HUMECOAL
PROJECT

VOLUME 10

Hume Coal Project

Environmental Impact Statement

Appendices S to U

Prepared for Hume Coal Pty Limited
March 2017

EMM

VOLUME 1 **Main Report**

VOLUME 2 **Appendices A to C**
Appendix A Schedule of lands
Appendix B Secretary's Environmental Assessment Requirements
Appendix C Study team

VOLUME 3A **Appendix D**
Appendix D Berrima Rail Project Environmental Impact Statement
– Main report
– Appendices A to D

VOLUME 3B **Appendix D**
Appendix D Berrima Rail Project Environmental Impact Statement
– Appendices E to H

VOLUME 3C **Appendix D**
Appendix D Berrima Rail Project Environmental Impact Statement
– Appendices I to J

VOLUME 3D **Appendix D**
Appendix D Berrima Rail Project Environmental Impact Statement
– Appendices K to M

VOLUME 4A **Appendix E**
Appendix E Water Impact Assessment Report
– Main report
– Appendices A to E

VOLUME 4B **Appendix E**
Appendix E Water Impact Assessment Report
– Appendices F to O

VOLUME 5 **Appendices F and G**
Appendix F Soil and Land Assessment Report
Appendix G Agricultural Impact Statement

VOLUME 6 **Appendix H**
Appendix H Biodiversity Assessment Report

VOLUME 7 **Appendices I to L**
Appendix I Noise and Vibration Assessment Report
Appendix J Health Impact Assessment Report
Appendix K Air Quality and Greenhouse Gas Assessment Report
Appendix L Subsidence Assessment Report

VOLUME 8 **Appendices M to O**
Appendix M Traffic and Transport Assessment Report
Appendix N Visual Amenity Assessment Report
Appendix O Rehabilitation and Closure Strategy

VOLUME 9 **Appendices P to R**
Appendix P Hazard and Risk Assessment Report
Appendix Q Economic Impact Assessment Report
Appendix R Social Impact Assessment Report

VOLUME 10 **Appendices S to U**
Appendix S Aboriginal Cultural Heritage Assessment Report
Appendix T Statement of Heritage Impact
Appendix U Site Verification Certificate

Appendix S

Aboriginal Cultural Heritage Assessment Report

Hume Coal Project

Environmental Impact Statement | Appendix S | Aboriginal Cultural Heritage Assessment Report

Prepared for Hume Coal Pty Limited | 24 February 2017

Hume Coal Project

Environmental Impact Statement | Appendix S

| Aboriginal Cultural Assessment Report

Prepared for Hume Coal Pty Limited | 24 February 2017

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Hume Coal Project

Final

Report J12055ARP1 | Prepared for Hume Coal Pty Limited | 24 February 2017

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Acknowledgement

We would like acknowledge and pay respect to the traditional owners of the land on which the project is proposed. We would like to thank all members of the Aboriginal community who generously gave their time and knowledge in regards to the Aboriginal cultural heritage values associated with the project.

The registered Aboriginal parties (RAPs) consulted for the project wished to share statements of significance for the project area and the wider Country in which it situated. Yamanda Aboriginal Association stated the following:

> "The Gundungurra Aboriginal people are the traditional custodians of the land on which the proposed mine is sited. The significant number and value of Aboriginal sites and Artefacts found demonstrate clearly the longstanding occupation and connection of the Gundungurra people to this Country. Aboriginal people respected and cared for these sites, managing land and water resources sustainably for thousands of years and conducting their lives and ceremony, in harmony with the environment".
>
> *– Aunty Val Mulcahy, November 2016*

Buru Ngunawal Aboriginal Corporation (BNAC) provided a detailed letter describing aspects of intangible Aboriginal cultural heritage (letter attached in Appendix A). The following excerpts highlight the significance that Aboriginal sites and the wider environment have to the Aboriginal community:

> "BNAC wish to state that we consider all Aboriginal sites to be of significance to us as the Traditional Carers for this area. BNAC also consider all sites to be of value to us socially, culturally and spiritually...
>
> Aboriginal intangible cultural heritage...includes Aboriginal cultural knowledge and practices (such as language and knowledge of food plants), cultural landscapes or broad areas with important cultural values (for example, story lines, travel routes, and areas connecting sites)...
>
> The intangible cultural heritage is transmitted from generation to generation, and is constantly recreated by communities and groups, in response to the environment, the interaction with nature, and our history. It provides people with a sense of identity and continuity, and promotes respect for cultural diversity and human creativity..."
>
> *– Wally Bell, October 2016*

Executive Summary

ES1.1 Background

Hume Coal Pty Limited is seeking approval to develop and operate the Hume Coal Project (the project), an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales (NSW). The surface infrastructure area referred to throughout the report relates to where the mine infrastructure will be constructed and the underground mine area refers to the footprint of the underground mine.

Hume Coal holds exploration Authorisation 349 located to the west of Moss Vale, in the Wingecarribee local government area. A349 covers approximately 8,900 hectares (ha) though mining is not proposed across its full extent; the proposed underground mine area occupies approximately 3,400 ha.

Approval for the Hume Coal Project is being sought under *Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. Submission of an environmental impact statement (EIS) is a requirement of the determination processes. This Aboriginal cultural heritage assessment (ACHA) report forms part of the EIS. This report does not detail the impact assessment and management of the Aboriginal cultural heritage values in the nearby Berrima Rail Project area, but summarises the findings throughout and addresses the cumulative impacts of both projects in Chapter 10.

ES1.2 Assessment methods

This ACHA has been prepared in accordance with the Secretary's Environmental Assessment Requirements for the project and the leading practice guidelines outlined in Section 1.5. In summary, the ACHA has involved:

- background research of project area's environmental, archaeological and ethno-historical context;
- Aboriginal consultation in accordance with the *Aboriginal Consultation Requirements for Proponents 2010* (DECCW 2010b);
- an archaeological survey and test excavation program guided by the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a); and
- an assessment of archaeological (scientific) and socio-cultural and historic values (significance to the Aboriginal community), impact assessment and management recommendations for the identified Aboriginal cultural heritage values using the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

ES1.3 Aboriginal consultation

The SEARs require use of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010) for the project.

Aboriginal consultation followed two separate rounds of notification and Aboriginal party registration in 2012 and 2013. In the first round only three Aboriginal groups registered and thus a second round of notification and registration was considered appropriate to encourage all interested parties to register. Eight Aboriginal parties registered their interest in the project and are listed below in Table ES.1. They are referred to as registered Aboriginal parties (RAPs).

Table ES.1 List of registered Aboriginal parties (RAPs) for the project

Organisation	Date of registration
Gundungurra Aboriginal Heritage Association Inc.(GAHA)	07-Sep-12
Cubbitch Barta Native Title Claimants Aboriginal Corporation (Cubbitch Barta)	18-Sep-12
Illawarra Local Aboriginal Land Council (ILALC)	11-Dec-12
Peter Falk Consultancy	01-Aug-13
Northern Illawarra Aboriginal Collective Inc. (NIAC)	08-Aug-13
Koomurri Ngunawal Aboriginal Corporation (KNAC)	20-Aug-13
Buru Ngunawal Aboriginal Corporation (BNAC)	26-Aug-13
Yamanda Aboriginal Association (Yamanda)	11-Sep-13

Three Aboriginal groups that contacted EMM after the two rounds of registration also expressed their interest in being kept updated about the Hume Coal Project. They are:

- Joanne Goulding (contacted EMM on 16 May 2014);
- Moyengully Natural Resource Management Group (contacted EMM on 23 May 2014); and
- Koori Kulcha Experience (Marie Barbaric – also a member of the Illawarra LALC) (first contacted Hume Coal on 3 November 2014 with a request to visit the site).

RAPs were offered to provide cultural information about the project area, provided with draft assessment and fieldwork methods for review and kept updated about the project during consultation meetings. EMM conducted research with the Aboriginal community to determine whether any socio-cultural heritage values relates specifically to the project area regardless of archaeological evidence.

RAPs were issued with the draft ACHA for review and comment on 30 September 2016. A consultation meeting to discuss the draft ACHA and management recommendations was held during this period on 25 October 2016. Written responses were received by NIAC, Cubbitch Barta, BNAC, KNAC and Yamanda and verbal responses were recorded in meeting minutes. All RAP comments are addressed in this report.

To date, no information has been received that identifies specific heritage values unrelated to the Aboriginal sites and objects in the project area. No historical connection has been identified specifically about the project area.

NIAC suggested that an Aboriginal burial site exists near Oldbury Farm approximately 200 m east of the project area (refer to Section 2.4.1). If identified, the site would have high cultural and historical importance. However, the proposed location is outside of the project area and on private property which could not be accessed for verification.

ES1.4 Landscape overview

The landscape of the project area can be divided in two broad areas. The first is characterised by sandstone scarps, cliffs stream channels underlain by Hawkesbury sandstone geology. This landscape is on the western side of the project area in the Belanglo State Forest and increases in relief to the west and beyond the project area. This landscape characterises where the western portion of the underground mining area is proposed.

The second area is markedly different to the east of the Belanglo State Forest and characterised by low rolling hills, now mostly used as farmland. This landscape characterises the land on which the surface infrastructure area is proposed and also includes the eastern portion of the underground mining area.

ES1.5 Archaeological background

Searches of the Aboriginal Heritage Information Management System register identified 89 sites in a 34 km^2 search area based on the centred of the project area. Only two sites were registered in the project area: a rock shelter with art (AHIMS #52-4-0097) and a grinding groove site (AHIMS #52-4-0098). Another 37 sites had been recorded in 2007 (Therin 2007) but were not submitted to AHIMS until 2016 by EMM.

A review of previous investigations indicated that a number of Aboriginal site types were likely to exist in the project area. Notably, open stone artefact scatters and isolated finds close to streams on suitable landforms, rock shelters in areas along rocky scarps and cliff lines, and grinding groove sites in or adjacent to stream beds on outcropping sandstone.

Consultation with registered Aboriginal parties also identified that a burial site may exist outside the project area; however it was on private property and not accessible during surveys (refer to Chapter 2).

ES1.6 Archaeological survey

A predictive model of Aboriginal site location was made based on the implications from the environmental context, archaeological and ethno-historic context and Aboriginal consultation. The predictive model was used to target specific areas during archaeological surveys and test excavation, given that the project area spans over a considerable area and the whole project area could not be surveyed.

The survey strategy was designed to address the type of potential impacts that could be caused by the development of surface infrastructure and underground mine areas. The survey in the surface infrastructure area focused on the proposed ground disturbance footprint while the survey over the underground mine area focused on landforms predicted to have outcropping sandstone where sites such as rock shelters could occur.

The survey also covered areas outside the project area in the Berrima Rail Project area.

The survey team covered approximately 124 km and recorded 181 sites made up of:

- 166 newly recorded sites in the project area;
- 11 newly recorded sites in the Berrima Rail Project area;
- two newly recorded sites outside both project areas; and
- two sites previously recorded on AHIMS (grinding groove site 'International House' AHIMS# 52-4-0098 and rock shelter with art 'Compartment 157' AHIMS#52-4-0097) that were re-recorded.

A variety of Aboriginal sites were recorded including rock shelters (some with art, artefacts and potential archaeological deposit), grinding grooves, open stone artefact sites, areas of PAD and potential scar trees. The survey also identified areas warranting further investigation through test excavation.

ES1.7 Archaeological test excavation

An archaeological test excavation program was conducted over three weeks from October to November 2015. The aim of the archaeological test excavation was to understand the archaeological landscape of the project area so that the environmental impact statement could be supported by appropriately collected data. Moreover, in the event of project approval, the data would result in suitable decisions about conservation and mitigation.

The program involved digging 160 50 cm x 50 cm test pits across 16 linear transects in the project area (n=10) and in the Berrima Rail Project area (n=6).

A total of 281 artefacts were recovered from the test pits (overall average artefact density of 7 artefacts/m^2). The distribution of artefacts was very uneven with almost half (45%) being found in one transect (Transect 6) next to Oldbury Creek. Soils vary throughout the landscape and the upper soil profile was generally mixed from historic ploughing and bioturbation. The upper soil profile was the artefact bearing layer and no stratigraphically intact deposits were identified.

The excavation results were grouped into two categories to identify if artefact concentrations where higher next to perennial streams rather than ephemeral streams. This approach suggests that:

- Suitably elevated level to gently inclined land within 150 m of ephemeral streams is likely to contain a very low density subsurface deposit containing an average density of up to 2.7 artefacts/m^2; and
- suitable elevated level to gently inclined land within 200 m of perennial streams and prominent hill crests are likely to contain moderate density subsurface deposits containing an average density of up to 14 artefacts/m^2.

The results of the survey and test excavation helped to develop a model for "archaeological sensitivity" (refer to Section 8.4). The model is a visual guide for defining the predicted distribution of sites and artefact densities across the landscape. It also serves as a refinement of the predictive model for site location. The model predicts the location of rock shelters, grinding groove sites, open stone artefact sites and other archaeological deposits.

ES1.8 Significance assessment

A significance assessment was undertaken for 219 sites, comprising:

- the 166 newly recorded sites in the project area;
- 11 newly recorded sites in the Berrima Rail Project area;
- two newly recorded sites outside both project areas;
- two sites previously recorded on AHIMS (grinding groove site 'International House' AHIMS# 52-4-0098 and rock shelter with art 'Compartment 157' AHIMS#52-4-0097) that were re-recorded;
- 37 sites previously recorded by Therin in 2007 (refer to Section 4.4 for report summary); and
- one site identified through test excavation (HC_178).

Ten sites were assessed to be of high scientific significance (rock shelter and grinding groove site types only), 39 of moderate significance (four of which have a higher level of moderate significance), and 170 of low scientific significance.

To date, no information has been received that identifies specific heritage values to the Aboriginal sites and objects in the project area. No historical connection has been identified specifically about the project area. As such, each site in this report has not been attributed with a socio-cultural or historic significance rating.

ES1.9 Impact assessment

This report addressed the 206 sites in the project area and the two sites that are outside both the project area and the BRP area (208 sites in total). Impacts to the 11 sites within the Berrima Rail Project (BRP) area are not addressed in this report.

Out of the 206 Aboriginal sites in the project area, 20 sites will be impacted to some degree by the direct disturbance footprint. This comprises:

- no sites of high significance;
- six sites of moderate significance, two of which are of higher moderate significance (HC_135 and HC_151); and
- 14 sites of low significance.

There are 89 sites above the underground mine area that are not predicted to be impacted by subsidence.

There are 99 sites outside both the direct disturbance footprint of the surface infrastructure area and the underground mine area.

Taking the very low risk of subsidence impacts into account, it is very likley that 199 (91%) of the 219 sites assessed in this report will not be directly impacted by the project. The sites that will be impacted by the project (n=20) are those that are within the direct disturbance footprint. The additional impacts of the Berrima Rail Project are addressed cumulatively in section 10.8.3.

ES1.10 Management measures

A Hume Coal Project Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed in consultation with DP&E and RAPs. The ACHMP will detail the management measures and include provisions for:

- active protection of Aboriginal sites close to the surface infrastructure area (within 25 m);
- passive management by avoidance of Aboriginal sites that are within the project area but which will not be impacted by current plans;
- monitoring of a sample of sites for subsidence despite there being no predicted subsidence impacts;
- salvage of Aboriginal sites in the direct disturbance footprint; and
- procedures that specify actions to be undertaken in the event of discovery of human skeletal remains, discovery of Aboriginal sites, and for the ongoing care of salvaged Aboriginal objects within a keeping place.

A summary of the management recommendations is provided in Table ES.2.

Table ES.2 List of registered Aboriginal parties (RAPs) for the project

Management measure	Count of sites
Passive management avoidance	161
Active management: fence and avoid	11
Partial collection/fence and avoid	4
Collection	10
Unmitigated impacts	2
Subsidence monitoring	16
Partial salvage excavation/avoid remainder of deposit	4
Refer to Berrima Rail Project for management	11
Total	**219**

ES1.11 Conclusion

The impact of the project on the archaeological resource at the broader landscape level is relatively small considering the extensive traces of archaeological evidence throughout the project area and its surrounds. The surface infrastructure facilities have been specifically designed to avoid the areas of highest archaeological sensitivity and will only partially impact the more significant deposits by linear project elements. These deposits are generally disturbed to some degree from historic land use and bioturbation but still have value to the Aboriginal community as tangible links to their culture and scientifically by providing information about stone artefact types, materials and their broader landscape associations. However, these deposits do not have the contextual integrity to warrant outright conservation that would further constrain the project. As such, the most suitable approach is to mitigate the loss of archaeological material through management measures suitable for the significance of the sites.

The project will not impact grinding groove sites, rock pools, rock shelters or modified trees. The underground mining method has been designed to result in imperceptible surface subsidence. This will significantly reduce the risk of cracking of rock shelters or expanses of sandstone. Despite there being no predicted subsidence impacts, subsidence monitoring will still be used as a precautionary measure.

Overall, the project area and its surrounds have a diverse archaeological resource and the project will have a relatively minor impact on it. This statement is made considering that cumulatively, 191 of the 219 addressed in this report and the Berrima Rail Project EIS will not be directly impacted. The project impacts will be mitigated through a range of salvage measures, including collecting the affected surface artefact distributions and partially salvaging four of the six sites of moderate significance through excavation. Additionally, indirect impacts are very unlikely to affect any Aboriginal sites but a monitoring program will be implemented for the most significant rock shelter and grinding groove sites.

Furthermore, with the use of archaeological sensitivity modelling, it is reasonable to assume that many undiscovered Aboriginal sites comparable to those impacted in the surface infrastructure area occur within parts of the project area not designated for impacts and the surrounding region.

Table of contents

Table of contents *(Cont'd)*

Table of contents *(Cont'd)*

Table of contents *(Cont'd)*

Table of contents *(Cont'd)*

Appendices

Tables

Tables

Figures

Figures

Plates

Plates

1 Introduction

1.1 Overview

Hume Coal Pty Limited (Hume Coal) is seeking approval to develop and operate the Hume Coal Project (the project), an underground coal mine and associated mine infrastructure in the Southern Coalfield of New South Wales (NSW). Figure 1.1 illustrates the location of the project in a regional context.

Hume Coal holds exploration Authorisation 349 (A349) located to the west of Moss Vale, in the Wingecarribee local government area (LGA). A349 covers approximately 8,900 hectares (ha) though mining is not proposed across its full extent; the proposed underground mine area will occupy approximately 3,474 ha. The project area boundary is illustrated in Figure 1.2, and covers the combined Mining Lease Application (MLA) areas for the project that have been submitted under the NSW *Mining Act 1992*, (MLA 527, MLA 528 and MLA 529), as well as the parts of the project that do not require a mining lease. The project area is therefore larger than the combined MLA area.

Hume Coal acquired A349 from Anglo Coal in December 2010, and commenced exploration drilling shortly after in May 2011. Since this time the project has been developed following several years of detailed geological, engineering, environmental, financial and other technical investigations to define the mineable resource, and to identify and address environmental and other constraints. This has included two stages of environmental and engineering investigations and three stages of opportunities and constraints analysis and workshops. Numerous alternative designs have been prepared and evaluated.

The project incorporates leading practice innovations, some of which set new benchmarks for underground coal mining in NSW. For example, the rail wagons to be used to transport product coal off-site will be covered and all coal reject material (the stone that is separated out of the coal during processing) will be returned underground to partially backfill the mined-out void and reduce visual and other environmental impacts. A low impact mining system will be used which leaves pillars of coal in place so that the overlying strata is supported (rather than collapsing into the mined-out void) and surface subsidence impacts will be negligible.

1.2 Purpose and scope

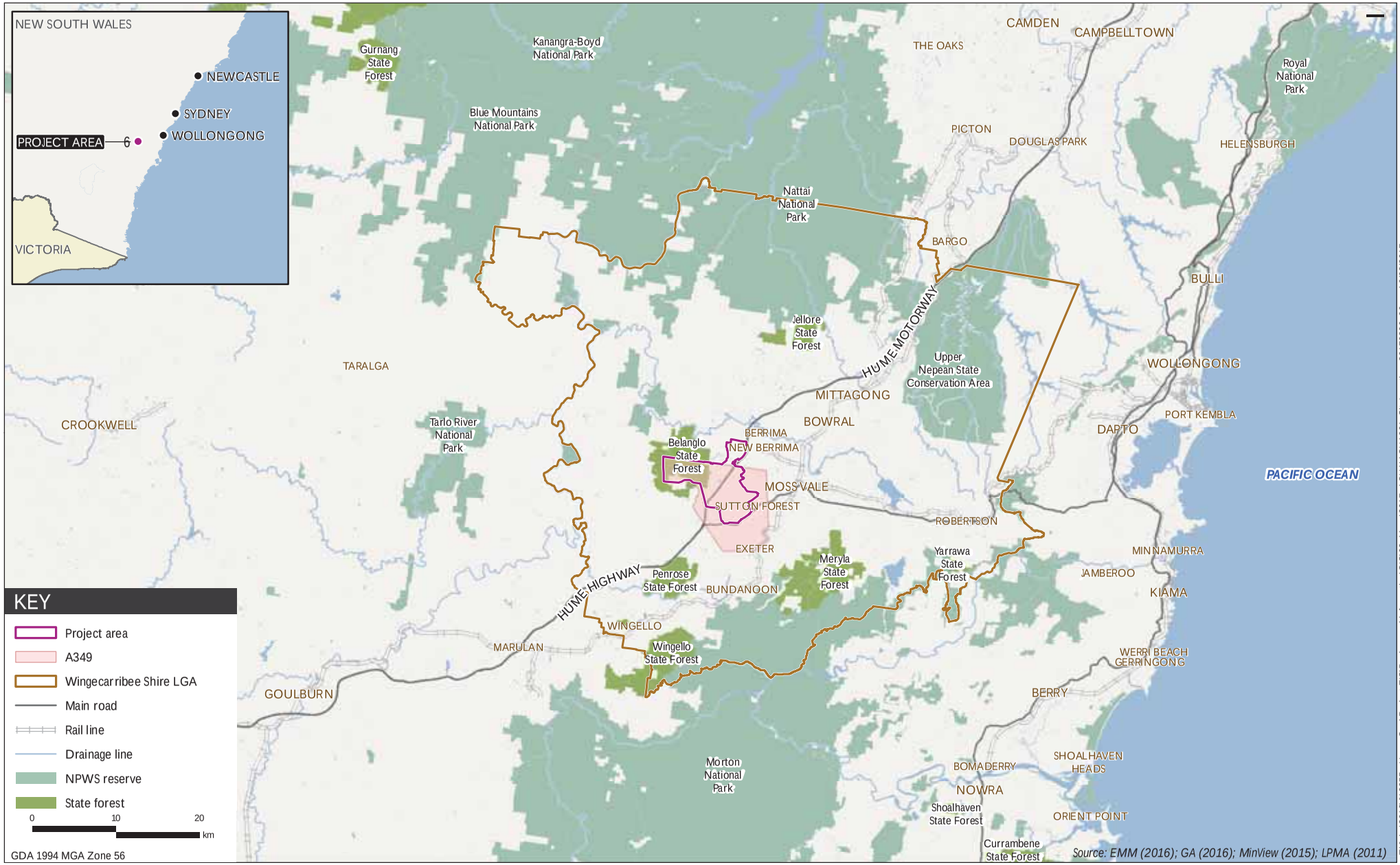
Approval for the Hume Coal Project is being sought under *Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979* (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Submission of an environmental impact statement (EIS) is a requirement of the determination processes. This Aboriginal cultural heritage assessment (ACHA) report forms part of the EIS. The ACHA documents the methods, results, and the initiatives built into the project design to avoid and minimise impacts to Aboriginal cultural heritage values. Additionally it proposed mitigation and management measures to address any residual impacts that cannot be avoided.

The objectives of the ACHA are to:

- identify Aboriginal cultural heritage values relevant to the project area which include:
    - Aboriginal objects and sites;
    - Aboriginal socio-cultural or historic values which might not be related to Aboriginal objects; and
    - areas of archaeological sensitivity;
- assess the significance of Aboriginal objects, sites and locations identified in the course of the archaeological investigations and through Aboriginal community consultation;
- assess the impact of the project on identified Aboriginal cultural heritage values; and
- propose appropriate management measures for potentially impacted Aboriginal cultural heritage values in response to their assessed significance.

The associated rail works and use, known as the 'Berrima Rail Project', are the subject of a separate development application. This is because the rail infrastructure which will be used by other parties as well as Hume Coal, being Boral, Ingham and Omya. The Berrima rail project EIS and accompanying ACHA chapter is given in Appendix D to Hume Coal Project EIS. The Berrima Rail Project ACHA addresses the environmental context of the Berrima Rail Project area and details the results of the archaeological survey and test excavation in its boundaries. The Hume Coal Project ACHA provides an overview of the assessment results in the Berrima Rail Project area but only to characterise the archaeology of the broader landscape.

The Berrima Rail Project ACHA specifically addresses the potential impacts and management measures for the Aboriginal cultural heritage values identified in the Berrima Rail Project area, which are not addressed in this ACHA. Notwithstanding, the cumulative impacts from both projects are addressed in this ACHA (refer to 10.6.3).

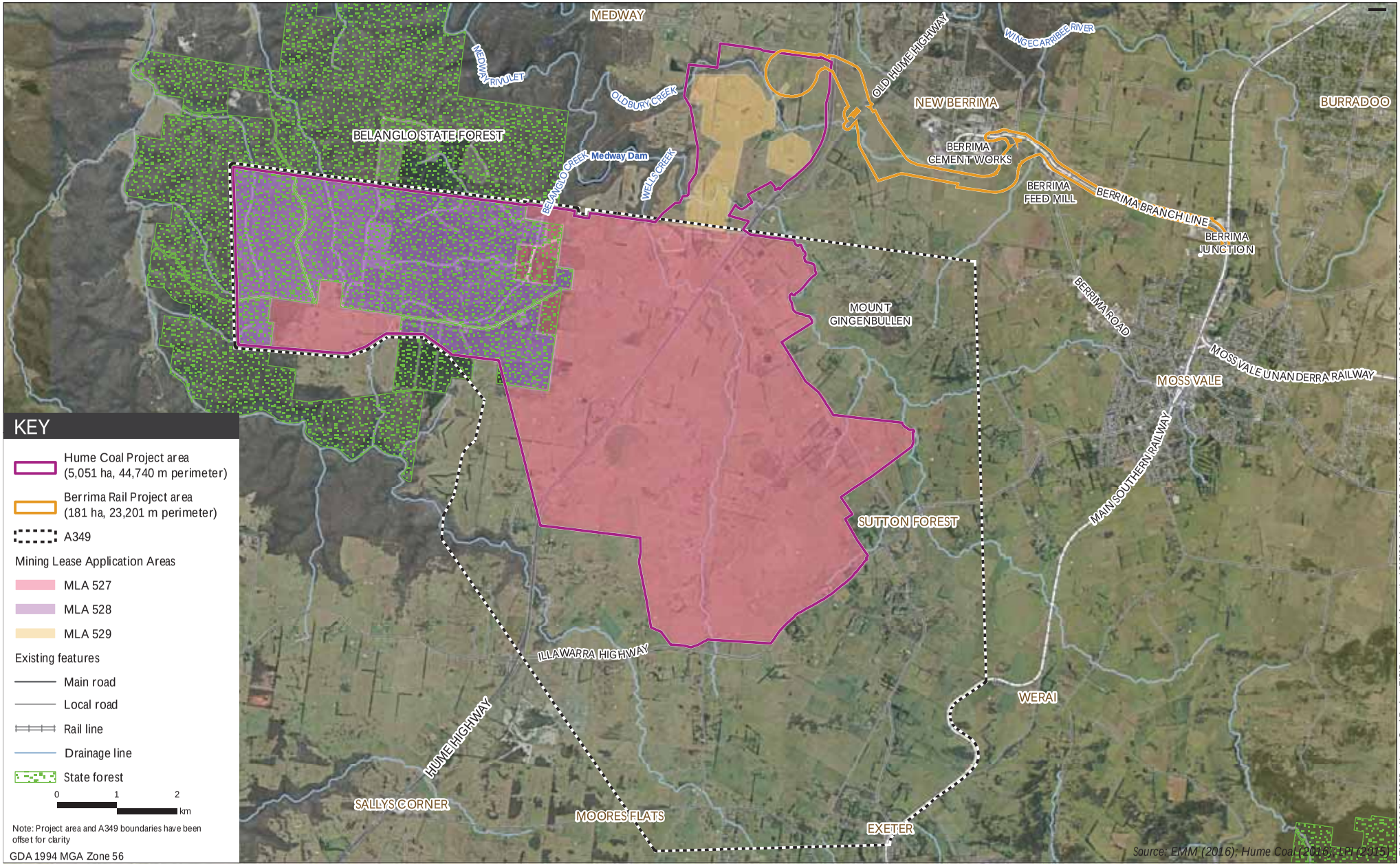


Regional context

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 1.1



Local context

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 1.2

1.3 Project description

The project involves developing and operating an underground coal mine and associated infrastructure over a total estimated project life of 23 years. Indicative mine and surface infrastructure plans are provided in Figure 1.3 and Figure 1.4. A full description of the project, as assessed in this report, is provided in Chapter 2 of the main EIS report (EMM 2017a).

In summary it involves:

- Ongoing resource definition activities, along with geotechnical and engineering testing, and other fieldwork to facilitate detailed design.
- Establishment of a temporary construction accommodation village.
- Development and operation of an underground coal mine, comprising of approximately two years of construction and 19 years of mining, followed by a closure and rehabilitation phase of up to two years, leading to a total project life of 23 years. Some coal extraction will commence during the second year of construction and hence there will be some overlap between the construction and operational phases.
- Extraction of approximately 50 million tonnes (Mt) of run-of-mine (ROM) coal from the Wongawilli Seam, at a rate of up to 3.5 million tonnes per annum (Mtpa). Low impact mining methods will be used, which will have negligible subsidence impacts.
- Following processing of ROM coal in the coal preparation plant (CPP), production of up to 3 Mtpa of metallurgical and thermal coal for sale to international and domestic markets.
- Construction and operation of associated mine infrastructure, mostly on cleared land, including:
    - one personnel and materials drift access and one conveyor drift access from the surface to the coal seam;
    - ventilation shafts, comprising one upcast ventilation shaft and fans, and up to two downcast shafts installed over the life of the mine, depending on ventilation requirements as the mine progresses;
    - a surface infrastructure area, including administration, bathhouse, washdown and workshop facilities, fuel and lubrication storage, warehouses, laydown areas, and other facilities. The surface infrastructure area will also comprise the CPP and ROM coal, product coal and emergency reject stockpiles;
    - surface and groundwater management and treatment facilities, including storages, pipelines, pumps and associated infrastructure;
    - overland conveyors;
    - rail load-out facilities;
    - a small explosives magazine;
    - ancillary facilities, including fences, access roads, car parking areas, helipad and communications infrastructure; and

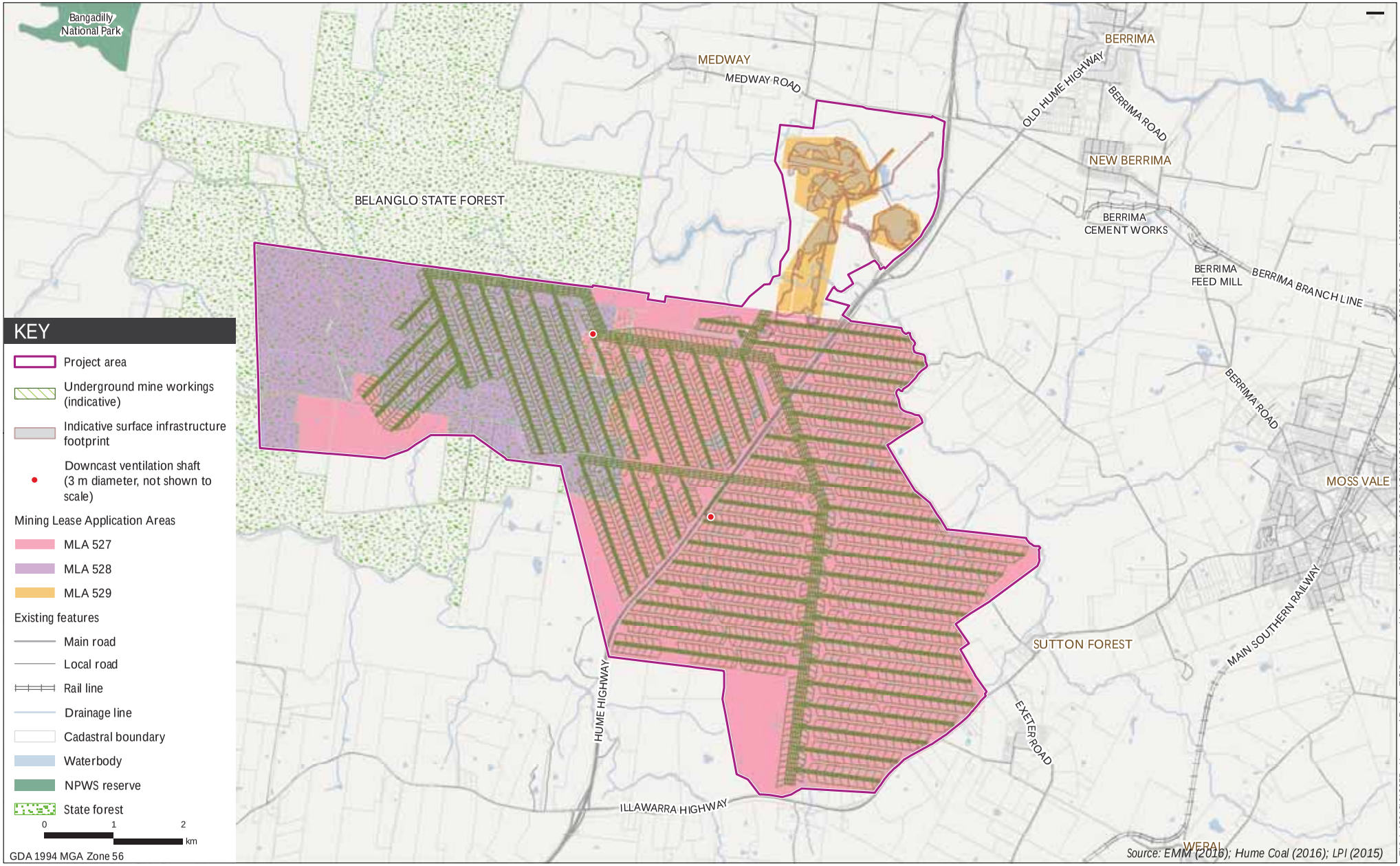
- environmental management and monitoring equipment.

- Establishment of site access from Mereworth Road, and construction of minor internal roads.
- Coal reject emplacement underground, in the mined-out voids.
- Peak workforces of approximately 414 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations.
- Decommissioning of mine infrastructure and rehabilitating the area once mining is complete, so that it can support land uses similar to current land uses.

The project area, shown in Figure 1.2 is approximately 5,051 hectares (ha). Surface disturbance will mainly be restricted to the surface infrastructure areas shown indicatively on Figure 1.4 though will include some other areas above the underground mine, such as drill pads and access tracks. The project area generally comprises direct surface disturbance areas of up to approximately 117 ha, and an underground mining area of approximately 3,472 ha, where negligible subsidence impacts are anticipated.

A construction buffer zone will be provided around the direct disturbance areas. The buffer zone will provide an area for construction vehicle and equipment movements, minor stockpiling and equipment laydown, as well as allowing for minor realignments of surface infrastructure. Ground disturbance will generally be minor and associated with temporary vehicle tracks and sediment controls as well as minor works such as backfilled trenches associated with realignment of existing services. Notwithstanding, environmental features identified in the relevant technical assessments will be marked as avoidance zones so that activities in this area do not have an environmental impact.

Product coal will be transported by rail, primarily to Port Kembla terminal for the international market, and possibly to the domestic market depending on market demand. Rail works and use are the subject of a separate EIS and State significant development application for the Berrima Rail Project.

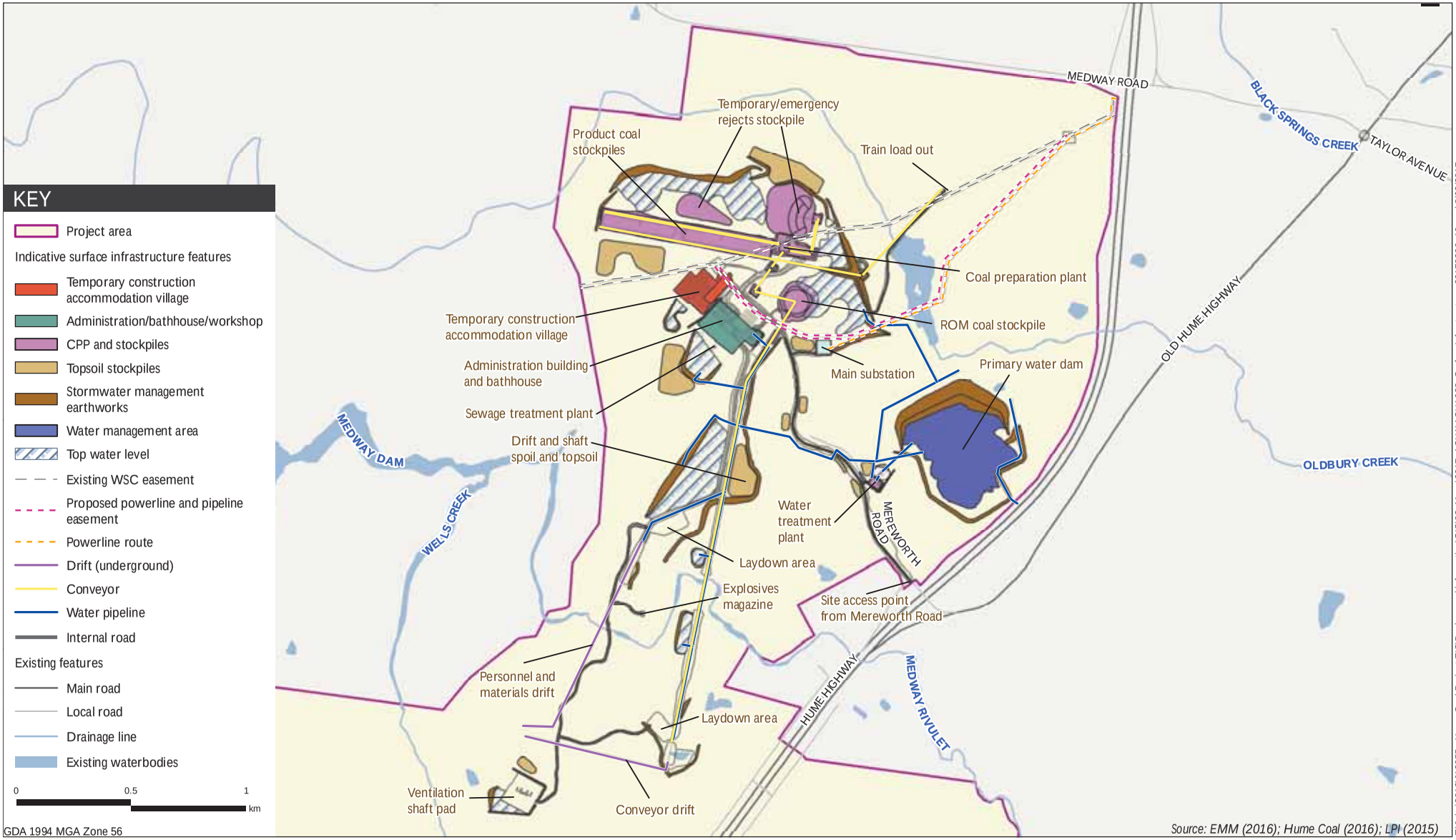


Indicative project layout

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 1.3

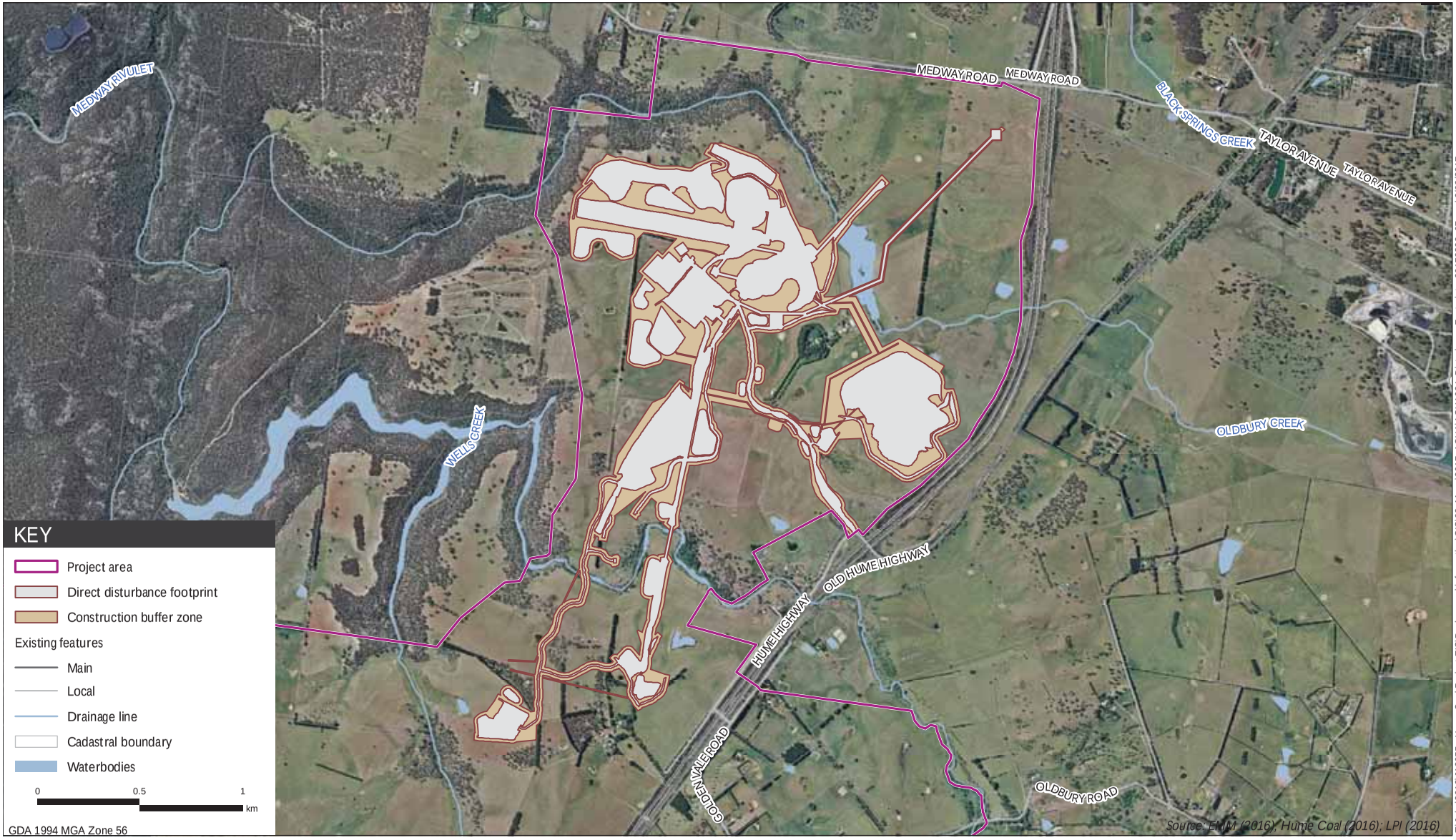


Indicative surface infrastructure layout

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 1.4



Direct disturbance footprint and buffer zones

Hume Coal Project
Aboriginal Cultural Heritage Assessment

Figure 1.5

1.4 General site description

The project area is approximately 100 km south-west of Sydney and 4.5 km west of Moss Vale town centre in the Wingecarribee LGA (refer to Figure 1.1 and Figure 1.2). The nearest area of surface disturbance will be associated with the surface infrastructure area, which will be 7.2 km north-west of Moss Vale town centre. It is in the Southern Highlands region of NSW and the Sydney Basin Biogeographic Region.

The project area is in a semi-rural setting, with the wider region characterised by grazing properties, small-scale farm businesses, natural areas, forestry, scattered rural residences, villages and towns, industrial activities such as the Berrima Cement work and Berrima Feed Mill, and some extractive industry and major transport infrastructure such as the Hume Highway.

Surface infrastructure is proposed to be developed on predominately cleared land owned by Hume Coal or affiliated entities, or for which there are appropriate access agreements in place with the landowner. Over half of the remainder of the project area (principally land above the underground mining area) comprises cleared land that is, and will continue to be, used for livestock grazing and small-scale farm businesses. Belanglo State Forest covers the north-western portion of the project area and contains introduced pine forest plantations, areas of native vegetation and several creeks that flow through deep sandstone gorges. Native vegetation within the project area is largely restricted to parts of Belanglo State Forest and riparian corridors along some watercourses.

The project area is traversed by several drainage lines including Oldbury Creek, Medway Rivulet, Wells Creek, Wells Creek Tributary, Belanglo Creek and Longacre Creek, all of which ultimately discharge to the Wingecarribee River, at least 5 km downstream of the project area Figure 1.2. The Wingecarribee River's catchment forms part of the broader Warragamba Dam and Hawkesbury-Nepean catchments. Medway Dam is also adjacent to the northern portion of the project area Figure 1.2.

Most of the central and eastern parts of the project area have very low rolling hills with occasional elevated ridge lines. However, there are steeper slopes and deep gorges in the west in Belanglo State Forest.

Existing built features across the project area include scattered rural residences and farm improvements such as outbuildings, dams, access tracks, fences, yards and gardens, as well as infrastructure and utilities including roads, electricity lines, communications cables and water and gas pipelines. Key roads that traverse the project area are the Hume Highway and Golden Vale Road. The Illawarra Highway borders the south-east section of the project area.

Industrial and manufacturing facilities adjacent to the project area include the Berrima Cement Works and Berrima Feed Mill on the fringe of New Berrima. Berrima Colliery's mining lease (CCL 748) also adjoins the project area's northern boundary. Berrima colliery is currently not operating with production having ceased in 2013 after almost 100 years of operation. The mine is currently undergoing closure.

1.5 Name and boundary definitions used for the project area

The project area referenced throughout this ACHA is shown in Figure 1.2. The project area encompasses the underground mine area and the surface infrastructure area footprint which is shown in Figure 1.3 and referenced specifically where relevant. The ACHA also refers to the following properties in the project area for more specific reference: Mereworth, Evandale and Wongonbra (owned by Hume Coal) and the Belanglo State Forest in Figure 1.2.

Part of the Berrima Rail Project area is within the north-eastern part of the project area (refer Figure 1.2). This section includes the Berrima Rail Project rail loop and a buffer surrounding it. Importantly, the Aboriginal cultural heritage values identified within the entire Berrima Rail Project area are described in this report but the impact assessment and management measures for these sites are addressed separately in the Berrima Rail Project ACHA. Therefore, the references made to the sites specifically in the 'project area' throughout this report do not include the sites shared in the Berrima Rail Project area (sites HC_138, HC_137, HC_139 and HC_140).

1.6 Leading practice innovations

Early in the planning process Hume Coal decided that the project was to incorporate leading practices wherever it was practical and appropriate to do so. This included environmental and social management measures that are above and beyond the standard measures normally used at Australian coal mines, and those required to comply with regulatory standards. Relevant leading practice innovations adopted in the project design are discussed in the following sections.

The surface disturbance footprint has been designed to largely avoid the most archaeologically sensitive areas in the landscape, and the underground mining method has been developed to significantly reduce the risk of land subsidence, which could affect certain Aboriginal sites, such as rock shelters.

1.6.1 Mine design and process

To eliminate and/or minimise impacts on surface features and water resources, Hume Coal will use an innovative non-caving coal extraction method, leaving coal pillars in place throughout the mine that are designed to provide indefinite long-term support to the overlying rock. Given this mining system is first workings only, there will be no associated subsidence impacts, and therefore the overlying aquifer and surface features will be protected. The mine design also incorporates the construction of bulkheads, which will be used to seal each panel immediately after extraction of coal and backfilling with rejects is completed. This will enable groundwater recovery in each panel area to begin once the bulkhead is installed. The incorporation of bulkheads in the project design will result in a much shorter recovery time for groundwater levels post mining than other mines currently operating in NSW.

Similar mining systems to that proposed for the project have been used before in various mines around the world, including the United States of America and in Australia. Further discussion on the previous use of the mining system to be adopted is provided in Chapter 25 of the EIS report.

1.6.2 Underground reject emplacement

All coal reject material will be returned underground to partially backfill the mined-out voids, rather than keeping it at the surface in a large above ground emplacement or trucking it off-site for emplacement elsewhere. This technology has so far only been adopted at one other Australian underground coal mine and is considered leading practice internationally. This method eliminates the requirement for tailings ponds or cells on the surface yet has higher operating costs than surface emplacement; but it was selected due to the following environmental and social benefits:

- significantly reduced potential for visual, dust and noise impacts compared to conventional surface emplacement practices;
- reduced surface disturbance footprint by avoiding the need for large above-ground reject stockpiles;
- provision of additional ground support and pillar confinement in backfilled areas; and

- directly responds to an expressed preference from regulatory officials that above-ground reject stockpiles be minimised.

1.6.3 Groundwater management

Groundwater that flows into the active mine workings will be collected and recirculated back into the groundwater system. This will provide environmental benefits including reducing net groundwater 'take' from the system and associated groundwater drawdown impacts to other users. Groundwater management is described in detail in Section 2.9.2 of the EIS.

1.7 Assessment guidelines and requirements

This ACHA has been prepared in accordance with the requirements of the Commonwealth Department of the Environment (DoE) and NSW Department of Planning and Environment (DP&E). These were set out in the Secretary's Environmental Assessment Requirements (SEARs) for the Hume Coal Project, issued on 20 August 2015. The SEARs identify matters which must be addressed in the EIS and form its terms of reference. A copy of the SEARs is given in Appendix B to the EIS while Table 1.1 lists those requirements relevant to the ACHA and where they are addressed in this report.

Table 1.1 Aboriginal cultural heritage – relevant SEARs issued by DP&E

Aboriginal cultural heritage	Section addressed
Heritage — including an assessment of the likely Aboriginal and historic heritage (cultural and archaeological) impacts of the development, having regard to OEH's requirements (see Attachment 2).	Whole report. This report only includes matters relating to Aboriginal cultural heritage and not historic heritage.

DP&E also invited other government agencies to recommend matters to address in the EIS, which the Secretary for DP&E took into account when preparing the SEARs. The Office of Environment and Heritage (OEH) raised matters relevant to the ACHA. The matters raised include standard requirements for projects of this nature, as well as some project-specific requirements. The matters raised are listed in Table 1.2 and have been addressed in this assessment.

Table 1.2 OEH's comments: standard and project-specific assessment recommendations

Recommendation	Section addressed
Standard OEH requirements	
2. The EIS must identify and describe the tangible and intangible Aboriginal cultural heritage values that exist across the whole area that will be affected by the project and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH2011) and consultation with OEH regional officers.	Chapters 3–9 Key correspondence with OEH is provided in Appendix G

Table 1.2 OEH's comments: standard and project-specific assessment recommendations

Recommendation	Section addressed
3. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal Cultural Heritage consultation requirements for proponents 2010* (DECCW) The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.	Chapters 2, 9 and Appendix A
4. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. This EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.	Chapters 10 and 11
Project specific requirements	
B. The assessment of cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the EIS.	Chapter 6 (survey) and Chapter 7 (test excavation)
C**.** The EIS must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the development to formulate appropriate measures to manage unforseen impacts.	Chapter 11
D. The EIS must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.	Chapter 11

This assessment has been guided by the following documents in the preparation of the ACHA to fulfil the requirements of the SEARs:

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (the Code) (DECCW 2010a); and
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

Aboriginal consultation undertaken as part of the assessment has followed the *Aboriginal Consultation Requirements for Proponents 2010* (DECCW 2010b).

EMM also consulted with the OEH Illawarra Region archaeologist during the ACHA process for their advice on the methods used for survey, consultation and test excavation. Relevant consultation documentation with OEH is provided in Appendix G.

1.8 Authorship and acknowledgments

This report was prepared by Ryan Desic (EMM Senior Archaeologist – BA Hons Prehistoric and Historical Archaeology) and reviewed by Pamela Kottaras (EMM Heritage Services Manager – BA Hons Prehistoric and Historical Archaeology) and Paul Mitchell (EMM Director).

EMM would like to thank all Aboriginal community members, including registered Aboriginal parties (RAPs) for their involvement in consultation meetings, ongoing correspondence and fieldwork.

EMM would also like to thank Rose O'Sullivan (OEH Archaeologist) for her assistance and advice throughout the ACHA, as well as the fieldwork team, listed in Table 1.3 below, involved during the surveys and test excavation:

Table 1.3 Fieldwork team

Fieldwork team member	Organisation
Keith Ball	NIAC
Wally Bell	BNAC
Tyronne Bell	BNAC
Karyn Bell	BNAC
Marco Benischek	Hume Coal
Shane Button	ILALC
Glenda Chalker	Cubbitch Barta
Jayden Chalker	Cubbitch Barta
Kirsty Lee Chalker	Cubbitch Barta
Andrew Crisp	EMM
Ryan Desic	EMM
Sharara Clarke	Cubbitch Barta
Duncan Falk	Peter Falk Consultancy
Glen Freeman	KNAC
Pamela Kottaras	EMM
Kieran McNally	GAHA
Karl Morthorpe	EMM
Rebecca Newell	EMM
Joshua Reid	Hume Coal
Daniela Reverbi	NIAC
Nikolass Svede	EMM
Allan Walker	ILALC
Donna Whillock	Cubbitch Barta
Peter Woodley	EMM

2 Aboriginal consultation

2.1 Consultation process

2.1.1 Statutory basis

The SEARs require use of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW 2010c) for the project.

In accordance with the 2010 guidelines (DECCW 2010c), each private Aboriginal organisation or individual who requested to be registered for consultation within the timeframes of the requirements is referred to as a *registered Aboriginal party* (RAP). Late respondents were also registered up to 2016.

Consultation documentation is provided in Appendix A of this report.

2.1.2 Overview

Aboriginal consultation followed two separate rounds of notification and Aboriginal party registration in 2012 and 2013. In the first round only three Aboriginal groups registered and thus a second round of notification and registration was considered appropriate to encourage all interested parties to register.

2.2 Stage 1 — notification and registration of Aboriginal parties

2.2.1 Agency contact

For the first stage of notification, EMM issued a letter to government agencies on 10 August 2012 requesting advice on which Aboriginal parties to invites for consultation. An additional request to identify Aboriginal parties for consultation was issued on 26 July 2013 to the same agencies. The agencies contacted are listed below:

- OEH Planning, Aboriginal Heritage;
- Illawarra Local Aboriginal Land Council (Illawarra LALC);
- Wingecarribee Shire Council;
- Hawkesbury-Nepean Catchment Management Authority;
- National Native Title Tribunal;
- The Office of the Registrar of Aboriginal Owners; and
- NTSCorp.

2.2.2 Newspaper advertisements

For both stages of consultation a media notification was placed in a local newspaper detailing the project name, proponent, project location, project details and a request for Aboriginal knowledge holders to register interest in the project. For the first stage of notification an advertisement was placed in the Highlands Post on 6 September 2012 and for the second stage of notification an advertisement was placed in the Southern Highlands News on 12 August 2013. Copies of each advertisement are included in the consultation documentation provided in Appendix A of this report.

2.2.3 Aboriginal group invitation to register

The Aboriginal parties identified by the government agencies were invited to register their interest in the project on 4 September 2012 during the first round of notification.

The second round of notification involved:

- notifying existing RAPs of Hume Coal's intention to continue consultation on 26 July 2013;
- sending all previously identified (but unregistered) parties an invitation to register for the project on 26 July 2013; and
- sending all newly identified parties (based on the updated government agency lists) an invitation to register on 23 August 2013.

EMM did not receive postal delivery confirmation for the invitation from a number of Aboriginal groups. In these instances, EMM attempted to contact the nominated individual or group by calling the telephone numbers provided by the government agencies. The outcomes of these attempts are detailed in a communications record in Appendix A.

2.2.4 Native title considerations

The Native Title Tribunal search results in July 2013 listed that a native title claim was registered (#NC1997/007) over the project area and its surrounds. The application name was the "Gundungurra Tribal Council Aboriginal Corporation #6" which had been registered from 29 April 1997. No determination by the Federal Court, High Court of Australia or other recognised bodies was established for the claim.

Although no native title determination applied to the project area, it was a priority of the ACHA to consult with the claimants (Gundungurra Tribal Council Aboriginal Corporation). Nevertheless, despite numerous attempts to contact the Gundungurra Tribal Aboriginal Corporation, no registration of interest was received (refer to the communications record in Appendix A).

The registered native title claim Gundungurra Tribal Aboriginal Corporation #6 was repealed and replaced by an Indigenous Land Use Agreement (ILUA) (#NI2014/001) on 20 June 2014. This includes the project area. One of the parties to the agreement is the Gundungurra Aboriginal Heritage Association (GAHA) which is a project RAP and was registered with the project on 7 September-2012. In accordance with the consultation guidelines (DECCW 2010c, section 4.1.1), the existence of an ILUA over the project area does not exclude other RAPs not listed on the ILUA from being consulted for the project.

2.3 Registered Aboriginal parties

Eight Aboriginal parties registered their interest in the project and are listed below in Table 2.1.

Table 2.1 List of RAPs

Organisation	Date of registration
Gundungurra Aboriginal Heritage Association Inc.(GAHA)	07-Sep-12
Cubbitch Barta Native Title Claimants Aboriginal Corporation (Cubbitch Barta)	18-Sep-12
Illawarra Local Aboriginal Land Council (ILALC)	11-Dec-12
Peter Falk Consultancy	01-Aug-13
Northern Illawarra Aboriginal Collective Inc. (NIAC)	08-Aug-13
Koomurri Ngunawal Aboriginal Corporation (KNAC)	20-Aug-13
Buru Ngunawal Aboriginal Corporation (BNAC)	26-Aug-13
Yamanda Aboriginal Association (Yamanda)	11-Sep-13

Three Aboriginal groups that contacted EMM after the two rounds of registration also expressed their interest in being kept updated about the Hume Coal Project. They are:

- Joanne Goulding (contacted EMM on 16 May 2014);
- Moyengully Natural Resource Management Group (contacted EMM on 23 May 2014); and
- Koori Kulcha Experience (Marie Barbaric – also a member of the Illawarra LALC) (first contacted Hume Coal on 3 November 2014 with a request to visit parts of the project area).

The three late registrants listed above were incorporated more closely into the consultation process in September 2015 once the project area had been refined for presentation and before the start of the test excavation program. The draft test excavation method and the slides and minutes from the first consultation meeting (including the proposed ongoing assessment method) were provided for their review and comment. Furthermore, these groups were issued with the draft ACHA report for review and invited to attend the second consultation meeting.

2.4 Stages 2 and 3 — presentation of information and gathering cultural information

2.4.1 Presentation of project information and assessment methods

A letter was issued to RAPs on 17 April 2014 presenting an overview of the Hume Coal project, outlining the proposed assessment methods and requesting cultural information associated with the project area. No information was provided by the RAPs about the cultural significance of the project area specifically, but the comments discussed below were received. RAPs were given 28 days to respond to the proposed assessment method, but were told that cultural information could be provided throughout the duration of the assessment.

RAPs were also kept updated about the project and assessment methods through letters issued before Stages 1–4 of the survey and also prior to test excavation program.

2.4.2 RAP responses to method and provision of cultural information

In response to the presentation of information, assessment method and request for information, the following information was received:

KNAC suggested the possibility of there being Aboriginal Women's Sites near streams associated with birthing, healing, recreation and ceremony.

> NIAC suggested that an Aboriginal burial site exists on a natural rise above Oldbury Farm at the base of Mount Gingenbullen. NIAC provided EMM with an excerpt of Chris Illtert's publication, *Three Sisters Dreaming* (2003), which places the burial ground at this location. Illert references Louisa Atkinson's accounts of a burial mound in her newspaper publications in 1853 and 1863 (Atkinson 1853; 1863). Atkinson describes the mound as 100 feet long and 40–50 feet high and conical in shape. She also noted a number of carved trees in proximity to the mound. Atkinson also argued that a 'battle' had occurred near the mound on a flat area below (Atkinson 1863, p.2).
>
> EMM was aware of Atkinson's writings and had included them in the Aboriginal and historical heritage reports, but no specific location of the burial mound was given. Louisa Atkinson's texts as well as those of her father, John, were reviewed for this report together with the historical assessment but the location of any burial is not indicated in these texts. The closest reference is "On a high hill, a few miles from Berrima, is situated a tumuli, forty-four years since an old man was buried there" (Atkinson 1863, p.2). Despite the ambiguous location provided by the historical information, NIAC claim that there are other Aboriginal knowledge holders who know of this location.
>
> The general area identified for the location of the burial mound is approximately 200 m east of the project area's eastern boundary and approximately 2.5 km away from the direct disturbance footprint. This area is on private property outside the project area and was not accessible for inspection as it does not form part of the project. This area has not been demarcated on any figures as the location is unverified, although Atkinson describes it as "rising abruptly from the hanging level on the mountain side" (Atkinson in Lawson 1989, p. 60; *Sydney Mail*, 26 September 1863, p.2).

Further into the consultation process, other RAPs, including Yamanda (October 2016) and those present at the consultation meeting of 25 October 2016 expressed that the Southern Highlands in general may contain mass burial sites relating to massacre sites, but none were known to be in the project area.

2.4.3 Draft test excavation method

The draft test excavation method was presented to the RAPs during the first consultation meeting on 26 August 2015. Following this EMM issued a letter about the draft test excavation method on 27 August 2016 for all RAPs to review. There were a number of responses received during the meetings and through written communications. Summaries of the RAP comments and EMM's responses are shown in Table 2.2. The draft test excavation method was also issued to the OEH archaeologist (Illawarra Office) on 4 September 2015 for comment and feedback. The draft test excavation method was revised after review by RAPs, OEH and based on the results of Stage 4 of the field survey.

The revised test excavation method was issued to RAPs and OEH on 15 October 2015. Detailed information about the test excavation method is provided in Section 7. Furthermore, correspondence with OEH about the test excavation method is provided in Appendix G.

Table 2.2 Responses to test excavation method

RAP	Summary of comment	Response summary
Peter Falk Consultancy	There was concern that the length of the proposed test pit transects and number of test pits along each transect were inadequate and that there should be a minimum of 20 pits per transect. There was also specific reference that the Rail Loop area (a project element of the Berrima Rail Project) would benefit from more testing.	To respond to the request while still addressing the original scope and aims of the draft test excavation method, the following changes were made. The test pit size and layout was changed from 1 m x 1 m test pits spaced at 20 m intervals along transects up to 80 m in length (up to five test pits) to 50 cm x 50 cm test pits spaced at 10 m intervals along transects. This allowed for a greater number of pits to be excavated in each area at closer spacing.
	Recommended that the first test pit at each location be excavated in 5 cm spits and subsequently 10 cm spits (rather than the proposed method of excavating firstly in 10 cm and subsequently 20 cm) spits.	No changes to the excavation units ('spits') were incorporated into the test excavation. This was because EMM's background research indicated that the consistently disturbed nature of the topsoils would not warrant a reduction in the depth of spits as intact stratigraphic sequences were not predicted.
Cubbitch Barta Native Title Claimants Aboriginal Corporation	Recommended that the excavated material be wet-sieved only.	The test excavation method was modified to include wet sieving. Wet sieving was used exclusively during the test excavation.
	Recommended that test pits should be 50 cm x 50 cm spaced at 10 m rather than 1 m x 1 m spaced at 20 m intervals.	The test excavation method was modified to adopt this approach (refer to the above response to Peter Falk Consultancy).
	Recommended that sieve aperture be 3 mm instead of the proposed 5 mm.	EMM used one 5 mm aperture sieve and one 3 mm sieve throughout the excavation. It was noted which sieve was used for each test pit. Any differences in results were noted in the test excavation results.

2.5 Consultation meetings

2.5.1 Aboriginal consultation meeting 1 – 26 August 2015

Hume Coal and EMM held a consultation meeting on 26 August 2015 at the Blue Circle Sport and Recreation Centre in New Berrima. EMM issued an open invitation to RAPs and representatives from KNAC, Cubbitch Barta, BNAC and NIAC attended the meeting. Hume Coal addressed questions about the project and the mine design, while EMM addressed details about the ACHA methods and results. The meeting included a slide show presentation including figures of the project design and project area.

The meeting was held to update RAPs on:

- project information;
- the progress of the ACHA , including a summary of the results of surveys completed at the time (survey Stages 1 to 3);
- the next steps in the ACHA process, including an additional stage of survey and test excavation; and
- to gather any relevant cultural information about the area as a result of project updates.

All the meeting attendees were presented with maps that defined the locations and extents of all the Aboriginal sites recorded at the time of the consultation meeting. Maps showing the proposed areas for the test excavation were also provided.

Most of the topics discussed by RAPs related to the project design and potential environmental impacts. There was discussion around the protection of the sites to be avoided, but it involved the level of detail (eg fencing method) that would be better suited to consultation during the development of the ACHMP.

The minutes of the meeting and the presentation slides were provided to all RAPs on 3 September 2015.

2.5.2 Additional meeting 1 – held on18 July 2016

Through ongoing consultation, EMM arranged a meeting with Yamanda at the Mittagong Aboriginal community centre. Jo Albany from Moyengully Natural Resource Management Group was also present to facilitate the meeting. The meeting was held on 18 July 2016 and covered some minor project changes that had taken place since the last meeting in 2015.

Auntie Val Mulcahy (Yamanda) explained that there was no knowledge of Aboriginal places of socio-cultural or historic significance in the project but agreed that there was likley to be mass burial sites in the greater Southern Highlands region. The elders from Yamanda (Auntie Val and Auntie Annie Warren) were subsequently invited to visit the project area; however, were unable to attend. EMM offered to reorganise the meeting; however, Yamanda declined because of other commitments.

2.5.3 Aboriginal consultation meeting 2 – held on 25 October 2016

Hume Coal and EMM held a consultation meeting at Moss Vale Services Club on 25 October 2016 during the draft ACHA review period. The primary aim of the meeting was to enable RAPs to discuss the draft assessment and draft management recommendations. It also provided a final opportunity for RAPs to provide cultural information that may contribute to the significance of identified Aboriginal sites or other sites or places. It also gave RAPs the opportunity to ask any outstanding questions about the project.

The meeting focused on the cumulative impacts and management recommendations for both the Hume Coal Project area and the Berrima Rail Project. As such, relevant figures showed the layout of both projects, the potential impacts of all sites across both project areas and the draft management measures for sites across both project areas.

The RAP attendees were:

- Wally Bell, BNAC;
- Glen Freeman, KNAC; and
- Duncan Falk and Virginia Falk, Peter Falk Consultancy.

Apologies were received by:

- Jo Albany, Moyengully Natural Resource Management;
- Auntie Val, Yamanda;
- Glenda Chalker, Cubbitch Barta; and
- GAHA – Sharyn Halls.

Responses were obtained verbally from RAPs which indicated general agreement with the draft assessment and draft recommendations. RAP attendees emphasised that the Aboriginal sites outside the project disturbance footprint need adequate protection against inadvertent impacts. Hume Coal reiterated that the proposed passive and active avoidance measures (refer Chapter 11) will be sufficient.

Other issues were raised about the general environmental impacts (such as ecology and water) from the project which were separate to the Aboriginal sites in the project area. RAP attendees were informed that they will have the opportunity to review and comment on other environmental issues as Aboriginal parties or as individuals during public exhibition of the EIS.

RAP attendees expressed that the Aboriginal community has broader connections to the wider land and environment which does not necessarily relate to specific socio-cultural or historical information about an Aboriginal site or place. The RAPs emphasised that the intangible significance of the environment to the Aboriginal people should receive greater acknowledgement. After further discussion, RAPs agreed that an opening statement of cultural significance be provided in the ACHA to convey this message. This is included at the start of this ACHA.

The meeting slides and meeting minutes were issued to all RAPs on 28 October 2016 for their consideration in making any final comments about the draft ACHA.

2.5.4 Additional meeting 2 – held on 31 October 2016

EMM arranged a meeting with Yamanda at the Mittagong Aboriginal community centre on 31 October 2016. The meeting was to allow Yamanda to discuss the draft ACHA as they were unable to attend the meeting on 25 October 2016. During the meeting, Yamanda submitted their response to the draft ACHA and emphasised that Yamanda should receive custodianship over the Aboriginal objects recovered from the project area. Yamanda's comments are addressed in Section 2.6.

2.6 Stage 4 — review of draft Aboriginal cultural heritage assessment

2.6.1 Distribution of draft report

A draft version of this report, which included all background information, results, draft significance assessment and draft management recommendations was issued to all RAPs on 30 September 2016. The draft report document included highlighted text indicating draft sections where RAP input was sought in regard to Aboriginal heritage values, input into significance assessment and management measures.

A letter indicating a 28 day timeframe for review was issued with the draft ACHA. The letter explained that time extensions would be considered if RAPs notified EMM. Each RAP was called on 11 October to confirm receipt of the report and for an indication if written feedback on the report would be provided.

A letter was issued to RAPs after the Aboriginal consultation meeting on 25 October 2016, on 26 October which provided an extension on the review timeframe until 1 November 2016. This was to provide RAPs additional time to consider and comment on the outcomes of the recent consultation meeting.

Responses were obtained verbally from meeting attendees on 25 October 2016 which indicated general agreement with the draft assessment and draft recommendations (refer to Section 2.4.3).

Written responses were received by NIAC, Cubbitch Barta, BNAC, KNAC and Yamanda. Most of the RAP responses were made generally about both the Hume Coal Project and the Berrima Rail Project. Only Cubbitch Barta provided separate comments for each project. As such, Cubbitch Barta's comments on the Berrima Rail Project ACHA are addressed separately in that report.

No new Aboriginal cultural heritage values were raised by RAPs other than those identified in the draft ACHA.

The issues raised in submissions to the draft ACHA and their responses are included in Table 2.3. The submissions are included in Appendix A.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
KNAC email of 12 October 2016	
"Having read this comprehensive report for the Hume Coal Project and the Berrima Rail Project, KNAC have no issues in regards to either."	None required.
KNAC noted that recent linguistic studies have helped refine the language group boundaries defined in the report.	Section 4.1.2 has been updated to reflect KNAC's comment.
BNAC letter of 31 October 2016	
BNAC provided a description about the cultural significance that generally applies to Aboriginal sites and places and broader cultural landscapes.	As discussed in the meeting of 25 October 2015, this is included in Appendix A and extracts have been included at the start of this ACHA.
BNAC agreed with the proposed management measures and requested to be consulted immediately if any further impacts are proposed on the Aboriginal sites.	Acknowledged. EMM and Hume Coal will notify all RAPs if any impacts change from that set out in the ACHA.
Yamanda letter of 31 October 2016	
Yamanda 's letter stated the following: (1) "Aunty Val would like to see Hume Coal contribute to the establishment of a permanent Keeping Place/Educational Facility at the Aboriginal community cultural centre in Mittagong. We would like the artefacts which need to be stored/removed to be stored in the centre not at the Hume Site.	The request is acknowledged. Section 11.2.8 has been updated to reflect that Yamanda has nominated to be the custodians of the recovered artefacts which would be confirmed during the development of the ACHMP. This will involve applying for a care agreement with OEH. The details of the facility for the recovered objects will be determined during the development of the ACHMP.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
(2) Aunty Val and Yamanda Association would ask that Hume Coal support an archaeological survey in the Wingecarribee to establish a baseline in partnership with OEH and Wingecarribee Shire Council as has been put in place in the Hunter Valley.	Hume Coal will use the information gathered during the preparation of this ACHA and the information gathered from the salvage measures outlined in Chapter 11 to prepare a salvage report. RAPs will have input as to what research questions the results will aim to address, which could include addressing baseline questions about the region. The archaeological investigation, including the existing results, will arguably be the largest in the local area. As such, Hume Coal are committed to increasing the baseline knowledge of the region, but will only use the information gathered in the project area from the assessment and salvage measures. Hume Coal will disseminate the information gathered to OEH and Wingecarribee Shire Council to inform any future studies in the region.
(3) Hills with an area view should not be disturbed without a full archaeological survey as remains are likley of ancestors.	Comment acknowledged. Yamanda verified during a subsequent meeting (31 October 2016) that the landscape feature/hill of concern was not inside the surface disturbance footprint. Furthermore, the hills in the project disturbance footprint have been surveyed and no features suggesting a burial have been identified.
(4) That Hume Coal provide a scholarship through the Ted Kennedy Fund for a local Aboriginal person to undertake a degree in Aboriginal studies at University and field workers.	Hume Coal currently have a charitable foundation. Each year the Foundation provides around $400,000 in funding, in two funding rounds, closing on 30th July and 1st November. The funding focus is on education, Indigenous programs and not-for-profit pre-school child care. Hume Coal ask that Yamanda apply for any scholarship through this avenue. Additionally, Hume Coal will engage suitable RAP fieldworkers to assist with salvage measures, in line with fieldwork already completed for the ACHA.
(5) That environmental restoration work be carried out by Aboriginal organisations.	Hume Coal will explore opportunities to engage members of the Aboriginal community with relevant knowledge during rehabilitation activities for the project.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
(6) That access to the Aboriginal shelters and rock art sites be made available to RAPs and Traditional Owners for educational purposes and a plan of management for these sites be established with traditional owners and native title holders under the Indigenous Land Use Agreement Gundungurra and funds be allocated to this plan of management. "	These sites are all within Belanglo State Forest which is owned by the Forestry Corporation of NSW (state-owned). Access to the rock shelters would mean that person(s) wanting to access these sites would need to follow the requirements for entering a state forest. Hume Coal are not authorised to grant access to the Belanglo State Forest., this must be done directly with Forestry Corporation of NSW, but could help facilitate access or provide information upon request. In reference to the requested plan of management: Sixteen of the most significant sites above the underground mine area (in the Belanglo State Forest) will be subject to monitoring as part of the ACHMP. The details of further monitoring and recording will be devised during the preparation of the ACHMP. This may include further research into the most appropriate monitoring method with regard to more recent subsidence monitoring studies. These matters will be decided in consultation with RAPs.
NIAC response to ACHA Original response provided on 24 October 2016. EMM sought clarification over some points on 26 and 27 October 2016. NIAC provided clarifications to some of their original comments on 10 February 2017.	
1) Original comment: It would be better for Hume Coal to pay for each individual group to get an independent assessment [given the complexity of things] from an expert of their own choosing who is to report directly to them. Clarification: This could be rephrased as: It would be helpful if Hume Coal could pay a independent third party expert, chosen by the groups themselves, to assess Hume Coal's reports relating to the environmental aspects, such as engineering, hydrology, environmental impacts, etc; or at least to get an independent third party opinion. The environment, water, water table, flora, fauna, landscape, etc, are Traditional Cultural Materials and important to Traditional Custodians. Note we do not have a problem with the archaeologists. It is likely that the botanists have done a good job identifying and categorising the flora and the ecologists, zoologists have no doubt suggested that all animals such as wombats, reptiles, kangaroos, etc, not be bulldozed and buried alive but relocated to a safe suitable location by expert handlers - we strongly suggest this. We need to be careful about geological, engineering, hydrological modelling, predicting the probability of mining impacts on water, water table, or landscape, etc, which are Traditional Cultural Materials; in general, the science is not good enough to predict impacts of mining with certainty. It can be safely stated that the probability of impact by mining on water, water table, landscape, and environment is not zero.	The main roles and responsibilities of RAPs under the consultation guidelines are to: • provide cultural information to determine if there are Aboriginal objects or places of cultural value in the project area; • have input into the proposed research, survey and test excavation methods with the aim of gathering information about cultural significance or respecting cultural protocols; and • have input into developing appropriate ways to avoid or mitigate harm to Aboriginal objects. It is acknowledged that broader environmental impacts are of concern to the Aboriginal community. It has been a primary aim for the project to minimise environmental impacts. RAPs or individuals will have the opportunity to review and make submissions about various technical studies (eg ecology and hydrology) during public exhibition of the EIS. Hume Coal does not intend to engage other consultants to provide RAPs with independent assessments. Notwithstanding, other technical studies have been subject to peer reviews where considered necessary. As discussed during the RAP meeting on 28 October 2016, Hume Coal will explore avenues for Aboriginal community involvement in future land management, specifically relating to areas that may be available for cultural plantings.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
We strongly suggest that a suitable trust fund be set aside for future rehabilitation and that this start immediately if mining proceeds and should be contingent for approvals being granted and continuing. Contributions should be made fortnightly or monthly. The amount needs to be assessed by independent experts and RAPs and the broader community must be involved in selection of these relevant experts and trustees. The trust fund is not to be spent for anything other than rehabilitation. This may have been discussed at meetings not attended by NIAC. In addition it needs noting that the contract for participation in the survey was not negotiated between the parties. Note, we do not disagree with things like health, safety, and common sense matters.	
(2) Original comment: Not all our comments have been included in the draft report. Clarification: We are happy with what has been included, most importantly, information about the massacre and burial of Traditional Owners at Gin Gen Bullen. We must not detract from this.	These extracts have been included in Appendix A.
(3) A big point is that given the proximity to a major massacre site it is likely the more burial sites (probably mass burials) are within the study area itself, thus whilst not commenting on the quality of the archaeology, the quantity is not reflective of the deep significance of the area and more test pits are needed. Clarification with archaeologist: NIAC clarified that this statement does not request for further testing to identify burial sites. NIAC clarified that they are satisfied that their request for more test pits will be addressed post-project approval in line with the salvage measures proposed in this report.	As explained in section 11.2.5, the salvage excavation will involve further testing and open area excavation. The aim of this will not be to further characterise the archaeology of the area, but rather to identify and target areas with higher artefact densities for salvage.
(4) The aboriginal groups should have been given a say in the location of the test pits and any future test pits, to remedy the inadequate number of test pits so far, given the serious significance of the area. Clarification with archaeologist: NIAC clarified that this comment related to during the test excavation program where an Aboriginal site officer requested for a specific area to be tested.	EMM wish to clarify that such areas were not tested because they were outside of the direct disturbance footprint and additional impacts from the test pits were not warranted. As addressed in the response to comment (3) above, further testing and salvage will be implemented post-project approval. The details of the salvage measures will be refined in the Aboriginal cultural heritage management plan (ACHMP). RAPs will be given the opportunity for input into the decisions for test pit locations at the sites identified for salvage excavation as set out in section 11.2.5.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
(5) Original comment: No mining should be within 1 km buffer of rivers and dams and also not within 1 km of massacre sites, or significant sites, eg the Oldbury Estate, Oldbury Road, Moss Vale, boundary. Additional comment: There must be no coal seam gas fracturing conducted. The damaging impacts of this would be catastrophic and completely unacceptable. We may not have stated this clearly enough previously.	No direct surface impacts will occur within approximately 2.5 km of the suggested burial site. Furthermore, no subsidence impacts are predicted to any surface features within or outside the underground mining area. The underground mining area cannot be placed outside 1 km of the features listed by NIAC. The impact on other environmental features (such as ground water) is addressed in the EIS and separate technical reports. The community will have the opportunity to review and respond to other issues during public exhibition of the EIS. The project does not involve any fracture stimulation of coal seams.
(6) Original comment: We remind you that landscape and water are also Traditional Cultural Materials and these are not to be disadvantaged nor damaged by any mining. Clarification: Note that this has been expanded on in point (1), also additional comment in point (5).	It has been a primary aim for the project to minimise environmental impacts. The community will have the opportunity to review and respond to other environmental issues during public exhibition of the EIS. Also, refer to comment (1) and (5).
(7) Removed as requested by NIAC	Not applicable
(8) Original comment: The 7 am starting hours of the field surveys, etc, was unreasonable, given that it is not the fault of disadvantaged communities which have been driven from their lands and scattered [to other places] at gun point. You did not consider the hardship suffered by groups. Clarification: In winter we need to rise in darkness to arrive at 7am. We suggest that it may be easier for some to start / finish one hour later; anyway it is only a suggestion.	The fieldwork times were not raised as an issue during fieldwork. However, the start time of any future fieldwork will be discussed with RAPS to set out a suitable time.
Cubbitch Barta letter of 31 October 2016	
(1) "The 37 sites previously recorded by Therin, were they recorded because of this project or another project? If they were all given a low scientific significance, because of the "disturbance", there must have been other sites recorded. Were RAP's given the opportunity to comment on their cultural significance?	Refer to Section 4.4 of this report. These sites were recorded as part of an assessment for a proposal to sub-divide the Wongonbra property into rural-residential lots (Therin 2007, p.1). The 37 sites were the only sites identified as part of that assessment. Aboriginal consultation was undertaken with five organisations and the report was sent to these parties for review. The report did not identify any Aboriginal socio-cultural or historic values specific to the 37 sites recorded on the Wongonbra property.
(2) Why do artefact scatters not get the same high significance as an art site? Is it because of the visual affect in some cases? An artefact scatter can contain beautiful artefacts and should be able to afford the same level of significance, based on visual affect.	As described in Section 9.3 of this report, the criteria for scientific significance and educational value is based on research potential, rarity and representatives, integrity, the ability to address pertinent research themes and also educational potential. Theoretically artefact scatters may be of high scientific significance, depending on how it relates to the assessment criteria.

Table 2.3 Summary of RAP comments and how they are addressed

RAP comment	Response to comment
(3) Artefact scatters that have been "disturbed" hold just as high a cultural significance as an "undisturbed" artefact scatter.	It is acknowledged that the Aboriginal community consider Aboriginal objects as culturally significant items regardless of their scientific significance. The rationale behind attributing different levels of scientific significance to each site is this: if all sites are assigned as having high significance, then nothing stands out as deserving management priority. As such, the finite resources available for management are weighted towards sites of higher significance.
(4) I do not believe that the phrase "common type" should be used anymore. That is because those "common" sites are becoming less and less "common" with the massive developments that are taking place in the Sydney Basin, and fast moving outwards towards the Southern Highlands.	This term is used irrespectively of how many sites have been destroyed; it is used to identify how commonly the site type has been recorded locally or regionally. Notwithstanding, the cumulative impact of development must be assessed to determine whether such site types are becoming rarer with the increase in development. Section 10.8 addresses the cumulative impacts of the project.
(5) Rock shelters should not be excavated for this project; the predictions for subsidence damage according to this document are low.	No rock shelters are designated for excavation. A sample of the rock shelters will be monitored which is a non-intrusive method (refer to section 11.2.7).
(6) The shelters recorded either with or without art should come under future Plan Of Management, which should include baseline recording of all, shelters and future monitoring, after mining. There has been a lot more work done on subsidence in the Southern coalfields, since Sefton (2000).	All rock shelters have been recorded to a baseline standard as described in Section 6.2.1. This has included site sketches (but not measured planning). The details of further monitoring and recording will be devised during the preparation of the ACHMP. This may include further research into the most appropriate monitoring method with regard to more recent subsidence monitoring studies. These matters will be decided in consultation with RAPs. It would be unfeasible to monitor all rock shelter sites, particularly because there are no predicted subsidence impacts on any surface features. As such, the impetus is to monitor a selection of the most significant and largest rock shelters above the underground mine area (refer to section 11.2.7).
(7) All excavated material should be wet sieved either on a 2.5 mm or 3 mm sieve. There is too much small material lost on a 5 mm sieve. All you get is large artefacts, and not a true count of numbers.	Section 11.2.5 previously stated that during salvage excavation, soil will be wet sieved through a 5 mm aperture mesh. A 3 mm sieve was used for a selection of test pits during the test excavation program but no discernible trend in artefact size was found when comparing the results to a pit sieved using 5 mm mesh. Notwithstanding, the section has been updated to include the provision for the use of smaller sieves in warranted situations which will be devised during the ACHMP.
(8) It is not appropriate for Hume Coal, a Korean owned entity to have Care and Control of any artefacts at any time. I will not support this recommendation in any way. The artefacts should either be reburied of a competent Aboriginal organisation should seek Care and Control.	During the review period, Yamanda Aboriginal Association requested for salvaged objects to be retained in the local Aboriginal community centre in Mittagong. This would involve applying for a care agreement with OEH to allow Yamanda to be a custodian of the recovered objects. This will be confirmed during the development of the ACHMP.
(9) Any artefacts recovered belong to Aboriginal people and they should be the decision makers as to their whereabouts in the future."	This statement is acknowledged. Yamanda have expressed their interest in being custodians of the recovered artefacts (refer to response to comment (8) above).

3 Environmental context

3.1 Rationale

The environmental characteristics of any area influence the way people who have occupied it used the landscape. In the past, the availability of resources such as drinking water, flora, fauna, stone material and topography played a substantial role in the choice of camping, transitory and ceremonial areas used by Aboriginal people. Understanding environmental factors assists with predicting where Aboriginal sites are likely to occur. Additionally, natural and cultural (human-made) post-depositional site formation processes influence the present location (eg if moved through disturbance), preservation, and archaeological integrity of archaeological material across a landscape.

3.2 Landscape character

The region containing the project area is characterised by the elevated Woronora-Nattai Plateau which remained relatively flat when uplifted in the late Tertiary Period. The primary topographic feature is the residual volcanically derived features such as Mount Gingenbullen – a flat-topped mountain with a dolerite extrusion which occupies approximately 70 ha. It is a product of the more erosion resistant characteristics of the Jurassic and Tertiary basalts and dolerites when compared to the surrounding sedimentary sandstones and shales.

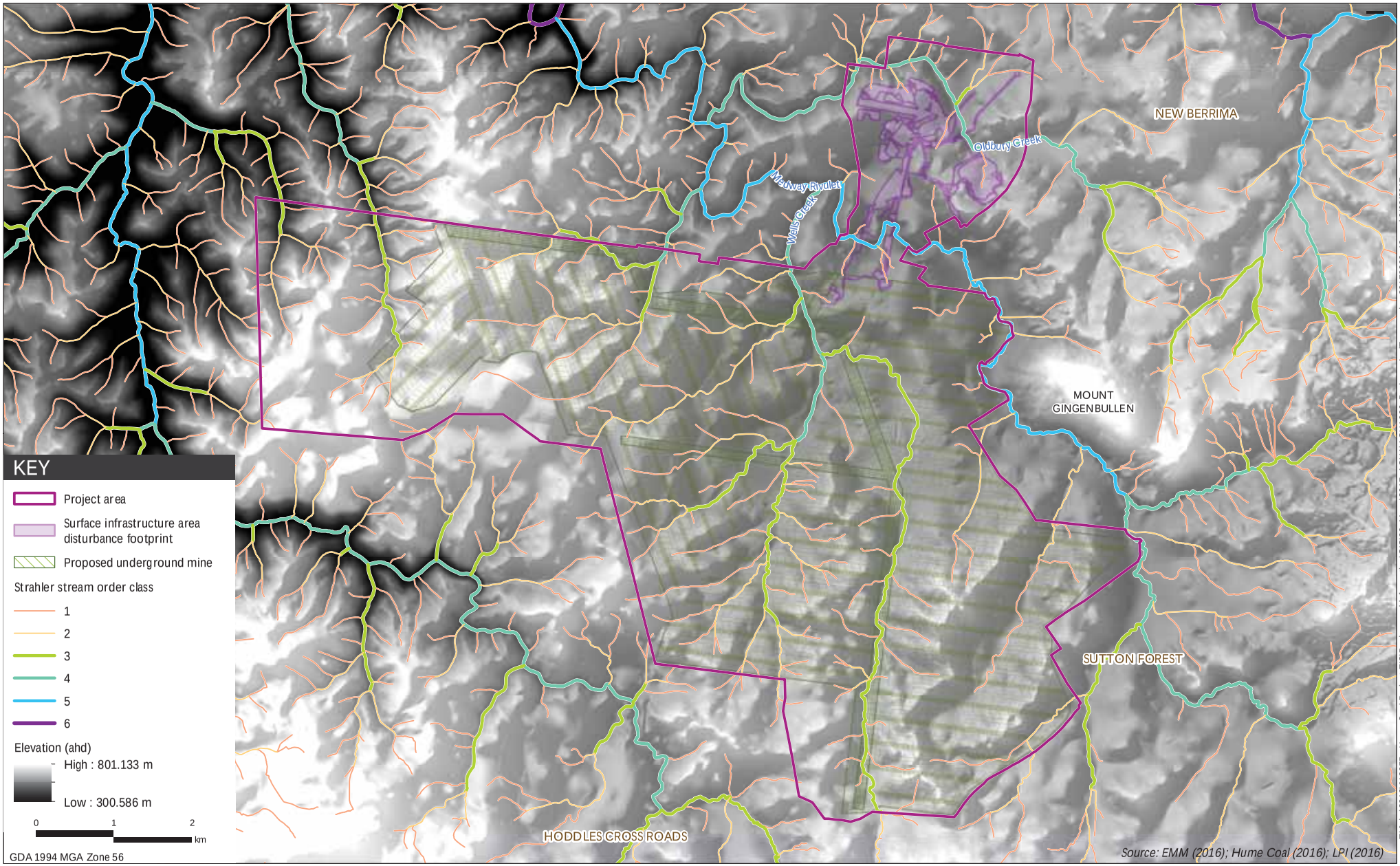
An escarpment made up of large expanses of outcropping sandstone scarps, cliffs, ridges and stream channels forms in the Belanglo State Forest and increases in relief in a westerly direction beyond the project area. The highest relief in the project area is in the north-western section, which is marked by the steep rise between the stream channels and cliff lines of Red Arm Creek and Longacre Creek. These areas have local relief up to 140 m.

The landscape inside the Belanglo State Forest, north of Belanglo Road, is divided by very broad hills that plateau and make suitable flat areas for the existing pine plantations. The low escarpment in the north-eastern part of the Belanglo State Forest has formed from the stream channels of Belanglo Creek, Fire Dam Creek and Planting Spade Creek which have formed deeply incised gullies, scarps and cliff lines; here, local relief is low (up to 70 m).

The landscape changes markedly to the east of the Belanglo State Forest as the outcropping of the Hawkesbury Sandstone geology decreases and eventually becomes confined to highly eroded crests and stream channels on the Evandale and Mereworth properties. The rest of the project area is characterised by low rolling hills, where the underlying geology gradually changes to Wianamatta Shales and outcropping sandstone is almost non-existent, but very occasionally occurs as small boulders. This area has low to very low local relief.

3.3 Surface water features

The project area is part of the Wingecarribee River catchment, which is a component of the broader Warragamba and Hawkesbury-Nepean catchments. The Wingecarribee River flows north-west before it reaches its confluence with the Wollondilly River north of Tugalong. The drainage system surrounding the underground mine area is characterised by northerly trending tributaries of the Wingecarribee River that form in the southern and south-western parts of the project area. Numerous 1st order streams (in accordance with the Strahler system of stream order) form from drainage depressions on low rolling hills and increase in stream order as drainage tends towards the Wingecarribee River, which is a 6th order stream.



Drainage and topography

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 3.1

The main streams in the project area are Medway Rivulet (5th order) and Oldbury Creek (4th order). Medway Rivulet drains north-west through the project area and into the Wingecarribee River approximately 4 km west of the project area. Medway Rivulet's named tributaries, along with their highest stream order rating in the project area, are (from west to east): Knapsack Gully (2nd order), Fire Dam Creek (3rd order), Planting Spade Creek (3rd order), Belanglo Creek (3rd order), Oldbury Creek (4th order), Wells Creek (4th order), Norris Creek (2nd order) and Paynes Creek (2nd order). Medway Rivulet is a perennial stream where it flows through Evandale and Mereworth. Oldbury Creek is perennial where it flows as a 4th order stream on the western side of the Hume Highway. Wells Creek is perennial where it flows through Evandale as a 3rd order stream.

Longacre Creek and Red Arm Creek are in the far western part of the project area and drain north-westerly into Black Bobs Creek which is also a main tributary of the Wingecarribee River.

Stony Creek (5th order) is another main water feature near the project area. It flows north 3 km east of the project area and drains directly into the Wingecarribee River to the north.

The streams and scarp in the Belanglo State Forest were originally created by lines of weakness in the sandstone which have gradually eroded the bedrock to form stream channels with adjacent scarp and cliff lines. This continuous process is accelerated by increased water flow undercutting the upper layers of rock and vegetation growth that invades fractures in the sandstone and levers off portions of sandstone. As valleys deepen and the water level decreases, overhangs and caves are created and exposed making ideal shelters for habitation. Therefore areas of exposed bedrock, scarps and cliff lines coincide with stream channels on Hawkesbury Sandstone geology, but only where significant erosion of the bedrock has occurred.

Stream channel development in the project area is erosional, with the exception of a small pocket of alluvial development on the eastern boundary of the project area (coinciding with the Wingecarribee River Soil Landscape). Subsequently, drainage in the project area reflects a 'fixed' migration system where stream channels are restricted by the hills and escarpment in the project area. This contrasts from examples with wide alluvial landscapes that can result in rapidly migrating stream alignments. Therefore, it is unlikely that the prehistoric stream channel alignments (at least during Aboriginal occupation) would have deviated significantly from their current alignment.

3.4 Geology

The overlying Triassic sequence of the project area comprises Hawkesbury Sandstone and Wianamatta Group Shales (Figure 3.2). Hawkesbury Sandstone is the main landform influence in the region. It is a flat lying massive quartzose sandstone with an extent of some 20,000 km^2 and its thickness varies between 40 m (Belanglo State Forest) to 180 m (Exeter) near the project area. It often represents the main cliff forming sequence. Outcropping of Hawkesbury Sandstone is concentrated in the north and north-western parts of the project area, primarily in cliff, scarp and stream channel landforms, but small isolated pockets occur elsewhere in the project area.

The eastern, southern and north-eastern parts of the project area are characterised by Wianamatta Group Shales which were laid down in the Middle-Triassic Period after the Hawkesbury Sandstone. Ashfield Shale is the earliest sequence in the group which forms a cap on the Hawkesbury Sandstone (Figure 3.2).

Bringelly Shale is the youngest stratum in the group and was deposited in an alluvial plain cut by meandering streams flowing from the west and resulting in discontinuous beds of sandstone. It is similar to Ashfield Shale, but generally has higher sandstone content.

There are small areas of Tertiary Period igneous geology in the southern, south-western and northern parts of the project area. These include dolerite and gabbro, as well as some former basaltic lava flows. These igneous flows have the ability to trap layers of silcrete — a commonly used raw material for Aboriginal stone tool manufacture — that may have formed in the area by weathering and silica enrichment of fine sandy sediments. Stratigraphic exposures of the local geology may indicate silcrete outcrops underlying igneous rocks.

3.5 Soils and terrain

The project area contains a number of soil landscapes which are defined in the *Soil and Land Resources of the Hawkesbury-Nepean Catchment* (DECCW 2008). The soil landscapes shown in Figure 3.3 provide important information including landform elements, soil types and rock outcrop percentage that characterise each landscape. The soil landscape information builds on the underlying geology of the project area and describes what soil types overlie the geology and where soils are likely to have been eroded or missing, exposing the underlying bedrock. This is particularly useful when refining predictions of where the underlying Hawkesbury Sandstone is expected to be outcropping in the form of expanses of weathered bedrock, boulders, cliffs, and/or scarp. Soil terminology is described in the glossary of this report.

The fourteen soil landscapes in the project area are : Avoca, Hawkesbury, Kangaloon, Kinnoul Hill, Larkin, Lower Mittagong, Moss Vale, Nattai Tablelands (and Nattai Tablelands variant a), Soapy Flat (and Soapy Flat variant a), Wingecarribee River (and Wingecarribe River variant a) and Wollondilly River. The soil landscapes and terrains described below are derived from the Soil and Land Resources of the Hawkesbury-Nepean Catchment (DECCW 2008) and supplemented by a review of topographic maps. The soil landscapes are described below.

The Soapy Flat residual soil landscape is in the western (primarily Belanglo State Forest) and north-western parts of the project area. It occurs on a landform pattern of rises and low hills and overlies Hawkesbury Sandstone geology. The terrain is characterised by altitudes of 477–796 m Australian Height Datum (AHD), very low local relief (10–30 m) and gently inclined slopes (2–10%). Soils comprise Brown Podosols, Yellow Podosols, and Earthy Sands on ridges and Acid Peats in swamps. These soils are prone to localised sheet erosion. Outcropping sandstone is less than 2%. The Soapy Flat variant a landscape is confined to foot slopes in the Belanglo State Forest and comprises deep earthy sands.

The Nattai Tableland erosional soil landscape is in the western (primarily Belanglo State Forest) and north-western parts of the project area. It primarily occurs adjacent to the Soapy Flat soil landscape in association with scarps that lead into stream channels that are deeply incised into the bedrock. Nattai Tableland terrain is characterised by altitudes of 87–173 m AHD, low local relief (10–90 m) and very gentle to moderately inclined slopes (2–25%). Soils comprise Yellow Earths, Earthy Sands, Lithosols and Yellow Podosols. Soils are discontinuous, with sandstone benches and small scarps outcropping in the landscape. Outcropping sandstone is 10–20%. There is a small portion of the Nattai Tablelands variant a in the far north-western portion of the project area where Hawkesbury Sandstone plateaus and outcropping sandstone exceeds 50%.

The Hawkesbury colluvial soil landscape is in the far western portion of the project area. It is in areas of scarps and benches within hills on Hawkesbury Sandstone geology. The terrain is characterised by altitudes of 1–1016 m AHD, low to high local relief (40–200 m) and moderately inclined to very steep slopes (20–70%). Soils comprise Lithosols, Siliceous Sands, Earthy Sands, Yellow Earths, and Yellow, Red and Grey Podosols. Outcropping sandstone typically exceeds 50% where sheet erosion is widespread.

The Lower Mittagong erosional soil landscape is in the northern, north-eastern, central and south-western parts of the project area. It occurs on Wianamatta Shale geology on rises and low hills. The terrain is characterised by altitudes of 534–820 m AHD, very low to low local relief (5–90 m) and level to moderately inclined slopes (0–25%). Soils are Yellow, Brown and Red Podosols, Yellow Earths, Red and Brown Earths and Soloths. Outcropping sandstone is typically non-existent in this soil landscape.

The Moss Vale erosional soil landscape is widespread and in the northern, north-eastern, central and south-eastern parts of the project area. It occurs on Wianamatta Group Shale and typically on the lower slopes of hills adjacent to the Lower Mittagong Soil Landscape, which dominate crests and landforms at higher elevations. The terrain is characterised by altitudes of 544–740 m AHD, extremely low local relief (5–30 m) and level to very gently inclined to gently inclined slopes (0–5%). Soils comprise Yellow and Red Podosols and Yellow Earths.

The Kangaloon transferral soil landscape is in the northern, north-eastern, central and south-eastern parts of the project area. It occurs on foot slopes and plains on Wianamatta Group Shale. Terrain is characterised by altitudes of 531–745 m AHD, extremely low local relief (0–9 m), and very gently inclined slopes (1–3%). Soils comprise Yellow Podosols and Humic Gleys. Outcropping sandstone is typically non-existent in this soil landscape.

The Larkin residual soil landscape is in the central-eastern part of the project area. It occurs on plains and rises on shale and quartz geology. The terrain is characterised by altitudes of 576–1,012 m AHD, very low to low local relief (0–10 m) and very gently inclined slopes (2–6%). Soils comprise krasnozems, Red Earths, and Red Podzolic Soils. Outcropping sandstone is typically non-existent in this soil landscape.

The Kinnoul Hill colluvial landscape is in the far south-western boundary of the project area. It occurs on hills on tertiary basalt. The terrain is characterised by altitudes of 489–1,123 m AHD, low to high local relief (30–100 m) and moderate to steep slopes (20–50%). Soils comprise lithosols and krasnozems. Outcropping sandstone is typically non-existent in this soil landscape.

The Avoca erosional soil landscape occurs in small pockets near the Belanglo State Forest on low hills on tertiary basalt extrusions. The terrain is characterised by altitudes of 519–10401 m AHD, low to high local relief (10–100 m) and gentle to moderately inclined slopes (3–50%). Soils comprise Chocolate Soils and krasnozems. Outcropping sandstone is less than 2% within this landscape.

The Wingecarribee River Quaternary alluvial soil landscape occurs along stream channels and plains within flood plains. The terrain is characterised by altitudes of 629-688 m AHD, extremely low relief (0-5 m) and level to very gently inclined slopes (0-1%). Soils are comprised of Dermosols (Chocolate Soils and Wesenbodens).

The Wingecarribee River variant A Quaternary alluvial soil landscape occurs in small pockets in the eastern part of the project area. It occurs on Quaternary Alluvium on flood plains, terraces and levees. The terrain is characterised by altitudes of 630–667 m AHD, extremely low local relief (0–5 m) and level to very gently inclined slopes (0–1%). Soils are comprised of Gleyed Podosols. Outcropping sandstone is typically non-existent in this soil landscape.

The Wollondilly River Quaternary alluvial soil landscape occurs along plains and terraces and is found in a small amount in the north-western corner of the project area. The terrain is characterised by altitudes of 110-720 m AHD, low relief (0-15 m) and level to very gently inclined slopes (0-1%). Soils are comprised of Rudosols, Brown Dermosols, Yellow Kandosols, and Brown Chromosols.

3.6 Climate

At the start of the Holocene epoch approximately 12,000 years ago, the climatic conditions changed substantially. The melting of the ice sheets in the Northern Hemisphere and Antarctica caused a rise in sea levels and an associated rise in temperature and rainfall. The changes reached their peak approximately 6,000 years ago. At around 1,000 years ago temperatures stabilised to today's climate. Thus, the climate of the project area for the past 1,000 years would probably have been much the same as present day conditions, providing a habitable environment for Aboriginal people.

The current climate records for Moss Vale show that the mean long-term minimum temperate is 2.4°C in July and the mean maximum temperature is 26.2°C. However, on a daily scale, temperatures can fall lower than -6°C and reach as high as 40°C (BOM 2016). The mean long-term annual rainfall is 730 mm and fluctuates between 115.4 mm in February and 41.6 mm in September.

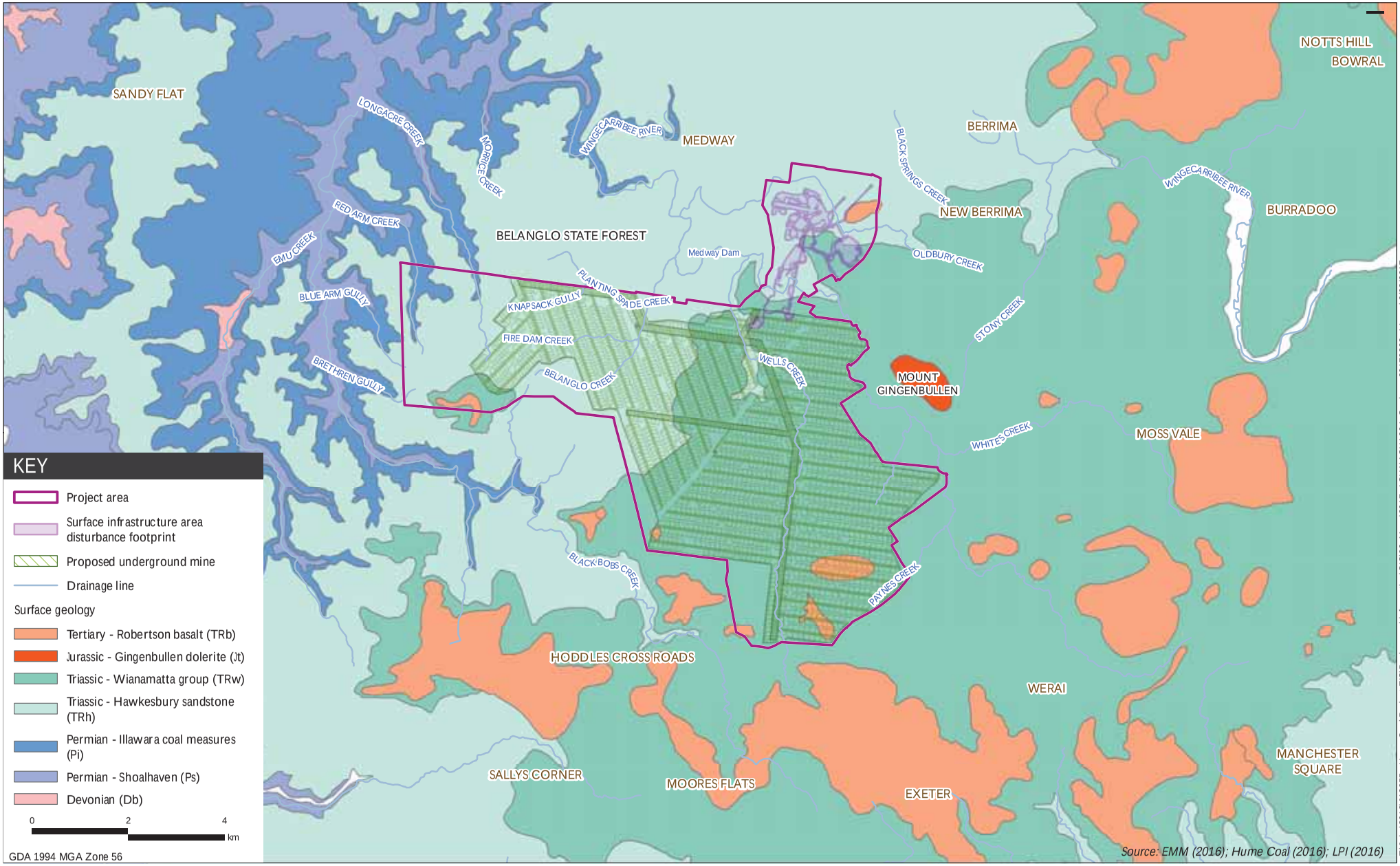
The Southern Highlands generally have lower temperatures than the coastal areas to the east and to the north towards Sydney. The colder temperatures experienced during autumn and winter may have reduced the desirability of the local area for Aboriginal occupation, especially during heavy frosts and occasional snowfalls. Notwithstanding, these conditions could have been mitigated with the use of clothing such as possum-skin cloaks and by occupying protected areas, such as rock shelters. Overall, there is little historic or archaeological evidence to ascertain the effect the climate had on seasonal Aboriginal occupation in the region.

3.7 Flora and fauna

The project area contains the remnants of the pre-colonial ecological communities that would have covered the landscape, although most of the project area has since been cleared. There are a number of corridors with remnant native vegetation adjacent to Medway Rivulet, Oldbury Creek and Wells Creek in the project area.

As an indication of the pre-colonial landscape, a total of 353 native flora species and 180 terrestrial fauna species have been recorded in the project area and its immediate surrounds (Appendix H of the EIS). The fauna species comprise:

- 119 native and three introduced bird species;
- 11 native reptile species;
- 10 native frog species; and
- 32 native mammal species (15 microbat, 6 arboreal, 10 ground-dwelling and 1 semi-aquatic) and 8 introduced mammal species.

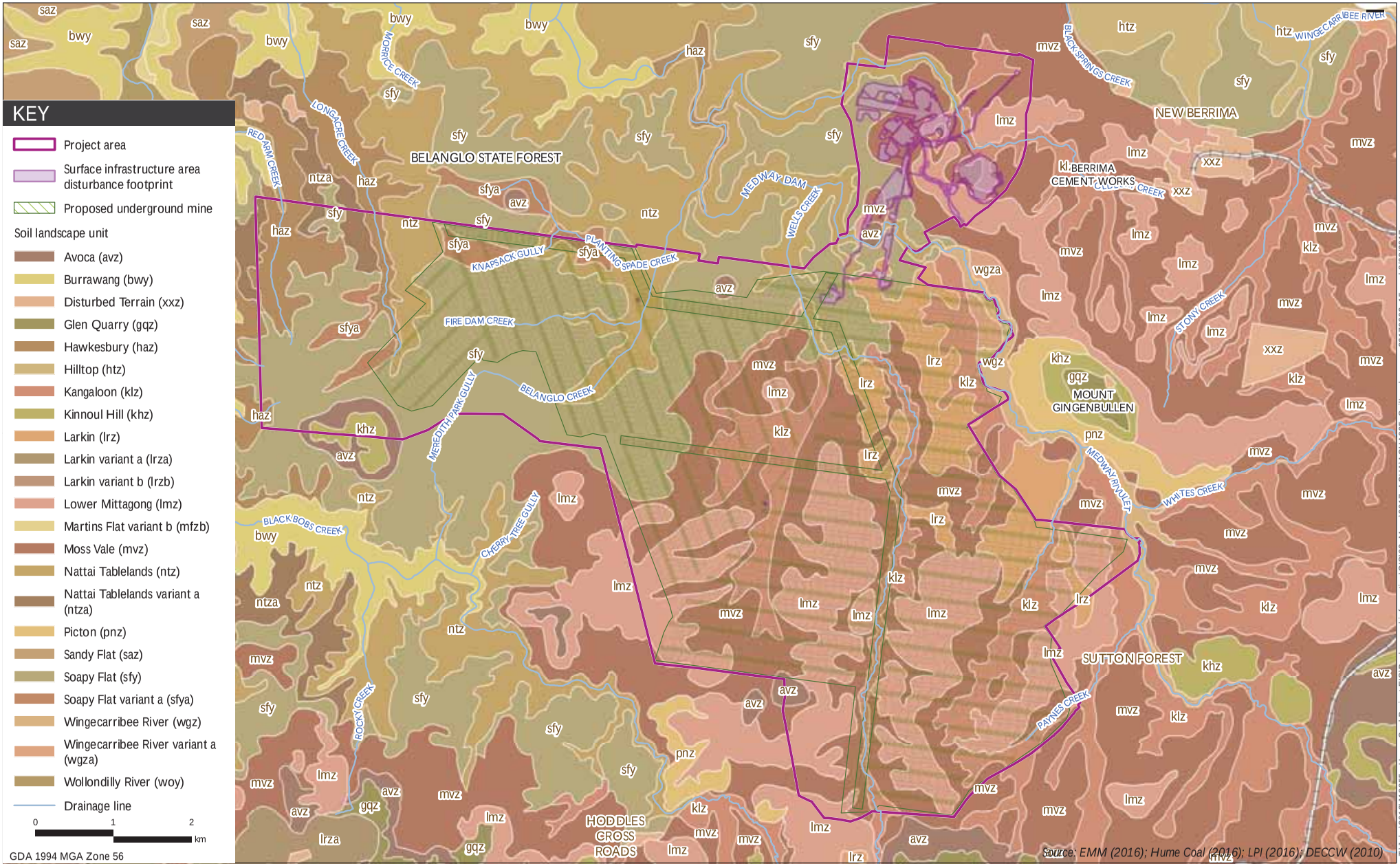


Geology of the project area

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 3.2



Soil landscapes
Hume Coal Project
Aboriginal Cultural Heritage Assessment
Figure 3.3

The landscape is likely to have been maintained by regular anthropogenic or natural bushfires. These communities in turn would have provided the environment for survival with plant and animal species providing food, shelter, clothing and material for tools.

Pre-colonial biodiversity in the project area would have been greater than today and without the impact of widespread vegetation clearance and the resulting impact on drainage systems. Subsequently, there would have been varied flora and fauna available for Aboriginal occupation.

3.8 Land use and disturbance

Most of the northern, eastern and southern parts of the project area have been cleared of vegetation and used for agricultural purposes for approximately the last 150 years. The Belanglo State Forest has mainly been used as a pine plantation since 1919 (Forestry Corporation 2015), but there are large tracts of remnant native vegetation where steep and rocky terrain has made it inaccessible for machinery. This has left most of the scarps and cliff lines protected from clearing. There are also corridors of native vegetation surrounding Medway Rivulet, Oldbury Creek and Wells Creek in the northern and north-western part of the project area where the underlying Hawkesbury Sandstone is found outcropping. Outside of these areas, only small pockets of remnant or regrowth vegetation exist which are generally discrete and isolated.

The earliest available aerial imagery of the project area is from 1949 (Figure 3.4). It shows that minimal changes to the landscape have occurred in the subsequent six decades. By 1949 the project area had been extensively cleared and ploughed to a similar resemblance of the current landscape. There are parts of the surface infrastructure area surrounding Medway Rivulet and Oldbury Creek along with portions of the Evandale property south of Medway Rivulet that have been subject to additional vegetation clearance between 1949 and 1989. It is reasonable to conclude, based on previous land use and evidence from aerial photography, that the cleared parts of the project area have been subjected to repeated ploughing and grazing events.

Many Aboriginal archaeological sites across the project area have been disturbed or damaged since colonial settlement. The main activities that are likely to have removed or highly disturbed Aboriginal sites in the project area include the construction of roads, repeated logging and planting activities in the Belanglo State Forest, establishment of homesteads and associated activities, dumps, stream damming, pipelines and water diversion bunds. Other activities that are likely to have disturbed Aboriginal sites in the project area include repeated ploughing, cropping, fencing, construction of electricity transmission lines, and to a lesser extent, livestock grazing.

Vegetation clearance and repeated ploughing is the most widespread form of disturbance in the project area. This typically results in soil loss from hill slopes. The soils are transported down-slope where they aggrade and erode at slower rates over time. This type of colluvial erosion tends to accumulate sediment at the base of slopes and also within stream channels. Notably, vegetation clearance and ploughing close to streams can alter stream morphology, increase bank erosion or cause sediment to accumulate. This process can significantly reduce the flow of surface water, especially in lower order streams adjacent to steeper hill slopes.

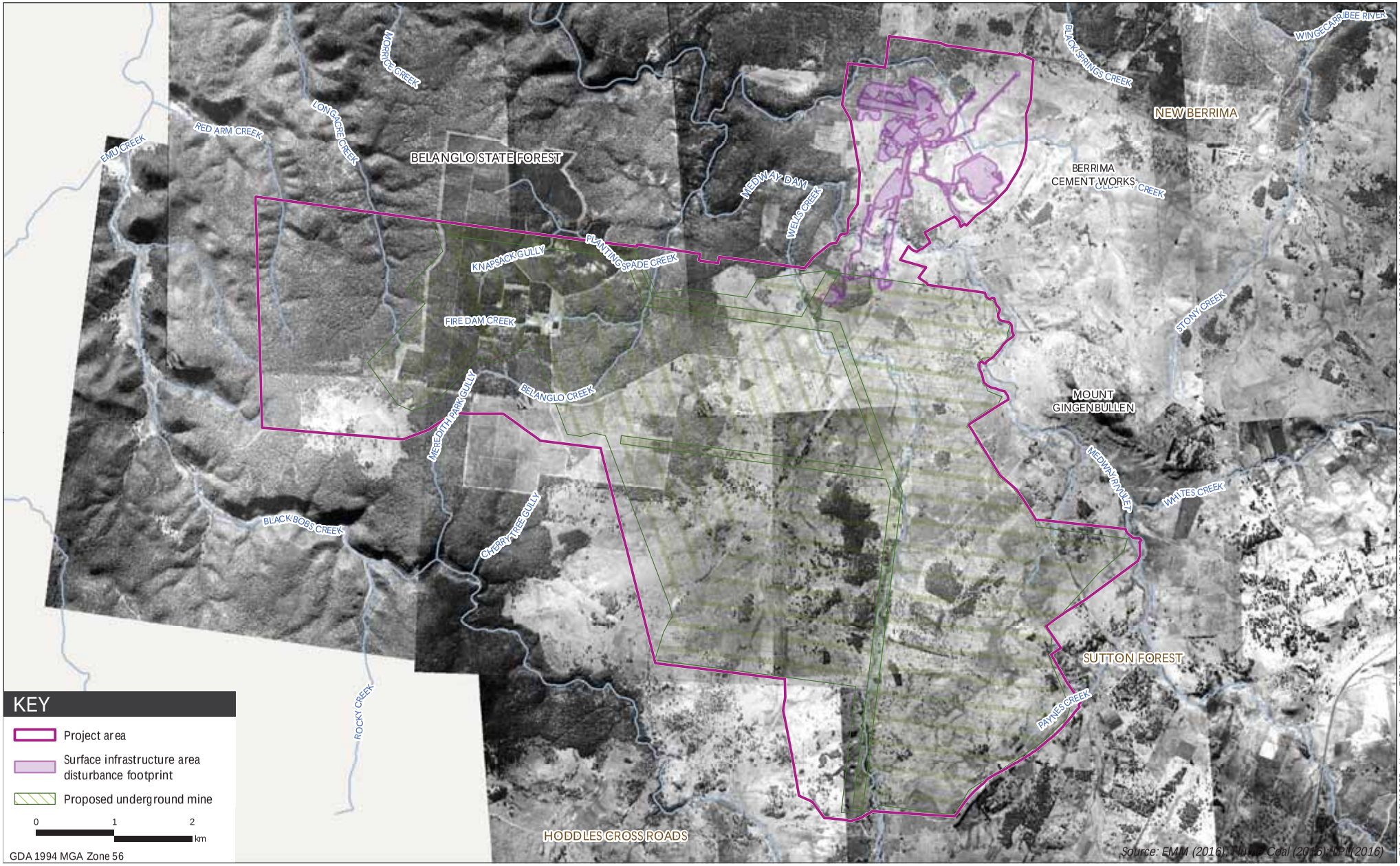
3.8.1 Disturbance from farming

The impact of farming, particularly ploughing, on artefact deposits has been investigated in a number of studies in an archaeological assessment of the Wongonbra property (Ammerman and Fieldman 1978, Ammerman 1985, Odell and Cowan 1987, Bowen *et al*. 1991 and Clark & Schofield 1991). Therin Archaeological Consulting (Therin 2007) provides an extensive review and discussion of these studies which are summarised for this report (Ammerman and Fieldman 1978, Ammerman 1985, Odell and Cowan 1987, Bowen *et al*. 1991 and Clark & Schofield 1991). Therin argues that Odell and Cowan (1987) and Clark and Schofield (1991) have undertaken rigorous studies of artefact movement through ploughing. In these studies, a known number of stone artefacts were buried in ploughed fields and the movement and condition of the artefacts was recorded after ploughing. This also included recording the frequency and direction of ploughing. Their findings concluded that:

- ploughing causes artefacts to move both in the direction of ploughing and perpendicular to the ploughing direction;
- mean artefact movement of between 0.7 m and 1.9 m occurred after each of six ploughing events (Odell and Cowan 1987, p.98);
- there was a mean artefact movement of 1.69 m in the direction of ploughing and 0.92 m perpendicular to the ploughing direction after 12 ploughing events (Odell and Cowan 1987, p.471);
- there was no substantive evidence for the vertical size sorting (by weight) of artefacts; and
- irregularly shaped artefacts (eg blades, which are over twice as long as they are wide) moved greater distances vertically and horizontally than more regular shaped artefacts (eg artefacts with similar length and width).

Odell and Cowan concluded that while the total area of their site had doubled (from the artefacts initially spread across 234 m^2, to being spread across 471 m^2 after the ploughing experiment) the mean artefact movement calculated over all of the ploughing episodes was starting to reach equilibrium. That is, while artefacts were still moving as a result of ploughing, the mean distance moved from their initial burial location remained approximately the same; the area of the site was not growing any larger.

Overall, these experiments indicate that ploughing disturbs, but does not destroy, the spatial distribution of open artefact sites. Therefore, it is likely that the open stone artefact sites within the ploughed portions of the project area are spread over a larger area than their original deposition. Even with potentially 100 years or more of ploughing, the artefacts are likely to have reached their 'equilibrium' of movement whereby they will remain generally within the landform where they were initially deposited.



Historic aerial imagery 1949 - Project area

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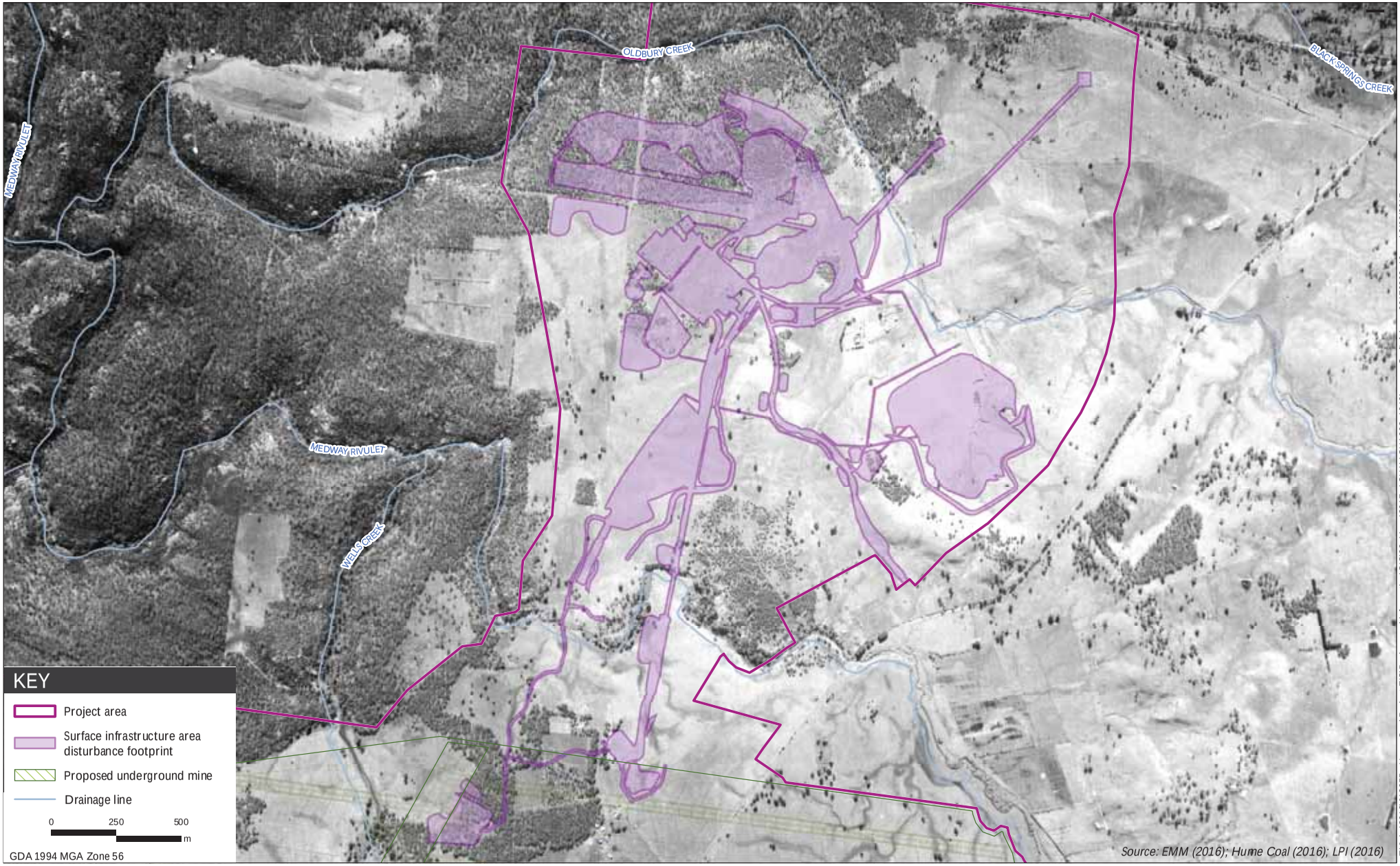
Aboriginal Cultural Heritage Assessment

Figure 3.4



Historic aerial imagery 1949 - Surface infrastructure area

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Aboriginal Cultural Heritage Assessment

Figure 3.5

3.9 Implications for archaeology

There are particular landscape features in the project area that are more likely to have been associated with Aboriginal activities than others. Some of these past activities are traceable through the archaeological evidence left behind, but this is dependent on how favourable the environmental conditions have been for preserving the remains.

3.9.1 Landforms and drainage

The main environmental features that indicate archaeological sensitivity for the presence of open stone artefact sites are the project area's level-to-gently inclined landforms such as lower slopes, elevated terraces or plains, hill crests and to a lesser extent, ridge lines. The most sensitive landscapes are mainly areas on these landform types near the major perennial streams such as Medway Rivulet, Oldbury Creek, Wells Creek, Longacre Creek and Stony Creek. Open stone artefact sites are also likely to occur on the same landform types near the ephemeral tributaries of the main streams, but in lower density artefact distributions.

3.9.2 Outcropping sandstone

Outcropping Hawkesbury Sandstone is suitable for the occurrence of Aboriginal grinding grooves, rock shelters (including those with art), rock engravings and modified rock pools. Landscape analysis indicates that outcropping sandstone is confined to deeply incised streams, scarps and cliff lines. These areas are predictable through the identification of streams in association with higher local relief on Hawkesbury Sandstone geology. This assessment has identified through observations during field survey that the best guide to target outcropping Hawkesbury Sandstone is through the mapping of the Nattai Tablelands and Hawkesbury soil landscapes which have 10–20% and >50% outcropping sandstone respectively (refer to Figure 3.3). The Soapy Flat and the Avoca soil landscapes are the only other areas that are likely to have outcropping sandstone, but at very low frequencies (less than 2%).

Outcropping sandstone is unlikely to occur in the project area outside the soil landscapes listed above, because Wianamatta Group Shales dominate the rest of the project area. Notwithstanding, grinding grooves have been recorded on the Kangaloon (AHIMS #52-4-0196 52-4-0196, 52-4-0175), Moss Vale (AHIMS #52-4-0031) and Lower Mittagong (AHIMS #52-4-0136) soil landscapes within 100 m of streams. As such, grinding grooves may occur on eroded stream channels or nearby.

3.9.3 Vegetation clearance

Mature trees of suitable age exhibiting carving or scarring (also known as modified trees) are unlikely to occur in the project area as most of the woodland and forest areas have been cleared over the past century. However, remnant vegetation in riparian corridors, agricultural areas and a considerable tract of the Belanglo State Forest are the most likely areas to retain modified trees.

3.9.4 Land use

Most of the agricultural land in the project area has been cleared of its native vegetation and subjected to repeated ploughing. These activities are likely to have displaced Aboriginal stone artefacts more than natural disturbances such as bioturbation, but without totally diminishing their cultural and archaeological value. The stratigraphic integrity of artefacts within the topsoil is unlikely to have been preserved, and the artefacts are likely to have moved both horizontally and vertically in the soil matrix, but generally within the landforms in which they were originally deposited. Overall, the extent of displacement depends on the types of ground disturbance, gradient of slope and degree of erosion, such as sheet wash on hill slopes and gullying and scouring adjacent to streams.

4 Aboriginal heritage context

4.1 Ethno-history

4.1.1 Historic overview

European contact with Aboriginal people was made during the very beginnings of British settlement. In the nearby Illawarra region, sightings by Aboriginal people of the Endeavour were made in April 1770 during Captain James Cook's expedition to seek evidence of the postulated *Terra Australia Incognita* or 'unknown southern land'. Up and down the coastline the *Endeavour* — a strange 'monster with white wings'— was noted, and stories of contact at Woonana and Botany Bay were told (Organ and Speechly 1997, p.8).

It was not until 18 years later, with the arrival of the First Fleet at Botany Bay in January 1788 that life began to change significantly for the Aboriginal people of Sydney and beyond. Exploration by George Bass and Matthew Flinders reached Lake Illawarra in 1796, where they were informed by the local Aborigines that a number of convict escapees were living among them and growing potatoes and corn (Organ and Speechly 1997, p.10).

One of the earliest encounters with the Aboriginal people near the project area is referenced in John Wilson's journal of the 1798 expedition that reached as far as Mt Towrang (north of Goulburn) (Koettig 1981). Wilson observed that the local Aborigines were wearing large skin cloaks at the time (Wilson 1798).

In 1816, as the result of mounting territorial tensions between European settlers and Aboriginal people, Governor Macquarie unofficially campaigned to eradicate the Cumberland Plain of its Aboriginal population. As part of this punitive action, early on 17 April 1816, 13 Dharawal people and a Gundungurra man were killed near Appin by a detachment of the 46th Regiment. However, this number only reflects those who were accounted for (Glenda Chalker *pers comm*. 2016). The deceased included elderly people, men, women and children. It was argued by Macquarie that the action was in retaliation to attacks against settlers between 1814 and 1816 (Kohen 1993).

It was not until 1817 that major European expansion into the Southern Highlands occurred. Charles Throsby led an investigative party with a view to establishing grazing lands in the Moss Vale/Sutton Forest area. Little of Aboriginal and European interaction has been recorded during these initial years of settlement.

In 1826, an article detailing the murder of a herdsman from Argyle (*Monitor* – Sydney, NSW Friday 29 December 1826) by three Aboriginal males states that in May of that year *"a great concourse of natives, inhabitants of parts beyond Lake George"* returned from Bong Bong where they had been performing *"certain ceremonies of their nation, particularly that of knocking out the front tooth"*. On the way, one group called at a farm at Lake Bathurst, the next morning at another property two miles from the northern side of the Lake. The article also refers to knives, tomahawks, a spear and throwing-stick as being used by the Aboriginal men during the murder (Monitor 1826, p.3).

A newspaper account from 1827 (*Monitor* – Sydney, NSW Saturday 13 January 1827), regarding the apparent murder of a night watchman by an Aboriginal man, shed light on the presence of Aboriginal family groups living in and travelling through the landscape of the study area. The night watchman worked for a Mr Jamison who owned a stock station at Greenwich Park, on the "Wollendelly River", county Argyle which is described as located 120 miles from Sydney. The watchman was supposedly killed while passing a large Aboriginal camp on the four mile trip between the main station and a smaller sheep station at "Paddon-bellon" (*Monitor* – Sydney, p.4). A dozen Aboriginal males and their families were residing on Jamison's station. These people were not the same tribe as those residing about Lake Bathurst yet the language was very alike and the two groups were known to interact during ceremonial/ritual events.

European customs and materials gradually diffused into local Aboriginal usage. Many adopted items were used in a traditional way; for instance glass and iron materials occasionally replaced stone and organic materials for tool manufacture. In 1836 James Backhouse, a botanist and Quaker missionary, visited Berrima and observed the local Aboriginal customs. He noted that Aborigines were still wearing traditional skin cloaks, but had incorporated European clothing and blankets into their assemblage.

The effects of European settlement on Aboriginal land and the associated farming and grazing practices on the land resulted in the destruction of much of the Aboriginal food supplies. Vast deforestation programs caused the widespread clearing of native game habitat, and in its place left fields for crops and livestock. Aboriginal people were not familiar with the European concept of trespassing and, if caught hunting cattle and sheep, they were harshly dealt with and often killed. Those people remaining after the first decades of settlement had the limited options to either work for Europeans in often servile positions, move to other regions, or live in camps at the fringes of European settlement, maintaining some semblance of traditional life (Organ and Speechly 1997, p. 11).

Colonial settlement and expansion disrupted traditional Aboriginal life by the time of the gold rushes of the mid nineteenth century. The last colonial record of a corroboree/initiation rite (bunan ceremony) in Wollongong (approximately 70 km east) occurred in the New Year of 1839–1840 (Organ and Speechly 1997, p. 11).

4.1.2 Local population

Information about the socio-cultural structure of Aboriginal society prior to European contact largely comes from ethno-historical accounts made by colonial settlers. These accounts and observations were made after massive social disruption due to disease and displacement. As a result, this information is often contentious, particularly in relation to language group boundaries. Therefore, it is likely that language group boundaries were far more diffuse than the arbitrary demarcations drawn by colonial observers.

According to Tindale (1974) the project area falls within the Aboriginal language group boundary of the Gundungurra people (also known as Gandangara, Gundungair, Gundanora, Gurra-gunga and Byrragorang) (Figure 4.1). Tindale describes their location as "At Goulburn and Berrima; down the Hawkesbury River (Wollondilly) to about Camden" (Tindale 1974). Earlier accounts by anthropologist R.H Mathews details that "the territory of the Gundungurra tribes includes Burragorang, Katoomba, Picton, Berrima, Taralga and Goulburn, with the intervening country" (1908, pp.203–204). The tribal name incorporates terms meaning 'west' and 'east' (Tindale 1974).

The Ngunawal people inhabited the land to the south of the project area and whose territory extended from "Queanbeyan to Yass, Tumut to Boorowa, and east beyond Goulburn; on highlands west of the Shoalhaven River" (Tindale 1974). However, KNAC (project RAP) has informed that Tumut is in fact Wiradjuri country (KNAC correspondence 12 October 2016). KNAC has also informed that the Ngunawal language has relationships with the Gundungurra, Nairgo and possibly the Wodi Wodi and Yuin peoples (KNAC correspondence 12 October 2016).

The project area also borders land originally inhabited by the Dharawal-speaking Wodi Wodi people to the west and Dharawal people to the north-west. The Dharawal dialect extended from the south side of Botany Bay and Port Hacking, throughout the Illawarra Escarpment, and across areas now known as the Macarthur, Southern Highlands and Illawarra regions, as far south as the Shoalhaven River. The boundary between the Gundungurra and Wodi Wodi was most likely the divide of the ranges between the inland and coastal rivers (Sullivan 1982, p.21).

These language groups comprised smaller family groups or 'clans'. Each member of a clan was spiritually associated with an identifiable place or object. Clans were typically controlled through unlineal descent — being either through the mother or father or through spiritual conception (Attenbrow 2010, pp.22–24). It has been argued that the population density of the Southern Highlands was probably much lower than the more resource-rich coastal region (Flood 1980, p.35).

Figure 4.1 **Aboriginal language group boundaries (source: Tindale 1974). The project area is marked by a red circle.**

In 1988, Elizabeth Rich collated a series of ethnographic accounts relating to the population distribution of the Gundungurra and surrounding groups (Rich 1988, p.25). The following observations were made:

- the areas around Berrima and further west may have been used by the Gundungurra, while the area around Bowral/Burradoo and the Wingecarribee Swamp may have been used by the Wodi Wodi;
- Aboriginal people regularly used a route over the coastal escarpment between the Illawarra and Kangaroo Valley. These people were probably the Wodi Wodi Tribe;

- people moved around in extended family groups, such as three couples and children;
- people may have stayed in one place for several days; and
- large groups gathered together for special purposes, for instance to learn a new song like the one recorded at the Cowpastures.

4.1.3 Prehistoric landscape

The prehistoric landscape of the project area and its surrounds was very different to that which emerged since colonial settlement. There are some historic observations that give insight into the appearance of the landscape as it existed during prehistoric Aboriginal occupation. James Atkinson, who established the Oldbury property directly east of the project area, made general observations about the County of Argyle to the south-west of the project area:

> Though pleasing to the eye, having a beautiful park-like appearance is poor and seldom adapted for cultivation; but the soil is light, dry and extremely well suited for sheep grazing, the surface being covered with a thin but very nutritive herbage (Atkinson 1826, p. 5-6).

> In the unoccupied districts of the interior, and also in those tracts that are only used for the purposes of grazing, the grass in winter becomes withered by the frosts, and assumes the appearance of bad coloured hay; in this state it is refused by the cattle; and as it impedes the growth of young grass, the common practice is to set fire to it. The Natives also pursue the same system, setting fire to the thick brushes and old grass every summer; the young herbage that springs up in these places, is sure to attract the kangaroos and other game; the horned cattle are also very fond of feeding upon this burnt ground, as it is termed in the Colony; they should, however, be kept from it as much as possible till it has acquired sufficient growth to form a good bite (Atkinson 1826, p 20–21).

These observations indicate that the area was characterised by grasslands, open forests and woodlands and that much of the vegetated understory was regularly burnt, either by Aboriginal people or natural bushfires, which attracted grazing animals and provided hunting opportunities.

4.1.4 Living arrangements

Shelter at open camp sites would have involved the construction of temporary timber-framed huts, also known as gunyas. These were clad in bark cut from nearby trees leaving evidence in the form of modified trees expected to have existed nearby open campsites (Sullivan 1982, p.57). Camp fires, or hearths, were typically placed in front of hut structures (Mitchell 1828). Two types of hut structures were observed by Major Thomas Mitchell, the Surveyor General of New South Wales, when he visited the Berrima district in 1828. These were:

- a sheet of bark propped against a tree apparently used by a single individual as a sleeping area; and
- a framework of a few boughs, covered with bark or branches, which seems to have been the structure used by a family group.

Louisa Atkinson was, amongst other pursuits, a botanist, 'journalist' and author of fiction. She was also the daughter of James Atkinson who established Oldbury. Writing in 1863 of her life in the Southern Highlands in the 1830s and 1840s, she describes the appearance and construction techniques of gunyas:

> Their dwellings were of a description most readily constructed, soon dilapidated, and forsaken without regret. Sometimes a sheet of bark supported on end in an inclined position by a small pole, at others, a few branches placed round a triangle, formed by partially severing a sapling so as to bend both ends to the ground, and supported in the middle by a sloping forked stick, were the materials almost always employed; but occasionally these were rendered more comfortable, and impervious to wind and rain, by being built over with grass (Atkinson in Lawson 1989, p.46).

This description, although saturated with Victorian European values very different to those of the original inhabitants, accords with early photographs and drawings of gunyas.

In 1802, French explorer Francis Barrallier led an expedition into the The Cowpastures south-west of Sydney, through the Nattai and on to the Wollondilly River. Barrallier observes the manner in which temporary dwellings were built:

> The place where I decided to spend the night was the territory of the Mountaineer Bungin. He has proof of his friendship and gratefulness for my good treatment by building a hut for me and I was thankful for his kind attention. The natives do not allow a stranger to inhabit the territories they have appropriated themselves. They themselves build huts for the strangers they wish to receive as friends (Barrallier 1802).

4.1.5 Burial customs and ceremony

Burial practices of the Gundungarra and surrounding groups were considered typical to that of the broader Sydney Region. The first British colonists reported that two common ways of disposing of the dead was burial, and cremation followed by burial. Traditional burial practices of the Gundungurra extended well into the nineteenth century, where in one instance trees were carved at the grave of Moyengully, an elder of the Gundungurra who died in 1858 (Attenbrow 2010, p.141). Flood notes that burials also occurred in caves and hollow trees, and secondary burial was also practiced (Flood 1980, p.117–120).

Aboriginal burials have been recorded south of the project area. In 1892 Etheridge noted that the grave of a 30-year old Aboriginal man, Jimmy Aremoy had been marked by a carved tree at Burragorang (AHIMS #52-1-17). The body had been wrapped in an old coat, a blanket and a possum rug. The body was also buried with a number of personal items of colonial and Aboriginal origin. The tradition of tree carving is further demonstrated where a 'chief' of the local tribe in Burragorang was claimed to have buried 15 people close to three marked trees placed in a triangle (Attenbrow 2010).

The local Aboriginal population also took part in a variety of ceremonies and customs. For example, the Gundungarra practiced the Bunan ceremony of initiation for boys. Bunan ceremonies involved the congregation of local tribes. In 1896 Matthews visited a Bunan ground which included a main camp site, a circular Bunan ground located c.120 m from the main camp comprised of circular, animal-shaped, and anthropomorphic (human-shaped) earthen mounds. A large number of surrounding trees were also marked with a hatchet (Matthews 1896, p.330).

4.1.6 Tools and weapons

Ethno-historical information lists an array of tools and weapons; many of which are unlikely to have survived as artefacts because of their susceptibility to decomposition. Items made of wood are a primary example. Torches made out of bundles of bark which were beaten and tied up, and were observed to have assisted with night fishing (Sullivan 1982, p.57). Wooden vessels were used as containers and hollowed logs were fashioned into traps to catch eels in fresh water lagoons (Flood 1980, p.294). In one instance, Backhouse observed that women carried bark knot containers full of "native currants" (*Lepotmeria acida*) (c.1836).

Barralier observed that the local Aboriginal people in the Burragorang area had an assemblage of wooden weapons, including sharp-edged boomerangs, spears and spear throwing aids known as woomeras. Spears were generally 10 to 12 feet long and made of up to three distinct components and generally of iron bark wood (Barralier 1802, pp. 771–3, 775).

Hatchets were used for a range of purposes such as removing bark from trees, making wooden vessels, and in manufacturing wooden weapons and spears. Hatchets would have originally been shaped from stone, but European contact soon saw iron used as a replacement. By the time Barralier toured the Wollondilly River in 1802, local people were using steel hatchets despite the fact that the majority had not yet encountered colonial settlers. In one instance on the Nattai River, a local man was seen to use his hatchet to cut steps into the trunk of a gum tree to reach a parrot's nest (Barralier 1802, p. 763). It was apparent by this stage that the trade of European items had diffused into local Aboriginal toolkits. Another such instance was observed by Backhouse, who noted that spears were barbed by rows of glass fragments to create deadly weapons (Sullivan 1982, p.50).

Bone and shell were also used as tools. While touring on the Wollondilly River, Barralier noted that kangaroo bones were used as chisels and bivalve shells were used for sharpening spears (Barralier 1802, p.78). Despite the examples quoted in this report, there is a notable lack in local ethno-historical accounts of stone tools used in daily life. However, the use of a variety of stone tool types in almost all areas of daily life is well demonstrated in the archaeological record.

4.1.7 Apparel and adornments

There are many accounts of the Gundungarra people wearing cloaks made from the skins of various animals. These cloaks were typically fastened over one shoulder and under the other (Jervis 1986, p.2). Men also wore belts made from possum hair fastened above the hips to hang their tools and weapons (Rich 1988, p.29). Both men and women wore headpieces and necklaces made up of materials such as kangaroo teeth and beads (Backhouse c.1836).

Louisa Atkinson notes the complexities of cloak making:

> If they (the women) require the skin for cloak-making it is stripped off and pegged out on a small sheet of bark, the fur within, warm ashes are rubbed over it to expedite its drying; after that it is carefully scraped with a sharpened flint or bit of glass, and then carved by being folded in peculiar forms, and the inner skin removed, so that the pattern, usually angles or curves, is rough; into these, red ochre is rubbed; so slow is the process that a single skin will occupy a woman all day to cure. They are squared and neatly sown together with sinews – a slender piece of bone constituting the needle in former days.
>
> If the skin is not required the fur is merely plucked from it, and probably spun into yarn. Between the fingers; this yarn is worn many times twisted round the waist, and depending in ends [*sic*] round the body; it was the usual dress of the men formerly (Atkinson in Lawson 1989, p. 46).

4.1.8 Food

There was a wide variety of food supplies available to the local Aboriginal people. In the lower Nattai/Wollondilly Rivers, Barrallier observed a range of game including kangaroos, possums, wombats, wild dogs, and lizards. Food that was sourced from rivers and swamps included, fish, shellfish and eels. Vegetable foods included native currants, macrozamia paste and cabbage tree hearts (Barrallier 1802, p.27). Overall, a variety of mammals, fish, reptiles, vegetables, fruits, roots and flowers were available for consumption.

Louisa Atkinson noted that "the hunting of kangaroo, emu, and native dog is confined to the men; near streams the men are expert in spearing fish; the women will stand all night in water fishing or eeling: they employ a hook" (Atkinson in Lawson 1989, p.12).

4.1.9 Ethno-historical implications for archaeology

Aboriginal toolkits indicate that organic materials like wood, bark, shell, bone and fur were integral to subsistence. However, these are not likely to have survived to form part of the archaeological record. Although stone tools are rarely mentioned in historical accounts, many of these were made when modern materials, such as iron and glass, would have been preferred over stone. Overall, stone, iron, and glass Aboriginal objects would be the materials most likely to have survived in the archaeological record.

Aboriginal burials were often marked by carved trees and mounds and are known to have occurred in the wider region. Burials also may have been in hollow trees or caves. Such carved trees or tree hollows may remain in uncleared areas, but the project area is generally cleared of its native vegetation which may have removed any such markers. Burials are typically rare but it is likely that larger mounds dating to the contact period, such as that described in Section 2.4.1 by Atkinson (1862, p.2), would still be visible in the landscape. Smaller singular burial mounds may have deflated over time and been levelled-out by repeated ploughing of pasture lands.

Trees were also scarred by bark removal for huts, toe-holds for tree climbing and marking for ceremonies. These may remain in uncleared areas. It is unlikely that individual campsites would have been extensive in size due to the relatively small family groups inhabiting the area. The sizes of individual camps are often difficult to define archaeologically, as many sites are the accumulation of repeated camp occupation and not singular camping events. Bunan camps are likely to have been much larger in size as they accommodated numerous people from neighbouring tribes.

4.2 Previously recorded sites

4.2.1 AHIMS search

Two searches of the Aboriginal Heritage Information Management System (AHIMS) register were undertaken. The most recent was on 1 December 2015 and copies of the AHIMS searches are provided in Appendix B.

The two searches covered 34 km^2 surrounding the project area. The searches covered a large enough area to identify all previously registered Aboriginal sites in the project area and to assist in characterising the broader archaeological record. A wide variety of Aboriginal site types and their distribution across multiple landforms are represented in the AHIMS results.

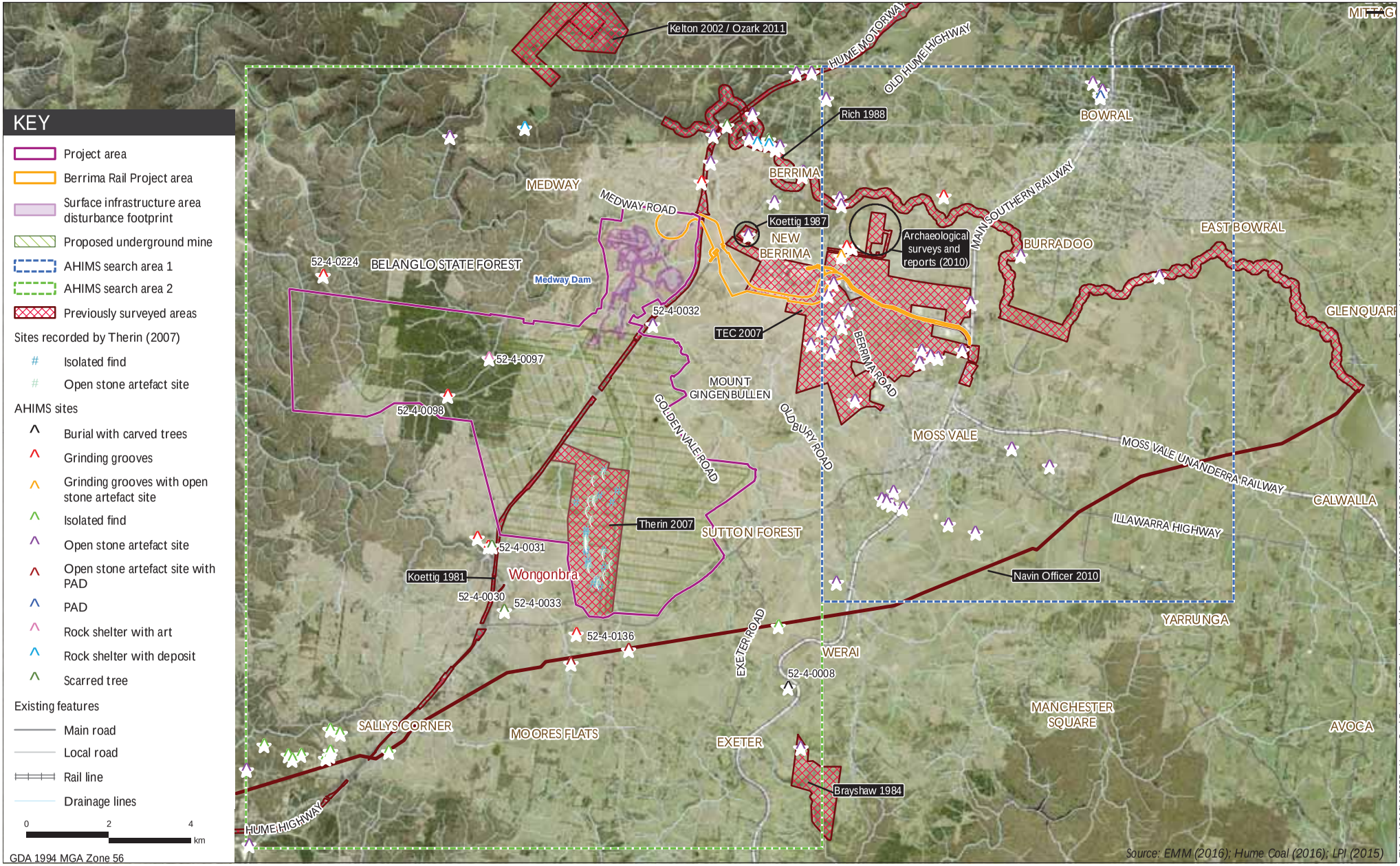
A total of 89 Aboriginal sites were identified in the search area, but only two of these are in the project area (Figure 4.2). A summary of the individual site types is provided in Table 4.1.

Analyses of the 89 AHIMS registered Aboriginal sites (excluding the non-site type 'PAD') in the search area show that 80% of recorded sites have one or more stone artefacts, 13% are axe grinding groove sites, 6% are rock shelters comprising four rock shelters with deposits and one rock shelter with art, and 6% are modified trees. Additionally, one carved tree next to a burial is located within a cluster of old-growth trees 3.5 km south-west of the project area.

Most of the previously identified sites are to the north and east of the project area. Generally, open stone artefact scatters and grinding grooves have been recorded near streams throughout the search area. Grinding groove sites have only been recorded within 100 m of streams and where the underlying sandstone geology is exposed. Rock shelters with art and deposits have been recorded within 100 m of streams and only on sandstone geology. Modified trees have been recorded in areas of remnant native vegetation, typically associated with riparian corridors surrounding streams.

Table 4.1 AHIMS registered sites in the search area

Site type	Number of sites
Open stone artefact site (including isolated finds and open sites with potential archaeological deposit)	66
Rock shelter with art	1
Rock shelter with deposit	4
Open stone artefact site and grinding grooves	2
Grinding grooves	9
Scar tree	5
Burial with carved tree	1
PAD	1
Total	**89**



AHIMS results and locations of previous surveys

Hume Coal Project

Aboriginal Cultural Heritage Assessment

Figure 4.2

4.2.2 Aboriginal sites within the project area and its vicinity

Table 4.2 describes all of the AHIMS sites in the project area and a selection of sites that displays the variety of site types nearby.

Table 4.2 AHIMS registered sites within the project area and its vicinity

AHIMS site number/site name	Summary	Location
52-4-0097 Compartment 157	Rock shelter with art in the north-western portion of the project area. The site is a sandstone rock shelter with art featuring several handprints. The site is also described as containing axe grinding grooves and bowls cut into sandstone. The site is close to the confluence of Belanglo and Fire Dam creeks. Subsequent inspection of the site by EMM did not identify any 'bowl' features associated with the site. These may have been obscured during EMM's inspection or originally mistaken for natural grooves in the sandstone, caused by erosion.	Underground mine area
52-4-0098: International House	Set of twelve visible grinding grooves in the north-western portion of the project area, collectively known as 'International House'. These were recorded in 1982 by a forester during maintenance works. The site is noted as being located within a grazed and fenced house site on the southern side of Belanglo Creek, 50 m from Dalys Road. More recently, a series of small, carved rock pools were also recorded as part of this site.	Underground mine area
52-4-0136: Sutton Forest Grooves	Set of three grinding grooves recorded in 2005 by a NPWS officer on a private property known as "Murrish". The grooves are said to be located on a sandstone boulder approximately 50 m from an ephemeral stream that drains into Black Bobs Creek.	Within 500 m of project area (south)
52-4-0033: HCA 2 Sutton Forest	Scarred tree to the south of the project area recorded at the same general location as Site #52-4-0030. The tree is approximately 15 m tall and features a large rectangular scar on its lower trunk, caused by the removal of bark.	2 km south of project area
52-4-0030: HCA 1 A&B	Set of grinding grooves in the south of the project area. The grinding grooves were identified on the banks of a tributary to Black Bobs Creek on one flat rock ledge and one flat-topped sandstone boulder.	2 km south of project area
52-4-0008: Kirby's Meadow Estate, Exeter.	Site comprising five carved trees around a mound grave. The site is noted as probably destroyed, although it was originally located on the side of a hill within a thick patch of trees that was situated about 3 km from Exeter Station. This AHIMS card states that the site was the grave of "Charley", buried in 1853, and recorded in an article by A.D. Badgery in 1899 in the *Science of Man* journal.	3.5 km south-east of the project area.
52-4-0031: Bob's Creek	Set of grinding grooves located in the south-western portion of the project area. The site consists of two adjacent groups of grinding grooves situated in a shallow valley that forms the head of a tributary to Black Bobs Creek.	Within 500 m of project area
52-4-324: Comfort Hill Grooves	Set of seven grinding grooves. The site is recorded next to a tributary of Black Bobs Creek to the south of the project area.	Within 500 m of project area (south)
52-4-325: as Comfort Hill MT	Modified tree site bordering an unsealed road adjacent to a tributary of Black Bobs Creek.	Within 500 m of project area
52-4-0224: Bunigalore Grinding Grooves	Set of 13 grinding grooves approximately 500 m north of the project area in the Belanglo State Forest. The site is within 300 m of Longacre Creek (an ephemeral stream) and within 800 m of Black Bobs Creek (a perennial stream). The site is located on a ridge within 30 m of Bunigalore Road.	Within 500 m of project area
52-4-0032: Belanglo	Open artefact scatter approximately 300 m north of the project area. The site is on a low hill disturbed by numerous rabbit holes and land used for horse grazing. The site comprises one stone artefact flake and several 'small quartz chips having the appearance of flakes'.	Within 500 m of project area

4.3 Regional archaeological context

4.3.1 Overview

There have been a number of archaeological investigations undertaken in the Southern Highlands over the last 30 years. These have largely been in response to infrastructure and mining developments. Most investigations have included archaeological surveys and a number have also included archaeological excavations. The most relevant investigations undertaken to date are summarised below.

i Archaeological investigation of sites RC-PAD and MF2 Mt Flora near Mittagong (Rich 1993)

In a synthesis of local research, Rich calculated an average site density of 4 sites/km^2 for the greater Southern Highlands region. Recorded site types varied and included open stone artefact sites, grinding grooves, shelters with art, shelters with deposit and scarred trees and a burial. The study exemplifies the variation and frequency of Aboriginal sites.

In 1993, Rich identified 21 sites and PADs in the Hill Top and Colo Vale area approximately 20 km north-east of the project area. Two sites were excavated, one of which was a sandstone rock shelter which revealed long and repeated occupation from 7,500 +/- 120 BP (years before present) through to the historic period (Rich 1993). A total of 4,559 stone artefacts were recovered from one site (RC PAD), most of which were quartz (63%). Chert comprised 29% of the assemblage and silcrete made up the remainder of artefacts (8%). Rich argued that these results reflected a set of complex cultural rules governing the distribution of raw materials as opposed to a purely functional explanation that material use was solely based on the proximity to raw material sources.

ii Subsurface archaeological salvage at Penrose Quarry Rock shelter (Kelton and Mills 2003)

In 1997, Kelton and Mills surveyed the proposed expansion area of Penrose Quarry approximately 15 km south of the project area. The survey identified a rock shelter with Aboriginal ochre and charcoal markings on the roof and a potential floor deposit. Kelvin Officer, a rock art specialist, assessed the art and determined it was of low scientific significance in terms of rock art style and graphic variation. However, the shelter floor was considered to have high significance, because of the depth of floor deposit.

Subsequently, three trenches were excavated to basal weathered sandstone. Artefacts, including backed blades and a dense charcoal deposit, were found throughout the soils. Beneath the disturbed portion of the shelter floor (approx. 15 cm), a large hearth area approximately 1.5 m x 2 m in area was identified containing stone artefacts, bone and shell. Rock fall disrupted the site at 70 cm depth, which when removed was found to overlay artefacts sitting on sterile weathered sandstone at 1.9 m depth. It was proposed that the stone tool assemblage below the rock fall may be associated with Pleistocene occupation indicated by the absence of backed blades, the absence of quartz and a predominance of silcrete and chert.

Inspection by a geomorphologist confirmed that the geological stratification supported the theory of two distinct periods of occupation at the shelter. Although not discussed in the body of the report, carbon dating (^{14}C dating) of nine deposit samples revealed dates ranging from 2,977 +/- 39 BP to 14,829 +/- 68 BP (Appendix of Kelton and Mills 2003). Prior to the excavation, the study had indicated that the rock shelter was probably not particularly large enough to be archaeologically significant. This was attributed not only to the small size of the rock shelter, but its unusual location on a moderate slope below a sandstone cliff and its reasonable distance from water. However, the site was considered highly archaeologically significant after the recovery of artefacts from the two occupation periods.

iii Renwick Sustainable Village, Mittagong Southern Highlands, NSW Test Excavation (AMBS 2007)

In 2006 Australian Museum Business Services (AMBS) conducted an archaeological test excavation in the Renwick Sustainable Village 115 ha development area, 2 km north-east of Mittagong. Two test areas were placed in each of the three landform types targeted (crests, terrace slopes and creek flats) which were associated with 2nd and 3rd order streams. The hill crests held shallow residual soils from weathering bedrock and were deflated. In lower lying areas the soil was alluvial silty clay with laminated silts and sub-rounded gravels. A total of 1,786 artefacts were recovered from 138 1 m x 1 m test pits (artefact density: 12.8 artefacts/m^2 or 44.2 artefacts/m^3). Most artefacts were recovered from a depth of 19–45 cm (av. 29 cm depth).

The highest densities of artefacts were recovered from alluvial deposits adjacent to drainage lines or on terrace slopes with deep sandy deposits presenting intact stratigraphy and cultural material. Areas of lowest subsurface artefacts tended to be on spur crests and slopes with shallow soil deposits and disturbance from pastoral activity.

Quartz (41%) was the dominant material, present in all test areas, followed by quartzite (34.4%) and silcrete (10.5%). Chert, tuff and other materials made up less than 10% each. The small number of cores (1.7%) indicated that flaking occurred, but the cores were taken away from the site. The low number of bipolar artefacts, the use of quartz and presence of backed artefacts suggest a date range of 5000–1600 years ago.

iv Archaeological Survey and Test Excavations at a Proposed Clay Extraction Pit at Bowral (Silcox 1987)

In 1987, Bowral Brickworks commissioned a survey prior to the extension of their existing clay pit approximately 8 km north of the project area (Silcox 1987). Only two isolated stone artefacts were found. However, test excavation was recommended because of low ground surface visibility and the areas potential for subsurface artefacts. The test excavation was conducted later that same year by Silcox and Pagett.

In 1987, Silcox and Pagett conducted a test excavation at the extension area. The tested area was on a floodplain which was bordered to the south and east by Mittagong Creek and to the west by a basalt outcrop. While the area had been mostly cleared it had not been extensively ploughed. In selecting the location of the pits, the following factors were considered:

- proximity to water;
- elevated rises in the landscape suitable for camping; and
- the location of artefacts at this site and similar sites in the region.

Test excavation results showed low densities of artefacts on lower slopes, including an alluvial fan and a much denser sample of artefacts upslope on the fan. A total of 41 artefacts were recovered from 17 pits 25 cm^2 in size. The highest artefact density was 12 artefacts/m^2, which was argued to be the remnants of a knapping floor. The average density was around 7.5 artefacts/m^2 across the rest of the site. Most of the artefacts were flakes, broken flakes and flaked pieces except for three cores. 90% of the artefacts were quartz, while silcrete, quartzite and fine grained siliceous (FGS) made up less than 5% each.

v Hoddles Crossing to Alpine: Archaeological investigations of the proposed F5 extension (Koettig 1981 & 1985)

In 1981 Margrit Koettig completed an archaeological survey assessment for the widening of the Hume Highway. The survey covered a distance of 34 km within the easement of the proposed highway route. A total of 24 Aboriginal sites were recorded, and comprised grinding grooves, scarred trees, open stone artefact sites, rock shelters with deposit, rock shelters with art and one quarry site. Open stone artefact sites were the most common site type and typically occurred on the banks of watercourses, on small but elevated level areas near the confluence of watercourses, on level areas of low spurs or on ridges above watercourses and on open expanses of sandstone. Artefact material types consisted of red and grey silcrete, quartz, quartzite and chert. Rock shelter sites were confined to the geological areas of Hawkesbury Sandstone and where exposures of sandstone occurred within the overlying shale geological sequence. Grinding grooves were also confined to outcropping sandstone exposures of the otherwise shale lithology. The rarity of scarred trees was largely attributed to post-European vegetation clearance.

Two open artefact sites near Berrima and two near Mittagong were subsequently excavated (Koettig 1985). At Berrima the archaeological deposit extended to a depth of 25 cm. The most common raw materials recovered were silcrete and quartz which was attributed to these materials being locally available. One of the more significant sites, HCA 14 – a site adjacent to a 2nd order stream on the lower portion of a hill slope, contained three dense stone artefact concentrations featuring backed blades and was considered to represent knapping floors. A hearth from this site was dated to 1780 ± 60 BP and is stratigraphically associated with the knapping floors (Koettig 1985).

vi Proposed Subdivision at Lot 1, Sackville Road, Hill Top NSW (Julie Dibden 2005)

In 2005, Julie Dibden conducted a surface collection and test excavation at Lot 1 Sackville Road, Hill Top NSW, after identifying two open artefact scatter sites during a field survey in 2003. The study area was on the Hill Top Soil Landscape overlying Hawkesbury Sandstone geology. The landform was considered to be a broad ridge 500 m to the east of Running Water Creek and adjacent to a 1st order open drainage depression. The landscape was characterised by mature native vegetation and thin, sandy, locally derived soils.

Thirty 0.5 m^2 test pits were excavated by hand. The soil was a sandy silt with a brown humic topsoil A1 horizon to a depth of 20 cm overlying an orange sandy silt A2 horizon with fragments of degrading sandstone. The majority of artefacts were recovered from the top 20 cm of soil. A total of 15 artefacts were recovered from eight of the 30 test pits, which was considered to be “patchy”. Artefact density was calculated to be 2 artefacts/m^2.

A total of 241 artefacts were recovered from the site, most of which were collected from the ground surface. Quartz was the most common raw material type (48%), followed by silcrete (20%), silicified tuff (15%) and various fine grained siliceous materials, silicified wood and chalcedony (12%). Artefact types included cores, bipolar cores, two backed artefacts and six retouched artefacts.

Dibden concluded that the local Aboriginal population had access to a wide range of stone artefact types, and the relatively high number of larger artefacts indicates that they were not under pressure to conserve their stone supplies. She also identified that raw materials would have had to have been imported onto site. Dibden proposed that the “patchy” distribution of artefacts was because the site was next to an ephemeral source of water and probably occupied in short stays.

Dibden made a regional comparison of artefact density based on 12 examples of test and open area excavation results. It firstly identified that there had been only limited excavation samples in the region: only one site had been excavated over 60 m^2, five sites had been excavated over 10 m^2 and four sites had been excavated over less than 5 m^2. Dibden found the Sackville Road site to have very low artefact densities density (2 artefacts/m^2). Regionally, artefact density ranged from <1 artefact/m^2 to 298 artefacts/m^2. As expected, the highest densities were associated with open area excavations which generally involved expanding test pits that have the highest frequencies. Dibden noted that it was questionable whether such small amounts of excavation is adequate to describe artefact density in open sites, some of which cover many hundreds of square metres.

All regional comparisons were within 200 m of water and artefact density varied considerably regardless of stream order. In fact, the highest artefact density (298 artefacts/m^2) was associated with a saddle adjacent to a 1st order stream, but this was partly attributed to the site being on a prominent landform feature (HCA14). It was proposed that prominent peaks or ridges may have been used more frequently and intensively by Aboriginal people than the results of archaeological assessments have previously surmised.

4.4 Archaeological reports in the local area

Since the 1980s the project area and its surrounds have been subject to a number of archaeological investigations, the majority of which have involved archaeological surveys, with test and salvage excavations being less common. A number of Aboriginal site types have been identified within the local landscape, including grinding grooves, modified trees (one including a burial), open stone artefact sites and rock shelters, some of which contain archaeological deposits and art. Where the data is available, areas previously surveyed in the local area are shown in Figure 4.2.

i Exeter Quarry (Brayshaw and Associates 1984)

In 1984, Brayshaw and Associates completed an archaeological survey for a proposed extension of the Exeter Quarry approximately 1 km south of the project area (Brayshaw 1984). The survey included an area proposed for blue metal quarrying extensions and new dam construction. The local landforms comprised terraces separated by steep scree slopes, with the two upper terraces formed by basalt flows and the lower terrace formed by the surface of underlying Wianamatta Shales. One isolated milky quartz blade and one site comprising silcrete, quartz and chert were identified. The site was on Wianamatta Shale geology, on an elevated terrace overlooking the confluence of two flowing streams. No grinding grooves or modified trees were identified in the survey area.

ii Berrima Sewerage Scheme (Margit Koettig 1987)

In 1987, Koettig conducted an archaeological assessment for the Berrima Sewerage Scheme approximately 1 km north-east of the project area (Koettig 1987a). Koettig surveyed the proposed pipeline routes and the proposed treatment works site area throughout Berrima and approximately 1.3 km to the south. The survey traversed land which was over Hawkesbury Sandstone and Wianamatta Shale geology. The surveyed landscape is gently undulating with landform units comprised of low ridgeline, low ridgeline slopes, alluvial floodplains and the banks of the Wingecarribee River and its tributaries. Two open artefact sites were identified during the survey: one site (B1) was in a bulldozer scour exposure on the alluvial floodplain of the Wingecarribee River and the other site (B2) was on a spur ridge approximately 100 m from a tributary of the Wingecarribee River. Artefact materials comprised chert, silcrete and quartz and one backed blade. The assessment indicated that alluvial floodplains and tributaries to major rivers were archaeologically sensitive, and test excavations of these landforms were recommended.

Subsequently, Koettig conducted a test excavation program at the Berrima Sewerage Scheme treatment works site (1987b). This was based on the results of the archaeological survey assessment conducted earlier that year (1987a). The program sampled a low, wide, spur which had been largely cleared (subsequently referred to as site B3). Site B3 was between 150–300 m from an ephemeral stream, which flows south-west into a perennial water course, Oldbury Creek, approximately 1 km from the project area.

The test excavation comprised 13 backhoe pits (each 2 m x 0.5 m in size) in conjunction with two shovel test pit transects made up of nineteen 1 m x 0.2 m test pits. A total of 67 artefacts were recovered from the test excavation (average density of 4 artefacts/m^2).

The results indicated that stone artefacts were distributed across the whole tested area in low densities ranging from 0 to 11 artefacts per test location. Most artefacts were recovered from 10–20 cm depth, but artefacts were found up to 35 cm deep. Artefact material type comprised quartz, silcrete, indurated mudstone, chert and an unidentified fine grained material. An unidentifiable charcoal feature containing bark was also recovered, but it was not established whether it was of Aboriginal origin.

Overall, the test excavations indicated a widely dispersed low density scatter with small concentrations of artefacts occurring in discrete knapping events (Koettig 1987b, p.14). Koettig argued that, because few archaeological investigations had been conducted in the region, the test excavation results could not determine whether the recovered archaeological evidence was typical of sites occurring more than 100 m away from a stream. Koettig concluded that spurs and undulating ground close to minor streams are of moderate archaeological sensitivity in the local area.

iii Shoalhaven Water Supply Scheme (Elizabeth Rich 1988)

In 1988, Elizabeth Rich completed an archaeological assessment approximately 2 km north of the project area for the proposed modification to the Wingecarribee River as part of the Shoalhaven Water Supply Scheme. The survey was commissioned to cover Aboriginal and historical sites along the Wingecarribee River between the Wingecarribee Reservoir (near Robertson) and Black Spring Creek junction below Berrima. Rich's study included a review of the archaeological record in the Southern Highlands which focused on Aboriginal site types and frequencies in relation to underlying geological units. Rich observed the following trends in Aboriginal site distributions (1988, p.40).

- open sites, rock shelters with art and/or deposit and axe grinding groove sites have been recorded on the Berry Formation, Illawarra Coal Measures and Hawkesbury Sandstone; and
- open sites and (rarely) axe grinding grooves occur on shale geology.

Rich proposed that the underlying Mittagong geological formation, a narrow band of sandstone between Ashfield Shale and Hawkesbury Sandstone, although not mapped as a surface geological unit, may have extruded to the surface and be the reason why grinding groove sites have been identified on otherwise shale lithology.

Rich proposed that underlying Hawkesbury Sandstone geology provides the most archaeologically sensitive landscapes. This is followed by Wianamatta Shales and Berry Formation, with the remaining geological formations being of lower sensitivity (Rich 1988, p.39).

Rich identified 12 open artefact sites, one rock shelter with PAD and six isolated finds. The artefact densities of the open sites were generally very low, with the highest density having eight artefacts found within 1 m^2. Quartz and silcrete were the dominant raw material type with few artefacts made of mudstone, chert and quartzite. A number of bipolar quartz flakes were identified (22% of the assemblage), and one third of artefacts featured retouch/usewear.

Nine open stone artefact sites were within 50 m of the Wingecarribee River along with one isolated find. All of the sites were above the flood level. In relation to geological units, nine open artefact sites and one rock shelter with a PAD occurred on sandstone geology. The isolated find occurred on shale, and one each on basalt, quaternary alluvial deposit and sandstone. The distributions of sites across geological units generally agreed with observations from previous investigations, primarily that site distributions were most concentrated in landforms with underlying sandstone.

Rich argued that past Aboriginal people may have preferred camping on sandstone areas, possibly because of the steeper topography and the sandy soils which were better drained. Sandstone also may have been preferred, because they were better timbered than some of the surrounding flats and would have provided better resources and shelter. The wider spread of isolated finds indicated that other areas were used as resource zones, but were not selected for camping sites. Furthermore, localities close to the river were probably casually used, while camp sites were further away (Rich 1988, p.76). Overall this study added to the regional pattern for site location by confirming that sites were clustered along minor streams and selectively located along major rivers. Rich proposed that the clustering of sites along minor streams was because:

- the ground may not be as damp as along major rivers;
- flash floods would not be nearly as severe;
- cold air drainage would not be as pronounced;
- more extensive tree cover was probable; and
- minor creeks and streams would not present a barrier during winter.

iv Berrima Colliery (Kelton 2002)

There have been a number of assessments undertaken for the Berrima Colliery, approximately 2.5 km north-west of the project area at Medway. In 2002, Kelton surveyed the area above a series of extraction panels related to underground mining at the Berrima Colliery. The survey covered a wide range of landforms including ridge crests, low and upper-mid hill slopes, ephemeral and spring-fed creeks, alluvial and colluvial terraces and exposed sandstone formations. The sandstone formations surveyed were further divided into specific groups comprising isolated floaters/boulders, minor exposures of bedrock and sandstone strata, sandstone cliff lines and exposed sandstone bedrock along survey area creek lines.

Kelton's study predicted areas of archaeological sensitivity using previously developed site predictive models for the region. The most sensitive areas were undisturbed creek lines, alluvial/colluvial terraces, adjacent low ridge crests and outcrops of exposed sandstone. Confirming Kelton's predictions, three Aboriginal sites were recorded, comprising two rock shelters with art and deposit and one open artefact site. Rock shelter MC-S-1 was located 10 m from the eastern side of Mandemar Creek and the second rock shelter (MC-S-2) was approximately 200 m north-west of MC-S-1 on an upper hill slope/ridge crest shoulder overlooking Mandemar Creek to the east. The site was also in close proximity to an unnamed tributary that feeds into Mandemar Creek. The open artefact site (MC-OS-1) was on a low hill slope/low ridge crest overlooking an unnamed tributary of Wingecarribee River. The only PADs identified by Kelton were those associated with sites MC-S-1 and MC-S-2.

v Berrima Colliery Continued Operations Project (Ozark 2011)

In 2011, Ozark Environmental and Heritage Management (Ozark) completed an Aboriginal heritage assessment for the Berrima Colliery Continued Operations Project, approximately 3 km north of the study area. The landform context was a ridgeline orientated roughly north-south. Only a small artefact scatter was identified in this study area. Although exposed sandstone occurred near streams, much of it was silted and covered by vegetation and leaf litter that may have obscured open stone artefact sites and grinding grooves.

vi Highlands Source Project (Navin Officer 2010)

Navin Officer Heritage Consultants have completed a number of archaeological investigations for the Highlands Source Project (HSP), within 1 km south of the project area. In 2010, Navin Officer surveyed approximately 43 km of an 83 km proposed pipeline across the Southern Tablelands and the Southern Highlands of NSW (52% of the total project), with 13 km of survey undertaken in the Wingecarribee LGA. The survey identified five isolated finds, 13 open stone artefact sites and 7 PADs.

Two of the PADs (HSP PAD6 and HSP PAD7) were identified approximately 1.5 km south of the project area. HSP PAD6 was on the eastern side of Black Bobs Creek on a low spur, only a few metres above the adjacent water course. HSP PAD7 was on a broad spur crest adjacent to Wells Creek.

Subsurface testing of HSP PAD6 in 2011 confirmed the presence of Aboriginal objects (Navin Officer 2012). Out of seven test pits excavated, only two Aboriginal objects were retrieved. The site (now HSP35) was assessed to be of low significance within the local archaeological context based on the low technological diversity in the artefact assemblage and the relatively low and discontinuous frequency of artefacts. Subsurface testing of HSP PAD7 retrieved 31 stone artefacts in four out of the 10 test pits. The site (now HSP36) was assessed to be of low significance within a local context due to its limited research potential in terms of assemblage richness; despite the artefact distribution including isolated occurrences of moderate artefact density.

vii Aboriginal heritage assessment of Wongonbra (Therin 2007)

In 2007 as part of a proposed subdivision, Therin completed an Aboriginal heritage assessment for the Wongonbra property in the project area. The survey identified 37 Aboriginal sites including artefact scatters and individual artefacts. These sites are shown in Figure 4.2.

Therin used a predictive model of artefact density that anticipated low to moderate density on hill crests, low density on hill slopes and moderate to high density close to creek lines. Surface exposure due to erosion was a greater factor in the visibility and identification of sites. The majority of sites (25) were identified on the highly eroded main access track that traversed the hill crest of the study area. In total, 32 of the 37 sites were concentrated on the hill crest.

Only one site was identified within 100 m of Wells Creek, but this could have been because of low ground surface visibility rather than the absence of artefacts in proximity to Wells Creek.

Silcrete was the dominant raw material (43%), followed by chert (29%), quartzite (17%) and quartz (11%). Retouched tools made up 23% of the artefacts. Some of these had a fairly steep retouched edge which Therin associated with scraping and wood working, while the presence of small cores led him to conclude that the cores were discarded in proximity to their last use. There was also evidence of some bipolar artefact knapping.

Although these sites were recorded, they were not submitted to AHIMS as part of the 2006 investigation. They were submitted to AHIMS by EMM in January 2016.

viii Wingecarribee Shire Council residential subdivision (Total Earth Care 2006)

In 2006, Total Earth Care (TEC) completed an Aboriginal heritage and archaeological assessment for Wingecarribee Shire Council's (WSC) proposal to release land for residential subdivision. The study was south-west of Moss Vale, approximately 4 km east of the project area. The survey identified 18 open stone artefact sites. Thirteen of these artefacts were concentrated at one 50 m x 70 m site (MVSW1) whilst the remaining five were recorded as isolated finds up to 250 m from MVSW1. The finds were located on an elevated and level ridgeline, distant from permanent water. TEC interpreted the assemblage as having accumulated over a long period of sporadic daytime use rather than as a more permanent domestic camp site (TEC 2006, p.18-19).

ix Moss Vale 'Enterprise Zone' (Total Earth Care 2007)

In 2007, TEC completed another assessment for the proposed Moss Vale 'Enterprise Zone'. This included a survey along sections of Stony Creek approximately 3 km east of the project area.

Seven open artefact scatters and 11 isolated finds were identified, comprising of 64 artefacts and seven grinding groove panels. There is also one previously identified site (B3) in the area which had previously been subject to test excavation (Koettig 1987). Aboriginal sites MVEnt Art 12, MVEnt Art 15 and MVEnt Site 3 were recorded in the study area (Figure 4.2).

Five open artefact scatters (Sites 1 to 5) were identified along Stony Creek which indicates that this was "a significant landscape that was a focus for camping, resource use of travel for Aboriginal people" (TEC 2007, p.7). All of the sites were located on level raised areas above the creek's flood zone and all of them were considered to have high levels of associated subsurface deposits.

4.5 Summary of findings from archaeological background

Regional archaeological investigations have found that:

- Open stone artefact sites are usually found close to streams on elevated, level to gently inclined landforms, such as hill crests and hill spur crests, alluvial plains and terraces.
- Subsurface archaeological deposits mostly occur on level to gently inclined landforms, such as hill crests and hill spur crests.
- To a lesser extent archaeological deposits are found on foot slopes. However, the integrity and extent of the deposit is reliant on the condition and depth of soils.
- The dominant raw materials for stone artefact production in the area are silcrete and quartz which are regionally outcropping.
- Quartzite appears to be more common in the Southern Highlands region.

Local archaeological investigations have found that:

- Open stone artefact sites have most frequently been recorded near:
    - stream channels, alluvial floodplains and terraces;
    - low elevated areas near the confluence of watercourses; and
    - low ridge crests, saddles and spurs and to a lesser extent slopes.
- Open stone artefact sites have mostly been recorded above Hawkesbury Sandstone and Wianamatta Shale geology.
- Most open stone artefacts sites are made up of less than 10 artefacts.
- Rock shelters have been recorded on the Hawkesbury Sandstone geology, but also on sandstone from the Illawarra Coal Measures and the Berry Formation. Rock shelters mostly occur near streams where scarps, cliff lines and boulders have formed from extensive water-aided erosion. A limited number of rock shelter excavations have indicated that extensive deposits of stone artefacts, hearths, shell and bone occur in suitable deposits. Carbon dating of charcoal deposits has indicated occupation of the region dating back to 14,829 +/- 68 BP.
- Grinding grooves have been recorded adjacent to streams (typically within 100 m) where outcropping sandstone occurs. This predominately occurs in areas of sandstone geology. However, there are rare instances of these sites being identified on areas mapped as Wianamatta Shale but this is likely to reflect highly eroded areas such as stream channels.
- Quartz and silcrete were the most commonly recorded raw materials used for artefact manufacture. Chert, quartzite and indurated mudstone/tuff (IMT) are commonly distributed throughout the local area, but comprise smaller proportions of assemblages. Bipolar artefact reduction is commonly evidenced in quartz, and to a lesser extent, silcrete and chert. Backed artefacts have been identified, but in low densities suggesting a date range of 5000–1,600 years ago.
- Modified trees are rare, but most commonly occur adjacent to streams; however there may be a bias in this sample, because areas adjoining water courses have not been previously cleared of mature trees. Carved trees are also associated with burials.
- A burial site is recorded 3.5 km south-east of the project area (AHIMS # 52-4-0008: Kirby's Meadow Estate, Exeter) which was demarcated by five carved trees.

5 Predictive model

5.1 Basis of the model of Aboriginal site location

A predictive model of Aboriginal site location has been devised based on the data presented in the preceding sections. In summary the model has been formed by an analysis of:

- landscape features in the project area and its surrounds;
- pre-colonial period ecological conditions;
- advice from RAPs;
- ethno-historical information about Aboriginal life and material culture; and
- the type and distribution of Aboriginal sites described in previous reports and AHIMS data.

The model enabled predictions to be made about the location of Aboriginal sites and this information has guided the archaeological field investigation.

5.2 Model results

5.2.1 Open stone artefact sites

Open stone artefact sites (scatters of artefacts) and isolated finds are the site types most likely to occur in the project area; these may occur on all landforms as background scatter, but are most likely to occur on in concentration on elevated landforms or raised areas in lower-lying landforms adjacent to ephemeral and perennial streams (typically within 200 m). The most sensitive landforms comprise flood plains and terraces near reliable streams, hill crests, spur crests, low ridge crests, and to a lesser extent, slopes. Elevated landforms near the confluence of streams are particularly sensitive for open stone artefact sites. These features are found throughout the project area, but mainly to the east of the Belanglo State Forest in what is now open farmland.

Areas with subsurface archaeological deposits are likely to occur on the sensitive landforms where suitably intact soils exist and higher artefact densities are likely to occur near perennial streams. The areas that have been subject to vegetation clearance and ploughing are likely to contain artefacts in partially disturbed contexts. Slopes and crests subject to extensive erosion are the least likely to retain large deposits.

Open stone artefact sites are have potential to be on all geological formations and soil landscapes in the project area except where they are on large sloping expanses of sandstone.

5.2.2 Rock shelters (with potential for art and deposit)

Rock shelters (which may contain archaeological deposits, art or engravings) are likely to be present in areas along rocky scarps and cliff lines. In the project area, these are only likely to occur adjacent to streams on the Nattai Tablelands and Hawkesbury soil landscapes which overlay sandstone geology.

5.2.3 Grinding grooves, engravings and modified rock pools/bowls

Grinding groove and engraving sites are most likely to be present on outcropping sandstone in stream beds or adjacent to streams. The project area has outcropping sandstone on the Nattai Tablelands soil landscape and the Hawkesbury soil landscapes and therefore it is possible that grinding grooves exist throughout the project area but are confined to nearby streams. Grinding grooves may also exist in areas mapped as shale geology where discrete sandstone outcropping occurs; this situation occurs rarely, but where it does exist it takes the form of isolated boulders rather than large expanses of sandstone.

5.2.4 Modified trees (scarred or carved)

Scarred or carved trees may occur where mature trees of a sufficient age bear the marks of traditional Aboriginal scarring or carving. They are likely to be confined to areas that have not been cleared. They are most commonly identified near streams where native vegetation remains, and may also occur on now-dead trees. These are unlikely to exist in the surface infrastructure area footprint because of extensive historic clearing but could occur elsewhere throughout the project area in areas of remnant vegetation.

5.2.5 Other less common site types

Ceremonial grounds, mythological sites, and burials can occur anywhere in the landscape, but preferred methods of interment have been recorded and their identification is very rare. Generally they would be identified by mounds of earth, carved trees or stone markers arranged in a conspicuous layout. Burial sites have been historically and orally noted by RAPs in association with hills or at the base of a hill in one instance (Mount Gingenbullen). Evidence of burials is generally rarer because human bodies are susceptible to taphonomic processes and have limited preservation in the archaeological record. Such sites are also more susceptible to the impacts of low-level development (such as farming) than other sites.

6 Archaeological survey

6.1 Survey method

6.1.1 Overview

The survey strategy was designed to address the type of potential project impacts from development of the surface infrastructure and underground mine. Therefore, the project area has been divided into two survey areas which are detailed in the following sections:

- *The surface infrastructure survey area* – which considered the surface infrastructure area where the primary impacts will be from earthworks. This focused on the direct disturbance footprint but also included land outside the footprint, including the Berrima Rail project area.

- *The underground mine survey area* – which considered the whole underground mine area but only focused on certain landscape features potentially susceptible to subsidence impacts.. This area went beyond the current underground mine area as its footprint at the time of survey extended further to the west (refer to survey transect in Figure 6.1). This area will receive direct surface impacts only where the down cast shafts will be installed on Carlisle Downs and in the Belanglo State Forest.

6.1.2 Surface infrastructure area survey area

i Strategy

Part of the survey targeted the surface infrastructure area in its various design footprints during the EIS period (refer to Chapter 7 of the EIS). The survey effort was weighted towards sampling landforms in the surface infrastructure area which were identified as having the potential to retain archaeological evidence in accordance with the predictive model (eg crests, land within 200 m of streams, stream banks). Notwithstanding, the survey generally followed the disturbance footprint which included large areas predicted to have low archaeological potential (eg plains and hill slopes over 200 m from streams).

The survey targeted all Aboriginal site types including obtrusive site types (eg rock shelters, grinding grooves and scarred trees) and sites identified solely through ground surface visibility (eg stone artefact scatters, hearths).

ii Field method

The archaeological survey and data collection methods followed Section 2.2 of the Code which sets out best practice recording methods. The survey of the surface infrastructure area comprised pedestrian field transects across defined landform elements. The survey team varied between seven to 10 people and inspected the ground surface of each transect while spaced within a 50 m wide corridor where possible (typically spaced between five and six metres apart). The two additional days of survey involved two archaeologists spaced across a 20 m wide corridor (10 m spacing).

These methods were considered to be suitable as a large portion of the project area was grassed, and exposures were easily identified at this spacing.

The survey team targeted ground exposures such as ploughed fields, vehicle and cattle tracks, eroded scalds and stream banks, all which provided good ground surface visibility for identifying Aboriginal objects. Ground surface visibility was hindered in thickly grassed paddocks in many parts of the surface infrastructure area.

The survey team inspected all mature trees within the transect paths and within the direct disturbance footprint. All outcropping sandstone was inspected for grinding grooves, rock pools or engravings.

6.1.3 Underground mine survey area

i Strategy

The archaeological survey in the underground mine area targeted all land where outcropping sandstone was known or predicted to occur above the mine footprint. The survey aimed to identify obtrusive site types, particularly those that are theoretically susceptible to subsidence impacts, ie rock shelters, rock carvings, grinding groove sites and rock pools. To target the obtrusive site types in the underground mine survey area, the following mapping was analysed:

- Geological mapping to identify areas with underlying geology of Hawkesbury Sandstone;
- Soil landscape mapping – to identify the landscapes above Hawkesbury Sandstone geology with outcropping sandstone bedrock or scarps. The geographic extent of the Hawkesbury soil landscape (outcropping sandstone over 50%) and the Nattai Tables landscape (outcroppping sandstone 10–20%) were targeted; and
- Topographic maps – to identify where cliff lines and scarp landforms were shown by contours. These maps also showed where deeply incised streams cut into sandstone as these areas are suitable landform elements for grinding grooves.

The areas predicted to have obtrusive site types were confined to the western side of the Hume Highway, primarily on scarp and cliff landforms and outcropping sandstone bedrock associated with stream channels.

The survey aimed to inspect all outcropping sandstone in the Hawkesbury and Nattai Tablelands soil landscapes within the proposed underground mine area but also included areas to the west which were previously planned for mining but are now outside the footprint.

The Soapy Flat Soil Landscape was also predicted to have outcropping sandstone but in very rare instances (less than 2%). Small portions of it were sampled on Evandale and in the Belanglo State Forest. It was observed during survey that streams in this soil landscape were consistently gently inclined open drainage depressions with no rock outcrop. Small sandstone boulders were identified in only one instance (Transect 37) on an area of higher relief, which is atypical for the soil landscape. Therefore it was unnecessary to target all stream channels in this soil landscape because of the negligible chance of rock shelters and the low chance of grinding grooves.

To test the survey predictions, areas predicted to have no outcropping sandstone were also sampled in the underground mine area. Accordingly, the Wongonbra property was sampled, which featured Bringelly Shale geology and Avoca, Moss Vale, Lower Mittagong and Kangaloon soil landscapes. Outcropping sandstone was identified in one of the only four pockets of the Avoca soil landscape in the project area. It was characterised by stony crests with boulders scattered sporadically across otherwise grassed paddocks (refer to site HC_175). These soil landscapes were also sampled in the surface infrastructure area and no outcrops were observed except for a few small sandstone boulders in a stream channel on the Kangaloon soil landscape (refer to site HC_138).

ii Field method

A large portion of the survey in the underground mine survey area was confined to scarp landforms comprising very narrow, deeply incised rocky streams that restricted the survey team's spacing. As such, the survey team unavoidably covered multiple landform elements simultaneously. For example, when narrow gorges were surveyed, their width was so small that the survey team was sometimes spaced across the stream channel, scarp foot slope, scarp and its crest all at once.

The transect spacing was adjusted in more open areas to cover the full extent of scarp on each side of a stream. One transect path was adequate to cover the scarp on both sides of a stream where the landscape was narrow enough. Alternatively, the survey team followed separate transects where the scarp on each side of a stream was too widely spaced.

In open low rolling hills (ie not constrained by narrow gullies and gorges) such as the Wongonbra and Evandale properties, the survey was conducted as per the method for the surface infrastructure survey area.

All outcropping sandstone was inspected for grinding grooves, rock pools or engravings. Rock shelters were inspected for Aboriginal objects, pigment or discernible art. Other site types such as open artefact sites and potential scarred trees, although not the focus of the survey in this area, were recorded where identified.

6.1.4 Survey limitations

The underground mine area is substantial and therefore the survey focused on areas predicted to contain rock shelters, grinding grooves and other sites related to outcropping sandstone. The survey covered all areas predicted to contain sandstone outcrops above the underground mine areas in accordance with the survey strategy described in Section 6.1.2. All archaeologically sensitive areas in the surface infrastructure area were targeted in accordance with the predictive model and direct disturbance footprints.

6.1.5 Landform division for sampling

Survey transects were recorded using the *Australian Soil and Land Survey Field Book* (CSIRO 2009) as a guide. The project area and surrounds were divided into 142 survey transects made up of the following landform class types:

- hill crests (including hill spur crests);
- hill slopes;
- foot slopes;
- undulating plains;

- stream banks;
- drainage depressions;
- scarps; and
- scarps and stream channels.

The landform classes generally follow those defined in CSIRO 2009 with the following exceptions: the term 'scarp' is used in this report to describe sloping areas that are characterised by outcropping sandstone bedrock. Scarps comprise a combination of landform elements including scarp foot slopes, scarps, and cliff lines where outcropping sandstone is present in the landscape 10% and above. This classification was broken down further with the term 'scarp and stream channel' which is used to define transects where the survey team covered both scarp and stream channel landforms in a single transect.

Aboriginal sites recorded on 'hill crest' survey transects were further defined as being on either a 'hill spur crest' or 'hill crest'. The distinction of 'spur' was used to further define the lateral crests of land that descend from the summit of hills. Spurs typically extend, with decreasing elevation, closer to streams and valley floors than the main crest of a hill or ridge. The landform descriptor 'modified' was assigned to sites that, although within a particular landform, were so heavily disturbed by construction or imported soils (eg dam wall bund) that their spatial context was indeterminable.

6.2 Identification and recording of Aboriginal sites

Aboriginal sites recorded during the survey included open stone artefact sites, grinding grooves, rock pools, rock shelters and potential scar trees. The rationale and issues surrounding the identification and recording of these sites are outlined below.

6.2.1 General recording method

Site recording was completed in accordance with the Code. Site locations were recorded using a hand-held non-differential GPS unit (MGA94 Zone 56). Site locations were checked using ArcGIS software. Survey transects were accurately mapped by downloading tracks recorded on GPS.

Photographs identifying landscape context and representative samples of site features were taken for each site. Grinding grooves and rock shelters were also sketched and published using Adobe Illustrator. These details are provided on relevant site cards which have been submitted to AHIMS.

6.2.2 Site recording methods

i Open stone artefact sites and isolated finds

These sites were defined by the presence of one (isolated find) or more (open stone artefact site) Aboriginal objects. The boundaries of a site were limited to the spatial extent of the observed Aboriginal objects. The mapped 'site areas' in this report do not include the assumed extent of subsurface archaeological deposits (refer to the term 'PAD' below).

Sites were recorded by marking each artefact location or each cluster of artefacts within a 5 m radius as a separate waypoint in the GPS. Site boundaries were allocated by drawing a line around the cluster waypoints for each site using ArcGIS software. Stone artefacts more than 50 m apart were recorded as separate sites although this technique may not reflect the subsurface character between the 50 m distances. The 50 m rule is an arbitrary distinction and is mainly used as a tool for the consistency of results and for comparison with Aboriginal sites beyond the project area.

ii Potential archaeological deposits (PAD)

PADs are technically separate to sites as they are defined as the predicted extent of subsurface Aboriginal objects in a particular area. PADs are not technically Aboriginal sites until, and if, Aboriginal objects are identified, usually through archaeological excavation. PAD has been assigned to the landforms or portions of the landforms which are distinguishable from the surrounding landscape (eg elevated areas with good outlook) as being areas that are likely to retain higher artefact densities than the continuous distribution of archaeological material in which they exist. The identification of PAD assisted in identifying suitable areas for subsurface test excavation.

The 'PAD areas' mapped in this report apply to the inferred extent of subsurface deposits that were defined during the survey fieldwork. PAD areas are also mapped around open stone artefact sites where subsurface deposits are likely to extend beyond known artefact extents.

Following the results of the archaeological test excavation (refer to Chapter 7), it is considered that the areas of archaeological sensitivity mapped in Figures 8.1 and 8.2 should also be used as a guide to the subsurface distribution of artefacts near individual sites, rather than solely relying on the mapped PAD areas.

iii Rock shelters

Rock shelters with one or more Aboriginal objects visible on the rock shelter floor (stone artefacts in the case of this assessment) were recorded as the site type 'rock shelter with deposit'. Rock shelters without evidence of occupation but with floor soil deposit and sufficient room and shelter for at least one adult, were recorded as 'rock shelter with PAD'. The minimum rock shelter dimensions for this category were generally a roof height, length and depth of one metre in each direction (1 m^3). Theoretically, excavation of any of these shelter deposits may recover stone artefacts and other cultural deposits.

Rock shelters with only bare rock floors and no floor soil deposit (or art) were not recorded: there is no empirical way to verify occupation without the presence of a soil deposit, pigment or engravings. The criteria used to define rock shelters follows those established by Kuskie (for example, refer to Kuskie 2012a, p.88).

Each rock shelter was measured in general dimensions, sketched in plan and elevation view with features such as stone artefact, art/pigment locations and other features of interest marked on the sketches.

iv Grinding grooves and rock pools

Grinding grooves were defined as an area of outcropping sandstone containing evidence of one or more grinding grooves where ground-stone hatchets or other ground instruments were manufactured. Aboriginal rock pools were identified as circular depressions in sandstone which appeared to have been modified and enlarged by grinding tools. Some rock pools had small engraved channels diverting water into particular rock pools.

v Modified trees

Modified trees (either carved or scarred) can be difficult to identify.

Scars commonly occur on trees through natural processes such as branch tears. However, Aboriginal people were recorded using bark and cambium for canoes, containers, implements and other uses. The modified trees recorded during the survey were identified by Aboriginal site officers and have been evaluated against the publication *Aboriginal scarred trees in New South Wales: a field manual* (DEC 2005). At present they remain classed as 'potential scar trees', as they do not clearly show the necessary attributes based on the field manual.

6.3 Survey results

6.3.1 Overview

EMM archaeologists, accompanied by Aboriginal site officers and Hume Coal representatives, surveyed the project area and its surrounds in four stages (Stage 1 to Stage 4) between May 2014 and September 2015. The survey was undertaken over 16 days. Stages 1 and 2 sampled the underground mine area and Stages 3 and 4 sampled the surface infrastructure area and the Berrima Rail Project area. Additionally, EMM archaeologists inspected minor project changes on 19 and 20 April 2016. An overview of the survey is shown in Figure 6.1 with more detail shown in Figures 6.2 to 6.6.

6.3.2 Survey coverage data

i Rationale

The aim of recording and analysing survey coverage data is to determine the effectiveness of the survey. It is evaluated for its effectiveness in identifying the distribution of Aboriginal objects across the landscape, taking into account the potential for archaeological deposits. The percentage of the ground surface exposed in each landform and the visible ground surface within exposures (as ground exposures are often obscured by vegetation, gravels etc) influences the survey results. For example, an archaeologically sensitive landform surface that is highly exposed by erosion is likely to reveal Aboriginal artefacts, whereas a similar landform that is thickly grassed is unlikely to reveal any surface artefacts. Where there is limited visibility, subsurface testing is a more suitable method to test the predicted archaeological resource.

Overall, calculation of the effective survey coverage is used to estimate not only how much area was physically surveyed, but also how favourable the conditions were for the identification of Aboriginal sites. Therefore, an assessment of the effectiveness of survey coverage is important in determining further investigation measures such as the requirement for test excavation.

ii Coverage results

The survey comprised 142 pedestrian transects, adding up to a distance of approximately 124 km. A total of 118 transects were conducted in the project area. The remaining transects were either in the Berrima Rail project area or slightly outside the project area. The survey team covered approximately 63 km of transects in the underground mine survey area and 54 km in the surface infrastructure area. Landform coverage is summarised in Table 6.1 and survey coverage details for each transect are provided in Appendix C. Examples of varying ground surface exposure and visibility conditions in the project area are shown in Plate 6.1 to Plate 6.6.

Figure 6.1 presents the survey transects logged by GPS and represents only where the GPS holder walked during the survey. It does not represent the broader transect width covered by the survey team (typically 50 m).

The average effective survey coverage results across the project area was 15.3% and ranged from 1% to 72% across individual transects.

Table 6.1 Landform survey coverage summary

Landform	Length (m)	Proportion of survey (%)	Area covered (m²)	Area effectively surveyed (m²)	% of landform effectively surveyed
Drainage depression	7,997	6.5	381,953	38,721	10
Foot slope	5,240	4.2	261,984	29,808	11
Hill crest	39,672	32.1	1,934,327	454,994	24
Hill slope	17,325	14.0	803,863	56,162	7
Scarp	22,728	18.4	1,136,414	217,641	19
Scarp and stream channel	14,475	11.7	689,289	140,520	20
Stream bank	5,995	4.8	299,744	47,745	16
Undulating plain	10,315	8.3	478,429	27,122	6
Total	**123,747**	**100**	**5,986,003**	**1,012,713**	**N/A**

The landform type most surveyed was hill crest (32% of the survey) which also had the highest effective coverage results (24%). Most of this landform type was covered in the surface infrastructure area, Wongonbra and the southern parts of the Evandale property. In these areas the landscape is characterised by cleared and ploughed paddocks, with small pockets of remnant native vegetation often bordering streams. The high effective coverage on this landform class was primarily because the survey transects coincided with larger exposures such as vehicle tracks, plough lines and scalds on crests.

Scarps received a similar proportion of the survey effort (totalling 30% when 'scarp and stream channel' and 'scarp' landforms are combined). Most of the surveyed scarps were in the Belanglo State Forest amongst native vegetation which sometimes bordered onto pine plantations. Scarps received a high effective coverage result (19%) which is attributed to frequent outcropping sandstone. However, smaller Aboriginal objects, such as stone artefacts, were rarely found on this landform type (excluding those found on rock shelter floors), because much of the exposed sandstone was in the form of boulders, overhangs, or cliffs which had not accumulated soil.