3	40	1 X Spit 4
TP39	Creek terrace	GDA	56	290516	6219195	3	30	
TP40	Creek terrace	GDA	56	290508	6219155	3	50	
TP41	Creek terrace	GDA	56	290490	6219115	3	60	
TP42	Creek terrace	GDA	56	290486	6219075	3	60	
TP43	Creek terrace	GDA	56	290464	6219035	3	50	
TP44	Creek terrace	GDA	56	290442	6218995	3	30	
TP45	Creek terrace	GDA	56	290427	6218955	3	40	
TP46	Creek terrace	GDA	56	290427	6218915	3	50	
TP47	Creek terrace	GDA	56	290586	6219254	Additional pits	40	
TP48	Creek terrace	GDA	56	290589	6219214	Additional pits	40	
TP49	Creek terrace	GDA	56	290577	6219179	Additional pits	30	
TP50	Creek terrace	GDA	56	290537	6219186	Additional pits	30	
TP51	Creek terrace	GDA	56	290495	6219216	Additional pits	40	
TP52	Creek terrace	GDA	56	290538	6219143	Additional pits	40	



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niche Environment and Heritage

0 100
m

GDA 1994 MGA Zone 56

Test Excavation Results

Appin Mine Access and Ventilation Project ACHA

Niche PM: Sarah McGuinness
Niche Proj. #: 6152
Client: South32

Figure 7

Australia latest: @Metro Map

9.2.2 Soil Profile

The soil profile identified within the test pits was found to be consistent with the Theresa Park soil landscape within agricultural landforms. Topsoil across the Subject Area generally consisted of a brown to reddish brown sandy loam that varied from moderately loose to heavily compacted. The topsoil depth averaged approximately 20 cm across the test pits.

The subsoil was generally noted to be a reddish brown hard-setting sandy clay loam that ranged from approximately 20 cm to 40 cm in depth. This deposit contained occasional ironstone gravel inclusions.

The subsoil was found to overlie a red brown crumbly, sandy clay profile that averaged approximately 20 cm in depth. The crumbly clay layer generally had a diffuse transition onto heavily compact yellowish-brown clay. Excavation of test pits ceased at this sterile layer.

9.2.2.1 Disturbance to Soil Profile

Past agricultural land use of the Subject Area was observed within the soil profile in the form of poor soil development through land clearance, ploughing, cattle movement and soil erosion. The top 40 cm of deposit was found to be largely unstratified across the Subject Area and showed evidence of churning and poor deposition.

The southern half of the Subject Area in particular was noted to have heavily compact and thin topsoil profiles, which was consistent with the ongoing use of the area for machinery pads and agricultural storage as evidenced on the site.

The construction of an earthen dam in the central portion of the Subject Area was also evident within the soil profile. TP24 was situated 15 m from the southern bank of the dam and was excavated to a depth of 100 cm. The soil profile was found to be heavily impacted by the dam's construction, and consisted of a very thin topsoil above 90 cm of mixed, unstratified clay loam. No natural soil profile was identified within the test pit.

9.2.2.2 Typical Soil Profile

The typical soil profile observed within the Subject Area is presented below.

- **Reformed topsoil:** brown to reddish-brown sandy loam with grass root inclusions.
- **A Horizon:** Reddish-brown hard setting sandy clay loam, with a diffuse transition onto a red brown brittle sandy clay. Some occasional ironstone gravel inclusions. Not always a clear transition between A1 or A2 horizons.
- **B Horizon:** Compact yellowish-brown clay, waxy when wet.



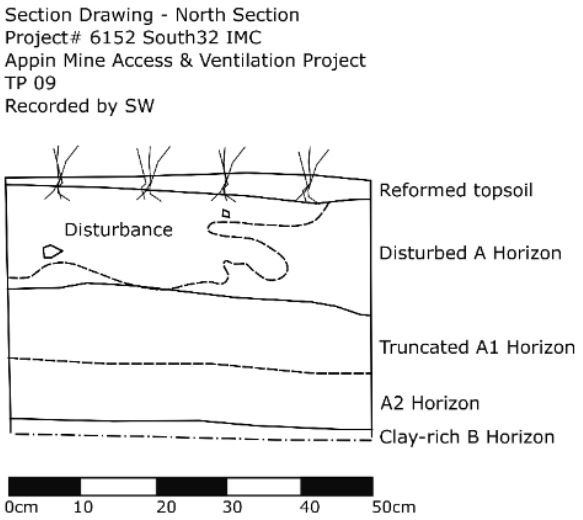


Plate 24: Example of the typical soil profile identified across the Subject Area (TP9).

Plate 25: Section Drawing of a typical soil profile (TP9).

9.2.3 Artefact Analysis

Artefact analysis and the preparation of a catalogue was conducted by Niche prior to the long-term management of the artefacts. The analysis, recording and cataloguing of artefacts was completed by Niche heritage consultant Marika Low in accordance with Requirement 19 of the Code of Practice and as per the methods described below. Full details of the artefact catalogue can be found in Annex 4.

Artefacts were sorted and given a unique ID number, individually analysed and entered into an excel spreadsheet, thus creating a comprehensive typological, technological and metrical analysis of the excavated assemblage. The location of the excavated artefacts was also recorded by site, spit/depth and excavation square. Analysis was aided by the use of a 10x hand lens and a standard digital vernier calliper. Measurements were made in millimetres to one decimal place.

The attributes recorded for each artefact are dependent on the technological class (i.e. if a complete flake, core or retouched flake/tool etc). Artefacts such as cores and tool generally represent a small fraction of an assemblage but can offer the greatest amount of information. An overview of the attributes and measurements recorded is provided in Table 24 below.

Table 24: Overview of attributes and measurements recorded for stone artefact assemblage

Attribute/ measurement	Categories/ description	Conditions of recording
ID	Unique identification number	All artefacts
Context details	Site name/ Test Pit #/ Spit #	All artefacts
Technological class	Core, Flake, Retouched flake, Flaked piece (also referred to as angular fragment/lithic fragment), Other	All artefacts
Artefact sub-type	Adze, Anvil, Axe, Backed blade, Backed flake, Bondi point, Irregular Retouched Flake, Geometric Microlithic, Core tool, Elouera, Scraper, Flake tool, Grindstone, Hammerstone, Manuport, Milling slab, Mortar, Muller, Nuclear tool, Pirri, Tula, Other, Modified, Unworked	All artefacts

Attribute/ measurement	Categories/ description	Conditions of recording
Flake form	Blade, Expanding, Elongated, Irregular	All complete flakes and retouched flakes
Raw material type	Basalt, Chert, Fine Grained Siliceous (FGS), Granite, Quartz, Quartzite, Sandstone, Silcrete, Siltstone, Mudstone, Tuff, Other, Indurated Mudstone	All artefacts
Colour	Raw material colour	All artefacts
Cortex type	Water-rolled/cobble, Quarried/weathered, Indeterminate	All artefacts
Cortex amount	0, 1-25, 26-50, 51-75, 76-99, 100	All artefacts
Completeness	Complete or Broken	All artefacts
Fragmentation	Proximal, Medial, Distal, Marginal, Left Longitudinal Cone Split (Left-LCS), Right Longitudinal Cone Split (Right-LCS), Indeterminate	All broken flakes and retouched flakes
Platform type	Cortical, Plane (single flaked surface), Flaked (2 flake scars), Facetted (3 or more small, systematic flake removals), Ground, Bipolar, Retouched, Indeterminate	All complete and proximal flakes and retouched flakes
Initiation type	Bending, Hertzian, Bipolar, Wedging, Indeterminate	All complete and proximal flakes and retouched flakes
Platform shape	Wide, Focal, Shattered, Bipolar, Indeterminate	All complete and proximal flakes and retouched flakes
Termination type	Feather, Hinge, Step, Plunge (aka. Outrepasse), Bipolar, Retouched, Indeterminate	All complete and distal flakes and retouched flakes
Percentage of margin retouched	Square, Rectangular, Lenticular, Conical, Trapezoidal, Triangular, Irregular, NA	All complete retouched artefacts
Retouch type per quadrant (1, 2, 3, 4)	Scalar, Backing, Stepped, Notch, Use-wear, Other	All complete retouched artefacts
Core type (based on scar direction)	Unidirectional, bidirectional, bifacial, multiplatform, prismatic, burin-blade core, test, bipolar	Complete cores
Core scar count	Number of core scars	Complete cores
Core platform number	Number of platforms on the core from which flakes were removed	Complete cores
Weight	Weight of the artefact in grams to 1dp	All artefacts
Max dimension	Maximum length of artefact measured in mm to 1dp	All artefacts
Length	Axial length of the complete flake/complete tool or percussion length of complete core measured in mm to 1dp	All artefacts
Width	Width of the complete flake/tool/core at mid-point at right length to the width measured in mm to 1dp	All artefacts
Thickness	Thickness of the complete flake/tool/core at mid-point at right angles to the width measured in mm to 1dp	All artefacts
Palimpsest	Various layers or diverse aspects	

9.2.3.1 Artefact Counts

A total of five (5) stone artefacts were recovered during the test excavation program from four artefact-bearing test pits within the Subject Area. Two artefacts were recovered from TP 26 with the remaining test pits recording only one stone artefact each. Artefacts were recovered from a range of spits/depths across the Subject Area (Plate 26). One artefact was recovered from the upper 10 cm (TP26), two artefacts were recovered from a depth of 10-20 cm (TP26 and TP29) and the remaining two stone artefacts were recovered from depths of 30-40 cm (TP9 and TP38).

The frequency and distribution of Aboriginal objects are representative of transient land-use resulting in low-density occupation.

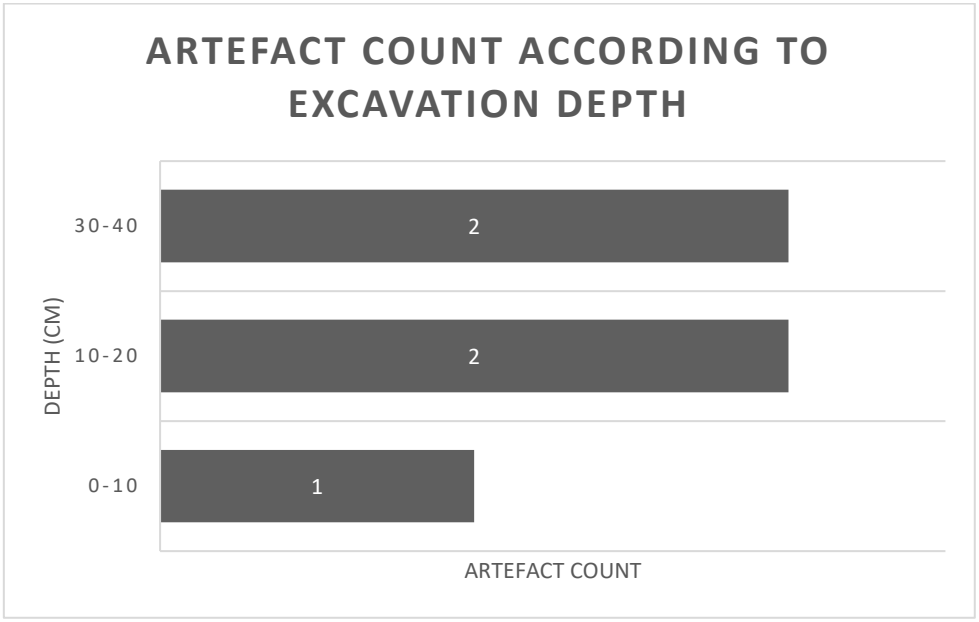


Plate 26: Number of artefacts recovered according to excavation depth/ spit (spit 1=0-10 cm; spit 2=10-20 cm; spit 3=20-30 cm and spit 4=30-40 cm)

9.2.3.2 Artefact Assemblage Description

Due to the small number of the recovered artefacts it is not possible to identify temporal changes in technology and behaviour between spits or spatial patterning within the Subject Area. As such the excavated assemblage will be analysed as a whole for the Subject Area to gain a general impression of the palimpsest of activities that resulted in the accumulation of these Aboriginal objects within the Subject Area. The raw material type, artefact technological class and size (maximum dimension and weight) of the excavated artefacts are summarised in Table 25, Table 26 and Table 27 below respectively.

The excavated assemblage is characterised by a range of raw material types with red fine silcrete making up the 40% (n=2) of the artefacts recovered from the excavation. Cortex type can be used to provide information regarding the likely source of the raw materials used to manufacture stone artefacts. Only two artefacts (40%) in the excavated assemblage retained cortex. A grey siltstone retouched flake and a milky quartz bipolar flake both retained water-rolled cobble/pebble cortex indicative of a creek/cobble bed as the likely source.

The majority of artefacts consist of complete or broken flakes (n=3; 60%) with two complete retouched artefacts making up the remaining assemblage (Table 27, Plate 27 and Plate 30). A single asymmetrical backed artefact (aka. Bondi point) was recovered from a depth of approximately 10-20 cm (TP26). The

backed artefact was manufactured on yellow indurated mudstone and contains uni-directional backing retouch on the left margin to form the point. The second retouched artefact in the assemblage was recovered from spit 4 and is an irregular shaped grey siltstone flake with discontinuous scalar retouch on the ventral surface and situated across quadrants 1 and 4. The two retouched artefacts likely represent accidental loss or discard while passing through the area. Most flakes are characterised by hertzian initiation type. A single bipolar flake manufactured from white milky quartz was recovered from a depth of approximately 30-40 cm (TP38) and provides evident for bipolar technology in the assemblage. No cores or evidence for the on-site manufacture of stone artefacts was identified.

A wide size range of flaked stone artefacts is represented in this assemblage, with artefacts ranging between 11.8 mm to 58.8 mm and weighting from 0.12 g up to 20.5 g. The average artefact size of artefacts in the excavated assemblage is relatively small with mean maximum dimension of 24.2 mm and an average weight of just over 1.3 g (Table 27).

Although the assemblage is very small, the presence of a backed artefact and evidence for bipolar technology is consistent with the character of assemblages associated with the mid-to-late Holocene (ca 5,000-1,600 years ago) which are typically referred to as the "Bondaian" phase of the Eastern Regional Sequence (McCarthy 1967).

Table 25: Raw material composition of excavated assemblage

Raw material	Frequency	Percentage of total
Silcrete	2	40%
Siltstone	1	20%
Indurated mudstone	1	20%
Milky quartz	1	20%
Total	**5**	**100%**

Table 26: Technological class composition of excavated assemblage

Technological class	Frequency	Percentage of total
Complete flake	1	20%
Marginal flake	1	20%
Distal flake	1	20%
Complete retouched flake	2	40%
Total	**5**	**100%**

Table 27: Artefact size – maximum dimension and weight

Measurement	Maximum	Minimum	Average
Maximum dimension	58.8 mm	11.8 mm	24.2 mm
Weight	20.50 g	0.12 g	1.33 g



Plate 27: AFT#001 – ventral surface of retouched flake manufactured from grey siltstone.



Plate 28: AFT#001 – ventral surface of retouched flake manufactured from grey siltstone.



Plate 29: AFT#002 – ventral surface of red silcrete marginal flake fragment.



Plate 30: AFT#003 – ventral surface of yellow indurated mudstone backed artefact/ Bondi point.



Plate 31: AFT#003 – dorsal surface of yellow indurated mudstone backed artefact/ Bondi point.



Plate 32: AFT#003 – backed margin of yellow indurated mudstone backed artefact/ Bondi point.

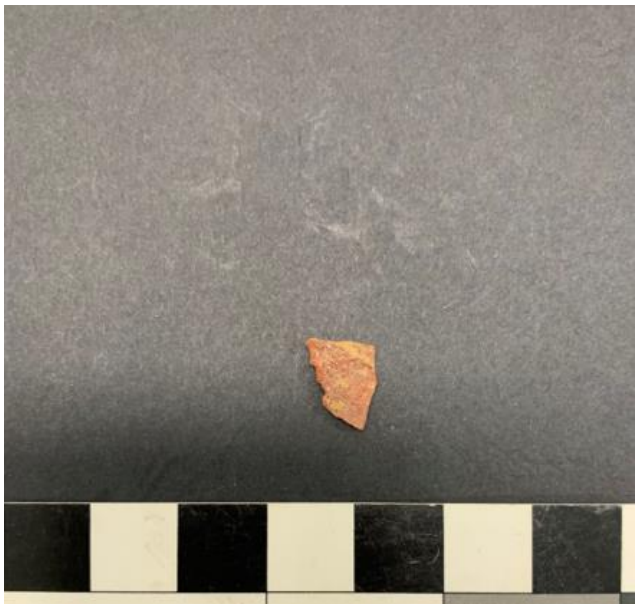


Plate 33**: AFT#004- dorsal surface of red silcrete distal flake.**



Plate 34: AFT#005- dorsal surface of milky quartz flake.

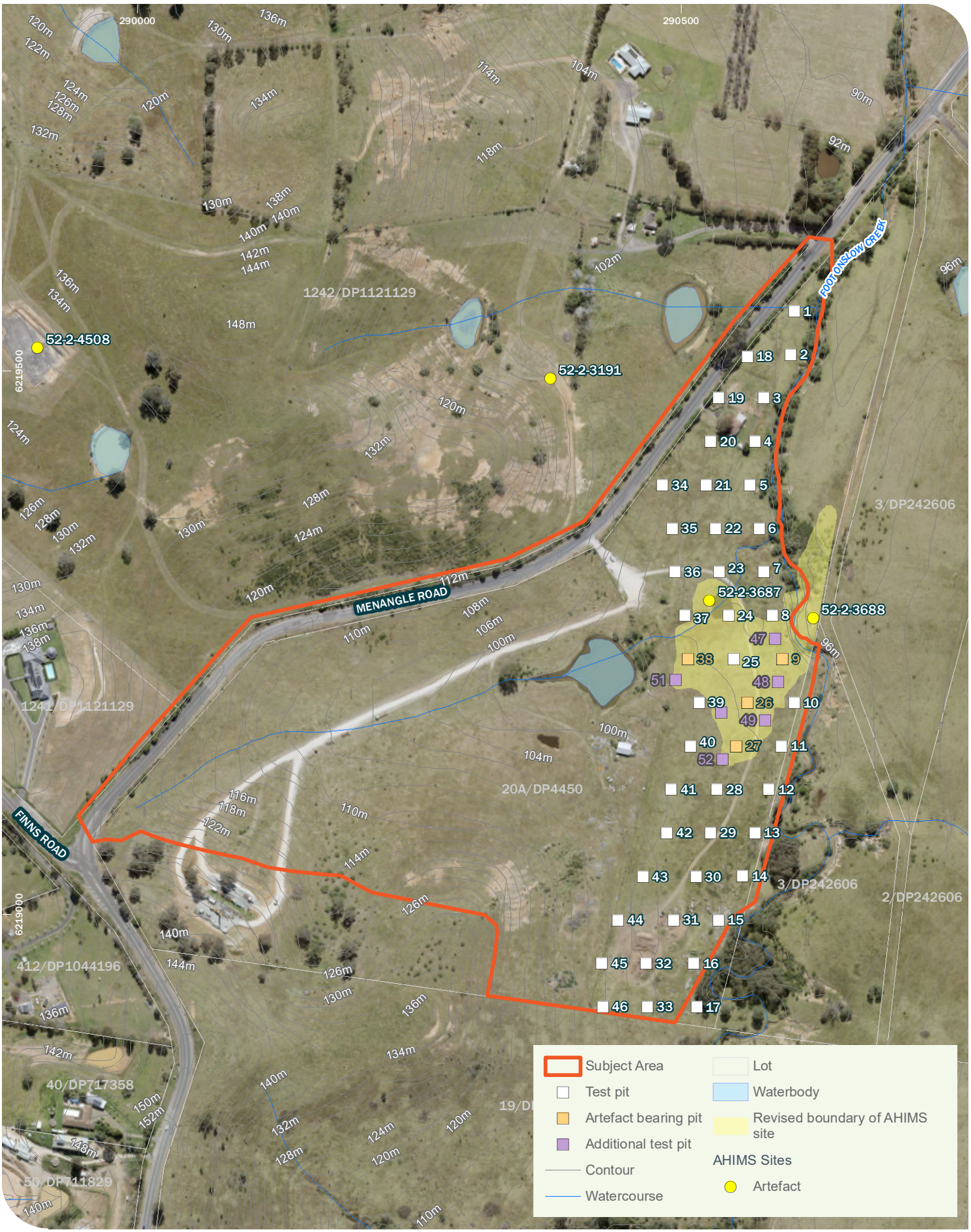
9.2.4 Nature and Extent of Sub-Surface Archaeological Profile

The strategic placement of test pits along the entirety of the raised creek terrace and surrounding the known Aboriginal cultural site Bulli Site 7 (AHIMS ID# 52-2-3687) aimed to assist in understanding the extent of these sites as well as the stratigraphic context and potential subsurface deposits.

Of the 52 test pits excavated, four contained Aboriginal cultural material and none contained any in situ archaeological features. Of the four artefact bearing pits, the highest number of artefacts from a single pit was two. All artefacts identified during the excavation were situated in the top 40 cm of deposit, which showed evidence of disturbances through land clearance, working of the soil and erosion. The disturbed context of the pits indicate that the recovered sub-surface artefacts and the artefact identified at Bulli Site 7 (AHIMS ID # 52-2-3687) are unlikely to be in situ.

Based on the results of the test excavation, the boundary of Bulli Site 7 (AHIMS ID # 52-2-3687) has been revised to include all artefact bearing pits (TP9, TP26, TP29 and TP26) and site Bulli Site 8 (AHIMS ID # 52-2-3688) that is situated on the eastern bank of Foot Onslow Creek (Figure 8 and Section 9.1.1.2). The AHIMS site cards will be updated to reflect these results, following finalisation of this report.

Overall, the results from the test excavation program demonstrate that the Subject Area was likely associated with a low- intensity occupation and use by Aboriginal people in the past. The broad association between artefact bearing test pits, the locations of Bulli Site 7 (AHIMS ID # 52-2-3687) and Bulli Site 8 (AHIMS ID # 52-2-3688) and the low number of subsurface artefacts recovered suggest that the entire area may best be considered as a whole with Aboriginal objects resulting not from isolated behavioural events but rather as a result of sporadic use of and/or movement through the Subject Area over a long period of time.



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niche Environment and Heritage

Revised AHIMS Site

Appin Mine Access and Ventilation Project ACHA

Niche PM: Sarah McGuinness
Niche Proj. #: 6152
Client: South32

Figure 8

Australia latest: @Metro Map

10. Analysis and Discussion

10.1 Analysis and Discussion of Results

The Subject Area is located on the southern margins of the Cumberland Lowlands region, a physiographic region of western Sydney characterised by low lying, gently undulating plains and hills with alluvium rich soil underlain by sedimentary geology. While the region is characterised by a rich Aboriginal archaeological record, the reconstruction of past land use of Aboriginal people in the Cumberland Plain and the structure of their society is an extremely difficult task often relying on biased historical documents and archaeological evidence resulting from environmental impact assessments rather than research-driven projects. Despite these inherent limitations, archaeologists have built up a picture of Aboriginal settlement patterns for the region, establishing a foundation for the testing of predictive models and the refinement of knowledge. The past Aboriginal land use indicated by the results of previous archaeological work in the region (reviewed in Section 7 of this report) suggests that certain areas nearby major creeks were used as locations for the intensive manufacture of silcrete and quartz artefacts (as suggested by the high-density artefacts recovered in association with knapping floors) as well as locations of artefact processing, use and/or maintenance.

The results of the survey and test excavation undertaken for the Subject Area, the recovery of five sub - surface Aboriginal objects and identification of additional surface artefacts associated with registered sites Bulli Site 7 (AHIMS ID # 52-2-3687) and Bulli Site 8 (AHIMS ID # 52-2-3688), provide a small glimpse into Aboriginal land-use practices within a small part of the Cumberland Plain. The presence of Foot Onslow Creek along the eastern boundary of the Subject Area would have provided seasonal access to water and the environment within and surrounding the Subject Area would have offered a diverse range of additional natural resources.

The Aboriginal objects identified and recovered during the test excavation program are considered representative of low-intensity background scatters, providing evidence of infrequent and periodic occupation or use of the Subject Area by Aboriginal people. Discard of artefacts is likely to have resulted from activities undertaken while moving between locations of more consistent and repeated occupation such as in closer proximity to the Nepean River as the closest permeant source of water and resources in the immediate area. The nature of the archaeological assemblage, while very small, is consistent with the character of assemblages associated with the mid-to-late Holocene (ca 5,000-1,600 years ago). This is consistent with the general intensification of occupation of the Cumberland Plain in this period (McDonald 1998).

The paucity of other archaeological investigations in the local area allows a limited scope for comparative analysis. Of most relevance to the Subject Area, are the test excavations undertaken at Howe's Creek Menangle Park in 2009, located approximately 6 km to the north (Jo McDonald CHM). The investigations found that repeated land cultivation and use resulted in a disturbed upper 20-30cm of deposit, and that pale sandy soils were most likely to contain a higher density of Aboriginal objects in comparison to pits with a dark loamy deposit. Proximity to Howe's Creek (a tributary of the Nepean River) was also found to be a factor to artefact density. When compared to the archaeological results of this assessment, the following similarities can be seen:

- Repeated cultivation and agricultural use have disturbed the upper soil deposits resulting in erosion and likely artefact movement from original locations.
- Test pits with dark loamy deposits generally contain a low density of artefacts.

10.2 Results summary

- Test excavation resulted in a total of five Aboriginal objects excavated within the Subject Area, and an additional single artefact identified on the ground surface within Bulli Site 7 (AHIMS ID # 52-2-3687).
- The low density of artefacts is indicative of infrequent and sporadic occupation/use of the area by Aboriginal people. The presence of a backed artefact and evidence for bipolar technology is consistent with the character of assemblages associated with the mid-to-late Holocene (ca 5,000-1,600 years ago) which are typically referred to as the "Bondaian" phase of the Eastern Regional Sequence.
- The boundary of Bulli Site 7 (AHIMS ID # 52-2-3687) has been revised to include all artefact bearing pits (TP9, TP26, TP29 and TP26) and site Bulli Site 8 (AHIMS ID # 52-2-3688) (Figure 8).
- Raw material for stone artefacts would likely have been sourced from outside the Subject Area, most likely from sources of silcrete and siltstone that are available from across the Cumberland Plain or from within gravel beds in the form of river cobbles.
- Evidence of disturbance to the upper soil deposits were observed across the Subject Area as a result of vegetation clearance and past agricultural land use including earthworks for dam construction. This has impacted the integrity of the soil profile and artefact bearing deposit.

11. Cultural heritage values and statement of significance

11.1 The Burra Charter

The Burra Charter (Australia ICOMOS 2013) defines the basic principles and procedures to be observed in the conservation of important heritage places. It provides a primary and 'best-practice' framework within which decisions about the management of heritage sites in Australia should be made. The Burra Charter (ICOMOS 2013) and the OEH policy *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) define cultural significance as being derived from the four values presented in Table 28.

Table 28: Definition of heritage values of the Burra Charter (Australia ICOMOS 2013)

Value	Description
Aesthetic	This value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.
Historic	This value 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.
Scientific	The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information.
Social	This value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group.

11.2 Scientific (Archaeological) Significance Assessment of Aboriginal Heritage Sites

The categorisation into aesthetic, historic, scientific and social values is one approach to understanding the concept of cultural significance. However, more precise categories may be developed as an understanding of a particular place or site increases.

The NSW Aboriginal cultural heritage regulatory framework supports the significance assessment of Aboriginal archaeological sites and provides guidelines for this ACHA within OEH 2011. OEH 2011 outlines two main themes in the overall Aboriginal cultural heritage significance assessment process, namely, the identification of the cultural/social significance of Aboriginal objects and/or places to Aboriginal people and the identification of the scientific (archaeological) significance to the scientific/research community. These themes encapsulate those aspects of the Burra Charter that are of particular relevance to Aboriginal objects and places.

OEH 2011 specifies that information about scientific values will be gathered through archaeological investigation carried out according to the Code of Practice. The Code of Practice itself does not specify criteria for assessment of Aboriginal objects, but rather suggests to "identify the archaeological values and assess their significance." The assessment must be supportable, and the assessment criteria must reflect best practice assessment processes as set out in the Burra Charter.

Notwithstanding the circularity of this advice, the scientific values described in the Burra Charter (Section 11.1) were considered further by the then NSW National Parks and Wildlife Service in their *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC 1997).

In lieu of specific criteria, the advice from DEC (1997) is summarised and paraphrased in Table 29 below to provide guidance to the assessment of scientific values.

Table 29: Criteria for Assessing Scientific Significance

Scientific value	Description
Research Potential	It is the potential to elucidate past behaviour which gives significance under this criterion rather than the potential to yield collections of artefacts. Matters considered under this criterion include the intactness of a site, the potential for the site to build a chronology and the connectedness of the site to other sites in the archaeological landscape.
Representativeness	As a criterion, representativeness is only meaningful in relation to a conservation objective. Presumably all sites are representative of those in their class or they would not be in that class. What is at issue is the extent to which a class of sites is conserved and whether the particular site being assessed should be conserved in order to ensure that we retain a representative sample of the archaeological record as a whole. The conservation objective which underwrites the 'representativeness' criteria is that such a sample should be conserved.
Rarity	This criterion cannot easily be separated from that of representativeness. If a site is 'distinctive' then by definition, it will be part of the variability which a representative sample would represent. The criteria might best be approached as one which exists within the criteria of representativeness, giving a particular weighting to certain classes of site. The main requirement for being able to assess rarity is to determine what is common and what is unusual in the archaeological record, but also the way that archaeology confers prestige on certain sites because of their ability to provide certain information. The criterion of rarity may be assessed at a range of levels including local, regional, state, national, and global.
Educational Potential	This criterion relates to the ability of the cultural heritage item or place to inform and/or educate people about one or other aspects of the past. It incorporates notions of intactness, relevance, interpretative value and accessibility. Where archaeologists or others carrying out cultural heritage assessments are promoting/advocating the educational value of a cultural heritage item or place it is imperative that public input and support for this value is achieved and sought. Without public input and support the educative value of the items/places is likely to not ever be fully realised.
Aesthetics	In relation to heritage places, aesthetic significance is generally taken to mean the visual beauty of the place. Aesthetic value is not inherent in a place but arises in the sensory response people have to it. The guidelines provide no expectation for archaeologists to consider aesthetic values, it is often the case that the aesthetics including the physical setting of an archaeological site or a landscape contributes to its cultural heritage significance. Examples of archaeological sites that may have high aesthetic values include rock art sites or sites located in environments that evoke strong sensory responses.

Educational potential and aesthetic values are not considered to be criteria against which scientific values and significance can be assessed. Aesthetic values should be considered as a distinct category (rather than a criterion that contributes to scientific value) in accordance with the Burra Charter and OEH 2011. Educational potential is considered to be a criterion that contributes to social value, rather than scientific value, and hence this is considered below in the overall cultural significance assessment.

Table 30: Scientific (Archaeological) Significance Assessment

AHIMS ID	Site Name	Features	Significance Statement	Research Potential	Representativeness	Rarity	Scientific Significance Rating
52-2-3687	Bulli Site 7	Open Camp Site	Bulli Site 7 is assessed to be low scientific significance due to the low-density nature of the identified artefacts as well as the highly disturbed context of the site, impacting the archaeological integrity of the site and limiting the data that can be contributed to the archaeological record at a local and regional level.	Limited	Low	Low	Low

11.3 Cultural Significance Assessment of Aboriginal Heritage Sites

OEH 2011 requires that a "clear description of the heritage values present across the area of the proposed activity" be presented, and be articulated back to the information collected during the assessment process, in particular to any submissions received from RAPs. OEH 2011 advises that "the assessment of values is a discussion of what is significant and why". The purpose of the statement of significance is to create a comprehensive assessment of values and significance by considering and stating the values identified under each of the value categories defined by the Burra Charter, namely, social values, historic values, scientific values, and aesthetic values. OEH 2011 states:

The assessment and justification in the statement of significance must discuss whether any value meets the following criteria (NSW Heritage Office 2001):

- *does the subject area have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons? – social value.*
- *is the subject area important to the cultural or natural history of the local area and/or region and/or state? – historic value.*
- *does the subject area have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state? – scientific (archaeological) value.*
- *is the subject area important in demonstrating aesthetic characteristics in the local area and/or region and/or state? – aesthetic value.*

11.3.1 Grading Values and Significance

The following gradations, where a site or zone satisfies at least one criterion, have been applied to provide a measure of the values/significance for Aboriginal objects identified within the Subject Area, and to provide an overall assessment of the significance of each of the zones used that define the Subject Area.

Table 31: Grades of values and significance

Grade of value	Description of grade
Low	The site or object contains only a single or limited number of features, and has no potential to meaningfully inform our understanding of the past beyond what it contributes through its current recording (i.e. no or low research potential). The site or object is a representative but unexceptional example of the most common class of sites or objects in the region. Many more similar examples can be confidently predicted to occur within the Subject Area, and in the region.
Moderate	The site or object derives value because it contains features, both archaeological and contextual, which through further investigation may contribute to our understanding of the local past. These features include, but are not limited to: the relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a relatively large assemblage of stone artefacts. The presence of a diverse artefact and feature assemblage, and connectedness with landscape features and other notable sites provide relatively higher representative and rarity values than sites of low significance.

Grade of value	Description of grade
High	The site or object has value because it contains archaeological and/or contextual features which through further investigation may significantly contribute to our understanding of the past, both locally and on a regional scale. These features include, but are not limited to: Aboriginal ancestral remains; the site's relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a very large assemblage of stone artefacts associated with other features such as oven remains or shell midden. Such sites will be relatively rare, and will be representative of a limited number of similar sites that make up this class; hence they derive high representative and rarity values.

11.4 Statement of Significance

Statements of significance for the Subject Area are presented in the following sub-sections. These statements of significance have been prepared in consideration of comments received from the RAPs during the consultation process, including those comments relating to the cultural significance of all sites and the interrelationships between the cultural and spiritual values with the natural landscape. All comments received from RAPs are considered in Section 4.3.

11.4.1 Social Value

The Subject Area is of high social significance to the Aboriginal community because it contains landscapes and resources that help define the communities' identity. Kadibulla Kahn of KYWH expressed that high cultural and social value exists within the wider cultural landscape.

A long time ago before the Europeans arrived, the land would have been very different from today. The flora and fauna would have been thriving, there would have been many water ways flowing, today they have been used for drainage. Aboriginal people would have used their environment to their advantage, utilising what they needed and never wasting or taking too much. This was a part of our lore looking after mother nature as she provides for us Aboriginal people and we give back to her.

The Aboriginal objects associated with the AHIMS registered site is valued for providing a tangible link to the past.

11.4.2 Aesthetic Value

The Subject Area has low aesthetic values as much of the surrounding environment have been significantly modified, however natural landforms still remain along with the presence of Foot Onslow Creek which adds to the strong sense of beauty and Aboriginal connectivity to the landscape.

11.4.3 Historic Value

The Subject Area contains no identified historic values relating to Aboriginal heritage.

11.4.4 Scientific (Archaeological) Value

The Subject Area contains one identified Aboriginal cultural heritage open camp site Bulli Site 7 (AHIMS ID # 52-2-3687). This archaeological site within the Subject Area is predominately of low scientific (archaeological) value. The Subject Area has the potential to yield information that would contribute to a further understanding of the cultural history of the local area and region. In particular, the nature of past Aboriginal land-use of the Cumberland Plain, and the relationship between past Aboriginal land use and the use of available resources –including the Nepean River – as expressed through archaeological sites and their context.

11.4.5 Summary

The Aboriginal cultural heritage site assessed during this Project (Bulli Site 7 (AHIMS ID # 52-2-3687)) was identified as having low scientific (archaeological) significance. A summary of scientific (archaeological) significance ratings is presented in Table 31.

12. Impact Assessment

12.1 Overview of Potential Impacts

OEH 2011 requires that both direct and indirect harm to Aboriginal objects and Aboriginal places be considered. Generally direct harm refers to occasions where an activity physically impacts a site or objects and therefore affects the heritage values possessed by the site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect sites or objects as an indirect consequence of the activity. Examples of such indirect harm are increased visitors to a site, or increased erosion in an area as a result of an activity.

As described in Section 9, a total of one (1) Aboriginal heritage site was identified within the Subject Area.

The potential impacts of the Project have been evaluated in consideration of comments received from the RAPs during the consultation process. These comments include those relating to the archaeological potential of landforms and the likelihood of occurrence and distribution of sites. All comments received from the RAPs are considered in Section 4.3.

12.2 Potential Impacts

A detailed description of the surface components of the Proposed Project is provided in Section 3 of this report.

Disturbance associated with the Project will only occur within a specified footprint (Figure 2) and not all parts of the Subject Area would be subject to disturbance. For the purposes of this ACHA it is conservatively assumed that the development of surface infrastructure for the Project would be wholly within the determined footprint and would be of a nature that would cause direct harm to any Aboriginal objects or areas of cultural value located within the footprint (Figure 3).

The direct harm associated with surface disturbance activities is anticipated to cause either a total or partial loss of heritage value at effected sites and would have a cumulative or landscape impact of partial loss of values for the area as a whole. The activities that may cause harm to Aboriginal objects or areas of cultural value would include:

- Vegetation clearance and topsoil stripping.
- Disturbance of soil units or the ground surface with Aboriginal objects on the surface or within the soil profile.
- Changes to a site or place's context that has secondary impacts to the site or place, resulting in the loss of cultural values.
- Excavation works and the removal and redistribution of soil by heavy machinery during site regrading or development of suitable surface conditions for various construction activities.

The proposed Project will directly impact Bulli Site 7 (AHIMS ID # 52-2-3687).

12.3 Potential for harm

One AHIMS registered Aboriginal cultural heritage site was identified within the Subject Area (Bulli Site 7 (AHIMS ID # 52-2-3687). The proposed works would impact the soil profile and thus the integrity of the site through direct and indirect disturbances. Table 32 below provides a summary of the type, degree and consequence of harm to Aboriginal objects identified within the Subject Area.

Table 32: Impact assessment summary

AHIMS ID#	Site name	Type of harm	Degree of harm	Consequence of harm
52-2-3687	Bulli Site 7	Direct	Partial	Partial loss of value

The results of a previous Aboriginal Cultural Heritage Assessment (Biosis 2009) for the greater Bulli Seams Operations (including the ongoing longwall mining operations and West Cliff Stage 4 Coal Wash Emplacement) led to the registration of Aboriginal cultural heritage site Bulli Site 7 (AHIMS ID# 52-2-3687). This site is located within the Subject Area and will be directly impacted as a result of the proposed activities.

Table 33: Details of the Aboriginal objects within the Subject Area

Portion of site to be impacted	AHIMS ID#	Site Name	Site Features	Easting (GDA 94, Zone 56)	Northing (GDA 94, Zone 56)
Western half of the revised site extent	52-2-3687	Bulli Site 7	Open camp site	290526	6219289

12.4 Project justification

An integral requirement of underground mining is adequate ventilation infrastructure and mine access facilities to ensure a safe and efficient underground working environment. Appin Mine operations are progressing further away from the existing surface infrastructure located in the Appin and Douglas Park areas, and additional infrastructure is required to support the ongoing operations.

The Project will ensure the continued usability of the Appin mine operations as well as its associated local employment and IMC support for local and regional communities.

12.5 Considerations for Ecological Sustainable Development

Section 5(vii) of the EP&A 1979 requires proponents to consider the key principles of Ecologically Sustainable Development (ESD) in the design of their projects. The principles of ESD are defined within the *Protection of the Environment Administration Act 1991*. This Act defines the precautionary principle and the principles of inter-generational equity, conservation of biological diversity and ecological integrity. The precautionary principle is defined as:

"*if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*".

Australia's National Strategy for ESD (1992) defines ecologically sustainable development as: 'using, conserving and enhancing the communities' resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.' Aboriginal heritage programs which seek to address indigenous concerns in relation to the land, heritage, economic and cultural development include the Commonwealth Indigenous Protected Areas Initiative, Land Acquisition and Maintenance, and Heritage Protection Programs; the Victorian Aboriginal Capital Projects and Aboriginal Cultural Heritage Programs; and the South Australian Aboriginal Tourism Strategy.' (Australian Government 1992: Chapter 22).

ESD in regard to the aforementioned Aboriginal cultural heritage sites needs to consider intergenerational equality; this is fundamental to identifying Aboriginal culture and identity into the future. Though Bulli Site 7 (AHIMS ID#52-2-3687) and Bulli Site 8 (AHIMS ID#52-3-3688) are significant to the Aboriginal community,

due the disturbed context and its similarities to a number of other sites in the greater region; any harm to these sites will not cause harm to Aboriginal communities' connection to country or cultural development within the community.

Table 34 considers the key principles of ESD with respect to the results of the literature review, Aboriginal heritage survey and archaeological test excavation results and significance assessment contained within this report.

Table 34: Assessment of ESD

Principles of the EIA and ESD Guidelines	ESD Assessment
A fundamental consideration for conservation of biological diversity and ecological integrity	This assessment takes into account consideration of the conservation of cultural heritage. The Proponent has undertaken an ACHA with test excavation proposed in consultation with the RAPs and determined that there is one site present with the Subject Area. The proposed activity would result in irreversible damage to the cultural heritage environment and result in intergenerational loss of cultural heritage items to the Aboriginal cultural heritage site.
Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment	The proponent has undertaken an ACHA and has provided consideration of options to avoid, where practical harm to Aboriginal objects. In the case of this assessment, avoidance was not considered warranted based on the significance assessment outlined in Section 11 and the consideration of harm and mitigation strategies in Sections 12 and 13.
Consideration of intergenerational equity	ESD in regard to Bulli Site 7 (AHIMS ID# 52-2-3687) is a significant Aboriginal cultural heritage site to the Aboriginal community, however due to low educational value and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at this site will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community
Where risk of serious or irreversible harm and lack of scientific knowledge of the nature of environmental harm combine, the precautionary principle applies. Where there is risk of serious or irreversible harm, it is necessary to establish whether there is adequate scientific knowledge of the subject to evaluate the perceived threat.	This assessment has considered a review of all Aboriginal heritage items and their associated scientific report identified in heritage searches of a 2 km radius of the Subject Area. An archaeological test excavation in accordance with the Code of Practice for Archaeological Investigation in NSW (OEH 2011) has been proposed to assess the subsurface potential for Aboriginal objects. Consultation with the RAPs has been undertaken in accordance with the Aboriginal Consultation Requirements (DECCW 2010b). The assessment was sufficient to identify Aboriginal objects, their likelihood and significance. Significance and impact assessments are outlined in Sections 11 and 12.
An assessment of the risk-weighted consequences of various options	A consideration of harm and mitigation is provided in Section 13. Avoidance is always preferred, however given the low archaeological value of Bulli Site 7 (AHIMS ID# 52-2-3687) and the overall purpose of the development, there is no justification for avoidance which would require IMC to redesign the proposed works.

13. Management and Mitigation Measures

13.1 Conservation Principles and Management Framework

The two founding principles behind the OEH 2011 are ESD and intergenerational equity. These principles hold that "the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations".

The strong emphasis, as in the Burra Charter, is to quantify and understand the heritage values of a place, a site, or an object and exhaust avenues of avoiding harm to those values. If harm cannot be avoided, then there must be consideration and implementation of strategies to minimise harm (OEH 2011:13).

It follows that the hierarchy for consideration in terms of the management strategies available for surface stone artefacts and subsurface stone artefacts and areas of archaeological potential, fall into four general categories, in order of preference from a conservation perspective:

avoidance and in-situ conservation.
partial avoidance and partial in-situ conservation (includes partial harm).
harm caused with mitigating circumstances such as collection or salvage; and
unmitigated harm.

The four general categories (described above) have been considered in the following subsections with regard to both direct impacts (e.g. surface disturbance) and indirect impacts (e.g. monitoring activities).

The management and mitigation measures have been prepared in consideration of comments received from the RAPs during the consultation process. These comments include those related to cultural considerations surrounding salvage works and the handling of artefactual materials, as well as the cultural significance of all sites. All comments received from the RAPs are considered in Section 4.3.

13.2 Detailed Design to Avoid Harm

During detailed design of the Project location, it is recommended the proponent give consideration to the known Aboriginal cultural heritage sites identified by this ACHA. This process should include a consideration of whether or not surface infrastructure can be designed in a way that avoids harm, and if harm cannot be avoided that harm be caused to as few sites as possible, within existing design and operational constraints.

This approach is consistent with the Heritage NSW requirements of ESD and intergenerational equity. If harm cannot be avoided, then there must be consideration and implementation of strategies to minimise harm (OEH 2011:13).

The archaeological test excavation was undertaken to understand the nature and extent of Bulli Site 7 (AHIMS ID # 52-2-3687) and other unknown Aboriginal cultural sites, and to evaluate the harm and impact of the Project on the sites.

At present, given the low archaeological significance of the identified Aboriginal cultural heritage site Bulli Site 7 (AHIMS ID # 52-2-3687), the approval of the Project and the consent to destroy Aboriginal objects in part through a program of salvage surface collection of remaining Aboriginal objects, is considered to be the appropriate way forward and should be in place prior to the Project works taking place.

The Proponent may also wish to consider mitigating cumulative impacts by undertaking positive actions to improving awareness of Aboriginal cultural heritage such as:

- Undertaking cultural heritage awareness as part of site inductions for employees, site visitors and contractors and making them aware of the presence of Aboriginal sites and their obligations under the National Parks and Wildlife Act 1974.
- Naming features of the development in consultation with the RAPs.
- Exploring means to promote awareness of the Aboriginal history of the region.

Several management and mitigation measures have been considered for this project and are presented in Table 35.

Table 35: Consideration of management and mitigation strategies

Management Risk / Impacted Value	Strategies considered	Response
Management Risk - Compliance	Aboriginal Cultural Heritage Management Plan (AHMP)	• An AHMP to be in place for the life of the project to help mitigate any potential Aboriginal cultural heritage constraints and impacts encountered. This is to be developed in consultation with the RAPs and relevant regulatory authorities.
Management Risk - Compliance	Entering into a Care and Control Agreement with the Registered Aboriginal Parties to determine the keeping place of Aboriginal objects collected during the Archaeological assessments undertaken as part of the ACHA.	Long term storage and care of Aboriginal Objects recovered during the ACHA and outlined within the AHMP as part of the ongoing management of the Aboriginal Objects, as required under S.89 of the National Parks and Wildlife Act through a Care and Control Agreement. • Provision should be made to rebury Aboriginal objects on site, or return Aboriginal objects to RAPs entitled to, and willing to accept possession, custody or control of the Aboriginal object in accordance with Aboriginal tradition.
Management Risk - Compliance	Completion of Aboriginal Site Impact Recording Forms	• Aboriginal site impact recording forms (ASIFS) will need to be completed and submitted to the AHIMS register for AHIMS ID# 52-2-3687 when harm has occurred as a result of the proposed activity under and the completion of any salvage requirements under any AHMP.
Management Risk – Compliance and Unexpected Finds (excluding human remains)	Communication to employees, site visitors, contractors and landowners	• All site personnel should be inducted into the Subject Area, so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future AHMP prior, during and after construction activities.
Management Risk – Unexpected Finds – human remains	Stop work and follow procedure for discovery of suspected human remains	• All site personnel should be inducted into the Subject Area, so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future AHMP prior, during and after construction activities. • In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately. • The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. • The NSW Police must be contacted immediately. • No further action is to be undertaken until the NSW Police provide approval via provision of a case number. • If the skeletal remains are identified as Aboriginal, Public Works Advisory Developments or their agent must contact: • the Heritage NSW's Enviroline on 131 555; and representatives of the RAPs. • No works are to continue until the Heritage NSW provides written notification to the proponent or their Agent.

Management Risk / Impacted Value	Strategies considered	Response
Impacted Cultural/ Education Value	Avoidance/Conservation	• Considering the low educational value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at this site will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Avoidance as a management option is unjustified and unfeasible at this stage.
	Mitigating harm through salvage surface collection of the remaining Aboriginal object located in the Subject Area	• Surface collection of remaining Aboriginal objects associated with AHIMS ID# 52-2-3687is recommended as a management option to mitigate impacts to cultural/educational value as all Aboriginal objects hold cultural value to the community.
	Ongoing consultation	• Registered Aboriginal Parties should continue to be consulted in accordance with the guidelines and any future AHMP.
Impacted Scientific (archaeological) / Research Value	Avoidance/Conservation	• Considering the low conservation and scientific/ research value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Avoidance as a management option is unjustified and unfeasible at this stage.
	Subsurface salvage excavation	• Considering the low scientific value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Salvage excavation as a management option is unjustified and unfeasible.
	Mitigating harm through salvage surface collection of the remaining Aboriginal objects	• This strategy will be undertaken as part of the AHMP.
Impacted Representativeness/ Conservation Value	Avoidance/Conservation	• Considering the low conservation and representative value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Avoidance as a management option is un justified and unfeasible at this stage.
	Subsurface test excavation	• Considering the low conservation and representative value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal

Management Risk / Impacted Value	Strategies considered	Response
		communities' connection to country or cultural development within the community. Salvage excavation as a management option is unjustified and unfeasible at this stage
	Mitigating harm through salvage surface collection of the remaining Aboriginal objects located on the dam.	• This strategy will be undertaken as part of the AHMP.
Impacted Aesthetic Value	Avoidance/Conservation	• Considering the low-medium conservation and aesthetic value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Avoidance as a management option is unjustified and unfeasible at this stage.
	Subsurface salvage excavation	• Considering the low-medium conservation and aesthetic value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Salvage excavation as a management option is unjustified and unfeasible at this stage
	Mitigating harm through salvage surface collection of the remaining Aboriginal objects located on the dam.	• This strategy will be undertaken as part of the AHMP.
Impacted Conservation value – rarity/ threatened resource	Avoidance/Conservation	• Considering the low conservation and rarity value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at these sites will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Avoidance as a management option is unjustified and unfeasible at this stage.
	Subsurface test excavation	• Considering the low conservation and rarity value of the identified Aboriginal sites AHIMS ID# 52-2-3687, and its similarity to a number of other sites within the Cumberland Plain; any harm suffered at this site will not cause significant harm to the Aboriginal communities' connection to country or cultural development within the community. Salvage excavation as a management option is unjustified and unfeasible at this stage
	Mitigating harm through salvage surface collection of the remaining Aboriginal objects located on the dam.	• This strategy will be undertaken as part of the AHMP.

14. Recommendations

This ACHA was carried out in accordance with the Code of Practice and OEH 2011. It included consultation with RAPs in accordance with the Consultation Requirements (details of which are in Appendix 1).

Based on the scientific significance of the Aboriginal heritage sites presented in Section 11, the impact assessment presented in Section 12 and the suggested management and mitigation measures outlined in Section 13, the following recommendations are made regarding the Aboriginal heritage site within the Subject Area (Table 36).

Table 36: Recommendations

Recommendations	
1.	An Aboriginal Cultural Heritage Management Plan (AHMP) should be developed for the Project that details and schedules (for the life of the Project) the mitigation and management measures presented in the report. The AHMP should be developed in consultation with the RAPs and relevant regulatory authorities and in compliance with the requirements of the BSO HMP 2017. The AHMP should include the following: • Protocols for the involvement of the RAPs in cultural heritage works conducted under the AHMP. This protocol should focus on members of the RAPS identified during this ACHA's consultation process. • A communications protocol that describes clear methods of communication, including expectations of suitable notification and response time, between the proponent and the RAPs. • A protocol for the discovery and management of Unexpected Finds, including stop work provisions and notification protocols. • A protocol for the discovery and management of human remains, including stop work provisions and notification protocols, as per Recommendation 7. • Procedures for the management and reporting of previously unknown Aboriginal heritage sites that may be identified during the life of the Project. • Protocols for heritage awareness training to be incorporated into the Project site inductions for both employees and sub-contractors who may be conducting works that have the potential to impact on any Aboriginal heritage sites. Consideration should be given to involving the RAPs in the development and presentation of the cultural awareness training. • A regular review process for the AHMP (in accordance with Condition 5 of Schedule 6 of the Appin Mine Approval, or every three years unless otherwise stipulated). • AHIMS Site impact forms to be submitted for any sites subject to impact. • Copies of the final report should be made available to each RAP, the Department of Planning, Industry and Environment and Heritage NSW.
2.	A surface collection of the isolated surface artefact at Bulli Site 7 (AHIMS ID#52-2-3687) be undertaken in consultation with the Project RAPs under the above AHMP.
3.	A Care and Control Agreement be developed for the long-term management of recovered artefacts.
4.	The five artefacts recovered during the test excavation, and the surface artefact to be collected as per Recommendation 2 be reburied on site outside of the area of impact. The reburial to be conducted under the AHMP and in accordance with the Care and Control Agreement.
5.	All site personnel should be inducted into the Subject Area, so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* as to their responsibilities in the conservation of Aboriginal Heritage.

Recommendations	
6.	Site Card information for Bulli Site 7 (AHIMS ID#52-2-3687) should be updated in the AHIMS database with revised site descriptions (i.e. Aboriginal Site Impact Form (ASIFs).
7.	In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately and: • The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. • The remains must be left in place and protected from harm or damage. • The NSW Police and Coroners Office must be contacted immediately. • No further action is to be undertaken until the NSW Police confirm the origin of the remains as non-human and provide a case number for South32's records. • If the skeletal remains are identified as Aboriginal, South 32 or their agent must contact: ▪ the Heritage NSW's Enviroline on 131 555; and representatives of the RAPs. ▪ No works are to continue until the Heritage NSW provides written notification to the Proponent or their Agent.

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Appendix 1: Aboriginal Community Consultation Logs

Appendix 2: AHIMS Extensive Search

Appendix 3: Excavation Records

Test Pit 1

Test Pit 1 Summary

Spit	Depth	Disturbance	Unit Description
1	0-5cm	Grass roots, and vegetation	Loose medium brown silty loam topsoil
2	5-10cm	Grass roots, and vegetation	Friable medium reddish brown silty sandy clay
3	10-15cm	Grass roots still present	Friable medium reddish brown silty sandy clay
4	15-20cm	Low amounts of grass roots	Transition to a light reddish brown silty sandy clay, friable in compaction
5	20-25cm	Low amounts of grass roots	Friable, light reddish brown silty sandy clay
6	25-30cm	Low amounts of grass roots	Friable, light reddish brown silty sandy clay, transition layer
7	30-35cm	Very low amounts of grass roots. Infrequent flecks of ironstone and manganese	Transition to a dark reddish brown silty sandy clay. Friable in compaction
8	35-40cm	Black clay mottles, infrequent ironstone and manganese	Friable, dark reddish brown sandy clay.
9	40-45cm	Black clay mottles	Friable, dark reddish brown sandy clay. Poorly sorted, coarse
10	45-50cm	Black clay mottles	Friable, dark reddish brown sandy clay. Poorly sorted, coarse
11	50-55cm	infrequent ironstone and manganese	Friable, dark reddish brown sandy clay. Poorly sorted, coarse
12	55-60cm	infrequent ironstone and manganese	Friable, dark reddish brown sandy clay. Poorly sorted, coarse
13	60-65cm	Clay mottles and infrequent ironstone and manganese	Dark reddish brown sandy clay. Poorly sorted, coarse. Plastic mostly but slightly friable



Photo of end of excavation of TP1

Test Pit 2

Test Pit 2 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Moderately compact, reddish brown sandy clay loam
2	10-20cm	Grass roots, and manganese flecks	Moderately compact, reddish brown sandy clay loam, increasing clay content
3	20-30cm	Manganese flecks	Reddish brown sandy clay
4	30-40cm	Infrequent manganese flecks	Reddish brown sandy clay onto cemented clay



Photo of end of excavation of TP2

Test Pit 3

Test Pit 3 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil, moist from previous rainfall
2	10-20cm	Manganese, clay mottles	Friable, transition to a light yellowish brown silty loam in southern section. Northern section transition to orange-brown clay loam
3	20-30cm	Charcoal flecks (5%)	Friable/firm, light yellowish brown silty loam in southern section. Orange-brown clay loam continuing in northern section.
4	30-40cm	Burnt clay nodules, plant roots	Friable/firm, orange-brown clay with burnt patches around roots
5	40-50cm	Large tree root at 45cm, charcoal in centre	Friable/compact, orange-red brown clay
6	50-60cm	Charcoal depression in centre	Compact, orange-red brown clay

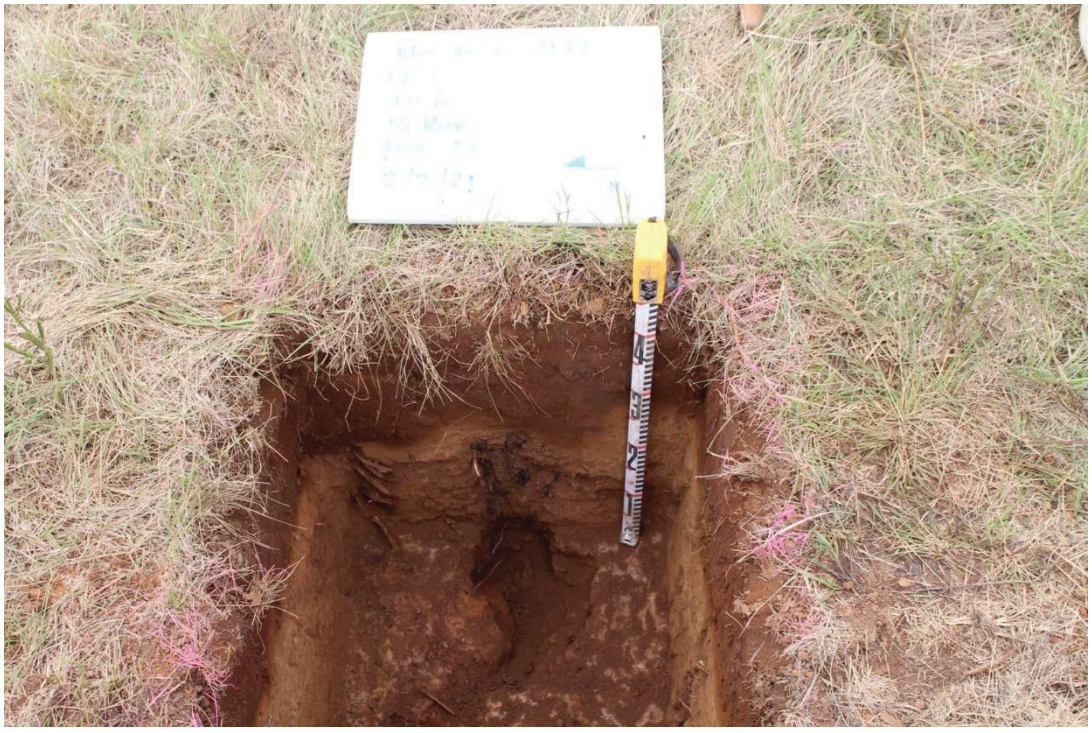


Photo of end of excavation of TP3

Test Pit 4

Test Pit 4 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Ironstone, grass rootlets	Friable, transition in lightness of colour with depth, orange brown silty loam
3	20-30cm	Ironstone and charcoal flecks (5%)	Friable/compact, orange brown silty loam
4	30-40cm	Grass rootlets (1%),	Friable/compact, orange clay with darker red clay mottles



Photo of end of excavation of TP4

Test Pit 5

Test Pit 5 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown silty loamy topsoil
2	10-20cm	Grass rootlets	Friable, transition to a light brown-orange sandy loam, medium grained
3	20-30cm	Grass rootlets	Firm, light brown-orange silty sandy loam, medium grained
4	30-40cm	Manganese flecks, ironstone (5%)	Firm, light brown-orange silty clay loam, fine to medium grained
5	40-50cm	Red clay mottles	Compact, orange clay



Photo of end of excavation of TP5

Test Pit 6

Test Pit 6 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Ironstone and manganese Grass rootlets	Friable, Brown silty loam
4	30-40cm	Manganese flecks, ironstone (5%)	Compact, brown silty loam
5	40-50cm	Manganese flecks, ironstone	Compact, orange brown clay, mostly plastic



Photo of end of excavation of TP6

Test Pit 7

Test Pit 7 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown silty loam
3	20-30cm	Ironstone and manganese (5%) (<2mm)	Firm, brown silty clay loam
4	30-40cm	Manganese flecks, ironstone (5%)	Firm, orange-brown silty clay loam
5	40-50cm	Clay mottling	Compact, orange clay



Photo of end of excavation of TP7

Test Pit 8

Test Pit 8 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown silty loamy topsoil
2	10-20cm	Grass rootlets, willow ceramic fragment	Friable, dark brown silty loamy topsoil
3	20-30cm	Ironstone and manganese flecks	Firm, brown silty clay loam
4	30-40cm	Manganese flecks, ironstone (10%)	Friable/firm, transition to a light brown-orange silty clay loam
5	40-50cm	Ironstone and manganese flecks (5%)	Friable/compact, orange-brown silty clay loam
6	50-60cm	Ironstone and manganese flecks (5%)	Friable/compact, orange-brown clay



Photo of end of excavation of TP8

Test Pit 9

Test Pit 9 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown silty loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown silty loamy topsoil
3	20-30cm	Grass rootlets (1%)	Firm, transition to a light brown silty clay loam
4	30-40cm	Manganese flecks, ironstone (5%)	Firm, light yellowish brown silty clay loam, fine to medium grained
5	40-50cm	Manganese flecks, ironstone (10%) (<10mm)	Friable/compact, light yellowish brown silty clay
6	50-60cm	Red clay mottles	Friable/compact, light yellowish brown clay



Photo of end of excavation of TP9

Test Pit 10

Test Pit 10 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange burnt clay mottling (1%), charcoal flecks	Friable, dark brown loamy topsoil
3	20-30cm	Charcoal flecks	Friable, dark brown loamy soil, sharp transition to orange clay at base of spit
4	30-40cm	Compacted	Friable, orange clay



Photo of end of excavation of TP10

Test Pit 11

Test Pit 11 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil, on eastern section “pottins mix” soil is present
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Charcoal flecks	Friable, dark brown loamy soil
4	30-40cm	Charcoal flecks	Friable/compact, light greyish brown silty loam
5	40-50cm	Charcoal and orange clay flecks	Compact, light greyish brown silty loam
6	50-60cm	Compaction	Firm, transition to orange clay at base



Photo of end of excavation of TP11

Test Pit 12

Test Pit 12 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Grass rootlets	Friable/firm, dark brown loamy topsoil, transitioning to clay at bottom of spit
4	30-40cm	Charcoal fleck (1%)	Compact, orange clay natural layer



Photo of end of excavation of TP12

Test Pit 13

Test Pit 13 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, brown silty loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Charcoal and clay flecks	Compact, dark brown loamy topsoil
4	30-40cm	Charcoal flecks	Compact, orange clay natural layer



Photo of end of excavation of TP13

Test Pit 14

Test Pit 14 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Firm, dark brown loamy topsoil
3	20-30cm	Ironstone/manganese flecks	Compact, transition to light grey soil
4	30-40cm	Compaction	Compact, orange clay natural layer



Photo of end of excavation of TP14

Test Pit 15

Test Pit 15 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets, mottled clay	Compact, dark brown topsoil
2	10-20cm	Mottled clay, ant holes	Compact, dark brown loamy topsoil
3	20-30cm	Mottled clay	Compact, orange clay, decreasing mottling of dark brown topsoil. Lens of light grey soil midway through the spit.
4	30-40cm	Clay mottles, iron/manganese flecks	Compact, light grey soil
5	40-50cm	Tree roots, iron/manganese flecks	Light grey soil, transitioning to orange clay natural layer



Photo of end of excavation of TP15

Test Pit 16

Test Pit 16 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, brown topsoil
2	10-20cm	Iron/manganese flecks	Firm, dark brown loamy topsoil, transitioning to light grey soil
3	20-30cm	Iron/manganese flecks	Firm, light grey soil
4	30-40cm	Iron/manganese flecks, (20%)	Compact, light grey soil
5	40-50cm	Iron/manganese flecks (5%)	Compact, transition to orange clay



Photo of end of excavation of TP16

Test Pit 17

Test Pit 17 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, light brown silty sandy loam, fine to medium grained
2	10-20cm	Iron/manganese flecks, scattered orange clay mottles	Compact, light greyish brown silty loam, fine to medium grained
3	20-30cm	Iron/manganese flecks, orange clay mottles	Compact, light greyish brown silty loam, fine to medium grain
4	30-40cm	Iron/manganese flecks, orange clay mottles	Compact, transition to orange-red brown clay



Photo of end of excavation of TP17

Test Pit 18

Test Pit 18 Summary

Spit	Depth	Disturbance	Unit Description
1	0-5cm	Grass roots	Firm, medium brown red silty sandy clay, poorly sorted
2	5-10cm	Grass rootlets	Firm, medium brown red silty sandy clay, poorly sorted
3	10-15cm	Grass roots still present	Firm, medium brown red silty sandy clay, poorly sorted
4	15-20cm	Iron/manganese flecks	Firm, medium brown red silty sandy clay, poorly sorted
5	20-25cm	Compaction	Firm, dark red brown silty clay, poorly sorted, plastic



Photo of end of excavation of TP18

Test Pit 19

Test Pit 19 Summary

Spit	Depth	Disturbance	Unit Description
1	0-5cm	Grass roots, and vegetation	Friable/firm, dark red brown silty clay, poorly sorted
2	5-10cm	Grass roots	Friable/firm, light yellow brown silty clay, poorly sorted
3	10-15cm	Iron/manganese flecks	Friable/firm, light yellow brown silty clay, poorly sorted
4	15-20cm	Iron/manganese flecks	Friable/firm, light yellow brown silty clay, poorly sorted
5	20-25cm	Iron/manganese flecks	Friable/firm, light yellow brown silty clay, poorly sorted
6	25-30cm	Iron/manganese flecks	Friable/firm, light yellow brown silty clay, poorly sorted
7	30-35cm	Infrequent flecks of ironstone and manganese	Friable/firm, light yellow brown silty clay, poorly sorted
8	35-40cm	Infrequent ironstone and manganese	Friable/firm, light yellow brown silty clay, poorly sorted
9	40-45cm	Infrequent ironstone and manganese	Friable/firm, light yellow brown silty clay, poorly sorted
10	45-50cm	Charcoal flecks	Friable/firm, light brown-orange silty clay loam, fine to medium grained
11	50-55cm	Charcoal flecks	Friable/firm, light brown-orange silty clay loam, fine to medium grained
12	55-60cm	Clay mottles	Firm, transition to yellow orange clay
13	60-65cm	Red clay mottles	Compact, yellow orange clay



Photo of Spit 10 of TP19

Test Pit 20

Test Pit 20 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown sandy loam
2	10-20cm	Grass rootlets	Friable, dark brown sandy loam, transitioning to a lighter colour
3	20-30cm	Grass rootlets	Friable/firm, dark brown-orange silty loam, fine to medium grained
4	30-40cm	Rootlets, charcoal flecks	Friable/firm, brown-orange silty clay loam, fine to medium grained
5	40-50cm	Compaction	Friable/firm, orange-brown clay



Photo of end of excavation of TP20

Test Pit 21

Test Pit 21 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown silty topsoil
2	10-20cm	Grass rootlets	Friable/firm, dark brown silty loam, transitioning to an orange brown silty loam
3	20-30cm	Grass rootlets	Firm, dark brown loamy topsoil
4	30-40cm	Compaction	Firm/compact, dark brown loamy topsoil transitioning to compacted orange clay
5	40-45cm	Compaction	Compact, orange clay



Photo of end of excavation of TP21

Test Pit 22

Test Pit 22 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown silty loam
2	10-20cm	Grass rootlets	Friable, dark brown silty loam, transitioning to a lighter colour
3	20-30cm	Grass rootlets	Friable, light brown transitioning to orange sandy loam
4	30-40cm	Rootlets, black clay mottles, burnt branch	Friable/firm, orange sandy loam
5	40-50cm	Compaction	Friable/firm, light orange-brown sandy clay



Photo of end of excavation of TP22

Test Pit 23

Test Pit 23 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Red clay mottles	Friable, dark brown loamy topsoil, transition to clay in SE corner
4	30-40cm	Rootlets, black clay mottles, burnt branch	Compact, transition to clay in SE corner, topsoil still present



Test Pit 24

Test Pit 24 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown sandy loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown sandy loamy topsoil
3	20-30cm	Grass rootlets	Friable, dark brown sandy loamy topsoil
4	30-40cm	Charcoal and iron/manganese flecks, orange clay mottles	Friable, end of dark brown sandy loamy topsoil, start of brown-orange sandy loam, fine to medium grained
5	40-50cm	Orange clay mottles	Friable/firm, orange sandy loam, fine to medium grained
6	50-60cm	Orange clay mottles	Friable/firm, orange sandy loam, fine to medium grained
7	60-70cm	Orange clay mottles	Friable/firm, orange sandy loam, fine to medium grained, light grey soil channel midway through spit
8	70-80cm	Mottled clay	Firm, dark brown clay/loamy topsoil
9	80-90cm	Mottled clay	Firm, orange clay mottled with dark brown loamy topsoil
10	90-100cm	Compaction	Compact, orange clay base



Photo of end of excavation of TP24

Test Pit 25

Test Pit 25 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil with sharp transition to orange clay at base of spit
3	20-30cm	Compaction	Compact, orange natural clay layer



Photo of end of excavation of TP25

Test Pit 26

Test Pit 26 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottling	Friable, dark brown loamy topsoil
3	20-30cm	Compaction	Friable, dark brown loamy topsoil, transitioning into orange clay
4	30-40cm	Compaction	Orange clay continues with depth



Photo of end of excavation of TP26

Test Pit 27

Test Pit 27 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown sandy loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown sandy loamy topsoil, transitioning into a lighter colour
3	20-30cm	Grass rootlets	Friable/firm, light orange-brown loam
4	30-40cm	Black clay mottles	Friable/firm, light orange-brown loam
5	40-50cm	Black and red mottled clay	Friable/firm, light orange-brown loam
6	50-60cm	Black and red mottled clay	Friable/firm, light orange-brown loam, increased clay content



Photo of end of excavation of TP27

Test Pit 28

Test Pit 28 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Grass rootlets, charcoal flecks	Friable, dark brown loamy topsoil, transitioning to orange clay layer
4	30-40cm	Charcoal flecks	Compact, orange clay soil layer
5	40-50cm	Compaction	Orange natural clay layer



Photo of end of excavation of TP28

Test Pit 29

Test Pit 29 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles	Friable, dark brown loamy topsoil
3	20-30cm	Charcoal flecks	Compact, dark brown loamy topsoil, transitioning to orange and red clay layer
4	30-40cm	Charcoal patches	Compact, orange and red clay layer, layer of dark brown loamy soil at base
5	40-50cm	Tree root	Compact, orange clay layer, mottled with dark brown loamy soil
6	50-60cm	Compaction, tree roots	Compact, orange clay layer, mottled with dark brown loamy soil
7	60-70cm	Compaction	Orange natural clay layer



Photo of end of excavation of TP29

Test Pit 30

Test Pit 30 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil, transitioning to orange clay
2	10-15cm	Charcoal flecks	Orange natural clay layer



Photo of end of excavation of TP30

Test Pit 31

Test Pit 31 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Compact, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles	Friable, dark brown loamy topsoil
3	20-30cm	Compaction	Compact, dark brown loamy topsoil, transitioning to orange layer
4	30-40cm	Compaction	Compact, orange clay natural layer



Photo of end of excavation of TP31

Test Pit 32

Test Pit 32 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Compact, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles, ironstone (<5%)	Compact, dark brown loamy topsoil
3	20-30cm	Compaction, red clay mottles	Compact, orange clay



Photo of end of excavation of TP32

Test Pit 33

Test Pit 33 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, ironstone	Friable, dark brown loamy topsoil
3	20-30cm	Ironstone, burnt clay	Friable, dark brown loamy topsoil, transitioning to orange clay
4	30-40cm	Compaction, ironstone	Compact, orange clay



Photo of end of excavation of TP33

Test Pit 34

Test Pit 34 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Grass roots	Loose, dark brown sandy loam
2	10-15cm	Grass roots	Loose, dark brown sandy loam
3	15-20cm	Grass roots	Loose, dark brown sandy loam
4	20-25cm	Grass roots, charcoal flecks	Friable/firm, dark brown orange silty sandy loam, medium grained
5	25-30cm	Iron/manganese flecks, grass rootlets	Friable/firm, dark brown orange silty sandy loam, medium grained
6	30-35cm	Iron/manganese flecks, grass rootlets	Friable/firm, light brown orange silty sandy loam, medium grained
7	35-40cm	Iron/manganese flecks, clay mottles	Friable/firm, light brown orange silty sandy loam, medium grained
8	40-45cm	Iron/manganese flecks, clay mottles	Friable/firm, light yellow orange silty sandy loam, medium grained



Photo of end of excavation of TP34

Test Pit 35

Test Pit 35 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown sandy loamy topsoil
2	10-20cm	Charcoal flecks, orange mottled clay, grass rootlets	Friable, light orange brown silty sandy loam
3	20-30cm	Charcoal flecks, grass rootlets	Friable, light orange brown sandy clay loam
4	30-40cm	Ironstone/manganese flecks, red mottled clay	Compact, light brown orange mottled clay



Photo of end of excavation of TP35

Test Pit 36

Test Pit 36 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown sandy loamy topsoil
2	10-20cm	Charcoal flecks, orange mottled clay, grass rootlets	Friable, light greyish white silty chalk, possible disturbance from nearby track
3	20-30cm	Ironstone/manganese flecks (10%)	Friable, light greyish white silty chalk
4	30-40cm	Ironstone/manganese flecks	Compact, light orange brown clay
5	40-50cm	Compaction	Compact, orange red mottled clay



Photo of end of excavation of TP36

Test Pit 37

Test Pit 37 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil, orange clay in SE corner
3	20-30cm	Compaction	Friable, dark brown loamy topsoil transitioning to an orange clay loam
4	30-40cm	Clay mottles	Friable/firm, brown orange clay loam
5	40-50cm	Compaction	Compact, orange clay natural layer



Photo of end of excavation of TP37

Test Pit 38

Test Pit 38 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles	Friable, dark brown loamy topsoil
3	20-30cm	Grass roots, orange clay mottles	Friable, dark brown loamy topsoil
4	30-40cm	Clay mottles	Friable/firm, transition to light grey clay loam
5	40-50cm	Ironstone/manganese flecks, clay mottles	Friable/firm, light grey clay loam
6	50-60cm	Compaction, ironstone/manganese pebbles	Compact, orange mottled clay



Photo of end of excavation of TP38

Test Pit 39

Test Pit 39 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown sandy loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles	Friable, dark brown sandy loamy topsoil
3	20-30cm	Black clay mottles	Compact, transition to orange red clay



Photo of end of excavation of TP39

Test Pit 40

Test Pit 40 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Loose, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil, starting transition to orange-brown silty sandy loam
3	20-30cm	Grass rootlets	Friable/firm, orange brown sandy silty loam, medium grained
4	30-40cm	Grass rootlets, orange mottled clay	Friable/firm, orange brown sandy silty loam, medium grained
5	40-50cm	Orange black mottles of clay	Compact, orange clay



Photo of end of excavation of TP40

Test Pit 41

Test Pit 41 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Firm, medium brown orange loamy topsoil
2	10-20cm	Grass rootlets, orange clay mottles	Firm, medium brown orange sandy loam
3	20-30cm	Orange clay mottles	Firm, medium brown orange sandy loam
4	30-40cm	Orange clay mottles	Firm, medium brown orange sandy loam
5	40-50cm	Red, orange and black clay mottles	Firm/compact, orange sandy silty loam
6	50-60cm	Red, orange clay mottles	Firm/compact, orange silty clay



Photo of end of excavation of TP41

Test Pit 42

Test Pit 42 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, brown sandy silty soil, medium grained
3	20-30cm	Iron/manganese (<2mm)	Firm, brown orange sandy silty clay
4	30-40cm	Iron/manganese (<2mm)	Firm, light brown orange sandy silty clay
5	40-50cm	Scattered black clay mottles	Firm, light brown orange silty clay loam
6	50-60cm	Black clay mottles	Firm/compact, light brown orange silty clay, transitioning to orange natural clay



Photo of end of excavation of TP42

Test Pit 43

Test Pit 43 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown sandy loamy topsoil
2	10-20cm	Grass rootlets, flecks of baked clay	Friable, brown orange sandy silty clay, medium sand grains
3	20-30cm	Ironstone/manganese, mottled clay	Firm, brown orange-yellow sandy silty clay
4	30-40cm	Ironstone/manganese (<10mm), mottled clay	Firm, orange brown sandy clay
5	40-50cm	Black clay mottles	Firm/compact, reddish brown sandy silty clay, transitioning on red clay



Photo of end of excavation of TP43

Test Pit 44

Test Pit 44 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets, orange and black clay mottles	Friable, light brown orange sandy silty loam
2	10-20cm	Red, orange and black clay mottles	Friable/firm, orange clay silty loam brown orange sandy silty clay, medium sand grains
3	20-25cm	Red and black clay mottles, ironstone/manganese (10%)	Compact, orange mottled clay



Photo of end of excavation of TP44

Test Pit 45

Test Pit 45 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, ironstone/manganese (<10mm), scattered clay mottles	Friable, light orange brown silty sandy clay, fine grained
3	20-30cm	Ironstone/manganese, mottled clay	Friable/firm, orange brown silty sandy clay, fine grained
4	30-40cm	Ironstone/manganese (<10mm), mottled clay	Compact, orange clay



Photo of end of excavation of TP45

Test Pit 46

Test Pit 46 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, flecks of ironstone/manganese	Friable, light brown orange sandy silty clay, fine to medium sand grains
3	20-30cm	Ironstone/manganese, mottled clay	Friable, light brown orange sandy silty clay, fine to medium sand grains
4	30-40cm	Ironstone/manganese flecks (<5mm)	Firm, orange silty clay loam, with additional yellow silty loam
5	40-50cm	Ironstone/manganese flecks (<5mm)	Firm/compact, orange mottled clay



Photo of end of excavation of TP46

Test Pit 47

Test Pit 47 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Compaction	Friable, dark brown loamy topsoil, transitioning to orange clay
4	30-40cm	Compaction	Compact, natural orange clay layer



Photo of end of excavation of TP47

Test Pit 48

Test Pit 48 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, light brown silty sandy loam, fine to medium sand grains
3	20-30cm	Ironstone/manganese, scattered	Friable, greyish brown orange silty loam
4	30-40cm	Ironstone/manganese flecks (<5mm)	Firm, light greyish orange silty clay loam
5	40-50cm	Ironstone/manganese flecks (<5mm)	Compact, transition to yellowish brown natural clay at base



Photo of end of excavation of TP48

Test Pit 49

Test Pit 49 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil transitioning to orange clay
3	20-30cm	Compaction	Compact, orange clay



Photo of end of excavation of TP49

Test Pit 50

Test Pit 50 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets	Friable, dark brown loamy topsoil
3	20-30cm	Compaction	Compact, transition to orange clay at base of spit



Photo of end of excavation of TP50

Test Pit 51

Test Pit 51 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, brown loamy topsoil
2	10-20cm	Grass rootlets, red clay mottles	Friable, brown sandy clay, medium sand grains
3	20-30cm	Ironstone/manganese, scattered, red clay mottles	Friable/firm, brown sandy clay, transitioning to orange clay
4	30-40cm	Ironstone/manganese flecks (<5mm), clay mottles	Firm, medium orange brown sandy clay
5	40-50cm	Ironstone/manganese flecks (<5mm) (20%), black clay mottles	Firm, medium orange brown sandy clay
6	50-60cm	Mottled clay, ironstone/manganese (20%)	Firm, medium orange brown sandy clay, transition to a light grey silt
7	60-70cm	Ironstone/manganese	Compact, transition to yellowish brown mottled clay



Photo of end of excavation of TP51

Test Pit 52

Test Pit 52 Summary

Spit	Depth	Disturbance	Unit Description
1	0-10cm	Abundance of grass rootlets	Friable, dark brown loamy topsoil
2	10-20cm	Grass rootlets, ironstone/manganese	Friable, dark brown loamy topsoil
3	20-30cm	Mottled clay	Friable, dark brown loamy topsoil
4	30-40cm	Ironstone/manganese flecks (<5mm)	Compact, dark brown loamy topsoil transitioning to orange clay

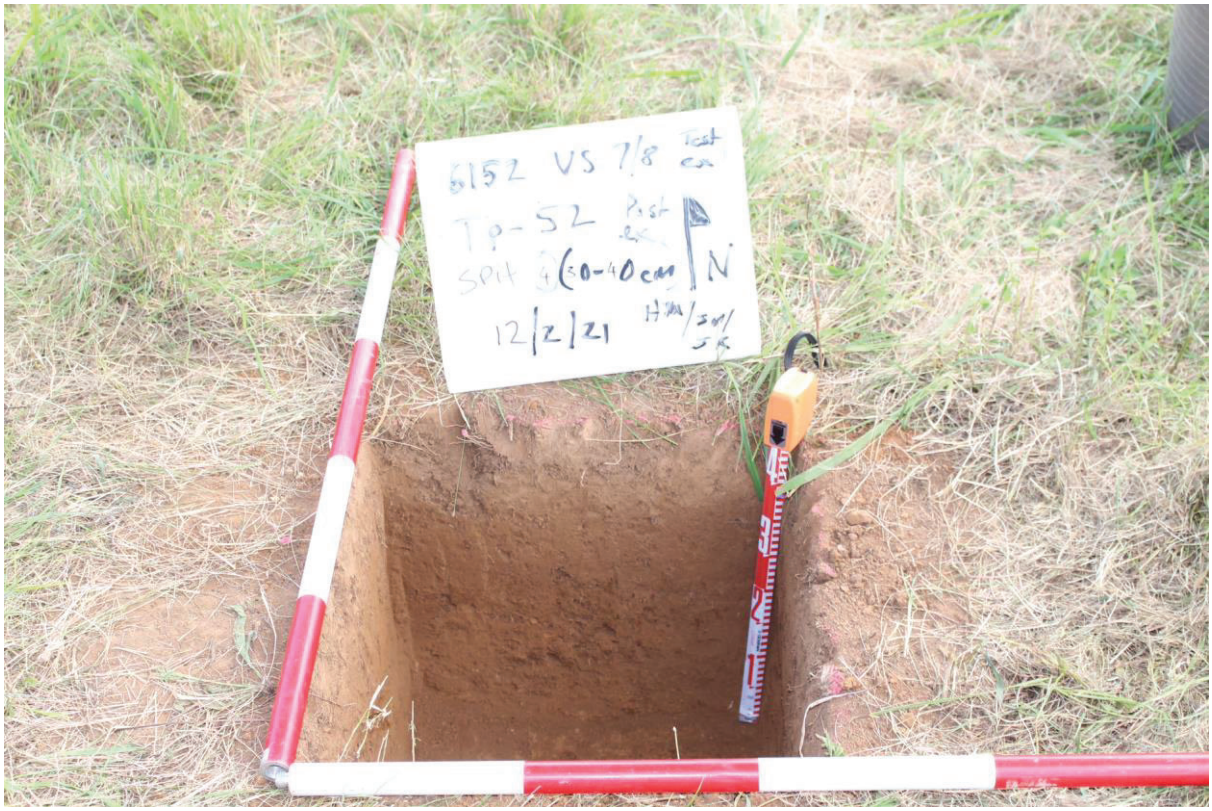


Photo of end of excavation of TP52

Appendix 4: Artefact Catalogue

AFT ID#	Test Pit #	Spit	Depth (cm)	Techno-class	Type	Raw material	RM quality	Colour	Complete-ness	Cortex %	Cortex type	Flake form
AFT#001	9	4	30-40	Retouched flake	Irregular ret flake	siltstone	medium	grey	complete	1-25	water-rolled	irregular
AFT#002	26	1	0-10	Marginal flake		silcrete	fine	red	broken	0	NA	NA
AFT#003	26	2	10-20	Retouched flake	Bondi point/ backed artefact	indurated mudstone	fine	yellow	complete	0	NA	elongate
AFT#004	29	2	10-20	Distal flake		silcrete	fine	red	broken	0	NA	NA
AFT#005	38	4	30-40	Complete flake		milky quartz	fine	white	complete	26-50	water-rolled	elongate

AFT ID#	Plat type	Initiation type	Plat shape	Plat width	Plat thick	Termination	% retouched edge	Quad 1 retouch	Quad 2 retouch	Quad 3 retouch	Quad 4 retouch	Scar count	Scar direct-ion
AFT#001	multi-flake	bending	wide	21.7	5.5	feather	1-25%	scalar	NA	NA	scalar	4	uni
AFT#002	NA	NA	NA										
AFT#003	plain	hertzian	wide	5.4	1.7	feather	26-50%	NA	NA	backed	backed	2	uni

AFT#004	NA	NA	NA			feather							
AFT#005	crushed	bipolar	bipolar	2.6	0.3	crushed						2	bi-dir

AFT ID#	Max dim (mm)	Axial length (mm)	Width (mm)	Thick-ness (mm)	Weight (g)	Comments
AFT#001	58.8	53	35.9	9.8	20.5	scalar retouch on ventral surface initiated from left margin
AFT#002	16.6				0.18	
AFT#003	21.3	20	8.5	3.8	0.64	uni-directional backing on the left margin
AFT#004	11.8				0.2	
AFT#005	12.3	12	4.4	2.4	0.12	small bipolar flake

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Offset strategy and assessment (NSW, QLD, Commonwealth)
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