Appendix 15

Aboriginal Archaeological Values Assessment

ABORIGINAL ARCHAEOLOGICAL VALUES ASSESSMENT

UNITED WAMBO PROJECT

SINGLETON LOCAL GOVERNMENT AREA

APRIL 2016

REPORT PREPARED BY

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FOR GLENCORE/PEABODY ENERGY

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Acknowledgement

OzArk acknowledge Traditional Owners of the area on which this assessment took place and pay respect to their beliefs, cultural heritage and continuing connection with the land. We also acknowledge and pay respect to the post-contact experiences of Aboriginal people with attachment to the area and to the elders, past and present, as the next generation of role models and vessels for memories, traditions, culture and hopes of local Aboriginal people.

EXECUTIVE SUMMARY

This Aboriginal scientific values assessment has been prepared by OzArk Environmental & Heritage Management for the *Environmental Impact Statement* for the United Wambo Project. The Aboriginal scientific values assessment has been undertaken in accordance with the Secretary's *Environmental Assessment Requirements* (SEARs) and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011). This report will form part of the overarching *Aboriginal Cultural Values Assessment*.

Assessment of the Survey Area took place with the assistance of Registered Aboriginal Parties and Wonnarua Knowledge Holders from March 2015 and has included a 19 day survey program and a test excavation and auger program that ran from 27 July to 11 August 2015 (see **Section 2** for further details).

The assessment of the Survey Area recorded 25 artefact scatters, 34 isolated finds and 20 extensions to previously recorded sites (all artefact scatters). Within the site extensions are a further nine previously recorded sites that have been subsumed into the larger site area (see **Section 6** for further details).

In addition, there are a further 49 sites listed on AHIMS as valid or partially destroyed. Of these 49 sites, 36 (73 per cent) are listed as artefact scatters, 11 (22 per cent) as isolated finds and two as PADs.

Therefore, in total, this assessment considers 128 sites. All of these sites are stone artefact sites as no other site type was recorded during the survey or remains extant from previous recordings.

The results of the test excavation program were surprisingly sparse. 153 0.5m by 0.5m excavation squares were excavated at six separate localities: a total of 38.25 square metres. From this area of excavation, 192 artefacts were recovered; an average of 1.25 artefacts per excavation square. This density of artefacts is extremely low (see **Section 7** for further details).

As a result of the survey and test excavation results, the majority of sites (n=122; 95 per cent of all 128 sites) have been assessed as having low scientific significance. In most cases this is because the sites are low density artefact scatters or isolated finds located in landforms with thin A Horizon soils where further subsurface archaeological deposits are unlikely. In some cases the artefacts may be more numerous but erosion has affected a large percentage of the site and the visible artefacts are displaced and of limited archaeological value. The remaining six sites have been assessed to have a low-moderate scientific significance. Due to the level of disturbance within the Survey Area, no sites have been assessed as having a high or moderate scientific significance (see **Section 9** for further details).

For the purposes of this assessment it is assumed that 127 sites (80 artefact scatters, 45 isolated finds and two PADs) will be harmed (totally) by the Project. One site (Wambo 202; #37-5-0343)

will be partially harmed by the Project. Those sites within the Project Disturbance Boundary would be harmed by the proposed open cut pit, emplacement areas and other axillary infrastructure should the Project be approved.

A series of management options are advanced in this report to manage these impacts. Eight sites are recommended for further subsurface investigation and all sites will be salvaged by a surface collection and recording of all visible surface artefacts (see **Section 10** for further details).

In the face of the proposed works, it is hoped that the archaeological management strategy proposed here will ensure that management not only removes artefacts from direct impact but, within a research framework, our understanding of the archaeological record within the Survey Area will be enhanced.

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FIGURES

TABLES

1 PROJECT BACKGROUND

1.1 INTRODUCTION

The United Mine (United) and Wambo Mine (Wambo) are situated approximately 16km west of Singleton in the Hunter Valley of New South Wales (NSW; **Figure 1–1**). United is owned 95 per cent by Glencore Coal Pty Limited (Glencore) and five per cent by the Construction, Forestry, Mining and Energy Union (CFMEU) and is managed by Glencore. Wambo is an existing coal mining operation and is a neighbour operation to United. Wambo Coal Pty Limited (Wambo Coal) is a subsidiary of Peabody Energy Australia Pty Limited (Peabody).

The United and Wambo coal mining operations were established in 1989 and the late 1960s, respectively. There have been a range of underground and open cut coal mining operations at both of these adjoining coal mines since that time, with a number of agreements entered into by United Collieries Pty Limited (United Collieries) and Wambo Coal over time in relation to access to underground and open cut coal reserves within mining titles held by each company.

Whilst open cut coal mining has previously been undertaken at United, over the last two decades the focus has been on underground mining. Underground longwall mining operations were approved to provide up to 2.95 million tonnes per annum (Mtpa) of saleable coal. Operations were suspended at United in March 2010 with the mine entering a period of care and maintenance. At that time, exploration and pre-feasibility works were commenced to determine the potential for future mining activities within United's mining lease. Ongoing exploration has identified substantial reserves of coal suitable for open cut mining.

The current existing and approved Wambo open cut coal mine adjoins the United operations, and was planned to produce up to 8 Mtpa of run of mine (ROM) coal up to 2017. The combined Wambo underground and open cut operations, have approval to extract up to 14.7 Mtpa run of mine (ROM) coal, and to transport up to 15 Mtpa product coal via the approved train loading facility until 2025.

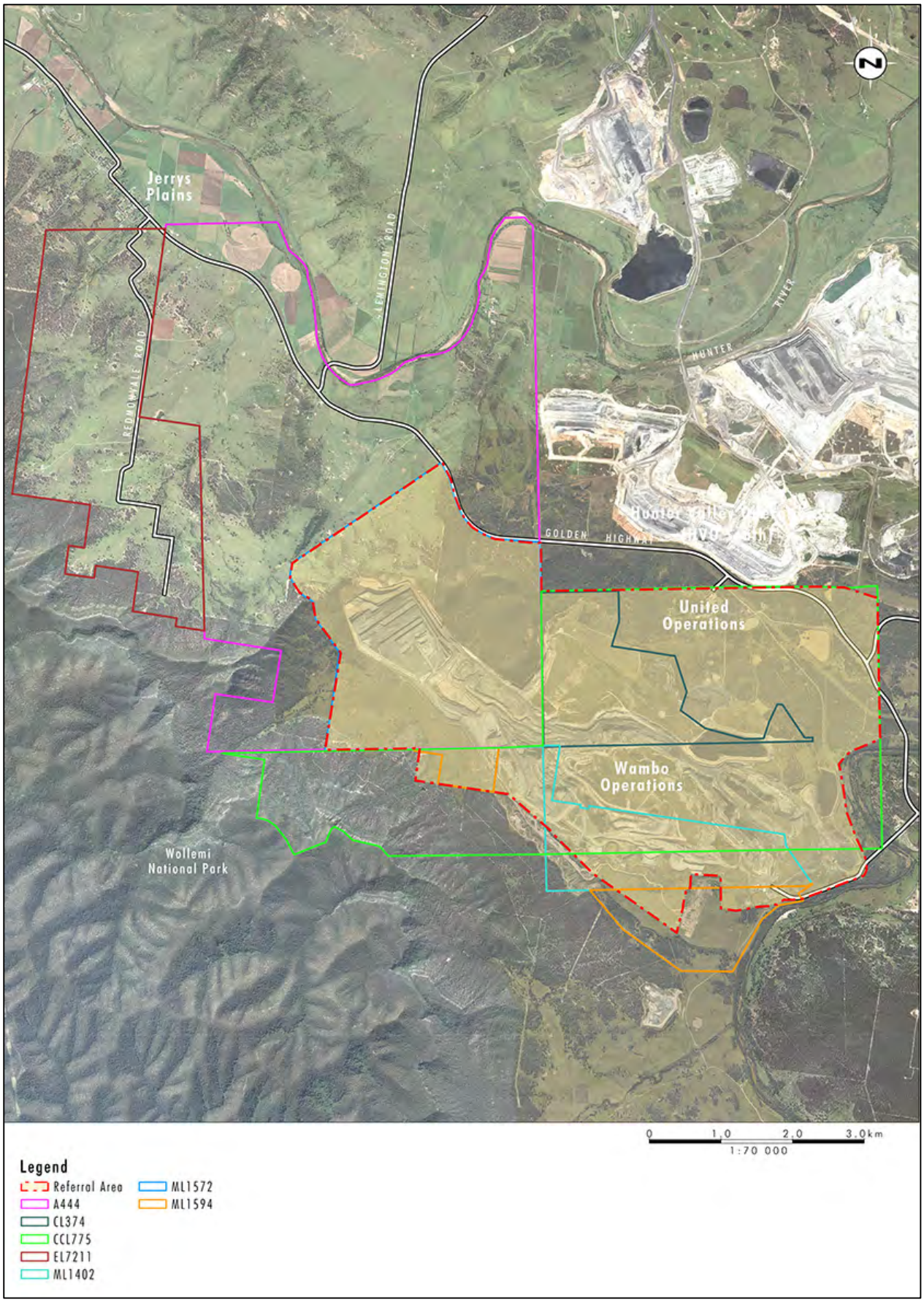
In November 2014, a 50:50 Joint Venture between United Collieries Pty Limited (United Collieries) and Wambo Coal Pty Limited (Wambo Coal) was announced which combines the extraction and exploration rights for a number of mining tenements at United and Wambo (**Figure 1–2**). The Joint Venture will look to develop the United Wambo Open Cut Coal Mine Project (the Project) that combines the existing open cut operations at Wambo with a proposed new open cut coal mine at United.

The Project is a State Significant Development as defined under *State Environmental Planning Policy (State and Regional Development) 2011* and will require development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project will also require a modification to the existing Wambo development consents under section 75W of the

EP&A Act. An Environmental Impact Statement (EIS) has been prepared to accompany these applications. This Aboriginal scientific values assessment has been prepared by OzArk Environmental & Heritage Management (OzArk) for the EIS for the Project. The Aboriginal scientific values assessment has been undertaken in accordance with the Secretary's *Environmental Assessment Requirements* (SEARs) and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011).

Figure 1-1. Location of the Project.

Figure 1-2. Existing mining and exploration lease areas.



1.2 PROJECT OVERVIEW

The Project includes open cut mining operations in two areas, the proposed United Open Cut and modified operations in the approved Wambo Open Cut for a period of approximately 21 years. The existing Wambo Open Cut has approval for continued open cut mining until 2017. The Project seeks to modify the approved mine plan for the Wambo Open Cut to access additional resources from within existing mining and exploration tenements held below the Wambo Open Cut.

The Joint Venture is anticipated to deliver up to 10 Mtpa of ROM coal production in total from the combined management of the United Open Cut and Wambo Open Cut mines. The existing Wambo Coal Handling and Preparation Plant (CHPP) will be utilised for the Project, with no change proposed to the CHPP's approved annual throughput of 14.7 Mtpa ROM coal feed. The Wambo CHPP will also continue to receive coal from the ongoing Wambo underground mine (that is not the subject of this Project).

The Project requires a number of changes to the layout of existing open cut mining, public and private infrastructure within the Project Area. The Project will provide continued employment for the existing Wambo open cut workforce and create additional employment from the development of the Project.

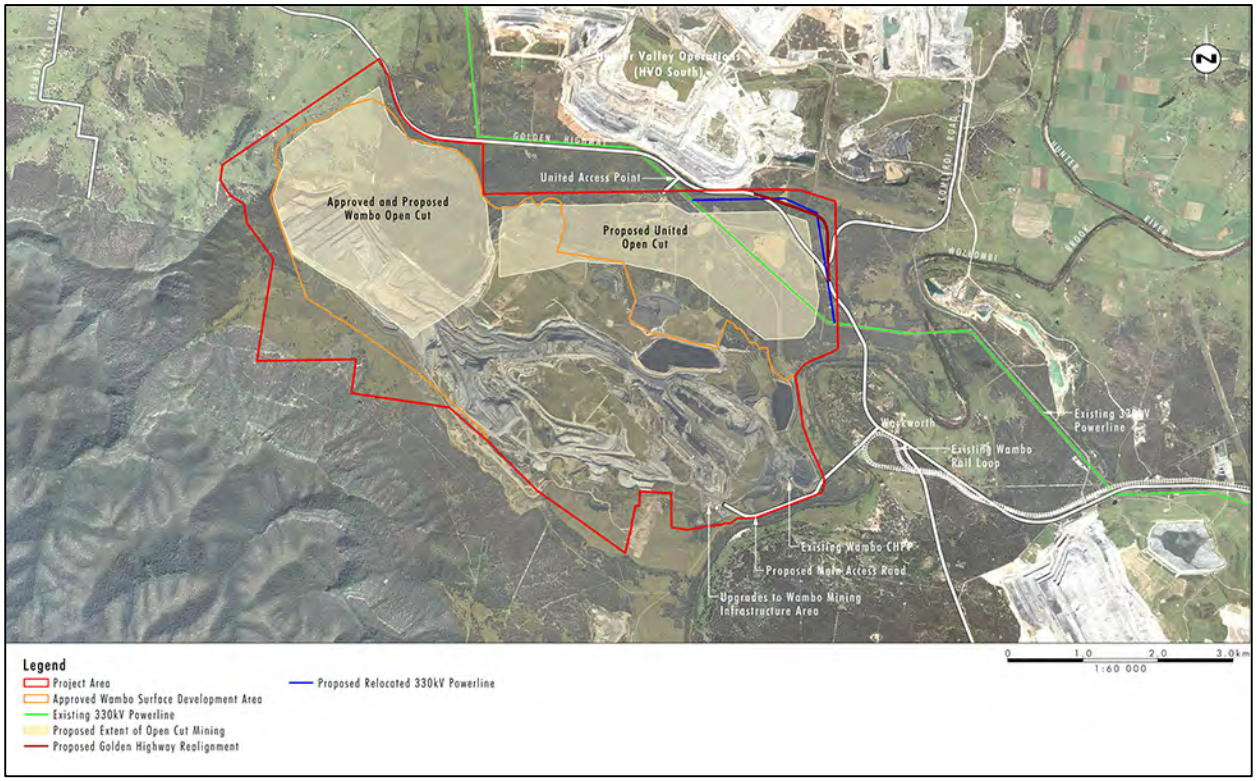
The key aspects of the Project are shown in **Figure 1–3** and a summary of the key Project details is provided in **Table 1–1**. The Project Disturbance Boundary is the area in which all Project-related impacts will be contained.

Table 1-1. Summary of key Project details.

Key Project Components/Aspects	Proposed Operations
Key feature of the Project	The operation of a multi-seam open cut mining operation integrating the existing and approved Wambo Open Cut under a modified mine plan and the proposed United Open Cut.
Total Economically Recoverable Reserve	Approximately 110 million tonne (Mt) of ROM coal from the United Open Cut. In total, approximately 66 Mt of ROM coal from the Wambo Open Cut, including an additional 39Mt accessed from the depth of mining modification.
Extraction Rates	Up to 10 million tonne per annum (Mtpa) ROM coal.
Life-of- Mine	Approximately 21 years from granting of approval.
Operating Hours	24 hours per day, 7 days per week.
Number of Employees	Up to 500 total operational employees.
Mining Methods	Open cut mining using a truck and excavator fleet.
Extent of Mining Areas	Refer to **Figure 1.3** for the proposed extent of open cut mining. The Project proposes realignment of the Wambo Open Cut boundary to maximise resource recovery. The realignment would result in approximately 5 hectares of additional disturbance for the approved Wambo Open Cut mine.
Infrastructure	Initial use of existing United mine infrastructure area prior to its decommissioning and removal due to the progression of the United Open Cut. Construction of temporary facilities in the construction phase in the mining infrastructure area within United lease CCL775. Expand and upgrade Wambo Mining Infrastructure Area. Use of existing Wambo CHPP, coal handling facilities and train loading facility.

Key Project Components/Aspects	Proposed Operations
Tailings and Rejects Strategy	Decommissioning and capping of existing tailings storage facilities located in areas proposed for overburden emplacement and ongoing use of existing tailings storage facilities and storages established in other mine voids as required. Coarse rejects from coal preparation to be transported by truck to the open cut overburden areas for emplacement and subsequent covering by overburden material. Coarse rejects will continue to be co-disposed within the open cut overburden areas for the life of operations.
External Coal Transport	Product coal will continue to be transported off site via rail from the existing Wambo train loading facility. Product coal transport rates proposed to increase from six to eight trains per day.
Roads	Realignment of a 2 kilometre section of the Golden Highway to accommodate the proposed United Open Cut. The main entrance to the Project will be via the current entrance to Wambo. The existing United access road will be used in the initial phase for construction and ancillary services with limited ongoing use as a property access point.
Power Infrastructure	An existing 330 kV transmission line which traverses CCL775 is proposed to be relocated as part of the Project. Several other 66 kV and 11kV power lines will also require relocation outside of proposed mining areas.
Water Management	Construction of additional mine water management controls. Use of the United underground mining voids for water storage.

Figure 1-3. The Project.



1.3 RELEVANT LEGISLATION

Cultural heritage is managed by a number of state and national acts. Baseline principles for the conservation of heritage places and relics can be found in the *Burra Charter* (Australia ICOMOS 2013). The *Burra Charter* has become the standard of best practice in the conservation of heritage places in Australia, and heritage organisations and local government authorities have incorporated the inherent principles and logic into guidelines and other conservation planning documents. The *Burra Charter* generally advocates a cautious approach to changing places of heritage significance. This conservative notion embodies the basic premise behind legislation designed to protect our heritage, which operates primarily at a state level.

A number of Acts of parliament provide for the protection of heritage at various levels of government.

1.3.1 State Legislation

Environmental Planning and Assessment Act 1979 (EP&A Act)

This Act established requirements relating to land use and planning. The framework governing environmental and heritage assessment in NSW is contained within the following parts of the EP&A Act:

- **Part 4:** Local government development assessments, including heritage. May include schedules of heritage items;
    - **Division 4.1:** Approvals process for state significant development;
- **Part 5:** Environmental impact assessment on any heritage items which may be impacted by activities undertaken by a state government authority or a local government acting as a self-determining authority; and
- **Part 5.1:** Approvals process for state significant infrastructure.

Secretary's *Environmental Assessment Requirements* (SEARs)

Sears relating to Aboriginal heritage aspects this Project state:

> *An assessment of the likely impacts of the development on Aboriginal heritage (cultural and archaeological), including consideration of the significance of these objects or declared places to Aboriginal people and having regard to the OEH's* [Office of Environment and Heritage] *requirements.*

In particular the Project SEARs state that the following documents and guidelines should be followed:

- *The Burra Charter* (The Australia ICOMOS charter for places of cultural significance);

- *Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation* (DP&E);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (OEH) (ACHCRs; DECCW 2010b);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (OEH) (Code of Practice; DECCW 2010); and
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH).

OEH requirements state:

> *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 development 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 the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2010) and consultation with OEH regional officers.*
>
> *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.*
>
> *Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The 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.*

Project Specific Requirements

> *A. 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.*
>
> *B. The EIS must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the [development/project) to formulate appropriate measures to manage unforeseen impacts.*

C. 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.

National Parks and Wildlife Act 1974 (NPW Act)

Amended during 2010, the NPW Act provides for the protection of Aboriginal objects (sites, objects and cultural material) and Aboriginal places. Under the Act (Part 6), an Aboriginal object is defined as:

any deposit, object or material evidence (not being a handicraft for sale) relating to indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction, and includes Aboriginal remains.

An Aboriginal place is defined under the NPW Act as an area which has been declared by the Minister administering the Act as a place of special significance for Aboriginal culture. It may or may not contain physical Aboriginal objects.

As of 1 October 2010, it is an offence under Section 86 of the NPW Act to 'harm or desecrate an object the person knows is an Aboriginal object'. It is also a strict liability offence to 'harm an Aboriginal object' or to 'harm or desecrate an Aboriginal place', whether knowingly or unknowingly. Section 87 of the Act provides a series of defences against the offences listed in Section 86, such as:

- The harm was authorised by and conducted in accordance with the requirements of an *Aboriginal Heritage Impact Permit* (AHIP) under Section 90 of the Act;
- The defendant exercised 'due diligence' to determine whether the action would harm an Aboriginal object; or
- The harm to the Aboriginal object occurred during the undertaking of a 'low impact activity' (as defined in the regulations).

Under Section 89A of the Act, it is a requirement to notify the OEH Director-General of the location of an Aboriginal object. Identified Aboriginal items and sites are registered on Aboriginal Heritage Information Management System (AHIMS).

1.3.2 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Amendments in 2003 established the National Heritage List and the Commonwealth Heritage List, both administered by the Commonwealth Department of the Environment. Ministerial approval is required under the EPBC Act for proposals involving significant impacts to National/Commonwealth heritage places.

1.3.3 Applicability to the Project

Any Aboriginal sites within the Project Area are afforded legislative protection under the NPW Act.

The current Project will be assessed under Part 4, Division 4.1 of the EP&A Act. As a Division 4.1 consent, management of Aboriginal cultural heritage will be conducted under an approved Aboriginal Cultural Heritage Management Plan (ACHMP) rather than an AHIP.

The SEARs have been followed. Community consultation has followed the ACHCRs (DECCW 2010b) and the current assessment has followed the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011) and the Code of Practice. This report details the archaeological investigation of the material culture of the Survey Area while the *Aboriginal Cultural Heritage Assessment* (ACHA) of which this report forms part shall consider the intangible cultural connections within the Project Area. This report discusses Project impacts to Aboriginal cultural heritage objects and places, and recommends management in the face of those impacts in so far as the material cultural remains within the Project Area are concerned.

The EPBC Act does not apply to Aboriginal Cultural Heritage within the Project Area.

It is noted that the Project Area includes land currently subject to Native Title Claim (Scott Franks and Anor on behalf of the Plains Clans of the Wonnarua People, Tribunal file no. NC2013/006). The Proponent will need to obtain legal advice as to whether land tenure will require Native Title consultation.

2 THE ARCHAEOLOGICAL ASSESSMENT

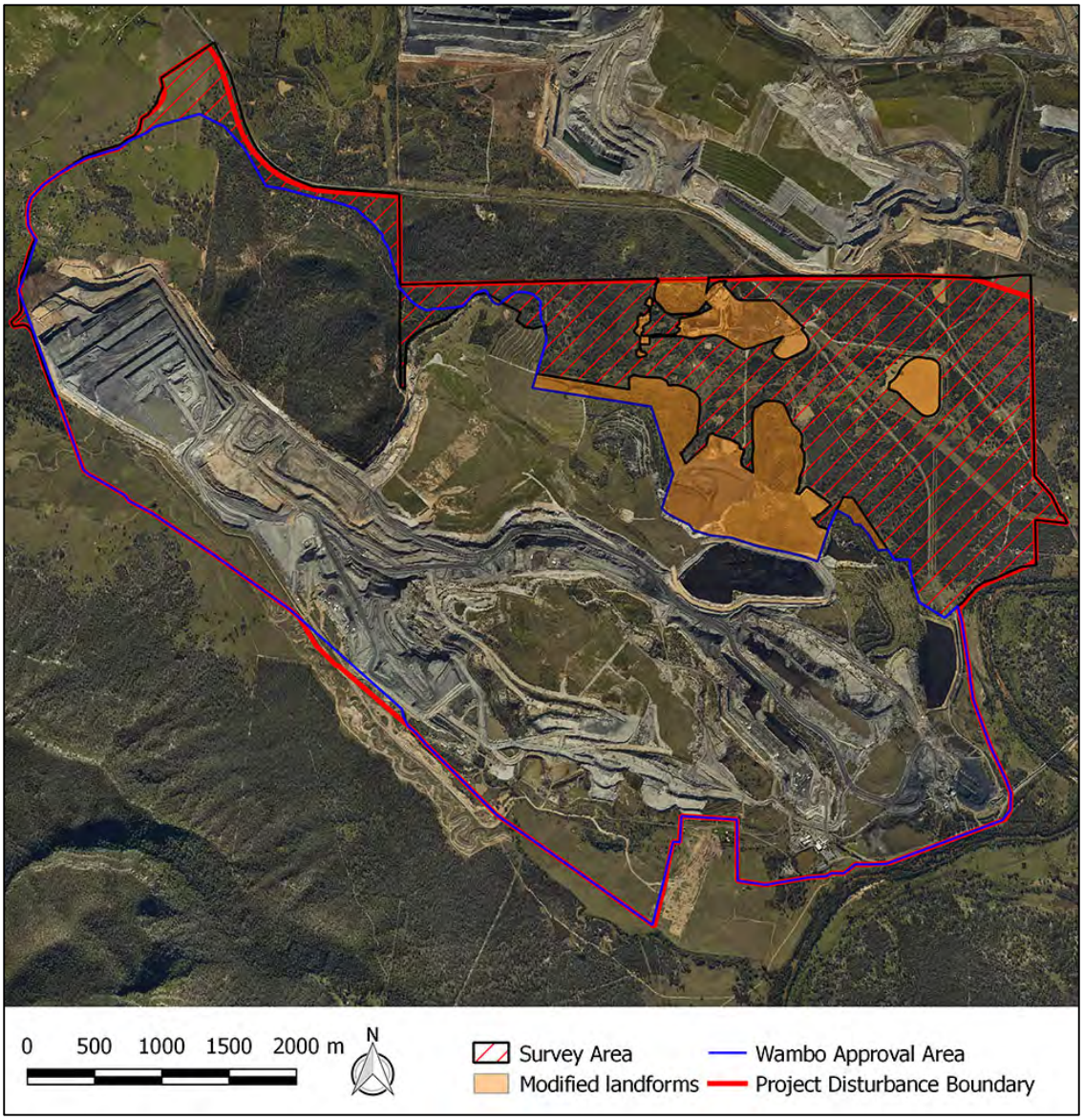
2.1 THE SURVEY AREA

This report uses the term Survey Area to denote the area in which this archaeological investigation is focused. The Survey Area forms a portion of the Project Area and is comprised of all areas that are not:

- Extensively modified by mining activity. This includes pit areas, emplacement dumps and major dams; and
- Already approved for disturbance by approvals consented to the Wambo mine.

Figure 2–1 shows the Survey Area in relation to the Project Area. It is within the Survey Area that all archaeological investigations within this report took place and where all discussion on environment and past archaeological investigations is focused.

Figure 2-1. Aerial showing the Survey Area in relation to the Project Disturbance Boundary.



2.2 INTRODUCTION TO THE ARCHAEOLOGICAL ASSESSMENT

The archaeological assessment for the Survey Area was undertaken by OzArk from March 2015 to September 2015.

This report contains:

- A study of the archaeological and environmental context of the Survey Area (**Sections 3** and **4**);
- The methodology and results of the archaeological survey of the Survey Area (**Sections 5** and **6**);
- The methodology and results of test excavation and auger program undertaken within the Survey Area (**Section 7**);
- Discussions of the results from the survey and excavation (**Section 8**);
- An assessment of scientific significance for all Aboriginal sites within the Survey Area based on the results of the survey and excavation (**Section 9**); and
- Discussion of archaeological management options based on the assessment of scientific significance; and archaeological mitigation strategies for sites likely to be harmed by the Project (**Section 10**).

2.3 DATE OF ARCHAEOLOGICAL ASSESSMENT

The fieldwork component of this assessment was undertaken by OzArk, Registered Aboriginal Parties (RAPs) and Wonnarua Knowledge Holders over the course of several months between March and September 2015. The survey, test excavation and auger program during this time was broken in nine weeks with not all weeks being five day working weeks. Specifically this involved 31 field days, namely:

- Week 1: 23-27 March (5 days; survey);
- Week 2: 30 March – 2 April (4 days; survey);
- Week 3: 8-10 April (3 days; survey);
- Week 4: 15-17 April (3 days; survey);
- Week 5: 22-24 June (3 days; survey);
- Week 6: 27-31 July (5 days; test excavation);
- Week 7: 3-7 August (5 days; test excavation);
- Week 8: 10-11 August (2 days; test excavation); and
- Week 9: 17 September (1 day; survey).

2.4 ABORIGINAL COMMUNITY INVOLVEMENT

RAPs and Knowledge Holders assisted with and contributed to the field work on all days based on a roster organised by the Project team. Details of who worked which days are available from

the Project and further details of community consultation is presented in ACHA. In general, there were at least eight RAPs or RAP representatives present on each day.

Documents pertaining to the assessment of archaeological values were issued to RAPs and Knowledge Holders at various times through the course of the Project. These documents are presented in the appendices to this report namely:

- **Appendix 1**: Archaeological Survey Methodology Phase 1 (March 2015);
    - This document is the main survey methodology for the survey of the Survey Area.
- **Appendix 2**: Archaeological Survey Methodology Phase 2 (May 2015);
    - This document is an addendum to the document presented in **Appendix 1** to take into account the survey of an expanded Survey Area.
- **Appendix 3**: Archaeological Survey Results Phase 1 (May 2015);
    - This document was issued to RAPs and Knowledge Holders for their information to provide information on the results of the Phase 1 survey.
- **Appendix 4**: Archaeological Survey Results Phase 2 (September 2015);
    - This document was issued to RAPs and Knowledge Holders for their information to provide information on the results of the Phase 2 survey.
- **Appendix 5**: Archaeological Test Excavation Methodology (July 2015);
    - This document establishes the methodology for the test excavation program within the Phase 1 Survey Area.
- **Appendix 6**: Archaeological Test Excavation Methodology Additional Area (July 2015);
    - This document is an addendum to the document presented in **Appendix 5** to include two areas of investigation based on the results of the Phase 2 survey (**Appendix 2**).
- **Appendix 7**: Archaeological Test Excavation Summary (August 2015).
    - This document was issued to RAPs and Knowledge Holders for their information to provide information on the results of the test excavation program.

2.4.1 Comments on survey methodology

The survey and test excavation methodologies (**Appendices 1**, **2**, **5** and **6**) were issued to all RAPs and Knowledge Holders for comment. On each occasion, at least 28 days were provided to allow reasonable time for RAP consideration and comment.

Comments on the survey methodologies were received from RAPs and Knowledge Holders were responded to by both OzArk and the Project team (Glencore). The comments and responses concerning the survey methodology are included in the appendices to this report, specifically:

- **Appendix 8**: Plains Clans of the Wonnarua People (PCWP) response to the survey methodology;
- **Appendix 9**: Glencore response to PCWP concerning the survey methodology comments;
- **Appendix 10**: Wonnarua Traditional Custodians Native Title Aboriginal Corporation (WTCNTAC) response to the survey methodology; and
- **Appendix 11**: Glencore response to WTNTAC concerning the survey methodology comments.

All comments on the survey methodology were carefully considered and amendments made to the survey methodology where applicable. The changes made to the survey methodology are set out in **Appendix 9** and **Appendix 11**.

2.4.2 Comments on survey efficiency

During the course of the survey, the WTNTAC commented in writing that they believed the survey methodology was not being followed and that, as a result, survey efficiency had been compromised. Correspondence concerning this matter is set out in the appendices to this report, specifically:

- **Appendix 12**: WTNTAC complaint concerning survey effectiveness; and
- **Appendix 13**: Glencore response to WTNTAC complaint concerning survey effectiveness.

This comment was taken very seriously by both OzArk and the Glencore Project team and the detailed response is set out in **Appendix 13**. In summary, it was held that the WTNTAC misunderstood the role of survey in an archaeological investigation and that the survey methods employed by OzArk during the survey were more than adequate to accurately characterise the archaeological values of the Survey Area.

2.4.3 Comments on the test excavation methodology

The PCWP provided a detailed and considered comment on the test excavation methodology that was responded to by OzArk and Glencore. Correspondence concerning this matter is set out in the appendices to this report, specifically:

- **Appendix 14**: PCWP comment concerning the test excavation methodology; and
- **Appendix 15**: Glencore response to the PCWP comment on the test excavation methodology.

OzArk, working with the advice of Jakub Czastka, Senior Archaeologist for Tocomwall on behalf of the PCWP, appreciated the concern the PCWP held for a fuller understanding of the geomorphological history of the Survey Area; particularly with concern to buried (Pleistocene) soil

layers that may not necessarily be detected during standard survey or test excavation investigations. Another major concern for the PCWP was the lack of a 'scientific' predictive model to guide the test excavation methodology.

The response to these concerns is set out in **Appendix 15** although, in summary, the following points can be made:

- Based directly on the concerns raised by the PCWP, an extensive auger program was included within the test excavation program. While this only partially contributed to a geomorphological understanding of the Survey Area, it was devised to ensure that a number of locations were investigated to ensure that the soil profiles within the Survey Area were understood. This ensured that the investigations had confidence that buried soil layers were not common and that the survey and test excavation programs were adequately assessing the archaeological potential of the Survey Area; and
- As noted in **Appendix 15**, the PCWP desire for a more rigorous predictive model was appreciated but was not seen as applicable either to the Survey Area or to the test excavation methodology. In summary, theoretical outcomes as set out in the PCWP comment, rely on a robust data set that could not hope to be gained through the statutory constraints of a test excavation program.

2.4.4 Comments on the draft version of this report

A draft version of this report was issued to all RAPs and Knowledge Holders on 8 January 2016 for a 28 day review period that concluded on 10 February 2016.

Following the review period, two comments were received that are presented in the appendices to this report. Specifically these comments are presented as:

- **Appendix 16**: Wanaruah LALC comment on the draft scientific values report; and
- **Appendix 17**: PCWP comment on the draft scientific values report.

2.4.4.1 Response to Wanaruah LALC comment

The Wanaruah LALC contains four main comments which will be responded to individually below (Wanaruah LALC comments in italics).

> *We have reviewed the above document and from a scientific point-of-view it seems to be a thorough assessment covering the excavation and surveying process and of what was found. However, it is disappointing that no acknowledgement appears to have been made in this document, to the input and consultation of the Aboriginal community. We are aware that there will be separate Aboriginal cultural assessments produced and it is hoped that credit will be given in the reports to the input of all stakeholders not just the umbrella groups. A listing of those individual representatives from the stakeholder groups and what days they were present on site, would have been helpful in this scientific archaeological report.*

Response: OzArk does acknowledge the contribution of all RAPs, Knowledge Holders and their representatives who may have participated in the field program. Specifically, in **Section 2.5** this acknowledge is made as far as the investigation of scientific values is concerned. The overarching ACHA, of which this report is part, will outline the RAP and Knowledge Holders' contribution of cultural knowledge to the Project. A list of all names and the groups the personnel represented is held by the Project but as this aspect was not organized by OzArk this information is not included in the report.

> *Page 273 (line 2) states "A site displaying either a large number of artefacts or a number of interesting artefacts would engender fascination and discussion on purely archaeological grounds (Where did people live I eat? How did they live? How did they use the artefact and what does it tell us about the people who made it?)" Surely these would be interest from Aboriginal cultural grounds, not 'purely' archaeological grounds! We don't ask those questions? Where does the scientific grounds fall into these questions?*

Response: The author was not imagining that these are not cultural concerns but was emphasising that such questions form the basis of archaeological study but are not confined to the professional archaeological community alone but are of interest to a broad range of people, including Aboriginal people. This passage is within **Section 9.3** and the full context should be read as it is saying that Aboriginal people and others interested in prehistory ask precisely these questions: not just archaeologists.

> *The Wanaruah LALC is disappointed that the cultural views of the Aboriginal stakeholders has not been included in this report and the cultural values are only to be seen as an attachment to the report. Obviously the Aboriginal stakeholders input to the archaeological work is not as important as the 'technical advisor's' conclusions!*

Response: Rather than cultural values being an attachment to this report, this report is an attachment to the ACHA that sets out the cultural values of the Survey Area. The Code of Practice establishes equal weight to cultural, scientific, aesthetic and historic values (see **Section 9**) and the cultural values of the community are equally important as the technical scientific values.

> *Section 8.6.3 (Archaeological Management Summary) state that the sites have been assessed as low and low-moderate scientific significance, then 'what information are you trying to gather ' before further artefacts, contexts and information are lost due to erosion? We suggest that any further work undertaken out at United Wambo in relation to this project, be carried out as a 'Cultural Salvage' and the Aboriginal stakeholders be given the opportunity to gather as much of their significant cultural heritage material as they can –with the work only completed when the Aboriginal stakeholders are satisfied with what has been salvaged and are happy with the final*

determination of a keeping place. We wonder what the other groups think about this issue and whether the determining authorities will care anyway.

Response: As this report is a scientific values report, only management with a scientific basis is provided. As 'cultural salvage' has no scientific basis it is not a recommendation in this report. However, the views of the Wanaruah LALC should be noted by the project team and consideration given to this request.

2.4.4.2 Response to the PCWP comment

The comment by the PCWP on the draft version of this report prompted a peer review of the scientific values report to be undertaken to ensure the report meets adequacy (see **Section 2.4.5**).

The comment by the PCWP is presented in **Appendix 17**. The response to these comments is tabulated in **Table 2–1**.

Table 2-1. Response to PCWP comments on the draft scientific values report.

PCWP comment	OzArk comment
PCWP have not responded to the significance assessment or the management recommendations because we consider the report to lack scientific rigour and based on our conclusions, we do not believe the management recommendations are based on sound analysis of the available information. PCWP therefore reject the significance assessment and management recommendations and will continue to do so until an appropriate report is tabled.	As will be set out below, OzArk has approached this project with an open mind and *has* used the available evidence to frame the significance assessments and management recommendations. With respect, OzArk feels that the respondent has failed to understand that the Survey Area is highly disturbed and that a pristine archaeological landscape no longer exists. This is very different to how OzArk envisioned the Survey Area prior to commencing work but a combination of background research (previous archaeological investigations and interpretation of historical aerial photographs), the ground-truthing of the Survey Area (in particular noting the extensive erosion and thin soils) and the lack of subsurface deposits noted during the test excavation program has enabled OzArk to realise that the archaeological landscape has been, generally, displaced and is largely in a secondary context. With this realisation, OzArk appreciated that the archaeology of the Survey Area has very limited potential to meaningfully add to our knowledge either of settlement patterns or chronology in the immediate area or in the regional context. OzArk's significance assessments and management recommendations reflect this.
There is absolutely no geomorphic analysis in which to place the soil landscape data in order - for example - to develop a soil chronosequence for the study area. This is a very significant drawback of the report and means that there is absolutely no understanding of stratigraphy: chronological controls that should have been informed by the identification of and/or consideration of the nature of time-transgressive sequences and whether they illustrate historical overlap or not are simply not considered.	The project was aware of the views of the PCWP who also commented similarly on the test excavation methodology. As a result, the auger program was included with the test excavation program; not to undertake a full geomorphic assessment but to investigate soil sequences from a variety of landforms within the Study Area to determine if there were anomalies that should be further investigated. OzArk appreciates that a full geomorphic study of a Study Area is always a benefit but it is not essential to gain accurate archaeological data. Archaeological studies preceded by a geomorphic study are not common and normally the geomorphology is brought in later once the archaeology has identified an anomaly that requires geomorphic analysis.
No attempt has been made during the course of the testing program to test Pleistocene aged deposits despite the fact that the B Horizons are sodic soils and therefore highly susceptible to dispersal in water due to deflocculation… The nature and distribution of the soils within the study area make it an ideal laboratory for testing whether Pleistocene aged archaeology is present. Unfortunately, this was not considered in the testing program.	The test and auger program did investigate B Horizon soils and seek Pleistocene deposits either in the form of buried soil layers or buried barrier sands associated with Wollombi Brook: although none were found. The B Horizon was tested to a depth of at least 1m at 63 separate locations and, in addition, in test excavation squares the auger was used to probe down a metre beyond the end of excavation into the B Horizon. At no location were discontinuities in the B Horizon noted and there was no indication of cultural material contained within the B Horizon. In addition, the Study Area contains many creek banks with high standing sections. At none of these was the B Horizon discontinuous or seen to contain cultural material. The profiles obtained routinely accorded with the standard soil profile for the area's dominant sodosols; namely shallow A1 Horizon of clayey-loam (0-10cm), A2 Horizon of leached clayey-loam (to 20-50cm), B Horizon of mottled medium

PCWP comment	OzArk comment
	clay. This soil profile is also confirmed by soil profiles recorded by the NSW Soil and Land Information System (16 available profiles from within the Survey Area). The NSW Soil and Land Information System notes bedrock (sandstone) ranging from a depth of 0.6m to 3m with no discontinuities in the B Horizon above it. While often sought, no secure Pleistocene deposits have been identified within the Upper Hunter Valley in over 30 years of investigations by a large number of archaeologists and geomorphologists. This common observation was also observed at United/Wambo. [soil descriptions in **Section 3.2** have been augmented further in this version of the report, including the inclusion of a soils map (**Figure 3–2**) in response to this comment]
A representative example is Site United OS-1, a discrete (defined here as less than 10m apart) series of several artefact concentrations located on a lower slope landform. From a spatial and geomorphic perspective, the location of the site boundary is arbitrary: there is no logic to the grouping of these discrete artefact locations with one another in either time or space. The site boundary cannot therefore be supported: it looks like these artefacts have been grouped together - not because they represent a site - but because of expediency. That is, it's easier to deal with larger 'site boundary's' and less sites than to be more accurate and call these sites separate 'events.' Furthermore, Site United OS-1 is not an archaeological site in the archaeological meaning of the term. Rather, it is a series of lag gravels resulting from the erosion of deposits observed as a surface expression of possibly (probably?) unrelated artefacts, i.e. the spatial association is a function of geomorphic processes rather than human behaviour. The interpretation of these artefacts as a site would have been archaeologically meaningful had some form of association been proven: for example some of the artefacts could be refitted or they were located within a discrete landform element. This is clearly not the case for this site. Unfortunately, the same applies to all of the remaining 24 'open sites' identified across the study area, with extreme examples of incredibly tentative 'associations' such as United OS-4, United OS-5, United OS-10 etc. Clearly, locating a series of artefacts that reflect geomorphic rather than anthropogenic processes and have no obvious spatial, temporal or behavioural attributes that can be linked has resulted in a series of 'site' groupings that cannot be substantiated from an archaeological perspective.	At a surface survey stage of investigation all site boundaries are arbitrary as the subsurface boundaries, if present, are unknown. OzArk has to work within commonly accepted norms (artefacts within 50m of each other can be grouped together into a site) and the legislation (even an artefact in a highly modified landform becomes a ‘site’ on AHIMS). OzArk has grouped artefacts together into artefact scatters when they are in proximity to each other and when they are all within a similar landform unit. OzArk agrees that almost all surface artefacts are in a secondary context and this is particularly the case in much of the Hunter Valley given the long history of disturbance. Further, OzArk believes that surface artefacts are rarely what can be seen as an archaeological manifestation (i.e. artefacts found at the locations they were left by the humans that used them) but rather a manifestation arising from erosion or other post-formation processes. The designation of low scientific values to such sites indicates that OzArk believes that there is a very limited likelihood that the surface artefacts are associated with subsurface deposits or that they represent artefacts in a primary context that have the ability to be able to meaningfully add to the regional archaeological context. [site definitions in **Section 6.1.2** have been made clearer in this version of the report in response to this comment]
Furthermore, Ozark note that "The test excavation program was concentrated along Redbank Creek ... (Ozark December 2015: 179)." With respect to testing an archaeological model (see below for more detail), the expectation is that testing should occur both in areas where one predicts archaeology to be extant, as well as in areas where one does not predict archaeological sites to be present. This was not undertaken: i.e. only areas where archaeology was predicted were tested. This is an unscientific approach and leaves the current 'testing' program as little more than an exercise in pursuing 'expected site distributions' and ultimately presenting a 'self fulfilling prophecy' rather than a scientifically meaningful sampling strategy.	As noted above, the test excavation program include traditional test pitting (153 0.5m by 0.5m squares excavated at six separate locations), as well as the auger program (63 auger probes at nine separate locations). The stated aim of the test excavation program was to determine the nature and extent of undisturbed deposits adjacent to large surface artefact scatters to investigate whether the artefacts originated from closely adjacent landforms. As these large surface manifestations were along Redbank Creek, this is where the test program was concentrated. Further, archaeological results from across the Hunter Valley indicate that sites have a close association to permanent water and that this is where any subsurface testing should be concentrated to interact with sites of greater significance. The auger program was three-fold: 1. To determine soil depth in areas where artefact scatters were recorded during the survey but where shallow soil depth was assumed; 2. To determine the nature of archaeological deposits in areas where ground surface visibility was extremely limited during the survey; and 3. To test areas away from the creek systems.

PCWP comment	OzArk comment
	Therefore, by use of the auger program landforms away from the banks of existing creeks were tested to enable a meaningful appreciation of the archaeological potential at a variety of landforms within the Study Area.
The statement "The postulation of a predictive model for the Project Area is almost superfluous given the intensive and long running investigations that have taken place over the past 30 years (Ozark December 2015: 52)" is, by-and-large, indicative of the poor level of scholarship applied to the current study. Furthermore, it is dismissive of the previous investigations undertaken across the study area and is, quite frankly, offensive to the members of the PCWP. *The same respondent commented on the United Wambo Project Test Excavation Methodology that:* PCWP would like to see a predictive model that includes considerations of chronology, depositional and post-depositional changes, seasonality, gender-specific activities, function, consideration of 'off-site' archaeological models, in addition to formulating a strategy for investigating Pleistocene and Holocene settlement patterns looking at intensification and whether it can be identified in the archaeological record of Redbank Creek.	OzArk believes it has followed commonly accepted and tested predictive modelling used throughout the Hunter Valley. While attempts have been made elsewhere to test for inter-seasonal variability for example (notably in work at Mt Owen: see **Section 4.5.1**), the archaeological data in all instances was not robust enough to hope to answer such theoretical questions. Nor, as far as OzArk is aware, has any work in the Hunter Valley had extensive enough archaeological deposits available in order to answer the types of issues the respondent is interested in. As such theoretical issues, as valid as they are, are highly unlikely to be answered in the Hunter Valley context, they were not included within the predictive model. As predicted, following the survey and test program, such data is lacking in the Study Area that produced very few subsurface artefacts, no archaeological stratigraphy or features and only one or two instances of *in situ* deposits. In such an environment, as predicted, theoretical considerations are null and void as the data set is lacking. OzArk feels that all data is available in the report to support this predictive model although **Section 4.5.2** has been augmented in response to this comment.

In light of this, PCWP strongly objects to the lack of scientific rigour apparent in the Ozark report with regard to predictive modelling. In many respects a predictive model is the cornerstone of any archaeological testing program: its absence in the Ozark report and equally importantly, the failure to take into account PCWP's concerns regarding the paucity of modelling, is again a serious misjudgement and error on Ozark's part to take the study seriously.	OzArk has taken into account previous investigations at United, as well as previous investigations in the region, to frame a reasonable study that takes into account the tested realities of archaeology in the Hunter Valley.
	According to the Code of Practice, the predictive model must:
	• integrate the distribution of known sites, summarised or modelled using the landscape descriptions derived in Requirement 2 (i.e. landscape units interpreted in terms of their archaeological potential)
	  o **Section 4.4** of the report maps all previously recorded sites in the vicinity of the Study Area. This was not overlain on the landform units identified in **Section 3.1** (**Figure 3–1**) in the draft report but has been in this version in response to this comment (**Figure 4–4**).
	• characterise the patterning of material traces from known social and behavioural characteristics evidenced in the ethnohistorical review
	  o The limited ethnohistorical evidence for the Study Area is given in **Sections 4.2** and **4.3**. The implications of this evidence is made more explicit in the predictive model (**Section 4.5.2**).
	• consider the distribution of natural resources, and the probable land-use strategies employed by Aboriginal people in the specific landscape context
	  o This is set out in **Section 4.2** and is made more explicit in the predictive model in response to this comment.
	• consider the spatial and temporal relationships of sites
	  o This is discussed in **Sections 4.1** and in **Section 4.4.2**. The predictive model does address the spatial distribution of sites in association with certain landform types.
	• identify what sorts of material traces are predicted to be present, and in what densities
	  o The predictive model addresses this aspect.
	• make inferences about past Aboriginal occupation of the landscape based on the evidence collected and presented.
	  o The predictive model addresses this aspect.
	The Code of Practice states that the landscape description must:
	• describe the landscape history at a scale that allows the subject area to be characterised into meaningful components (or units) for the archaeological investigation

PCWP comment	OzArk comment
	o **Sections 3.7.2** and **3.7.3** provide extensive evidence of this aspect. • describe the landforms present within the subject area using standard or generally accepted classifications o **Section 3.1** addresses this aspect. • identify the primary modes of geomorphic activity in the subject area: aggraded, aggraded or eroded (stable), or eroded, and determine if objects are likely to be concealed below the ground surface or revealed by erosional processes o **Sections 3.7.2** and **3.7.3** provide extensive evidence of this aspect. **Section 3.8** summarises the effect of the observed disturbances on the archaeological record. • identify the forms of erosion within the archaeologically surveyed area, and where appropriate, subject area as a whole o **Sections 3.7.2** and **3.7.3** provide extensive evidence of this aspect. • describe the soils present and, where available, outline their formation history o **Section 3.2** provides evidence of this aspect. • describe the land-use history of the subject area o **Section 3.7** provides evidence of this aspect • describe, and if relevant, map the natural resources and natural features that will have influenced the use of the landscape in the past. o There are no known resources or natural features (beyond drainage lines) within the Survey Area to make this applicable. Nor, as far as OzArk is aware, have any specific landscape features/resources within the Project Area been identified during the ACHA that has been conducted by Australian Cultural Heritage Management Pty Ltd.
The only other point to add is that the Ozark report has contributed no new data in regard to predictive modelling or our understanding of Aboriginal lifeways in the Hunter Region and specifically in relation to Redbank Creek. This is a serious failure in the reporting by Ozark, particularly since they did not test the previous models and conclusions postulated by various authors within their own fieldwork, e.g. no testing was undertaken in areas where the expectation was that no archaeological deposits would be located. Furthermore, the 'sampling' strategy failed to include a Pleistocene testing component.	The respondent has failed to grasp the overall findings of the assessment; namely: • that the Survey Area is highly disturbed in many parts, particularly along Redbank Creek where areas of higher archaeological sensitivity would be expected; • There is a very low subsurface artefact density and only two isolated pockets of *in situ* artefacts were documented; and • There has already been extensive salvage programs within the Survey Area since the early 1980s that have removed many thousands of artefacts. As noted above, an extensive surface survey, test excavation program and auger program has failed to locate an intact archaeological landscape which may hope to answer some of the questions the respondent is interested in. As noted above, without a primary data set, theoretical questions are without local validity as the theories are not testable paradigms.
The presentation of the results by Ozark and in particular their surprise at the relatively 'low density' of artefacts can be explained in a number of ways, particularly by reference to archaeological models such as Foley's (1981) 'off-site' archaeological model, as well as geomorphological processes.	OzArk agree that the low density can be explained but not by 'off-site' models but due to the extensive, invasive and lengthy nature of the disturbances within the Survey Area, which includes a significant previous archaeological salvage programme. (OzArk's work for the Bulga Optimisation Project also noted that salvage programs in the 1980s and 1990s recorded thousands of artefacts at particular locations that were subject to salvage excavations by OzArk in 2015. While subsurface artefacts were far more numerous than is the case at United, a noticeable decrease in artefact numbers was noted showing the effects of on-going erosion over the past 30–20 years combined with the past archaeological removal of artefacts from the landscape.)
The surface sites recorded by Ozark are usually in the order of several hundred square metres - as defined by their arbitrary boundaries - and rarely consist of more than 20 artefacts. This being the case, we are looking at artefact densities of 1 artefact per tens of square metres in most cases: it is unrealistic therefore to expect the deposits that were tested to contain densities of a higher magnitude. The parameters that warranted further investigation -15 artefacts per	OzArk disagrees with the respondent's assertion that most sites only consisted of less than 20 artefacts. For those sites in association with Redbank Creek (where the test program was concentrated) artefact densities were far higher (in the 100s). Densities such as this would normally be picked up by the test excavation program had they extended into non-eroded portions of the landscape.

PCWP comment	OzArk comment
0.5m x 0.5m test pits - are, when compared to the surface densities, unrealistic.	
…comparison with archaeological models such as that by Foley (ibid) clearly demonstrate that the expected distribution (e.g. [deleted] October 2015: Figure 7: 50) of artefact densities across a landscape is a product of the nature of the type of 'settlement' or 'activity' performed (refer also for example to Binford 1980; Lourandos 1977). One can interpret the background scatters as possibly representing short-term 'one-off' events such as foraging or butchering for example, i.e. peripheral activities. On the other hand artefact distributions that reflect higher densities may be associated with base camps and reflect activities that were 'long-term', particularly in comparison with the peripheral activities. Whilst very much a generalisation reflecting two simple (and limited) interpretations of the material record, it serves as a useful 'yardstick' to compare and contrast potential explanations for the distribution of material culture across a landscape. Furthermore, if we consider the fact that there is a high probability that Redbank Creek was a series of waterholes rather than a continuous creekline with access to open water - at various times in the pre-Contact past - then we have another possibility for the uneven distribution of artefacts, namely clustering around waterholes.	OzArk agrees but notes that the respondent has failed to understand the wide-spread and invasive nature of past disturbances within the Survey Area. Rather than dealing with an *in situ* archaeological landscape where such issues of settlement patterns can be postulated, the Survey Area has been heavily eroded and denuded reducing the confidence that any current surface artefacts even originated from the immediate vicinity but are likely to have been deposited at their find location by water movement. While it is accepted that these artefacts originated in the Redbank Creek catchment, their primary context and therefore patterning will never be known. The paucity of subsurface deposits contributes to this uncertainty of what the original archaeological landscape was like. However, previous investigations, as well as OzArk's, tend to indicate clusters of artefacts and OzArk agrees that this land use does represent either sporadic events or clustering around particular resources (waterholes). It is noted that no work to date has identified what would commonly be accepted as a 'base camp' indicating the irregular/seasonal use of the Redbank Creek catchment when compared to nearby permanent water resources such as Wollombi Brook.
As was clearly demonstrated in the recent NSW Land and Environment Case - Darkinjung Local Aboriginal Land Council v Minister for Planning and Infrastructure & Anor; Australian Walkabout Wildlife Park Pty Limited (ACN 115 219 791) at Trustee for the Gerald and Catherine Barnard Family Trust v Minister for Planning and Infrastructure & Anor - there are serious issues with the way that archaeology is being practiced in NSW.	OzArk has reviewed this case and disagrees that it demonstrates that "there are serious issues with the way that archaeology is being practiced in NSW" rather that it demonstrates the failings of a particular consultant to gain enough archaeological information in order to predict the likelihood of there being further sites in the impact area under discussion. This shortcoming by the consultant (from OzArk's understanding) was not to implement what would be regarded as reasonable suggestions from RAP respondents (in this case clearing off neighbouring rock shelves to see if there were more engravings) and by not carrying out test excavation. OzArk has not only responded to reasonable requests by the Aboriginal community to gain further knowledge concerning the Survey Area (instituting the auger program) but has also undertaken a reasonably extensive test excavation program. Therefore while OzArk's predictive model in the draft report could have been better framed to reference the findings in the environmental context section of the report, OzArk is confident that the assessment to this point has been to industry standard and responsive to 'reasonable' requests by the Aboriginal community.

2.4.5 Peer Review of the Draft Scientific Values Report

As a consequence of the PCWP not expressing confidence in the overall scientific values report, the report was offered for peer review to Neville Baker (BA Hons MAACAI) of Baker Archaeology Pty Ltd. The peer review included a site visit by Mr Baker accompanied by Ben Churcher from OzArk. Mr Baker's review is presented in **Appendix 18** and concludes:

> *The report complies overall with OEH guidelines and is of a high standard in its coverage and presentation of information. Minor departures from the Code do not detract from the overall quality and suitability of the report.*

In his review, Mr Baker suggested that a map be provided to show the relationship between proposed impacts and known sites. This has been provided in this version of the report as **Figure 10–1**.

2.5 ACKNOWLEDGEMENT

OzArk would like to acknowledge the input of RAPs and Knowledge Holders during the assessment which included both survey and test excavation. This work was physically demanding in sometimes warm to hot weather, however, the RAP participants continued to work with diligence and professionalism throughout. OzArk benefited from the RAP's experience in the field and the results presented here are, in no small way, a testament to their work.

2.6 OZARK INVOLVEMENT

2.6.1 Field Assessment

The fieldwork component of the current project was undertaken by:

- Fieldwork Director: Ben Churcher (OzArk Principal Archaeologist. BA [Hons], University of Queensland; Dip Ed, University of Sydney);
- Archaeologist: Nick Harrop (OzArk Senior Archaeologist, BA [Hons], University of Sydney);
- Archaeologist: Chris Lovell (OzArk Senior Archaeologist, PhD, BA [Hons], BSc, University of Queensland);
- Archaeologist: Jennifer Bertolani (OzArk Project Archaeologist, BS [Anthropology], Central Washington University);
- Archaeologist: Morgan Wilcox (OzArk Project Archaeologist, BArch [Hons], La Trobe University);
- Archaeologist: Stephanie Rusden (OzArk Archaeology Officer, BSc, University of Wollongong, BA, University of New England); and
- Operations Officer: Rowan Murphy (BEnvSc/LLB [Hons], University of New England).

2.6.2 Reporting

The reporting component of the current project was undertaken by:

- Report Author: Ben Churcher;
- Contributor: Stephanie Rusden; and
- Reviewer: Dr Jodie Benton (OzArk Director, PhD University of Sydney).

3 LANDSCAPE CONTEXT

An understanding of the environmental contexts of a Study Area is requisite in any Aboriginal archaeological investigation (DECCW 2010). It is a particularly important consideration in the development and implementation of survey strategies for the detection of archaeological sites. In addition, natural geomorphic processes of erosion and/or deposition, as well as humanly activated landscape processes, influence the degree to which these material cultural remains are retained in the landscape as archaeological sites; and the degree to which they are preserved, revealed and/or conserved in present environmental settings.

The Project Area is located wholly within the Sydney Basin Bioregion (SBB) and the Hunter Subregion. The Hunter is situated at the far north of the SBB and contains the townships of Scone, Muswellbrook, Singleton, Cessnock, Maitland and the city of Newcastle. The Project Area is almost wholly comprised of the Central Hunter Foothills landscape unit. The south eastern portion of the Project Area falls within the Central Hunter Alluvial Plains landscape unit (Mitchell 2002).

Prior to mining, the Project Area exhibited similar landscape features of the broader Hunter Subregion: rolling hills with low ridges and gentle to moderate slopes. The major landform units and existing modified areas of the Survey Area are shown in **Figure 3–1**.

The Project Area encompasses approximately 3875ha, while the Survey Area encompasses approximately 566ha of which approximately 66.8ha (12 per cent of the total Survey Area) is modified by mining activities.

Within the Survey Area, but outside of areas modified by mining, a range of landforms are retained.

In general terms, the topography is sloping from west to east and is mostly part of the catchment for Wollombi Brook and the Hunter River, located east of the Project Area. Redbank Creek flows to the east through the centre of the Survey Area.

3.1 TOPOGRAPHY

The topography of the Central Hunter Foothills is characterised by undulating lowlands, rounded to steep hills with rock outcropping on ridges while the topography and geology of the Central Hunter Alluvial Plains is characterised by channels, floodplain and terraces of the Hunter River on Quaternary alluvium. (Mitchell 2002: 73, 72).

Explanations for the terms used in **Figure 3–1** are in **Table 3–1**. **Table 3–2** quantifies the extent of these landform features specific to the Survey Area (i.e. these figures are not representative of the Project Area as a whole, only to the Survey Area which forms the basis of this assessment).

Table 3-1. Landform descriptions.

Landform	Description
Crest / Ridge	Raised area with a confined summit.
Upper slope	Sloping land adjoining hill tops or ridges. In the Survey Area upper slopes are moderately steep with over 10° slope.
Mid slope	Sloping land often between upper and lower slopes. In the Survey Area mid slopes form an undulating topography with average slopes between 5° and 10°.
Lower slope	Sloping land often between upper and lower slopes. In the Survey Area lower slopes are gentle with less than 5° slope
Flat / Drainage	For much of the Survey Area, flat landforms are associated with drainage lines.

Figure 3-1. Major landform units within the Survey Area.

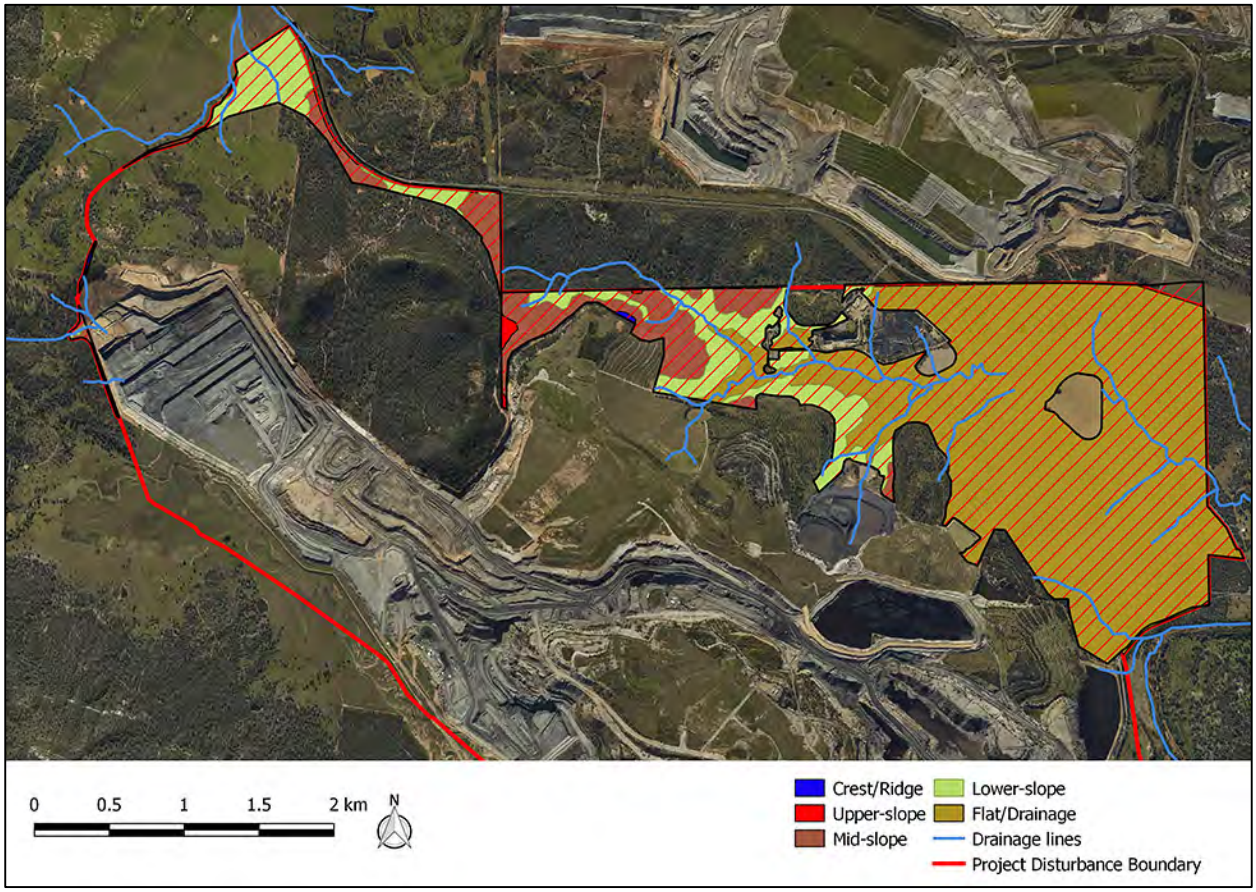


Table 3-2. Summary of key terrain features within the Survey Area.

Total Survey Area	Crest/ Ridge	Upper slope	Mid slope	Lower slope	Flat/ Drainage
570ha (area within Project Disturbance Boundary = 558ha: this area is used in the figures to right)	0.76ha (0.14%)	1.5ha (0.27%)	59.8ha (10.8%)	81.7ha (14.7%)	414ha (74%)

3.2 GEOLOGY AND SOILS

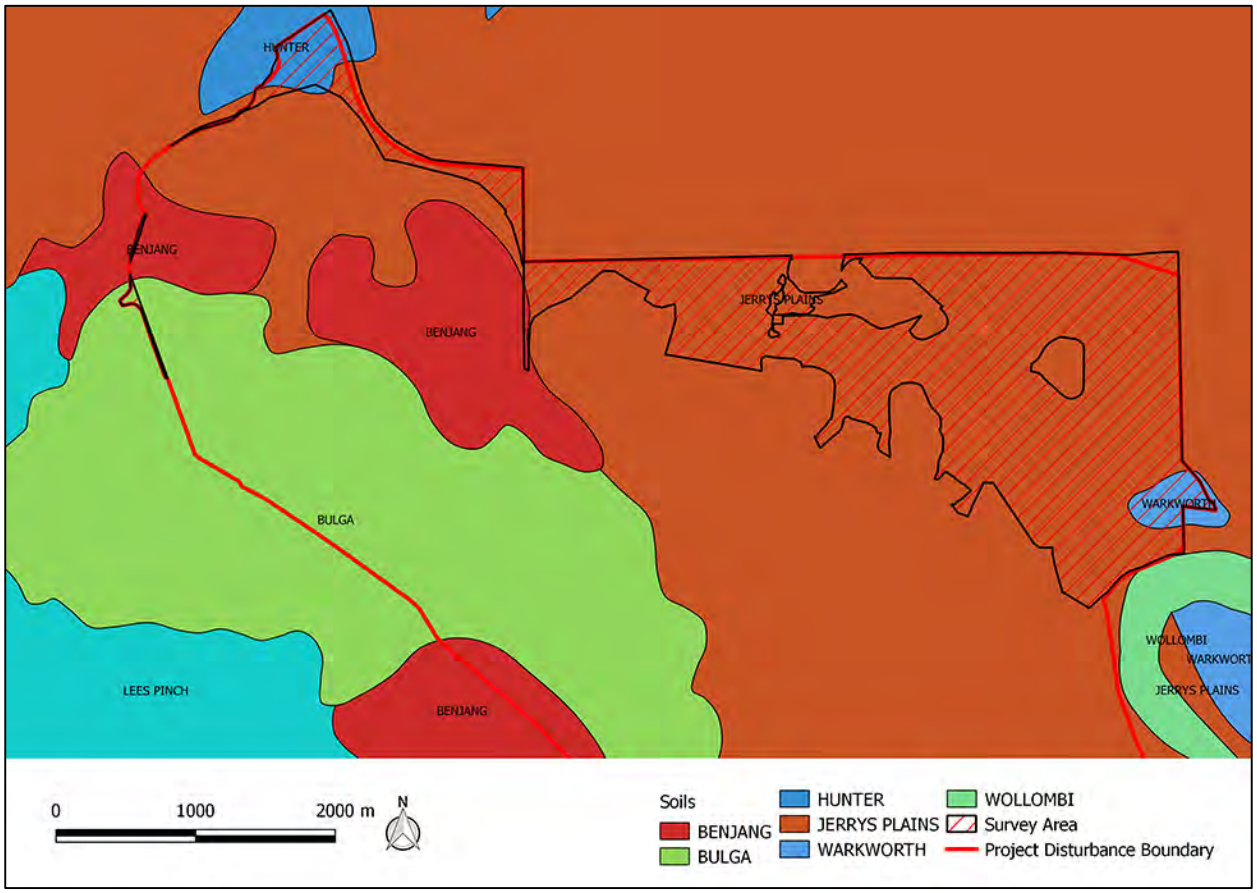
The geological processes within the Hunter Valley resulted in a landscape with several elements of particular importance to Aboriginal people, including prominent topographical features bearing cultural significance; outcropping and overhanging sandstone utilised for axe grinding, shelter and carving; and terrace / river bed gravels and nodules utilised for tool manufacture.

The stratigraphy underlying the Project Area comprises Permian sandstone, mudstone, siltstone, coal seams, tuff, gravels and conglomerate which forms part of the Sydney Basin Permian Geological Zone (Kovac and Lawrie 1991: 226). Along ridge tops and upper slopes within the Project Area outcrops of these materials were present, however, little to no outcropping was present along Redbank Creek and drainage lines decreasing the possibility of grinding groves being present. Lower sections of ridges and steeply inclined slopes down to drainage lines are mantled with stony colluvial deposits which merge with the extensive stony colluvial / alluvial fills of the Redbank Creek valley (Koettig and Hughes 1983: 10; Umwelt 2005: 52).

Soils within the SBB are typically sandstone and shale derived. Within the Hunter Valley, harsh texture contrast soils are present on slopes whilst valley floors exhibit deep sandy loam alluvium. Southern tributaries of the Hunter River contain source bordering dunes. Soil salinity is common in the upper catchment.

Four soil landscapes occur in the Survey Area with the most prominent being Jerrys Plains Soil Landscape with isolated occurrences of the Hunter Soil Landsacpe, Benjang Soil Landscape and the Warkworth Soil Landscape. The Jerrys Plains Soil Landscape consists of soloths on crests to mid slopes. With solodic soils on lower slopes and in drainage lines. Red-brown clays in mid slope depressions (Umwelt 2002; **Figure 3–2**).

Figure 3-2. The Survey Area showing major soil types.



Previous archaeological surveys have described a variety of soils specific to the Project Area. These descriptions have a direct bearing on interpretations of the archaeological resource because they provide an indication of the taphonomic processes and stratigraphy likely to be present. Koettig and Hughes (1983) note that sheet erosion is prominent on slopes and ridges, whilst gully erosion is common along creek lines. Both forms of erosion are likely to have disturbed and altered archaeological deposits.

Koettig and Hughes (1983) indicate that two depositional units tend to occur throughout the Project Area:

- **A Horizon**[1]: upper grey to buff, containing fine sand, silt and gravel. Usually less than 50cm thick with a weakly developed soil profile. Distinctive from the B Horizon, discontinuous on hill slopes. Generally considered to be modern to Holocene in age and open sites in the region tend to occur within the A Horizon.
- **B Horizon**: brown-red gravel rich clay. Contains strongly contrasting horizons and evidence of deep weathering. Generally considered to be Pleistocene in age.

Soil profiles were visible along the creek banks of the Survey Area where erosion is on-going. Even though these 'sections' were adjacent to the drainage line where one would expect deeper A Horizon soils, it was noted that the A Horizon is generally thin (10cm to 20cm). These soils rest directly on homogenous B Horizon soils that extend down some metres: mostly to bedrock where this was visible (**Figure 3–3**). This observation accords with the observations of previous researchers over 20 years ago[2].

[1] It is noted that in his peer review of this report (**Section 2.4.5** and **Appendix 18**) Neville Baker commented: "Reference to soil horizons [in the draft report] is inconsistent with the predominant view put by Hughes in his contribution to the Upper Hunter Aboriginal Heritage Baseline Study of 2004 (ERM 2004). Hughes refers to the common duplex soil profile soil profile in the Central Lowlands as "Unit A" and "Unit B", rather than A Horizon and B Horizon (ERM 2004: 23). This sedimentological nomenclature reflects the distinct origin of the overlying fine grey upper soil layer within the typical texture contrast soil profile. The use of "Horizon" in the report is considered an accidental replacement with more familiar pedological terminology." The reader should be aware of this alternative interpretation although the term 'Horizon' will continue to be used in this report as this accords with the site records from the fieldwork.

[2] The profiles obtained by soil scientists routinely accorded with the standard soil profile for the area's dominant sodosols; namely shallow A1 Horizon of clayey-loam (0-10cm), A2 Horizon of leached clayey-loam (to 20-50cm), B Horizon of mottled medium clay. This soil profile is also confirmed by soil profiles recorded by the NSW Soil and Land Information System (16 available profiles from within the Survey Area). The NSW Soil and Land Information System notes bedrock (sandstone) ranging from a depth of 0.6m to 3m with no discontinuities in the B Horizon above it.

Figure 3-3. Observed soil profiles.

	
1. EXPOSED SOIL PROFILE ON REDBANK CREEK. THE PROFILE SHOWS THIN A HORIZON SOILS ON TOP OF DEEP AND UNDIFFERENTIATED B HORIZON SOILS.	2. EXPOSED SOIL PROFILE ON A TRIBUTARY TO WOLLOMBI BROOK. THE PROFILE SHOWS THIN A HORIZON SOILS (WITH ARTEFACTS IS A SECONDARY [WASH] CONTEXT) ON TOP OF CRACKING, UNDIFFERENTIATED B HORIZON SOILS.

3.3 HYDROLOGY

Hydrology in the Hunter subregion is dominated by the eponymous Hunter River. The Hunter River rises in the Liverpool Range to the north and flows south via Scone and Muswellbrook. Its main tributary, the Goulburn River, joins the Hunter River south-west of Muswellbrook, whence the Hunter River flows east towards the coast. Also joining the Hunter River (approximately 10km west of Singleton) is the north-flowing Wollombi Brook, which is located just to the southeast of the Project Area. The generally low-lying terrain surrounding the Hunter River forms an effective route between the coast and the interior.

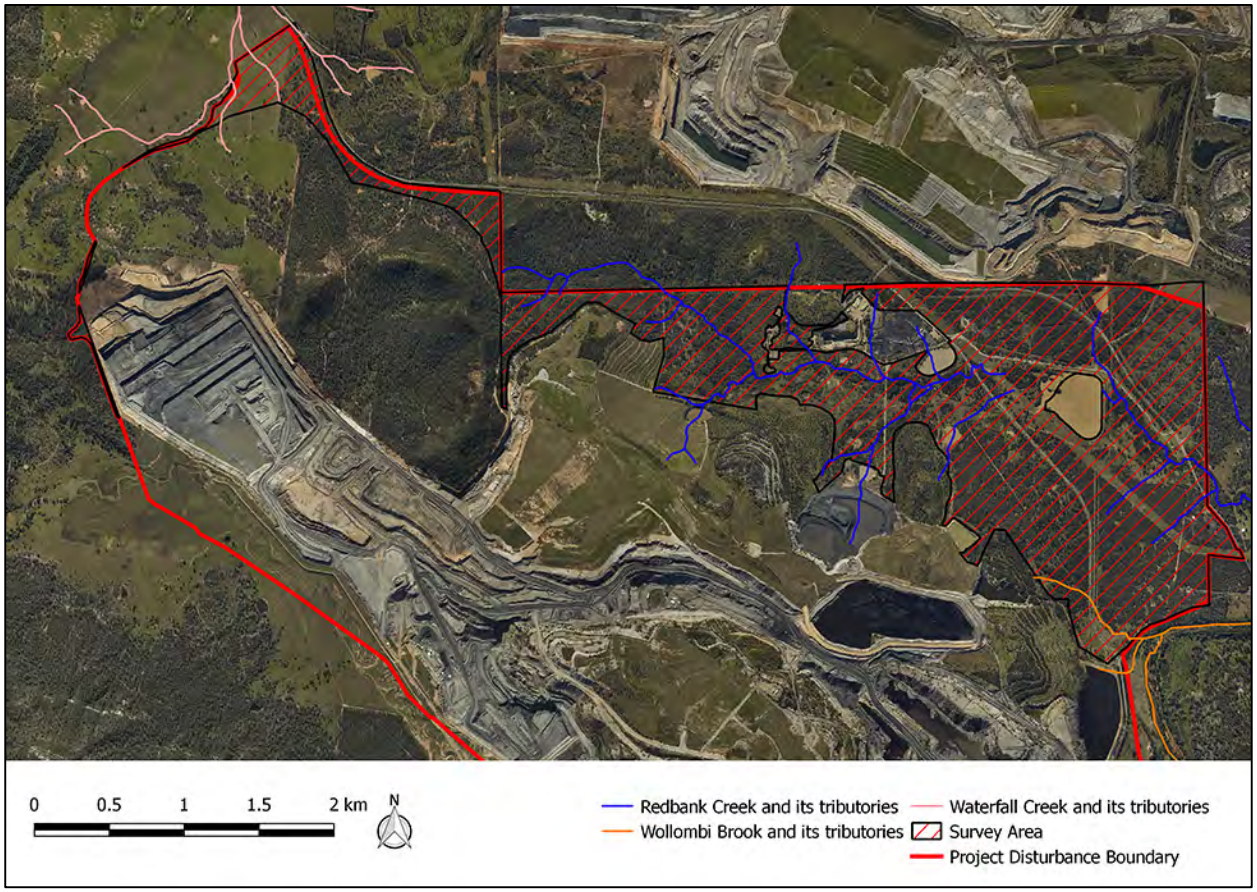
The Survey Area's landscape is well described through reference to its streams.

One named drainage feature, Redbank Creek and its tributaries, dominate the Survey Area. Additionally, tributaries of Waterfall Creek are situated in the north-western section of the Survey Area and a tributary of Wollombi Brook is situated in the southeast of the Survey Area (**Figure 3–4**). Creek banks within the Survey Area exhibit both gully and sheet erosion and form the principal exposures providing ground surface visibility.

Redbank Creek is the major creek system of the Survey Area that would have held water for most of the year although, in times of low water flow, the water would have been confined to pools. Redbank Creek joins Wollombi Brook to the east of the Project Area. The creek has been altered by the approved construction of Dams 1 and 2 at United Collieries and the main arm of the creek has been mined within the Wambo mine area. Approximately 117.8ha or 23.7 per cent of the Survey Area consists of Redbank Creek, small tributaries, and adjacent landforms. Redbank Creek flows to the east across the Survey Area and drains into Wollombi Brook which in turn

flows northeast into the Hunter River. The main channel of Redbank Creek is often deeply incised with banks of 2–3m.

Figure 3-4. Hydrology within the Survey Area.



3.4 FLORA

Species diversity is high within the SBB. A range of environments are present within the bioregion, including coastal, dune, estuarine, rainforest, plateau, lowland, riparian and swamp ecosystems. Vegetation communities within the SBB environments are summarised in NSW NPWS (2003: 186-7).

The Survey Area contains no extensive stands of unmodified vegetation. Previously subject to clearing, the extant vegetation primarily consists of either natural regrowth or deliberate revegetation with only occasional mature trees. Koetigg and Hughes (1983) noted during their assessment that Narrow-leaved Ironbark (*Eucalyptus crebra*) and Bull Oak (*Allocasuarina luehmannii*) dominated wooded areas while regenerating woodland present largely along Redbank Creek and its tributaries were fringed with Swamp Oak (*Casuarina glauca*). Following their assessment in 2005, Umwelt concluded that the Project Area would have supported woodland communities of Yellow Box (*Eucalyptus melliodora)*, Forest Red Gum (*Eucalyptus tereticornis*) and Narrow-leaved Ironbark based on remnant patches of remaining vegetation.

The 2002 Environmental Impact Statement (EIS, HLA 2002) contains a valuable assessment of the plant communities within the Project Area which may have been utilised by Aboriginal communities in the past.

This study concluded that the grasslands and Narrow-leaved Ironbark would have provided a variety of useful resources for exploitation as they provide habitats for macropods and grassland bird species. Tree hollows and fallen logs in these communities and others also provide suitable habitats for small mammals and reptiles. Native flora, including Smooth-barked Apple Gum (*Angophora costata*) provided valuable medicine resources and was noted as being located near a number of previously recorded sites.

3.5 FAUNA

Since the introduction of farm dams and a decrease in hunting there has been a substantial increase in the number of Eastern Grey Kangaroos (*Macropus giganteus*) and, from observations during the survey, they dominate the ground dwelling fauna observed across the Survey Area.

Also of economic importance to Aboriginal hunter-gatherers and present throughout the Project Area are the Common Brushtail Possum (*Trichosurus vulpecula*), the Red-neck Wallaby (*Macropus rufogriseus*), Swamp Wallaby (*Wallabia bicolor*) and Common Wombat (*Vombatus ursinus*). 11 bird species have been recorded in the Project Area (Umwelt 2005) and many were probably food resources for Aboriginal hunter-gatherers. The eggs would have provided a good source of protein. One reptile species was recorded within the Project Area by Umwelt in 2005 which would have been important food source in the past.

The distribution of the fauna suggests that species suitable for hunting were most common in and around watercourses, however, the largest prey species (and thus the greatest suppliers of protein) kangaroo, wallaby and wombat could be hunted away from the watercourses.

3.6 CLIMATE

The SBB exhibits a temperate climate. Summers are warm and there is no dry season. The north-east portion of the SBB (within which the current Project Area is located) is described as sub-humid.

The closest climate data is from Singleton, approximately 16km to the east of the Project Area. Records since 2002 show that average annual rainfall is approximately 685mm. It peaks between November and February, but is relatively consistent throughout the year. January is the warmest month, with mean temperatures peaking at 31.7°. July and August are the coldest months with mean minimum temperatures of 4.3° and 4.2° respectively (BoM 2015).

3.7 LAND–USE HISTORY AND EXISTING LEVELS OF DISTURBANCE

Disturbance, cultural or natural, potentially alters the archaeological record. It can do this in a variety of ways, directly or indirectly. For example, land clearing directly removes a particular site type - usually scarred trees or stone arrangements. Indirectly, land clearing accelerates soil erosion, potentially resulting in previously buried occupation / activity sites becoming exposed and altered / damaged.

The Project Area is situated within a broader landscape subject to the following land uses:

- Coal mining operations (open cut and underground);
- Agriculture, horticulture, viticulture and pastoralism;
- Rural-residential holdings and rural towns; and
- Hospitality and tourism operations.

3.7.1 Existing levels of disturbance within the Survey Area

The Survey Area itself has experienced the following forms of disturbance:

- Agricultural clearing, periods of over-stocking and soil compaction;
- Agricultural infrastructure such as houses, fences and farm tracks;
- Gully and sheetwash erosion;
- Subsidence resulting from underground mining operations; and
- Road construction, modifications to hydrology (including diversions, culverts, contour banks and dams), electricity easements, access tracks and other pieces of mine infrastructure.

More specifically, Redbank Creek catchment area has experienced the following forms of disturbance:

- Significant gully erosion, particularly along creek and drainage lines; and
- Vegetation clearing resulting in the removal of mature woodland vegetation. Much of the Survey Area is now dominated by regrowth vegetation.

3.7.2 Effect of disturbance on the archaeological landscape

The major disturbances within the non-mined portions of the Survey Area that have altered the archaeological landscape are:

- Erosion: outside of the previously mined areas, erosion has had the greatest impact across the Survey Area;
- Subsidence: cracking and remedial works have impacted undermined areas; and

- Farm and mine infrastructure: large portions of the Survey Area have been modified by the historical and on-going land uses.

The impact to the archaeological landscape from each of these disturbances will be discussed in more detail below.

Erosion

It is noted above that erosion is one of the most extensive forms of disturbance in the non-mined areas within the Survey Area. This disturbance has had a significant impact on the archaeological landscape within the Survey Area. This disturbance of the Survey Area has been noted by archaeological researchers for over 20 years (for example Koettig and Hughes 1983). In many areas the erosion regime was well-established prior to mining impacts in the area.

The texture contrast soils of the Survey Area are very prone to erosion and the removal of the native vegetation during past agricultural land use and the subsequent compactions of the soil have exposed extensive areas to erosion.

At many places the soils in the Survey Area display that fine clay particles are carried off in sediment laden wash leaving the heavier materials (and any stone artefacts should they be present) to slump vertically but essentially remain in the same general location, at least in the first instance. The results of the erosion are severe in their outcome. Even ephemeral drainage lines can supply sufficient water to create a sizeable erosion gully and when extensive, the erosion can create a large areas of exposed B Horizon soils surrounding a drainage feature.

This scale of erosion on the archaeological landscape has the capacity to completely remove archaeological sites. However, in the process of erosion, many archaeological sites have been newly exposed for the survey team as the higher rainfall levels in recent years has encouraged on-going erosion (**Figure 3–5**).

In conclusion, the erosion across the Survey Area is extensive and is most prevalent in areas of higher archaeological sensitivity such as along drainage lines. It is entirely possible for this erosion to have removed entire and sizable portions of sites. The erosion, however, also exposed a large number of artefacts to the surveyors.

Figure 3-5. Examples of erosion from the Survey Area.

1. EROSION ASSOCIATED WITH REDBANK CREEK.

2. EROSION ASSOCIATED WITH REDBANK CREEK.

Subsidence

Considerable portions of the Survey Area have been undermined resulting in land subsidence and cracking. This has affected the archaeological landscape as subsidence can have the effect of vertically displacing any artefacts and deposits should they be present. Secondly, approved remedial work for such areas has usually entailed running a bulldozer over the affected area and covering in the subsidence cracking. This can be followed by ripping and revegetation. All these actions impact on the ground surface and any archaeological sites in the area had they existed.

Farm, civic and mine infrastructure

The Survey Area has been extensively modified by the construction of farm, civic and mine infrastructure (**Figure 3–6**). For most of the modern period the Survey Area has been a working farm/s, mostly for grazing activities. This entailed the clearing of land (see discussion regarding erosion above) and the construction of dams, fences and tracks. While erosion can be severe (see above) and while dam construction can be locally destructive, the impact to archaeological landscape from the other farming activities have been relatively limited.

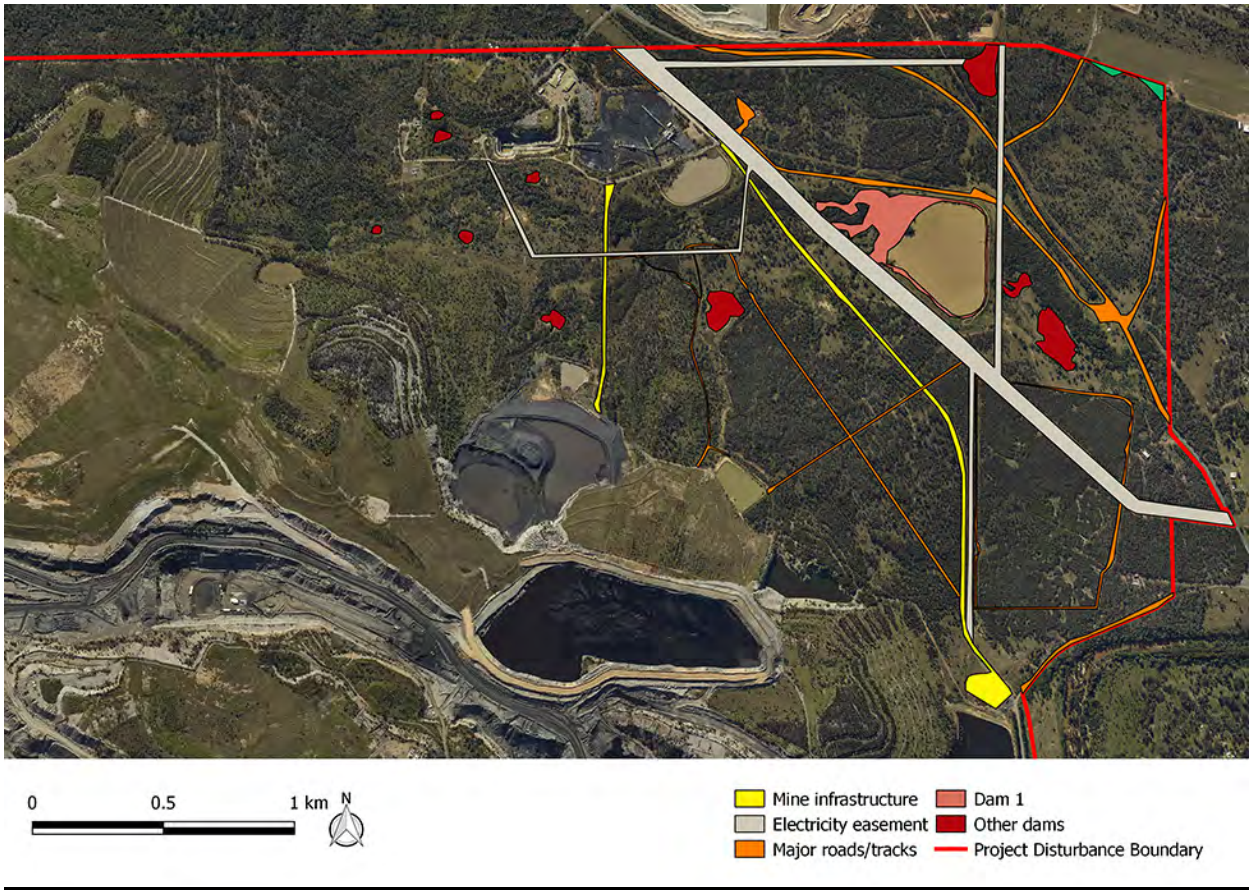
As a previously operating coal mine, United Collieries has affected large areas of land with approved mine related infrastructure and workings. Some of these activities have had approved, although severe, impacts on the archaeological landscape by altering large areas of land to a point where the former landscape is either unrecognisable or mostly covered with various pieces of infrastructure or overburden (such as the area around Dam 1). Other forms of mine infrastructure such as haul roads and revegetated areas have less impact on the overall landscape but still have localised impacts to the ground surface.

Figure 3–7 maps the location of major mine and civic infrastructure within the Survey Area.

Figure 3-6. Examples of mine and farm infrastructure impacts within the Survey Area.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. Disused underground mine portal within the United Collieries lease area.</td><td>2. Farm and mine infrastructure such as dams were frequent across the Survey Area.</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>3. Mine related infrastructure such as electricity easements are present through the Survey Area.</td><td>4. Other mine related infrastructure such as access tracks have a more limited impact on the ground surface.</td></tr>
</table>

Figure 3-7. Mine and civic infrastructure within the Survey Area.



Alterations to Redbank Creek

Redbank Creek, due to approved mining activity, has been diverted from its original course in places, such as south of Dam 2, or dammed, as in the case of Dam 1. The inundation associated with Dam 1 has not only disturbed the surrounding vegetation but it would have also had the effect of submerging any sites that were originally located on the creek's banks, as well as moving the erosion line further back away from the creek (**Figure 3–8**).

The impacts to Redbank Creek has affected the archaeological landscape of the area by altering the form of Redbank Creek (the major drainage feature of the Survey Area), increasing the impact of erosion and the preventing the relationship between site locations and the original bed of the creek to be understood.

Figure 3-8. Example of the altered flow of Redbank Creek.

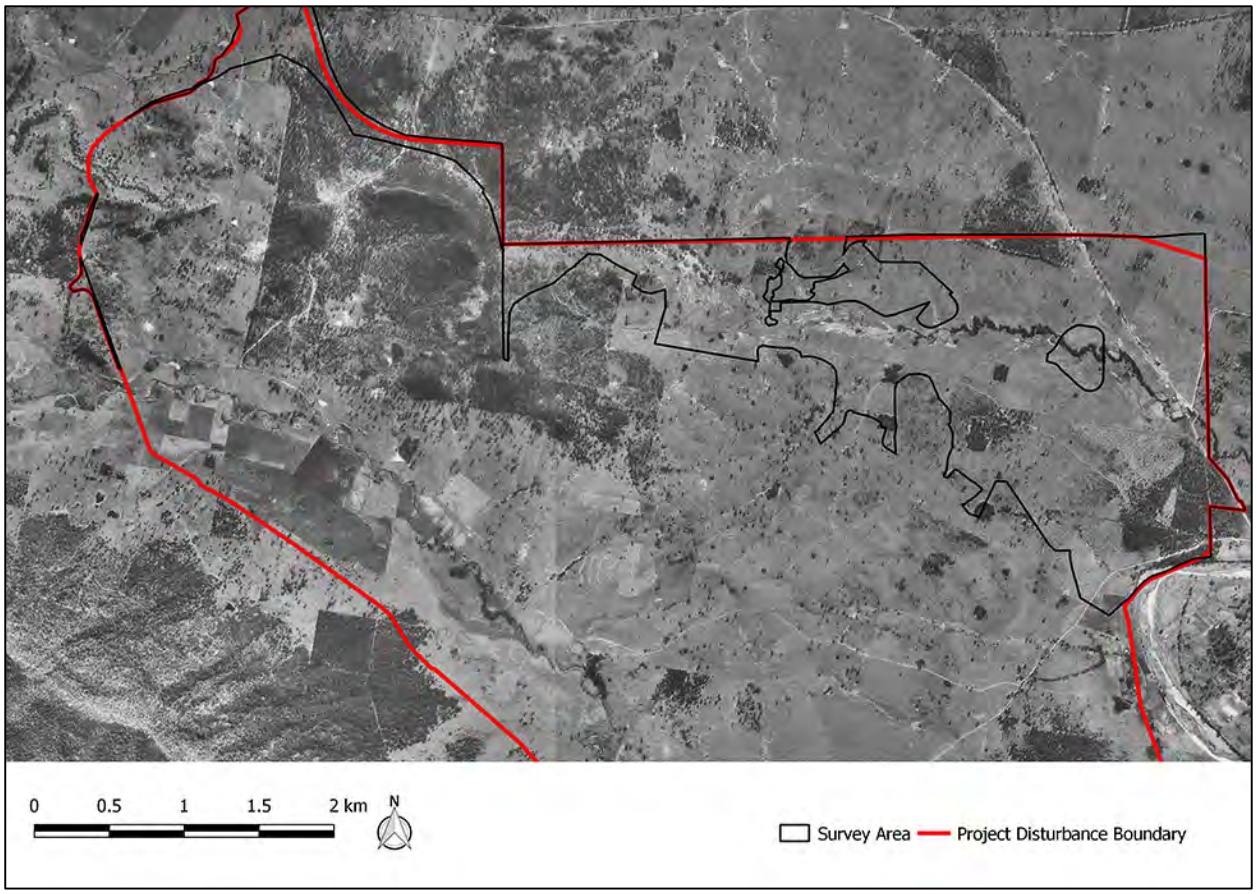
	1. REDBANK CREEK IS WITHOUT NATURAL FLOW SURROUNDING DAM 1 LEADING TO POOLING WATER UPSTREAM FROM THE DAM.

3.7.3 Historical disturbances

As mentioned above, the Survey Area has been affected by a high degree of disturbance over the past 200 years, primarily as a result of the agricultural and mining history of the region. More specifically these past and present disturbances include vegetation clearing, grazing use, and soil loss and infrastructure installations such as access tracks, power lines and dams. **Figures 3–9** to **3–12** show the Survey Area overlaid on aerial images to represent the extent to which the landscape has been modified since 1963.

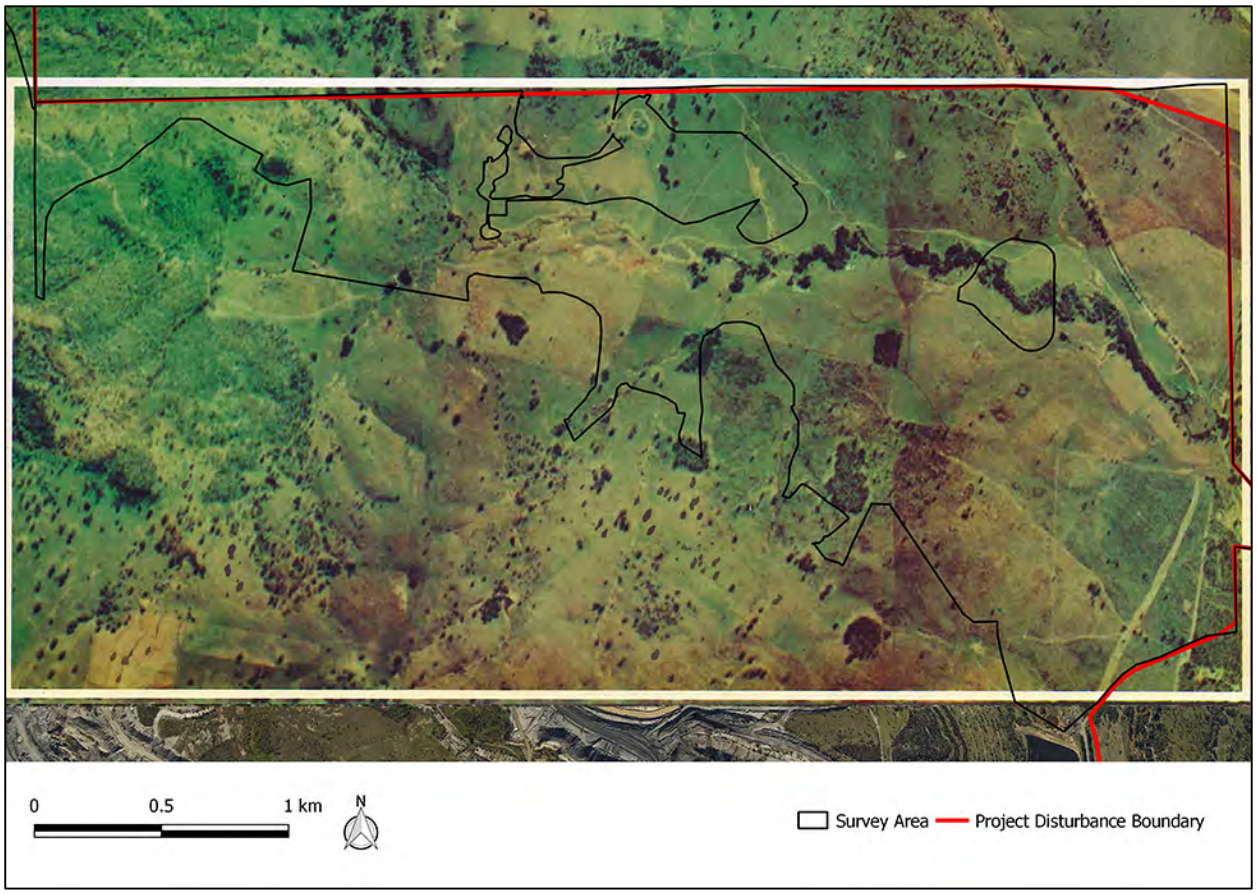
Overlaying the Survey Area on a 1963 aerial of the landscape now occupied by the United Colliery (**Figure 3–9**) displays a number of disturbed landscape features. Extensive vegetation clearing has occurred throughout the Project Area with stands of vegetation extant only in isolated pockets and along Redbank Creek. In addition to this, Redbank Creek displays a multi-channel morphology with signs of extensive erosion and there are large areas of sheetwash exposures adjacent to Redbank Creek. During their survey in 1983, Koettig and Hughes described most of the study area as being cleared for agricultural purposes and supporting large areas of pasture with scattered remnants of natural woodland. They also concluded that much of the gently sloping to flat ground had been ploughed and that only along the creek margins do *in situ* deposits remain (Koettig and Hughes 1983: 11).

Figure 3-9. The Survey Area superimposed on a 1963 aerial image.



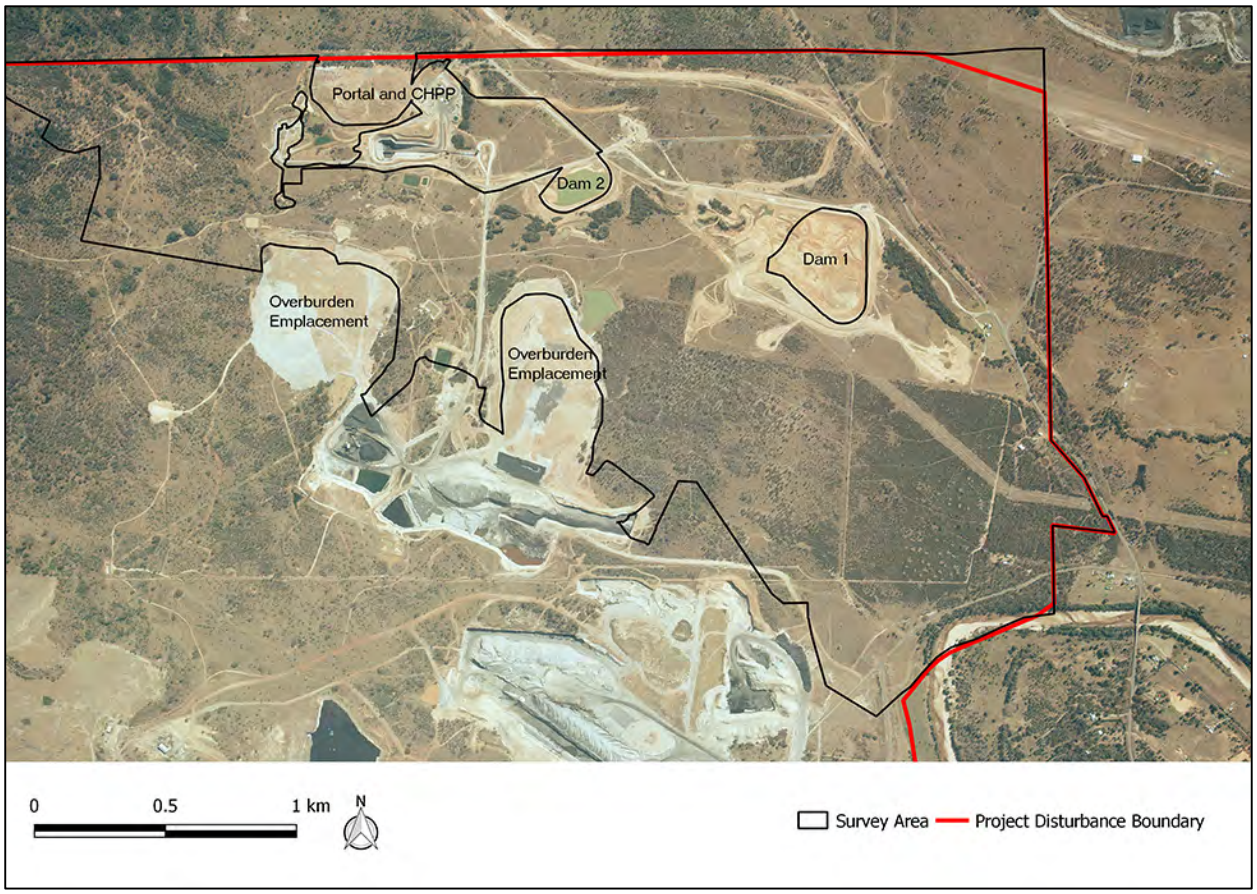
Superimposing the Project Area on a colour aerial from 1981 (**Figure 3–10**) is illustrative of the areas devoted to cropping along the banks of Redbank Creek. These almost tree-less paddocks on the creek flats were commented on by researchers of the time (Dyall 1980, Koettig and Hughes 1983) and can be discerned in the aerial. In areas where slopes become more moderate the tree cover is thin but extant and presumably devoted to grazing.

Figure 3-10. The Survey Area (eastern portions) superimposed on a 1981 aerial image.



Overlaying the Project Area on an aerial taken in approximately 1987 (**Figure 3–11**) of the landscape displays extensive landscape modifications with mining activities occurring in the area. Associated mining construction and infrastructure is also visible with the construction of Dam 1 in the eastern portion of the Survey Area and the installation of roads, buildings and electricity easements. The construction of Dam 1 within Redbank Creek significantly disrupted the natural flow of the creek and was accompanied by expansive disturbance surrounding Dam 1, and to a lesser extent, Dam 2. Sheetwash exposures adjacent to Redbank Creek remain visible although less extensive than is seen in the 1963 aerial. In areas not actively mined, dense regeneration of vegetation has begun, particularly in the eastern portions of the Survey Area.

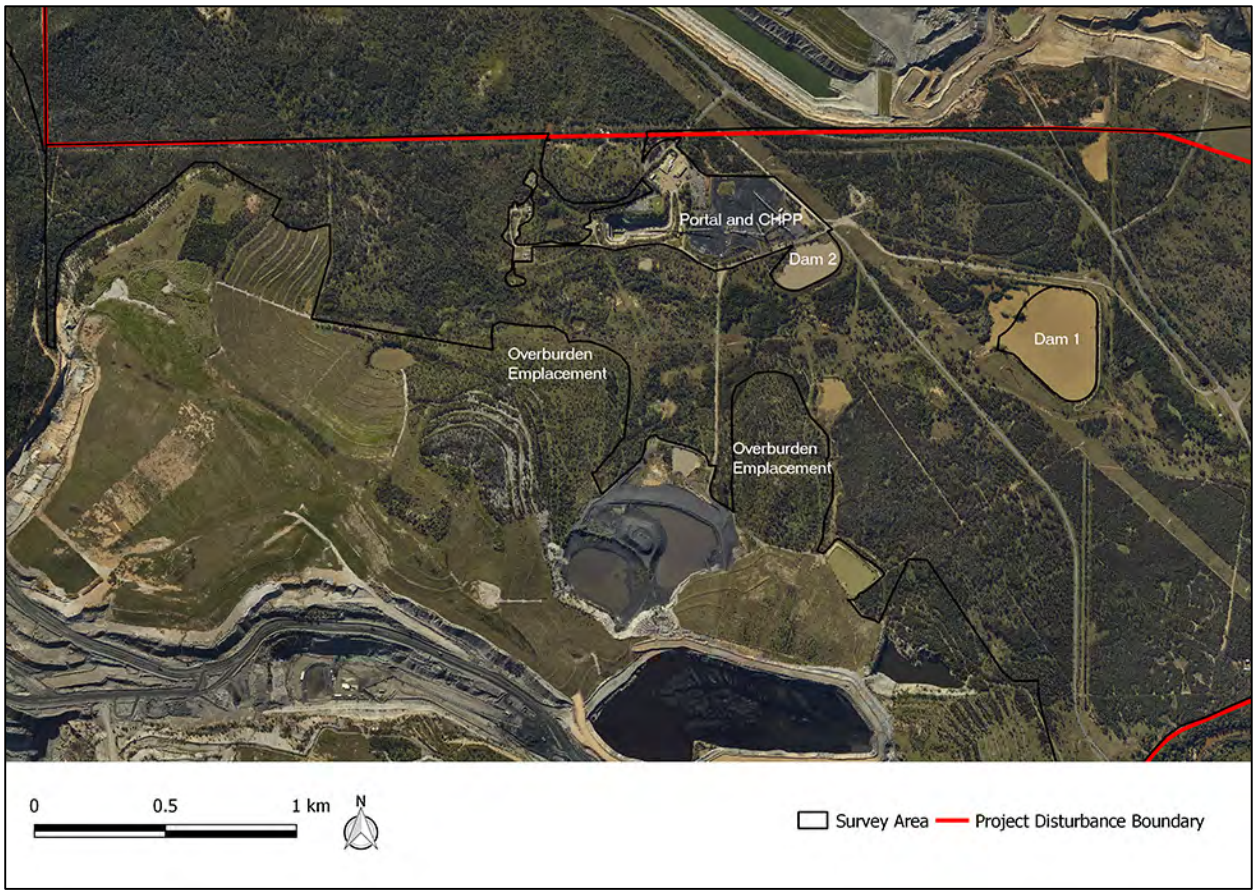
Figure 3-11. The Survey Area (eastern portion) superimposed on a 1987 aerial image.



Finally, overlaying the Project Area on an aerial taken in 2015 of the landscape now occupied by the Survey Area (**Figure 3–12**) displays a number of landscape features including the extensive regeneration of vegetation. Redbank Creek also displays more vegetation along its banks than any time in the past 50 years. There has not been a noticeable increase in mine related infrastructure within the Project Area when compared to the 1987 aerial and exposures are far rarer in the landscape than in previous periods. During their survey in 2002, Umwelt noted that in the 19 years since the Koettig and Hughes survey, there have been considerable regeneration of the vegetation and considerable impacts from ancillary activities associated with the mining operation (Umwelt 2002).

The veneer of trees and grass that now obscure much of the Survey Area should not disguise the fact that the landscape seen today is probably more-treed than any time since the nineteenth century and that erosion is less-noticeable than previously. However, as seen above, these disturbances have occurred and their impact on the archaeological landscape is manifest.

Figure 3-12. The Survey Area (eastern portion) superimposed on a 2015 aerial image.

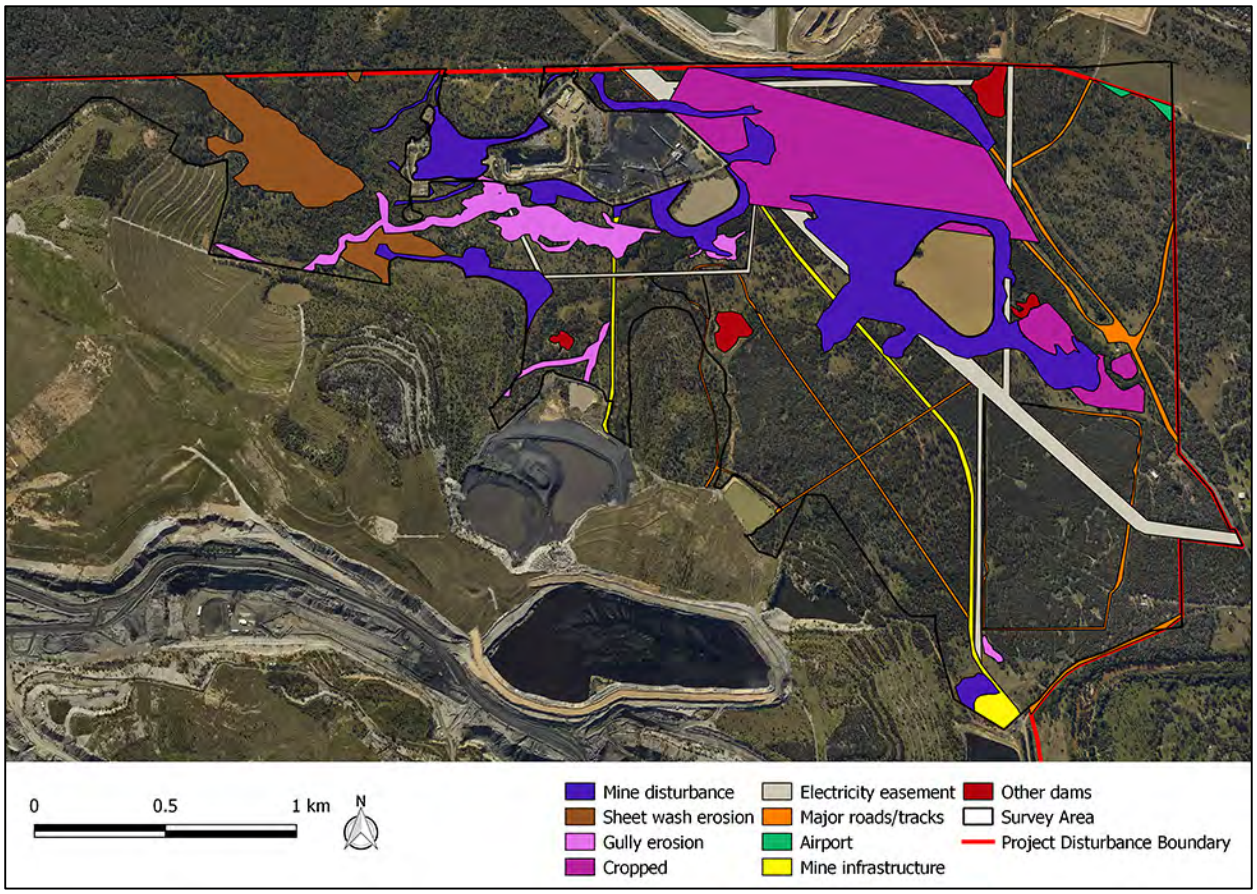


Overall, an examination of the 1963, 1981 and 1987 aerials enables an evaluation of cumulative disturbances within the Survey Area that are not visible today due to vegetation regrowth (**Figure 3–13**). These disturbances fall into two broad categories:

- Major erosion disturbances. Largely taken from the 1963 aerial, this area encapsulates the severe sheetwash and gully erosion observed in the 1963 aerial along Redbank Creek. This area includes 17.8ha or 3.2 per cent of the Survey Area.
- Major mine related disturbances. Largely taken from the 1987 aerial, this area encapsulates those areas severely impacted by mine related infrastructure construction such as that associated with Dam 1 and the edges of dumps both from Wambo and United Collieries. This only includes major disturbances as there are other mine-related disturbances outside of these areas such as roads, tracks, haul roads, dams, drilling pads, vents and flares. This area includes 78.6ha or 15.8 per cent of the Survey Area.

When mapped the extent of past disturbances are clear, particularly in the eastern portions of the Survey Area (**Figure 3–13**).

Figure 3-13. Cumulative impacts to the Survey Area.



3.8 CONCLUSION

The Project Area contains a reliable water source, Redbank Creek, as well as ephemeral drainage systems that are likely to have provided a range of faunal, floral, hydrological and geological resources during antiquity.

Apart from the hilly terrain located in the far western portion of the Project Area, the topography presents no major obstacles to occupation of, movement through, or resource procurement within the Survey Area.

There are no extant landscape features such as rock overhangs that would be suitable for occupation. The Survey Area's vegetation has been altered significantly, and as a result, little of the original native vegetation patterning remains intact within the Survey Area.

The tendency for the local soils to erode indicates that archaeological surface manifestations should generally be regarded as partially or heavily disturbed. Finally, mining has dramatically altered a significant proportion of the Survey Area, removing the likelihood that these areas contain intact archaeological deposits.

4 ABORIGINAL ARCHAEOLOGY BACKGROUND

4.1 CHRONOLOGY OF THE HUNTER VALLEY

Early chronological frameworks for Australian prehistory have been based primarily on sequences of stone artefacts (Hiscock 1994) with the earlier sequence being termed the 'core tool and scraper tradition' and the more-recent being termed 'the Australian small tool tradition'. Archaeological excavations have so far determined that human occupation of the Hunter Valley has occurred since the last Glacial Maximum (approximately 27,000 – 17,000 years BP (Before Present; HLA 2005).

Characterising the lithic technology which existed before the advent of the Australian Small Tool Phase in the Hunter Valley is problematic due to a lack of local assemblages dating to this early period (Hiscock 1986: 19). However, studies by Koettig (1990) and Baker (1994) suggest that the technology practiced by early Hunter Valley knappers was part of the 'core tool and scraper tradition' described for much of Pleistocene Australia. This technology focused on early reduction cores-some of them quite large-to provide flake blanks for use as tools. Cutting tools were often made on robust flake blanks struck from cores carried off-source or were made on flake blanks struck from cores abandoned on-source. The sizes and shapes of the resulting tools were probably influenced by the nature of the raw material from which they were manufactured. Tool edges were refurbished by unifacial retouching (Holdaway 1995). In early Hunter Valley assemblages, volcanic materials were preferred over silcrete and mudstone (Koettig 1990, 1992: 5; Baker 1994).

It is hypothesised that it is likely that evidence predating this earlier period will be unearthed/studied in the future.

However, very few archaeological sites within the Hunter Valley have been directly dated by radiocarbon or thermoluminescence dating, as there are limitations in applying this technology to the open sites that dominate the archaeological resource of the region. These site types – artefact scatters and isolated finds – are generally exposed by erosion processes, which also act to remove the stratified and datable context of archaeological sites. Where datable materials such as charcoal are found at an archaeological site, the association between the dated sample and cultural materials may not be provable, unless the sample comprises an intact feature such as a hearth (Dean-Jones and Mitchell 1993). Further, artefacts exposed on the ground surface may result from a single visit or from discard events from repeated visits, which could span time periods of 10s, 100s, or even 1000s of years. Although the above constraints are noted, previous archaeological investigations within the Hunter Valley have provided dates of occupation for several sites that inform our understanding of the antiquity of Aboriginal occupation of the region, including:

- Glennies Creek (Falbrook) north of Singleton, where a hearth located on a burial alluvial terrace provided radiocarbon dates between 13020±360 BP (before present) and 34580±650 BP (Koettig 1986, 1987);
- Wollombi Brook (west of Singleton), where artefacts identified on a terrace in a clay Horizon were dated to late Pleistocene (between 18,000 and 30,000 BP) by a geomorphologist (reported in Kuskie and Kamminga 2000: 215);
- Moffats Swamp near Medowie (close to Port Stephens), where radiocarbon dating of a charcoal fragment recovered from the base of a dune provided an uncalibrated date of 14,750 BP (Baker 1994); and
- Bobadeen (Moore 1970) near Cassilis, where excavation of a rockshelter provided a date of 7750±120 BP (Moore 1970).

Consideration of technological attributes of stone artefacts also provides an indication of the age of occupation, and is most beneficial in excavations of open sites where there is most often no stratigraphic integrity and very rarely datable material. Excavations throughout south-east Australia provide evidence for the appearance of backed artefacts during the Early Holocene period and their proliferation ca 3,000 BP (Hiscock and Attenbrow 1998). These artefacts have been used as a distinguishing feature of Holocene occupation deposits, and on this basis, many sites are considered to be Holocene in age.

Other material culture also appears in south-east Australia in the mid-late Holocene period, such as edge ground axes, hatchets and adzes. Edge grinding has been present in the archaeological record of northern Australia since the late Pleistocene; however, the antiquity of edge grinding in south-eastern Australia appears (on currently available information from dated sites) limited to the mid-Holocene to recent period. The earliest known accepted date for a flake from the cutting edge of an edge ground axe in south-eastern Australia comes from a rockshelter excavation at Graman near Inverell. Binns and McBryde (1972: 65) report that the flake had an antiquity of around 4,000 years.

Based on evidence from the Bulga Coal Complex, the Australian Small Tool Phase toolkit included the following items in various proportions: (1) primary cobble blanks, (2) large primary flake blanks struck during on-source reduction of large cores, (2) secondary flake blanks for use and/or reduction as blade cores, (3) blade cores, (4) flake blanks for backing, (5) unused microliths, (6) flake tools, and (7) composite tools made from microliths. The precise composition of the toolkit was probably influenced by a number of variables such as the availability of suitable stone cobbles in the foraging radius, the timing of the last visit to the Hunter River gravel bars, and stone usage rates (Koettig 1994).

4.2 SETTLEMENT PATTERNS

There are a number of theories regarding how Aboriginal people used and affected the landscape in which they lived. These theories attempt to explain or interpret the location and nature of the

archaeological record in any region. It is generally assumed that the environment, and implicitly resource distribution, was a major factor influencing patterns of occupation.

Kuskie and Kamminga (2000: 33-34) have summarised a number of postulated models of occupation for the Central Lowlands:

- Koettig (1994) argues that the location of camps and the patterning within them was determined by rules based on the location of water sources, the demographics of the group and length of stay. The number of occupational episodes may therefore be interpreted through the spacing and distribution of features within a camp. The frequency of these episodes was probably influenced by the availability of resources.
- Witter (1995) argues that long-term base camps were located on the Hunter River and its major tributaries, and other open campsites in the region were peripheral to these.
- Haglund (1992) postulates that sites on Doctors Creek and Sandy Hollow Creek are the result of small groups of people visiting the area many times to utilise the rich resources located there.
- Dean-Jones and Mitchell (1993) suggest that various landforms were used to avoid climatic extremes and associated problems, to take advantage of resource-rich areas, and for ease of travel through the landscape. They also suggest that the saline groundwater associated with Permian Coal Measures may have influenced the seasonality of occupation in some areas and hence the pattern of archaeological evidence.
- Rich 1995 argues that technological strategies enabled people to manage resources in the landscape and social strategies enabled management of the uncertainty and risk involved in hunting and gathering.

4.3 REGIONAL ARCHAEOLOGICAL CONTEXT

The Project Area is located in the Wonnarua tribal area of the upper Hunter Valley.

Using ethno-historic sources, Helen Brayshaw has shown that the Wonnarua people lived in an environment rich in food resources (Brayshaw 1986). Freshwater fish, shellfish, reptiles, mammals, birds and plant food provide a diverse diet. Brayshaw (1986: 82) suggests that inland groups visited the coast during the summer when marine resources were plentiful, and coastal groups travelled inland to participate in the winter kangaroo hunts. Trade and/or exchange also occurred between the coastal and inland groups. Reed spears and shells were traded inland for possum skin rugs and fur cord (Brayshaw 1986: 41). Social gatherings were a feature of Aboriginal life in this area.

ERM (2004: 54) summarises the archaeological context of the upper Hunter Valley as:

> *Archaeological sites other than artefact scatters or isolated artefacts are not common. Quarry sites have been identified where silcrete outcrops; however the vast majority of raw material used in the manufacture of stone artefacts would have derived (been quarried) from the Hunter River. In some cases quarry sites have not been*

distinguished from artefact scatters. The importance of silcrete sources found within the Hunter River terraces may be quite minor given the widespread availability of silcrete cobbles along the river corridor. Axe-grinding grooves often occur where suitable sandstone is located in association with water or a creek line. Scarred trees are rare, presumably because most trees that may be old enough to have been scarred by the removal of bark by Aboriginal people have either been cleared since European settlement or have died naturally. Art sites, ceremonial sites or Bora grounds within the study area are also rare and are either deteriorating or can no longer be located.

The 2009 United Colliery ACHMP notes that the most common Aboriginal site type within the Hunter Valley is the stone artefact site; the key characteristics have been well-established as:

- the widespread distribution of low density sites comprising generally between one and fifteen across all parts of the landscapes;
- the common raw materials being indurated mudstone and silcrete with small proportions of quartz, quartzite, chert, petrified wood, tuff and various volcanic rock types;
- surface exposures eroding from a mainly buried subsurface distribution which is largely continuous close to major water sources;
- the common association of backed artefacts and associated manufacturing products associated with their manufacture, often in knapping floors; and
- the rarity of abraded artefacts such as axe heads; and the rarity of features such as hearths.

The rarity of hearths and grindstones is a key difference between Hunter Valley sites (and other adjacent seaboard regions) and Aboriginal sites west of the Great Diving Range.

4.4 LOCAL ARCHAEOLOGICAL CONTEXT

4.4.1 AHIMS Registrations

An AHIMS search was conducted on 2 February 2015 for a search area that included the Project Area and surrounding areas[3].This returned 737 sites of which 700 (95 per cent) are listed as 'valid' or 'partially destroyed' (**Figure 4–1**; **Appendix 19**). However, as was seen in the Survey Area (see below), a large number of inaccuracies exist within these listings either to do with site location or site status and therefore the figures should be treated with caution. In particular, a

[3] GDA Zone 56, Eastings 308000–309500, Northings 6392000–6398250 with a buffer of 50 meters.

GDA Zone 56, Eastings 309500–311500, Northings 6392000–6398250 with a buffer of 50 meters.

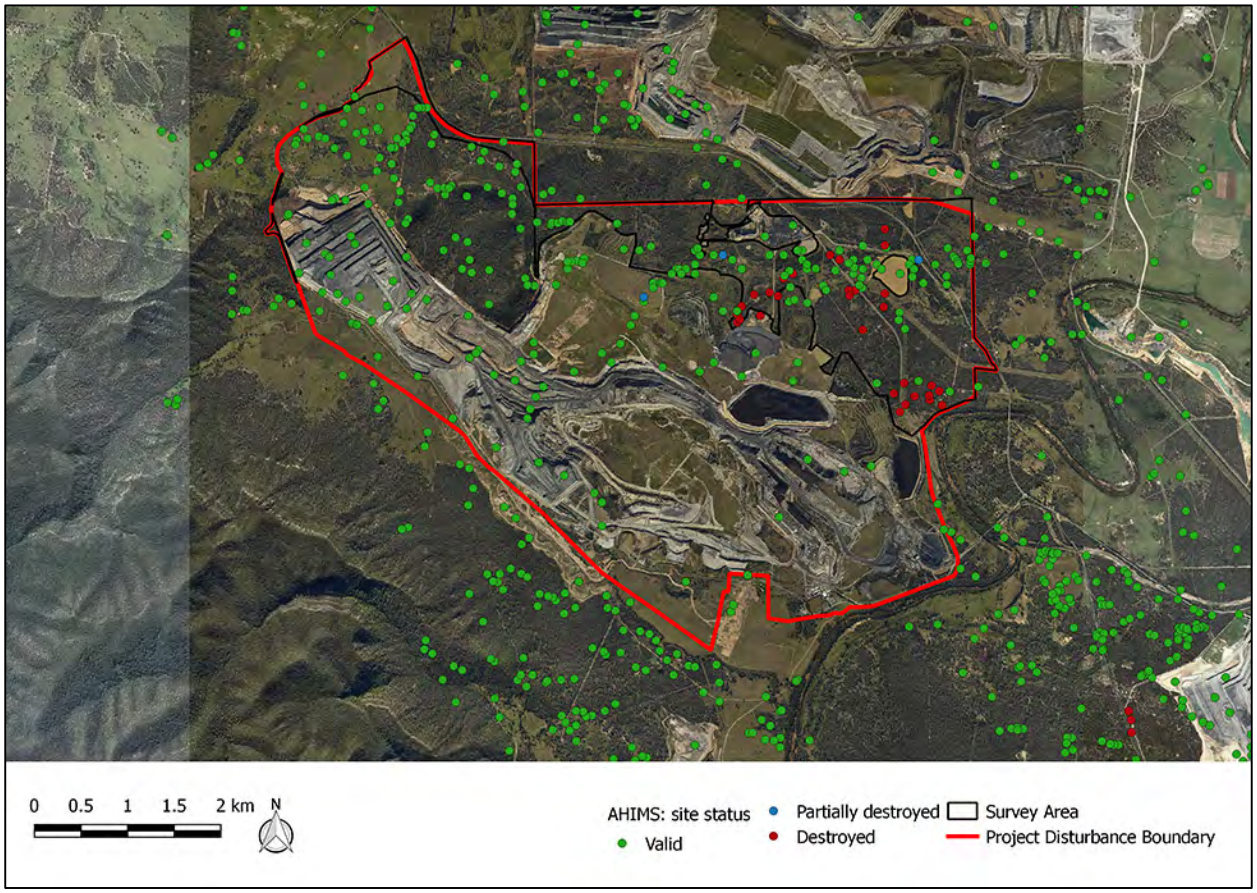
GDA Zone 56, Eastings 311500–314000, Northings 6392000–6398250 with a buffer of 50 meters.

GDA Zone 56, Eastings 314000–316000, Northings 6392000–6398250 with a buffer of 50 meters.

GDA Zone 56, Eastings 308000, Northings 6392000–6401000 with a buffer of 50 meters.

number of sites are listed as 'valid' with AHIMS although they can be clearly seen in **Figure 4–1** to plot to highly modified landforms, such as within open cut pits. This underlines the caution with which the AHIMS records must be treated. While correct location and status information has been updated on AHIMS by OzArk for the Survey Area, this has not been done for the entirety of the Project Area.

Figure 4-1. Distribution of previously-recorded sites within and adjacent to the Project Area showing site status.

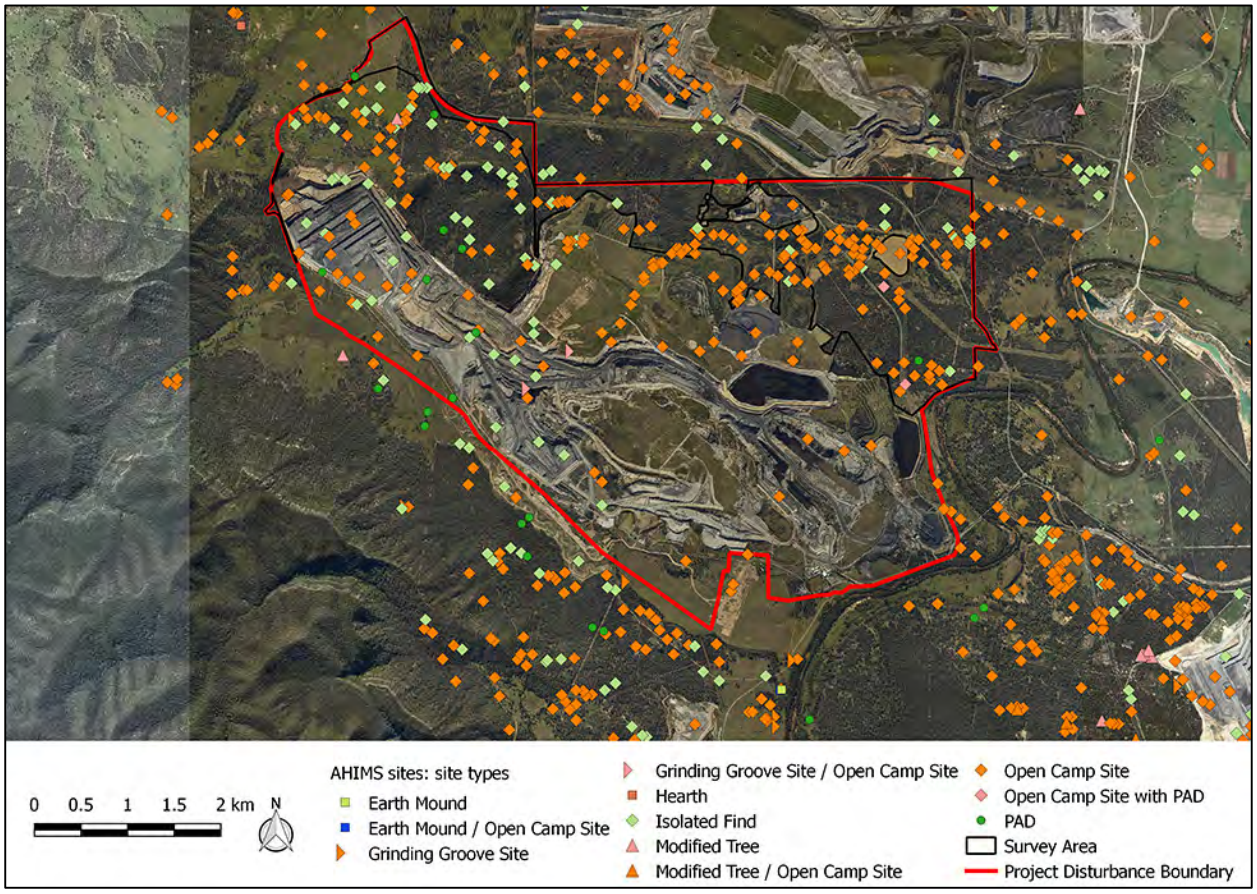


The recorded site types range from artefact scatters and isolated finds, through to art and heart sites. The site types are shown in **Table 4–1** and **Figure 4–2**.

Table 4-1. AHIMS site types and frequencies.

Site Type	Number	% Frequency
Open Camp Site	534	72.4
Isolated Find	151	20.5
Potential Archaeological Deposit (PAD)	21	2.8
Modified tree with/without open camp site	14	1.9
Grinding groove with/without open camp site	11	1.5
Open Camp Site with PAD	2	0.27
Earth mound with/without open camp site	2	0.27
Hearth	1	0.14
Total	**737**	**99.78**

Figure 4-2. Distribution of previously-recorded sites within and adjacent to the Project Area showing site type.



Within the Survey Area OzArk has investigated the veracity of site location and site status for all sites resulting in a number of sites being moved and/or their status changed from 'valid' to 'destroyed'. A number of sites, particularly those recorded some time ago, are impossible to locate in today's landscape with any accuracy as the original coordinates were done from topographic maps and their actual location is only an approximation.

There are 108 sites recorded within the Survey Area. Of these 30 sites (28 per cent) are listed as 'destroyed' with AHIMS while the remainder are listed as 'valid' or 'partially destroyed'. 88 sites (81 per cent) are registered as artefacts scatters, 16 sites (15 per cent) are isolated finds, two are listed as artefacts scatters with potential archaeological deposits (PAD) and two are listed as PADs. Details are shown in **Table 4–2** and the location of the sites is shown in **Figure 4–3**. The data in this table and figure includes the OzArk site rectification of sites within the Survey Area.

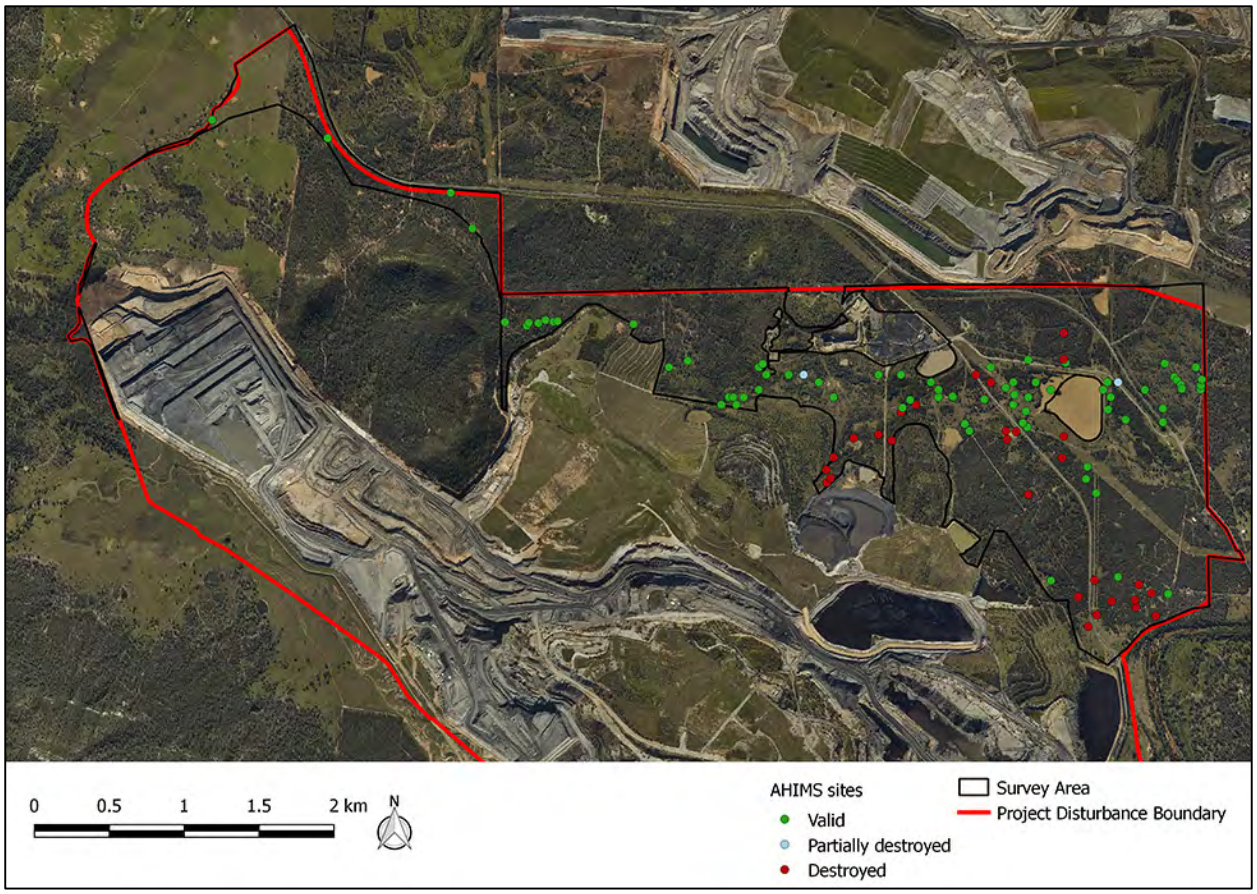
Table 4-2. AHIMS registered sites within the Survey Area.

Site ID	Site Name	GDA Zone 56 East	GDA Zone 56 North	Site Status	Site Type
37-5-0023	Warkworth Agip 8	312205	6396590	Valid	Open Camp Site
37-5-0024	Malabar	311405	6396590	Valid	Open Camp Site
37-5-0025	Agip 2 Malabar	311305	6396690	Valid	Open Camp Site
37-5-0027	Malabar	310705	6396590	Valid	Open Camp Site
37-5-0028	Malabar Agip 3	310305	6396790	Valid	Open Camp Site
37-5-0073	Red Bank Creek 57	311705	6396340	Destroyed	Open Camp Site
37-5-0074	Red Bank Creek 58	311405	6396190	Destroyed	Open Camp Site
37-5-0075	Red Bank Creek 59	311355	6396106	Destroyed	Open Camp Site
37-5-0083	Red Bank Creek 51	312455	6396790	Valid	Open Camp Site
37-5-0085	Red Bank Creek 35	310905	6396640	Valid	Open Camp Site
37-5-0092	Red Bank Creek 24	311855	6396490	Destroyed	Open Camp Site
37-5-0095	Red Bank Creek 27	310655	6396540	Valid	Open Camp Site
37-5-0096	Red Bank Creek 28	310735	6396590	Valid	Open Camp Site
37-5-0097	Red Bank Creek 29	310805	6396590	Valid	Open Camp Site
37-5-0098	Red Bank Creek 30	310755	6396540	Valid	Open Camp Site
37-5-0099	Red Bank Creek 31	310905	6396790	Valid	Open Camp Site
37-5-0100	Red Bank Creek 32	310955	6396740	Valid	Open Camp Site
37-5-0101	Red Bank Creek 33	311105	6396740	Valid	Open Camp Site
37-5-0102	Red Bank Creek 23	311955	6396540	Destroyed	Open Camp Site
37-5-0103	Red bank Creek 22	312105	6396590	Valid	Open Camp Site
37-5-0104	Red Bank Creek 21	312355	6396740	Destroyed	Open Camp Site
37-5-0105	Red bank Creek 20	312055	6396690	Valid	Open Camp Site
37-5-0106	Red Bank Creek 19	312055	6396690	Valid	Open Camp Site
37-5-0109	red bank Creek 16	311855	6396740	Valid	Open Camp Site
37-5-0110	Red bank Creek 15	311705	6396740	Valid	Open Camp Site
37-5-0115	Red Bank Creek 8	312105	6396640	Valid	Open Camp Site
37-5-0116	Red Bank Creek 5	311205	6396740	Partially destroyed	Open Camp Site
37-5-0288	UNITED 4	311540	6396317	Destroyed	Open Camp Site
37-5-0324	Wambo site 183	310069	6397078	Valid	Isolated Find
37-5-0343	Wambo site 202	308847	6397954	Valid	Isolated Find
37-5-0349	Wambo site 190	309210	6397091	Valid	Open Camp Site
37-5-0387	Wambo site 272	308026	6398319	Valid	Isolated Find
37-5-0429	Wambo site 189	309356	6397068	Valid	Open Camp Site
37-5-0430	Wambo site 188	309369	6397087	Valid	Isolated Find
37-5-0432	Wambo site 187	309433	6397085	Valid	Open Camp Site
37-5-0433	Wambo site 186	309480	6397105	Valid	Open Camp Site
37-5-0434	Wambo site 185	309534	6397094	Valid	Open Camp Site
37-5-0435	Wambo site 184	309561	6397098	Valid	Open Camp Site
37-5-0496	Haul Road 2	313100	6396125	Valid	Open Camp Site
37-5-0508	UNITED 3	311361	6396021	Destroyed	Open Camp Site
37-5-0509	UNITED1	311359	6396021	Destroyed	Open Camp Site
37-5-0512	United Collieries 13	312200	6396595	Valid	Open Camp Site

Site ID	Site Name	GDA Zone 56 East	GDA Zone 56 North	Site Status	Site Type
37-5-0514	United Collieries 11	311916	6396572	Valid	Isolated Find
37-5-0516	United Collieries 14	311793	6396300	Destroyed	Open Camp Site
37-5-0517	United LOMEA1	311385	6396050	Destroyed	Open Camp Site
37-5-0518	United Collieries 2	312281	6396412	Valid	Open Camp Site
37-5-0519	United Collieries 8	312411	6396575	Valid	Open Camp Site
37-5-0520	United Collieries 23 (Doyles Creek)	312312	6396365	Valid	Open Camp Site
37-5-0523	UNITED 6 (Relocated Redbank creek 24)	311865	6396520	Valid	Open Camp Site
37-5-0561	Wambo PAD T	307254	6398441	Valid	PAD
37-5-0576	UCL 12-1	310431	6396833	Valid	Open Camp Site
37-5-0577	UCL 12-2	310931	6396812	Valid	Isolated Find
37-5-0669	Wambo Site 328	308993	6397716	Valid	Open Camp Site
37-6-0130	Agip 7 Warkworth	312689	6396497	Valid	Open Camp Site
37-6-0131	Agip 6 Warkworth	313238	6396508	Valid	Open Camp Site
37-6-0132	Agip 10 Warkworth	313234	6396691	Valid	Open Camp Site
37-6-0133	Warkworth Agip 8	313605	6396423	Valid	Open Camp Site
37-6-0134	Agip 9 Warkworth	313604	6396515	Valid	Open Camp Site
37-6-0136	Wambo site 6 Warkworth	313262	6395228	Destroyed	Open Camp Site
37-6-0272	Red Bank Creek 12	313305	6396690	Partially destroyed	Open Camp Site
37-6-0275	Red Bank Creek 10	313355	6396440	Valid	Open Camp Site
37-6-0323	Redbank Creek No.45	312855	6396640	Valid	Open Camp Site
37-6-0324	Redbank Creek N0.46	312755	6396690	Valid	Open Camp Site
37-6-0325	Redbank Creek No.47	312705	6396590	Valid	Open Camp Site
37-6-0326	Redbank Creek No.48	312605	6396540	Valid	Open Camp Site
37-6-0327	Redbank Creek No.49	312605	6396690	Valid	Open Camp Site
37-6-0328	Redbank Creek No.50	312455	6396690	Destroyed	Open Camp Site
37-6-0330	Redbank Creek No.42	313205	6396640	Valid	Open Camp Site
37-6-0711	WB 13	313825	6396790	Valid	Open Camp Site
37-6-1007	UC1/6	312955	6396820	Valid	Open Camp Site
37-6-1008	UC1/7	312705	6396840	Valid	Open Camp Site
37-6-1009	UC4/2	312705	6395940	Destroyed	Open Camp Site
37-6-1010	UC5/1	313105	6395060	Destroyed	Open Camp Site
37-6-1020	UNITED site 2	313039	6395258	Destroyed	Open Camp Site
37-6-1033	UC2/1	313255	6396590	Valid	Open Camp Site
37-6-1611	Haul Road 1	313162	6395137	Destroyed	Open Camp Site with PAD
37-6-1612	Haul Road 3	313148	6395369	Destroyed	Open Camp Site
37-6-1613	Haul Road 5	312930	6396184	Destroyed	Open Camp Site with PAD
37-6-1614	Haul Road 6	312624	6396362	Destroyed	Open Camp Site
37-6-1657	Haul Road 4	313159	6395950	Valid	Open Camp Site
37-6-1771	140	313617	6396815	Valid	Isolated Find
37-6-1773	142	313680	6396725	Valid	Open Camp Site
37-6-1774	143	313698	6396703	Valid	Isolated Find
37-6-1775	144	313725	6396671	Valid	Open Camp Site

Site ID	Site Name	GDA Zone 56 East	GDA Zone 56 North	Site Status	Site Type
37-6-1776	145	313731	6396646	Valid	Open Camp Site
37-6-1777	146	313484	6396639	Valid	Open Camp Site
37-6-1778	147	313857	6396641	Valid	Isolated Find
37-6-1779	148	313859	6396669	Valid	Isolated Find
37-6-1780	149	313864	6396708	Valid	Isolated Find
37-6-1781	150	313864	6396708	Valid	Isolated Find
37-6-1910	United Collieries 3 (Singleton)	312555	6396364	Destroyed	Open Camp Site
37-6-1911	United Collieries 4 (Singleton)	312698	6396391	Valid	Isolated Find
37-6-1912	United Collieries 5 (Singleton)	312668	6396418	Valid	Open Camp Site
37-6-1913	United Collieries 9 (Singleton)	312613	6396607	Valid	Open Camp Site
37-6-1914	United Collieries 10 (Singleton)	312554	6396653	Valid	Open Camp Site
37-6-1915	United Collieries 15 (Singleton)	312942	6396844	Destroyed	Isolated Find
37-6-1916	United Collieries 16 (Singleton)	312942	6397019	Destroyed	Isolated Find
37-6-1917	United Collieries 17 (Singleton)	312942	6396328	Destroyed	Open Camp Site
37-6-1918	United Collieries 18 (Singleton)	312857	6395366	Valid	Open Camp Site
37-6-1919	United Collieries 19 (Singleton)	313425	6395188	Destroyed	Open Camp Site
37-6-1920	United Collieries 20 (Singleton)	313640	6395277	Valid	Isolated Find
37-6-1921	United Collieries 21 (Singleton)	312562	6396308	Destroyed	Open Camp Site
37-6-1922	United Collieries 22 (Singleton)	313091	6396045	Valid	Open Camp Site
37-6-1923	United Collieries 24 (Singleton)	313556	6395131	Destroyed	Open Camp Site
37-6-1924	United Collieries 25 (Singleton)	313417	6395237	Destroyed	Open Camp Site
37-6-1925	United Collieries 26 (Singleton)	313444	6395341	Destroyed	Open Camp Site
37-6-1926	United Collieries 27 (Singleton)	313527	6395282	Destroyed	Open Camp Site
37-6-2075	Wambo PAD B	313304	6395391	Valid	PAD

Figure 4-3. AHIMS sites within the Survey Area showing site status.



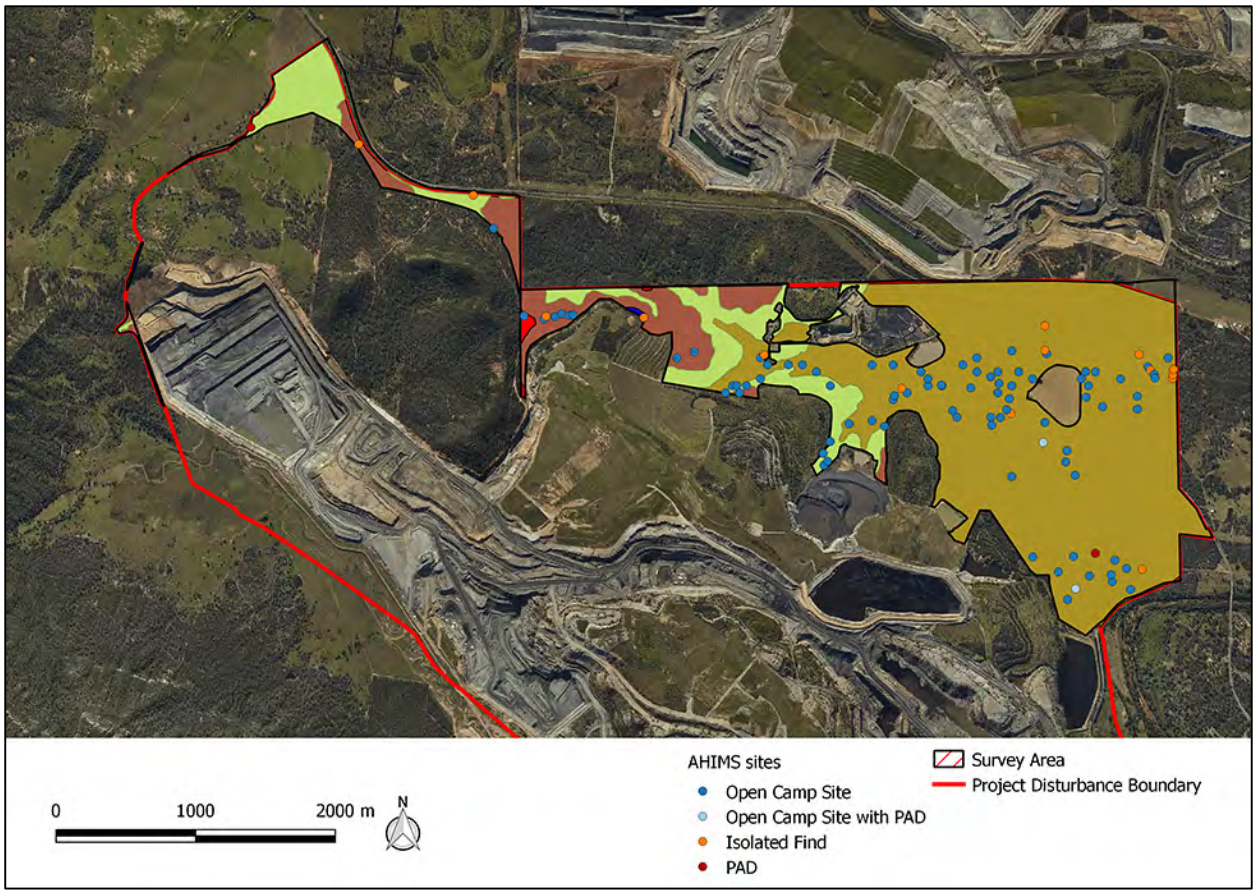
When AHIMS sites recorded within the Survey Area are plotted against mapped landform units it is clear that a majority of sites have been recorded associated with the flat landforms adjacent to the major drainage lines within the Survey Area. As seen in **Table 4–3** and **Figure 4–4**, 80 per cent of sites are associated with the flat landforms in the east of the Survey Area with far less numbers in lower and mid slope landforms (nine per cent in each landform type) and very low numbers in upper slope or crest/ridge landforms (one per cent in each landform type).

This reinforces the regional paradigm that there is a close relationship between site location and the availability of water.

Table 4-3. AHIMS sites in relation to landform units.

Landform unit	Number of sites	Percentage of total (n=120)
flat/drainage	96	80
lower slopes	11	9
mid-slope	11	9
upper slope	1	1
crest/ridge	1	1

Figure 4-4. AHIMS sites in relation to landform units.



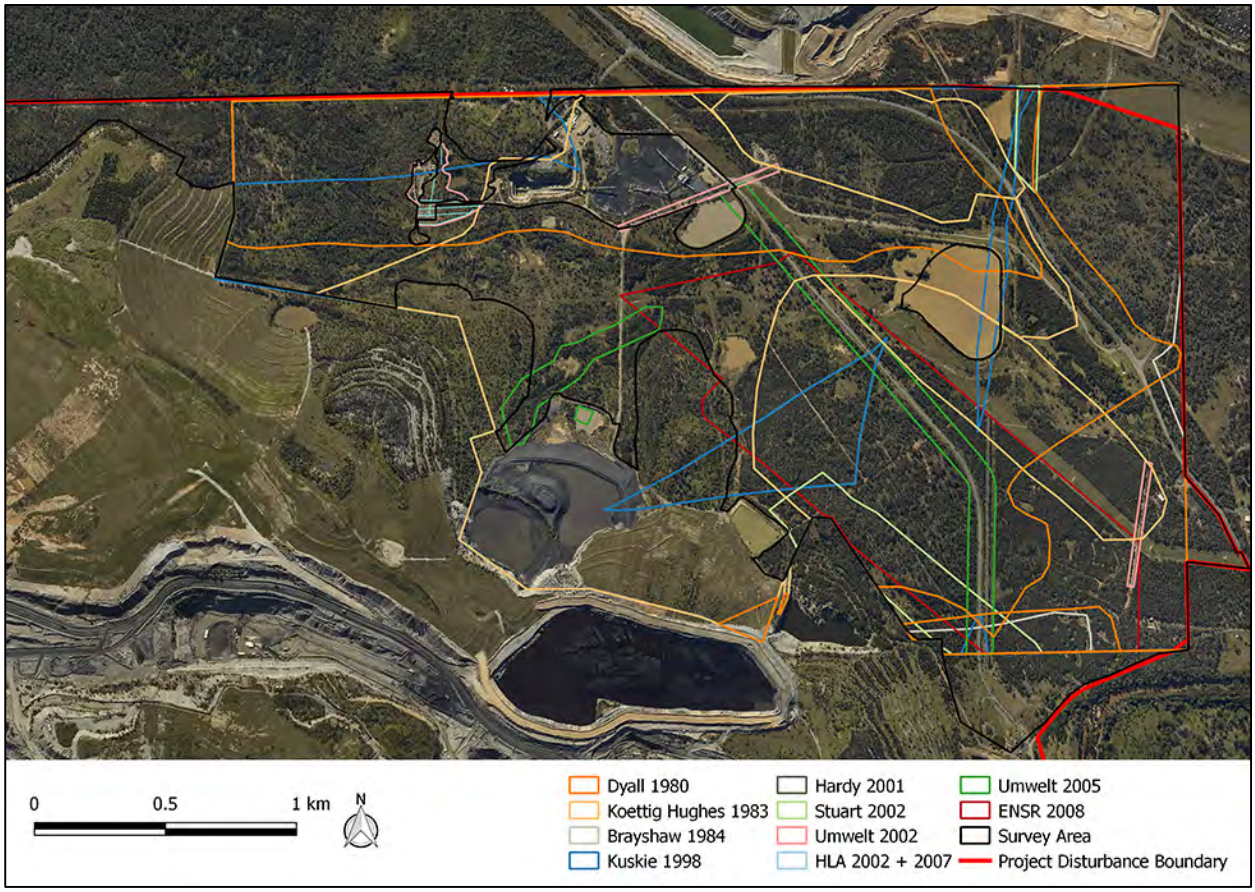
4.4.2 Previous Archaeological Investigations

The Survey Area has been subject to numerous Aboriginal archaeological investigations resulting in recordings and excavations at many archaeological sites including Dyall 1980a, Dyall 1980b, Koettig and Hughes 1983, Brayshaw & Associates 1984, Mary Dallas Consulting Archaeologists 1988 (Dallas 1988), HLA-Envirosciences 2002 (HLA 2002), Umwelt Pty Limited 2002 (Umwelt 2002), Umwelt 2005, HLA 2007, ENSR 2008, Insite Heritage Pty Limited 2009a, Insite Heritage 2009b, Insite Heritage 2010a and Insite Heritage 2010b (**Figure 4–5**; the reports by Kuskie 1988, Hardy 2001 and Stuart 2002 were not able to be located and are therefore not summarised below). Cumulatively, these studies emphasise the dominance of artefact scatters and isolated finds over other site types, the dominance of mudstone and silcrete over other raw materials and interpretational difficulties associated with ground disturbance (primarily erosion and vegetation clearing). It is apparent from these studies that stone artefacts are numerous, largely but not exclusively concentrated along watercourses, and predominately situated in disturbed deposits or disturbed surface contexts where artefacts are detectible on the ground surface during survey. Such observations are broadly consistent with the regional archaeological context.

As can be seen in **Figure 4–5** the previous survey effort is concentrated in the east of the Survey Area and areas to the west have undergone no previous assessment. Assessment associated

with the Wambo mine did include some of these areas but are not shown in **Figure 4–5** that focuses on assessments for United Collieries.

Figure 4-5. Previous archaeological assessments of the Survey Area (eastern portions).



4.4.2.1 Report on Aboriginal Relics on AGIP Coal Lease, Warkworth, Hunter Valley, NSW (Dyall 1980a)

Dyall (1980a) completed an archaeological survey of the AGIP coal lease area at Warkworth. The Hunter River is located approximately 3km south of the study area while Redbank Creek runs through the study area. In total, 10 open camp sites were identified as well as one set of axe-grinding grooves (the grinding grooves are not within the current Project Area). Of the open camp sites, eight were located in close proximity to watercourses, however, most were noted as being relatively minor sites comprising waste stone flakes with the occasional stone implement present such as scrapers and backed blades. Eight shallow grooves were recorded at the axe-grinding grooves site located on a sandstone boulder in the bed of a minor watercourse running to the North Wambo Creek. Dyall concluded by noting the area along Redbank Creek shows clear evidence of extensive occupation by Aboriginal people.

4.4.2.2 Report on Aboriginal Relics on Wambo Coal Lease, Warkworth (Dyall 1980b)

Dyall completed another archaeological survey in 1980, this time of a section of the Wambo Mining Corporation Pty Ltd lease area bounded by North Wambo Creek to the southwest and

Wollombi Brook to the east. During his survey Dyall noted large areas of disturbed land resulting from extensive mining activities. Despite this, six sites were identified including five open camp sites and one set of axe-grinding grooves (the grinding grooves are not within the current Project Area). All open camp sites were recorded on the eroded banks of watercourses including Doctors Creek and its tributaries with the most extensive site extending nearly 1km along both banks of Doctors Creek. Overall Dyall concluded that given the presence of the site types identified and their density that Aboriginal people hunted through the area and had minor camps but that major campsites in the area were likely situated closer to permanent water sources such as the Hunter River.

4.4.2.3 Archaeological Investigations on the United Collieries Coal Lease, Warkworth, Hunter Valley, NSW (Koettig and Hughes 1983)

Following an archaeological survey in 1983, Koettig and Hughes carried out subsurface investigations at United in advance of proposed underground coal mining, which included the construction of a number of water pondage complexes and associated overburden storage areas. Of the 66 sites identified during the survey, excavations were conducted on three, being Red Bank Creek 5 (on the southern bank of Redbank Creek), Red Bank Creek 12 (on the northern bank of Redbank Creek) and Red Bank Creek 13 (on the western bank of a tributary leading northeast into Redbank Creek). These sites were selected due to the presence of dense concentrations of artefacts and relatively intact knapping floors eroding out of A Horizon sediments. Excavation was conducted in squares of 50cm by 50cm with 27 to 30 squares excavated at each site. Subsurface investigations revealed that the majority of artefacts were recovered from lower levels of the A Horizon above a culturally-sterile B Horizon. The main artefact types identified included cores, flakes, flaked pieces and retouched flakes comprised from indurated mudstone and silcrete with chert, quartz, quartzite and volcanics. Of the three sites, Red Bank Creek 5 presented the highest density of artefacts from both the surface and subsurface.

Red Bank Creek 5 is located on a terrace-like landform between Redbank Creek and a shallow channel at the break of slope and was noted as being relatively undisturbed by agricultural activities. Major visible concentrations of redeposited artefacts within two erosion areas were identified. *In situ* artefacts were identified on the terrace with artefacts appearing to be eroding out of the homogeneous 'silty' layer (A Horizon), recorded at most 30cm deep and overlying orange weather clay (B Horizon). The survey also identified several knapping floors with some artefacts still *in situ* within the A Horizon, 10cm from the top of the deposit. Subsurface investigations targeted the locations of knapping floors. The densest square excavated at the site, Square 2, recovered a total of 681 artefacts while Square 3 contained the least amount of artefacts with 145. Results from the excavation program showed that the knapping floors were generally confined within an area of $2m^2$; the predominant materials utilised were mudstone and

silcrete; most pieces ranged in size from 1–3cm and 3–5cm; backed artefacts were the only modified pieces recorded and all in situ pieces were found within the A Horizon. Investigations at Red Bank Creek 5 are discussed further in **Section 4.4.3**.

4.4.2.4 Archaeological Survey at Wambo near Warkworth, NSW (Brayshaw & Associates 1984)

Brayshaw & Associates (1984) completed an archaeological survey of an area of land on behalf of Wambo Mining Corporation Pty Ltd in advance of proposed open cut mining. The area subject to survey is located in the north eastern corner of the colliery holding boundary, adjoining the southern boundary of United Colliery. The survey covered a number of landforms including creek lines, ridgetops and slopes. A total of three new sites were recorded during the survey along the central watercourse. These assemblages were all low density artefacts scatters consisting of two to seven artefacts with only few artefacts recorded *in situ*. All artefacts were recorded as being associated with A Horizon sediments with none of the sites displaying a likelihood of possessing subsurface deposits. Although the assemblages are very small it is apparent that they conform to patterns discerned in the larger Hunter Valley investigations. While one modified artefact, a backed flake, was recorded this result also conforms to patterns found throughout the Hunter Valley that the proportion of modified artefacts in assemblages is generally low: less than five per cent overall on Redbank Creek for example.

4.4.2.5 United Collieries coal lease, Warkworth, Hunter Valley, New South Wales: additional archaeological survey (Mary Dallas Consulting Archaeologists 1988)

Mary Dallas Consulting Archaeologists (Dallas 1988) carried out an additional archaeological survey at the United Collieries lease area previously surveyed and investigated by Len Dyall in 1981 and Koettig and Hughes in 1983. The survey covered the north eastern corner of the lease boundary area for a proposed coal haul road route approximately 1km in length with 20m either side of the route inspected. The route traversed a low, cleared hill above Redbank Creek which showed little top soil development thereby reducing the likelihood of subsurface deposits. No Aboriginal sites or relics were located during the additional archaeological survey and therefore there were no archaeological constraints for the proposed route.

4.4.2.6 Archaeological Assessment United Collieries Extension EIS. Hunter Valley, NSW (HLA-Envirosciences Pty Limited 2002)

In 2001 HLA-Envirosciences Pty Ltd completed an archaeological assessment of the Aboriginal heritage associated with the proposed mining extension to the United Collieries operations (HLA 2002). The principal aims of this assessment were to provide information about the nature of the archaeological resources within the proposed impact footprint and provide recommendations in consultation with the local Aboriginal community. The survey area was divided into categories according to the level of disturbance they have previously been subject to. In total these three

survey areas were carried out covered 45 per cent of the low disturbance zone, 48 per cent of the moderate disturbance zone and seven per cent of the high disturbance zone. The survey identified three new Aboriginal sites (United Site 1, United Site 2 and United Site 3) within the survey area. United Site 1 and United Site 2 were both isolated finds comprising a mudstone flake while United Site 3 was recorded as an artefact scatter with approximately 90 artefacts identified. United Site 3 was also recorded as containing several potential intact knapping floors. One knapping floor was described as containing two yellow mudstone cores with multidirectional flaking approximately 10cm in width, 15 flakes of 5cm width, one notched flake and three blades, all of yellow mudstone. This site was considered to be of high significance. HLA recommended conservation of this area of high archaeological sensitivity, or programme of test excavations prior to future impacts.

4.4.2.7 Life of Mine Emplacement Area Location and Assessment of Aboriginal Sites (Umwelt [Australia] Pty Limited 2002)

Umwelt (2002) conducted an archaeological survey to identify any known, significant Aboriginal archaeological sites/areas within the proposed Life of Mine Emplacement Area within the United Collieries lease area. The aim of the assessment was to re-locate previously recorded sites as identified by Koettig and Hughes (1983) and assess their current condition and significance. It was noted by Umwelt that in the intervening 19 years since the Koettig and Hughes survey, there had been considerable regeneration of vegetation and considerable impact by ancillary activities associated with the mine operations. In addition to the re-identified sites, three new sites were recorded comprising an isolated find located on the western bank of a dam and two artefact scatters, one located in an erosion scour on a tributary terrace with the other situated on lower slope on the eastern bank of a tributary. All sites were considered to be located within disturbed contexts.

The survey was conducted with representatives of the local Aboriginal stakeholder groups and was carried out in December 2001 and again in July 2002 with additional stakeholder groups. During the consultation and field survey, the RAPs were encouraged to provide feedback on the Aboriginal cultural significance of the area, on the archaeological sites and areas located within the Project Area.

The following statements were supplied in relation to Aboriginal cultural significance:

- there will be impact to a large number of Aboriginal archaeological sites and landforms of significance to registered Aboriginal stakeholders;
- only Wonnarua traditional owners/descendants have an understanding of how culturally significant sites/areas within the study area are and it is important that all decisions being made about the management of sites are made by Wonnarua people; and

- Redbank Creek is particularly significant and landforms associated with this watercourse are likely to have subsurface artefacts.

It was recommended that prior to the approval of the proposed Life of Mine Emplacement Area, Section 90 consents be sought for sites Red Bank Creek 24, 56, 58 and 59, United 1, 3 and 4 with subsurface investigations to be undertaken at Red Bank Creek 57.

4.4.2.8 Aboriginal Archaeological Survey and Assessment of Proposed Haul Road within the United Mine Lease, Warkworth (Umwelt [Australia] Pty Limited 2005)

Umwelt (2005) completed another archaeological assessment in 2005 within the United Mine lease area for the proposed realignment of an internal haul road with the area surveyed totalling 2km in length by 100m wide. A site search prior to the survey revealed there were 84 sites within the surrounds of the survey area with the most common site type within the area were artefact scatters followed by isolated finds. The survey was completed over two days with the participation of members from the relevant RAPs surveying landforms largely comprising of gently undulating slopes and crests. Six previously recorded sites (#37-6-1009, #37-5-0104, #37-6-0328, #37-6-1020, #37-6-1010, and #37-6-0136) were identified within the impact footprint prior to the survey. A total of 6 sites, Haul Roads 1 to 6, were identified during the survey, including 1 site (Haul Road 1) which incorporated three previously recorded sites (#37-6-1020, #37-6-1010, #37-6-0136). Over 350 artefacts were identified at Haul Road 1 (#37-6-1611 incorporating #37-6-1020), #37-6-1010, #37-6-0136) dominated by mudstone comprising 70 per cent followed by silcrete (15 per cent). Between five and 150 artefacts were recorded at Haul Roads 2 to 6 with PADs identified at all new sites except for Haul Road 4. Previously recorded sites #37-5-0104 and #37-6-0328 were not able to be located during the survey. The report recommended a Section 90 with subsurface salvage to be sought and that geofabric be laid over Haul Road 1 and 5 for protection.

4.4.2.9 Section 90 Permit #2527 for United Collieries Haul Road: Results and Findings (HLA-Envirosciences Pty Limited 2007)

HLA-Envirosciences Pty Ltd (HLA 2007) completed a salvage program within the United Collieries lease area for the sites located within the proposed haul road impact footprint following the 2005 assessment by Umwelt. The aim of this project was to re-identify, record and collect a series of artefact scatters to be impacted by the proposed works under Permit #2527. These sites included Haul Road 1 (#37-6-1611 incorporating #37-6-1020, #37-6-1010, #37-6-0136); Haul Road 3 (#37-6-1612), Haul Road 5 (#37-6-1613), Haul Rd 6 (#37-6-1614), Red Bank Creek 21 (#37-5-0104) and Red Bank Creek 50 (37-6-0328). Sites #37-6-1611, #37-6-1612, #37-6-1613 and #37-6-1614 were successfully relocated and collected during the salvage program. In total, 609 artefacts were collected from these four sites with 427 of these artefacts being collected from #37-6-1611 comprising largely chert, mudstone and silcrete. Of the 609 artefacts recovered only 10 identifiable tools were recorded based on the presence of either deliberate retouching or the

presence of macroscopic edge wear. Sites #37-5-0104 and #37-6-0328 were both investigated, however, no archaeological material was identified at either of the sites and based on their distance from Redbank Creek it was believed that the sites are likely to be located further to north east.

4.4.2.10 Aboriginal Heritage Assessment of Proposed Longwalls 10 and 11, United Collieries, Warkworth, NSW (ENSR Australia Pty Limited 2008)

ENSR Australia Pty Ltd (ENSR 2008) completed an assessment of Aboriginal sites within the proposed impact footprint of Longwalls 10 and 11 within the United Collieries lease area. The survey area totalled approximately 220ha encompassing 16 previously recorded sites. However, prior to the assessment it was noted that there were discrepancies in the locations of the 'Haul Road' sites. For example, coordinates for Haul Road 2 (#37-5-0496) place the sites location 930m to the west of the sites actual location, while the coordinates provided for Haul Road 4 (#37-5-1657) place the site 260m north east of its actual location. Results from the field inspection showed that the largest of the recorded sites were located along creek banks and flats, predominately in a landform context associated with drainage lines. The density of artefact scatters throughout the study area ranged from low (several artefacts) to high (several hundred artefacts) and the dominant raw materials were mudstone, silcrete and chert. The majority of stone artefacts were identified as flakes and flaked pieces with formal tools such as backed blades, hammerstones and microliths occurring much less frequently.

4.4.2.11 Aboriginal Cultural Heritage Impact Assessment, Proposed Longwall Panels 10 & 11, United Collieries, Warkworth, NSW (Insite Heritage Pty Limited 2009a)

Insite Heritage Pty Ltd (Insite Heritage 2009a) was commissioned by United Collieries to prepare an AHIP to allow for the salvage and subsurface excavation of recorded Aboriginal sites to be impacted by the proposed Longwall Panels 10 and 11 and the extension of the Life of Mine Emplacement Area. Details specific to the sites to be impacted by the proposed works were identified previously by an assessment completed by ENSR in 2008. A total of 18 sites were identified within the impact footprint and therefore all of these sites were included within the AHIP application for surface collection (**Table 4–4**). Subsurface excavations at #37-6-1611 were proposed to consist of three transects of shovel probes with 10 50cm by 50cm probes undertaken along each transect every 10m. The application stated that all sites were to be collected with the recovered artefacts to be reburied within the United Collieries conservation area at individual locations with their site ID number displayed on stakes at each location.

Table 4-4. Sites to be included in the AHIP (Source: Insite Heritage 2009).

Site	Type	Contents	Significance	Action	Identified by
Site 3 37-6-1910	Artefact scatter	7 flakes chert, silcrete & mudstone. Numerous flaked pieces.	Low	Collection	ENSR
Site 17 37-6-1917	Artefact scatter	3 mudstone 1 chert flakes	Low	Collection	ENSR
Site 24 37-6-1923	Isolated find	1 chert core	Low	Collection	ENSR
Site 25 37-6-1924	Artefact scatter	2 chert flakes	Low	Collection	ENSR
Site 26 37-6-1925	Artefact scatter	2 chert flakes	Low	Collection	ENSR
Site 27 37-6-1926	Artefact scatter	2 chert, 2 silcrete & 1 mudstone flakes 1 core	Low	Recommended Sect 90 Collection	ENSR
37-6-1611	Artefact scatter & PAD	Scatter along eroded creek line	Moderate	Areas of PAD salvaged as part of the haul road. Collection of surface artefacts.	Umwelt ENSR AHIP #2527
37-6-1009	Artefact scatter	3 artefacts in two exposures	Low	Collection	Kuskie 2000
37-6-0136 part of 37-6-1611	Artefact scatter	Over 50 artefacts incorrect co-ordinates included in 1611	Poss sub surface	Areas of PAD salvaged as part of the haul road. Collection of surface artefacts.	Kuskie Consent 2527 Known as JP42 & UC 5/1
Site 16 37-6-1916	Isolated find	Chert flake	Low	Collection	ENSR
Site 15 37-6-1915	Isolated find	Silcrete flake	Low	Collection	ENSR
Site 19 37-6-1919	Artefact scatter	1 silcrete backed 1 mudstone flake	Low	Collection	ENSR
37-6-1613	Artefact scatter	More than 50 artefacts	Low	44 artefacts collected in 2006	ENSR 2006 #2527
37-6-1921	Artefact scatter	7 artefacts on stockpile originated from site 37-6-1910.	Low	Collection	ENSR
37-5-0092	Artefact scatter	Disturbed artefact scatter recorded 1983	Low	Collection	Koettig & Hughes
37-5-0102	Artefact scatter	Consent issued 1983 (PM/3395) for road – however a couple of mudstone flakes remain on the road.	Low	Collection	Koettig & Hughes
37-5-0516	Artefact scatter	1 silcrete flake and some flaked pieces	Low	Collection	ENSR

4.4.2.12 Aboriginal Archaeological Assessment, United Collieries – Longwall Panel 12 & Adjacent Mine Development Areas, Warkworth, Upper Hunter Valley, NSW (Insite Heritage Pty Limited 2009b)

In 2009 Insite Heritage Pty Ltd (Insite Heritage 2009b) carried out an Aboriginal archaeological assessment for Longwall Panel 12 and adjacent mine development areas covering approximately 4ha. Foot transects were conducted over the study area approximately 10m apart in a north south direction. Disturbances within the surveyed area included erosion, land clearance, bund wall constructions and fencing. The survey identified two locations of Aboriginal artefacts while previously recorded site, #37-5-0028, was unable to be located. Site UCL 12-1 was identified in an erosion scour mid slope to the west of a contour bank. Two artefacts were located at this site comprising a mudstone core and a mudstone flake. Site UCL 12-2 was located on a contour bank which was bisected by an access road. Artefacts were noted on the western and eastern sections of the contour bank in B-Horizon soil. A total of two artefacts were recorded at UCL 12-2 including

a mudstone core and a silcrete flake. Both sites were assessed as holding low significance and located outside the proposed subsidence zone and would not be impacted by the proposed works. It was recommended that the sites be added to the United Collieries ACHMP and managed in accordance with the conditions outlined in the ACHMP.

4.4.2.13 Aboriginal Heritage Impact Permit No. 1091346 Archaeological Excavation, Life of Mine Emplacement Area, United Collieries, Warkworth, Hunter Valley, NSW (Insite Heritage Pty Limited 2010a)

Insite Heritage Pty Ltd (Insite Heritage 2010a) completed a salvage program within the United Collieries mine lease area for the proposed Life of Mine Emplacement Area that had been subject to previous investigations (Koettig and Hughes 1981; Brayshaw & Associates 1984 and Umwelt 2002) and involved both surface collection and excavation components. The salvage area was centred on Redbank Creek and the adjoining hill slopes. The salvage program involved both surface collection and subsurface salvage components, undertaken on two main landforms/geomorphic units being terrace and footslope. Surface collection and excavations at #37-5-0072 (RBC56), #37-5-0074 (RBC58), #37-5-0075 (RBC59), #37-5-0288 (United 4), #37-5-0508 (United 3) and United 1 recorded twice as #37-5-2091 and #37-5-0517 (United LOMEA1) resulted in a total of 472 artefacts being collected with a further 142 angular fragments and five pot lids recorded.

Table 4–5 details the significance ascribed to each of the sites as presented in Umwelt 2002.

Table 4-5. Significance assessment of sites (source: Umwelt 2002).

AHIMS Site No.	Site Name	Scientific Significance	Cultural Significance
37-5-0072	Red Bank Creek 56	Low	Not assessed
37-5-0073	Red Bank Creek 57	Low	Medium to high
37-5-0074	Red Bank Creek 58	Low	Not assessed
37-5-0075	Red Bank Creek 59	Low	Low to medium
37-5-2091	United 1	Low	Medium
37-5-0508	United 3	Low	Medium
37-5-0288	United 4	Low	Low

A number of findings from the surface collection and excavation program completed by Insite Heritage (2010a) were consistent with the findings presented by Koettig and Hughes in 1983. The first of these findings included a large concentration of the artefacts being recovered from the A Horizon. Mudstone was the dominant raw material type comprising 76 per cent of the artefacts collected during the surface collection, while 50 per cent of the artefacts recovered from the subsurface investigations were silcrete with 36 per cent comprising mudstone. Similarly, silcrete and mudstone were the dominant raw materials identified by Koettig and Hughes who also found variations in the proportions of the raw material types between and within sites. Investigations undertaken by Koettig and Hughes also noted that a higher proportion of backed

artefacts were mudstone as opposed to silcrete (Koettig and Hughes 1983: 54), this was also the case for the small number of implements recovered from these investigations. The presence of backed artefacts in the assemblage dates the site to the last 5000 years BP, which is similar to other sites in the Hunter Valley.

The majority of artefacts recovered from this salvage were reburied within the United Collieries conservation area with each salvaged site buried at an individual location and a marker placed at each location identifying the site. Artefacts which were classed as holding high educational potential were placed in a glass cabinet at the United Collieries office.

4.4.2.14 Aboriginal Heritage Impact Permit No. 1102321, Archaeological Salvage Works, Longwalls 10 and 11, United Collieries, Warkworth, Hunter Valley, NSW (Insite Heritage Pty Ltd 2010b)

Insite Heritage Pty Ltd completed an additional salvage program for United Collieries in 2010 for the proposed works associated with Longwalls 10 and 11 consisting of both archaeological surface and subsurface salvage works (Insite Heritage 2010b). The proposed works impact footprint resulted in the surface collection of sites #37-6-1910 (United Collieries 3), #37-6-0516 (United Collieries 14), #37-6-1917 (United Collieries 17), #37-6-1923 (United Collieries 24), #37-6-1924 (United Collieries 25), #37-6-1925 (United Collieries 26), #37-6-1926 (United Collieries 27), #37-6-1611/0136 (Haul Road 1), #37-6-1009 UC4/2, #37-6-0136/1611 (Wambo 6), #37-6-1916 (United Collieries 16), #37-6-1915 (United Collieries 15), #37-6-1919 (United Collieries 19), #37-6-1613 (Haul Rd 5), #37-6-1921 (United Collieries 21), #37-5-0092 (RBC24) and #37-5-0102 (RBC 23) as well as partial subsurface salvage of #37-6-1611. A total of 262 artefacts were collection during the surface salvage while 616 artefacts were salvaged from the subsurface excavations.

Four transects (A, B, C and D) were laid out at 10m intervals, in a south-north orientation on a gentle rise north of an unnamed tributary of Wollombi Brook. Another five transects (E, F, G, H and I) were also placed at 10m intervals, in an east-west orientation, on the tributary flats to the west of the knoll and north of the unnamed tributary. 99 per cent of artefacts recovered from the excavation were within Transect I with two areas of open excavation of 13.75m^2 and 19m^2. The small number of retouched artefacts recovered was also observed by Koettig and Hughes 1983 and Insite Heritage 2010a who also identified a spatial pattern in the increasing proportions of artefacts as distance increased from the main channel of Redbank Creek. As with the artefacts recovered from the Life of Mine Emplacement Area salvage program, the artefacts recovered from this program were also reburied within the United Collieries conservation area with educational pieces being displayed in the United Collieries front office.

4.4.3 Research at Site Red Bank Creek 5

The major excavation and study that occurred in the same areas as the current test excavation program (**Section 6**) was that undertaken by Koettig and Hughes in 1983 and a subsequent study of the artefacts by Hiscock. The following section will provide some context of this work that will be referred to in the following analysis.

Background

The archaeology of the United Colliery lease area was initially investigated by Dr L.K. Dyall and the results presented in the United Project EIS (Dyall 1981). In his survey Dyall located 12 campsites represented by scatters of stone artefacts, all of them along Redbank Creek. One of the sites was described as a major campsite (site 5), another as a campsite of modest size (site 10) and the rest as very minor campsites.

Following comments on the EIS by NSW National Parks and Wildlife Service (NPWS), the EIS authors, Dames and Moore, engaged Philip Hughes to undertake follow up archaeological investigations. Hughes advised that a reconnaissance survey of the area should be undertaken as a first step in formulating a programme of survey and salvage work. This reconnaissance was undertaken by Hughes and Margrit Koettig in November 1982.

The results of the reconnaissance were reported to the client and to NPWS in early January 1983. Briefly, the reconnaissance demonstrated that in the previous survey for the EIS only a small proportion of the sites in the lease area had in fact been located.

However, it was predicted from the reconnaissance results that relatively few additional sites would be located through further survey work, and that such sites would be relatively sparse in artefacts compared with most of the sites already located. On the assumption that none of these as yet undiscovered sites would warrant salvage work, three sites were identified at which salvage collections and excavations should be carried out; sites 5, 12 and 13. During the course of this salvage program 3,702 artefacts were retrieved with 2,945 (surface and excavation) from Red Bank Creek 5, 143 (surface and excavation) from Red Bank Creek 12 and 614 (surface and excavation) from Red Bank Creek 13.

In relation to the current assessment, Site 5 (Red Bank Creek 5 is located within test excavation Area 2, Site 12 (Red Bank Creek 12) is located to the north of test excavation Area 6 and Site 13 (Red Bank Creek 13) was located on the main branch of Redbank Creek that has now been mined by Wambo.

Hiscock 1984

Following the 1983 excavations Peter Hiscock (1984) was hired to describe the stone-working technology at the three sites investigated by Koettig and Hughes in order to answer certain questions raised by the excavations; namely:

1. How were the artefacts made?
2. How does the raw material determine artefact morphology?
3. What are the technological differences between the knapping floors at the sites?

Hiscock's work, later expanded on in later work (1985, 1986), developed a technological schema for artefact reduction known as the Redbank reduction sequence. In simple terms, Hiscock analysed the steps used by knappers to produce, primarily, backed artefacts.

Hiscock's analysis concentrated on Red Bank Creek 12 and Red Bank Creek 13 as these were small sites which Koettig and Hughes reported to be discrete knapping floors. As these sites apparently contained the full variety of raw materials and artefact types it seemed likely that they would be sufficient for a description of the technology. Site Red Bank Creek 5 was examined in a more superficial manner. At this site the technological classes were recorded and any interesting specimens or features of reduction were noted.

Based on his analysis, Hiscock concluded:

- The reduction procedures between the sites are highly standardized although he notes that this is not the same thing as having the artefacts themselves standardised.
- Although the same knapping processes occur at each site, the sequence does not necessarily involve the production of a large number of elongate flakes. The sites studied by Hiscock varied in the extent to which the knapping produced elongate flakes but none showed the sorts of emphasis on 'blades' which have been identified elsewhere. The implication of this is that the production of elongate blades is not necessarily a precursor to the production of backed blades.
- Hiscock found that sometimes a large number of elongate flakes were removed before a suitable flake was removed that would be used for backing. This implied that the decision to back a particular flake occurred after the core had been exhausted. No real evidence was available to determine a particular flake was chosen for backing used for backing but Hiscock suspected it was a choice based on a flake's suitable morphology.
- Hiscock concluded that most backed flakes were produced on an anvil using a bipolar technique. This often produced a transverse snap across the distal third of the flake.
- It was argued that whilst both indurated mudstone and silcrete were generally reduced in the same way there were processes applied to silcrete which were not applied to the indurated mudstone; for example, heat treatment.

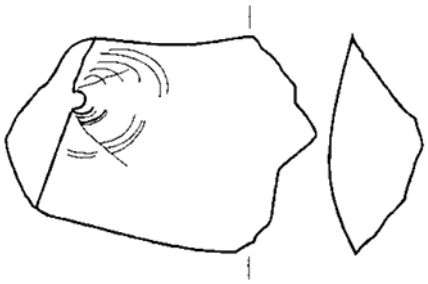
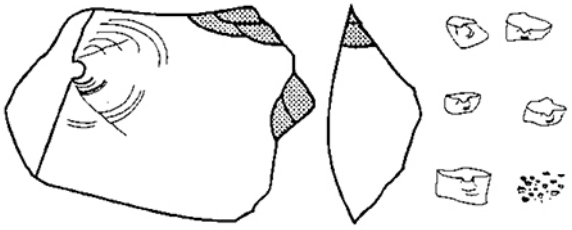
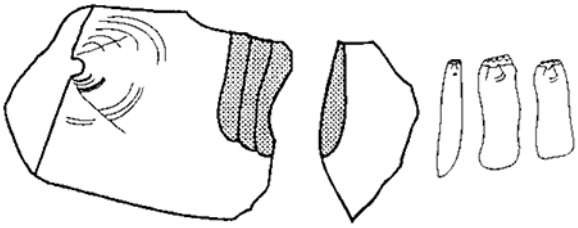
Hiscock's work, later expanded on in later work (1985, 1986), developed a technological schema for artefact reduction known as the Redbank A Strategy (RAS). In simple terms, Hiscock analysed the steps used by knappers to produce, primarily, backed artefacts (**Table 4–6**).

RAS was first identified after extensive conjoining and analysis of the three knapping locations along Redbank Creek but was refined during the salvage and analysis of 21 open sites from Saltwater Creek and Mount Arthur North and South to the west of Singleton. Re-analysis of material excavated from the Sandy Hollow 1 rockshelter, to the north of the Project Area,

confirmed the interpretations gained from the open sites. Thus, the description of the RAS presented by Hiscock is derived from sites throughout the floor of the Hunter Valley between Singleton and Muswellbrook (Hiscock 1993).

Hiscock's work remains an important contribution to our understanding of stoneworking techniques but unfortunately relies on a level of analysis that is beyond most consultancy projects.

Table 4-6. The Redbank A Strategy.

Phase	Description	Idealized specimen showing the reduction in phases 1, 3 and 4 (stippled area shows flakes removed during each phase). From Hiscock 1993.
1	A large, thick flake is struck from a core.	
2	This flake is thermally altered, either before or during the retouching process.	
3	This flake is first retouched by blows applied to the ventral surface which remove small flakes from the dorsal surface. Location of each blow is related to the purpose of the retouch, and two types of locations can be defined: • Retouch on the lateral margins acts to set up potential platforms. • Retouch on the proximal and distal ends sets up ridges and removes unwanted mass.	
4	Blows are then applied to the platforms set up on the lateral margins in phase 3. These blows remove longer flakes from the ventral surface of the retouched flake.	
5	Phases 3 and 4 are repeated to enable reduction to continue.	
6	Some of the flakes produced in phase 4 may be backed to form bondi points.	

Hiscock 1985

Hiscock (1985) prepared a paper based on archaeological findings at sites within the Hunter Valley, including Red Bank Creek 5, to show that it is necessary to have a taphonomic perspective on morphological characteristics of stone artefacts. Red Bank Creek 5 was chosen based on its ability to reveal stratigraphic contexts and its high density of stone artefacts. Following subsequent technological analysis which involved calculating the number of fragments representing removal from an original flake, an indication of the amount of breakage was

revealed. From this Hiscock found that approximately 900 original flakes were recovered, half the number of stone fragments recorded by Koettig and Hughes in 1983. For example, the 1300 silcrete fragments were derived from 650 flakes. Breakages were attributed to factors including heat shatter, ploughing and livestock grazing. However, at some of the open sites, subsurface artefacts were more highly broken than on the surface suggesting that neither ploughing nor trampling from stock may totally explain the pattern. Using the example of Red Bank Creek 5, Hiscock concluded that estimates of the composition of the original assemblage are more easily and accurately made after the identification and study of any taphonomic processes that may have acted upon the material.

4.5 PREDICTIVE MODEL FOR SITE LOCATION

Across Australia, numerous archaeological studies in widely varying environmental zones and contexts have demonstrated a high correlation between the permanence of a water source and the permanence and/or complexity of Aboriginal occupation. Site location is also affected by the availability of and/or accessibility to a range of other natural resources including: plant and animal foods; stone and ochre resources and rock shelters; as well as by their general proximity to other sites/places of cultural/mythological significance. Consequently sites tend to be found along permanent and ephemeral water sources, along access or trade routes or in areas that have good flora/fauna resources and appropriate shelter.

In formulating a predictive model for Aboriginal archaeological site location within any landscape it is also necessary to consider post-depositional influences on Aboriginal material culture. In all but the best preservation conditions very little of the organic material culture remains of ancestral Aboriginal communities survives to the present. Generally it is the more durable materials such as stone artefacts, stone hearths, shell, and some bones that remain preserved in the current landscape. Even these however may not be found in their original depositional context since these may be subject to either (a) the effects of wind and water erosion/transport - both over short and long time scales or (b) the historical impacts associated with the introduction of European farming practices including: grazing and cropping; land degradation associated with exotic pests such as goats and rabbits and the installation of farm related infrastructure including water-storage, utilities, roads, fences, stockyards and residential quarters. Scarred trees may survive for up to several hundred years but rarely beyond.

4.5.1 Background to the formulation of the predictive model

In response to a review of a draft version of this report, the PCWP commented on the formulation of the report's predictive model stating (see **Appendix 17** for full context):

> *Our understanding of the prehistory of the Hunter Valley is still very limited: studies conducted over the last 30 years or so have focused on a very basic predictive model*

> *and more importantly, this model has rarely been tested in regard to its veracity. As a result our knowledge of Aboriginal settlement patterns of the region is largely based on the distribution of artefacts in association with erosional features. In effect, our understanding of prehistoric activities such as subsistence, migration and mobility, differential use of landscapes (seasonal, functional, cultural etc), trade etc is still rudimentary. There has been no development or advancement of theories from the early studies undertaken in the Hunter Valley. Instead, reports tend to concentrate on simple observations without a theoretical basis, lack a chronological framework and do not question the nature of artefact distribution, e.g. the bias of sites associated with erosional factors. The models largely centre on the proximity of watercourses and assume these provided everything needed (water, food, raw materials). They ignore the fact that they are founded on observations in a modern landscape that has been considerably altered since the introduction of European land management practices. For example, many modern-day creeks have become entrenched and were actually chains of ponds at the time of contact.*

Consideration of this statement is important in the framing of the predictive model below as it needs to be emphasised that at various times, by highly qualified researchers, alternative predictive models to the one presented here have been attempted.

For example, as a result of past archaeological investigations along Bettys Creek (approximately 20km north of the Survey Area), two theories on settlement patterns were advanced. The first of these was formulated by AMBS (1997) on the basis of excavations at Bettys Creek within the Mount Owen lease area. Based on the results of the excavations, AMBS (1997: Appendix A: 10B) argued that sites along the creek line were occupied for short periods of time during the winter months. The sites represented field camps that were utilised only briefly and in which the primary subsistence activity was high-risk hunting of animals, with the subsidiary use of gathering winter plant foods. Risk in this instance refers to the likelihood that foraging activities would result in the expenditure of energy but would not result in the recovery of adequate food.

Umwelt (2005b) argued that floral, faunal and water resources were most concentrated and reliable in the Bettys Creek area during the summer months and, based on modern rainfall patterns, water availability would also have been greater in summer. During winter, reduced rainfall would have resulted in limited water flow and the stagnation of permanent water supplies in all but swampy areas, whilst plant foods were limited in their nutritional value due to the diminishment of starch reserves (Umwelt 2005b: 3.6). The Umwelt (2005b: 3.7) model proposed that Aboriginal use of the upland portion of Bettys Creek consisted of a risk averse strategy whereby people moved between several short-term camp sites within the area before relocating to another area with similar resources. The essential differences between the two models therefore relate to the season and length of occupation of the area, not the length of use of

individual sites. Umwelt (2005b: 3.7-3.9) listed a series of hypothesised archaeological signatures to distinguish between the two models. The AMBS (1997) model suggested that people travelled away from the concentrated resources of the Hunter River and associated floodplain for short periods of time only, carrying with them minimal stone resources that were conserved and curated. Due to the limited availability of water resources during the winter months, occupation focussed on the permanent sources of potable water, namely swamps. Although the Umwelt model also maintained that site use was brief, use of the entire area was longer-term in comparison to the AMBS (1997) model. Consequently, it was necessary to carry larger quantities of stone resources in order to maintain the supply of artefacts throughout the occupation period. However, as the length of occupation increased, manufacturing practices would have involved conserving diminishing raw material resources.

A series of archaeological salvage programs that began in 2004 (Mount Owen Extension Area) to mitigate proposed impacts to Aboriginal cultural heritage, were carried out by Umwelt. As one of the research aims of this program, the AMBS/Umwelt model was to be tested to see if the archaeological signatures of the two models manifested themselves during the excavations.

A total of 8,304 artefacts were recovered during the Mount Owen Extension Area salvage including 1,151 (13.9%) from the surface collection, 5,999 (72.2%) from the manual excavations and 1,154 (13.9%) from the grader scrapes (Umwelt 2012). The artefact assemblages were subject to intra-assemblage analysis and the results of these analyses were then subject to inter-assemblage comparative analysis between the Mount Owen Extension Area assemblages and those salvaged from a number of mine sites in the Singleton, Broke and Muswellbrook area. As a result of the comparative analysis a number of the artefact attributes were chosen for more detailed investigation. All of the data was then collated and used to answer the questions posed as part of the research design.

The investigations in the Mount Owen Extension Area indicated that neither of the seasonal risk models were proven or disproven by the evidence acquired through the analysis of the spatial distribution of the artefacts recovered, or by the nature of the artefacts recovered. The residue and use-wear analysis, however, identified likely late spring and summer occupation in association with the former swamp on Bettys Creek (at Excavation 5; a swamp area of Bettys Creek).

This meticulous study with a robust data set therefore failed to produce evidence of that could illuminate settlement patterns beyond the assessment ‘that very small groups of Aboriginal people (most likely single family groups) hunted and gathered across the whole of the Mount Owen Extension Area’ (Umwelt 2012: 8.20).

Therefore, while the PCWP comment presents laudable outcomes, the results of over 30 years of archaeological research has demonstrated that the archaeological landscape of the Hunter

Valley is not preserved to the level to allow detailed modelling of settlement patterns, trade or resource procurement beyond the most basic attributes. While this is not taken as a sign to abandon all such modelling, it does suggest that over-reliance on such modelling is very likely to be unfulfilled during fieldwork. As such, the predictive model here focuses on a realistic level of archaeological questioning: until such time as the data is evidently available to move to a higher level of research outcomes.

4.5.2 Predictive model

The postulation of a predictive model for the Survey Area has been influenced and informed by the intensive and long-running investigations that have taken place over the past 30 years. As noted in **Section 4.5.1** this predictive model will attempt to address five models that, under the normal circumstances found in the Hunter Valley, should be able to be tested. These are:

- Site location model: to test the established paradigm of a close association of occupation evidence to water resources;
- Site type model: to test the established paradigm that the majority of sites consist of artefact scatters or single artefacts;
- Site distribution model: to test the observation that sites in the Survey Area consist of clusters of artefacts separated by areas of low artefact density;
- Site condition model: to test whether degrading and aggrading landforms preserve sites in varying ways; and
- Chronological model: to test the established paradigm that most sites date to the late Holocene epoch and that Pleistocene sites are extremely rare, if not non-existent.

4.5.2.1 Site location model

Previous archaeological research has demonstrated a high correlation between landform and site location, particularly that sites with greater artefact densities and complexity will be located adjacent to permanent supplies of water.

To determine whether the Survey Area adheres to this model, the predictive model below will be tested by:

- Ensuring that all landforms within the Survey Area are assessed during the survey with the same methodology to determine if sites are indeed associated with water; and
- Ensuring that the geoarchaeological auger program assesses landforms located distant to water to ensure that a representative selection of landforms are investigated.

4.5.2.2 Site type model

In **Section 4.2** and **4.3** it is seen that the predominant evidence in the region is for short-term camps utilising particular resources such as a waterhole. This type of occupation is expected to be reflected within the Survey Area and was also noted during Koettig's investigations along Redbank Creek where she noted isolated knapping events separated by areas of low artefact density (1983 pp 30ff). Regional investigations have also noted the predominance of artefact sites with very low numbers of other site types being recorded on the valley floor (**Section 4.3**).

To determine whether the Survey Area adheres to this model, the predictive model below will be tested by:

- By determining through full pedestrian survey whether other site types should be expected within the Survey Area; and
- To use the test excavation program to determine if site boundaries can be delineated and thereby test Koettig's observation of small concentrations of artefacts surrounded by areas of low artefact density.

4.5.2.3 Site distribution model

Koettig's observation of clusters of artefacts surrounded by areas of low artefact density suggests very short-term and/or sporadic visits to the Survey Area. Had visitation been higher then site boundaries would have become blurred through repeated use. Instead, previous investigations tend to show that the Survey Area was not a focus of past occupation, and while undoubtedly used, it was not the location of long-term occupation that was probably focused more on the nearby Wollombi Brook and the not-too-distant Hunter River. This archaeological record also suggests a low population density as areas such as Redbank Creek were relatively unvisited: even if an assumption that only 5000 years of late Holocene occupation is made. For example, when investigated by Koettig, Red Bank Creek 5 recorded approximately 3000 artefacts. Even if, generously, it is assumed that this artefact count represents only one per cent of the available artefacts at the site (i.e. an assumed total of 300,000 artefacts), this still only equates to around 60 artefacts being produced per year over the past 5000 years. Or alternatively, if it is assumed that approximately 100 artefacts[4] can be produced in a single knapping event, this artefact count may only represent 3,000 knapping events or 0.6 knapping events for each of the past 5000 years. While the above is hypothetical, it is used to illustrate that over such a period of occupation (5000 years), even seemingly rich sites yielding 3000 artefacts may still represent a very low visitation and use rate[5].

[4] Based on an experimental project undertaken by OzArk in 2014 using mudstone from the Hunter Valley as a raw material. This number refers to flakes with greater dimensions than 10mm.

[5] The scenario postulated here refers to evidence based on stone tool manufacture and does not therefore imply that the area may have been more frequently visited but with visits not involving stone tool manufacture (activates such as day-trips or hunting trips would satisfy this scenario). However, as stone artefacts are our only evidence of past occupation we can neither prove nor disprove

To determine whether the Survey Area adheres to this model, the predictive model below will be tested by:

- By determining through full pedestrian survey whether site distribution can be mapped and thereby determine whether the Survey Area was used frequently or infrequently; and
- To use the test excavation program to determine if site boundaries can be delineated and thereby test Koettig's observation of small concentrations of artefacts surrounded by areas of low artefact density and, by implication, a low visitation rate.

4.5.2.4 Site condition model

The predictive model will also take into account the varying depositional regimes within the Survey Area. In this model, ridgelines, slopes and the in-stream portions of waterways are within a degrading environment where soil loss due to erosion is more prevalent and sites are likely to have been dispersed. Conversely, landforms on valley floors and adjacent to waterways will be in an aggrading environment with the likelihood of artefacts becoming obscured by overburden and silts.

To determine whether the Survey Area adheres to this model, the predictive model below will be tested by:

- Ensuring that all landforms within the Survey Area are assessed during the survey with the same methodology to determine if sites in degrading landforms have been dispersed;
- Examining the frequent deeply incised banks along Redbank Creek to determine if the sections reveal buried soil layers in aggrading environments; and
- Ensuring that the geoarchaeological auger program assesses a variety of landforms to determine the presence or absence of buried soil layers.

4.5.2.5 Chronological model

The results of many previous investigations within the Hunter Valley indicate that the vast majority of the results date to the Holocene epoch (i.e. the past 12,000 years) and, on the basis of tool types[6] and carbon-14 dating[7], to the latter part of this epoch. While some earlier dates have been

these non-stone-manufacturing trips and are left with the evidence of stone artefacts with which to construct a theory. While the time frame of 5000 years roughly averages the most common dates returned from Hunter Valley investigations, it could also be that occupation, for whatever reason, was concentrated in more-recent times thereby raising the visitation rate.

[6] Principally from the recording of backed flakes within the assemblages. This brackets these particular artefacts to being discarded sometime between 7000 BP and 1500 BP and most likely between 3500 BP and 1500 BP as this is the era of greatest backed artefact manufacture.

[7] There are too numerous examples to be cited here although dates obtained, mostly from unstratified deposits on the valley floor, are often within the past 5,000 years (for example, Umwelt 2013: 11).

postulated for valley floor sites (see **Section 4.1**), these sites are neither numerous nor reliable in terms of stratified dates.

To ensure that the predictive model ensures that the chronological model is evaluated, the following will be undertaken:

- Artefact assemblages will be examined to ensure that earlier tool kits (such as the core and scraper tradition) are noted and the implications understood; and
- It is generally accepted that the B Horizon (or unit) is likely to date to the Pleistocene epoch. As such, B Horizon deposits within the incised creek banks will be examined for cultural material. In addition, the test and auger program will ensure that a representative sample of B Horizon soils are investigated to determine whether this stratum contains cultural material.

On the basis of the environmental context described in **Section 3** and previous research summarised in **Section 4**, the following predictive model is relevant to the Survey Area:

- **Artefact scatters** are most likely to be observed in exposed areas in proximity to drainage features. Open sites may also occur along ridgelines and on elevated ground overlooking watercourses. As the Survey Area contains Redbank Creek and its tributaries, as well as the tributaries or Waterfall Creek and Wollombi Brook, open sites are considered likely in these areas within 200m of water. In areas further than 200m from water open sites are still possible but will have lower artefact densities and smaller site sizes. The main channel of Redbank Creek is likely to contain the largest and most complex sites.
- **Isolated finds** may occur on any landform within this region. As such, isolated finds are considered likely.
- **Grinding grooves** are most likely to occur on flat outcrops of coarse-grained stone in the vicinity of water sources. Given that such outcrops are minimal in the vicinity, grinding grooves are considered unlikely to occur.
- **Hearths** are possible in association with larger artefact scatters on the larger creek lines in areas where A Horizon soils are relatively undisturbed.
- **Scarred trees** are most likely to occur within stands of mature trees of scar-bearing type. As the majority of the Survey Area was cleared during the historical period, scarred trees are considered unlikely.
- **Shelters with deposit** are likely to occur where overhanging outcrops of stone occur. As no such outcrops occur within the Survey Area, shelters with deposit are considered unlikely.

In terms of assemblage composition, the following predictive model is derived based on the following:

- **Raw materials.** Mudstone is likely to be the dominant raw material, followed by silcrete. Additional raw materials represented are likely to include quartzite, quartz, tuff, chert, volcanic (basalt) and petrified wood.

- **Artefact types.** The majority of artefacts are likely to consist of flakes / broken flakes. Additional artefacts represented are likely to include flaked pieces, cores, retouched flakes, backed points and / or blades (including bondi points and geometric microliths), grindstones, hammerstones and axes. Backed blades are likely to occur at most sites containing a large number of artefacts.
- **Knapping floors.** The larger assemblages are likely to include knapping floors. Knapping debris is likely to be mixed with backed and used artefacts. Prior disturbance, however, is likely to obscure knapping floors.
- **Reduction sequences.** Three sequences are likely to be present:
    - Single reduction sequence of a block or cobble, resulting in a discard core.
    - Single reduction of a flake.
    - Multiple reduction sequence, with a reduction of a block / cobble resulting in a core and subsequent flakes used as cores.

4.5.3 Conclusion

As seen in **Figure 4–4**, the Survey Area lies within a region that has been extensively studied and this, along with the previous archaeological work in the Project Area, allows high degree of prediction as to the location of sites within the Survey Area. Given that the landforms within the Survey Area contain sizeable areas of drainage landforms it is expected that the incidence of site recording will be high within this landform. It is also noted that past land use, both mining and pre-mining, has had a profound impact on some landforms within the Survey Area that has had the effect of modifying the archaeological landscape.

The previous archaeological research within the Project Area enables a characterisation of the most typical site likely to be recorded within the Survey Area. The 'most frequent' site type:

- Will be an artefact scatter of low–moderate artefact density within 200m of a drainage feature;
- Will consist of concentrations of artefacts (knapping events) along a drainage feature separated by areas of low artefact densities;
- Will have an artefact assemblage dominated by flakes from mudstone and silcrete and will have few chronological markers in the typology apart from the presence of backed blades; and
- Will be affected by erosion and thus may not retain a high level of integrity.

5 ARCHAEOLOGICAL SURVEY BACKGROUND

5.1 SURVEY METHODOLOGY

The methodology of the current archaeological assessment was circulated to all RAPs and Wonnarua Knowledge Holders in March 2015 (phase 1; **Appendix 1**). An addendum to the survey methodology to include new areas identified by Project design changes was sent to RAPs and Wonnarua Knowledge Holders in May 2015 (phase 2; **Appendix 2**).

The proposed survey methodologies stated that the Survey Area would be surveyed by intensive survey coverage methods. This intensive survey coverage included:

- Pedestrian field survey to identify and record any Aboriginal archaeological sites within the landscape, and to record any areas that may have potential to have subsurface Aboriginal artefacts present; and
- In the northwest and northeast portions of the Survey Area, field survey, wherever possible, was conducted in transects of 50 metre intervals (with up to ten recorders spaced five metres apart). If field conditions did not allow straight transects, some areas were investigated more opportunistically where exposures and/or vegetation allowed.

5.2 DATE OF THE ARCHAEOLOGICAL SURVEY

Following RAP and Wonnarua Knowledge Holder discussion and approval of the draft survey methodology, the survey component of the Aboriginal heritage assessment was initiated on 23 March 2015.

The survey began in the largely previously non assessed areas in the northwest of the Survey Area before moving to other areas. The weeks were arranged through a roster between the RAPs and total team sizes ranged from six to eight people per day. Six ‘weeks’ of survey occurred totalling 19 days, namely:

- Week 1: 23-27 March (5 days);
- Week 2: 30 March–2 April (4 days);
- Week 3: 8–10 April (3 days);
- Week 4: 15–17 April (3 days);
- Week 5: 22–24 June (3 days); and
- Week 6: 17 September (1 day).

A summary of the phase 1 survey results were sent to all RAPs and Wonnarua Knowledge Holders in May 2015 (**Appendix 3**) and a summary of phase 2 survey results was sent in July 2015 (**Appendix 4**).

5.3 ARCHAEOLOGICAL SURVEY: FIELD METHODOLOGY

As the survey progressed, variations to the survey methodology were required in order to successfully complete the heritage assessment.

The major variations are discussed below.

Precisely positioned survey transects were not stipulated in the methodology and this was borne out in the field as the topography and vegetation in many parts of the Survey Area made this an impossible expectation. Instead, the team of experienced surveyors were able to target areas of archaeological potential and survey these intensively. To balance this targeted approach, many transects were also performed across areas chosen largely at random (such as a route to a known GPS point). It can be summarised that the intensive survey coverage included all locations of archaeological potential, while a full range of other landforms within the area were more selectively sampled by intensive pedestrian transects.

The survey methodology was refined in the field in two ways:

1. The terrain and vegetation of the landscape did not always allow systematic pedestrian transects of the intensive survey coverage areas. Rather, all areas of archaeological potential were targeted and this was complemented by pedestrian transects of other selected landforms within the area.
2. The Project Area, in its entirety, was not assessed but all areas within the Survey Area have been fully assessed.

It is assessed that the field methodology was able to achieve the major aims of the survey methodology and that a large and representative sample of the archaeological values from across the Survey Area have been recorded[8]. Due to the relatively long assessment (19 days), and the combined experience of the survey team, it is felt that an accurate assessment has been made of all areas within the Survey Area.

5.4 ARCHAEOLOGICAL SURVEY: EFFECTIVE COVERAGE

The assessment covered large areas of the Survey Area by pedestrian transects. **Figure 5–1** shows the areas that were walked by the survey team. It needs to be borne in mind that this is the recorded track of the senior archaeologist and his assistant only and is therefore representative of the areas assessed: as larger areas on either side of these tracks were assessed as all members of the survey crew spread out to cover more ground.

Effective survey coverage over the Survey Area was variable; mostly either due to exposure incidence or the amount of ground surface visibility (GSV) away from exposures. When the effective survey coverage is calculated, the level of effective coverage was very low (**Table 5–1**)

[8] Please note that a comment on the efficiency of the survey methodology was received from the WTCNTAC and was responded to by OzArk and Glencore (see **Appendix 10** and **11**).

due to the general lack of GSV and the lack of sizable exposures away from the drainage lines. While these calculations give a statistical agreement to the observation that, overall, ground surface visibility was low across the Survey Area, these figures do not show that it was in areas of greatest archaeological potential (i.e. along banks of creeks) where the exposures were located.

Additionally, the data in **Table 5–1** does not capture the fact that while exposure incidence may have been very low in survey units, that the survey team on the ground was aware of this and made every effort to fully inspect any exposures that were afforded such as along tracks, around gates and around ant mounds. Therefore, while the exposure incidence was low, the survey was able to sample these landforms adequately through targeted assessments performed by a survey crew who had individuals very experienced in locating sites within the landscape.

In general, the results of **Table 5–1** should be understood as being relative figures whereby it can be seen that survey efficiency was highest in flat/drainage landforms, then in descending order, ridge/crest landforms, lower slope landforms, upper slope landforms and was the lowest in mid slope landforms.

Figure 5-1. Pedestrian survey transects in the Survey Area.

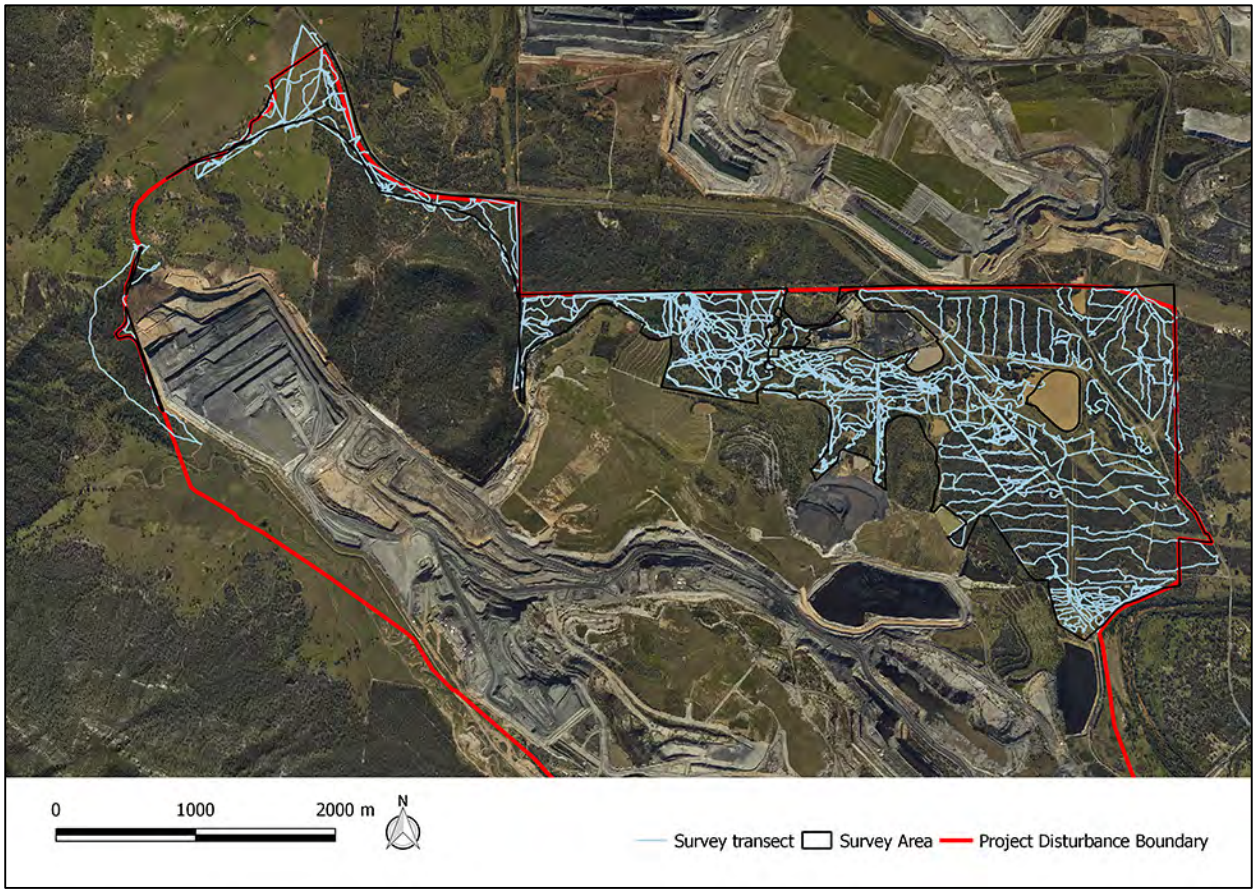


Table 5-1. Survey coverage data within the Survey Area.

Total Survey Area (ha)	Landform(s)	Visibility	Exposure	Effective Coverage (ha)	Effective Coverage (per cent)
0.76	Ridge / Crest	7%	10%	0.005ha	0.7%
1.5	Upper slope	5%	5%	0.005ha	0.3%
59.8	Mid slope	5%	5%	0.1ha	0.02%
81.7	Lower slope	5%	7%	0.3ha	0.4%
414	Flat / Drainage	60%	15%	46.3ha	11.2%
558					**2.5% (average)**

It can be seen that survey coverage was most effective along the drainage lines due to the higher incidence of exposures. Ridge / crest landforms had the next most effective coverage, mostly due to the presence of access tracks and areas cleared of vegetation from bulldozing. Lower slopes had moderate effective survey coverage because although large areas were covered in thick grass there was an increased incidence of exposures associated with flat landforms adjacent to drainage lines. On both upper and mid slope landforms, the effective survey coverage was low as these areas comprised thick grass cover and densely regenerating Casuarinas.

5.5 ARCHAEOLOGICAL SURVEY CONSTRAINTS

There were no access issues in any region of the Project Area that prevented the archaeological assessment from being carried out. The weather was mostly dry with warm to hot temperatures that did not inhibit the progress of the survey team. Wet weather forced the cancellation of one afternoon of survey throughout the entire survey program.

There were no other constraints that hindered the successful completion of the archaeological assessment apart from the usual archaeological constraint: variable GSV.

As discussed above, the variable GSV was not a great hindrance to the overall assessment. In areas of low GSV such as mid and lower slope landforms adjacent to drainage lines there were sufficient exposures along tracks and fences as well as features such as dams and ant mounds. While this is a sample of these landforms, the survey team also felt that these areas had low archaeological potential and that it would be unlikely that large sites in these landforms would be missed. In drainage landforms, in the areas of highest archaeological potential, extensive exposures often existed which afforded view of the ground surface.

In summary, due to the extensive exposures along the drainage systems, the most archaeologically important areas were assessed with very little hindrance. While areas of no GSV existed along these creeks as well, the exposures were frequent enough as to allow extrapolation between exposures. In other landforms, the archaeological potential was much lower and the assessment was sufficiently able to sample these landforms both through extensive pedestrian surveys across them and also by utilising any available exposure to characterise the archaeological values of the landform.

6 THE ARCHAEOLOGICAL SURVEY: RESULTS

6.1.1 Introduction

The current survey comes after nearly 30 years of archaeological research within the Project Area. Although this provides an enormous benefit in terms of being able to more accurately place the current findings into a previously-established framework, it has also resulted in a large number of registered sites across the Project Area. These sites, recorded over 30 years, have been subject to varying degrees of management, either in the form of archaeological salvage under AHIPs, or being ground-truthed for avoidance. Some of the locations of the previously recorded sites are marked with a stake, however the majority of previously recorded sites are not fenced off or signed.

This large body of prior archaeological study has produced a complex history of site recordings, survey areas and site management.

With many previously recorded sites within the Project Area, the overall archaeological character of the Project Area is, to a degree, known. However, a level of uncertainty exists over the data as much of this work had been conducted at different times by different teams and ranging over a long period of time.

There is often considerable confusion when it comes to locating sites that may have been evident 30 years ago: let alone the task of locating an isolated find in a landscape. Whilst this survey attempted to locate all previously recorded sites when they were in the vicinity of the survey area, in a minority of cases were artefacts noted at either GPS references or the stake when they were in place. Whilst the author accepts that these sites once existed, variations in GPS recordings and site changes made it difficult to locate the sites during the current survey.

This study also suspects that some previously recorded sites may have been double-recorded, that others are long gone through natural attrition from erosion and that others, although technically ‘salvaged’, still had artefacts present. Therefore, previously recorded sites were used to give an indication of archaeological potential although the current study re-surveyed the entire area rather than focusing on the identification of previously recorded sites.

A result will be that recordings from this survey will amalgamate many of the previous individual site recordings in an effort to amend the current misleading distribution pattern of a large number of individual recordings and will instead group sites in a landscape based approach.

This landscape-based approach has been made possible by the fact that the current assessment covers much of the United Collieries area and therefore has a wider scope than any previous assessment. For example, this study was able to examine all major drainage systems within the Survey Area and therefore was able to examine any similarities or differences that may arise in the recording of Aboriginal cultural heritage.

Due to the size of the Survey Area and the frequency of artefact recordings, the research aim was to map the artefact distribution using hand-held GPS mapping devices and to take a representative sample of scaled photographs of artefacts for illustrative purposes. Where a large number of flakes or incidence of debitage was noted, photographs were taken *in situ*. Site features such as the incidence of tool manufacture (cores / debitage), tool use (reworked tools) and the reduction stage of the visible artefacts were noted. This allowed a preliminary 'snapshot' of the archaeological value of an area but it also allowed a large area of land to be assessed and wider distribution issues to be examined.

A full catalogue of all artefacts recorded during the survey is presented in **Appendix 20.**

6.1.2 Survey Results Framework

The current assessment distinguishes in site naming between open sites and isolated finds. The current assessment defines this as:

- Open Site: an artefact scatter of two or more artefacts in a discrete area (i.e. artefacts closer than 50m apart). The term is also applied to diffuse open sites that consist of a number of seemingly unassociated artefacts within a single landform unit; and
- Isolated Finds: is an artefact without any other associated artefacts in the vicinity (i.e. no artefacts within 50m).

It is accepted that the designation of site boundaries is often ambiguous and subjective. Particularly, the determination of site boundaries from the presence of surface artefacts is fraught as these artefacts are often in a secondary context. However, the inter-relationship of the presence of surface artefacts and landform units allows a landform to be used as the determining factor in the demarcation of site boundaries. In this way, the presence of surface artefacts, interpreted within their landscape context on a site by site basis, allows a probable site area to be demarcated. This is particularly the case for diffuse artefact scatters that are defined as a number of isolated artefacts, perhaps a little more than 50m apart, but all clearly associated with a single landform unit. If the assessment concluded that the artefacts originated from the landform unit, they are grouped together as a 'site' rather than being represented as a number of isolated finds.

The term 'open site' technically refers to any site that is located in the open and is not enclosed in a feature such as a shelter. If in the open, artefact scatters, isolated finds, scarred trees and grinding groove sites are all open sites. The majority of open sites recorded within the State, and within the Project Area, are artefact scatters and OzArk follows an established tradition in site naming that refers to artefact scatters as open sites in the sense that they are named OS-1, OS-2 etc. When referring directly to this category of site, the term 'open site' is used, although, technically, it is only referring to one type of open site, an artefact scatter.

Twenty-five open sites and thirty-four isolated finds were recorded within the Survey Area and these will be dealt with below. The Survey Area also contains a number of previously recorded sites whose boundaries have been altered as a result of the current assessment. These sites will be discussed below.

The following section constitutes the main results of the fieldwork and will be presented in the following order:

- Open Sites
    - United OS-1 to United OS-25.
- Isolated Finds
    - United IF-1 to United IF-34.

The locations of all open sites and isolated finds are shown in **Figures 6–1** and **6–64**.

6.2 ARTEFACT SCATTERS

The current assessment recorded 25 artefact scatters, termed here as open sites (OS).

Table 6–1 summarises the data concerning the recorded artefact scatters. **Figure 6–1** shows the location of United OS-1 to United OS-25.

Details of the recorded artefact scatters follow **Table 6–1**.

Table 6-1. Descriptions of United OS-1 to United OS-25.

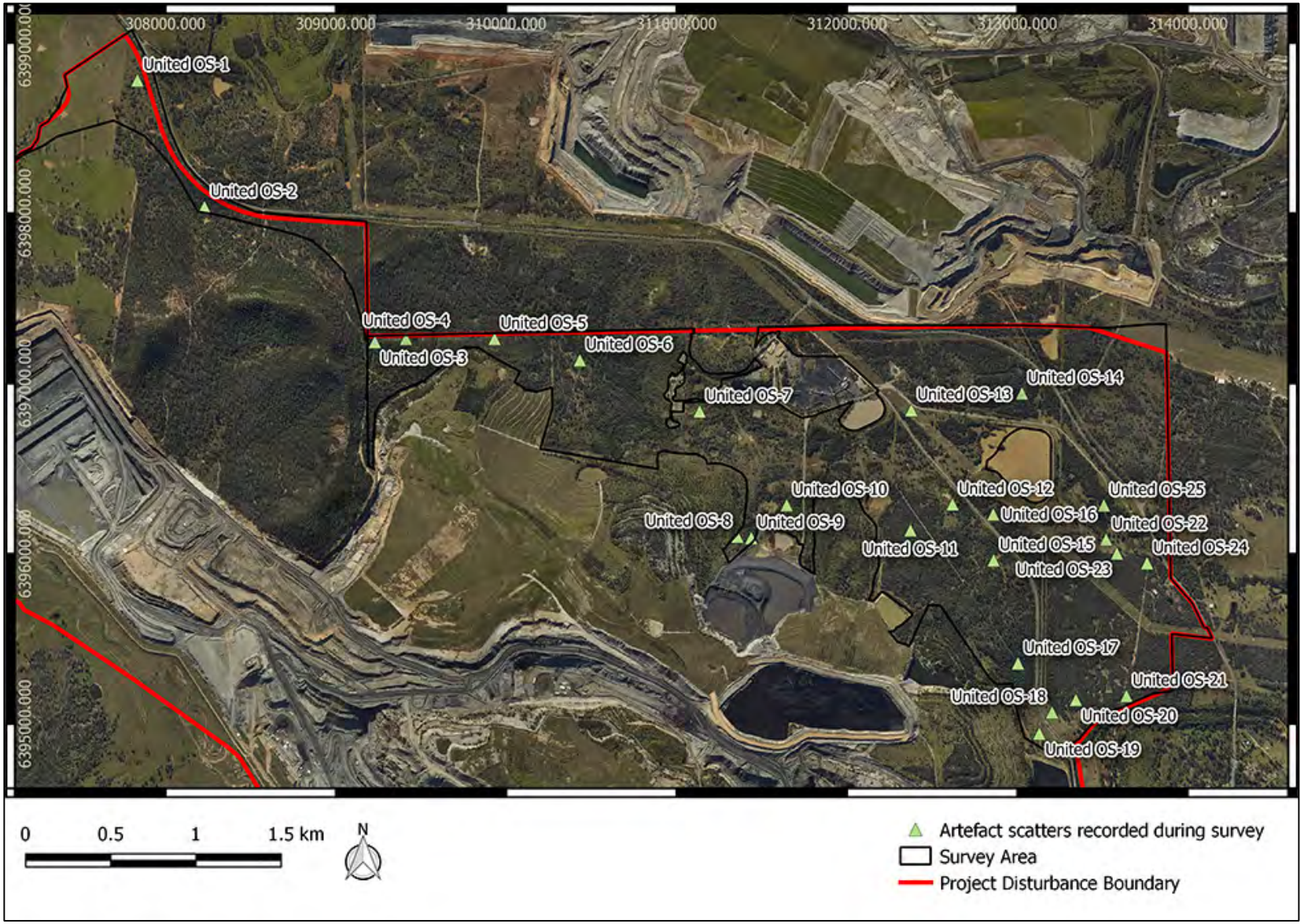
Site name	Centre-point location (GDA94 Zone 56)	Site description	Site condition
United OS-1	307834E 6398781N	United OS-1 consists of more than twenty artefacts that are visible along a farm track and exposed areas within a lower slope landform. The site extends 390m (north-south) and 270m (east-west) covering 8.1ha.	The site today represents an eroded surface scatter of low density artefacts. The site has undergone impacts from agricultural land use and erosion. No A Horizon soil depth present.
United OS-2	308228E 6398037N	United OS-2 consists of more than ten artefacts that are visible in a landform where most of the A Horizon soils have been removed. United OS-2 occupies a mid-slope gently sloping to the west overlooking a gully. The site runs 137m (northwest-southeast) by 53m (southwest-north-east) and covers 0.5ha.	The site today is located either side of an eroding ephemeral gully in an area of densely regenerating woodland.
United OS-3	309228E 6397244N	United OS-3 consists of more than six artefacts that are visible along an access track within a mid-slope landform. The site has a low density of artefacts and extends 42m (north-south) and 22m (east to west). The site covers 0.10ha.	The site occupies an area within a mid-slope landform. The site represents an eroded surface scatter of low density artefacts. The site has undergone impacts from agricultural land use and erosion. No A Horizon soil depth is present.

Site name	Centre-point location (GDA94 Zone 56)	Site description	Site condition
United OS-4	309411E 6397262N	United OS-4 consists of four artefacts that are visible along an access track and a fence line. The artefacts were recorded within lower-slope landform increasing to a mid-slope to the west. An eroding gully is present within the eastern portion of the site with two artefacts recorded within the gully bed. The site has a very low density of artefacts and extends 26m (north-south) and 170m (east to west). The site covers 0.4ha.	The site occupies lower to mid slopes with an eroding gully located in the eastern portion. Site represents an eroded surface scatter of low density artefacts. The site has undergone impacts from agricultural land use and sheetwash erosion. No A Horizon soil depth is present.
United OS-5	309931E 6397262N	United OS-5 consists of two artefacts in an exposed area on a slight slope within a lower-slope landform. The site has a very low density of artefacts and extends 105m (east-west) by 45m (north-south) covering an area of 0.5ha.	Site occupies a slope within a lower-slopes in an exposed area of densely regenerating woodland. The site has undergone impacts from agricultural land use and erosion. Thin A Horizon soil depth is present.
United OS-6	310432E 6397137N	United OS-6 consists of more than fifty artefacts within a lower to mid-slope landform where all A Horizon soil has been removed. United OS-6 is visible on the south bank of a tributary of Redbank Creek. The site has a low to moderate artefacts density which extends 310m (northwest-southeast) by 280m (southwest-northeast). The site covers 5.6ha.	Site occupies a slight slope generally overlooking an area that may have provided resources in the past. The site is within a gully which has been subject to extensive erosion where a large percentage of artefacts are displaced. No A Horizon soils depth is present.
United OS-7	311135E 6396836N	United OS-7 consists of more than fifty artefacts within a lower-slope landform. The site is diffused and extends to the northern bank of Redbank Creek. The site has a low to moderate artefact density and extends 400m (southwest-northeast) by 180m (northwest-southeast). The site covers 4.4ha.	Site occupies a bench within a lower-slope generally overlooking an area that would have provided resources in the past. The site displays a number of exposures resultant from mining activities, agricultural activities and erosion. A Horizon soil depth is present in places.
United OS-8	311357E 6396100N	United OS-8 consists of five artefacts within a lower-slope landform. The site covers 0.1ha and extends 52m (southwest-northeast) by 22m (northwest-southeast).	Previously recorded AHIMS site #37-5-0075 (Red Bank Creek 59) (destroyed) is located within the site. The site has been subject to in-stream gully erosion. No A Horizon soil depth is present.
United OS-9	311438E 6396092N	United OS-9 consists of more than ten artefacts within a lower-slope landform. The site extends for 90m (southwest-northeast) by 42m (northwest-southeast) and covers 0.4ha.	Site occupies a bench within a lower-slope landform. The site contains a number of very small exposures and has undergone impacts from erosion and mining related activities. The site is located to the west of a small dam and north of a tailings area. A Horizon soil depth is present in places.
United OS-10	311646E 6396285N	United OS-10 has artefacts visible in an exposed area within a flat drainage landform. United OS-10 is a very low density artefact scatter consisting of three artefacts. The site extends 62m (north-south) by 47m (east-west) and covers 0.2ha.	The site contains a small exposure where all the A Horizon soils have been removed as a result of erosional processes.
United OS-11	312373E 6396137N	United OS-11 consists of three artefacts that are visible in an exposed area within a flat landform. The site has a very low density of artefacts that extends 50m (north-south) by 26m (east-west) covering an area of 0.2ha.	The site is a surface scatter of low density artefacts. The site has undergone a high level of disturbances from agricultural land use and is surrounded by woodland largely consisting of regenerating Casuarinas. Limited A Horizon soils are present.

Site name	Centre-point location (GDA94 Zone 56)	Site description	Site condition
United OS-12	312620E 6396290N	United OS-12 consists of more than twenty artefacts that are visible within a landform where most of the A Horizon soils have been removed. The site is located within a large exposure in a flat landform. The site extends 230m (northwest-southeast) by 93m (southwest-northeast) and covers an area of 2.6ha.	Site occupies a slight slope to the south within a flat landform. The site is located to the west of the sealed haul road in an open grassed area. The site has undergone impacts from agricultural land use and erosion. No A Horizon soil depth is present and gravels are exposed on the surface.
United OS-13	312378E 6396843N	United OS-13 is a low density artefact scatter consisting of less than ten artefacts. The recorded artefacts are visible within exposed areas in a flat landform. The site extends 31m (northwest-southeast) by 22m (southwest-northeast) and covers an area of 0.1ha.	Site occupies a slight slope to the south within a flat landform adjacent to Redbank Creek. The site is located within a cleared easement with modern rubbish within a nearby gully. The site has undergone impacts from infrastructure constructions and agricultural land use. A Horizon soil depth is limited.
United OS-14	313027E 6396942N	United OS-14 consists of two artefacts recorded within a flat landform. The very low artefact scatter was recorded within an exposed area surrounded by regenerating Casuarinas. The site covers 0.3ha and extends 60m (north-south) by 44m (east-west).	The site is located within an exposed area containing imported gravels. The site has undergone impacts from the installation of mining related infrastructure. No A Horizon soil depth is present.
United OS-15	312861E 6395961N	United OS-15 is a very low density artefact scatter consisting of two artefacts. The site is located within a flat drainage landform with the artefacts visible along an access track where the A Horizon soils have been removed. The site extends 111m (southwest-northeast) by 43m (northwest-southeast) and covers 0.7ha.	The site is low density surface artefact scatter along an access track with exposed gravels. The site has undergone impacts from mining related activities such as road construction and stockpiling as well as erosion. Eucalyptus regrowth is present south of the site. No A Horizon soils are present.
United OS-16	312859E 6396231N	United OS-16 consists of less than ten artefacts visible in a landform where the A Horizon soils have been removed. The site is a low density artefact scatter and is located within a flat drainage landform. The site extends 83m (southwest-northeast) by 75m (northwest-southeast) and covers an area of 0.4ha.	The site is a low density artefact scatter visible in a moderately sized exposure that has been subject to erosion. No A Horizon soils are present. Site is located on the south east bank of a spillway.
United OS-17	313004E 6395356N	United OS-17 is a low density artefact scatter consisting of more than ten artefacts located in the east of the Project Area that are visible along an access track in a flat landform. The site is diffused and extends 53m (southwest-northeast) by 188m (northwest-southeast) and covers an area of 1.5ha.	The site is low density surface artefact scatter along an access track with exposed gravels the site has undergone impacts from erosion. No A Horizon soils are present.
United OS-18	313204E 6395068N	United OS-18 is a low to moderate density artefact scatter consisting of more than fifty artefacts within a flat landform. The site is visible largely within an eroded gully with artefacts recorded to the east within an area surrounded by regenerating Casuarinas. The site extends northwest-southeast for 277m and 98m northeast-southwest covering an area of 3.5ha.	The site is a low to moderate density artefact scatter visible within an eroded drainage line. Site has been disturbed by sheetwash erosion and mine related infrastructure with an electricity easement running through the north west of the site. A Horizon soils are present in places.
United OS-19	313129E 6394943N	United OS-19 is a low density artefact scatter. The site is diffused and consists of more than ten artefacts located within a flat drainage landform. The site extends 341m (northwest-southeast) by 126m (southwest-northeast) and covers an area of 5.2ha.	The site has undergone impacts from mining infrastructure and mine related activities with buried pipelines present. A Horizon soils are present in places, largely within the northern portion of the site.

Site name	Centre-point location (GDA94 Zone 56)	Site description	Site condition
United OS-20	313344E 6395141N	United OS-20 is a very low density artefact scatter consisting of two artefacts. The artefacts were recorded within small exposures on a flat landform. The site extends 57m (northwest-southeast) by 43m (southwest-northeast) covering an area of 0.3ha.	With only two artefacts recorded, United OS-20 probably represents a onetime event. The land is flat and disturbances are limited to the past agricultural land use which included grazing and the removal of mature trees. As a result, A Horizon soils have been lost from across the area and the A Horizon is estimated to be thin.
United OS-21	313641E 6395164N	United OS-21 consists of three artefacts. The low density artefact scatter is visible within a flat landform in an exposed area where A Horizon soils are limited. The site extends 56m (southwest-northeast) by 42m (northwest-southeast) and covers an area of 0.3ha.	The site is located on the south and eastern banks of a small dam. This site is also located between two unsealed roads to the west and to the east.
United OS-22	313521E 6396083N	United OS-22 consists of five artefacts. The low density artefact scatter was recorded within a flat landform in an exposed area where the A Horizon soils have been removed. The site extends 45m (southwest-northeast) by 26m (northwest-southeast) covering an area of 0.13ha.	The site is located on the southern bank of a small farm dam and has undergone impacts from agricultural land use activities including cropping and vegetation clearance.
United OS-23	313585E 6396001N	United OS-23 consists of two artefacts visible within a flat landform. The low density artefact scatter was recorded along an access track where all the A Horizon soils have been removed. The site extends south for 14m and west for 36m.The site covers 0.07ha.	The low density artefact scatter is located along an access track and is surrounded by regenerating Casuarinas. The site has undergone impacts from erosion and from the construction and use of the access track.
United OS-24	313762E 6395944N	United OS-24 consists of two artefacts that are visible within a landform where all the A Horizon soils have been removed. The site is located within a flat drainage landform. The site extends 28m (north-south) by 18m (east-west) and covers an area of 0.07ha.	The low density artefact scatter is located along an access track surrounded on either side by regenerating Casuarinas. No A Horizon soil are present.
United OS-25	313508E 6396284N	United OS-25 consists of less than ten artefacts. The site was recorded within a flat landform adjacent to the north west bank of Redbank Creek where A Horizon soils are present. The site extends 98m (northwest-southeast) by 32m (southwest-northeast) covering an area of 0.5ha.	The low density artefact scatter is present adjacent to land than has been cropped in the past. A Horizon soils are present within densely regenerating Casuarinas.

Figure 6-1. Location of United OS-1 to United OS-25.



United OS-1

GPS Coordinates: 306963E, 6398215N (GDA 94 Zone 56).

Details of United OS-1 are presented in **Table 6–2** and the location of the site is shown in **Figure 6–2**.

Figure 6–3 shows the site locality and **Figure 6–4** shows a selection of the artefacts recorded at the site.

United OS-1 is a diffuse artefact scatter consisting of more than twenty artefacts that are visible along a farm track and exposed areas within a lower slope landform. The landform containing United OS-1 overlooks a tributary to Waterfall Creek. The diffused and low density artefact scatters is now within a partially cleared paddock where A Horizon soils tend to be thin, therefore the potential for archaeological deposits are low.

Table 6-2. United OS-1. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-1	Lower slope	<50m	20+	Low	Low

Figure 6-2. United OS-1. Location of site in relation to the Project Disturbance Boundary.

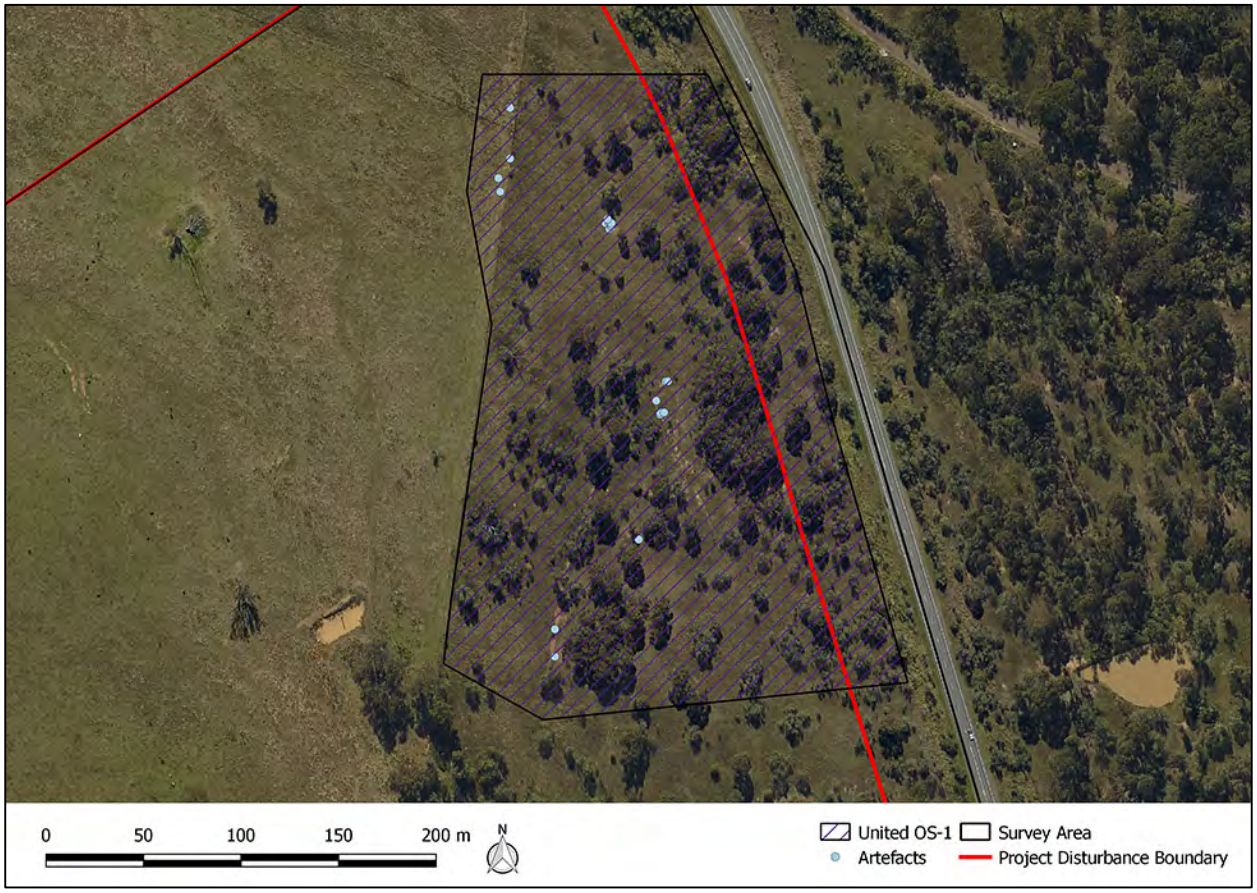


Figure 6-3. United OS-1. View of site.

	
1. United OS-1 consists of 20+ artefacts that are visible on a landform where all A Horizon soils have been removed.	2. View of northern extent of United OS-1. View to the south.

Figure 6-4. United OS-1. Selection of artefacts.

	
1. United OS-1. 307809E, 6398866N (GDA Zone 56). Backed mudstone flake.	2. United OS-1. 307811E, 6398864N (GDA Zone 56). Range of mudstone and silcrete flakes.

United OS-2

GPS Coordinates: 308228E 6398037N (GDA 94 Zone 56).

Details of United OS-2 are presented in **Table 6–3** and the location of the site is shown in **Figure 6–5**.

Figure 6–6 shows the site locality and **Figure 6–7** shows a selection of the artefacts recorded at the site.

United OS-2 is a small artefact scatter recorded within a mid-slope landform gently sloping to the west which overlooks a gully. A Horizon soils have been removed by sheetwash erosion from the area of United OS-2 and most artefacts were recorded resting on the top of the B Horizon clay.

As a result, most artefacts have been displaced (probably from within the vicinity) and there is little possibility of further subsurface archaeological deposits. United OS-2 is located further than 100m from a reliable water source.

Table 6-3. United OS-2. Landform and site details.

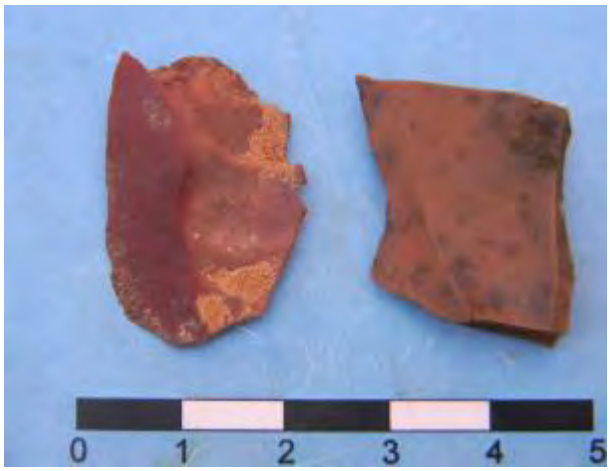
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-2	Mid-slope	0m	10+	Low	Low

Figure 6-5. United OS-2. Location of site in relation to the Project Disturbance Boundary.

Figure 6-6. United OS-2. View of site.

	
1. United OS-2 consists of 10+ artefacts that are visible on a landform where all A Horizon soils have been removed.	2. United OS-2 recorded in an area subject to sheetwash erosion.

Figure 6-7. United OS-2. Selection of artefacts.

	
1. United OS-2. 308203E, 6398063N (GDA Zone 56). Two mudstone flakes	2. United OS-2. 308247E, 6398018N (GDA Zone 56). Bifacial, bladelet mudstone core.

United OS-3

GPS Coordinates: 309228E 6397244N (GDA 94 Zone 56).

Details of United OS-3 are presented in **Table 6–4** and the location of the site is shown in **Figure 6–8**.

Figure 6–9 shows the site locality and **Figure 6–10** shows a selection of the artefacts recorded at the site.

United OS-3 is a small artefact scatter that was detected along an access track within a mid-slope landform. The site is surrounded by Eucalyptus woodland that has been extant in this area for at least the past 50 years. However, due to the slope on which the artefacts were recorded, as well

as their find location on a track, the artefacts are likely to be in a secondary context. Due to sheetwash erosion on the slope, A Horizon soil depth is thin and there is little likelihood of further archaeological deposits at the site. Although located in the general vicinity of the headwaters for the northern branch of Redbank Creek the site is greater than 100m from a reliable water source.

Table 6-4. United OS-3. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-3	Mid-slope	130m	<10	Low	Low

Figure 6-8. United OS-3 and OS-4. Location of sites in relation to the Project Disturbance Boundary.

Figure 6-9. United OS-3. View of site.

	
1. United OS-3 consists of less than 10 artefacts recorded on an access track along a fence line.	2. United OS-3 lies within a landform where all A Horizon soils have been removed.

Figure 6-10. United OS-3. Selection of artefacts.

	
1. United OS-3. 309227E, 6397244N (GDA Zone 56). Two mudstone flakes.	2. United OS-3. 309229E, 6397240N (GDA Zone 56). A secondary mudstone flake.

United OS-4

GPS Coordinates: 309411E 6397262N (GDA 94 Zone 56).

Details of United OS-4 are presented in **Table 6–5** and the location of the site is shown in **Figure 6–8**.

Figure 6–11 shows the site locality and **Figure 6–12** shows a selection of the artefacts recorded at the site.

United OS-4 consists of four artefacts that were recorded along and access track within a lower-slope landform increasing to a mid-slope landform in the west. An eroding gully is present within the eastern portion of the site with two artefacts recorded within the gully bed. The site has

undergone impacts from track construction and use, as well as sheetwash erosion. The artefacts recorded are certainly in a secondary context and with no A Horizon soils, there is no likelihood of further archaeological deposits at the site. Although located in the general vicinity of the headwaters for the northern branch of Redbank Creek the site is greater than 100m from a reliable water source.

Table 6-5. United OS-4. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-4	Mid to low-slope	0m	4	Very low	Low

Figure 6-11. United OS-4. View of site.

1. United OS-4 consists of four artefacts recorded along an access track where all A Horizon soils have been removed.

2. Gully erosion at the eastern extent of United OS-3. View to the west.

Figure 6-12. United OS-4. Selection of artefacts.

1. United OS-4. 309470E, 6397261N (GDA Zone 56). A silcrete and a quartz flake.

2. United OS-4. 309355E, 6397258N (GDA Zone 56). A silcrete and a mudstone flake.

United OS-5

GPS Coordinates: 309931E 6397262N (GDA 94 Zone 56).

Details of United OS-5 are presented in **Table 6–6** and the location of the site is shown in **Figure 6–13**.

Figure 6–14 shows the site locality and **Figure 6–15** shows a selection of the artefacts recorded at the site.

United OS-5 is a diffuse, low density artefact scatter located within a lower-slope landform south of an access track in an area of regenerating woodland. The site today displays limited A Horizon soils with a low likelihood of further archaeological deposits. United OS-5 is located further than 100m from a reliable water source.

Table 6-6. United OS-5. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-5	Lower-slope	>200m	2	Very low	Low

Figure 6-13. United OS-5. Location of site in relation to the Project Disturbance Boundary.

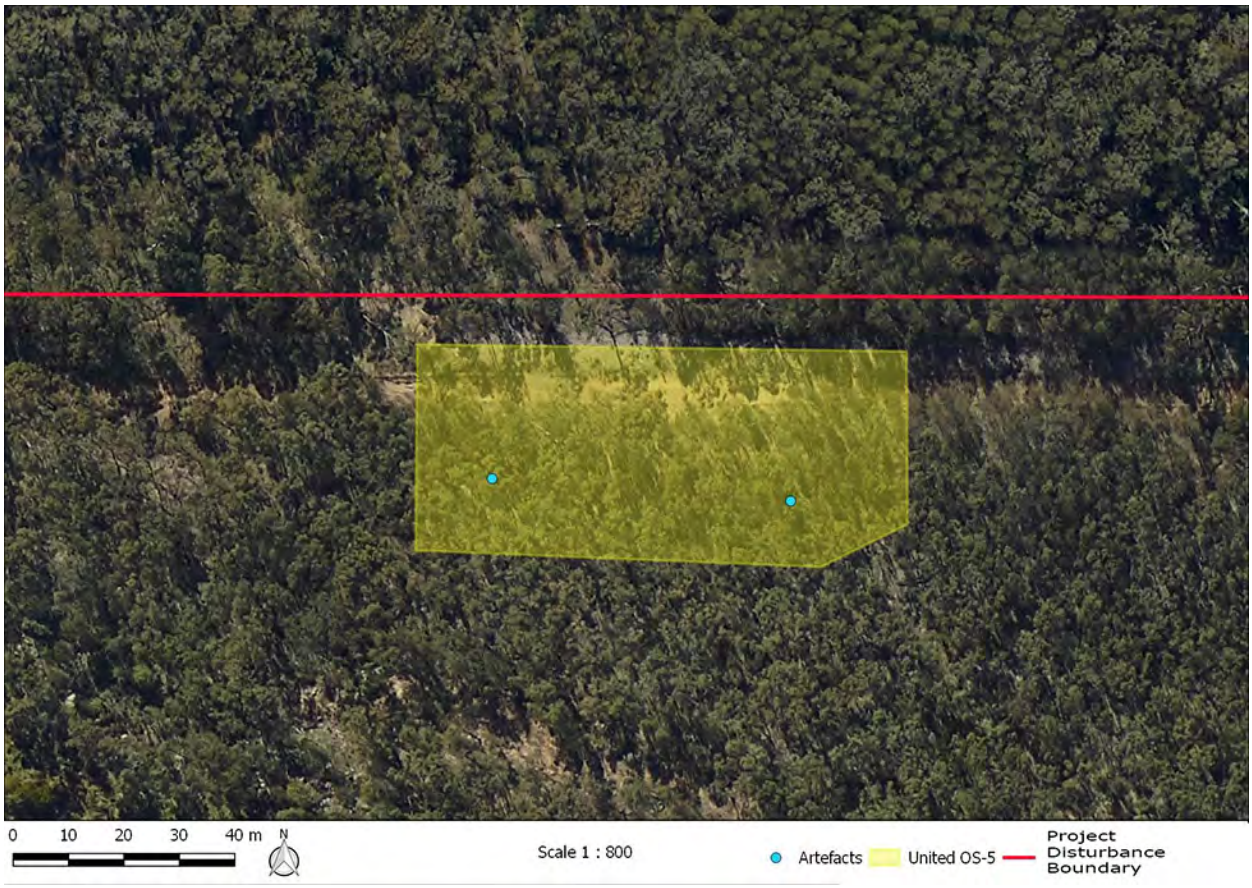


Figure 6-14. United OS-5. View of site.

	
1. UNITED OS-5 CONSISTS OF 2 ARTEFACTS THAT ARE VISIBLE IN AN EXPOSED AREA ON A LANDFORM WHERE ALL A HORIZON SOILS HAVE BEEN REMOVED.	2. UNITED OS-5 WAS RECORDED IN AN AREA OF REGENERATING CASUARINAS.

Figure 6-15. United OS-5. Artefacts.

	
1. UNITED OS-5. 309955E, 6397254N (GDA ZONE 56). A QUARTZ FLAKE.	2. UNITED OS-5. 309901E, 6397257N (GDA ZONE 56). A QUARTZ FLAKE.

United OS-6

GPS Coordinates: 310432E 6397137N (GDA 94 Zone 56).

Details of United OS-6 are presented in **Table 6–7** and the location of the site is shown in **Figure 6–16**.

Figure 6–17 shows the site locality and **Figures 6–18** and **6–19** show a selection of the artefacts recorded at the site.

United OS-6 is a low to moderate density artefact scatter consisting of more than fifty artefacts within a lower to mid-slope landform. United OS-6 is visible on the south bank of the northern arm

of Redbank Creek that has been subject to extensive erosional processes and as a result most artefacts have been displaced (probably from within the vicinity). The observed soil profile showed the A Horizon at the erosion edge was less than 5cm offering little potential for further archaeological deposits. This diffused site extends from the bank of the waterway towards the south but at all locations the level of landform modification has been moderate and gravel lag surfaces are common. Historically this area was subject to extensive sheetwash erosion although this is stabilising now.

Table 6-7. United OS-6. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-6	Mid to low-slope	0m	50+	Low-moderate	Low

Figure 6-16. United OS-6. Location of site in relation to the Project Disturbance Boundary.

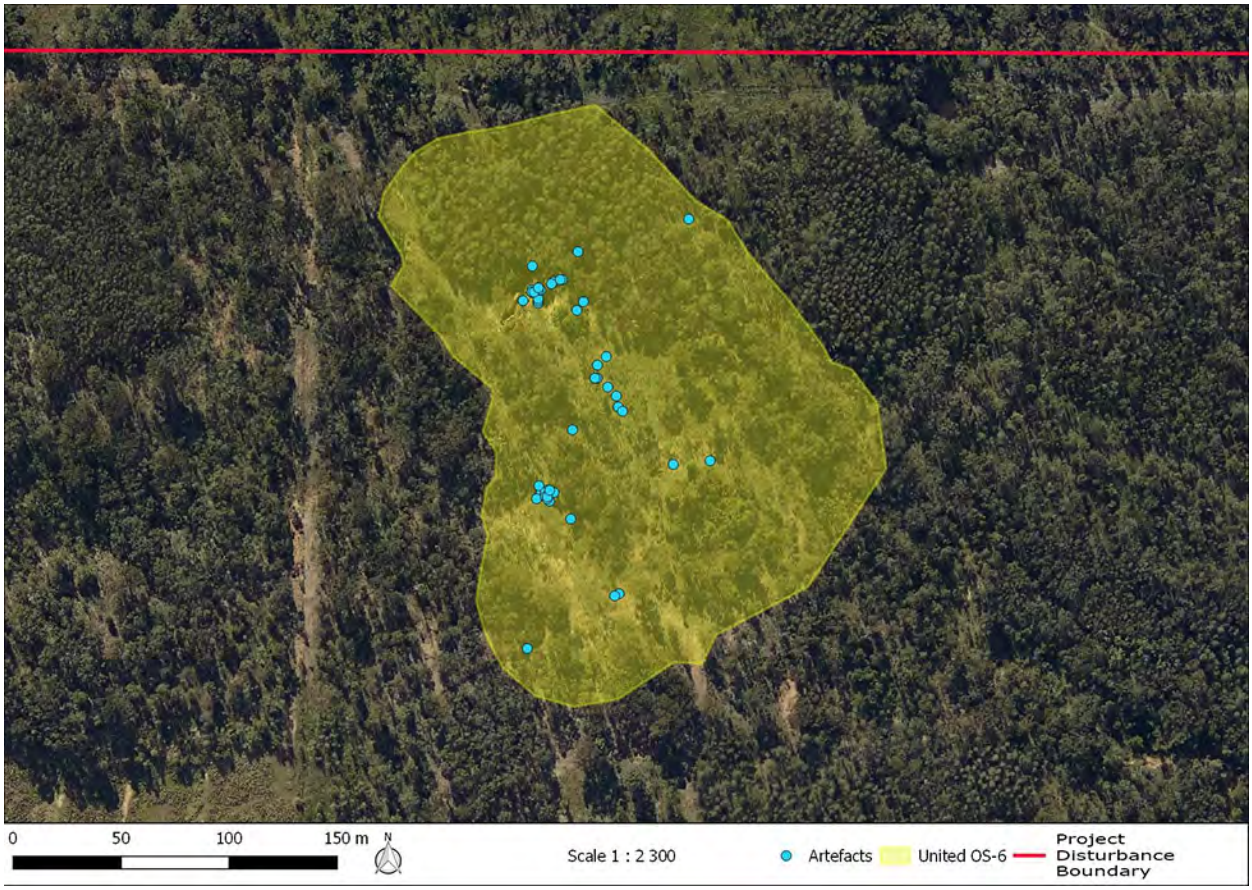


Figure 6-17. United OS-6. View of site.

	
1. United OS-6 consists of 50+ artefacts that are visible on a landform where all A Horizon soils have been removed.	2. Area of United OS-6 located on the south bank of a tributary of Redbank Creek subject to extensive gully erosion.

Figure 6-18. United OS-6. Selection of artefacts.

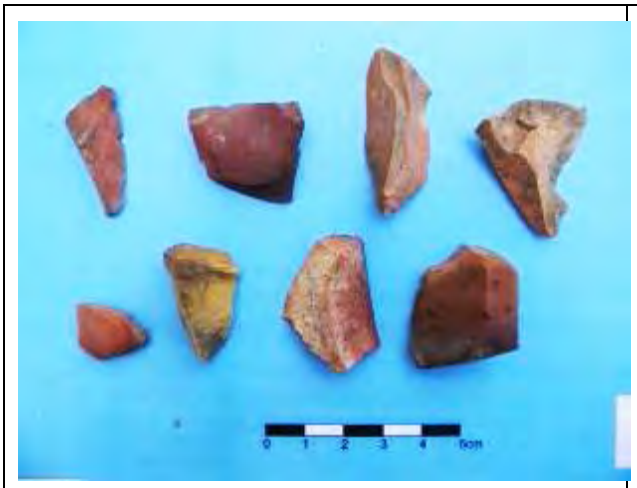
	
1. United OS-6. 310371E, 6397184N (GDA Zone 56). Range of mudstone and silcrete flakes.	2. united OS-6. 310380E, 6397096N (GDA Zone 56). Mudstone blade with steep retouch on one margin.

Figure 6-19. United OS-6. Selection of artefacts (continued).

	
3. UNITED OS-6. 310401E, 6397154N (GDA ZONE 56). A VOLCANIC HAMMERSTONE.	4. UNITED OS-6. 310399E, 6397155N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.

United OS-7

GPS Coordinates: 311135E 6396836N (GDA 94 Zone 56).

Details of United OS-7 are presented in **Table 6–8** and the location of the site is shown in **Figure 6–20**.

Figure 6–21 shows the site locality and **Figure 6–22** shows a selection of the artefacts recorded at the site.

United OS-7 consists of more than fifty artefacts within a lower-slope landform. The site is diffused and extends to the northern bank of Redbank Creek with artefacts visible within small exposures and along extended earth mounds resultant from agricultural and mine related activities. An artificial bund is present throughout the site where a large number of artefacts are exposed. A Horizon soil depth is present further back from the bank of Redbank Creek.

Table 6-8. United OS-7. Landform and site details.

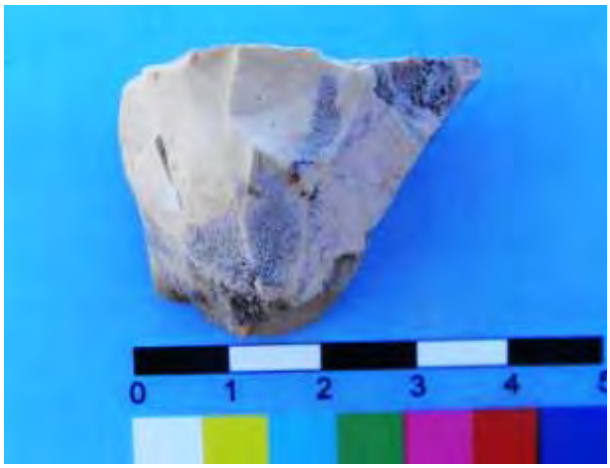
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-7	Lower-slope	0m	50+	Low-moderate	Low-moderate

Figure 6-20. Location of United OS-7 and recorded artefacts.

Figure 6-21. United OS-7. View of site.

	
1. United OS-7 consists of 50+ artefacts that are visible along a stockpile of earthen materials.	2. Southern extent of United OS-7 in an exposed area along Redbank Creek.

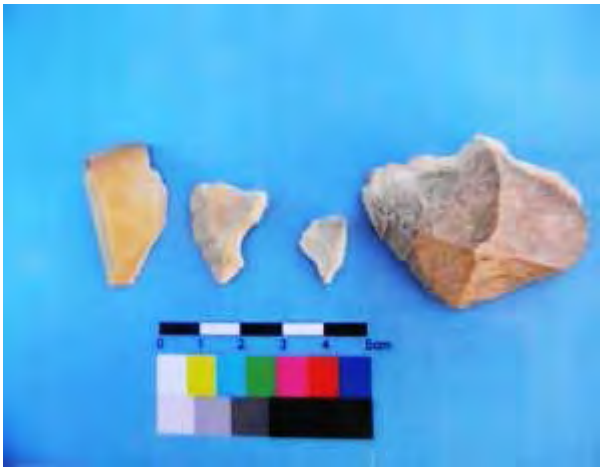
Figure 6-22. United OS-7. Selection of artefacts.



1. UNITED OS-7. 311048E, 6396870N (GDA ZONE 56). 39MM REDUCED MUDSTONE CORE.

2. UNITED OS-7. 311199E, 6396808N (GDA ZONE 56). RANGE OF SILCRETE FLAKES.

3. UNITED OS-7. 311095E, 6396830N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.



4. UNITED OS-7. 311199E, 6396805N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.

United OS-8

GPS Coordinates: 311357E 6396100N (GDA 94 Zone 56).

Details of United OS-8 are presented in **Table 6–9** and the location of the site is shown in **Figure 6–23**.

United OS-8 is in an area where previously an archaeological site has been salvaged in 2007 (#37-5-0075, Red Bank Creek 59; for salvage see Insite Heritage 2010a). The site is now in an area of densely regenerating Casuarinas and is located on the eastern bank of the main arm of Redbank Creek. The site has been impacted by gully and instream erosional processes which has removed large areas of A Horizon soils.

No photographic record exists for this site recording.

Table 6-9. United OS-8. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-8	Lower-slope	10m	5	Very low	Low

Figure 6-23. Location of United OS-8 and United OS-9 with the recorded artefacts.

United OS-9

GPS Coordinates: 311438E 6396092N (GDA 94 Zone 56).

Details of United OS-9 are presented in **Table 6–10** and the location of the site is shown in **Figure 6–23**.

United OS-9 consists of more than ten artefacts within a lower-slope landform. The site is within 50m of the main arm of Redbank Creek and contains a number of small exposures where artefacts were recorded. The site has undergone impacts from erosion of nearby mining related activities which has removed A Horizon soils in places.

No photographic record exists for this site recording.

Table 6-10. United OS-9. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-9	Lower-slope	50m	10+	Low	Low

United OS-10

GPS Coordinates: 311646E 6396285N (GDA 94 Zone 56).

Details of United OS-10 are presented in **Table 6–11** and the location of the site is shown in **Figure 6–24**.

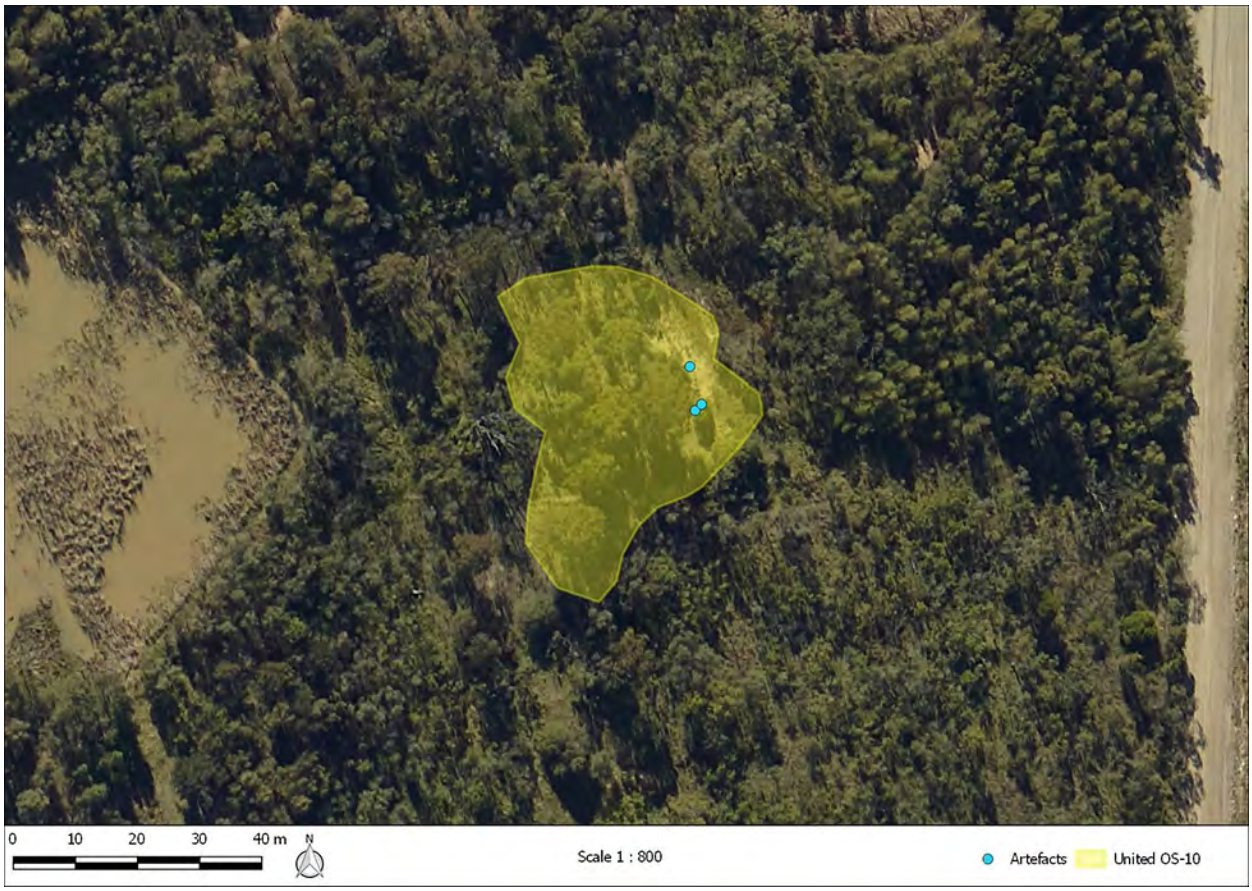
United OS-10 consists of three artefacts that are visible in an exposed area within a flat drainage landform. The low density artefact scatter is located 20m west of the main arm of Redbank Creek with artefacts recorded within small exposures surrounded by regenerating woodland. The tributary of Redbank Creek located west of the site has been impacted by gully erosion and the location of the artefacts has undergone some landform modification with piles of earth still existing. A Horizon soils tend to be thin and sandy within the site. A large quartzite side scraper was recorded adjacent to an ant mound.

No photographic record exists for this site recording.

Table 6-11. United OS-10. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-10	Flat-drainage	20m	3	Low	Low

Figure 6-24. Location of United OS-10 and recorded artefacts.



United OS-11

GPS Coordinates: 312373E 6396137N (GDA 94 Zone 56).

Details of United OS-11 are presented in **Table 6–12** and the location of the site is shown in **Figure 6–25**.

Figure 6–26 shows the site locality and **Figure 6–27** shows a selection of the artefacts recorded at the site.

United OS-11 consists of three artefacts that are visible in an exposed area within a flat, featureless, landform. The site is in an area of densely regenerating Casuarinas and there is no obvious topographic reason for this location to have been used. United OS-11 represents a low density, diffuse artefact scatter.

Table 6-12. United OS-11. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-11	Flat-drainage	>200m	3	Low	Low

Figure 6-25. Location of United OS-11 and recorded artefacts.

Figure 6-26. United OS-11. View of site.

	
1. UNITED OS-11 CONSISTS OF THREE ARTEFACTS THAT ARE VISIBLE ON A LANDFORM WHERE LIMITED A HORIZON SOILS ARE PRESENT.	2. UNITED OS-11 LOCATED WITHIN AN EXPOSED AREA SURROUNDED BY REGENERATING CASUARINAS.

Figure 6-27. United OS-11. Selection of artefacts.

	
1. UNITED OS-11. 312370E, 6396122N (GDA ZONE 56). A UNIDIRECTIONAL MUDSTONE CORE FRAGMENT.	2. UNITED OS-11. 312369E, 6396145N (GDA ZONE 56). RANGE OF SILCRETE FLAKES.

United OS-12

GPS Coordinates: 312620E 6396290N (GDA 94 Zone 56).

Details of United OS-12 are presented in **Table 6–13** and the location of the site is shown in **Figure 6–28**.

Figure 6–29 shows the site locality and **Figure 6–30** shows a selection of the artefacts recorded at the site.

United OS-12 consists of more than twenty artefacts on the western side of the sealed haul road. Artefacts were recorded within an extensive erosion scald where all the A Horizon soils have

been removed. A low density of artefacts was recorded and the observed soil profile showed that the A Horizon at the edge was less than 5cm offering little potential for further archaeological deposits.

The site has previously undergone archaeological salvage and once contained two sites (#37-6-1910; United Collieries 3 [Singleton] and # 37-6-1921; United Collieries 21 [Singleton]) with another just outside the site boundary (#37-6-1614; Haul Road 6). #37-6-1910, United Collieries 3 (Singleton), and # 37-6-1921, United Collieries 21 (Singleton), were salvaged in 2009 by Insite Heritage (2010b) who recovered 50 and 60 artefacts respectively from the sites. #37-6-1614, Haul Road 6, was salvaged by HLA (2007) who recovered 130 artefacts from the site.

This area, as evidenced by the 1987 aerial photographs, was heavily impacted by works associated with the construction of Dam1 and so not too much can be read into why artefacts were recorded in such numbers at this location as they may well have been transported to this area from elsewhere during the construction works.

Table 6-13. United OS-12. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-12	Flat-drainage	>200m	20+	Low	Low

Figure 6-28. Location of United OS-12 and United OS-16 with the recorded artefacts.

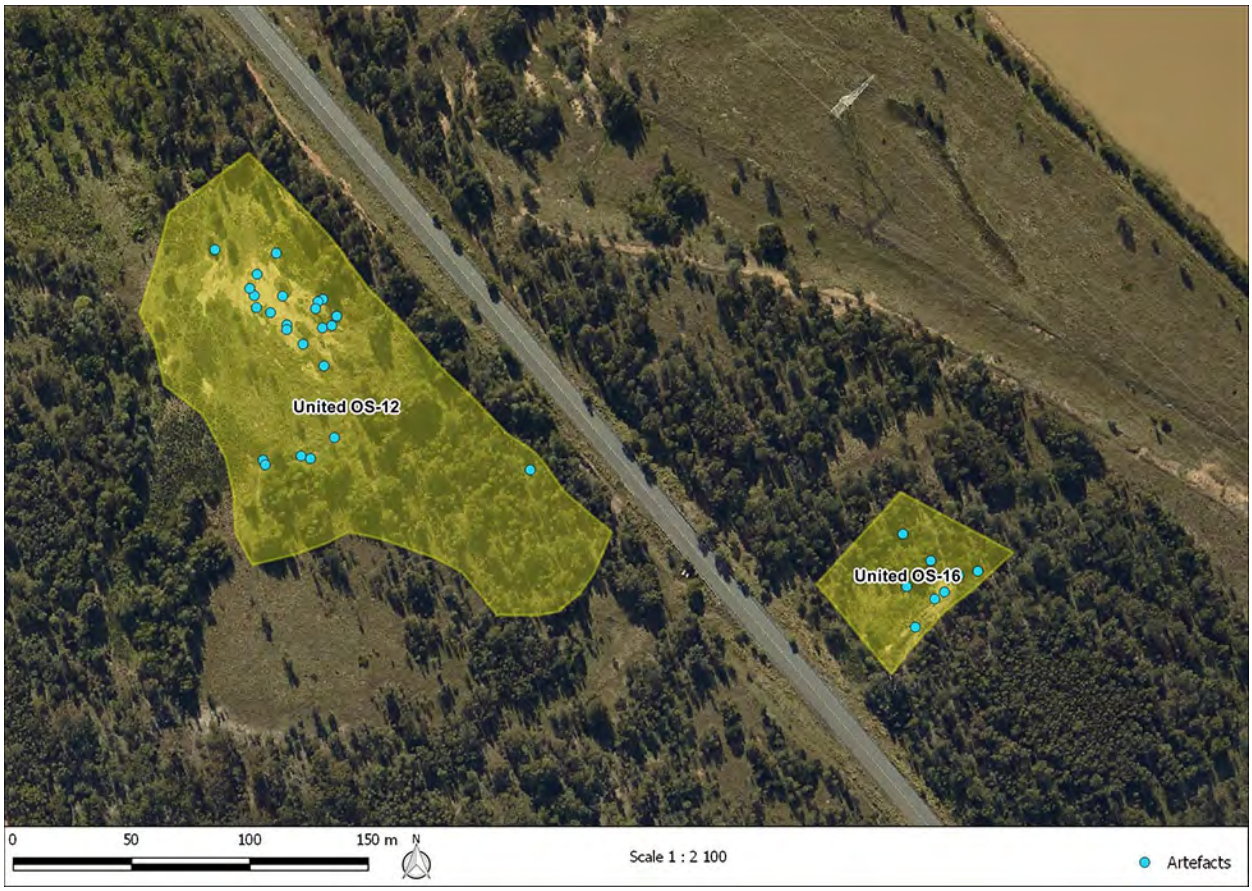


Figure 6-29. United OS-12. View of site.

	
1. United OS-12 consists of 20+ artefacts that are visible on a landform within an extensive erosion scald where all A Horizon soils have been removed.	2. United OS-12 recorded in an area of flat/gently sloping land to the west of the sealed haul road.

Figure 6-30. United OS-12. Selection of artefacts.

	
1. United OS-12. 312581E, 6396346N (GDA Zone 56). A mudstone flake a silcrete flake and a mudstone backed blade.	2. United OS-12. 312583E, 6396343N (GDA Zone 56). Range of mudstone flakes.

United OS-13

GPS Coordinates: 312378E 6396843N (GDA 94 Zone 56).

Details of United OS-13 are presented in **Table 6–14** and the location of the site is shown in **Figure 6–31**.

Figure 6–32 shows the site locality and **Figure 6–33** shows a selection of the artefacts recorded at the site.

United OS-13 is in an area that has been cleared and maintained for an electricity easement. The low density artefact scatter consisting of less than ten artefacts are visible with small exposures

within a flat landform adjacent to Redbank Creek. The site displays further European disturbances with steel waste located nearby. In addition, the 1987 aerial shows that there was moderate disturbance in this area from the construction of Dam 1 and associated tracks. Therefore the artefacts are in a disturbed landform and likely to be in in a secondary context.

Table 6-14. United OS-13. Landform and site details.

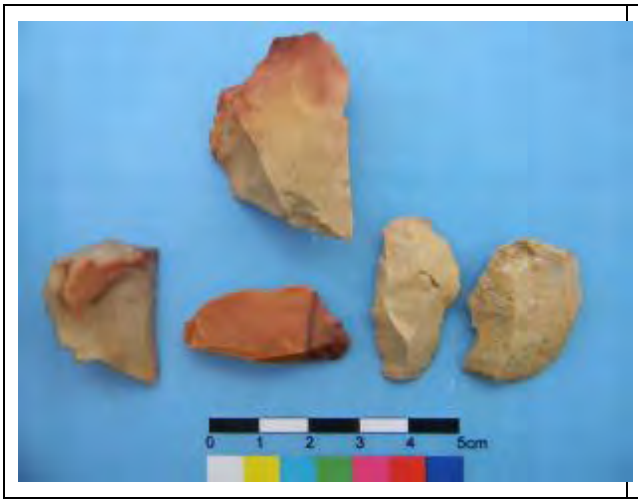
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-13	Flat-drainage	50m	<10	Low	Low

Figure 6-31. Location of United OS-13 and recorded artefacts.

Figure 6-32. United OS-13. View of site.

1. UNITED OS-13 CONSISTS OF LESS THAN TEN ARTEFACTS WITHIN A CLEARED ELECTRICITY EASEMENT IN SMALL EXPOSURES.

Figure 6-33. United OS-13. Selection of artefacts.



1. UNITED OS-13. 312374E, 6396846N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.

United OS-14

GPS Coordinates: 313027E 6396942N (GDA 94 Zone 56).

Details of United OS-14 are presented in **Table 6–15** and the location of the site is shown in **Figure 6–34**.

Figure 6–35 shows the site locality and **Figure 6–36** shows a selection of the artefacts recorded at the site.

United OS-14 is a very low density, diffuse, artefact scatter consisting of two artefacts located in a flat, highly modified landform. The site is surrounded by regenerating Casuarinas and mine-related disturbances with little potential for further archaeological deposits.

Table 6-15. United OS-14. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-14	Flat-drainage	100m	2	Very low	Low

Figure 6-34. Location of United OS-14 and recorded artefacts.

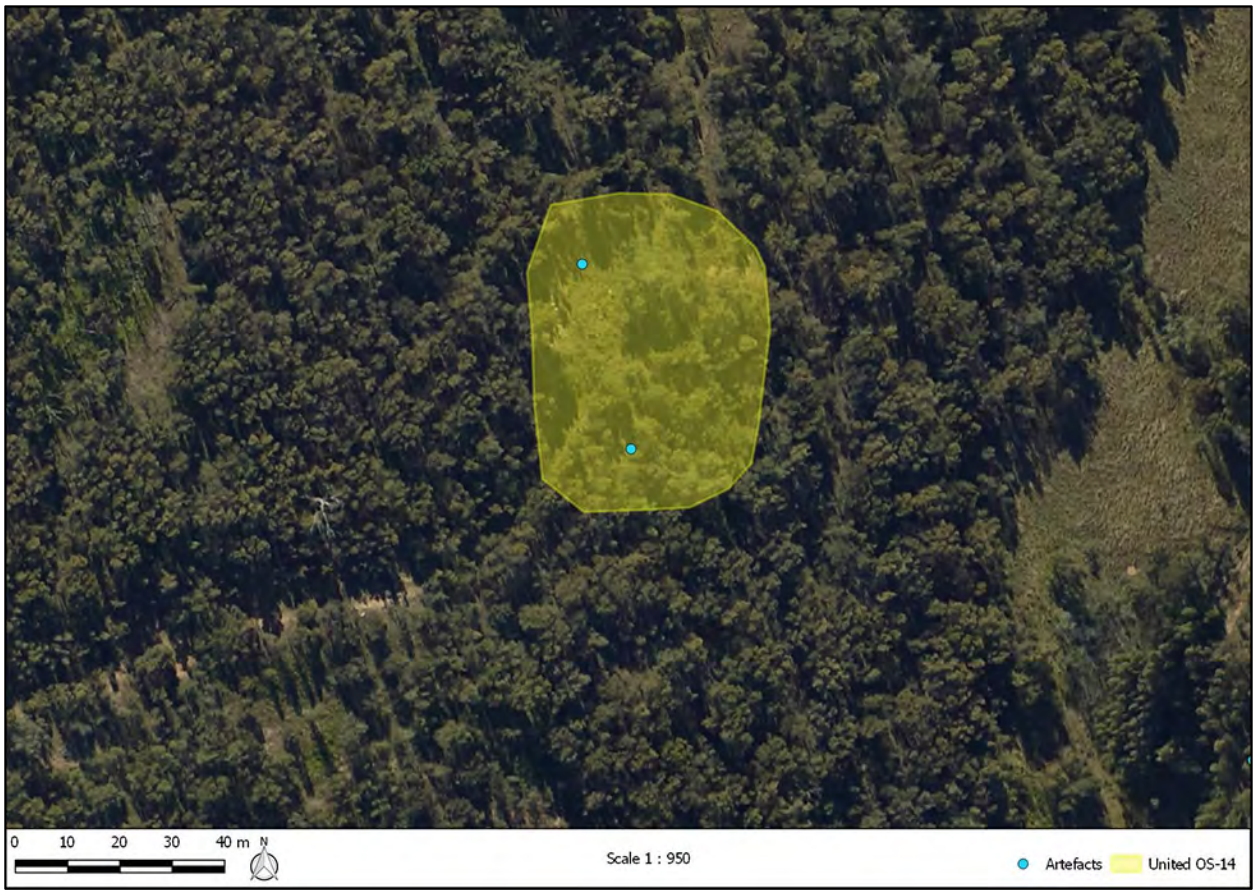


Figure 6-35. United OS-14. View of site.

1. UNITED OS-14 CONSISTS OF TWO ARTEFACTS THAT ARE VISIBLE WITHIN A FLAT LANDFORM.

2. HIGHLY MODIFIED AREA WITHIN UNITED OS-14 FROM MINING RELATED INSTALLATIONS.

Figure 6-36. United OS-14. Selection of artefacts.

	
1. UNITED OS-14. 313025E, 6396923N (GDA ZONE 56). A SECONDARY MUDSTONE FLAKE.	2. UNITED OS-14. 313015E, 6396958N (GDA ZONE 56). A TERTIARY MUDSTONE FLAKE.

United OS-15

GPS Coordinates: 312861E 6395961N (GDA 94 Zone 56).

Details of United OS-15 are presented in **Table 6–16** and the location of the site is shown in **Figure 6–37**.

Figure 6–38 shows a selection of the artefacts recorded at the site.

United OS-15 is a very low density, diffuse, artefact scatter consisting of two artefacts. The site is located within a flat, featureless, landform with the artefacts visible along an access track. The artefacts were recorded in an area with considerable disturbance from track construction and use, a gravel dump, and earth mounds from earthworks. As a result, the artefacts recorded have been probably displaced (probably from within the vicinity) and there is little possibility of further subsurface archaeological deposits. United OS-15 is located further than 100m from a reliable water source.

Table 6-16. United OS-15. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-15	Flat-drainage	>200m	2	Very low	Low

Figure 6-37. Location of United OS-15 and recorded artefacts.

Figure 6-38. United OS-15. Selection of artefacts.

1. UNITED OS-15. 312838E, 6395945N (GDA ZONE 56). A MUDSTONE FLAKED PIECE.

2. UNITED OS-15. 312885E, 6395973N (GDA ZONE 56). A SILCRETE FLAKED PIECE.

United OS-16

GPS Coordinates: 312859E 6396231N (GDA 94 Zone 56).

Details of United OS-16 are presented in **Table 6–17** and the location of the site is shown in **Figure 6–28**.

Figure 6–39 shows the site locality and **Figure 6–40** shows a selection of the artefacts recorded at the site.

United OS-16 consists of less than ten artefacts visible in a landform where the A Horizon soils have been removed. The artefacts are visible within a moderately sized exposure within a flat landform. The site is located southeast of a spillway to Dam 1.

The nearby site (37-6-1613; Haul Road 5) was salvaged by Insite Heritage in 2009 (under AHIP #1102321) when two mudstone flakes were recovered. However, this followed an earlier salvage when more than 50 artefacts were salvaged under AHIP #2527 (Insite Heritage 2010b: 19).

1987 aerial images of the site show it heavily disturbed by the construction of Dam 1 and the site lacks any archaeological integrity.

Table 6-17. United OS-16. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-16	Flat-drainage	>200m	<10	Low	Low

Figure 6-39. United OS-16. View of site.

1. UNITED OS-16 CONSISTS OF LESS THAN TEN ARTEFACTS THAT ARE VISIBLE ON A LANDFORM WHERE ALL A HORIZON SOILS HAVE BEEN REMOVED.

2. UNITED OS-16 LOCATED WITHIN A FLAT/DRAINAGE LANDFORM.

Figure 6-40. United OS-16. Selection of artefacts.

	
1. UNITED OS-16. 312891E, 6396233N (GDA ZONE 56). A SILCRETE FLAKE.	2. UNITED OS-16. 312861E, 6396226N (GDA ZONE 56). RANGE OF SILCRETE AND MUDSTONE FLAKES.

United OS-17

GPS Coordinates: 313004E 6395356N (GDA 94 Zone 56).

Details of United OS-17 are presented in **Table 6–18** and the location of the site is shown in **Figure 6–41**.

Figure 6–42 shows the site locality and **Figure 6–43** shows a selection of the artefacts recorded at the site.

United OS-17 is a low density, diffuse, artefact scatter consisting of more than ten artefacts located along an access track in a generally flat landform with a slight slope to the southeast. United OS-17 is adjacent to the western bank of an unnamed tributary to Wollombi Brook. Wollombi Brook itself is just over 300m from the site. The artefacts were recorded in landforms disturbed by track construction and drill pads. As a result, the artefacts recorded have been displaced (probably from within the vicinity) and there is little possibility of further subsurface archaeological deposits.

Table 6-18. United OS-17. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-17	Flat-drainage	0m	10+	Low	Low

Figure 6-41. Location of United OS-17 and recorded artefacts.

Figure 6-42. United OS-17. View of site.

1. UNITED OS-17 CONSISTS OF MORE THAN TEN ARTEFACTS THAT ARE VISIBLE IN A MODIFIED LANDFORM.

2. UNITED OS-17: ARTEFACTS LOCATED IN A FORMER DRILL PAD.

Figure 6-43. United OS-17. Selection of artefacts.

1. UNITED OS-17. 313021E 6395278N (GDA ZONE 56). A MUDSTONE FLAKE.

2. UNITED OS-17. 313031E 6395343N (GDA ZONE 56). A SILCRETE FLAKE.

United OS-18

GPS Coordinates: 313204E 6395068N (GDA 94 Zone 56).

Details of United OS-18 are presented in **Table 6–19** and the location of the site is shown in **Figure 6–44**.

Figure 6–45 shows the site locality and **Figure 6–46** shows a selection of the artefacts recorded at the site.

United OS-18 is a low to moderate density artefact scatter consisting of more than fifty artefacts within a flat landform on either bank of an unnamed tributary to Wollombi Brook. The site is visible largely within an eroded gully with artefacts recorded to the east within an area surrounded by regenerating Casuarinas. United OS-18 has been disturbed by sheetwash erosion and mine related infrastructure with an electricity easement running through the north west of the site. A Horizon soils are present in places. Some artefacts were recorded *in situ* within the site.

United OS-18 has been impacted in the past by previous surface collections of artefacts (HLA 2007) and previous archaeological excavation, particularly along its eastern boundary (Insite Heritage 2010b). For further discussion of these investigations, see **Section 8.2**.

Table 6-19. United OS-18. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-18	Flat-drainage	0m	50+	Low-moderate	Low-moderate

Figure 6-44. United OS-18, United OS-19 and United OS-20. Location of sites in relation to the Project Disturbance Boundary.

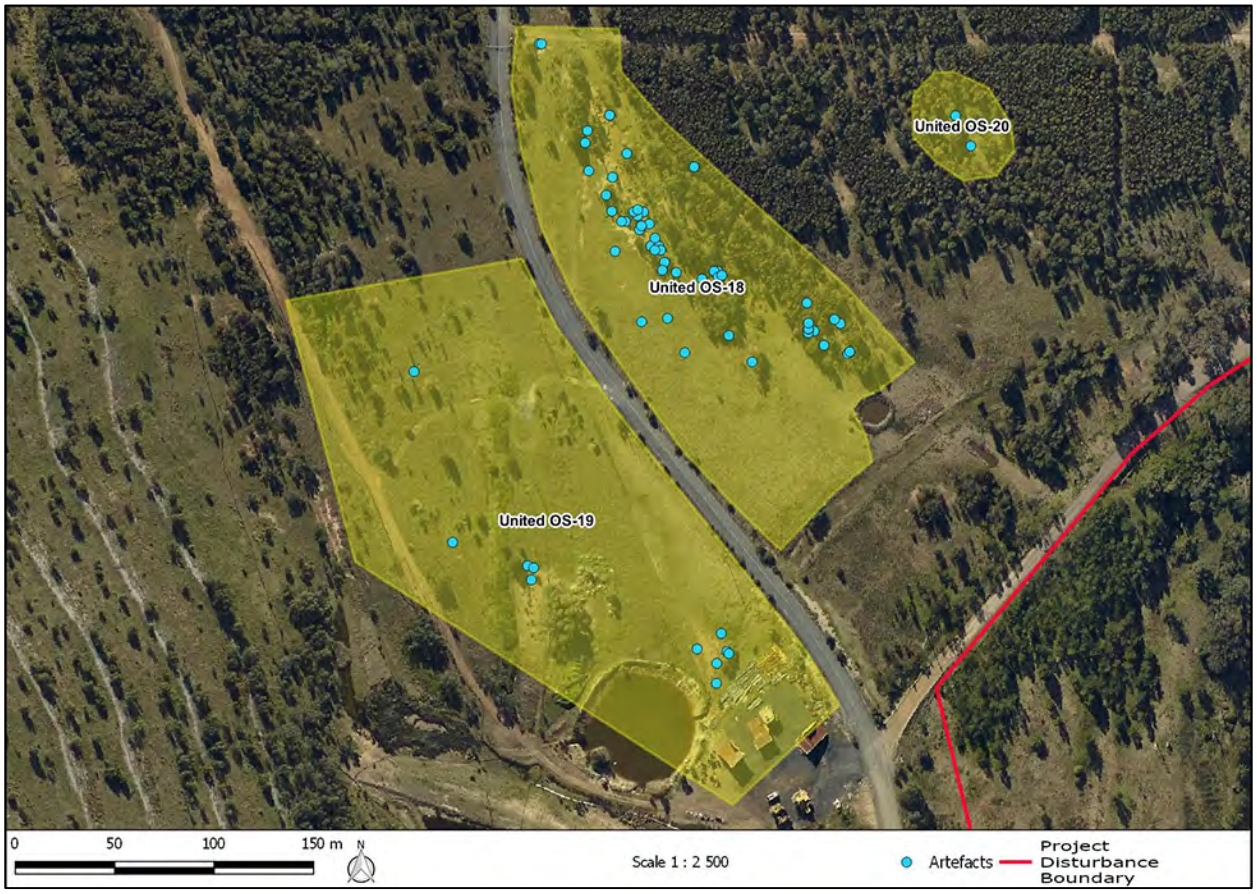
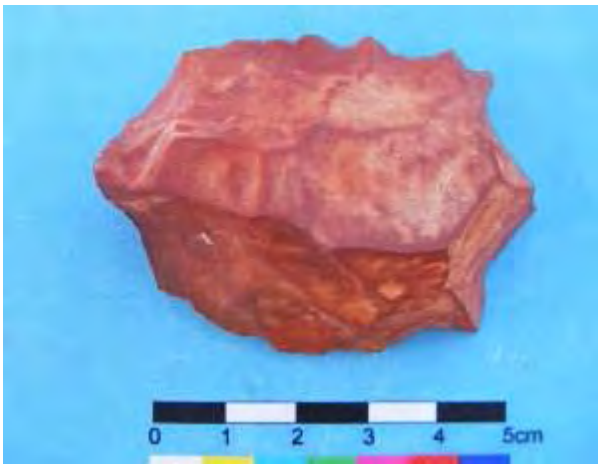


Figure 6-45. United OS-18. View of site.

1. UNITED OS-18: VIEW OF EROSION WITHIN SITE.

2. EASTERN PORTION OF UNITED OS-18.

Figure 6-46. United OS-18. Selection of artefacts.

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1. UNITED OS-18. 313169E, 6395113N (GDA ZONE 56). RANGE OF SILCRETE FLAKES.</td><td>2. UNITED OS-18. 313285E, 6395042N (GDA ZONE 56). A UNIFACIAL, SECONDARY MUDSTONE CORE.</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>3. UNITED OS-18. 313224E, 6395065N (GDA ZONE 56). MUDSTONE ARTEFACTS ERODING FROM OR BEING DEPOSITED WITHIN A HORIZON SOILS.</td><td>4. UNITED OS-18. 313167E, 6395144N (GDA ZONE 56). A MUDSTONE END SCRAPER WITH STEEP, UNIFACIAL RETOUCH.</td></tr>
</table>

United OS-19

GPS Coordinates: 313129E 6394943N (GDA 94 Zone 56).

Details of United OS-19 are presented in **Table 6–20** and the location of the site is shown in **Figure 6–44**.

Figure 6–47 shows the site locality and **Figures 6–48** and **6–49** show a selection of the artefacts recorded at the site.

United OS-19 is a low density artefact scatter. The site is diffused and consist of more than ten artefacts located within a flat landform to the west of an unnamed tributary to Wollombi Brook. The site has undergone obvious impacts from mining infrastructure and mine related activities

particularly within the southern portion of the site. A Horizon soils are present largely within the northern portion of the site which has been cleared of native vegetation.

Table 6-20. United OS-19. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-19	Flat-drainage	50m	10+	Low	Low

Figure 6-47. United OS-19. View of site.

1. UNITED OS-19 CONSISTS OF 10+ ARTEFACTS THAT ARE VISIBLE ON A LANDFORM WHERE ALL A HORIZON SOILS HAVE BEEN REMOVED.

2. UNITED OS-19 LOCATED WITHIN AN AREA THAT HAS BEEN SUBJECT TO MODIFICATION FROM MINING RELATED ACTIVITIES.

Figure 6-48. United OS-19. Selection of artefacts.

1. UNITED OS-19. 313071E, 6395014N (GDA ZONE 56). A MULTIDIRECTIONAL MUDSTONE CORE.

2. UNITED OS-19. 313232E, 6394876N (GDA ZONE 56). A MUDSTONE BLADE WITH STEEP RETOUCH TO ONE MARGIN.

Figure 6-49. United OS-19. Selection of artefacts (continued).

	
1. UNITED OS-19. 313133E, 6394917N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.	2. UNITED OS-19. 313216E, 6394878N (GDA ZONE 56). A SILCRETE FLAKE.

United OS-20

GPS Coordinates: 313344E 6395141N (GDA 94 Zone 56).

Details of United OS-20 are presented in **Table 6–21** and the location of the site is shown in **Figure 6–44**.

Figure 6–50 shows the site locality and **Figure 6–51** shows a selection of the artefacts recorded at the site.

United OS-20 is a very low density artefact scatter consisting of two artefacts. The artefacts were recorded within small exposures in a flat landform approximately 120m from Wollombi Brook. Disturbances are limited to the past agricultural land use which included grazing and the removal of mature trees. As a result, A Horizon soils have been lost from across the area and the A Horizon is estimated to be thin.

Table 6-21. United OS-20. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-20	Flat-drainage	150m	2	Very low	Low

Figure 6-50. United OS-20. View of site.

	
1. UNITED OS-20 CONSISTS OF TWO ARTEFACTS THAT ARE VISIBLE WITHIN A FLAT/DRAINAGE LANDFORM.	2. UNITED OS-20 SURROUNDED BY REGENERATING CASUARINAS.

Figure 6-51. United OS-20. Selection of recorded artefacts.

	1. UNITED OS-20. 313349E, 6395132N (GDA ZONE 56). A MUDSTONE FLAKE.

United OS-21

GPS Coordinates: 313641E 6395164N (GDA 94 Zone 56).

Details of United OS-21 are presented in **Table 6–22** and the location of the site is shown in **Figure 6–52**.

Figure 6–53 shows the site locality and **Figure 6–54** shows a selection of the artefacts recorded at the site.

United OS-21 is a low density, diffuse, artefact scatter consisting of three artefacts located on the south and eastern banks of a small dam. The site is within a flat landform where A Horizon soils are limited. The site has been heavily modified by the construction of the dam and it is almost certain that the artefacts are in secondary contexts.

Table 6-22. United OS-21. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-21	Flat-drainage	100m	<10	Low	Low

Figure 6-52. United OS-21. Location of site in relation to the Project Disturbance Boundary.

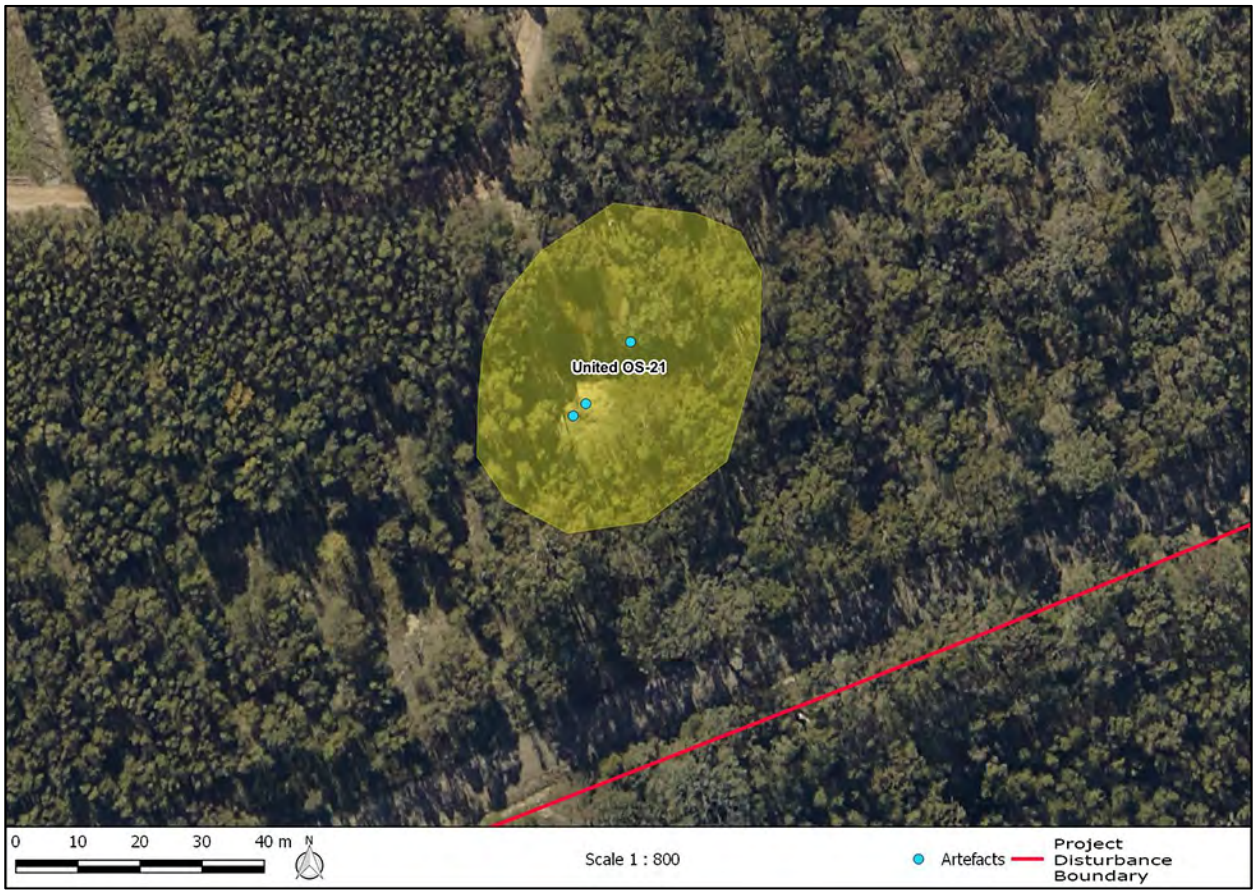


Figure 6-53. United OS-21. View of site.

1. United OS-21 consists of three artefacts located on the southern bank of a small dam.

Figure 6-54. United OS-21. Selection of artefacts.

1. UNITED OS-21. 313636E, 6395158N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.

United OS-22

GPS Coordinates: 313521E 6396083N (GDA 94 Zone 56).

Details of United OS-22 are presented in **Table 6–23** and the location of the site is shown in **Figure 6–55**.

Figure 6–56 shows the site locality and **Figure 6–57** shows a selection of the artefacts recorded at the site.

United OS-22 is a low density artefact scatter consisting of five artefacts recorded within a flat landform. The site is located on an artificial dam wall and all recorded artefacts are in a secondary context.

Table 6-23. United OS-22. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-22	Flat-drainage	15m	<10	Low	Low

Figure 6-55. Location of United OS-22 and United OS-23 with recorded artefacts.

Figure 6-56. United OS-22. View of site.

	1. UNITED OS-22 CONSISTS OF LESS THAN TEN ARTEFACTS LOCATED ON THE WALL OF A DAM.

Figure 6-57. United OS-22. Selection of artefacts.

	
1. UNITED OS-22. 313504E, 6396088N (GDA ZONE 56). A SILCRETE FLAKE.	2. UNITED OS-22. 313521E, 6396086N (GDA ZONE 56). RANGE OF MUDSTONE FLAKES.

United OS-23

GPS Coordinates: 313585E 6396001N (GDA 94 Zone 56).

Details of United OS-23 are presented in **Table 6–24** and the location of the site is shown in **Figure 6–55**.

United OS-23 consists of two artefacts visible within a flat landform. The low density, diffuse, artefact scatter was recorded along an access track where all the A Horizon soils have been removed and is surrounded by regenerating Casuarinas. There was no obvious topographic reason why this location should be used.

No photographic record exists for this site.

Table 6-24. United OS-23. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-23	Flat-drainage	>200m	2	Very low	Low

United OS-24

GPS Coordinates: 313762E 6395944N (GDA 94 Zone 56).

Details of United OS-24 are presented in **Table 6–25** and the location of the site is shown in **Figure 6–58**.

Figure 6–59 shows the site locality and **Figure 6–60** shows a selection of the artefacts recorded at the site.

United OS-24 is located along the same access track as United OS-23. The low density, diffuse, artefact scatter consists of two artefacts within a flat landform where all the A Horizon soils have

been removed offering little to no potential for further subsurface deposits. The access track is surrounded on either side by regenerating Casuarinas.

Table 6-25. United OS-24. Landform and site details.

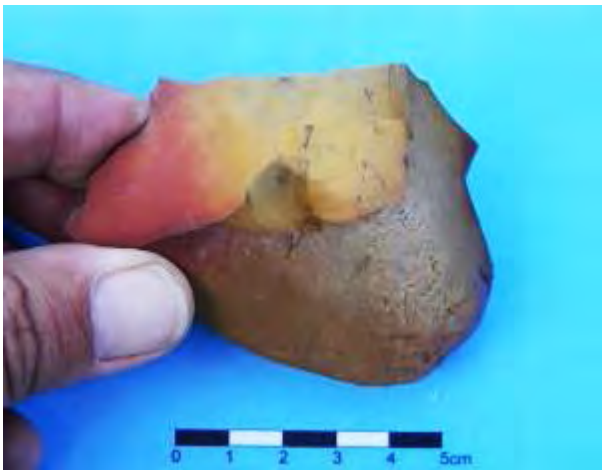
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-24	Flat-drainage	90m	2	Low	Low

Figure 6-58. Location of United OS-24 and recorded artefacts.

Figure 6-59. United OS-24. View of site.

1. UNITED OS-24 IS VISIBLE ALONG AN ACCESS TRACK WHERE ALL A HORIZON SOILS HAVE BEEN REMOVED.

Figure 6-60. United OS-24. Selection of artefacts.

	
1. UNITED OS-24. 313764E, 6395938N (GDA ZONE 56). A MUDSTONE FLAKE.	2. UNITED OS-24. 313761E, 635948N (GDA ZONE 56). MUDSTONE COBBLE WITH EDGE-WEAR.

United OS-25

GPS Coordinates: 313508E 6396284N (GDA 94 Zone 56).

Details of United OS-25 are presented in **Table 6–26** and the location of the site is shown in **Figure 6–61**.

Figure 6–62 shows the site locality and **Figure 6–63** shows a selection of the artefacts recorded at the site.

United OS-25 consists of less than ten artefacts. The site was recorded within a flat landform adjacent to the northwest bank of Redbank Creek where A Horizon soils are present. The low density artefact scatter is located adjacent to land than has been cropped and undergone further impacts from mine related activities (dam construction).

Table 6-26. United OS-25. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
United OS-25	Flat-drainage	10m	<10	Low	Moderate

Figure 6-61. Location of United OS-25 and recorded artefacts.

Figure 6-62. United OS-25. View of site.

1. UNITED OS-25 CONSISTS OF LESS THAN TEN ARTEFACTS THAT ARE VISIBLE WITHIN A FLAT LANDFORM ADJACENT TO REDBANK CREEK.

2. UNITED OS-25 LOCATED WITHIN AN AREA OF DENSELY REGENERATING CASUARINAS.

Figure 6-63. United OS-25. Selection of artefacts.

1. UNITED OS-25. 313522E, 6396240N (GDA ZONE 56). A MUDSTONE FLAKE.

2. UNITED OS-25. 313514E, 6396257N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.

6.3 ISOLATED FINDS

Table 6–27 lists the 34 isolated finds recorded during the assessment and **Figure 6–64** shows their location within the Project Area. **Figures 6–65** and **6–66** show details of the Survey Area with the location of recorded isolated finds.

Table 6-27. United IF-1 to United IF-34. Description and location.

Site name	Location (GDA94 Zone 56)	Artefact	Probability of associated deposits
United IF-1	306963E, 6398215N	Silcrete flake: size 3[9].	None: A Horizon soil depth is limited.
United IF-2	307034E, 6398216N	Silcrete flake: size 2.	None: A Horizon soil depth is limited.
United IF-3	307283E, 6398374N	Mudstone flaked piece: size 5.	None: A Horizon soil depth is limited.
United IF-4	308042E, 6398409N	Mudstone flake: size 3.	None: A Horizon soil depth is limited.
United IF-5	306437E, 6396944N	Silcrete flake: 25mm	None: A Horizon soil depth is limited.
United IF-6	306724E, 6396397N	Mudstone flake: 50mm	None: A Horizon soil depth is limited.
United IF-7	309192E, 6396998N	Silcrete flake, proximal fragment: size 1.	None: A Horizon soil depth is limited.
United IF-8	309356E, 6397070N	Mudstone flake: size 1.	None: A Horizon soil depth is limited.
United IF-9	310119E, 6397274N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-10	311776E, 6396718N	Mudstone flake: size 3.	None: A Horizon soil depth is limited.
United IF-11	312296E, 6395887N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-12	312436E, 6395857N	Mudstone flake, longitudinal break: size 4.	None: A Horizon soil depth is limited.
United IF-13	312524E, 6396079N	Silcrete flake: size 4.	None: A Horizon soil depth is limited.
United IF-14	312571E, 6395769N	Silcrete flake: size 2.	None: A Horizon soil depth is limited.
United IF-15	312184E, 6397195N	Mudstone flake: size 4.	None: A Horizon soil depth is limited.
United IF-16	312478E, 6397253N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.

[9] Size ranges are 1 = 0–20mm; 2 = 20–40mm; 3 = 40–60mm; 4 = 60–80mm; 5 = 80_100mm and 6 = 100mm and larger.

Site name	Location (GDA94 Zone 56)	Artefact	Probability of associated deposits
United IF-17	312703E, 6397015N	Mudstone flake: size 3.	None: A Horizon soil depth is limited.
United IF-18	312603E, 6396745N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-19	312734E, 6396857N	Unidirectional silcrete core: 39mm.	None: A Horizon soil depth is limited.
United IF-20	313145E, 6396866N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-21	313267E, 6396982N	Multidirectional mudstone core: 33mm.	None: A Horizon soil depth is limited.
United IF-22	312874E, 6395349N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-23	313073E, 6395177N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-24	313365E, 6394924N	Silcrete flake, longitudinal break: size 2.	None: A Horizon soil depth is limited.
United IF-25	313190E, 6395321N	Volcanic axe blank: Size 5.	None: A Horizon soil depth is limited.
United IF-26	313431E, 6395020N	Silcrete flake: size 1.	None: A Horizon soil depth is limited.
United IF-27	313418E, 6395092N	Mudstone flake, proximal fragment: size 2.	None: A Horizon soil depth is limited.
United IF-28	313494E, 6395072N	Mudstone blade, proximal fragment: size 2.	None: A Horizon soil depth is limited.
United IF-29	313519E, 6395238N	Mudstone flake: size 3.	None: A Horizon soil depth is limited.
United IF-30	313283E, 6396158N	Mudstone flake, distal fragment: size 1.	None: A Horizon soil depth is limited.
United IF-31	313313E, 6396222N	Mudstone flake: size 2.	None: A Horizon soil depth is limited.
United IF-32	313645E, 6395904N	Mudstone flake, proximal fragment: size 2.	None: A Horizon soil depth is limited.
United IF-33	313699E, 6396061N	Mudstone backed blade: size 4. Partial retouch on margin.	None: A Horizon soil depth is limited.
United IF-34	313828E, 6396242N	Silcrete flake, size: 4.	None: A Horizon soil depth is limited.

Figure 6-64. Location of United IF-1 to United IF-34.

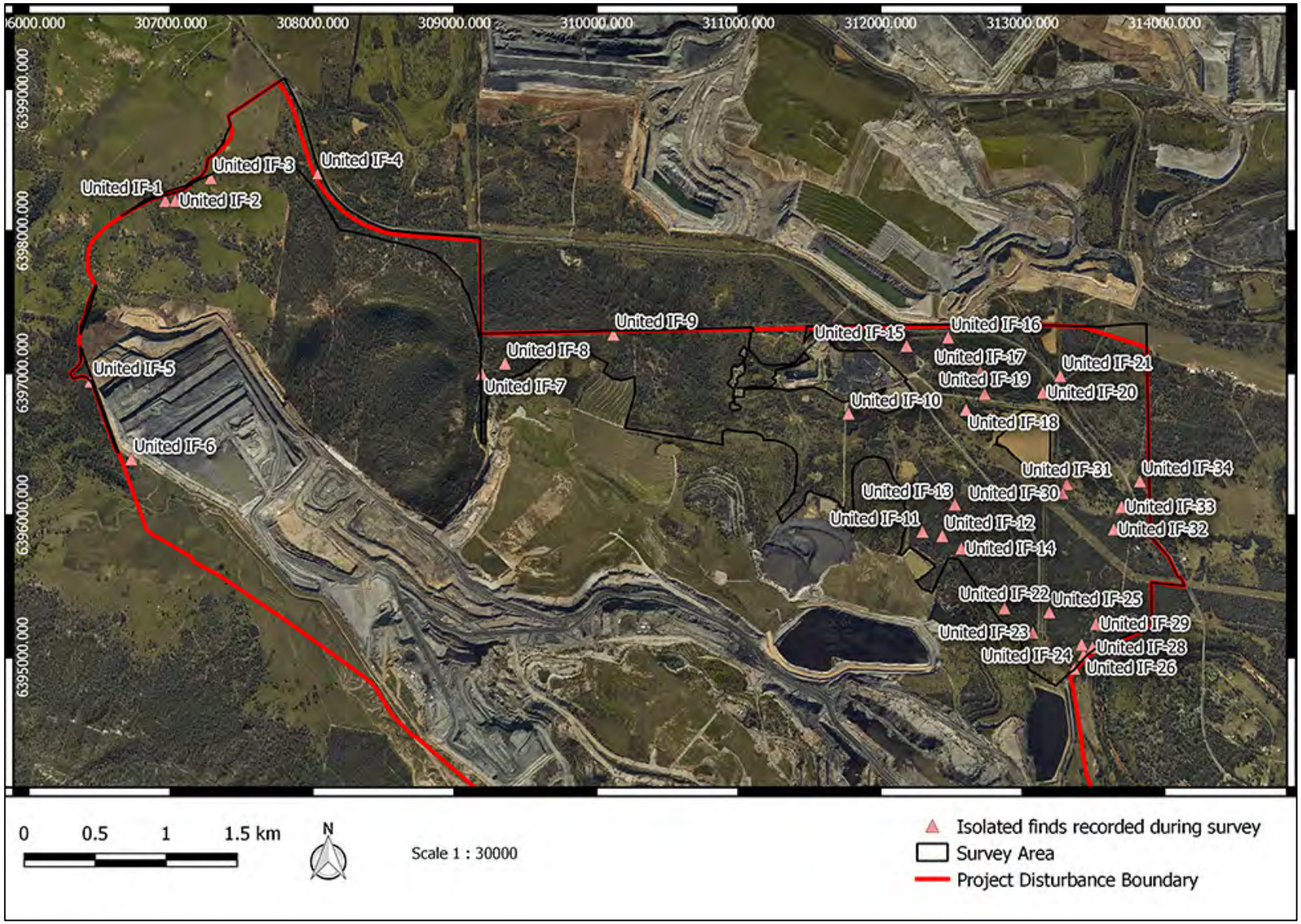


Figure 6-65. Isolated Finds IF-1 to IF-9. Western portion of Survey Area.

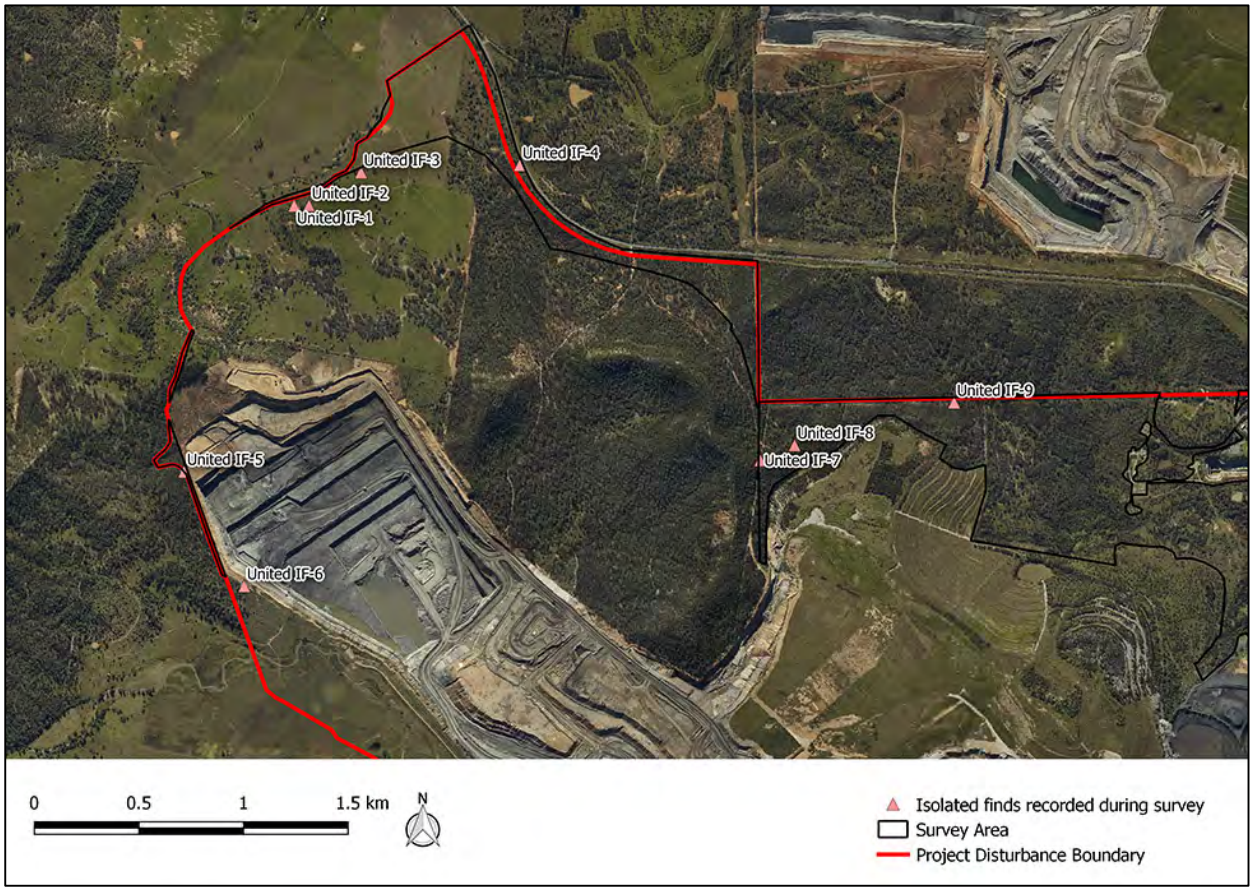
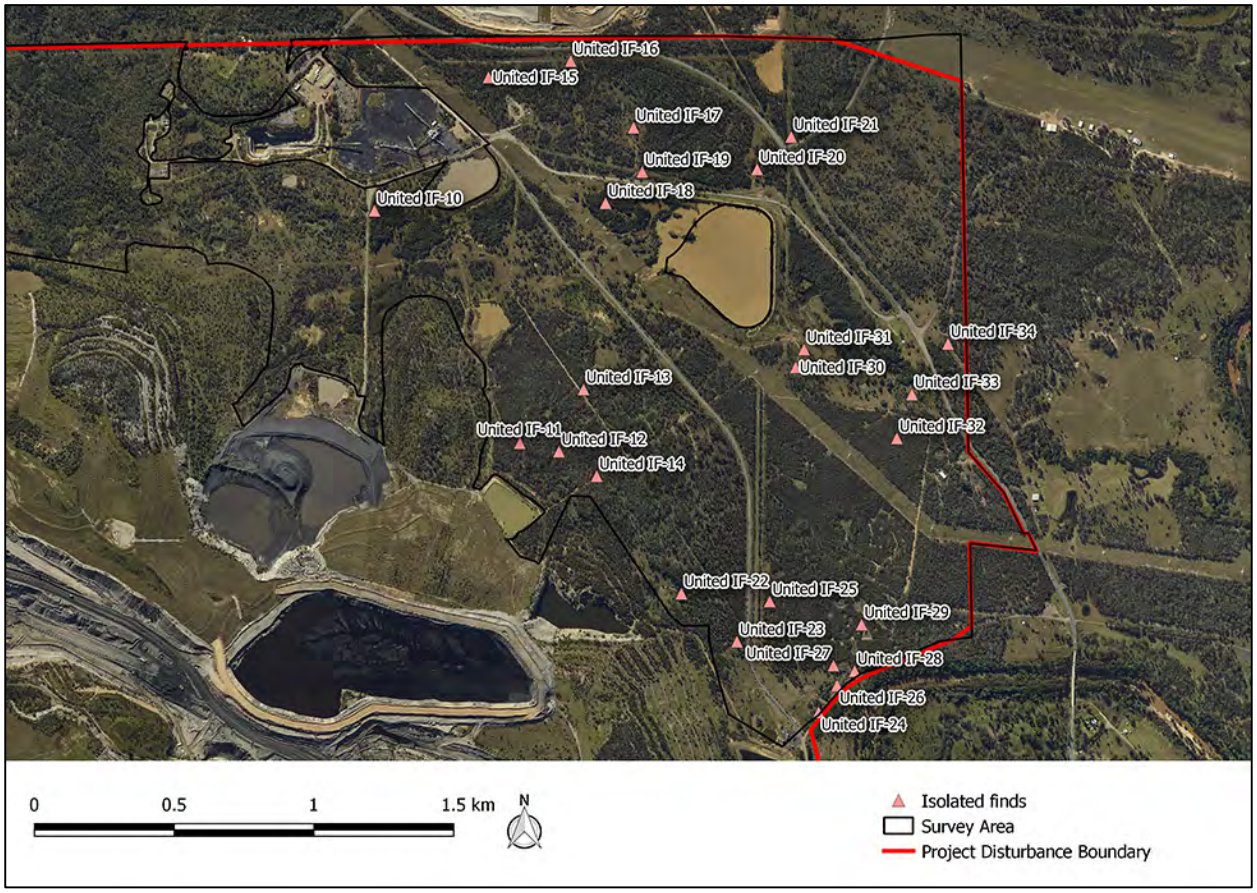


Figure 6-66. Isolated Finds IF-10 to IF-34. Eastern portion of Survey Area.



United IF-1

Location: 306963E, 6398215N (GDA Zone 56).

The isolated silcrete flake was recorded in an area cleared of native vegetation in a mid-slope landform. The landform slopes gradually to the north towards Waterfall Creek located about 130m to the northwest. United IF-1 is located 83m west of United IF-2 on land that is currently used for grazing (**Figure 6–67**). It is highly likely the artefact is in a secondary context having been washed downslope.

Figure 6-67. United IF-1. Location and Artefact.

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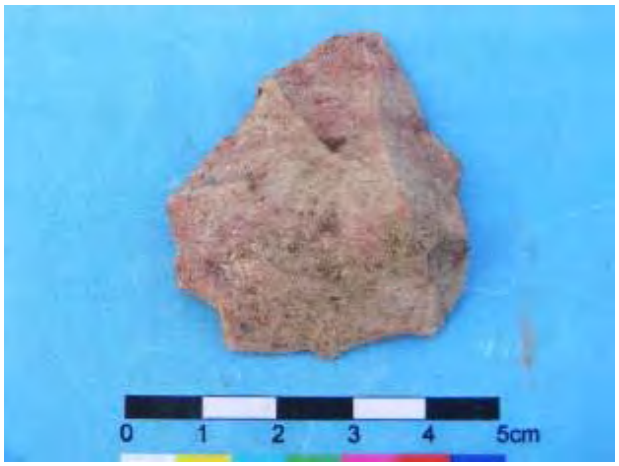
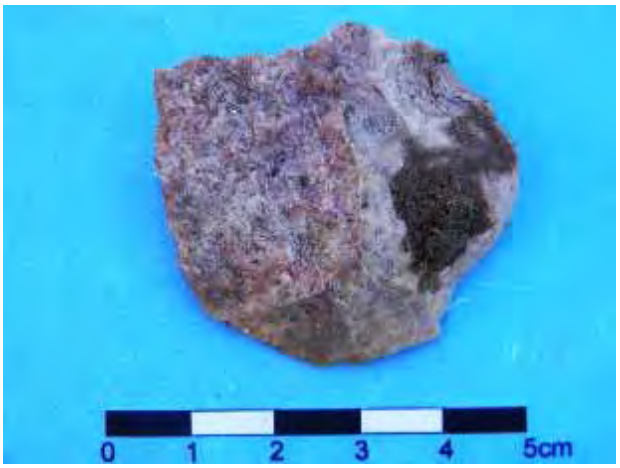
<td> 
</td>
</tr>
<tr>
<td>1. UNITED IF-1. 306963E, 6398215N (GDA ZONE 56). VIEW OF LOCATION.</td>
<td>2. UNITED IF-1. 306963E, 6398215N (GDA ZONE 56). SILCRETE FLAKE.</td>
</tr>
</table>

United IF-2

Location: 307034E, 6398216N (GDA Zone 56).

United IF-2 is located 83m east of United IF-1 on land currently used for grazing. The isolated silcrete flake was recorded in an area cleared of native vegetation in a mid-slope landform which slopes gradually to the northeast towards Waterfall Creek located about 140m to the north (**Figure 6–68**). The artefact was recorded in an area of an old rabbit warren and due to the moderate slope it is highly likely the artefact is in a secondary context.

Figure 6-68. United IF-2. Location and Artefact.

	
1. UNITED IF-2. 307034E, 6398216N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-2. 307034E, 6398216N (GDA ZONE 56). SILCRETE FLAKE.

United IF-3

Location: 307283E, 6398374N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of disturbance next to a cow trough. The site is located on a lower slope about 30m from a tributary of Waterfall Creek on land that is currently used for grazing (**Figure 6–69**).

Figure 6-69. United IF-3. Location and Artefact.

	
1. UNITED IF-3. 307283E, 6398374N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-3. 307283E, 6398374N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-4

Location: 308042E, 6398409N (GDA Zone 56).

The isolated mudstone flake was recorded on a mid-slope in an exposed area. The landform slopes gradually towards the east towards a tributary of Waterfall Creek located about 270m to

the northeast. United IF-4 is located adjacent to a fence line and the Golden Highway is 20m to the east (**Figure 6–70**).

Figure 6-70. United IF-4. Landform and artefact.

	
1. UNITED IF-4. 308042E, 6398409N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-4. 308042E, 6398409N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-5

Location: 306437E, 6396944N (GDA Zone 56).

United IF-5 is located 14m from the Wambo Open Cut Mine (Montrose Pit) within a natural exposure. The isolated silcrete flake was recorded on a 2° slope in an area of regenerating ironbark about 120m south an ephemeral drainage line. United IF-5 is located 740m northwest of United IF-6 (**Figure 6–71**).

Figure 6-71. United IF-5. Landform and artefact.

	
1. UNITED IF-5. 306437E, 6396944N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-5. 306437E, 6396944N (GDA ZONE 56). SILCRETE FLAKE.

United IF-6

Location: 306724E, 6396397N (GDA Zone 56).

The isolated mudstone flake was recorded 3m to the west of the Wambo Open Cut Mine bund wall (Montrose Pit). The site is located on a slight slope in an exposed area disturbed by the construction of the bund wall. At its closest, United IF-6 is 266m north of a tributary of Splitters Hollow Creek (**Figure 6–72**).

Figure 6-72. United IF-6. Landform and artefact.

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<td>1. United IF-6. 306724E, 6396397N (GDA Zone 56). View of location.</td>
<td>2. United IF-6. 306724E, 6396397N (GDA Zone 56). Mudstone flake.</td>
</tr>
</table>

United IF-7

Location: 309192E, 6396998N (GDA Zone 56).

The isolated silcrete flake is located on access track that has been subject to erosion. The site is located on an upper slope about 230m southwest of the northern arm of Redbank Creek.

No photographic record exists for this site.

United IF-8

Location: 309356E, 6397070N (GDA Zone 56).

The isolated volcanic flake is located within an exposed area surrounded by immature ironbark woodland. The site is located 120m south of a drainage line on a mid-slope landform gradually sloping to the north (**Figure 6–73**). Possibly synonymous with previously recorded site Wambo 189 (#37-5-0429) as the artefact was recorded at the base of a wooden peg that presumably marks the location of Wambo 189. However, as the precise location of Wambo 189 is unknown, the artefact is recorded here as a separate site.

Figure 6-73. United IF-8. Landform and artefact.

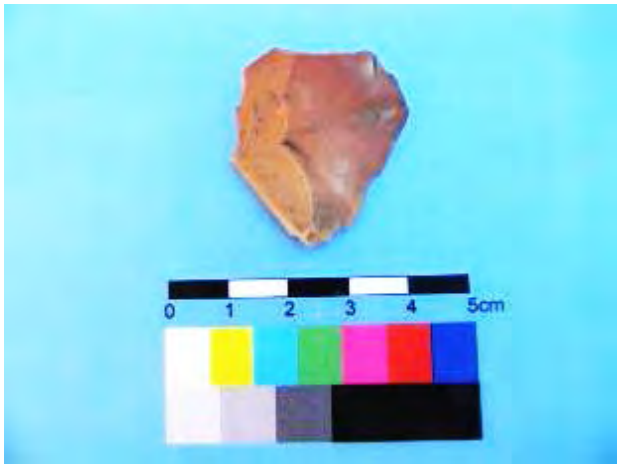
	
1. UNITED IF-8. 309356E, 6397070N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-8. 309356E, 6397070N (GDA ZONE 56). VOLCANIC FLAKE.

United IF-9

Location: 310119E, 6397274N (GDA Zone 56).

United IF-9 is an isolated mudstone flake recorded on an access track that has been subject to extensive sheet-wash erosion. The site is located in a mid-slope landform, 100m south of a tributary of Redbank Creek (**Figure 6–74**).

Figure 6-74. United IF-9. Landform and artefact.

	
1. UNITED IF-9. 310119E, 6397274N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-9. 310119E, 6397274N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-10

Location: 311776E, 6396718N (GDA Zone 56).

United IF-10 is located on flat ground about 13m north of Redbank Creek. The isolated mudstone flake was recorded in an area disturbed by gully and in-stream erosion and is closely surrounded

by areas disturbed my mining infrastructure such as an unsealed road 20m to the west and a drainage bund. Located on the edge of an ant mound.

No photographic record exists for this site.

United IF-11

Location: 312296E, 6395887N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of dense regenerating Casuarina in a generally featureless, flat landform. There are reasonably frequent deflated exposures within areas of low GSV from grass and Casuarina needles (**Figure 6–75**). The site is located greater than 100m from a reliable water source. There were no associated artefacts and the likelihood of there being further subsurface artefacts is very low.

Figure 6-75. United IF-11. Landform and artefact.

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<td>1. United IF-11. 312296E, 6395887N (GDA Zone 56). View of location.</td>
<td>2. United IF-11. 312296E, 6395887N (GDA Zone 56). Mudstone flake.</td>
</tr>
</table>

United IF-12

Location: 312436E, 6395857N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of dense regenerating Casuarina 140m west of United IF-11. The landform is featureless and flat. There are reasonably frequent deflated exposures within areas of low GSV from grass and Casuarina needles (**Figure 6–76**). The site is located greater than 100m from a reliable water source. There were no associated artefacts and the likelihood of there being further subsurface artefacts is very low.

Figure 6-76. United IF-12. Landform and artefact.

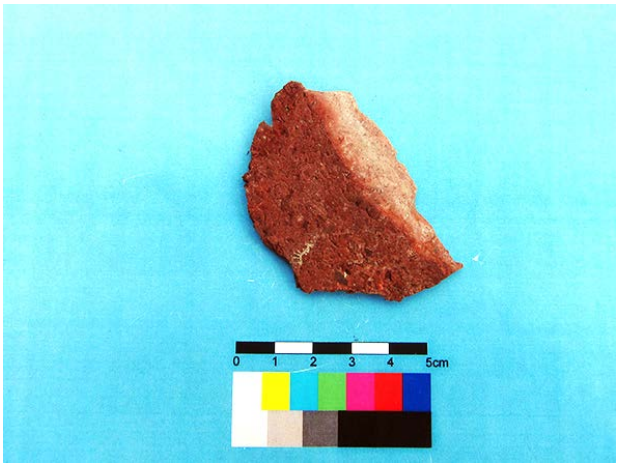
	
1. UNITED IF-12. 312436E, 6395857N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-12. 312436E, 6395857N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-13

Location: 312524E, 6396079N (GDA Zone 56).

Located within an area surrounded by densely regenerating Casuarinas, United IF-13 was recorded on the side of an unsealed road (**Figure 6–77**). The silcrete flake is located within a flat landform above slopes that rise from the southern bank of Redbank Creek. The site is located greater than 100m from the nearest reliable water source (Redbank Creek).

Figure 6-77. United IF-13. Landform and artefact.

	
1. UNITED IF-13. 312524E, 6396079N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-13. 312524E, 6396079N (GDA ZONE 56). SILCRETE FLAKE.

United IF-14

Location: 312571E, 6395769N (GDA Zone 56).

United IF-13 was recorded in the middle of an unsealed road that has additionally subjected to the natural disturbance of sheetwash erosion (**Figure 6–78**). United IF-14 is located over 100m from reliable water sources. Dense Casuarina regrowth is present on either side of the unsealed road.

Figure 6-78. United IF-14. Landform and artefact.

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<td>1. UNITED IF-14. 312571E, 6395769N (GDA ZONE 56). VIEW OF LOCATION.</td>
<td>2. UNITED IF-14. 312571E, 6395769N (GDA ZONE 56). SILCRETE FLAKE.</td>
</tr>
</table>

United IF-15

Location: 312184E, 6397195N (GDA Zone 56).

Located in an area of densely regenerating Casuarina, the area surrounding United IF-15 has been subject to disturbances in the form of cropping in the historic past. The flat landform is greater than 100m from reliable water and 110m south of the Golden Highway (**Figure 6–79**).

Figure 6-79. United IF-15. Landform and artefact.

	
1. UNITED IF-15. 312184E, 6397195N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-15. 312184E, 6397195N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-16

Location: 312478E, 6397253N (GDA Zone 56).

The isolated mudstone flake was recorded within an electricity easement and on an access track 40m south of the Golden Highway (**Figure 6–80**). The flat landform is greater than 100m from reliable water. The area surrounding the electricity easement is comprised on regenerating Casuarina.

Figure 6-80. United IF-16. Landform and artefact.

	
1. UNITED IF-16. 312478E, 6397253N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-16. 312478E, 6397253N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-17

Location: 312703E, 6397015N (GDA Zone 56).

United IF-17 was recorded on the eroding edge of an ephemeral drainage line (**Figure 6–81**). The landform is flat and located further than 100m from reliable water. The land on which the isolated find was identified has been subject to cropping in the past.

Figure 6-81. United IF-17. Landform and artefact.

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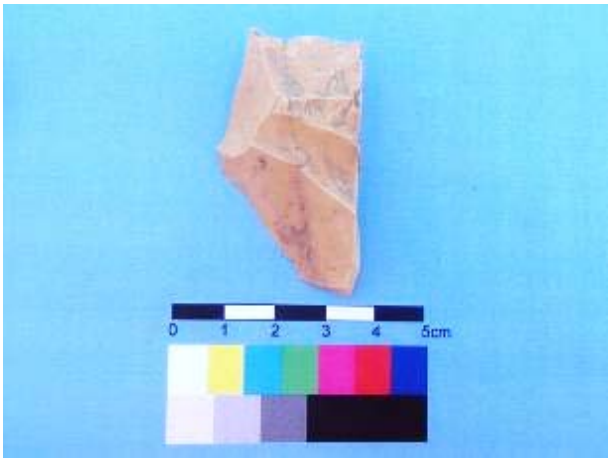
<td> 
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<tr>
<td>1. United IF-17. 312703E, 6397015N (GDA Zone 56). View of location.</td>
<td>2. United IF-17. 312703E, 6397015N (GDA Zone 56). Mudstone flake.</td>
</tr>
</table>

United IF-18

Location: 312603E, 6396745N (GDA Zone 56).

United IF-18 was recorded on the bank of an erosion gully associated with Redbank Creek in an area of regenerating Casuarina (**Figure 6–82**). The modified, flat landform has been subject to mine disturbances connected with the construction of Dam 1 and was located on a gravel lag surface. It is likely United IF-18 is in a secondary context.

Figure 6-82. United IF-18. Landform and artefact.

	
1. UNITED IF-18. 312603E, 6396745N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-18. 312603E, 6396745N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-19

Location: 312734E, 6396857N (GDA Zone 56).

United IF-19 is located within an electricity easement (**Figure 6–83**). The unidirectional silcrete core was recorded within a deflated exposure on a flat landform approximately 90m north of Redbank Creek. The land on which the site is located has also been disturbed by cropping in the past.

Figure 6-83. United IF-19. Landform and artefact.

	
1. UNITED IF-19. 312734E, 6396857N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-19. 312734E, 6396857N (GDA ZONE 56). SILCRETE CORE.

United IF-20

Location: 313145E, 6396866N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of regenerating Casuarina (**Figure 6–84**). The landform is generally flat and the site is located less than 5m from a south-flowing tributary of Redbank Creek. The site is located on the side of an ant hill and has been previously subjected to cropping.

Figure 6-84. United IF-20. Landform and artefact.

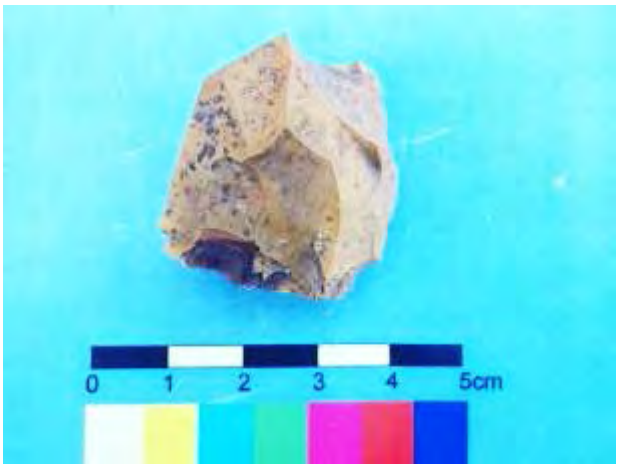
	
1. UNITED IF-20. 313145E, 6396866N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-20. 313145E, 6396866N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-21

Location: 313267E, 6396982N (GDA Zone 56).

United IF-21 is located within an electricity easement (**Figure 6–85**). The site was recorded on a flat landform 130m east of a tributary of Redbank Creek. The site is also located 35m northeast of the Golden Highway.

Figure 6-85. United IF-21. Landform and artefact.

	
1. UNITED IF-21. 313267E, 6396982N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-21. 313267E, 6396982N (GDA ZONE 56). MUDSTONE CORE.

United IF-22

Location: 312874E, 6395349N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of regenerating Casuarina (**Figure 6–86**). The landform is generally flat and the site is located 7m from an unnamed drainage line. United IF-22 is 25m south east of a small dam.

Figure 6-86. United IF-22. Landform and artefact.

	
1. UNITED IF-22. 312874E, 6395349N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-22. 312874E, 6395349N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-23

Location: 313073E, 6395177N (GDA Zone 56).

The isolated mudstone flake was recorded in an area of regenerating Casuarina in a landscape displaying moderate modification. The landform on which the site is situated is generally flat with

an unnamed tributary to Wollombi Brook 65m to the northeast. United IF-23 is located 27m west of the sealed haul road.

No photographic record exists for this site.

United IF-24

Location: 313365E, 6394924N (GDA Zone 56).

United IF-24 was recorded in an area of regenerating Casuarinas (**Figure 6–87**). The landform on which the site is situated is generally flat with an unnamed tributary to Wollombi Brook located 67m to the east and Wollombi Brook itself located 165m to the east. The isolated silcrete flake is located 7m on the northern side of an unsealed road.

Figure 6-87. United IF-24. Landform and artefact.

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<td>1. UNITED IF-24. 313365E, 6394924N (GDA ZONE 56). VIEW OF LOCATION.</td>
<td>2. UNITED IF-24. 313365E, 6394924N (GDA ZONE 56). SILCRETE FLAKE.</td>
</tr>
</table>

United IF-25

Location: 313190E, 6395321N (GDA Zone 56).

United IF-24 (a volcanic axe blank) was recorded in an area of densely regenerating Casuarinas (**Figure 6–88**). The landform on which the site is situated is generally flat with an unnamed tributary to Wollombi Brook located 110m to the southwest. An access track and electricity easement are located to the west of United IF-25, 30m and 45m distant respectively.

Figure 6-88. United IF-25. Landform and artefact.

	
1. UNITED IF-25. 313190E, 6395321N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-25. 313190E, 6395321N (GDA ZONE 56). VOLCANIC AXE BLANK.

United IF-26

Location: 313431E, 6395020N (GDA Zone 56).

United IF-24 was recorded in an exposed area lying adjacent to a fence line (**Figure 6–89**). The silcrete flake is situated on relatively flat land lying 45m north of an unnamed tributary of Wollombi Brook. United IF-26 is located 20m north of an unsealed road.

Figure 6-89. United IF-26. Landform and artefact.

	
1. UNITED IF-26. 313431E, 6395020N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-26. 313431E, 6395020N (GDA ZONE 56). SILCRETE FLAKE.

United IF-27

Location: 313418E, 6395092N (GDA Zone 56).

United IF-27 was recorded in an area of densely regenerating Casuarinas (**Figure 6–90**). The landform on which the site is situated is generally flat lying 120m to the north of an unnamed tributary to Wollombi Brook and 127m to Wollombi Brook itself. United IF-27 is located 127m north west of United IF-28 and 80m north of an unsealed road.

Figure 6-90. United IF-27. Landform and artefact.

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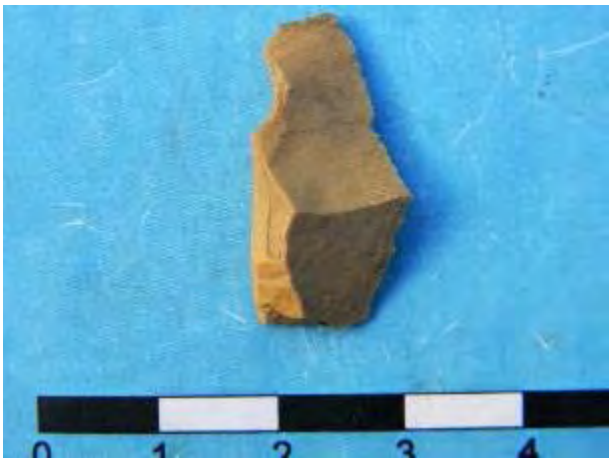
<td>1. United IF-27. 313418E, 6395092N (GDA Zone 56). View of location.</td>
<td>2. United IF-27. 313418E, 6395092N (GDA Zone 56). Silcrete flake.</td>
</tr>
</table>

United IF-28

Location: 313494E, 6395072N (GDA Zone 56).

United IF-27 was recorded in an area that has been subject to high levels of disturbance being next to an ant hill and surrounded by stockpiled materials (**Figure 6–91**). The mudstone flake is situated on relatively flat land lying 95m north of an unnamed tributary of Wollombi Brook.

Figure 6-91. United IF-28. Landform and artefact.

	
1. UNITED IF-28. 313494E, 6395072N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-28. 313494E, 6395072N (GDA ZONE 56). MUDSTONE BLADE.

United IF-29

Location: 313519E, 6395238N (GDA Zone 56).

United IF-27 was recorded in an old drill pad surrounded by regenerating Casuarinas (**Figure 6–92**). The landform on which the site is situated is generally flat lying 240m northwest of Wollombi Brook. The area has been subject to a high level of disturbance lying on the edge of a cleared track with gravels present on the surface.

Figure 6-92. United IF-29. Landform and artefact.

	
1. UNITED IF-29. 313519E, 6395238N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-29. 313519E, 6395238N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-30

Location: 313283E, 6396158N (GDA Zone 56).

United IF-30 was recorded on an access track about 25m east of an electricity easement (**Figure 6–93**). The landform on which the site is located is flat and located 270m southwest of Redbank Creek. Dam 1 is located 200m north of United IF-30 and the general vicinity of United IF-30 was disturbed during the dam's construction. The area is low-lying with swampy vegetation present. Gravel lag surfaces preclude subsurface deposits.

Figure 6-93. United IF-30. Landform and artefact.

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<td>1. UNITED IF-30. 313283E, 6396158N (GDA ZONE 56). VIEW OF LOCATION.</td>
<td>2. UNITED IF-30. 313283E, 6396158N (GDA ZONE 56). MUDSTONE FLAKE.</td>
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United IF-31

Location: 313313E, 6396222N (GDA Zone 56).

United IF-31 was recorded in an area of deflation at the eastern end of the spillway to Dam 1 and the general vicinity of United IF-31 was disturbed during the dam's construction (**Figure 6–94**). The landform on which the site is situated is generally flat within a swampy environment about 250m northwest of a tributary of Redbank Creek. United IF-31 is located 70m north east of United IF-30.

Figure 6-94. United IF-31. Landform and artefact.

	
1. UNITED IF-31. 313313E, 6396222N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-31. 313313E, 6396222N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-32

Location: 313645E, 6395904N (GDA Zone 56).

United IF-32 was recorded in an area of densely regenerating Casuarina (**Figure 6–95**). The landform is generally flat and the site is located 140m northwest of a tributary of Redbank Creek. The area surrounding the site has been subject to disturbances with the mudstone flake situated on an earth mound.

Figure 6-95. United IF-32. Landform and artefact.

	
1. UNITED IF-32. 313645E, 6395904N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-32. 313645E, 6395904N (GDA ZONE 56). MUDSTONE FLAKE.

United IF-33

Location: 313699E, 6396061N (GDA Zone 56).

United IF-33 was recorded in a cleared area surrounded by regenerating woodland (**Figure 6–96**). The mudstone blade exhibits partial retouch along one of its margins and is located on a flat landform about 50m south of Redbank Creek. The area in which the site was recorded has previously been subject to cropping.

Figure 6-96. United IF-33. Landform and artefact.

	
1. UNITED IF-33. 313699E, 6396061N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-33. 313699E, 6396061N (GDA ZONE 56). MUDSTONE BLADE.

United IF-34

Location: 313828E, 6396242N (GDA Zone 56).

United IF-34 was recorded in an area of regenerating Casuarinas, close to the edge of an electricity easement and 90m east of the junction between the Golden Highway and a sealed road (**Figure 6–97**). The mudstone flake lies with a flat landform about 90m north of Redbank Creek. The area surrounding United IF-34 is fenced off with temporary roping.

Figure 6-97. United IF-34. Landform and artefact.

	
1. UNITED IF-34. 313828E, 6396242N (GDA ZONE 56). VIEW OF LOCATION.	2. UNITED IF-34. 313828E, 6396242N (GDA ZONE 56). SILCRETE FLAKE.

6.4 AMENDED PREVIOUSLY RECORDED AHIMS SITES

There are 78 previously recorded Aboriginal sites that still exist within the Survey Area but are not included in the open sites described above. All of these sites are listed as 'valid', i.e. not salvaged or destroyed in the past.

During the survey, a number of these previously recorded sites were located and assessments carried out in their vicinity. In the majority of cases, no artefacts were observed at the location of previously recorded sites when it was revisited during the current assessment. Even sites that were staked in the field failed to contain any artefacts visible on the surface. There are many reasons for this including:

- exposures and GSV decreased dramatically away from the drainage lines making the detection of artefacts in these area difficult;
- sites have been recorded over a number of years by different researchers using different levels of technology to pin-point their location. It is accepted that many of the locations of these sites may be in the wrong location due to disagreements between coordinate systems over the years; and
- artefacts may have become displaced or obscured over the years due to changes in vegetation, erosion, water movement or other disturbances.

It is OzArk's experience that attempting to locate previously recorded artefacts in a landscape, even after a short period of time, is often difficult, especially if the site is an isolated find or a very low density artefact scatter.

The current assessment, therefore, sees many of these previous recordings as indicative only where it will be very difficult to absolutely locate a particular site or artefact in the field. Nevertheless, these previous recordings will be used to help characterise the archaeological

values of the landforms in which they are located as they indicate that, at some time in the past, artefacts were recorded in that landform. Such artefacts may or may not remain *in situ*.

During the survey a number of artefacts were recorded in proximity to the recorded location of previously recorded sites. In these cases the site boundaries of a previously recorded site have been amended to include the current artefact recordings. 20 sites were amended in this way and are shown in **Table 6–28** and **Figures 6–98** to **6–101**. Details on each of these sites follow **Figure 6–101**.

Table 6-28. Descriptions of amended previously recorded AHIMS sites within the Survey Area.

AHIMS ID	Site Name	Location (GDA94 Zone 56)	Site description
#37-5-0025	Agip 2 Malabar	311455E, 6396668N	Agip 2 Malabar consists of more than one hundred artefacts on a floodplain between the parallel watercourses of Redbank Creek and an anabranch. The new site boundary extends 410m (northwest-southeast) and 80m (southwest-northeast) covering 2.7ha.
#37-5-0028	Malabar Agip 3	310305E, 6396790N	Malabar Agip 3 consists of an isolated artefact visible in an artificial drainage line within a mid-slope landform. The new boundary for Malabar Agip 3 extends 140m (southwest-northeast) by 25m (northwest-southeast) and covers an area of 0.3ha.
#37-5-0096	Red Bank Creek 28	310742E, 6396601N	Red Bank Creek 28 consists of more than ten artefacts located within an eroding area that has previously been ploughed. The new site boundary extends 110m (east-west) by 35m (north-south) and encompasses previously recorded AHIMS site #37-5-0027 (Malabar). The site covers 0.3ha.
#37-5-0099	Red Bank Creek 31	310921E, 6396810N	Red Bank Creek 31 consists of more than fifteen artefacts recorded within a flat landform along an artificial bund. The new site boundary extends 80m (southwest-northeast) by 20m (northwest-southeast) covering 0.2ha and encompasses previously recorded AHIMS site #37-5-0577 (UCL12-2).
#37-5-0100	Red Bank Creek 32	310973E, 6396755N	Red Bank Creek 32 consists of more than sixty artefacts recorded along an artificial bund in close proximity to Redbank Creek. The new site boundary extends 85m (east-west) and 45m (north-south) covering 0.3ha.
#37-5-0110	Red Bank Creek 15	311701E, 6396723N	Red Bank Creek 15 consists of five artefacts recorded along an artificial drainage channel. The low density artefact scatter is diffused with the site extending 65m (southwest-northeast) by 34m (northwest-southeast) and covering an area up to 0.1ha.
#37-5-0115	Red Bank Creek 8	312119E, 6396619N	Red Bank Creek 8 consists of more than 80 artefacts recorded within a number of large exposures. The new site boundary of Red Bank Creek 8 encompasses AHIMS sites #37-5-0023 (Warkworth Agip 8) and #37-5-0512 (United Collieries 13). The new site boundary extends 200m (northwest-southeast) and 70m (southwest-northeast) covering 0.7ha.
#37-5-0116	Red Bank Creek 5	311209E, 6396747N	Red Bank Creek 5 consists of more than 50 artefacts visible within large areas of exposure. The site is located on a flat landform adjacent to Redbank Creek and has been impacted by erosion. The new site boundary extends 150m (east-west) and 80m (north-south) covering 1.1ha.
#37-5-0343	Wambo 202	308850E, 6397962N	Wambo 202 consists of two artefacts recorded within an eroding gully on a lower-slope landform. The site boundary extends 30m (north-south) by 30m (east-west) covering 0.09ha.

AHIMS ID	Site Name	Location (GDA94 Zone 56)	Site description
#37-5-0349	Wambo 190	309204E, 6397081N	Wambo 190 consists of four artefacts located in an upper-slope landform. The artefacts are visible along an access track that has been previously bulldozed. The site boundary extends 75m (northwest-southeast) and 55m (southwest-northeast) covering 0.2ha.
#37-5-0520	United Collieries 23	312357E, 6396285N	United Collieries 23 is located in the north east of the Project Area and consists of more than thirty artefacts visible along an access track to the east of Dam 3. The site boundary extends 310m (northwest-southeast) and 70m (southwest-northeast) covering 1.7ha. The new site boundaries encompass site #37-5-0518 (United Collieries 2).
#37-5-0523	United 6	311879E, 6396514N	United 6 consists of more than thirty artefacts visible along an access track on previously cultivated land. The new site boundary extends 230m (northwest-southeast) by 35m (southwest-northeast) covering 0.6ha.
#37-5-0576	UCL 12-1	310477E, 6396730N	UC12-1 consists of more than fifteen artefacts recorded within small exposures in a generally cleared landscape (with some pockets of regenerating trees). The site boundary extends 320m (north-south) by 400m (east-west) covering 9.6ha.
#37-6-0325	Red Bank Creek 47	312878E, 6396647N	Red Bank Creek 47 consists of more than thirty artefacts visible within areas of exposure to the west of Dam 1 and along the eroding banks of Redbank Creek. The site area has been highly modified in the past and is subject to inundation from water in Dam 1. The new site boundary extends 320m (north-south) and 250m (east-west) covering 5.3ha. Site includes #37-6-0323 (Redbank Creek No.45)
#37-6-0326	Red Bank Creek 48	312627E, 6396551N	Red Bank Creek 48 consists of a single artefact recorded within a small exposure in an electricity easement. The area of the site has been highly modified during the construction of Dam 1. The new site boundary extends 80m (northwest-southeast) and 40m (southwest-northeast) covering 0.2ha.
#37-6-1033	UC2/1	313323E, 6396475N	UC2/1 consists of more than twenty-five artefacts located to the east of Dam 1. The new site boundary extends 410m (northwest-southeast) and 80m (southwest-northeast) covering 8ha and encompasses previously recorded sites #37-6-0131 (Agip 6 Warkworth) and #37-6-0275 (Red Bank Creek 10).
#37-6-1777	146	313461E, 6396646N	Site 146 consists of more than fifteen artefacts that are visible along a large exposure within an electricity easement in a flat landform. The new site boundary extends 360m (northwest-southeast) and 44m (southwest-northeast) covering 1.6ha.
#37-6-1912	United Collieries 5	312882E, 6396331N	United Collieries 5 consists of more than fifty artefacts recorded along an artificial drainage channel within a flat landform. The new site boundary for United Collieries 5 extends 550m (northwest-southeast) and 150m (southwest-northeast) and encompasses AHIMS site #37-6-1911 (United Collieries 4 [Singleton]). It covers 3.1ha.
#37-6-1913	United Collieries 9	312608E, 6396599N	United Collieries 9 consists of less than ten artefacts recorded within a flat landform. The artefacts are visible within small areas of exposure in an electricity easement. The new site boundary extends 40m (southwest-northeast) by 30m (northwest-southeast) covering 0.1ha.
#37-6-1914	United Collieries 10	312558E, 6396674N	United Collieries consists of more than forty artefacts recorded within a flat landform. The artefacts are visible within small areas of exposure in an electricity easement. The new site boundary extends 140m (northwest-southeast) and 45m (southwest-northeast) covering 0.6ha.

Figure 6-98. Amended site boundaries in the west of the Survey Area.

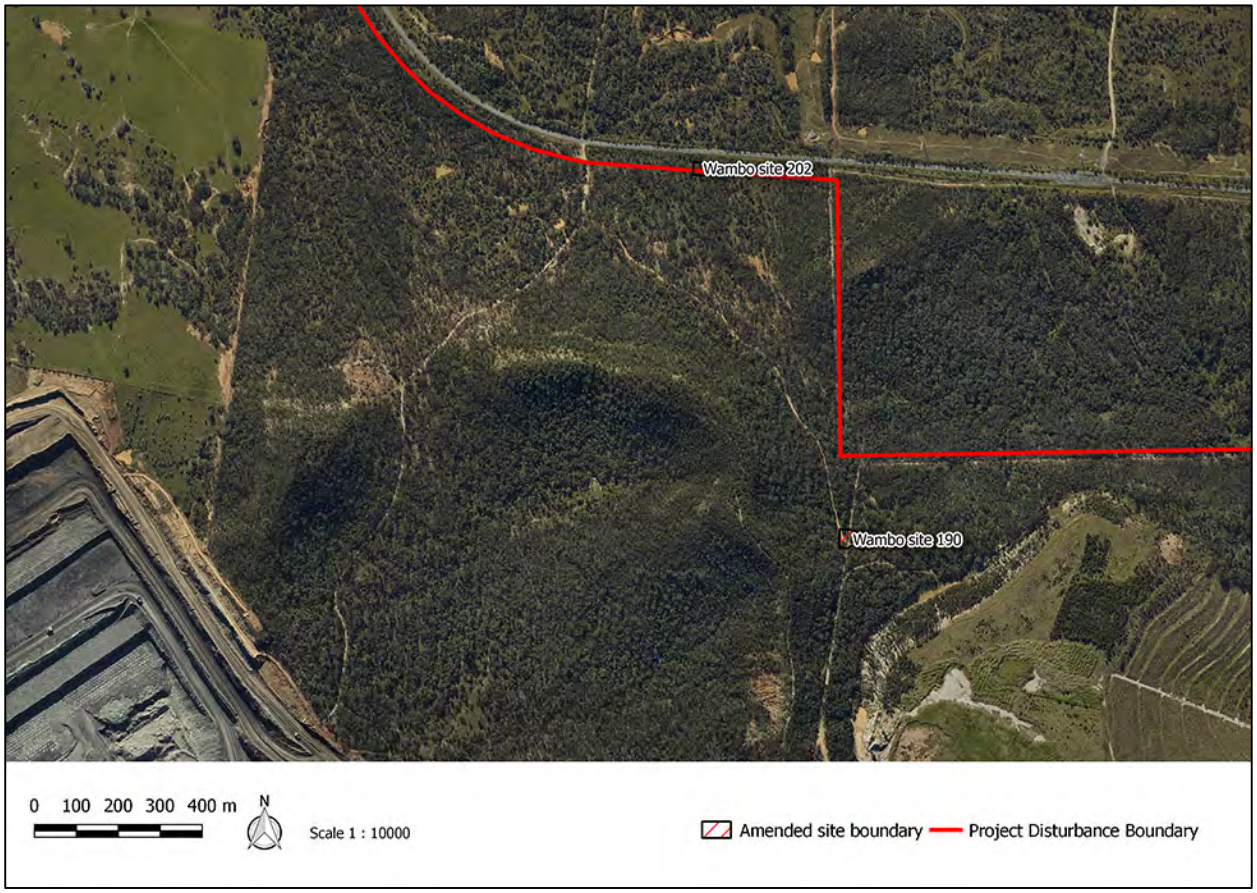


Figure 6-99. Amended site boundaries in the centre-west of the Survey Area.

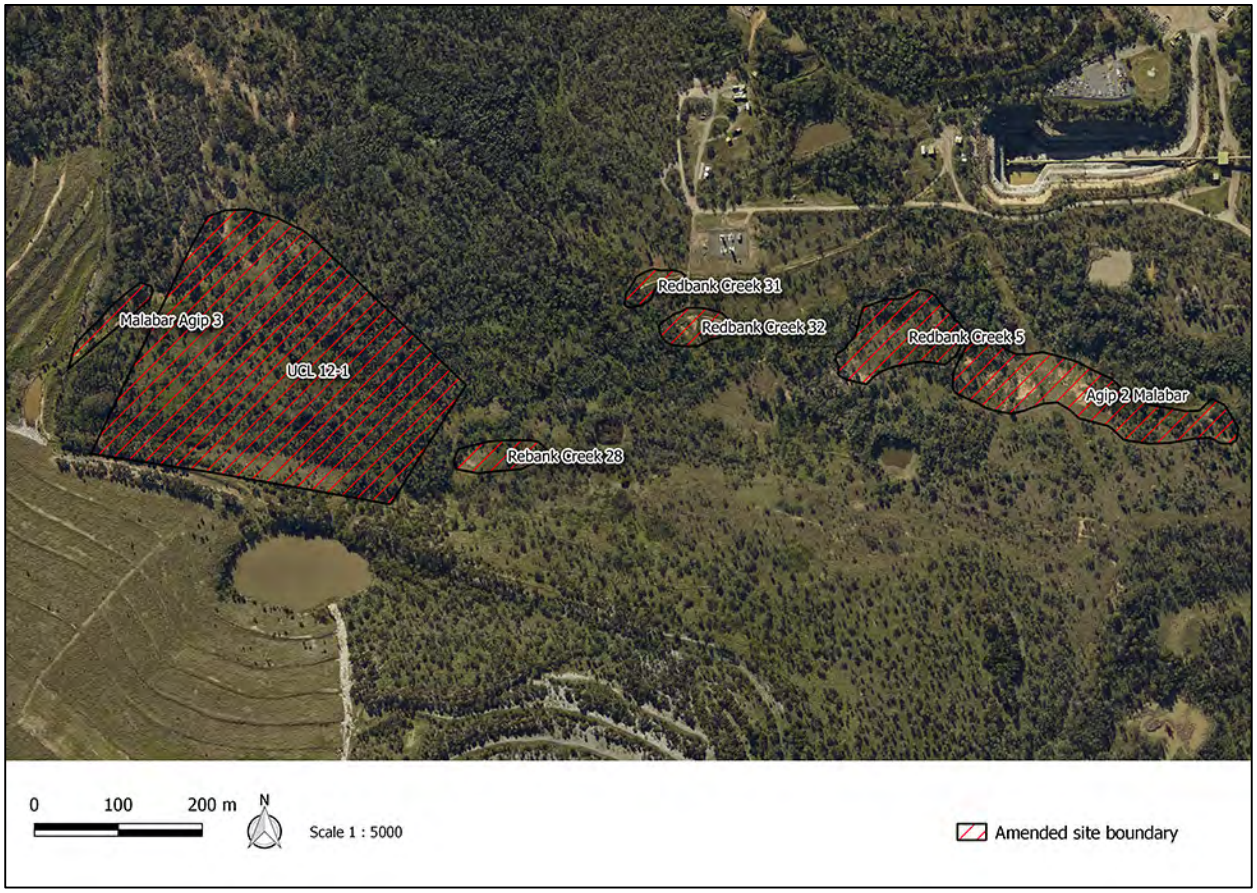
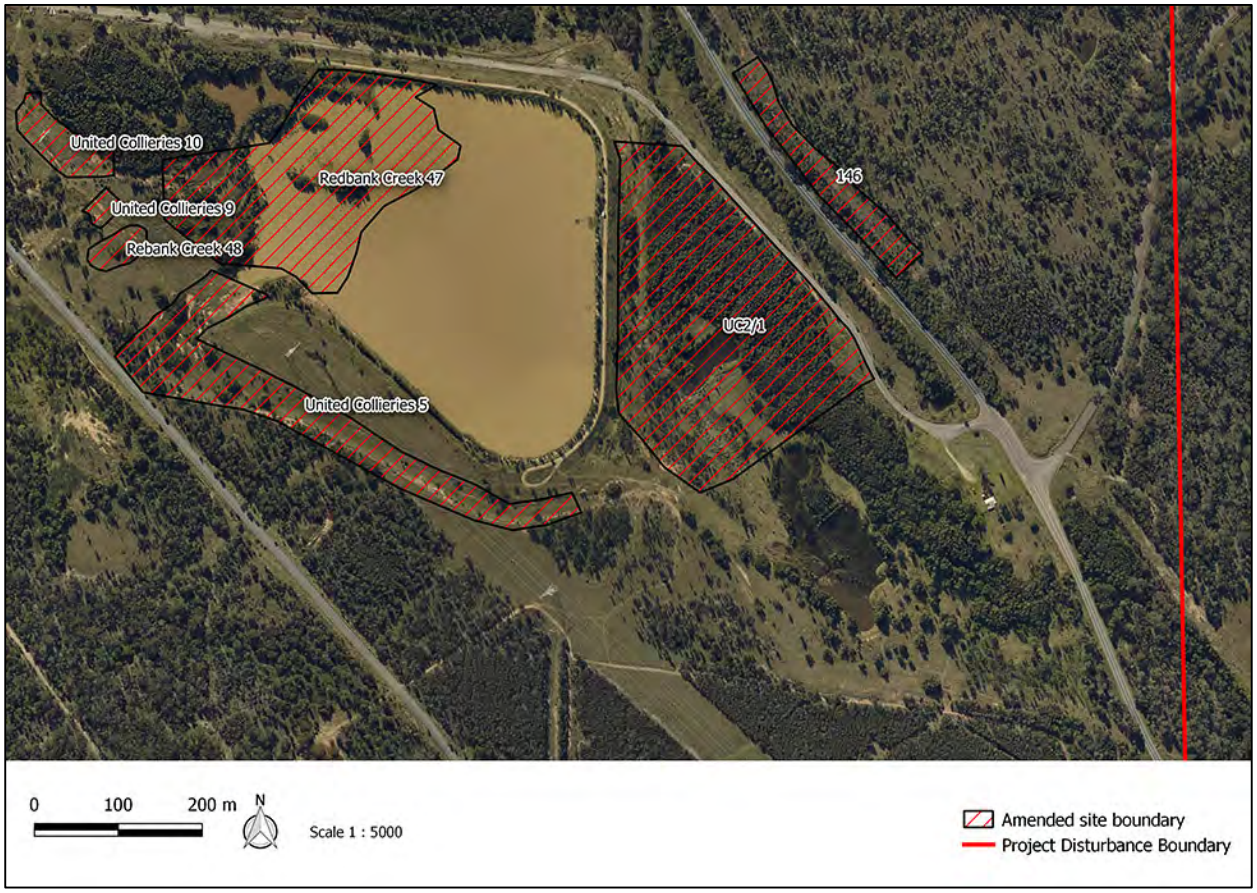


Figure 6-100. Amended site boundaries in the centre-east of the Survey Area.

Figure 6-101. Amended site boundaries in the east of the Survey Area.



Agip 2 Malabar (#37-5-0025)

Centre GPS Coordinates: 311455E, 6396668N (GDA 94 Zone 56).

Previously recorded AHIMS site Agip 2 Malabar (#37-5-0025) was originally recorded in 1981 by Len Dyall as an artefact scatter consisting of over 500 artefacts on a floodplain between the parallel watercourses of Redbank Creek and one of its tributaries (here termed an anabranch rather than a tributary). At the time of recording, the site was described as covering 0.5ha of a former wheat paddock and areas of impacted by sheetwash erosion. During the 2015 survey of the Project Area for the Wambo United Open Cut Project over 100 artefacts were visible in large exposed areas within the vicinity of Agip 2 Malabar. The new site boundary extends 410m (northwest-southeast) and 80m (southwest-northeast) covering 2.7ha (**Table 6–29** and **Figures 6–102**, **6–103** and **6–104**).

Table 6-29. Agip 2 Malabar. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
Agip 2 Malabar	Flat drainage	80m	100+	Moderate	Low

Figure 6-102. Agip 2 Malabar. Location of site and recorded artefacts.

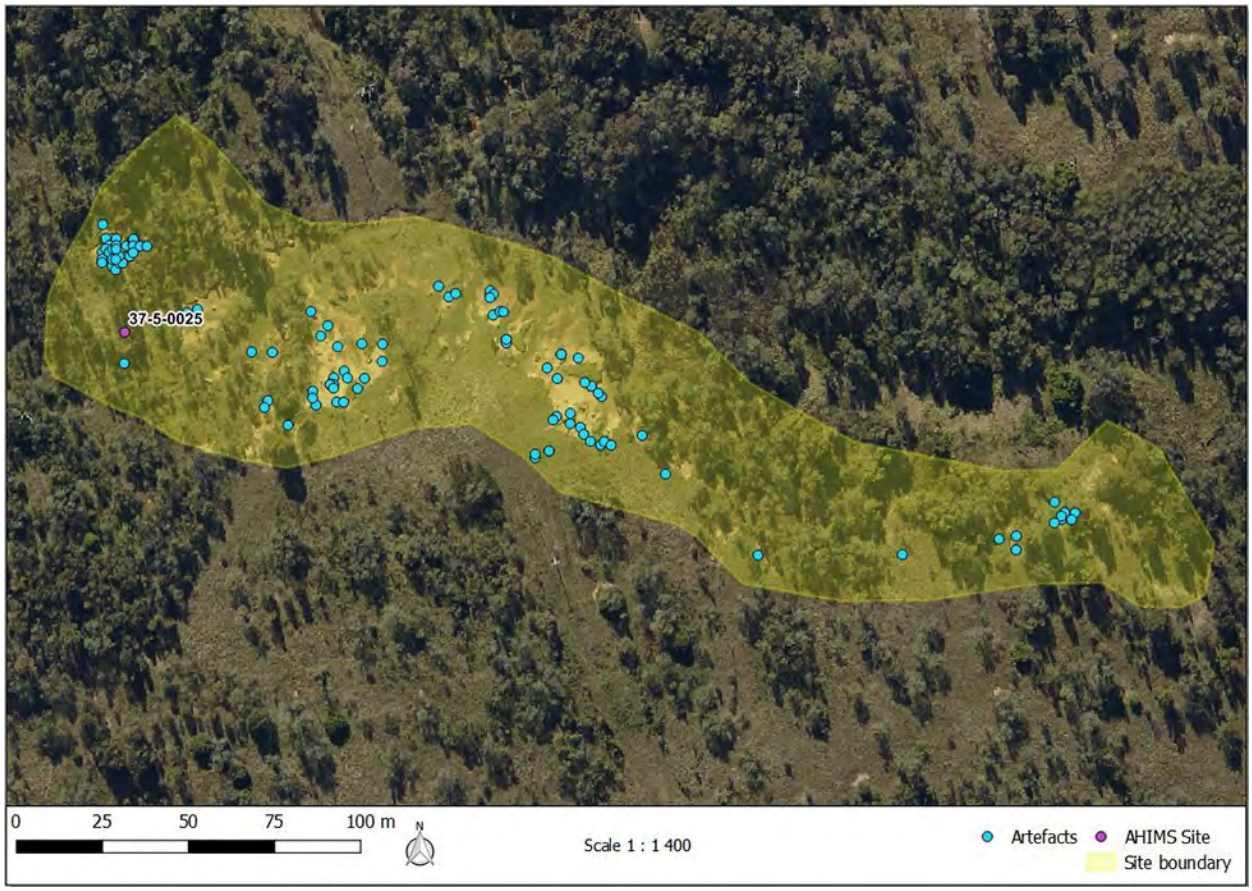
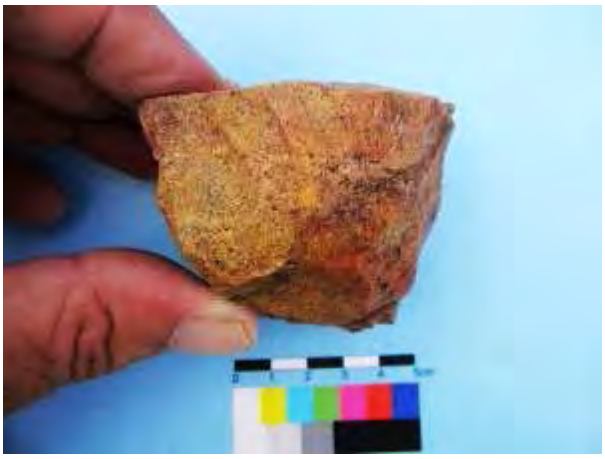


Figure 6-103. Agip 2 Malabar. View of site.

	
1. AGIP 2 MALABAR CONSISTS OF OVER 100 ARTEFACTS THAT ARE VISIBLE WITHIN LARGE EXPOSURES.	AGIP 2 MALABAR. VIEW OF RAISED TERRACE TO THE SOUTH WITH INTACT A HORIZON SOILS.

Figure 6-104. Agip 2 Malabar. Selection of artefacts.

	
1. AGIP 2 MALABAR. 311300E, 6396712N (GDA ZONE 56). A RANGE OF MUDSTONE FLAKES.	2. AGIP 2 MALABAR. 311342E, 6396685N (GDA ZONE 56). A MUDSTONE BLADE WITH STEEP RETOUCH TO ONE MARGIN.
	
3. AGIP 2 MALABAR. 311300E, 6396712N (GDA ZONE 56). A RANGE OF MUDSTONE AND SILCRETE FLAKES.	4. AGIP 2 MALABAR. 311309E, 6396715N (GDA ZONE 56). A MULTIDIRECTIONAL SILCRETE CORE FRAGMENT.

Malabar Agip 3 (#37-5-0028)

Centre GPS Coordinates: 310305E, 6396790N (GDA 94 Zone 56).

Previously recorded AHIMS site Malabar Agip 3 (#37-5-0028) was originally recorded in 1981 by Len Dyall as an artefact scatter consisting of up to 20 artefacts with the site extending 100m by 20m along a minor creek line. At the time of recording, the site was described as being located within a grazing paddock in an area that had been impacted by sheetwash erosion. During the 2015 survey of the Survey Area an isolated artefact was recorded within the vicinity of Malabar Agip 3 in an artificial drainage line. The new boundary for Malabar Agip 3 extends 140m (southwest-northeast) by 25m (northwest-southeast) and covers an area of 0.3ha (**Table 6–30** and **Figures 6–105**, **6–106** and **6–107**).

Table 6-30. Malabar Agip 3. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
Malabar Agip 3	Mid-slope	100m	1	Very low	Low

Figure 6-105. Malabar Agip 3. Location of site and recorded artefacts.

Figure 6-106. Malabar Agip 3. View of site.

	1. MALABAR AGIP 3 CONSISTS OF A SINGLE ARTEFACT RECORDED WITHIN AN ARTIFICIAL DRAINAGE LINE.

Figure 6-107. Malabar Agip 3. Selection of artefacts.

	1. MALABAR AGIP 3. 3102670E, 6396762N (GDA ZONE 56). A MUDSTONE FLAKE.

Red Bank Creek 28 (#37-5-0096)

Centre GPS Coordinates: 310742E, 6396601N (GDA 94 Zone 56).

Previously recorded AHIMS site Red Bank Creek 28(#37-5-0096) was originally recorded in 1983 by Koettig and Hughes as an artefact scatter consisting of thirteen artefacts largely comprised of mudstone flakes with the site dimensions measuring 10m by 10m. At the time of recording, the site was described as being located within an eroding area with an iron stone gravel base surrounded by thick grass cover in a previously ploughed paddock. During the 2015 survey over 10 artefacts were recorded within the vicinity of Red Bank Creek 28. Another previously recorded AHIMS site #37-5-0027 (Malabar) is located 30m directly west of Red Bank Creek 28. Given its proximity to Red Bank Creek 28 and that the site is located within the same landform it is believed to be one site. The new site boundary extends 110m (east-west) by 35m (north-south). The site covers 0.3ha (**Table 6–31** and **Figures 6–108**, **6–109** and **6–110**).

Table 6-31. Red Bank Creek 28. Landform and site details.

Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
Red Bank Creek 28	Flat to lower-slope	10m	10+	Low	Low

Figure 6-108. Red Bank Creek 28. Location of site and recorded artefacts.

Figure 6-109. Red Bank Creek 28. View of site.

1. RED BANK CREEK 28 CONSISTS MORE THAN TEN ARTEFACTS RECORDED VISIBLE IN A LANDFORM WHERE A HORIZON SOILS ARE THIN.

Figure 6-110. Red Bank Creek 28. Selection of artefacts.

	
1. RED BANK CREEK 15. 310695E, 6396599N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.	2. RED BANK CREEK 15. 310696E 6396596N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.

Red Bank Creek 31 (#37-5-0099)

Centre GPS Coordinates: 310921E, 6396810N (GDA 94 Zone 56).

Previously recorded AHIMS site Red Bank Creek 31 (#37-5-0099) was originally recorded in 1983 by Koettig and Hughes as an artefact scatter consisting of four distinct knapping floors with the site measuring approximately 15m by 30m. At the time of recording, the site was described as being located within channel of Redbank Creek adjacent to a densely grassed area in a previously ploughed paddock. During the 2015 survey no artefacts were recorded precisely at the site's coordinates, however, over 15 artefacts were recorded within the vicinity of Red Bank Creek 31. As a result of this, the site's boundary has been extended to include the artefacts which were recorded within the vicinity, as well as previously recorded AHIMS site #37-5-0577 (UCL 12/2). The area surrounding and within the site has been heavily modified by mining related activities largely from earth moving works. The new site boundary extends 80m (southwest-northeast) by 20m (northwest-southeast) covering 0.2ha (**Table 6–32** and **Figures 6–111**, **6–112** and **6–113**).

Table 6-32. Red Bank Creek 31. Landform and site details.

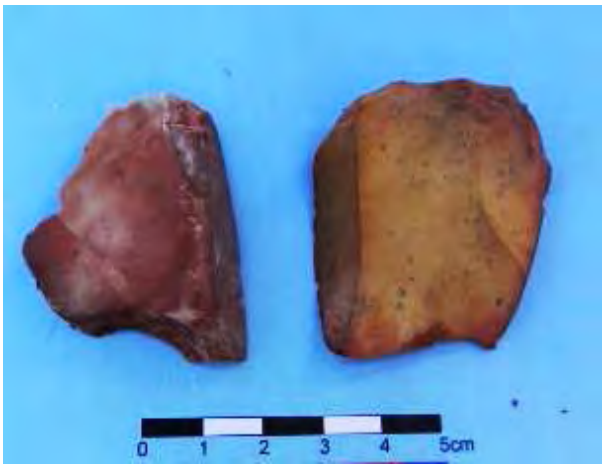
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
Red Bank Creek 31	Flat/drainage	20m	15+	Low	Low

Figure 6-111. Red Bank Creek 31. Location of site and recorded artefacts.

Figure 6-112. Red Bank Creek 31. View of site.

	1. RED BANK CREEK 31 CONSISTS OF MORE THAN TEN ARTEFACTS RECORDED IN A HIGHLY DISTURBED AREA LARGELY ALONG AN ARTIFICIAL BUND.

Figure 6-113. Red Bank Creek 31. Selection of artefacts.

	
1. RED BANK CREEK 31. 310922E, 6396817N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.	2. RED BANK CREEK 31. 310917E 6396814N (GDA ZONE 56). RANGE OF MUDSTONE AND SILCRETE FLAKES.

Red Bank Creek 32 (#37-5-0100)

Centre GPS Coordinates: 310973E, 6396755N (GDA 94 Zone 56).

Previously recorded AHIMS site Red Bank Creek 32 (#37-5-0100) was originally recorded in 1983 by Koettig and Hughes as an artefact scatter along the northern bank of Redbank Creek in an exposure extending 10m by 4.3m. At the time of recording, the site was described as being located adjacent to a previously ploughed paddock. During the 2015 survey over 60 artefacts were recorded; largely along an artificial bund and within a large exposure in close proximity to Red Bank Creek 32. The site has been highly disturbed and is located south of the explosives compound. The new site boundary extends 85m (east-west) and 45m (north-south) covering 0.3ha (**Table 6–33** and **Figures 6–114**, **6–115** and **6–116**).

Table 6-33. Red Bank Creek 32. Landform and site details.

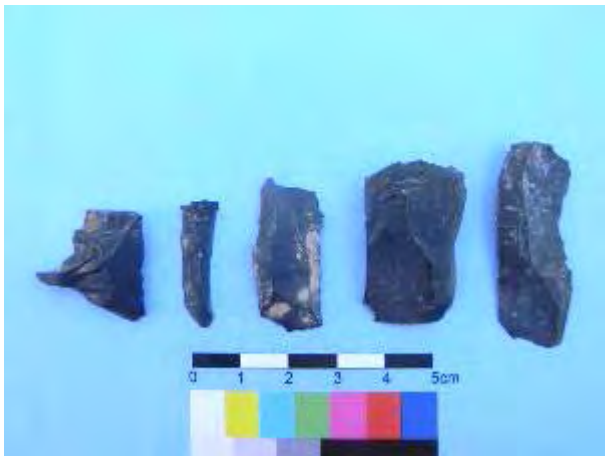
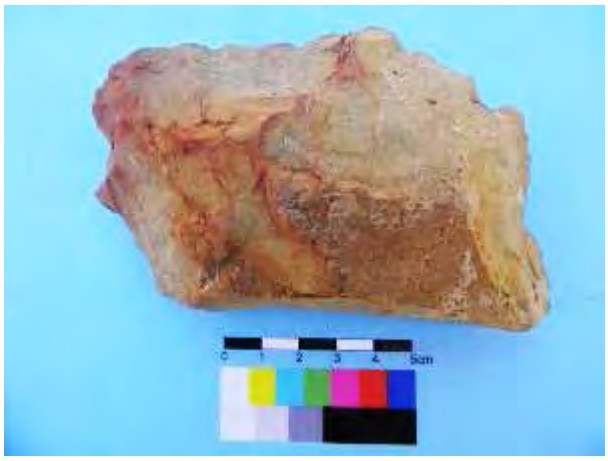
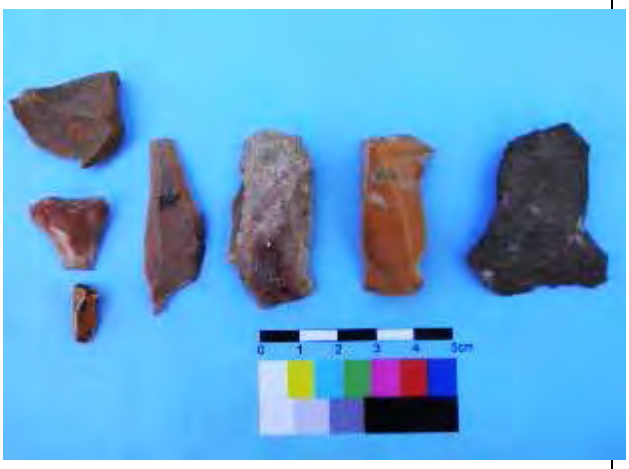
Site name	Landform unit	Distance to water	Number of recorded artefacts	Artefact density	Probability of associated subsurface deposits
Red Bank Creek 32	Flat/ drainage	20m	60+	Low-moderate	Low

Figure 6-114. Red Bank Creek 32. Location of site and recorded artefacts.

Figure 6-115. Red Bank Creek 32. View of site.

	1. RED BANK CREEK 32 CONSISTS OF MORE THAN FIFTY ARTEFACTS RECORDED ALONG AN ARTIFICIAL BUND AND WITHIN A LARGE EXPOSURE WITH ACTIVE EROSION.

Figure 6-116. Red Bank Creek 32. Selection of artefacts.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>1. Red Bank Creek 32. 310977E, 6396771N (GDA Zone 56). Range of volcanic flakes.</td><td>2. Red Bank Creek 32. 310996E 6396766N (GDA Zone 56). A Silcrete end scraper with steep, bifacial retouching.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>3. Red Bank Creek 32. 310966E 6396743N (GDA Zone 56). A silcrete side scraper with invasive retouch.</td><td>4. Red Bank Creek 32. 311004E 6396763N (GDA Zone 56). Range of mudstone flakes.</td></tr>
</table>

Red Bank Creek 15 (#37-5-0110)

Centre GPS Coordinates: 311701E, 6396723N (GDA 94 Zone 56).

Previously recorded AHIMS site Red Bank Creek 15 (#37-5-0110) was originally recorded in 1983 by Koettig and Hughes as an artefact scatter consisting of twelve artefacts including two cores with the site extending 30m by 25m. At the time of recording, the site was described as being located in an eroding gully of a tributary of Redbank Creek with thick grass cover present beyond the exposures. During the 2015 survey a total of five artefacts were recorded along a drainage line within close proximity to Red Bank Creek 15. The low density artefact scatter is diffused with the site extending 65m (southwest-northeast) by 34m (northwest-southeast) and covering an area up to 0.1ha (**Table 6–34** and **Figures 6–117**, **6–118** and **6–119**).