

Appendix C2

Aboriginal Heritage Assessment

Xstrata Mangoola Pty Limited

**Aboriginal Cultural Heritage and
Archaeological Assessment –
Proposed Mine Plan Modification,
Mangoola Coal**

December 2010

Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Mine Plan Modification, Mangoola Coal

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Xstrata Mangoola Pty Limited

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Executive Summary

Xstrata Mangoola Pty Limited trading as Mangoola Coal, has an existing Project Approval (PA 06_0014) to construct an open cut coal mine near Wybong, west of Muswellbrook NSW. The Mangoola Coal Mine (formerly known as the Anvil Hill Project) was the subject of an Environmental Assessment (Umwelt 2006a), which incorporated an Aboriginal Archaeological Assessment (Umwelt 2006b). PA 06_0014 has since been subject to three modifications (MOD1, MOD2 and MOD3).

Mangoola Coal has fulfilled its pre-construction requirements and preparation and approval of management plans required prior to commencement of development activities, including an Aboriginal Cultural Heritage Management Plan (ACHMP – Umwelt 2008a). Prior to the commencement of construction activities within the approved project disturbance area, the salvage of Aboriginal heritage sites was completed in accordance with the ACHMP (Umwelt 2008a).

Mangoola Coal is now seeking approval for modifications to the mine plans approved in PA 06_0014 to take into account additional coal resources and hydrological factors. As part of this process, Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to complete an Environmental Assessment (EA) (incorporating an Aboriginal cultural heritage and archaeological assessment) for the areas that are the subject of the proposed modification. As all Aboriginal heritage sites within the approved project disturbance area have been salvaged, there is no requirement for this assessment to address modifications within the approved project disturbance area. This assessment therefore relates to six areas outside the approved project disturbance boundary where modifications are proposed, with these areas referred to as Modification Areas 1 to 6.

This assessment was undertaken in accordance with the relevant legislation and guidelines including the New South Wales National Parks and Wildlife Service (NPWS) *Cultural Heritage Guidelines* (NSW NPWS 1997), the Department of Environment and Conservation (now Department of Environment, Climate Change and Water (DECCW)) *Interim Community Consultation Requirements for Applicants* (2004) and the DEC *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005). Based on the requirements for Aboriginal stakeholder consultation, the assessment was prepared in consultation with 33 Aboriginal stakeholder groups (of which one stakeholder group identified its interest in consultation following the completion of the relevant surveys).

In order to appropriately assess the modification areas, a review was conducted of both the environmental and cultural context of the areas and their surrounds and this information was used to develop a predictive model. It was predicted that artefact scatters and isolated finds would be the most common site type and will generally contain less than 10 artefacts and rarely more than 50 artefacts. Sites of this type are likely to have been disturbed to varying extents by natural and anthropogenic factors. Scarred trees were also predicted to be a rare site type that may occur where mature trees remain extant.

The modification areas were surveyed in their entirety by two archaeologists and seven Aboriginal stakeholder representatives. The survey resulted in the identification of four sites, consisting of three artefact scatters (one in each of Modification Areas 2, 3 and 4) and one scarred tree in Modification Area 2. The artefact scatter in Modification Area 3 (SC03) contained 13 artefacts. This site was located in the approved project disturbance area and had been previously identified and assessed and has since been subject to surface collection in accordance with previous recommendations. The remaining artefact scatters (SC58 and SC59) contained less than four artefacts in highly disturbed contexts. The scarred tree (SC-ST-02) was evaluated by an arboriculturalist. Based on the age of the tree, the size and depth of the scar and its location on the tree, it was assessed as likely to be of cultural origin.

No areas of Potential Archaeological Deposit (PAD) were identified in association with any of the sites or within the modification areas.

The Aboriginal significance and archaeological significance and research potential of the sites and archaeological landforms located within the modification areas were assessed, with the assessment of Aboriginal significance being undertaken by the relevant Aboriginal stakeholders. Aboriginal stakeholder representatives participating in the survey did not identify any areas or sites of particular Aboriginal cultural significance. Following consultation with the relevant Aboriginal stakeholders regarding the draft Aboriginal archaeological and cultural heritage assessment, no additional information on Aboriginal cultural significance was provided. Both the broader landscape context of the modification areas and the sites they contain are generally of low archaeological significance, with the exception of the scarred tree (SC-ST-02), which is of low to moderate archaeological significance.

The archaeological and Aboriginal cultural significance of the modification areas and the sites they contain formed the basis for the consideration of appropriate management and mitigation options for these areas. As part of this process, it was determined that site SC-ST-02 is located outside the area subject to inundation in Modification Area 2. Furthermore, as SC-ST-02 is a dead tree, it will not be immediately impacted by changes in the hydrology of the surrounding area. Consequently, the most appropriate management option for SC-ST-02 is *in situ* conservation and subsequent monitoring in accordance with a future revision of the Mangoola Coal ACHMP.

In contrast, conservation of the stone artefact scatters (SC58 and SC59) would involve considerable alterations to the proposed modification activities. Both of these sites are of low archaeological significance and have not been identified during field work as being of notable Aboriginal cultural heritage significance. The conservation of SC58 and SC59 is therefore not considered warranted. However, it is recognised that stone artefacts are of value to the local Aboriginal community and thus conducting a surface collection of artefacts at these sites using the methodology approved by the relevant Aboriginal stakeholders and DECCW within the Mangoola Coal ACHMP (Umwelt 2008a) is considered an appropriate management option.

In recognition of the potential for the proposed modifications to impact on Aboriginal cultural heritage, potential offset options were also considered as part of this assessment. Based on feedback received from Aboriginal stakeholder representatives, a proposed land-based offset (involving part of the existing Habitat Enhancement Area) was not considered suitable as an Aboriginal cultural heritage offset. As an alternative, Mangoola Coal has committed to the establishment of a suitable culturally appropriate offset to be determined following additional consultation with the relevant Aboriginal stakeholders as part of the Mangoola Coal biannual stakeholder meetings.

The following recommendations are therefore made in relation to the modification areas:

- Following receipt of approval for the proposed modifications and prior to undertaking any ground disturbance works (including the initiation of inundation associated with the raw water dam) in Proposed Modification Areas 2 and 4, it is recommended that surface artefacts within sites SC58 and SC59 should be subject to surface collection and analysis in accordance with the methodology approved under the Mangoola Coal ACHMP (Umwelt 2008a:Appendix 4) and provided in **Section 13.0**. Following the completion of analysis, the proposed repository for salvaged artefacts will be the subject of further consultation with the relevant Aboriginal stakeholders, DECCW and the Department of Planning. Dependent on the nature of the final artefact repository, a Care and Control permit for artefacts may be sought from DECCW.

- Prior to undertaking any ground disturbance works within Proposed Modification Area 2, a fence will be erected to enclose SC-ST-02, allowing a 10 metre buffer surrounding the tree. Mangoola Coal should ensure that all staff and contractors are aware of their statutory obligation to avoid any impacts (to SC-ST-02) and should be responsible for ensuring that no such impacts occur.
- Following the completion of the proposed cultural salvage activity (i.e. the surface collection of SC58 and SC59), ground disturbance works may commence within Proposed Modification Areas 2 and 4.
- No specific salvage works are required in Proposed Modification Areas 1, 3, 5 and 6 and ground disturbance works may commence in these areas following receipt of approval for the proposed modifications.
- Should skeletal material be exposed in the course of any activities conducted in relation to the modification areas, all work should cease in the immediate area and the New South Wales Police, DECCW and the Aboriginal stakeholders should be contacted immediately so that appropriate protocols for the management of the skeletal material can be implemented in accordance with Section 7.3.15 of the Mangoola Coal ACHMP (Umwelt 2008a).
- If any additional sites are identified within a modification area, work should cease within that area and the DECCW and representatives of Aboriginal stakeholder groups be contacted and appropriate management recommendations formalised, as per Mangoola's ACHMP.
- A suitable culturally appropriate offset will be determined following additional consultation with the relevant Aboriginal stakeholders within two years of Project Approval, in consultation with DECCW and to the satisfaction of the Department of Planning (DoP).

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1.0 Introduction

Xstrata Mangoola Pty Limited trading as Mangoola Coal, a wholly owned subsidiary of Xstrata Coal Pty Limited, has an existing Project Approval (PA 06_0014) that was granted in June 2007 to construct an open cut coal mine near Wybong, west of Muswellbrook NSW. The Mangoola Coal Mine (formerly known as the Anvil Hill Project) was the subject of an Environmental Assessment (Umwelt 2006a), which incorporated an Aboriginal Archaeological Assessment (Umwelt 2006b). PA06_0014 has since been subject to modifications.

Mangoola Coal's approved project disturbance area is located near Wybong, approximately 20 kilometres west of Muswellbrook and approximately 10 kilometres north of Denman in the Muswellbrook Local Government Area (LGA) (refer to **Figure 1.1**).

Mangoola Coal has fulfilled its pre-construction requirements and preparation and approval of management plans required prior to commencement of development activities, including those associated with Aboriginal cultural heritage. Of particular relevance is the Aboriginal Cultural Heritage Management Plan prepared for the project (Umwelt 2008a). Mangoola Coal has commenced construction of the mine and ancillary works within the approved project disturbance area. Mangoola Coal is now seeking approval for modifications to the mine plans approved in PA 06_0014 to take into account additional coal resources and hydrological factors.

As part of this process, Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to complete an Environmental Assessment (incorporating an Aboriginal cultural heritage and archaeological assessment) for areas that are the subject of the proposed modification (hereafter referred to as the modification areas and shown in **Figure 1.2**).

1.1 Location of the Modification Areas

Mangoola Coal is seeking approval to modify PA 06_0014 from the Minister for Planning in accordance with Section 75W of the *Environmental Planning & Assessment Act 1979* (EP&A Act). This assessment relates to six modification areas as shown in **Figure 1.2** and listed below.

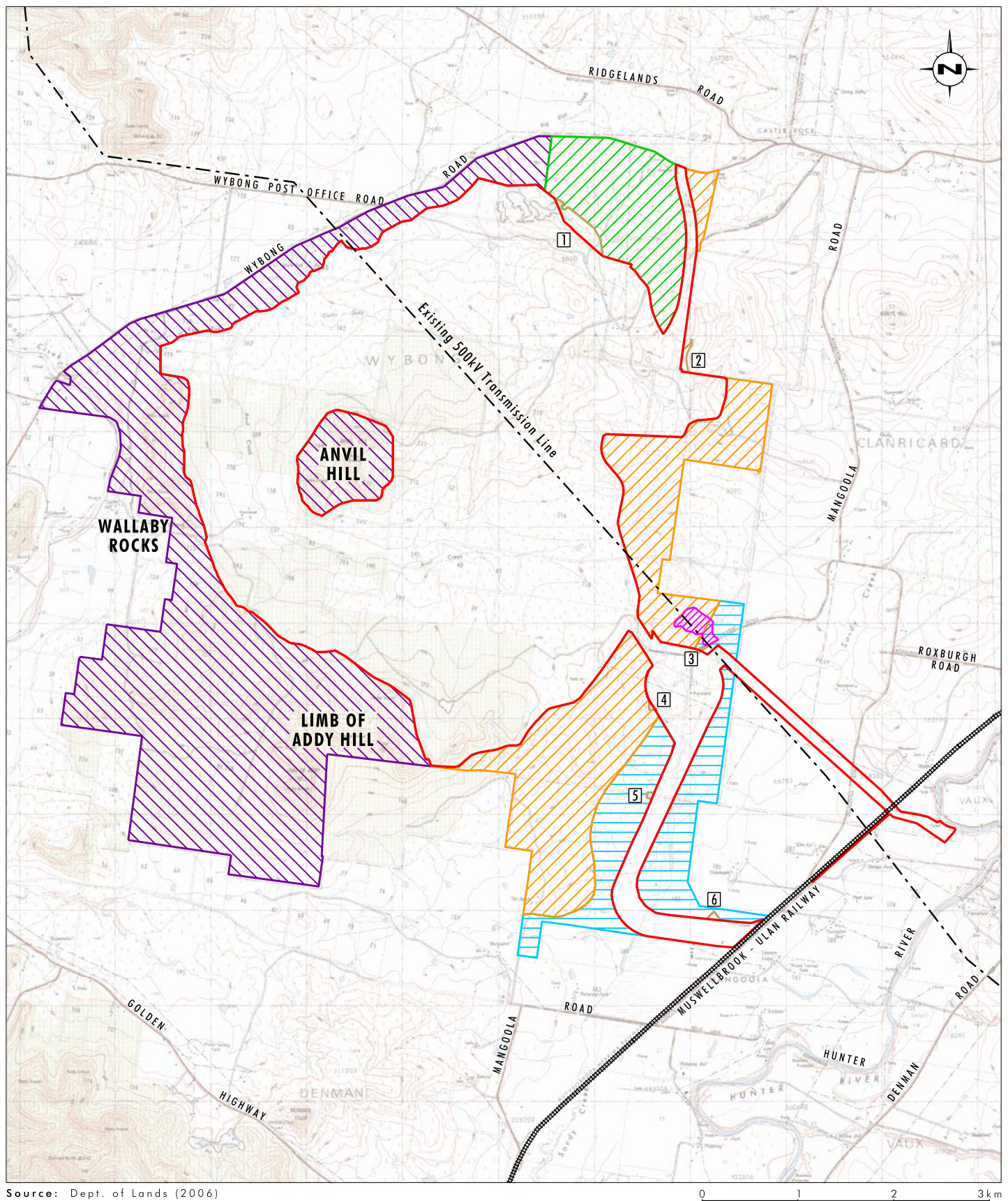
- Modification Area 1 consists of an area of approximately 8.4 hectares adjoining the northern portion of the approved project disturbance area;
- Modification Area 2 consists of approximately 1.7 hectares adjoining the eastern portion of the approved project disturbance area; and
- Modification Areas 3 to 6 comprise a total of approximately 1.6 hectares surrounding an approved rail loop.

1.2 Scope of Works

The main objective of this report is to assess the Aboriginal cultural and archaeological significance of the modification areas and to provide appropriate mitigation and management strategies for these areas. In order to meet this objective, the following tasks have been undertaken:



FIGURE 1.1
Locality Plan



Source: Dept. of Lands (2006)

Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Sustainable Agriculture Offset Area
- Approved Aboriginal Cultural Heritage Offset Areas
- Habitat Enhancement Area
- Surveyed Habitat Enhancement Area
- SC10 Management Zone

File Name (A4): R17_V1/2497_185.dgn

FIGURE 1.2

Location of Proposed
Modification Areas

- consultation with Aboriginal stakeholders (in accordance with relevant requirements) regarding the Aboriginal significance of the modification areas, any actual or potential Aboriginal sites/artefacts that may be included within the areas and any proposed mitigation or management strategies for the modification areas;
- a search of the Aboriginal Heritage Information Management System (AHIMS) database to determine the location of any previously recorded Aboriginal heritage sites within the modification areas and surrounds;
- a discussion of the archaeological, cultural and environmental context of the modification areas to obtain an understanding of the archaeological potential of the areas and the possible impacts of historical land use on any sites they may contain;
- a survey of the modification areas (conducted with Aboriginal stakeholder representatives) to identify and record any Aboriginal heritage sites or areas of potential archaeological deposit (PAD) that may be present;
- a discussion of the results of the survey, the significance of the identified sites and the general landscape; and
- the provision of appropriate strategies (developed in consultation with the relevant Aboriginal stakeholders) to mitigate and manage the impacts of the modifications on Aboriginal cultural heritage.

In fulfilling this scope of works, the assessment was undertaken in accordance with all relevant guidelines including the New South Wales National Parks and Wildlife Service (NPWS) *Cultural Heritage Guidelines* (NSW NPWS 1997), the Department of Environment and Conservation (DEC - now Department of Environment, Climate Change and Water (DECCW)) *Interim Community Consultation Requirements for Applicants* (2004) and the DEC *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005).

1.3 Authorship

This report was written by John Stevens (Senior Archaeologist) and Nicola Roche (Senior Archaeologist), with assistance from Kym McNamara (Archaeologist). Nicola Roche and Kym McNamara conducted the archaeological survey. Jan Wilson (Manager Cultural Heritage) provided strategic direction for the assessment and reviewed this report.

2.0 Description of Activities Associated with the Proposed Modifications

Modifications to the mine plans within the approved project disturbance boundary are proposed to achieve improved resource efficiency in the mining operation. However, in accordance with PA 06_0014, Mangoola Coal has previously conducted a range of Aboriginal cultural heritage salvage activities within the approved project disturbance area. These salvage activities have been completed and will be the subject of a detailed report (Umwelt in prep a). Furthermore, any activities associated with proposed modifications within the approved project disturbance area will be conducted in accordance with the approved Aboriginal Cultural Heritage Management Plan (AHCMP – Umwelt 2008a) that incorporates the recommendations of both Umwelt 2006b and Umwelt 2008b) and was developed in consultation with Aboriginal stakeholders. There is consequently no further requirement to undertake an Aboriginal cultural heritage or archaeological assessment for proposed modifications that relate to mine plan changes within the approved project disturbance area. This assessment therefore relates to proposed extensions to the approved project disturbance area, as referred to in **Section 1.1**. Throughout this document, these extension areas will be referred to as the proposed modification areas. These modifications relate to accessing additional coal resources (approximately 8.4 hectares), an increase in the footprint of an approved raw water dam (approximately 1.7 hectares) and the proposed construction of drainage works surrounding a rail loop (four areas with a combined area of approximately 1.6 hectares), as discussed in more detail below.

2.1 Modification Area 1

Modification Area 1 contains additional coal reserves of approximately 400,000 tonnes that extend beyond the approved project disturbance area. It is proposed to extend open cut mining into this area in order to extract the identified coal resources and allow for maximum reserve recovery. Open cut mining involves the bulk removal of all topsoil and therefore the disturbance or destruction of any archaeological sites that may be present within Modification Area 1.

2.2 Modification Area 2

Proposed activities in Modification Area 2 involve an increase in the footprint of an approved raw water dam so that it operates at full supply level (187 mAHD) and uses the infrastructure to its full design capacity. The extent of inundation will extend beyond the approved project disturbance area. Whilst submersion in water does not directly affect stone artefact scatters or isolated finds, increased water movement and associated changes in erosion may result in impacts to such sites. Furthermore, inundation may directly affect other site types such as scarred trees.

2.3 Modification Areas 3 to 6

Modification Areas 3 to 6 involve the proposed construction of drainage features surrounding an approved rail loop. The drainage features may include small culverts, drains and clean water diversions that are required to ensure adequate separation of clean and dirty water from the rail loop. The construction and ongoing operation of these structures will involve significant ground disturbance as a result of both excavation and construction activities and alterations in erosion patterns due to changes in water movement. Consequently, these activities may result in the disturbance or destruction of any archaeological sites that may be present within Modification Areas 3 to 6.

3.0 Statutory Policy and Framework

Aboriginal cultural heritage within New South Wales is primarily protected under the *National Parks and Wildlife Act 1974* (the NPW Act). In addition, the EP&A Act regulates development activity within New South Wales and contains provisions in relation to Aboriginal cultural heritage. Mangoola Coal Mine was approved as a Major Project under Part 3A of the EP&A Act and the proposed modifications are sought under Section 75W of the EP&A Act.

3.1 Environmental Planning and Assessment Act 1979

Part 3A of the EP&A Act applies to projects (such as the Mangoola Coal Mine) that meet specific requirements established in Section 75B of the EP&A Act. Under Section 75U of the EP&A Act, it is not necessary to obtain a permit under Section 87 or a consent under Section 90 of the NPW Act (as discussed below) in relation to activities approved under Part 3A of the EP&A Act. Projects approved under Part 3A of the EP&A Act are subject to conditions of approval issued by the Department of Planning (DoP) and (where relevant) Aboriginal cultural heritage is addressed by appropriate conditions and (where relevant) managed in compliance with an ACHMP. Furthermore, Section 75J (5) of the EP&A Act states that conditions of approval for the carrying out of a project may require the proponent to comply with obligations made in a statement of commitments submitted by the proponent as part of the development approval process.

3.2 National Parks and Wildlife Act 1974

DECCW is primarily responsible for regulating the management of Aboriginal cultural heritage in New South Wales under the NPW Act. As discussed above, projects approved under Part 3A of the EP&A Act do not require the proponent to obtain Section 87 permits or Section 90 consents, however, the other provisions of the NPW Act are still applicable and are discussed below.

The objectives of the NPW Act include:

The conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to: (i) places, objects and features of significance to Aboriginal people.

Consultation with the Aboriginal community is an integral part of identifying and assessing the significance of Aboriginal objects and/or places and determining and carrying out appropriate strategies to mitigate impacts upon Aboriginal heritage. Consultation with the relevant Aboriginal stakeholder groups regarding this Aboriginal cultural heritage assessment has been undertaken in accordance with the NPWS *Cultural Heritage Guidelines* (NSW NPWS 1997), the DEC *Interim Community Consultation Requirements for Applicants* (2004) and the DEC *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005).

The following information regarding the NPW Act is drawn from the *Interim Community Consultation Requirements for Applicants* (DEC 2004: 2-3) and outlines the sections of the NPW Act relevant to this report:

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary legislation regulating the protection of Aboriginal heritage through the administration of Part 6 of the NPW Act. DEC administers the NPW Act.

Part 6 of the Act provides protection for Aboriginal objects and Aboriginal places.

- An **Aboriginal object** is any deposit, object or material evidence (not being a handicraft made for sale) relating to Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains (as defined within the meaning of the NPW Act).
- An **Aboriginal place** is a place which has been declared so by the Minister administering the NPW Act because he or she believes that the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects. Aboriginal places are gazetted in accordance with Section 84 of the NPW Act.

Under Section 86 (a) of the NPW Act it is an offence to disturb or excavate any land or cause any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object whilst Section 90 (1) establishes that it is an offence to knowingly destroy, deface or damage or cause or permit the destruction, defacement or damage of an Aboriginal object without the consent of the Director-General.

As discussed in **Section 3.1**, projects approved under Part 3A of the EP&A Act do not require the proponent to obtain a Section 87 permit or Section 90 consent to impact on Aboriginal archaeological sites/objects. There is therefore no requirement to obtain any such permits or consents for any impacts to sites that may be present within the modification areas, if any. However, DoP will still forward the assessment report to DECCW for their review and input on the conditions for any Project Approval (or requirements for further information if it is perceived by DECCW that adequate information is not within the report). For DECCW to be able to complete this process it is necessary that the assessment report addresses not only the type of management/mitigation measures to be undertaken for each site to be impacted/protected, but also that it clearly demonstrates an appropriate research design and methodology for any salvage works proposed (if required). Thus the Aboriginal consultation process for a Part 3A project must address not only the survey, assessment and management process, but also the questions to be posed for the research design and the methodology for any salvage proposed and for the management/conservation of sites not subject to impact.

4.0 Aboriginal Consultation and Involvement

As part of any Aboriginal heritage assessment, it is both a requirement of the DECCW and best practice that consultation with the Aboriginal community be carried out as an integral part of assessing the significance of the areas subject to assessment and any Aboriginal cultural heritage objects they may contain. This section of the report outlines the consultation process undertaken for this assessment. **Appendix A** contains a record of consultation with Aboriginal stakeholders and copies of all correspondence discussed within **Section 4.0**.

4.1 Notification Process and Registration of Aboriginal Stakeholder Groups

The Mangoola Coal project is located within the Wanaruah Local Aboriginal Land Council boundary. Twenty seven Aboriginal groups had previously been identified by Mangoola Coal as interested parties in relation to Aboriginal cultural heritage assessments within its approved project disturbance boundaries. These groups were automatically considered as interested parties in relation to this assessment.

In accordance with the DECCW's¹ *Interim Community Consultation Requirements for Applicants*, the following notification process was undertaken:

On 26 May 2009, correspondence was forwarded to:

- DECCW;
- New South Wales Native Title Services;
- Office of the Registrar of Aboriginal Owners;
- Wanaruah Local Aboriginal Land Council; and
- Muswellbrook Shire Council.

The purpose of this correspondence was to notify these organisations and statutory bodies of the location, nature, and scope of the proposed Aboriginal heritage and archaeological assessment. It also requested that Umwelt be made aware of any relevant Aboriginal stakeholder groups not previously known to them within 20 working days. The correspondence stated that if no reply was received by the close of business on 8 June 2009, it would be assumed that the organisation was not aware of any additional Aboriginal stakeholder groups other than those specified within the correspondence (refer to **Appendix A**).

A response was received from the Wanaruah Local Aboriginal Land Council (9 June 2009) suggesting that St Clair Singleton Aboriginal Corporation should also be considered as an Aboriginal organisation with an interest in the Upper Hunter. DECCW responded (received 12 June) with an attached list of known Aboriginal stakeholder groups in the Hunter region. All of these groups had already been identified as registered Aboriginal stakeholders by Mangoola Coal, with the exception of the Lower Hunter Tribal Council. Lower Hunter Tribal Council was subsequently included as a registered stakeholder group. A response was also received from the Office of the Registrar of Aboriginal Owners after the closing date (3 June

¹ DECCW formerly DEC – Department of Environment and Conservation, then DECC – Department of Environment and Climate Change

2009) informing that the subject land does not currently have any registered Aboriginal owners. No response was received from New South Wales Native Title Services or Muswellbrook Shire Council.

An advertisement was placed in the public notices section of local print media the *Muswellbrook Chronicle* and *The Koori Mail* on Friday 17 April 2009. The advertisements briefly outlined the location, nature and scope of the proposed modifications to be assessed and invited registration of interest (within ten working days) from Aboriginal groups or individuals wishing to participate in the consultation program. A response to the public notice advertisements was received from Cacatua Culture Consultants, advising of their interest in the project. George Sampson of Cacatua Culture Consultants provided written response on 23 April 2009 (refer to **Appendix A**).

During this process, Mangoola Coal became aware of an additional four groups: Black Creek Aboriginal Corporation; Hunter Traditional Owners Environmental Management Services; Lower Hunter Wonnarua Council; and St Clair Singleton Aboriginal Corporation. A letter was sent to all 31 known Aboriginal stakeholder groups on 26 May 2009 inviting them to attend a meeting on 18 June 2009. These groups are listed below.

- 1) Aboriginal Native Title Consultants;
- 2) Black Creek Aboriginal Corporation;
- 3) Bullen Bullen Heritage Consultants;
- 4) Cacatua Culture Consultants;
- 5) Culturally Aware;
- 6) Gidawaa Walang Cultural Heritage Consultancy;
- 7) Giwiirr Consultants;
- 8) Hunter Traditional Owners Environmental Management Services;
- 9) Hunter Valley Aboriginal Corporation;
- 10) Hunter Valley Cultural Consultants;
- 11) Hunter Valley Cultural Surveying;
- 12) Hunter Valley Natural & Cultural Resources Management;
- 13) Lower Wonnarua Tribal Consultancy Pty Ltd;
- 14) Lower Hunter Wonnarua Council;
- 15) Mingga Consultants;
- 16) Muswellbrook Cultural Consultants;
- 17) St Clair Singleton Aboriginal Corporation;
- 18) Ungooroo Aboriginal Corporation;
- 19) Ungooroo Cultural & Community Services Inc;

- 20) Upper Hunter Heritage Consultants;
- 21) Upper Hunter Wonnarua Council Inc;
- 22) Valley Culture;
- 23) Wanaruah Custodians;
- 24) Wanaruah Local Aboriginal Land Council;
- 25) Wattaka Wonnarua Cultural Consultants Services;
- 26) Wonn1 Contracting;
- 27) Wonnarua Culture Heritage;
- 28) Wonnarua Elders Council;
- 29) Wonnarua Nation Aboriginal Corporation;
- 30) Yarrawalk; and
- 31) Yinarr Cultural Services.

On 18 June 2009 an Aboriginal stakeholder meeting took place at Muswellbrook PCYC. During this meeting an introduction to the project was provided by Mangoola Coal and a draft survey strategy was discussed by Jan Wilson (Manager Cultural Heritage, Umwelt). All stakeholder feedback received at this meeting was included into the draft survey strategy (refer to **Appendix A** for a summary of the outcomes of this meeting). Following the meeting and inclusion of Aboriginal stakeholder input, the revised survey strategy was sent to the Aboriginal stakeholders for comment.

On behalf of the Wanaruah Local Aboriginal Land Council, Suzie Worth provided a written response agreeing with the proposed survey strategy. The remainder of the stakeholders did not provide comment, however, the Aboriginal stakeholders did support the strategy at the meeting held on 18 June 2009.

Subsequent to the survey strategy meeting, Mangoola Coal became aware of an additional group, Wanaruah Custodians Aboriginal Corporation, which has been involved in the consultation undertaken for the project since 3 August 2009. An additional stakeholder group, Carrawonga Consultants, registered an interest in the project on 9 September 2009 and has been consulted since this date.

4.2 Fieldwork Participation

The survey of the modification areas was conducted in consultation with Aboriginal stakeholder groups. The Aboriginal stakeholder representatives who participated in the survey are listed in **Table 4.1**.

Table 4.1 – Aboriginal Stakeholder Participation in the Survey

Survey Date	Group	Representative
01/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Wonnarua Culture Heritage Culturally Aware Upper Hunter Wonnarua Council Incorporated	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Todd Maley Paulette Ryan Georgia Berry
02/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Wonnarua Culture Heritage Culturally Aware Upper Hunter Wonnarua Council Incorporated	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Todd Maley Paulette Ryan Georgia Berry

4.3 Comments on the Draft Aboriginal Heritage and Archaeological Assessment

A copy of the draft Aboriginal heritage and archaeological assessment was provided to all relevant Aboriginal stakeholders on 18 February 2010 and it was requested that comment on the draft assessment report be provided by no later than 19 March 2010. Aboriginal stakeholder consultation regarding the draft Aboriginal heritage and archaeological assessment was undertaken by Mangoola Coal and is documented in **Appendix A**. As recorded in **Appendix A**, Mangoola Coal provided reminders to all stakeholder groups regarding the closing date for comments, with contact made by telephone, email and fax (where appropriate contact details had been provided). Comments (either verbal or written) were received from ten stakeholder groups. Comments provided by the Aboriginal stakeholders on the draft Aboriginal heritage and archaeological assessment are summarised in this section of the report and written comments are included in full in **Appendix A**.

Verbal comments were received from seven stakeholder groups, of whom four stakeholder groups (Aboriginal Native Title Consultants, Lower Wonnarua Tribal Consultancy, Ungooroo Cultural and Community Services and Wonnarua Elders Council) elected not to provide specific comments on the draft Aboriginal heritage and archaeological assessment. The remaining three groups (Wanaruah Custodians, Yarrawalk and St Clair Aboriginal Corporation) endorsed the proposed recommendations outlined in the draft Aboriginal heritage and archaeological assessment.

Written comments were received from Gidawaa Walang Cultural Heritage Consultancy, Hunter Traditional Owners and Wanaruah Local Aboriginal Land Council. Gidawaa Walang indicated that it supports Management Option 11.3 (Site Destruction with Salvage – Surface Collection Only) and Offset Option 11.5.2 (Funding of a Culturally Appropriate Project). Hunter Traditional Owners stated that all of the relevant issues were addressed in the draft Aboriginal heritage and archaeological assessment and did not raise any objections.

Wanaruah Local Aboriginal Land Council provided a detailed response that raised a number of issues regarding the draft Aboriginal cultural heritage and archaeological assessment.

Mangoola Coal provided a written response to Wanaruah Local Aboriginal Land Council on 18 May 2010 (refer to **Appendix A**). The comments provided by Wanaruah Local Aboriginal Land Council that relate to this Aboriginal cultural heritage and archaeological assessment and the accompanying response from Mangoola Coal are summarised below.

Issue 1 – Potential Encroachment on Conservation/Preservation Areas

Wanaruah Local Aboriginal Land Council indicated that activities associated with the modification and ongoing mining activities may encroach on the SC10 Management Zone and the Habitat Enhancement Area and that these areas should be fenced, with no disturbance to occur within 100 metres of the defined areas.

Mangoola Coal's response identified that, in accordance with the Mangoola Coal Aboriginal Cultural Heritage Management Plan (ACHMP – Umwelt 2008a), the boundaries of the SC10 Management Zone are demarcated by permanent fencing and clear signage stating that the area is a 'cultural heritage site – no unauthorised entry, unauthorised entry or destruction may result in prosecution'. The boundaries of the SC10 Management Zone were determined in consultation with the relevant Aboriginal stakeholder groups, an archaeologist and a geomorphologist, with the fenced area including all of SC10 and the associated area of PAD. This process was undertaken to ensure the protection of SC10 and associated PAD in its entirety. In this respect, Mangoola Coal has entirely met its commitment regarding the SC10 Management Zone and it is not feasible to provide an additional 100 metre buffer surrounding the agreed-upon extent of the SC10 Management Zone.

The Habitat Enhancement Area has been identified on the basis of its ecological values and was not considered suitable as an Aboriginal Cultural Heritage Offset Area (ACHOA) by the majority of the relevant Aboriginal stakeholder representatives.

Areas that will be traversed within the Habitat Enhancement areas will be clearly marked by either pegs and/or flagging tape. This will ensure that personnel associated with the project work within this identified areas. Information will be provided in the induction regarding the requirement to work within these defined areas.

Issue 2 – Salvage of Sites within the Vicinity of Drainage Lines

The response from Wanaruah Local Aboriginal Land Council stated that site destruction with surface collection was not considered suitable for sites within the vicinity of drainage lines and that these sites should be subject to excavation as an Aboriginal cultural heritage salvage exercise. It is assumed that this recommendation relates to the three artefact scatter sites discussed in the draft report; namely SC03, SC58 and SC59.

The portion of SC03 associated with Modification Area 3 was identified as part of an assessment relating to a proposed modification associated with a water pipeline (refer to Umwelt 2008b). As part of this assessment, it was recommended that SC03 be subject to surface salvage on the basis that the site is highly disturbed, lacks integrity and has only very low potential for artefacts in a subsurface context. This modification to the Mangoola Coal Project approval (including the water pipeline) was approved by DoP (PA 06_0014 MOD2) on 23 June 2009.

As stated in **Section 9.1**, four loci of SC03 were recorded in association with Modification Area 3, of which only one is located within the currently proposed modification area. These loci were situated in areas of significant disturbance with excellent exposure and visibility. However, despite the high levels of disturbance and the excellent visibility only 13 artefacts were located. Soils within the SC03 site area generally consisted of a thin layer of A2 soil over a clay B horizon. The level of disturbance, lack of integrity and low likelihood of potential for artefacts within a subsurface context were consistent with those discussed

above and there were no grounds to modify this recommendation. Site SC03 was consequently subject to surface collection in accordance with the methodology approved under the Mangoola Coal ACHMP (Umwelt 2008a). The surface collection was completed in association with excavations within the Hunter River PAD. The results of the collection of SC03 and subsequent post-excavation artefact analysis will be detailed in Umwelt (in prep a).

As discussed in **Section 9.1**, SC58 consists of four artefacts located on an eroded ephemeral drainage line within Modification Area 4, and SC59 consists of two artefacts located on a heavily eroded and incised second order tributary of Sandy Creek. Due to the ephemeral nature of the drainage lines, the limited depth of remnant soils and the low numbers of artefacts despite the presence of large exposures with excellent visibility within both these sites, it was considered highly unlikely that any subsurface deposits that may be associated with SC58 or SC59 would contain high numbers or densities of artefacts. Furthermore, due to the level of erosion at the site, it is highly unlikely that any subsurface deposits that may be present will retain spatial or stratigraphic integrity. For these reasons, there is no PAD associated with SC58 and SC59 and there are no archaeological grounds for undertaking subsurface salvage at this site.

Mangoola Coal noted that extensive subsurface salvage has already been completed within the approved project disturbance boundary, which resulted in the salvage of approximately 11,000 artefacts. This large number of artefacts is considered to comprise a representative sample of subsurface artefacts within the approved project disturbance boundary.

Issue 3 – Commitment to In-Perpetuity Conservation of the SC10 Management Zone and the Aboriginal Cultural Heritage Offset Areas

Wanaruah Local Aboriginal Land Council raised several queries in relation to the conservation status of the SC10 Management Zone and the Aboriginal Cultural Heritage Offset Areas.

Mangoola Coal responded that Condition 40 of the current Mangoola Coal Project Approval (PA 06_0014 MOD5) relates to the securing of offsets. As stated in the Mangoola Coal ACHMP, Mangoola Coal is committed to the in perpetuity conservation of the ACHOAs and the SC10 Management Zone.

Issue 4 – Proposal for Aboriginal Stakeholder Workshop Regarding Funding of a Culturally Appropriate Project

Wanaruah Local Aboriginal Land Council stated that any funding provided as a cultural heritage offset should be discussed at an Aboriginal stakeholder workshop, funded and facilitated by Mangoola Coal.

Mangoola Coal has suggested that a culturally appropriate project would consist of the development of a shelter within the SC10 Management Zone. This would provide a facility for the Aboriginal Groups to use whilst visiting the SC10 Management Zone for educational purposes.

Issue 5 – Monitoring of Fencing of ST-SC-02

Wanaruah Local Aboriginal Land Council indicated that fencing of ST-SC-02 (as recommended in **Section 12.0**) would be an appropriate management activity but also recommended that the fencing should be inspected by at least two representatives of the Aboriginal stakeholders. Mangoola Coal responded that, as recommended in **Section 12.0**, a fence will be erected to enclose ST-SC-02 incorporating a 10 metre buffer around the tree itself. Although ST-SC-02 is not subject to impact by the modifications, it is located within

Modification Area 2 and therefore will be managed in accordance with the Mangoola Coal ACHMP. The proposed fencing of ST-SC-02 will be in accordance with Section 7.3.5 of the ACHMP and will include provision of a gate within the fence to allow access to the site.

4.4 Native Title Search

A National Native Title Register search of the Muswellbrook Local Government Area was requested from the National Native Title Tribunal on 30 July 2009. A response was received via email on 2 October 2009 stating that there were no registered native title or active claimant applications within this area (refer to **Appendix A**).

5.0 Environmental Context

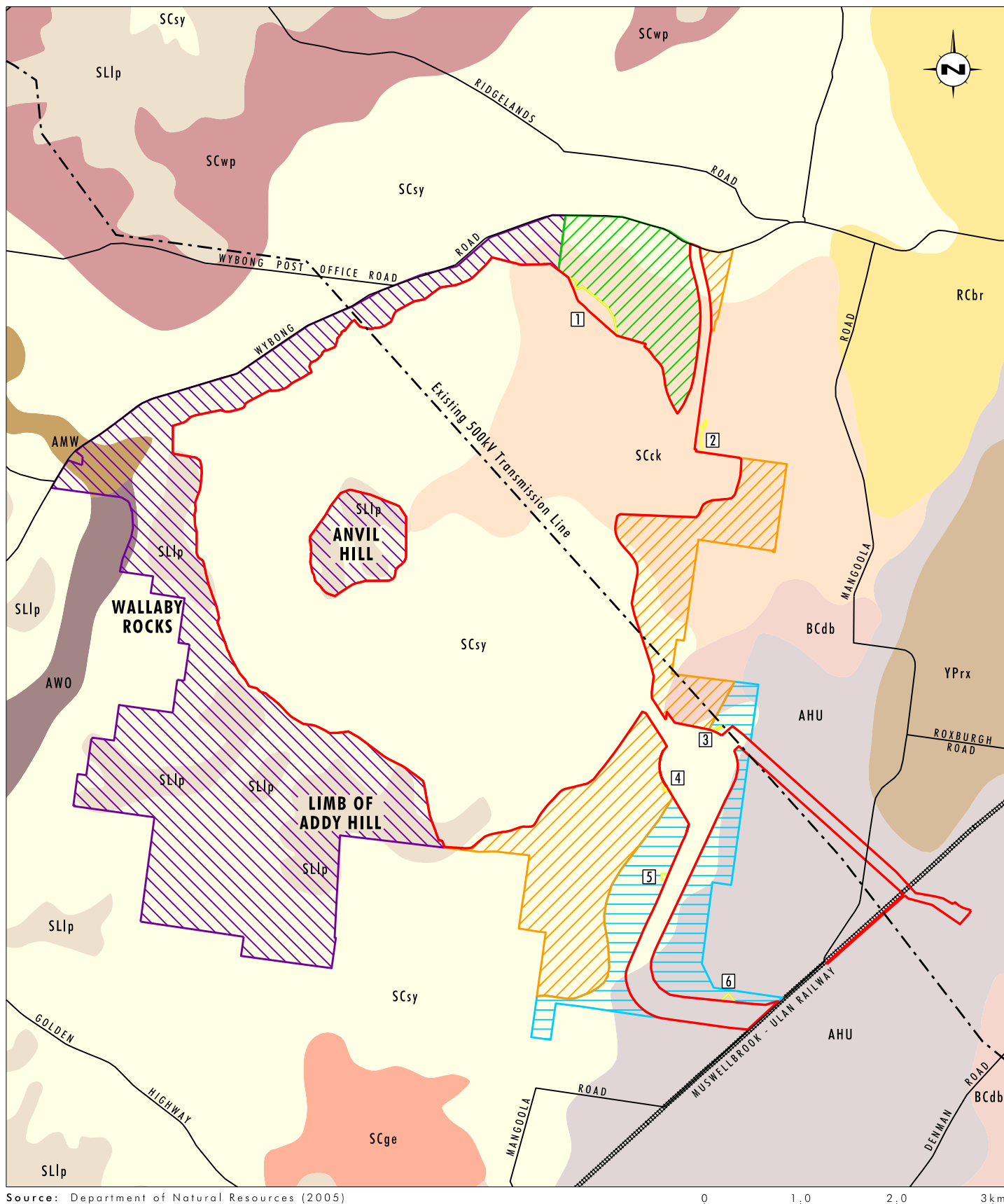
In order to develop a model with which to predict the likelihood that Aboriginal archaeological sites will be present and preserved within a particular landscape context, it is necessary to review the environmental factors that may have influenced how Aboriginal people utilised the landscape and that may affect site preservation. The decisions that people make regarding things such as where they live, the range of resources that they use and other aspects of daily life are all influenced by the environment in which they live. The likelihood that sites will be preserved and visible is also affected by environmental factors such as vegetation cover and past land use and disturbance. A review of the environmental context of the modification areas is therefore an essential component of this report.

5.1 Geology and Soils

The Mangoola Coal project area incorporates two major geological units: the Narrabeen Group (composed of chert sandstone, quartzose sandstone, shale and claystone) in the western portion; and the Newcastle Coal Measures (composed of shale, sandstone, conglomerate, tuff, chert, coal and torbanite) to the east (Umwelt 2006b). Quaternary alluvium is found in the southern section of the Mangoola Coal project area and extends from the Hunter River floodplain to the east and along the Sandy Creek floodplain, however, the boundaries between the Hunter River and Sandy Creek floodplains have not been clearly defined (Pam Dean-Jones pers comm.). The Hunter River, approximately 1 kilometre to the east of Modification Area 6, is a known source of silcrete and mudstone often used for knapping in the Upper Hunter Valley, but these raw materials have not been recorded in the other creek systems within the assessment area such as Sandy Creek and Big Flat Creek. In an assessment of the Mangoola Coal project area, Mitchell (2006) identified that some raw materials could be sourced from conglomerates found in the area and from scattered occurrences of silicified wood, but that no other raw materials suitable for tool manufacture were observed beyond the Hunter River corridor.

The modification areas are located in three different soil landscapes; with Modification Areas 1 and 2 associated with the Castle Rock soil landscape; Modification Areas 3, 4 and 5 associated with the Sandy Hollow soil landscape; and Modification Area 6 associated with the Hunter soil landscape (refer to **Figure 5.1**). **Table 5.1** summarises the key characteristics of these three soil landscapes.

The development of stone layers between topsoils (A horizon) and subsoils (B horizon) is a common feature of duplex soil profiles (Dean-Jones and Mitchell 1993:43), such as those found within all of the modification areas. In general, stones larger than the diameter of burrowing agents will 'sink' through the soil over time, creating an artificial layer of stone material at the interface of the A and B horizons. This stone material potentially includes stone artefacts that were originally deposited throughout the A horizon. The one major exception to this trend is stone movement towards the surface resulting from tree removal. Dean-Jones and Mitchell (1993:67) also found that surface layers of duplex soils (A horizons) may be quite young.



0 1.0 2.0 3km

Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Sustainable Agriculture Offset Area
- Approved Aboriginal Cultural Heritage Offset Areas
- Habitat Enhancement Area
- Surveyed Habitat Enhancement Area

Soil Landscapes:

- | | |
|--|---|
| Castle Rock (SCck) | Growee (SCge) |
| Lees Pinch (SLlp) | Castle Rock (SCck) |
| Wappinguy (SCwp) | Hunter (AHU) |
| Merriwa (AMW) | Sandy Hollow (SCsy) |
| Wollombi (AWO) | Roxburgh (YPrx) |
| Dartbrook (BCdb) | |
| Brays Hill (RCbr) | |

FIGURE 5.1
Soil Landscapes

Table 5.1 - Soil Landscape Descriptions (Kovac and Lawrie, 1991)

	Sandy Hollow Soil Landscape (p356-p353)	Hunter Soil Landscape (p212-p218)	Castle Rock Soil Landscape (p147-150)
Terrain	Undulating rises, elevation ranges from 150-500 m. Smooth and gentle slopes (<10%). Shallow valleys, 20-40 m deep cut into hills. Terraced alluvium along major streams.	Level plains and river terraces, elevation ranges from 20-60 m. Slopes <3%. Plains up to 3200 m wide. Local relief less than 10 m.	Undulating low hills and footslopes on areas of colluvium. Elevation ranges from 240-460 m. Slopes are 1-5% with slope lengths up to 1200 m. Local relief is 40-80 m
Vegetation	Savannah woodlands with yellow box, forest gum, narrow-leaved ironbark, narrow-leaved apple and black cypress pine. Mostly cleared in valleys, native vegetation on slopes.	Native vegetation cleared for improved pasture.	Spotted gum, red ironbark and narrow-leaved red ironbark.
General Soil Profile	Brown, red and yellow solodic soils, siliceous sands, red earths, and alluvium. Solodic soils associated with slopes, siliceous sands on lower slopes and alluvial soils along drainage lines.	Brown Clays on 1 st terrace. Black Earths along prior stream channels. Non-calcic brown soils on 2 nd terrace. Layered alluvial soils on minor tributaries. Alluvial soils occur on 1 st terraces as sands and loams. Red podzolic soils on old terrace.	Dark brown fine sandy loam topsoils overlying grey-yellow medium clay. Dark brown silt loam as topsoil in other areas overlying brownish-black sandy clay loam. Alluvial soils consist of greyish brown fine sandy clay loam to sandy clay.
Depth to Bedrock	120 cm+	300 cm+	40-100 cm+
pH Levels	5.5 - 6.5 on slopes, 8.5 in alluvial soils.	5.5 - 6.5 on 1 st terrace (midslope), 2 nd terrace, old terraces and minor tributaries. 7 - 7.5 on 1 st terrace and prior stream channels.	6.5 on topsoil and 7.0 in subsoil to 100 cm. 8.5 on alluvial soils.
Soil Erosion	Moderate gully erosion (<1.5 m) in drainage lines. Minor sheet and rill erosion on slopes.	Minor stream bank erosion along streams, with minor sheet and gully erosion on adjacent terraces. Aggrading landscape.	Minor to severe sheet erosion, with gully erosion in many of the drainage lines. This is exacerbated by salting in the flats.

Exposure conditions and therefore archaeological visibility varies between the soil landscapes observed across the modification areas. The Sandy Hollow and Hunter soil landscapes are subject to erosion along streams and drainage lines, so it is likely that visibility and therefore archaeological detection will improve along streams in these soil landscapes. The Castle Rock soil landscape is also subject to sheet erosion on hillslopes, so archaeological visibility of non-stream landforms may be improved in Modification Areas 1 and 2. Vegetation cover in all soil landscapes is likely to be the key constraint to ground surface visibility.

The soil pH throughout the modification areas ranges from slightly acidic, to neutral to alkaline (pH 6.0 to 8.5 on the scale of pH 1 to 14). Those areas with neutral soils (pH 7) will have greater potential for the preservation of organic materials, while organic materials are unlikely to survive in acidic soils (those less than pH 7) (Mays 1998). Given this, skeletal and wooden materials are unlikely to be preserved in most soils found within the modification areas.

5.2 Topography and Geomorphology

The modification areas lie within the Central Lowlands of the Upper Hunter Valley, one of the eight sub-regions of the Hunter Valley defined by Storey *et al.* (1963). ERM (2004) describes this sub-region as:

...belt of lowlands developed on relatively weak sedimentary rocks. These lowlands continue down to the coast. While the general altitude gradually rises inland from sea level to 500 metres at Murrurundi, the local relief in any given locality rarely exceeds 60 metres. The landscape is undulating or gently hilly with an abrupt transition to the steep country on either side. A line of alluvial flats between 0.5 and 2.5 kilometres wide extends along the Hunter River and its major tributaries where they flow through the lowland belt.

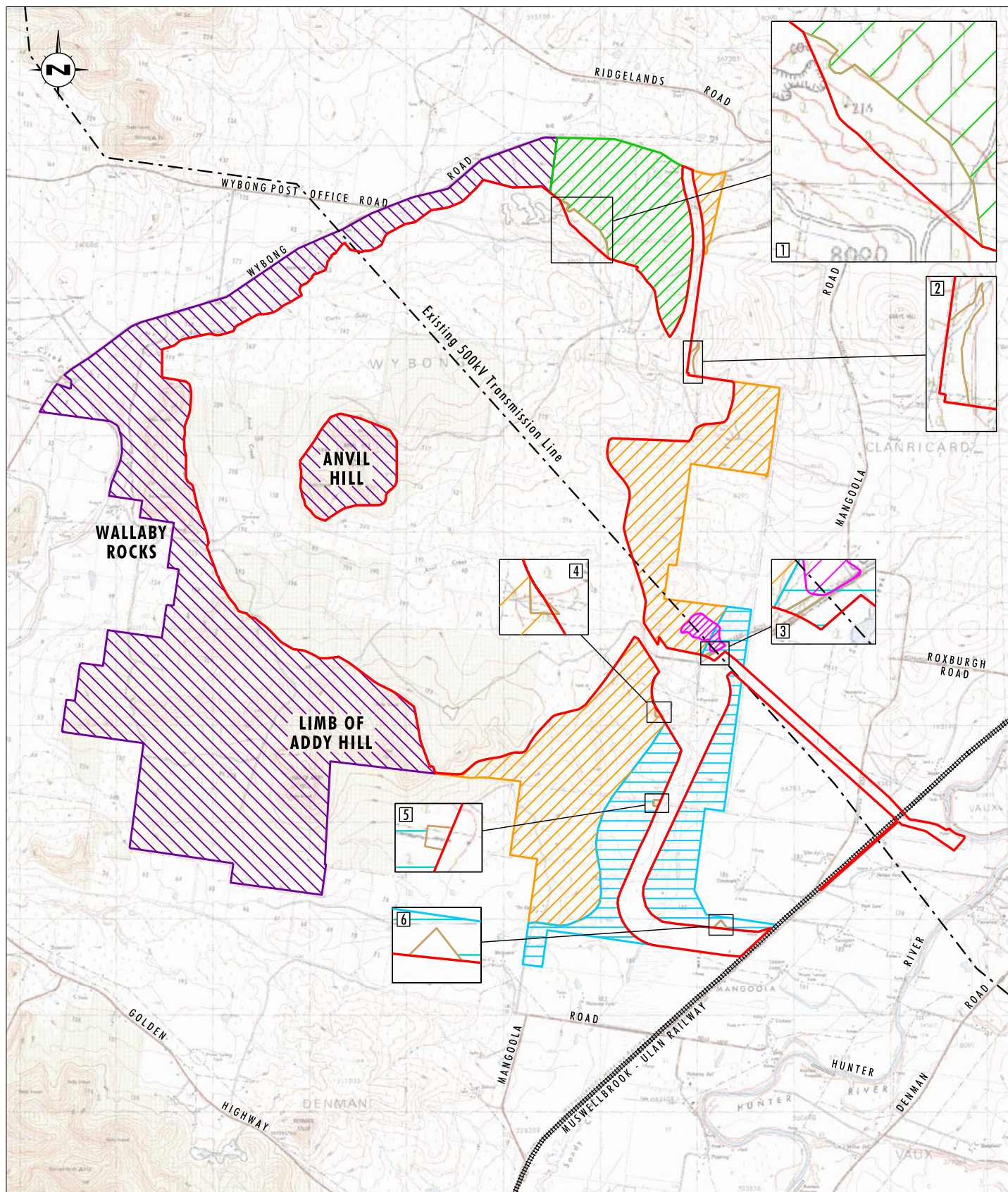
The topography of the modification areas reflects the broad characteristics of the region, being defined by catchment areas and tributaries of Sandy Creek and Big Flat Creek and their associated flats, and gently inclined undulating hillslopes (refer to **Figure 5.2**). The general landform units and topography of the modification areas are provided in **Table 5.2**.

Table 5.2 – Landform units and topography of the modification areas

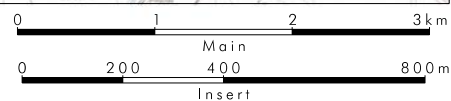
Area	Landform/Topography
1	Crest and slope landforms located approximately 170 metres from first order tributaries within the upper catchment area of Big Flat Creek
2	Lower slopes and a second order tributary of Sandy Creek
3	Lower slopes approximately 100 metres from a first order tributary of Sandy Creek
4	Lower slopes and a first order tributary of Sandy Creek
5	Lower slopes approximately 100 metres from a first order tributary of Sandy Creek
6	Sandy Creek / Hunter River floodplain

Both Sandy Creek and Big Flat Creek and their associated tributaries are ephemeral in nature and currently flow only after substantial rain. During periods of low or moderate rainfall, water is retained in a few small, deep pools along their channels. At the time of survey, some water was present in sections of the Sandy Creek tributary where it appeared that the watercourse had been modified. The upper tributaries of Big Flat Creek closest to Modification Area 1 did not contain any water. Prior to non-Aboriginal land clearance and subsequent entrenchment of drainage lines, it is likely that these watercourses were typified by far shallower, grassy channels interspersed by chains of ponds in some areas. Their current morphology, whilst occasionally incorporating a 'chain of ponds pattern' does not accurately represent the past nature of these watercourses.

A geomorphic investigation of the Sandy Creek catchment was conducted for the Anvil Hill (now Mangoola) Coal Mine by Mitchell (2006). **Table 5.3** provides a summary of observed characteristics of the upper and lower Sandy Creek catchments.



Source: Dept. of Lands (2006)



Legend

- Approved Project Disturbance Boundary
- Modified Project Disturbance Boundary
- Sustainable Agriculture Offset Area
- Approved Aboriginal Cultural Heritage Offset Areas
- Habitat Enhancement Area
- Surveyed Habitat Enhancement Area
- SC10 Management Zone

File Name (A4): R17_V1/2497_186.dgn

FIGURE 5.2
Topography

Table 5.3 – Geomorphic Characteristics of Sandy Creek Catchment

Characteristic	Upper Catchment	Lower Catchment
Terrain	Wide, alluvial valleys. Slope 3 to 5 degrees.	Evidence of very low amplitude micro-relief in the down slope areas. No obvious signs of the creek having had a chain of ponds morphology.
Vegetation	Regenerating vegetation.	
Soils	Shallow texture contrast soils on terraces and slopes. Stony uniform cracking black clay profiles on creek flats. A-horizon sandy loam (higher sand content near rock outcrops). Shallow uniform stony loams on higher slopes. Shallow gravels over quartz and lithic sandstones. No evidence of buried soil profiles.	Yellow brown texture contrast soils in the upslope areas and brown alluvial clay in the down slope areas.
Erosion	Sheet eroded to an average depth of 20 mm to 30 mm. Minor rills to gullies 2 m deep.	Areas disturbed by sheet erosion. High ground surface visibility.
Land use	Evidence of extensive earthworks including gully shaping and armouring of banks with sandstone boulders.	

In evaluating seven archaeological sites within the upper Sandy Creek catchment (SC6 to SC9 and SC11 to SC13), Mitchell (2006:6) found that any sites within the upper creek catchment would have been 'very damaged' by European land use practises and subsequent erosion, and that the prospect for the 'recovery of intact Aboriginal sites....is low'. In evaluating one archaeological site within the lower Sandy Creek catchment (SC10), Mitchell (2006:8) found that the site was unlikely to have intact artefactual material due to the degree of sheet erosion.

Umwelt (2006b) also discussed the integrity of the Sandy Creek floodplain which is associated with Modification Area 6, noting that the floodplain has evidence of channel migration and that this process is likely to have destroyed sites that may have been present in the area. Channel migration occurs in response to slight changes in water flow and resistance that can redirect water flow within the alluvial deposits of the floodplain, and also has the potential to expose and move any artefacts within those alluvial deposits and/or in areas downstream that are affected by alterations in flow and sediment movement. The Sandy Creek tributary floodplains also contain evidence of over bank flows and sheet wash, indicating that these floodplains are unlikely to retain archaeological sites with integrity. Umwelt (2006b) further noted that the Sandy Creek floodplain is only likely to retain archaeological sites with any integrity where overlapping alluvial and colluvial deposits are found, most likely at the boundary of floodplain and footslope landforms, assuming these areas have not been affected by post contact activities such as ploughing.

5.3 Flora and Fauna

Ecological survey of the approved project disturbance area (Umwelt 2006c) identified five vegetation communities: Slaty Box Woodland, Ironbark Woodland Complex, Disturbed Grassland, Planted Vegetation and a small remnant of Hunter Valley Weeping Myall Woodland. Disturbed grassland is the dominant vegetation community in the vicinity of the

modification areas. These areas have been subject to grazing. Ironbark and Slaty Box Woodland are the most widespread native vegetation communities in the wider area.

Umwelt (2008c) identified 116 floral species within the approved project disturbance area, of which 63 per cent are native and 37 per cent are introduced. A number of recorded species are known to have been traditionally used by Aboriginal people as food, economic or medicine plants, as listed in **Table 5.4**.

Table 5.4 - Flora Species and Known Aboriginal Use

Scientific Name	Common Name	Known Aboriginal Use	Reference
<i>Acacia</i> sp	Wattle	Food and economic plant	Australian National Botanic Gardens Education Services 2000
<i>Allocasuarina</i> sp.	Sheoak	Food and economic plant	Australian National Botanic Gardens 2007
<i>Cheilanthes</i> sp.	Ferns (roots)	Food plant	Brayshaw 1986:74-75
<i>Einadia</i> sp.	Saltbush	Food plant	Low 1989: 129
<i>Eremophila debilis</i>	Amulla	Food plant	MacDonald and Davidson 1998
<i>Eucalyptus</i> spp	Eucalypts	Economic plant	MacDonald and Davidson 1998
		Medicine plant	Australian National Botanic Gardens Education Services 2000
<i>Eucalyptus crebra</i>	Narrow-leaved ironbark	Economic plant	pers. comm. various Aboriginal people from the Dubbo Region (2000) and from AHIMS site card review
<i>Eucalyptus moluccana</i>	Grey box	Economic plant	MacDonald and Davidson 1998
<i>Geranium solanderi</i> var. <i>solanderi</i>	Native geranium	Food and medicinal plant	Flood 1980:95. Zola & Gott 1992:47, 56
<i>Juncus</i> & <i>Cyperus</i> spp.	Rushes and sedges	Food and/or economic plants	Low 1989:105; Zola & Gott 1992:60
<i>Lomandra</i> sp.	Mat-rush	Food and economic plant	Low 1989: 131, 174; MacDonald and Davidson 1998 Zola & Gott 1992:59
<i>Marsilea mutica</i>	Nardoo	Food plant	Flood 1980. Cribb & Cribb 1986 83
<i>Melaleuca</i> spp	Melaleuca	Food, economic and medicine plant	Albrecht 2000 in ERM 2004:34.
<i>Notelaea microcarpa</i>	Native Olive	Medicine plant	pers. comm. Walhallow LALC (2007)
<i>Panicum</i> sp.	Grass	Food plant	MacDonald and Davidson 1998
<i>Rumex brownii</i>	Swamp dock	Food plant	Low 1989: 28, 30, 153-154
<i>Wahlenbergia</i> sp.	Bluebell	Food plant	Fraser and McJannett 1993:65

Table 5.4 indicates that Aboriginal resource plants may be found in the vicinity of the modification areas, but clearance of vegetation since non-Aboriginal settlement has resulted in the loss of many resource plants that would once have been found within the area.

Numerous fauna resources known to have been used by Aboriginal people occur in the various environs of the Wybong-Denman area, as identified by Umwelt (2006c). **Table 5.5** lists these species. Species distribution varies in the region according to specialised habitat

requirements. For example, Anvil Hill, Wallaby Rocks, Limb of Addy Hill and Western Rocks provide suitable habitat for the common wombat (*Vombatus ursinus*), the brush-tailed rock-wallaby (*Petrogale penicillata*) and potentially the spotted-tail quoll (*Dasyurus maculatus*). A diversity of woodland birds was also observed to be utilising these areas, which would have provided for the hunting of faunal species not available in areas of lower gradient and without rock outcrop. Aquatic species were found in greater abundance in larger creek systems such as Big Flat Creek to the north, Wybong Creek to the west and Sandy Creek to the south, rather than the more ephemeral creek lines. Isolated pools of water found along these creeks would have been a focal point for faunal species in drier times.

Table 5.5 – Aboriginal Hunter-Gatherer Fauna Species

Scientific Name	Name
<i>Coturnix</i> spp.	Quail
<i>Chenonnetta jubata</i>	Wood duck
<i>Anas superciliosa</i>	Black duck
<i>Anas gracilis</i>	Teal
<i>Pelecanus conspicillatus</i>	Pelican
<i>Egretta novaehollandia</i>	White-faced heron
<i>Threskiornis spinicollis</i>	Straw-necked ibis
<i>Vanellus miles</i>	Masked lapwing
<i>Phaps</i> spp.	Bronzewings
<i>Ocyphaps lophotes</i>	Crested pigeon
<i>Geopelia striata</i>	Peaceful dove
<i>Varanus varius</i>	Lace monitor
<i>Pogon barbata</i>	Eastern bearded dragon
<i>Furina diadema</i>	Red-naped snake
<i>Pseudechis guttatus</i>	Blue-bellied black snake
<i>Chelodina longicollis</i>	Snake-necked turtle
<i>Tachyglossus aculeatus</i>	Short beaked echidna
<i>Phascolarctos cinereus</i>	Koala
<i>Vombatus ursinus</i>	Common wombat
<i>Petaurus norfolkensis</i>	Squirrel glider
<i>Pseudocheirus peregrinus</i>	Common ringtail possum
<i>Trichosurus vulpecula</i>	Common brushtail possum
<i>Macropus giganteus</i>	Eastern grey kangaroo
<i>Macropus robustus</i>	Common wallaroo
<i>Macropus rufogriseus</i>	Red-necked wallaby
<i>Petrogale penicillata</i>	Brush-tailed rock wallaby
<i>Wallabia bicolor</i>	Swamp wallaby

Based on this information, Umwelt (2006b) suggested that the Wybong-Denman area would have provided a sound resource base for Aboriginal people occupying and utilising the area, with some resources associated with relatively specific contexts.

5.4 Historical Land Use and Disturbance

Non-Aboriginal settlement and activity have been ongoing in the Hunter Valley since 1801. By the 1830s settlement had extended along the Hunter River into the upper Hunter Valley and radiated throughout the district. Pastoralism was the dominant early land use in the upper Hunter Valley, particularly cattle grazing. Timber clearing was closely linked with establishment of grazing lands (in addition to providing valuable resources for use) and this altered the landscape rapidly in the early to mid nineteenth century (Umwelt 2008c).

The non-Aboriginal settlement of the Wybong-Denman area (particularly in the vicinity of the modification areas) is directly linked to the 'Pickering' estate, one of the earliest land grants in the Hunter Valley. Throughout the nineteenth century, estate lands were primarily used for sheep raising and horse breeding, with a limited area also used for viticulture.

Prior to the approval of the Mangoola Coal project, agriculture remained the primary land use in the vicinity of the modification areas and was associated with major land clearance for cultivation and creation of pastoral lands. Clearance of native vegetation results in significant increases in erosion, with heightened levels of erosion reflected in the downslope movement and subsequent redeposition of A horizon soils (and any archaeological deposits that they may have contained). This increase in soil movement has also affected the morphology of water courses in the area (as discussed in **Section 5.2**), thus impacting upon the preservation and visibility of any archaeological sites that may have been present along affected water courses. The nature of these water courses has further been altered through the creation of farm dams and contour drains. It is apparent that historical land use within the vicinity of the modification areas is likely to have resulted in significant disturbance within these areas, thereby reducing the likelihood that archaeological sites will remain present in an undisturbed context.

5.5 Summary

The review of the environmental context of the modification areas indicates that they would have been moderately well resourced prior to non-Aboriginal settlement, with the exception of water resources, given that all water courses associated with the modification areas are ephemeral in nature. Furthermore, it is likely that the modification areas have been affected by natural processes including general erosion. Modification Area 6 is also located in a geomorphic context subject to significant natural disturbance. These natural processes are likely to have been exacerbated by vegetation clearance and use of the areas for agricultural purposes. Thus, whilst the general environmental context of the modification areas is suitable for use by Aboriginal people, the lack of water resources may have limited the nature and extent of this use. In addition, both natural factors and the historical land use of these areas are likely to have significantly increased the likelihood that any Aboriginal sites that were present within these areas have been subject to significant disturbance.

6.0 Cultural Context

In order to understand the cultural context of the modification areas it is necessary to consider the available information relating to both the tangible and non-tangible aspects of Aboriginal use of the local area and the broader Hunter Valley region. Early historical documents regarding the Hunter Valley region provide some information about Aboriginal people living in the area at the time. The use of ethnohistorical records has a number of significant limitations but can be valuable in providing contextual information regarding the social aspects of Aboriginal life and other elements that may not be detectable from the archaeological record. This information can be used to supplement that provided by contemporary Aboriginal people. A review of currently available archaeological information relating to the Hunter Valley region and specifically the Wybong-Denman area provides information necessary to develop a model with which to predict the likelihood that Aboriginal archaeological sites may be present within the modification areas and to assess the significance of any such sites.

6.1 Ethno-historical Accounts

Historical accounts relating to Aboriginal people can provide information regarding the way in which Aboriginal people used the area prior to non-Aboriginal settlement. However, the limitations of these documents must be recognised. Colonial observers generally tended to record unusual rather than everyday events, religious and social life rather than economic activity, and men's behavior rather than that of women and children. Further, many early observations of the Aboriginal people in the Hunter Valley do not differentiate between Aboriginal groups from coastal rather than inland areas. Lastly, by the time the Upper Hunter was settled by non-Aboriginal people, introduced diseases had already had an impact on the Aboriginal population (refer to Butlin, 1982). Subsequent European settlement also resulted in significant population movement and massive social disruption and dislocation. As such, ethno-historical records are neither unbiased nor complete, and they cannot provide a complete understanding of Aboriginal beliefs and practices at the time of contact.

Published ethno-historic sources for the Central Lowlands of the Hunter Valley region are relatively rare, although information can be found in sources such as Breton (1833), Cunningham (1827), Curr (1887), Dawson (1830), Ebsworth (1826), Eyre (1859), Grant (1803), Howe (1819), Ridley (1864) and Sturt (1833). Secondary sources such as Blyton *et al.* (2004), Brayshaw (1986), Davidson and Lovell-Jones (1993) and Wood (1972) form the basis of the following discussion of the Aboriginal history of the upper Hunter Valley.

The Central Lowlands of the Hunter Valley is the country of the Wonnarua² people. Early European observers recorded the lives of the Wonnarua as intensely religious and constrained by strictly enforced laws (Ridley 1864 in Brayshaw 1986). The traditional lives of the ancestral Wonnarua focused on the Hunter Valley and were structured around a schedule of social interactions designed to take advantage of seasonal availability of resources; meaning that people moved often, but not at random. Before the arrival of non-Aboriginal people, it is likely that the Wonnarua lived in typically small groups of individual family units and bands that occasionally came together for religious and ceremonial functions (Davidson and Lovell-Jones, 1993:3). People travelled freely within the broad area of responsibility of their own group. Social responsibilities and obligations meant that people also travelled beyond their own territories to attend ceremonies with neighbours, to trade and to develop social networks that linked people across extensive areas. The Wonnarua are

² The Wonnarua have variously been called: Wanaruah, Wonaruah, Wanarua and Wonnah-Ruah. Wonnarua is the spelling which will be used in this report except where a direct quote from another source is cited.

recorded as having had social links from the coast to the western plains of NSW (Brayshaw 1986: 38-41).

There is little ethno-historical evidence about where Aboriginal people camped, however there is mention of the importance of fresh water and the suitability of a site as a vantage ground in the case of enemy attack (Fawcett 1898:152 in Brayshaw 1986:42). While camping at a particular site, people would travel each day through the surrounding country to gather plant foods and to hunt or to visit areas that provided other required resources (for example stone, ochre, bark and resin). The daily foraging area was generally within a day's walk of camp (usually within about 5 kilometres).

Brayshaw (1986:59) noted that of all raw materials available, bark appears to have been the most widely used and the most adaptable. Use of bark for huts, or 'gunyers' (as they were commonly referred to in historical sources) is well documented (for example, Caswell 1841 and Threlkeld in Gunson 1974:45). Breton (1833) and Eyre (1859) noted suitable trees were also available to provide bark for wooden implements such as shields.

Early historical reports describe the Hunter Valley as having extensive grasslands and floodplains with few trees (Breton 1833, Cunningham 1827, Howe 1819). These grasslands are thought to be the result of Aboriginal fire stick farming techniques, which involved continually burning the countryside. Fire stick farming served to both clear the undergrowth and promote regrowth, which in turn was attractive to animals and facilitated hunting (Davidson and Lovell-Jones, 1993:5). Fawcett (1898) refers to the use of fire by the Wonnarua and other early accounts (Cunningham 1827) also report the use of fire in the area.

Kangaroos, emus, possums and fish were recorded as plentiful (Breton 1833, Cunningham 1827, Dawson 1830), and mention was made of an abundance of food on the flatter ridges and plains that supported large populations of kangaroos (Cunningham 1827: 157). Early observations refer to hunted animal species, including kangaroos, wallabies and emus (Fawcett 1898:153), echidna (Fitzpatrick 1914:43 from Brayshaw 1986), goanna and native dogs (Dawson 1830:203), bandicoot (Ebsworth 1826:80), snakes (Threlkeld in Gunson 1974:55), flying foxes (Dawson 1830:309), possums (Dawson 1830:68) and larvae (Grant 1803:162-3). There is very little evidence regarding the place of birds in the Aboriginal diet, although there are references to the mutton bird hunted on Nobbys Island, and ducks, geese, swans and pigeons (Threlkeld in Gunson 1974:55). Hunting was frequently a group exercise although animals were sometimes speared by individual hunters.

Brayshaw (1986:83) described initiation ceremonies in the Hunter region as taking place in areas within one or two cleared circles, which were often 350 metres apart. Around the circles, the trees were carved and in some cases, figures of raised earth were created on the ground. Threlkeld (in Gunson 1974:63-66) indicated that red ochre was used on important ceremonial occasions, as well as for other purposes. Threlkeld refers to Aboriginal people obtaining red pigment for important ceremonial occasions from a 'volcano up the River Hunter'. This reddish earth was altered through a process involving wetting the earth, moulding it into balls and burning them in a strong fire.

Several forms of burial have been recorded in the Hunter Valley. Burial in the earth is most commonly mentioned, although the placement of the body could be varied including extended or flexed, face down, on its side or up (Brayshaw 1986:86). The use of bark as a burial shroud was widespread. There is some indication that burial practices varied between coastal and inland areas, with Threlkeld (in Gunson 1974:47,89,100) indicating that coastal burials were deliberately smoothed and scattered with branches to leave little indication of the burial on the surface. This contrasts with descriptions of inland burials (Breton 1833, Howitt 1904:446, Sturt 1833:14), where burials were usually marked with carved trees. A

description of the burial of four men and two women of the Kamilaroi tribe by Breton (1833:203-204) involved the individuals being covered with mounds of earth (instead of being placed in a hole) in the centre of a circle approximately 30 feet in diameter cleared of vegetation. Breton further notes that the trees for some distance were carved with figures representing kangaroos, emus, possums and weapons, some of which extended 20 feet above ground.

Most of the evidence for Aboriginal occupation in the Hunter Valley comes from stone implements, however there is little ethno-historical information regarding the production and use of stone implements. The only known mention is in regard to the use of quartz as a barb on spears and of the use of stone hatchets (Brayshaw 1986: 66, 68).

The arrival of non-Aboriginal people in the Hunter Valley began with the discovery of coal at Newcastle in 1797. By 1801 the Valley was reserved by the Crown as both a new convict settlement (a penal settlement was established in the Newcastle area in 1804) and for its resources in coal and timber (Davidson and Lovell-Jones, 1993:8). This reservation placed on the region by the Crown effectively restricted free settlement of the area. However by 1819 the demand for grazing land and land for rural settlement increased beyond the current bounds of the colony's free settlement area and in 1821 Henry Dangar was commissioned to undertake a survey of the Hunter area to assess its suitability for settlement and farming. Within months of Dangar reporting the Hunter Valley as suitable for settlement, claims for purchase and leasehold were being made from selectors in Sydney and by 1825 '...both sides of the Hunter River and associated brooks had been claimed' (Davidson and Lovell-Jones, 1993:8). The rapid settlement in the area disrupted the Aboriginal economy and, in a very short time, the Aboriginal population was substantially affected by a combination of starvation, introduced diseases, violent conflicts and massacres.

Documentary evidence suggests that by 1830 (only nineteen years after the first non-Aboriginal settlers arrived in the Hunter) 'all armed resistance by local Aborigines' had ceased (Davidson and Lovell-Jones, 1993:17) and the traditional use of the land by the Wonnarua and their social structure and interactions had dramatically been affected. However, there are also some accounts of cultural ceremonies being conducted decades later, such as a ceremony held at Bulga in 1852, noted by Blyton *et al.* (2004:9); and a ceremony held at the junction of the Page and Isis Rivers at Gundy reported in the 1870s (McDonald 1878:255-258). This indicates a retention and/or adaptation of prior cultural practices even within a context of massive cultural upheaval.

In the period following non-Aboriginal settlement, the Hunter Valley landscape has undergone radical changes, as demonstrated by the establishment of pastoral holdings, small towns and villages. Blyton *et al.* (2004:9) argued that the non-Aboriginal pattern of settlement and land use rapidly became the normative occupation pattern 'replacing traditional Aboriginal communities' (Blyton *et al.*, 2004:9). Davidson and Lovell-Jones (1993:17) also argued that shortly after non-Aboriginal settlement, the impacts on Aboriginal lifeways were such that the Wonnarua existed 'on the fringes of towns and on properties trying as best they could to survive in a European modified environment'.

The material culture of Aboriginal people also changed dramatically following contact, with the rapid influx of new technologies and materials. For example, Threlkeld (in Gunson 1974:54, 67) provides two examples of new technologies being utilised by Aboriginal people within the Lake Macquarie area, noting that bottle glass was replacing stone ('fragments of quartz') in Aboriginal weapons and that iron and glass were being used for fish hooks.

Non-Aboriginal settlement and encroachment on resources and traditional camping groups restricted Aboriginal occupation and dramatically affected Aboriginal communities, but it did not completely destroy connections to traditional camping grounds. There is a continuation

of cultural connection and in some cases occupation of these places that dates well into the twentieth century.

6.2 Archaeological Context

As discussed above, the review of current archaeological information for both the general Upper Hunter Valley region and the Wybong-Denman area is essential to the formation of a justifiable and reasoned predictive model for the modification areas. This section presents a review of such information.

6.2.1 Site Types

In accordance with the professional guidelines for archaeological report writing (NPWS 1997), site types that occur within the Wybong/Denman area and surrounding region are defined below.

Artefact Scatters and Isolated Finds

An artefact scatter refers to areas (in the open landscape, not in a rockshelter or cave), that contain two or more stone artefacts, generally located within 20 metres of each other. An isolated find consists of a single stone artefact. Stone artefacts are pieces of stone modified for, or by, human use. Stone artefacts are robust and may be preserved in the archaeological record when other forms of evidence of Aboriginal use of the area are lost due to preservation biases (wooden implements, food remains).

Artefact scatters may result from the activities of a single person or a group of people. They may reflect a single occupation episode, or multiple episodes of occupation of a single place. Isolated finds may represent lost or discarded artefacts, but may also be the surface expression of a larger scatter of artefacts in a subsurface context.

Scarred Trees

Aboriginal people often removed the bark from trees to make toe holds (to aid in climbing to extract honey or possums from tree hollows), bowls, shields, spear throwers, coolamons. Large sections of bark were also removed from trees in order to manufacture canoes or for roofing material for shelters as well as for various other uses.

Carved Trees

Other trees were carved with designs, which were used to mark ceremonial grounds and burials (Etheridge 1918:84; McBryde 1974:126). Designs were often carved on the wood of the trunk exposed by the removal of the bark, and designs could include geometric or linear patterns or animal representations.

Rockshelter Sites

The term 'rockshelter site' refers to rockshelters/rock overhangs that contain evidence such as stone artefacts, bones, plant remains (from meals eaten at the site) and/or hearths (fireplaces).

Engraving Site

The term 'engraving site' refers to places where Aboriginal people have incised (using techniques such as pecking or abrasion) some form of motif into rock. The engravings may be on a rock outcrop, rock slab, boulder, cliff-face, rock overhang, or in a cave or rockshelter. Engraving sites are not necessarily located in sheltered positions, but are most often located on softer rock types (like sandstone).

Grinding Grooves

Grinding grooves are grooves on rock surfaces that have been manufactured by the sharpening of stone axe heads, hatchets, stone chisels or fire hardened wooden spear points. Grinding grooves are commonly located on sandstone ledges that outcrop in creek and river beds, as the availability of water facilitates the grinding process. Less commonly, grinding grooves are located on rock surfaces away from water and on stone types other than sandstone.

Grinding Bowls

Grinding bowls are rounded depressions on rock surfaces that have been manufactured by the grinding of ochre, seeds, nuts and other plant resources. Grinding bowls are commonly located on sandstone ledges that outcrop in creek and river beds, as water is often added during the grinding process to form a paste. Less commonly, grinding bowls are located on rock surfaces away from water and on stone types other than sandstone.

Waterholes/Wells

These are generally natural rock waterholes that contain water used for drinking or for special ritual purposes. These holes may be made larger by grinding out the sides and base of the well and may be protected by placing large stones over the hole to keep out animals and to prevent the water from evaporating.

Stone Arrangements

Stone arrangements are locations where Aboriginal people deliberately positioned stones to form shapes or patterns, ranging from simple stone mounds to complex circles and pathways. The purpose of stone arrangements is not well understood. Stone arrangements are found throughout inland New South Wales as well as on the coast.

Stone Quarries

Stone quarries are places where Aboriginal people have extracted raw material for the manufacture of tools. Quarries may be cobble beds in rivers or on beaches, or they may be rock outcrops. When outcrops are exploited the quarrying activity may involve flaking stone from the outcrop itself or utilising material from an adjoining scree slope. In some areas the stone may be extracted from below the ground surface as Aboriginal stone knappers often preferred rock which had not been dried out by exposure to the elements (Tindale 1965: 140; Jones and White 1988:61-62).

Ochre Quarries

Ochre quarries are places where Aboriginal people sourced ochre (hydrated iron oxides and iron hydroxides - Whitten and Brooks 1972:269) which they used for body decoration, implement decoration and rock art.

Ceremonial Grounds

In the Hunter region the main type of ceremonial ground recorded is associated with the Bora ceremony. Bora grounds generally consisted of two earthen rings or two rings outlined with stones. The Bora ground was used during male initiation ceremonies (Fife 1995). However the literature suggests that generally only the viewing of the smaller of the two rings was restricted to initiated males (for a summary of the data recorded about Bora grounds see Fife 1995).

Burial Sites

Burial sites can be classified as pre- or post-contact. Pre-contact burial sites refer to Aboriginal skeletal material dating to a time before non-Aboriginal settlement. The skeletal material may be buried, interred in a cave/rockshelter/under a ledge, in a tree hollow, or exposed on a platform in a tree. Post-contact burial sites refer to burials/interments that have taken place since non-Aboriginal settlement and that are not located in a recognised cemetery and are not documented. If they are documented then they are considered Aboriginal historic sites and not Aboriginal archaeological sites.

Massacre Sites

This term refers to an area known to have been the location of an Aboriginal massacre based on Aboriginal oral history or from local history. Most Aboriginal massacres occurred during the early non-Aboriginal settlement period.

6.2.2 Regional Context

Ongoing archaeological investigations in the Hunter Valley have provided a basis for the development of predictive models of site distribution within this region. Several regional syntheses of archaeological data have been completed (refer to ERM 2004, Koettig 1990 and Hughes 1984). These studies have demonstrated that open artefact scatters are common throughout the Hunter Valley, with larger open sites (in terms of both artefact density and areal extent) generally located in proximity to large creeks that provided a more reliable source of potable water, with smaller open sites distributed through a variety of landforms including large and small creeks, slopes and crests (ERM 2004). As discussed in **Section 5.0**, the preservation and visibility of sites within the Hunter Valley is at least partially a factor of land use and disturbance, with the increased occurrence of erosion along creek lines and lower slopes resulting in increased visibility of sites within these contexts (Koettig 1991:19, Dean-Jones and Mitchell 1993).

The most common site type within the region is artefact scatters, which may be the result of a single activity event (such as the manufacture of a single stone tool) or may represent the accumulation of knapping debris and/or tools over multiple events that occurred at various chronological intervals. Taphonomic processes such as erosion and bioturbation can also conflate or separate artefact assemblages in both surface and subsurface contexts. The majority of artefact scatters in the Hunter Valley are palimpsests of artefactual material discarded over an unknown period of time and consequently assigning an age to these sites is problematic. Certain typological temporal markers such as backed blades (typically found in the Sydney Basin during the early to mid Holocene) and eloueras (found in assemblages securely dated to the last 1500 years) are present within Hunter Valley assemblages. However these provide only a gross indication of time scale and may only represent a single period of use of a site that contains non-chronologically distinct evidence resulting from deposition over multiple time periods. Based on the age of the upper (A unit) soils and the presence of backed artefacts, the majority of sites in the Hunter Valley are considered to date to the mid to late Holocene (between 6000-5000 years ago and the present). However,

Aboriginal occupation of the Hunter Valley undoubtedly occurred prior to the late Holocene, with late Pleistocene dates reported from Glennies Creek, Lemington and Warkworth West (Koettig 1987, Kuskie 2000, AMBS 2002, ERM 2004:15). The apparent paucity of Pleistocene sites is likely to be a reflection of site preservation rather than occupation patterns.

6.2.3 Local Archaeological Context

The archaeological context of the Wybong-Denman area was reviewed as part of previous archaeological investigations associated with Mangoola Coal Mine (refer to Umwelt 2006b, Umwelt 2008b). This information is incorporated into the discussion of local archaeological context provided below.

The AHIMS database lists all sites reported to DECCW, in accordance with Section 91 of the NPW Act. A series of searches of the AHIMS database were conducted to cover the area extending from AMG E272894-292894, N6411000-6433810. The searches identified a total of 203 AHIMS registered sites within the search area, of which 202 remain listed as valid. However, it is noted that an additional 63 of these sites have been salvaged under approval in accordance with the Mangoola Coal ACHMP (Umwelt 2008a). The AHIMS registered sites are shown in **Figure 6.1** and the results of the site searches are provided in greater detail in Table 1 of **Appendix B**.

During a review of AHIMS search results, three errors in recorded site locations were identified. **Table 6.1** lists the incorrect registered site locations for AHIMS sites 27-2-2252, 37-2-2298 and 37-2-2303, and presents the actual site locations as sourced from Umwelt (2006b). Also, it was noted that the coordinates for a number of sites previously recorded by Umwelt (2006b) are listed on the database with a GDA datum. These sites were provided to DECCW with an AGD datum. DECCW will be provided with the updated information to assist in maintaining the AHIMS database.

Table 6.1 - Incorrect AHIMS Site Locations

AHIMS#	Site Name	Registered Site Location		Actual Site Location	
		AMG (E)	AMG (N)	AMG (E)	AMG (N)
27-2-2252	AC12	282618	6423785	282180	6424000
37-2-2298	SC11	284617	6424961	284517	6424961
37-2-2303	WC33	278785	6422344	278785	6422332

A series of sites (AH1-3, EWA1-19, Drilling Sites C, D, G and U, Clarks Gully Site and Big Flat Creek site) were recorded during previous archaeological investigations (refer to **Section 6.2.3.4** and **6.2.3.5** and Table 2 of **Appendix B**) but were not included on the information received from the AHIMS database. Umwelt (2006b) reasoned that, given the proximity of these sites to AHIMS sites #37-2-0509 and #37-2-0510 (refer to **Figure 6.1**), it was likely that the majority of these sites (excluding EWA1 and EWA19) were not distinct from previous recordings. Nineteen of these sites have been subject to salvage in accordance with the Mangoola Coal ACHMP (Umwelt 2008a).

The searches of the AHIMS databases did not identify a number of sites previously recorded and registered by Umwelt within the search area. These 71 sites are listed in Table 3 of **Appendix B** and illustrated in **Figure 6.1**.

When all of this information is combined, a total of 301 archaeological sites are known to occur within the search area. These sites consist of 167 artefact scatters, 112 isolated finds,

FIGURE 6.1
Location of
Previously Recorded Sites

18 rockshelters with PAD, one burial, one carved tree, one PAD and one scarred tree. One of these sites (MR-OS-1) is recorded as having been destroyed under consent, whilst an additional 125 have been salvaged under approval and in accordance with the Mangoola Coal ACHMP (Umwelt 2008a). Of the recorded sites, two sites (SC03 and SC010 – incorporating 37-2-0511, 37-2-0512 and 37-2-0513) are recorded in proximity to Modification Area 3 and SC04 is located approximately 100 metres north-west of Modification Area 6. No recorded sites are in proximity to the other modification areas (refer to **Figure 6.1**).

The majority of these sites have been identified as result of archaeological investigations associated with proposed or approved development activities. As detailed in **Table 6.2**, a significant amount of archaeological investigation has been conducted in the Wybong/Denman area for the Anvil Hill (now Mangoola) Coal Mine project, with some smaller projects also conducted in Denman, Sandy Hollow and Castle Rock areas. Archaeological investigations have predominantly involved survey, although some subsurface investigations have also been conducted (refer to Umwelt in prep a and b). These include site AC13 (refer to **Section 6.2.3.7**) and excavations on the Hunter River PAD (in prep refer to **Section 6.2.3.11**).

Table 6.2 – Previous Archaeological Investigations

Author	Date	Locality	Investigation		Recorded Sites
			Type	Area (ha)	
Silcox	1984	Anvil Hill	Survey	NA	5
Wright	1996	Denman	NA	NA	1
Umwelt	1999	Anvil Hill	Survey	2.5	4
Perry	2000	Denman	Survey	100	6
Russell	2002	Anvil Hill	Survey	NA	3
Witter	2002	Anvil Hill	Survey	14	9
ERM	2004	Upper Hunter Valley	Desktop review	NA	NA
Umwelt	2006	Wybong/Denman/Anvil Hill	Survey	3316	195
Umwelt	2008	Area of the pipeline survey	Survey	NA	10
Umwelt	2008	Denman to Mangoola Coal's disturbance boundary	Survey	26	12
Umwelt	2008	Mangoola Coal approved project disturbance boundary	Surface collection, subsurface testing, manual excavation and grader scrapes	2238	69
Umwelt	2009	Hunter River PAD subsurface investigation	Subsurface testing	NA	0

The results of each investigation are summarised below, with particular focus on assessments of the broader Mangoola Coal project area that provide the baseline understanding of site patterning, archaeological potential and significance for the Wybong/Denman area.

6.2.3.1 Archaeological Survey for Transmission Line (Silcox, 1984)

Silcox was commissioned to undertake an archaeological survey along the route of a proposed transmission line from Bayswater to Mount Piper. Silcox's study located and recorded five artefact scatters: one near Big Flat Creek, one near Clarks Gully and three sites (registered as AHIMS sites 37-2-0511, 37-2-0512 and 37-2-0513) in a cluster adjacent

to Modification Area 3 (refer to **Figure 6.1**). All of the sites were within 50 metres of the nearest watercourse. The dominant artefact types were flakes and flaked pieces. The dominant raw material used for artefact manufacture was indurated mudstone. This report could not be located in the DECCW AHIMS library and the information provided in this section was derived from Ruig (1993).

6.2.3.2 Report on Human Skeletal Remains from Denman (Wright 1996)

Due to the sensitive nature of this report it is not available to the general public in the AHIMS library, and the following information is sourced solely from the AHIMS site card (#37-2-0107). The burial site is positioned approximately 2 kilometres west of the Denman substation on Crown Land in a small cave formed in sandstone conglomerate. The cave opening is approximately 1 metre wide, leading to a small cave approximately 2 metres long. In 1981, an excavation was conducted by the Denman police and NPWS and resulted in the recovery of human skeletal material (ribs and limb bones) from the cave. The remains were subsequently transferred to Sydney for forensic analysis. The AHIMS site card includes a recommendation that the remains be returned to the site and that the cave be protected against animal movement, but it is unknown whether these works were carried out.

6.2.3.3 Anvil Hill Exploration Project Assessment of Potential Impacts on Aboriginal Archaeological Material at Exploration Drilling Sites (Umwelt 1999)

In April 1999, Powercoal Pty Ltd commissioned Umwelt to provide advice regarding the potential for a proposed exploration drilling program to impact on Aboriginal sites. The objective was to identify drilling sites that would not be constrained by Aboriginal archaeological material. A total of 28 drilling sites were inspected and four of these contained archaeological sites, with sites recorded along creeks and two recorded on hillslopes (200 and 250 metres from Wybong Creek). Artefact types recorded were cores, flakes (including blade flakes) and flaked pieces, manufactured on indurated mudstone, green siliceous material, quartz, silcrete, silicified conglomerate and quartzite. All stone artefactual material found was assessed as being of low archaeological significance.

6.2.3.4 Survey for Exploratory Bore Holes, Anvil Hill (Russell 2002)

Russell (2002) surveyed eight proposed drilling lines as part of the preliminary stages of the Anvil Hill Exploration Program, to identify any archaeological constraints affecting drilling works. The survey identified three archaeological sites, being an isolated find (a mudstone core) and two artefact scatters containing mudstone and silcrete flakes, flaked pieces and a silcrete core. One of these sites (AH-1) was associated with an area of PAD which ran parallel to Anvil Creek and lay within the impact area. Russell recommended an alternative drilling line that would not impact any identified sites or the PAD.

6.2.3.5 Great Northern Coal Project Bulk Sample Pit, Archaeological Survey (Witter 2002)

Witter (2002) conducted an archaeological survey for the Great Northern Coal Project, for inclusion in a Statement of Environmental Effects. The area surveyed is now within the approved project disturbance area. The survey retraced an area covered by Aiken (1985), although the area was surveyed in greater detail and artefact scatters were defined and grouped into larger sites. As a result, nine sites containing a total of 144 artefacts were identified, being four artefact scatters and five isolated finds. The three largest sites identified were:

- Anvil Vale, which contained 79 artefacts on a creek terrace/pasture and included site #37-2-0509;
- Big Flat Creek, which contained 24 artefacts on a creek/pasture and included site #37-2-0510; and
- Clarks Gully, which contained 31 artefacts on tributary flats, pasture and woodland.

Recorded sites were mainly low density concentrations consisting predominantly of what Witter described as debitage. Other artefact types recorded at these sites in small numbers include cores, some tools, including a snapped microconvex ('thumbnail') made on a blade, a large quartzite axe preform, a broken quartzite hammerstone, a burin and a flake tool with a serrated edge. Witter (2002:33) believed some microblade technology took place at the Anvil Vale site albeit of a minor nature, and also possibly at the Clarks Gully site. Tuff (mudstone) was the dominant raw material at all three of the largest sites, however the Anvil Vale and nearby Big Flat Creek sites contained greater quantities of artefacts without cortex, whereas artefacts bearing cortex were more common at the Clarks Gully site (Witter 2002:30). Other material types found at these sites include quartz, silcrete and an orange chert.

Witter discussed two other sites of interest beyond the larger site groupings. One was described as a small microblade workshop (EWA 19) located in a small scald of the valley bottom north of Big Flat Creek. This site is isolated and consisted of five silcrete flakes, four of which were blades. Witter suggested that the site may represent a 'quick repair event' servicing backed blade tools when away from the camp. In addition, there was a small elouera of orange chert which was found on the footslope below Anvil Hill; this was assessed as an uncommon and interesting artefact type manufactured from unusual stone material. It was described as part of a hafted flake tool and had probably been transported extensively.

None of the sites found during the course of Witter's survey were assessed as having exceptional educational or aesthetic importance. Nonetheless some of the individual artefacts were seen to represent a high quality of craftsmanship and had aesthetic value, such as the axe preform, the broken hammerstone, microblade core, burren, microconvex, and the isolated orange chert elouera. The Aboriginal stakeholders involved placed a similar aesthetic importance on these artefacts.

6.2.3.6 Aboriginal Archaeological Assessment - Anvil Hill Project (Umwelt 2006b)

In 2006, Umwelt undertook extensive survey of the Mangoola area for the Anvil Hill Project Environmental Assessment. Survey included areas proposed for open cut mining and potential cultural heritage offset areas. The survey identified 173 Aboriginal sites, including artefact scatters (88), isolated finds (69) and rockshelters with deposit and PAD (16). Of these sites, 69 were located in the Proposed Disturbance Area, 98 were located in the Proposed Offset Areas (including all rockshelter sites), and 6 were in areas that were not to be impacted.

Of the 173 sites located, 91 were recorded on creek banks and adjacent footslopes, 17 were in modified landscapes, 17 were found on mid-slopes, and lesser numbers were found on scree slopes, floodplains, saddle ridgelines, spur crests, lower slopes, upper slopes, confluence-creek terraces, spur saddles, creek beds and secondary spurs. Rockshelters were confined to upper slopes and ridge lines in areas of rock outcrop throughout the Wallaby Rocks, Western Rocks and Limb of Addy Hill regions to the west of Mangoola Coal's approved disturbance boundary. The majority of sites (98 of 173 sites) were found within 30 metres of a watercourse, but sites were recorded beyond 200 metres from water. The majority of sites (144 of 173) contained less than 10 artefacts, and only 7 sites contained

more than 50 artefacts and of these, only three contained more than 100 artefacts. These sites are AC13, SC10 and WC21. Of sites recorded, 14 were identified within the Sandy Creek catchment area, being 8 artefact scatters and 6 isolated finds. Of these sites, 13 of 14 were recorded adjacent to the Sandy Creek floodplain, creek bank or footslope landforms. Similarly, a number of sites (n=48) were recorded throughout Big Flat Creek area and within the existing ACHOA area. These sites consist of 18 isolated finds and 30 artefact scatters. A total of 35 of the 48 sites were located within 30 metres of natural water corridors (i.e. Big Flat Creek and associated drainage lines) while the remaining 13 sites were recorded on midslopes, scree slopes or modified landforms (refer to **Figure 6.1**).

The dominant artefact types within all sites were flakes (including retouched), followed by broken flakes and cores. The most common raw material was mudstone, with silcrete also occurring relatively frequently. Petrified wood and basalt were also present.

Umwelt (2006b) stated that survey results for the Mangoola Coal project area provide evidence of repeated use of the area by small groups of people over a long period of time, primarily in relation to reliable watercourses. The highest concentrations of artefacts and sites were recorded at creek confluences or in areas associated with former chains of ponds. The rockshelter sites on Anvil Hill, Limb of Addy Hill, Western Rocks and Wallaby Rocks, and the sites that are not in proximity to reliable water have minimal evidence of Aboriginal occupation. Umwelt (2006b) also noted that a relatively diverse number of fauna species hunted by Aboriginal people are present in the region, suggesting that the whole of the area would have been used for hunting with different areas targeted at different times in order to target specific resources.

The archaeological sites recorded were assessed by the Aboriginal stakeholder groups as having Aboriginal heritage value. The majority of sites were assessed to be of low archaeological significance (145) with 8 sites being of low to moderate significance, 5 of moderate significance, 4 of moderate to high significance and 11 sites of high archaeological significance. Sites assigned moderate to high or high significance were AC13, AC38, AC42, BFC12, CG01, CG10, WC02, WC05, WC21, WC25, WC26, WC27, WC43, WC45, WC46, WC47.

6.2.3.7 Mangoola Coal Aboriginal Archaeological Salvage Program Report (Umwelt in prep a)

The salvage program consisted of the following:

- surface collection of 103 sites within the approved project disturbance area (or which extended across the project disturbance boundary);
- grader scrapes of 29 sites within the approved project disturbance area;
- geomorphological investigation of site AC13 and Clarks Gully;
- test pitting within site AC13;
- manual salvage of site AC13 for archaeological and cultural purposes; and
- salvage of Scarred Tree site SC-ST-01 and its relocation into the SC10 Management Zone.

All salvaged artefacts from the approved project disturbance area will be deposited within the SC10 Management Zone when post-excavation analysis is completed.

6.2.3.8 Proposed 66 kV Transmission Line, Denman to Mangoola Coal Mine (Umwelt 2009a)

The survey inspected 100 per cent of a proposed 66 kV transmission line easement located outside the approved project disturbance area that covered a total area of approximately 26 hectares. The survey identified 12 Aboriginal archaeological sites, being eight isolated finds and four artefact scatters. The largest artefact scatter (SC48) contained approximately 500 artefacts, followed by SC47 which contained 26 artefacts. The remaining artefact scatters contained only two artefacts each. The dominant raw material observed was mudstone, with lesser quantities of silcrete, tuff, fine grained siliceous, quartz and chalcedony. Artefacts observed were predominantly flakes and broken flakes, with lesser numbers of cores, retouched flakes, flaked pieces and blades. A high level of artefact breakage was observed at all recorded sites and many artefacts were heat affected.

Two areas of high archaeological potential were also identified along the easement. Area #1 contains sites SC47 and SC48, two tributaries of Sandy Creek and the surrounding floodplain. Area #2 contains site SC53, one tributary of Sandy Creek and the surrounding hillslopes. Beyond these areas, the easement area was considered to be of low archaeological potential, as a significant proportion of the easement was within the easements of the Golden Highway and Mangoola Road, and the remaining area of the 66 kV easement to the north of Bells Lane has been affected by vegetation clearance, stock grazing and earthworks to construct dams and levees. The recommendations provided by Umwelt (2009a) in relation to specific sites are summarised in **Table 6.3** below.

Table 6.3 – Summary of Recommendations (Umwelt 2009a)

Site/Area	Site Type	Temporary Fencing	Surface Artefact Collection	Testing/ Salvage	Artefact Management
SC44	Isolated Find	✓			
SC45	Isolated Find	✓			
SC46	Isolated Find	✓			
SC47	Artefact Scatter	✓			
SC48	Artefact Scatter	✓	✓	✓	✓
SC49	Isolated Find	✓			
SC50	Isolated Find	✓			
SC51	Artefact Scatter	✓			
SC52	Isolated Find	✓			
SC53	Isolated Find	✓			
SC54	Isolated Find	✓			
SC55	Isolated Find	✓			
Area #1	Area of Archaeological Potential	✓	✓	✓	✓
Area #2	Area of Archaeological Potential	✓			

6.2.3.9 Modification for Mangoola Coal Pipeline (Umwelt 2008c)

As noted in **Section 1.0**, the Mangoola Coal project approval was modified (PA 06_0014_Mod 2) in June 2009 to include the construction of a pump station on the bank of the Hunter River and a pipeline from the pump station across the flat terrain of the valley fill associated with the Hunter River. Prior to the approval of this modification, an Aboriginal archaeological assessment was conducted of the area to be impacted by the pump station and pipeline (referred to as the impact area).

No Aboriginal archaeological material was identified during surveys of the section of impact area located on the Hunter River alluvium. However, it was considered possible that archaeological material could be present at depth, given the proximity of the corridor to the Hunter River and the associated reliable water supplies.

The proposed water pipeline survey covered all of the impact area that was accessible and not covered in dense, impenetrable vegetation. Known artefact scatter SC03 was inspected and confirmed to extend into the impact area. An additional 10 new sites (six isolated finds and four artefact scatters) were identified in the impact area. These sites and their management were assessed by Aboriginal stakeholder groups as part of the ACHMP for Mangoola Coal (Umwelt 2008a).

One Potential Archaeological Deposit (PAD) was identified within the floodplain and alluvial terrace of the Hunter River. The assessment of the area as a PAD was based on previous archaeological research, Aboriginal stakeholder group comments and geomorphic assessment. The floodplain of Sandy Creek was not assessed as PAD due to the dynamic nature of the floodplain and the extent of disturbance to this area. It was assessed that within the impact area, overlapping alluvial/colluvial sequences that may retain archaeological material in a stratigraphic context, were not present.

Management and mitigation activities associated with the majority of sites within the impact area involved surface collection in accordance with the Mangoola Coal ACHMP. In addition, it was recommended that SC03 be subject to surface collection in accordance with the same methodology and that geomorphic testing should be conducted within the Hunter River PAD. These works were subsequently conducted in September 2009 (refer to **Section 6.2.3.10**).

6.2.3.10 Aboriginal Cultural Heritage and Archaeological Assessment - Proposed Relocation of Electricity Transmission Line, Mangoola Coal (Umwelt in prep b)

An Aboriginal Cultural Heritage and Archaeological Assessment was conducted in relation to the proposed relocation of a TransGrid-owned and managed 500 kV electricity transmission line (ETL) in association with Mangoola Coal Mine. The assessment included the survey along the easement of an 11 kilometre section of relocated ETL. The survey focused on the approximately half of this easement that is located outside the approved project disturbance area, and the locations where existing ETL towers require removal and are within an Aboriginal Cultural Heritage Offset Area (ACHOA)/Management Zone. It also includes a survey of part of a conceptual Habitat Enhancement Area adjoining the approved project disturbance area to the north. A total of 22 new sites were identified and one previously recorded site (BFC49) could not be located. The majority of sites were associated with minor tributaries of Sandy Creek or Big Flat Creek. Two sites were assessed as being of low-moderate archaeological significance, one of moderate archaeological significance and the remaining sites were all of low archaeological significance.

No impacts to the identified sites were necessary as a result of the proposed activities. It was therefore recommended that the sites within Mangoola Coal's landholdings be managed

in accordance with the Mangoola Coal ACHMP (Umwelt 2008a) and that the remaining sites (which are located within an easement for which TransGrid is responsible) should be managed generally in accordance with the Mangoola Coal ACHMP (Umwelt 2008a) with sites demarcated (e.g. fencing) and included in TransGrid's ongoing easement maintenance plans.

6.2.3.11 Salvage Program on the Hunter River PAD and surface collection of SC03 (Umwelt in prep c)

Excavations were conducted within the Hunter River PAD as a result of the recommendations put forward by the Aboriginal stakeholders in relation to the assessment described in **Section 6.2.3.8** (Umwelt 2008c). Excavations within the Hunter River PAD consisted of three 3 metre by 1 metre trenches that were mechanically excavated in three distinct landforms (refer to Umwelt in prep c).

- Trench 1 was located at the pump station site, on the bank of the river and on a recently abandoned floodplain surface.
- Trench 2 was located on the eastern margin of the low terrace unit, approximately 150 metres from the Hunter River.
- Trench 3 was located on the extensive flat valley fill associated with the Hunter River, but some 500 metres from the current river course. This location is also at least 200 metres from the nearest hillslope/footslope terrain and would receive limited colluvial run on.

No archaeological material was recovered during the excavations (Umwelt in prep c).

In accordance with the recommendations provided by Umwelt (2008c) and endorsed by the relevant Aboriginal stakeholder groups and DECCW, a surface collection was also conducted at SC03 in accordance with the methodology approved under the Mangoola ACHMP (2008a). SC03 was resurveyed by archaeologists and Aboriginal stakeholders and all artefacts within the area were flagged. Based on this distribution, four additional loci were identified. The artefacts were then photographed and a GPS coordinate was taken at each loci. The artefacts were collected and placed into bags. The collection of SC03 and subsequent post-excavation artefact analysis will be detailed in Umwelt (in prep c).

7.0 Predictive Model

Predictive models are developed to provide an indication of the likely distribution, content, integrity and type of sites within an area. Importantly, predictive models also suggest what site types are not likely to be found in a particular area. A predictive model was developed by Umwelt (2006b) for the approved project disturbance boundary and associated ACHOAs and the SC10 Management Zone. This model was refined following extensive survey and has been further refined on the basis of the specific landscape context of the modification areas. The predictive model for the modification areas is provided below.

- Artefact scatters and isolated finds are the most likely site type.
- Scarred or carved trees are unlikely to occur due to extensive historic tree clearance and natural factors such as bushfires. Sites of this type may only be present where mature trees remain extant.
- Site types associated with sandstone outcrops or other geological resources (such as ochre) are unlikely to occur as the geology and topography of the modification areas are not suitable. It is possible that pebbles eroding from conglomerate soils occurring within the local area may have been used to manufacture stone artefacts but the use of such pebbles would not leave any recognisable evidence of quarrying.
- Stone arrangements and ceremonial grounds are rare site types that are particularly susceptible to disturbance or destruction as a result of land clearance and agricultural practices. As discussed in **Section 5.4**, the modification areas have been cleared and used for agricultural purposes and therefore it is unlikely that stone arrangements or ceremonial grounds will be present in these areas.
- The modification areas do not include contexts such as rockshelters or deep sandy deposits that are typically associated with burials. Deep alluvial deposits are present in association with Sandy Creek, however the extent of natural and anthropogenic changes to the Sandy Creek floodplain dictates that if burials were present in this context, they are unlikely to remain extant.
- Post-contact sites such as missions, reserves and massacre sites are considered unlikely to occur within the modification areas as these sites are not referred to in any ethno-historical or historical literature.
- Artefact scatters will typically contain less than 10 artefacts, will rarely exceed 50 artefacts and will generally have low artefact densities. Artefacts will most commonly be made from indurated mudstone followed by silcrete, with other raw materials present in smaller quantities. The majority of artefacts will be flakes and flaked pieces followed by cores and retouched flakes.
- Sites present within the modification areas are likely to have been disturbed to varying extents by natural and anthropogenic factors including geomorphic changes, erosion and agricultural land use. These activities are likely to have negatively impacted on the archaeological integrity of any sites that may be present.

8.0 Survey Strategy and Methodology

The aims and objectives of the archaeological survey of the modification areas were defined as:

- the need to inspect all of the modification areas, with a focus on ground surfaces with higher archaeological visibility such as exposures and scalds;
- the need to inspect any mature trees for evidence of Aboriginal scarring, any stone outcrops for evidence of extraction, and any sandstone bedrock for evidence of grinding grooves (where applicable);
- the need to inspect any areas specifically requested by the Aboriginal stakeholder groups because the area may have cultural heritage values; and
- the need to record any cultural knowledge or stories and information about the cultural heritage values of the modification areas supplied by the Aboriginal stakeholder groups.

As the modification areas are relatively small, it was considered achievable for the modification areas to be surveyed in their entirety by six or more Aboriginal stakeholders and two archaeologists.

During the survey, data was recorded using a hand-held GPS, maps, a compass and standardised field recording forms. Information recorded during the survey included:

- the nature of the landforms and vegetation;
- the nature of drainage lines and the effects of erosion on bank stability and surface exposure;
- the effects of erosion and disturbance on the area as a whole;
- the availability of Aboriginal resources;
- the level of exposure and visibility within each modification area;
- any archaeological sites present (in accordance with DECCW standards and requirements);
- the likelihood that PADs may be present in the modification areas (refer to the definition of PAD provided in **Section 8.1**); and
- any information provided by Aboriginal stakeholders regarding the cultural significance of the modification areas.

Visibility was recorded in terms of the percentage of the ground surface upon which artefacts may be sighted. Exposure was recorded as areas within which disturbance has partially or wholly removed the upper soil layer to permit the detection of artefacts (if any) that were formerly located in a subsurface context (NSW NPWS 1997:18). Areas of exposure were recorded in terms of their dimensions and the level of visibility within the exposure. In accordance with NPWS's Cultural Heritage Guidelines (NSW NPWS 1997), effective coverage was calculated by multiplying the area of exposure by the percentage of visibility. Effective coverage was then expressed as a percentage of each landform within the modification area and the modification area as a whole.

At the end of each survey day, Umwelt archaeologists and Aboriginal stakeholder representatives discussed survey areas and results, to provide opportunity for Aboriginal stakeholders to comment on cultural significance and appropriate management outcomes (in addition to discussions during each day).

8.1 Definition of PAD

As discussed above, each of the modification areas was assessed in terms of whether it contained any areas of PAD. PAD can be defined in a number of different ways. However, the primary archaeological importance of subsurface deposits is the possibility that they will provide information that can be used to interpret changes in the archaeological record through time and space. Consequently, for the purposes of this assessment, the term PAD refers to sites that may or may not retain stratigraphic or spatial integrity but that are predicted to contain artefacts in a subsurface context that may, by controlled salvage and analysis, add to the knowledge of Aboriginal use of the landscape or resource base of an area in a more general sense. Generally, this description refers to sites or defined areas that are likely to contain enough artefacts to allow for statistically viable detailed analysis and comparison of the artefact assemblage both within and between sites and/or sites or defined areas that are likely to contain materials that can be dated, either in relative or absolute terms.

Previous archaeological research reveals that areas within 50 metres of higher order creeklines that contain relatively reliable fresh water are the most likely landforms to meet the criteria outlined above, depending on previous impacts to the area.

9.0 Survey Results

The survey was conducted on 1 and 2 September 2009. **Table 9.1** lists the survey participants.

Table 9.1 – Survey Participants

Survey Date	Group	Representative
01/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Wonnarua Culture Heritage Culturally Aware Upper Hunter Wonnarua Council Incorporated Umwelt	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Todd Maley Paulette Ryan Georgia Berry Nicola Roche Kym McNamara
02/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Wonnarua Culture Heritage Culturally Aware Upper Hunter Wonnarua Council Incorporated Umwelt	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Todd Maley Paulette Ryan Georgina Berry Nicola Roche Kym McNamara

Each of the modification areas was surveyed separately and a summary of the recorded data for each modification area is provided in **Table 9.2**.

Table 9.2 – Survey Data Summary

Modification Area #	Landforms	Area (m ²)	Description
1	Lower slope (14,000 m²) Mid slope (34,000 m²) Upper slope (11,000 m²) Crest (27,000 m²)	86,000	Disturbance factors include a gravel extraction area and associated access track, additional access tracks and vegetation clearance. Modification Area 1 contains two very minor depressions that may briefly hold water during periods of rainfall. The area is currently vegetated by pasture grasses, native grasses, weeds, regrowth and mature red gums on the slopes and ironbark, lomandra and higher quantities of native grasses on the level crest. Ground surface visibility was approximately 1% throughout the area, with the exception of the crest landform, where visibility was approximately 20%. Eleven discrete areas of exposure were recorded. Soils on the crest and immediately adjoining slopes consisted of decomposed sandstone and gravels, with soils on all other landforms consisting of a mid brown fine sandy loam. Sandstone and conglomerate gravels are exposed along the crest. No sites were recorded in this area.
2	Minor drainage line (5700 m²) Lower slope (11,300 m²)	17,000	Modification Area 2 is centred on a heavily eroded minor drainage line that is bordered by lower slopes of gentle inclination (1-2 degree inclination) on the eastern side and moderate (>3 degree inclination) on the western side. Gullying and sheetwash erosion along the drainage line and adjoining slopes has resulted in a high level of disturbance. The area is currently vegetated by weeds, native grasses and ironbark regrowth, with some bulrushes present within the drainage line. Ground surface visibility was approximately 1%. Five discrete areas of exposure resulting from erosion along the drainage line were recorded. Soils consisted of a bleached light grey brown fine loam (A₂ horizon), overlying a mid yellow brown loamy clay with a high gravel content (B horizon), with sandstone exposed in some areas, particularly within the drainage line. Site SC-ST-02 is a scarred tree on the slope above the drainage line. Site SC59 was recorded in an area of exposure bordering the drainage line.

Table 9.2 – Survey Data Summary (cont)

Modification Area #	Landforms	Area (m ²)	Description
3	Lower slope (>1 degree westerly aspect)	2399	Disturbance factors include Coolibah Road (graded and surfaced with imported fill), land clearance, fencing for SC10 Management Zone, use for agricultural purposes. Modification Area 3 is highly disturbed. Modification Area 3 is bordered by a tributary of Sandy Creek. The area has been cleared and is currently vegetated by pasture grasses, weeds and native grasses. Ground surface visibility was 5%. Two discrete areas of sheetwash erosion exposure were identified. Soils consisted of a mid grey-brown fine sandy loam (A₂ horizon). Four additional loci of SC03 were recorded in association with the survey of Modification Area 3.
4	Drainage line (1200 m ²) Lower slope (2440 m ²)	3640	Disturbance factors include erosion along drainage line (sheetwash), vegetation clearance, cultivation of surrounding areas. Modification Area 4 is centred on a lightly incised first order drainage line. The drainage line is currently grassed over. A felled tree blocks the drainage line but no sediment has built up behind the tree, indicating that the drainage line has been inactive for some time. Although the drainage line is currently inactive, the area is likely to have been significantly affected by prior erosion. The area has been cleared and is currently vegetated by pasture grass, weeds and some native grasses. Ground surface visibility was 2-3%. Two areas of discrete exposure were recorded. Soils consisted of light yellow brown sandy clay loam (A₂ horizon) thinly overlying a mid yellow brown loamy clay with a high gravel content (B horizon). Site SC58 was recorded in an area of sheetwash erosion on the drainage line.

Table 9.2 – Survey Data Summary (cont)

Modification Area #	Landforms	Area (m ²)	Description
5	Lower slope (1-2 degree south-westerly aspect)	3765	Disturbance factors include excavation of a channel (leading to dam outside survey area) and contour banks (bordering survey area), both of which extend from west to east across the survey area. The area has been cleared and used for agricultural purposes. Modification Area 5 is highly disturbed No watercourses are present in Modification Area 5 but it is bordered by some minor drainage lines leading to Sandy Creek. The main channel of Sandy Creek is approximately 700 metres south-west. The area has been cleared and is currently vegetated by pasture grass, weeds and African boxthorn. Ground surface visibility was approximately 5%. One discrete area of exposure was recorded. Soils consist of a mid red-brown fine sandy loam with frequent sandstone inclusions (A₂ horizon). No sites were recorded.
6	Floodplain (Sandy Creek/Hunter River)	6343	Disturbance factors include a pump and associated soil stockpile immediately to the north-east of Modification Area 6. Modification Area 6 has been cleared and cultivated. No watercourses are present in the area. The main channel of Sandy Creek is approximately 700 metres north-west of Modification Area 6 and the Hunter River is approximately 1.5 kilometres south-east. The area has been cleared and is currently vegetated by pasture grasses and weeds. Ground surface visibility was 1%. One discrete area of exposure was recorded. Soils consisted of a mid brown fine sandy clay loam (A₂ horizon). No sites were recorded.

Table 9.3 provides information on general visibility, levels of exposure and the level of effective coverage for each landform unit within the modification areas (refer to **Appendix C**).

Table 9.3 – Effective Coverage

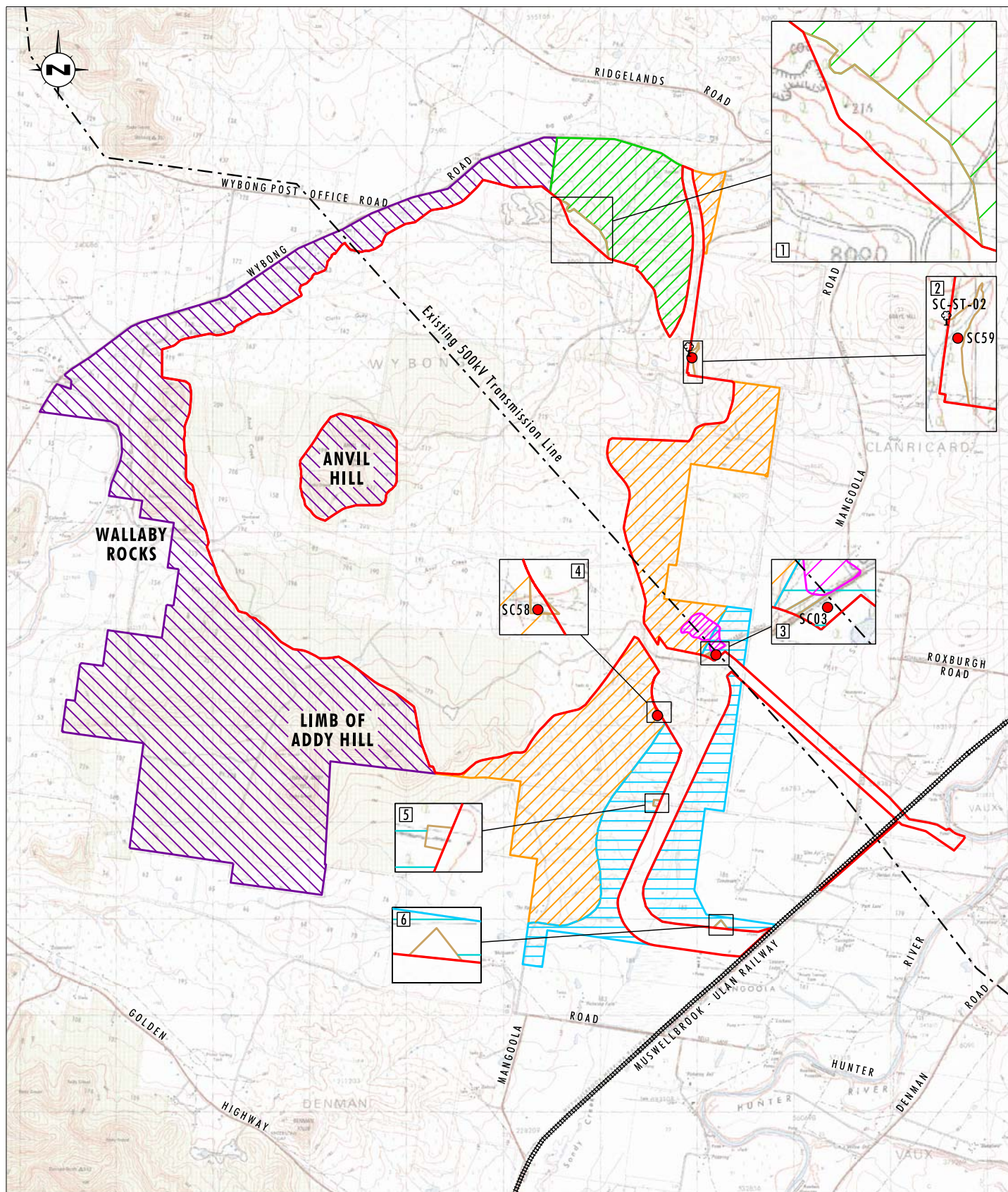
Modification Area	Landform Element	Area of Landform Element (m ²)	General Visibility (%)	Areas of Exposure Area (m ²)	Effective Coverage (m ²)	Effective Coverage (%)
1	Slope	59000	1	3230	1686	2.9
	Crest	27000	1	3500	2100	7.8
Total (1)		86000		6730	3786	4.4
2	Drainage Line	5700	1	1925	1035	18.2
	Slope	11300	1	2	1.6	0.0
Total (2)		17000		1927	1036.6	6.1
3	Slope	2399	5	260	83	3.5
4	Drainage Line	3640	3	260	168	4.6
5	Slope	3765	5	280	84	2.2
6	Floodplain	6343	1	1	0.85	0.0

As shown in **Table 9.3**, general visibility within the modification areas was poor and did not exceed 5 per cent within any landform element. This is largely a reflection of heavy vegetation coverage, with areas of enhanced visibility present in association with areas of exposure. Areas of exposure were most commonly associated with drainage lines, other areas of erosion and areas of disturbance such as the former quarry in Modification Area 1. The level of effective coverage within all modification areas was low, particularly in Modification Area 6.

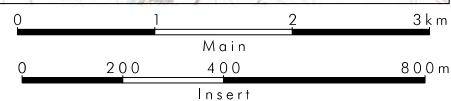
9.1 Recorded Archaeological Sites

Archaeological sites recorded within the modification areas were numbered sequentially following previously recorded archaeological sites within the Wybong-Denman area (Umwelt 2006b, Umwelt 2008a, Umwelt 2008b, Umwelt 2008c, Umwelt in prep b). The first two letters represent the catchment area (i.e. Sandy Creek SC, Big Flat Creek BFC or SC/BFC-ST for scarred trees), and the number carries on from the last site number recorded within that catchment area.

A total of four sites were identified and consisted of three artefact scatters (one in each of Modification Areas 2-4) and one scarred tree in the vicinity of Modification Area 2 (with this location subsequently determined to be outside the area to be impacted within Modification Area 2). It is noted that site SC03 (within Modification Area 3) was previously recorded and has been subject to salvage in accordance with recommendations provided by Umwelt (2008c) and endorsed by the relevant Aboriginal stakeholder groups and DECCW. **Table 9.4** provides a summary of key information for each site, including location, environmental content and site condition at the time of recording. Detailed site descriptions are also provided and the location of all recorded sites is illustrated on **Figure 9.1**. AHIMS site cards for all sites will be submitted to DECCW in accordance with Section 91 of the NPW Act 1974 and were provided to the relevant Aboriginal stakeholders for their records.



Source: Dept. of Lands (2006)



Legend

- | | |
|---|---|
| Approved Project Disturbance Boundary | ● Artefact Scatter |
| Modified Project Disturbance Boundary | ● Scarred Tree |
| Sustainable Agriculture Offset Area | |
| Approved Aboriginal Cultural Heritage Offset Areas | |
| Habitat Enhancement Area | |
| Surveyed Habitat Enhancement Area | |
| SC10 Management Zone | |

File Name (A4): R17_V1/2497_188.dgn

FIGURE 9.1

Location of Sites Associated with Modification Areas

The largest artefact scatter (SC03 – which has been subject to salvage) contained 13 artefacts, followed by SC58 which contained 4 artefacts. SC59 contained 2 artefacts. The dominant raw material observed was mudstone, with lesser quantities of silcrete, tuff, fine grained siliceous (FGS), quartz and chalcedony. Artefacts observed were predominantly flakes and broken flakes, with lesser numbers of cores, retouched artefacts, flaked pieces and blade flakes.

In addition to the three stone artefact scatters, a tree bearing a large scar was identified. A subsequent arboricultural assessment confirmed that the scar derives from modification of the tree by Aboriginal people (refer to **Appendix D** and the relevant site description provided below).

Table 9.4 – Recorded Aboriginal Archaeological Sites

Site	Mod Area	Site Type	MGA Coordinates		Landform	Site Contents	Area (m ²)	Condition
SC03	3 ⁺	Artefact scatter	285280	6422893	Lower slope	Locus 1 (outside the modification area) – quartz flaked piece and mudstone flake Locus 2 (outside the modification area) – 3 mudstone broken flakes, 2 mudstone broken flakes Locus 3 (within the modification area) – silcrete core and mudstone flake Locus 4 (outside the modification area) – 2 silcrete flakes, mudstone flake and mudstone flaked piece	5000	Poor
SC58	4	Artefact scatter	284698	6422285	Drainage line	1 mudstone flake, 2 silcrete flakes, 1 silcrete flaked piece	200	Poor
SC59	2	Artefact scatter	285055	6425984	Drainage line	Locus 1 – 1 silcrete flake Locus 2 – 1 silcrete flake	25	Poor
SC-ST-02	2*	Scarred tree	285023	6426030	Upper slope	Scarred ironbark (refer to Appendix D)	NA	Poor

+ Surface collection of SC03 was conducted as part of works associated with an approved pipeline

* SC-ST-02 was identified as part of the survey of Modification Area 2 but was subsequently determined to be outside the area to be impacted

SC03 Artefact Scatter

The SC03 artefact scatter was previously recorded in relation to the construction of an approved water pipeline (refer to Umwelt 2008c). The majority of SC03 lies outside Modification Area 3 on the opposite side of Coolibah Road on a gentle lower slope leading to a tributary of Sandy Creek. Soils within the area consisted of a mid brown grey sandy loam (A₂ horizon) in some areas, with mid red brown clay (B horizon) exposed in areas of extensive disturbance associated with the construction of the approved water pipeline. Visibility within all areas of exposure was excellent but non-exposed areas had limited visibility due to vegetation coverage.

A total of four loci were identified in the vicinity of Modification Area 3, however only one of these (Locus 3) is located within the modification area.

Locus 1 was positioned near two water tanks on the south side of Coolibah Road in a highly disturbed area. Two artefacts were recorded at this location in an exposure measuring approximately 30 metres by 20 metres within which visibility was excellent. These artefacts consisted of one quartz flaked piece and one mudstone flake. The area surrounding this locus is a large and highly disturbed area of exposure (B horizon) populated by weeds.

Locus 2 was situated on the south-east side of Coolibah Road approximately 50 metres to the west of Locus 1. The exposure measured 6 metres by 3 metres and visibility within the exposure was excellent. A total of five artefacts were present and consisted of broken flakes and flaked pieces. The majority of these were heat affected and all were made from mudstone.

Locus 3 consists of a small exposure within Modification Area 3 on the north-west side of Coolibah Road. Two artefacts are present within an exposure of approximately 9 metres by 2 metres. The artefacts consist of one heat affected silcrete core and one mudstone flake. Visibility within the exposure was excellent.

Locus 4 was located near a gate at the junction between an access track and Coolibah Road in an area of exposure measuring approximately 40 metres by 5 metres that had good visibility. The artefacts at Locus 4 consisted of two silcrete flakes, one mudstone flake, one mudstone flaked piece and a possible grindstone.

In accordance with the recommendations provided by Umwelt (2008c) and endorsed by the relevant Aboriginal stakeholder groups and DECCW, a surface collection has been conducted at SC03 in accordance with the methodology approved under the Mangoola ACHMP (2008a). The collection of SC03 and subsequent post-excavation artefact analysis will be detailed in Umwelt (in prep c).

SC58 Artefact Scatter

The SC58 artefact scatter is located on the south bank of a very minor and lightly incised first order tributary of Sandy Creek in Modification Area 4. The drainage line has grassed over and has not been active for some time. Vegetation in the area consisted of grasses, weeds, prickly pears and grey gums. Soils consisted of light yellow brown sandy clay loam (A₂ horizon) thinly overlying a mid yellow brown loamy clay with a high gravel content (B horizon). The lack of A horizon soils is a reflection of the level of sheetwash and gully erosion associated with the drainage line.

A total of four artefacts were identified within an exposure measuring 20 metres by 10 metres. Visibility within the exposure was excellent, with visibility in the surrounding area very limited. The artefacts consisted of flakes and flaked pieces of silcrete and mudstone.

The mudstone was grey in colour while the silcrete showed signs of having been heat affected.

Due to the ephemeral nature of the drainage line, the limited depth of remnant soils and the low numbers of artefacts despite the presence of a large exposure with excellent visibility, it is considered highly unlikely that any subsurface deposits that may be associated with SC58 would contain high numbers or densities of artefacts. Furthermore, due to the level of erosion at the site, it is highly unlikely that any subsurface deposits that may be present will retain spatial or stratigraphic integrity. For these reasons, there is no PAD (in accordance with the definition provided in **Section 8.1**) associated with SC58.

SC59 Artefact Scatter

SC59 is located on the eastern side of a heavily eroded and incised second order tributary of Sandy Creek tributary in Modification Area 2. Vegetation within the area included broad leaved ironbark, Kangaroo grass, casuarina, fireweed, acacia, kurrajongs and pepper trees. The site is located 10 metres from the centreline of the creek channel and is adjoined by gently inclined slopes. Soils consisted of a thin bleached grey brown fine loam (A₂ horizon) overlying a mid yellow brown loamy clay with a high gravel content (B horizon). The lack of A horizon is a reflection of significant sheetwash erosion.

The site consists of two loci, each containing a single silcrete flake. Locus 1 was within an area of exposure measuring approximately 50 metres by 15 metres and Locus 2 was in an exposure of 20 metres by 40 metres. Visibility within both exposures was good, with limited visibility in the surrounding areas due to vegetation coverage.

Due to the ephemeral nature of the drainage line, the limited depth of remnant soils and the very low numbers of artefacts despite the presence of relatively large exposures with good visibility, it is considered highly unlikely that any subsurface deposits that may be associated with SC59 would contain high numbers or densities of artefacts. Furthermore, due to the level of erosion at the site, it is highly unlikely that any subsurface deposits that may be present will retain spatial or stratigraphic integrity. For these reasons, there is no PAD associated with SC59.

Given the very small number and nature of artefacts within SC59 (silcrete flakes unsuitable for use in bark removal), there is no evidence with which to suggest an association between SC59 and the scarred tree (SC-ST-02 – see below) located approximately 55 metres to the north-west of SC59 other than that they are located in the same general area.

SC-ST-02

SC-ST-02 was recorded as a possible scarred tree and additional advice regarding the origins of the scar was obtained from an arboriculturalist, who advised that the scar is likely to be cultural in origin (refer to **Appendix D**). Due to changes in site numbering, SC-ST-02 is referred to as SC59 in the associated report provided in **Appendix D**.

SC-ST-02 is a dead, mature narrow-leaved ironbark that is estimated to have been between 150 and less than 250 years old at time of death. It is located on a gently inclined lower slope approximately 20 metres west of the drainage line in Modification Area 2. Gullying and sheetwash erosion on the slope has resulted in a high level of disturbance. Two fences including a recent construction and a former post-and-rail fence have been erected in the vicinity of SC-ST-02.

The scar is approximately 154 centimetres in length and a maximum of 0.7 centimetre wide at its widest point (located 140 centimetres from the base of the tree). The scar is recessed approximately 29 centimetres on the right margin and 17 centimetres on the left margin and

is approximately 8.5 centimetres wide at its widest point. The scar began approximately 33.5 centimetres from the current ground surface. Based on the age of the tree, the size and depth of the scar and its location on the tree, it was assessed as likely to be of cultural origin.

There were no surface artefacts identified within the vicinity of SC-ST-02 and, for the reasons outlined in relation to SC59 above, there is no area of PAD associated with the site.

Following the recording of SC-ST-02, additional works were undertaken to more accurately determine the location of SC-ST-02 in relation to the area of impact of the proposed modification. As a result, it was determined that SC-ST-02 is outside the area to be impacted within Modification Area 2 and will not be subject to inundation in association with the raw water dam proposed for this area.

9.2 Potential Archaeological Deposits

The detection and identification of artefacts and archaeological sites is closely related to levels of exposure and visibility, that is, artefacts that are obscured by vegetation or are beneath the ground surface will not be recorded during an archaeological survey. For the purposes of archaeological assessment and cultural heritage management, the likelihood that artefacts may be present below the ground surface has important archaeological and legislative implications for any proposed land use. This is particularly relevant to the current assessment given the relatively low levels of effective coverage across the majority of the modification areas.

Modification Areas 2 and 4 include minor drainage lines, and watercourses of this type are also present in proximity to Modification Areas 3 and 5. These minor drainage lines are ephemeral in nature and would contain water only immediately after lengthy periods of rain. As outlined in **Table 9.2**, these drainage lines have been significantly impacted by ongoing erosion, the construction of dams and the use of the area for agricultural purposes. Soil profiles on the drainage lines consisted of skeletal A₂ soils that were generally subject to moderate to severe erosion. Therefore, whilst the predictive model for the area suggests that larger sites may be associated with watercourses, the ephemeral nature of the watercourses, the high level of disturbance and the limited depth of soil associated with drainage lines in or near the modification areas indicates that they are unlikely to contain large subsurface archaeological deposits and that any deposits that may be present will have limited integrity. This is directly supported by the limited extent of the recorded sites despite the presence of discrete areas of high visibility and exposure.

Similarly, exposures on slope and crest landforms indicated an absence of A₁ soils and a limited depth of A₂ soils in these landforms. These landforms had also been subject to a relatively high level of disturbance due to vegetation clearance and ongoing use of the area for agricultural purposes and the presence of a gravel quarry in Modification Area 1.

Based on the results of the survey, the results of previous archaeological investigations in the area, the generally limited depth of topsoil and the level of disturbance across the modification areas, it is highly unlikely that large subsurface archaeological deposits are present within these areas. Furthermore, any deposits that may be present are highly unlikely to retain archaeological integrity. Therefore, whilst it is possible that the modification areas may contain limited numbers of additional artefacts in a subsurface context, they are not considered to contain any areas of PAD.

10.0 Significance Assessment

Cultural heritage significance is a measure of the relative value or importance of Aboriginal sites. Significance is assessed according to principles outlined originally in Australia in the Burra Charter (1979), which was adapted from the UNESCO sponsored ICOMOS (International Council for Monuments and Sites) Charter. The assessment of significance assists in the determination of appropriate cultural heritage management procedures for sites/artefacts that may be impacted by proposed development activities.

The Burra Charter defines cultural significance as the 'aesthetic, historic, scientific or social value for past, present or future generations' of a place. The NPWS Guidelines (1997) provide further discussion on the assessment of cultural significance for Aboriginal sites, and for artefact scatters in particular. Categories of significance relevant to Aboriginal archaeological sites include Aboriginal significance, archaeological/scientific significance, and aesthetic significance, tourism potential and educational significance. *The NSW NPWS Guidelines for Archaeological Report Writing* (1997: 25) states:

While Aboriginal sites and places may have educational, tourism, and other values to groups in society their principle values are likely to be in terms of their cultural/social significance to Aboriginal people and their scientific significance to archaeologists. It is thus possible to identify two main streams in the overall significance assessment process: the assessment of cultural/social significance to Aboriginal people and the assessment of scientific significance to archaeologists.

Therefore, the significance of the sites within the modification areas has been evaluated in relation to their Aboriginal significance and their archaeological significance. The criteria for assessing each type of archaeological 'significance' are detailed in **Section 10.2**. The archaeological significance assessment of the sites recorded in the modification areas is discussed and justification for their significance ranking provided. In addition, the archaeological significance of the modification areas (including the parts of these areas not containing recorded sites) is also evaluated in relation to the specified criteria.

10.1 Cultural Significance/Sensitivity

Archaeological significance is a scientific value which can be determined by archaeologists based on the characteristics of the landscape and archaeological evidence from the area. However cultural heritage significance can only be determined by members of the Aboriginal stakeholder groups.

During the survey of the modification areas, Aboriginal stakeholder representatives were requested to provide comment on the cultural significance of any sites located and of the areas as a whole. No areas of particular cultural significance were identified by the stakeholders participating in the survey. Comments on each specific site are provided in **Table 10.1**.

Table 10.1 – In-field Comments Regarding Aboriginal Cultural Significance

Site	Aboriginal Cultural Significance
SC03	Low (refer to Umwelt 2008c)
SC58	Low
SC59	Low
SC-ST-02	No in-field assessment provided as expert advice was required as to the origins of the scar

As discussed above, it was requested that further feedback is provided by Aboriginal stakeholders regarding the Aboriginal cultural significance of these sites. No further comments were received on cultural significance of individual sites.

10.2 Archaeological Significance

The Burra Charter defines the archaeological/scientific significance of an Aboriginal site, object or place according to its potential to address research questions and provide greater insight into Aboriginal society and chronological changes in how Aboriginal people utilised the landscape and its resources (Australian ICOMOS Incorporated 2000:12). The significance of Aboriginal archaeological sites is assessed by examining the following six criteria:

- **Rarity** – The scientific significance of a site is assessed as higher if it is perceived as unique or rare within the local area and/or within the region; conversely, the scientific significance of a site is assessed as lower if it is perceived as common within the local area and/or within the region. This rarity may relate to the type of site, the age of the site, the location of the site in the landscape, the preservation of the site (undisturbed sites are rare), or the nature of the site contents (it may contain artefact types or reduction strategies that are unknown or not well represented in other sites; it may contain raw material types or mixes of raw material types that are not usually found in sites or are unusually informative of Aboriginal resource use in that area; it may contain hearths or other features rarely preserved in sites).
- **Representativeness** – One of the aims of cultural heritage management is to ensure that a representative sample of sites is preserved for future generations. The objective is to preserve a sample of every type of site in the range of landscapes in which they occur to provide for future research that may have different research agendas than those of the contemporary Aboriginal and archaeological community.
- **Integrity/Intactness** – The archaeological integrity or intactness of a site is important when assessing its significance and conservation value. A site that has been subject to minimal disturbance following the deposition of cultural materials contains considerably more information about environmental change and/or cultural sequences than a similar site that has been disturbed by natural process or human actions.
- **Connectedness** – Connectedness refers to the relationship between sites within an area, and in its broadest sense refers to patterns linking sites within an area. Connectedness is often difficult to ascertain as the chronological sequence of use of surface sites is unknown at this stage of their assessment, and often cannot be determined through archaeological dating. Thus connectedness must be related to other features of sites and/or their assemblages. Sites may appear connected due to their location within the landscape (for example a series of sites associated with a terrain unit or landform element) or because of the nature of their assemblages (for example, the use of similar raw materials and reduction sequences aimed at producing similar implement types) or the nature of features within the sites (for example heat treatment pits, hearths, knapping floors). In some cases, it may be that a series of sites within an area relates to a number of different activities which are in fact all components of a single land use system (for example, a stone quarry, a camp site at which reduction of that stone takes place, a sandstone outcrop on which that stone is ground). As mentioned above, the difficulty with assessing such an aspect of connectedness arises in demonstrating that all of the sites relate to the same period of time. While it is broadly possible to assign some artefacts to limited time periods (backed blades, Bondi points, eloueras, edge ground axes), these time periods still span thousands of years and the artefacts in question

generally only represent a minor component of most assemblages and thus their presence cannot be used to make statements about the majority of the artefacts within any assemblage. Thus, the use of 'artefact types' to date surface assemblages remains too broad (e.g. 4000 to 7000 years) to be useful in discussing the operation of a pattern of land use at any given time and to make judgements related to connectedness.

- **Complexity** – The complexity of a site is an indication of its ability to contribute information on the local Aboriginal culture. The complexity of a site may be indicated by the number and/or density of stone artefacts it contains, or by the range of raw materials, knapping methods, reduction strategies and/or features that occur within it. Features that may occur within a site include knapping floors, heat treatment pits, hearths or other items that do not fall within the description of a generalised scatter of flaked stone artefacts.
- **Potential Archaeological Deposits (PAD)** – For a site to be able to contribute to an understanding of cultural sequences, it must contain distinguishable features or aspects that can be shown to have been created at different times within the context of that site or between sites. For such relationships to be possible the artefacts or features within the sites need to be located within a stratified context. It is also possible that a site may contain artefacts in a subsurface context that may not remain in a stratified context, but that may by their investigation add to the knowledge of Aboriginal use of the landscape/resource base in a more general sense.

The identified sites are afforded a numerical value for each significance criterion so that an overall significance assessment can be quantified (refer to **Table 10.2**). The values for each criterion are scored as follows:

- low significance was afforded a score of 1;
- moderate significance was afforded a score of 2; and
- high significance was afforded a score of 3.

Overall significance was scored as follows:

- low significance 12-15;
- low to moderate significance 16-19;
- moderate significance 20-23;
- moderate to high significance 24-27; and
- high significance 27+.

Table 10.2 - Criteria Used in Evaluating Archaeological Significance

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Rarity	The location of the site within the landscape, its type, integrity contents and/or potential for subsurface artefacts is common within the local and regional context.	The location of the site within the landscape, its type, integrity contents and/or potential for subsurface artefacts is common within the regional context but not the local context.	The location of the site within the landscape, its type, integrity, contents and/or potential for subsurface artefacts is rare within the local and regional context.
Representativeness	This site when viewed in relation to its type, contents, integrity and location in the landscape is common within a local and regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site when viewed in relation to its type, contents, integrity and location in the landscape is uncommon within a local context but common in a regional context and sites of similar nature (or in better condition) are already set aside for conservation within the region.	This site when viewed in relation to its type, contents, integrity and location in the landscape is uncommon within a local and regional context and sites of similar nature (or in better condition) are not already set aside for conservation within the locality or region.
Integrity	Stratigraphic integrity of the site has clearly been destroyed due to major disturbance/loss of topsoil. The level of disturbance is likely to have removed all spatial and chronological information.	The site appears to have been subject to moderate levels of disturbance, however, there is a moderate possibility that useful spatial information can still be obtained from subsurface investigation of the site, even if it is unlikely that any useful chronological evidence survives.	The site appears relatively undisturbed and there is a high possibility that useful spatial information can still be obtained from subsurface investigation of the site, even if it is still unlikely that any useful chronological evidence survives. (In cases where both spatial and chronological evidence is likely to survive the site will gain additional significance from high scores for rarity and representativeness.)

Table 10.2 - Criteria Used in Evaluating Archaeological Significance (cont)

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
Connectedness	There is no evidence to suggest that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and • information provided by Aboriginal oral history.	There is no evidence to suggest that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and • information provided by Aboriginal oral history.	There is no evidence to support the theory that the site is connected to other sites in the local area or the region through: • their chronology (rarely known); • their site type (e.g. connectedness could be argued between an axe quarry, a nearby set of axe grinding grooves and an adjacent site exhibiting evidence of axe reduction); • by the use of an unusual raw material, knapping technique/reduction strategy; • similar designs/motifs in the case of art sites and engravings; and • information provided by Aboriginal oral history.
Complexity	The site does not exhibit and is not predicted to contain either of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials (including use of local and imported raw materials) and/or knapping techniques/reduction strategies; and • features such as hearths or heat treatment pits, activity areas.	The site does not exhibit or can be predicted to contain one of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and • features such as hearths or heat treatment pits, activity areas.	The site does not exhibit or can be predicted to contain both of the following in a subsurface context: • a complex assemblage of stone artefacts in terms of artefact types and/or raw materials and/or knapping techniques/reduction strategies and/or use of local and imported raw materials; and • features such as hearths or heat treatment pits, activity areas.

Table 10.2 - Criteria Used in Evaluating Archaeological Significance (cont)

Criterion	Low (Score of 1)	Moderate (Score of 2)	High (Score of 3)
PAD	The site does not have or has only a low potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that suggest its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site does not have or has only a low potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.	The site does not have or has only a low potential to contain subsurface archaeological material that has stratigraphic integrity or is of a nature that its subsurface investigation would assist with answering questions of contemporary archaeological interest or that indicate it should be preserved for its future research potential.

10.2.1 Archaeological Site Significance

Table 10.3 provides a summary of the archaeological significance afforded to the three additional sites recorded during the survey of the modification areas. As SC03 has previously been assessed, recommendations for its salvage have already been endorsed and the salvage has been completed, its significance is not reassessed.

Within **Table 10.3** when a site was assessed to have low local significance (when compared to other sites within a 5 kilometre radius) for any criterion then this aspect of the site was also deemed to be low at the regional level. If, however, a site had been assessed as having moderate or high archaeological significance on a local scale for any criterion, then it would have been assessed against other sites known from the literature in the broader Upper Hunter region.

Table 10.3 – Archaeological Site Significance

Site	Rarity		Represent- ativeness		Archaeological Integrity		Connectedness		Complexity		Potential for Archaeological Deposit		Archaeological Significance	
	L*	R*	L	R	L	R	L	R	L	R	L	R		
SC58	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC59	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC-ST-02	2	2	2	2	1	1	1	1	1	1	1	1	16	Low to moderate

* L=local, R=regional.

Both of the artefact scatters recorded in Modification Areas 2 and 4 are of low archaeological significance for the following reasons:

- artefact scatters are common site types at local and regional levels, and are not considered rare;
- similar or better representative examples of these sites are presently conserved within the existing ACHOA and the SC10 Management Zone, and therefore they are not considered representative;
- the integrity of the sites is very low, with all sites recorded in areas of disturbance resulting from human action and/or geomorphic processes, which has resulted in sites with no potential for stratigraphic integrity and little potential for spatial integrity;
- there is no evidence for connectedness amongst the sites, as recorded archaeological features do not directly link any sites; and
- the sites are predicted as likely to have only extremely low, to low density and low complexity subsurface assemblages in disturbed contexts and thus do not retain potential archaeological deposits with archaeological research value.

SC-ST-02 is of low-moderate significance for the following reasons:

- SC-ST-02 is one of two scarred trees recorded in association with the Mangoola Coal Mine, with sites of this type relatively rare in the local area due to the relatively fragile nature of this site type and the intensive agricultural use of the area and the associated level of vegetation clearance;
- scarred trees are also relatively rare within the regional context;

- the nature of scarring on the tree and the preservation of the tree itself is not remarkable in comparison to the other scarred tree that was located within the approved project disturbance boundary (SC-ST-01) or in comparison to other scarred trees recorded in the region;
- SC-ST-01 has been conserved as a representative sample of this site type from a local context and therefore SC-ST-02 cannot be considered to have high significance in relation to representativeness;
- SC-ST-02 has low significance in terms of its archaeological integrity as it is dead and in very poor condition; and
- SC-ST-02 has low significance in terms of its connectedness, complexity and potential for archaeological deposit as it is not directly associated with any other sites and is not associated with any areas of PAD.

10.2.2 Archaeological Significance of the Modification Areas

Assessing the archaeological significance of the modification areas requires the consideration of the potential values of these areas outside the context of the identified sites. As discussed previously, the modification areas are comprised of landform contexts that are typically not associated with high numbers of sites or high densities of artefacts. Furthermore, the impacts of erosion (resulting from both natural factors and historical land use) have resulted in the removal of much of the upper soil units in these areas, thereby greatly diminishing the possibility that additional large (in terms of artefact numbers or areal extent) subsurface deposits will be present. Consequently, no areas of PAD were identified within these areas. The subsequent ongoing alterations to the landscape have also affected the natural aspects of the modification area that may also be of archaeological value such as the presence of flora and fauna communities comparable to those present prior to non-Aboriginal settlement of the area. The modification areas therefore have low archaeological significance when considered on a landscape basis.

10.2.3 Summary of Aboriginal and Archaeological Significance

The Aboriginal significance and archaeological significance and research potential of the sites and archaeological landforms located within the modification areas have been summarised in **Tables 10.1** and **10.3**. The Aboriginal stakeholders participating in the survey did not identify any areas or sites of particular Aboriginal cultural significance. As discussed above, it was requested that further feedback is provided by Aboriginal stakeholders regarding the Aboriginal cultural significance of these sites. No further comments were received on cultural significance of individual sites. Both the broader landscape context of the modification areas and the sites they contain are generally of low archaeological significance, with the exception of SC-ST-02, which is of low to moderate archaeological significance.

11.0 Management Options

There is a range of management options available in relation to the Aboriginal archaeological sites located within the modification areas. The selection of management options is guided by the archaeological and Aboriginal cultural heritage significance of the sites located within the modification areas and the impacts associated with the proposed modifications. The management options were developed from an archaeological perspective and were the subject of consultation with the relevant Aboriginal stakeholders.

11.1 Option 1 Site Conservation

This management option would involve the conservation of all or some of the sites within the modification areas. As noted in **Section 9.1**, additional works were undertaken to more accurately determine the location of SC-ST-02 in relation to the proposed expansion of the area of inundation associated with the raw water dam within Modification Area 2. It was determined that SC-ST-02 is located outside the area subject to inundation. Furthermore, as SC-ST-02 is a dead tree, it will not be immediately impacted by changes in the hydrology of the surrounding area. Consequently, the most appropriate management option for SC-ST-02 is *in situ* conservation involving no interference with the tree itself. The condition of SC-ST-02 will subsequently be monitored in accordance with a future revision of the Mangoola Coal ACHMP.

In relation to the remaining two artefact scatters (SC58 and SC59), this management option would involve considerable alterations to the proposed modification activities. Both of these sites are of low archaeological significance and have not been identified during field work as being of notable Aboriginal cultural heritage significance. The conservation of SC58 and SC59 is therefore not considered to be warranted.

11.2 Option 2 Site Destruction without Salvage

Option 2 would involve proceeding with the project and the subsequent destruction of SC58 and SC59 without any further investigation/salvage. These sites represent tangible heritage that is valued by Aboriginal people. It is therefore not considered appropriate from an Aboriginal cultural heritage perspective to destroy the sites without undertaking some mitigative works.

11.3 Option 3 Site Destruction with Salvage (Surface Collection Only)

Option 3 would involve the collection of all visible artefacts at SC58 and SC59 prior to any disturbance associated with the proposed modifications. As discussed above, stone artefacts are considered to be of value to the local Aboriginal community and thus conducting a surface collection of artefacts at these sites using the methodology approved by the relevant Aboriginal stakeholders and DECCW within the Mangoola Coal ACHMP (Umwelt 2008a) is considered an appropriate management option.

11.4 Option 4 Site Destruction with Salvage (Subsurface Investigation)

Option 4 would involve undertaking subsurface salvage (manual or mechanical excavations) at SC58, SC59 or other locations within the modification areas as well as completing a surface collection of all visible artefacts. Subsurface salvage is only an appropriate option from an archaeological perspective when it is considered likely that the salvage will provide information that can address relevant research questions. For the reasons outlined in **Section 9.2**, no sites or areas within the modification areas were identified as containing PAD. Consequently, there is no justification for undertaking subsurface salvage within these areas, should impacts be required in the future.

11.5 Offset Options

Conservation outcomes are fundamental to the Mangoola Coal project management strategy, to ensure the long-term protection and management of Aboriginal archaeological sites and landforms not impacted by the proposed modifications and to offset the loss of Aboriginal cultural heritage values and places as the result of the proposed project. Sites subject to impact in association with the proposed modifications are of low archaeological significance and comprise a relatively small number of sites and artefacts. However, the proposed modifications will involve impacts on an existing Aboriginal Cultural Heritage Offset Area and the SC10 Management Zone, therefore warranting consideration of an offset.

Mangoola Coal offered two conservation options to offset. Three offset options have been identified in relation to any cumulative loss of cultural values arising from the proposed modifications and relocation of the ETL. These options are detailed below.

11.5.1 Land Based Offset

Mangoola Coal identified a proposed offset area on the grounds that impacts to Aboriginal cultural heritage associated with the cumulative impacts of the relocation of the ETL (Umwelt in prep b) and proposed modifications may require offsetting. As part of the conservation outcome for this project Mangoola Coal originally proposed to add the area to the existing ACHOA and to ensure the long term conservation of the Aboriginal sites in this area.

It is noted that Aboriginal stakeholders participating in the survey of the modification areas and in a subsequent on-site meeting conducted on 11 September 2009 indicated that the proposed offset area was not considered suitable from an Aboriginal cultural heritage perspective.

11.5.2 Funding of a Culturally Appropriate Project

Given that the land based offset option is not seen as appropriate by the Aboriginal stakeholders, Mangoola Coal identified an alternative offset in the form of the construction of a shelter at SC10. However, based on comments received from the relevant Aboriginal stakeholders, a suitable culturally appropriate offset will be determined following additional consultation with the relevant Aboriginal stakeholders within two years of Project Approval, in consultation with DECCW and to the satisfaction of DoP.

11.5.3 Other Offset Option

Mangoola Coal identified that it was also open to suggestions from the registered Aboriginal stakeholders in relation to other suitable offset options. As part of this process, Mangoola Coal indicated that in order for an option to be considered appropriate it must relate to the conservation of Aboriginal cultural heritage. Based on comments provided by stakeholders at the inspection meeting, the development of a shade structure and associated rest/picnic area in association with a remaining electricity transmission tower base in the SC10 Management Zone was one such suitable option. This would provide a facility for the Aboriginal Groups to use whilst visiting SC10 for educational purposes. However, as discussed above, the relevant Aboriginal stakeholders have identified that they wish to undertake additional consultation to identify a suitable culturally appropriate offset.

12.0 Management Recommendations

The following recommendations are made on the basis of:

- the relevant legislation concerning the protection of Aboriginal places and objects;
- the results of a search of the DECCW Site Register, a search of the National Native Title Tribunal and archaeological literature relating to the general locality of the project;
- the results of the survey of the modification areas;
- an evaluation of the impacts of the proposed modifications on Aboriginal cultural heritage values;
- an evaluation of the impacts of the proposed modifications on archaeological values;
- the assessment of the Aboriginal and archaeological significance of the sites and landforms within the modification areas;
- consultation with the registered Aboriginal stakeholder groups regarding management recommendations during the assessment process and comments received on the draft report; and
- respect and consideration of the views of the local Aboriginal stakeholder groups.

The recommendations in relation to the proposed modifications are provided below:

- Following receipt of approval for the proposed modifications and prior to undertaking any ground disturbance works (including the initiation of inundation associated with the raw water dam) in Proposed Modification Areas 2 and 4, it is recommended that surface artefacts within sites SC58 and SC59 should be subject to surface collection and analysis in accordance with the methodology approved under the Mangoola Coal ACHMP (Umwelt 2008a:Appendix 4) and provided in **Section 13.0**. Following the completion of analysis, the proposed repository for salvaged artefacts will be the subject of further consultation with the relevant Aboriginal stakeholders, DECCW and the Department of Planning. Dependent on the nature of the final artefact repository, a Care and Control permit for artefacts may be sought from DECCW.
- Prior to undertaking any ground disturbance works within Modification Area 2, a fence will be erected to enclose SC-ST-02, allowing a 10 metre buffer surrounding the tree. Mangoola Coal should ensure that all staff and contractors are aware of their statutory obligation to avoid any impacts (to SC-ST-02) and should be responsible for ensuring that no such impacts occur.
- Following the completion of the proposed cultural salvage activity (i.e. the surface collection of SC58 and SC59), ground disturbance works may commence within Modification Areas 2 and 4.
- No specific salvage works are required in Modification Areas 1, 3, 5 and 6 and ground disturbance works may commence in these areas following receipt of approval for the proposed modifications.
- Should skeletal material be exposed in the course of any activities conducted in relation to the modification areas, all work should cease in the immediate area and the New South Wales Police, DECCW and the Aboriginal stakeholders should be contacted

immediately so that appropriate protocols for the management of the skeletal material can be implemented.

- If any additional sites are identified within a modification area, work should cease within that area and the DECCW and representatives of Aboriginal stakeholder groups be contacted and appropriate management recommendations formalised, as per Mangoola's ACHMP.
- Pending approval of the proposed modification, the Mangoola Coal ACHMP will be revised to incorporate the modification areas and associated sites.

12.1 Cultural Heritage Offset

Based on comments received from the relevant Aboriginal stakeholders, Mangoola Coal has committed to the establishment of a suitable culturally appropriate offset to be determined following additional consultation with the relevant Aboriginal stakeholders.

13.0 Surface Collection Methodology

The following surface collection methodology is extracted from the Mangoola Coal ACHMP (Umwelt 2008a), was developed in consultation with Aboriginal stakeholder groups and was subsequently endorsed by DECC (now DECCW).

The collection methodology will include flagging of artefacts so that distribution can be photographed – detailed survey plans are not warranted for the majority of sites due to their location within eroded contexts, the small number of surface artefacts and the displacement of the artefacts; however, a recording will be made of the location and distribution of the artefacts so that this information can be used for the spatial analysis.

In accordance with this methodology, the spatial distribution of the artefacts will be recorded prior to collection but will not require detailed survey plans.

In accordance with the approved Mangoola Coal ACHMP (Umwelt 2008a), it is intended that salvaged artefacts (from completed and proposed salvage activities) will be deposited in the SC10 Management Zone, which will be conserved in perpetuity. However, the detail of the artefact care process will be the subject of further consultation with the relevant Aboriginal stakeholders following completion of artefact analysis and will be determined in consultation with the relevant Aboriginal stakeholders, DECCW and DoP. Dependent on the nature of the final artefact repository, a Care and Control permit for artefacts may be sought from DECCW.

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APPENDIX A

Aboriginal Stakeholder Group Comments

Date	First_Name	Surname	Group	MC_Contact_Host	Communication_Method	Topic	Details	Follow_Up_Actions
11-Jun-09	Irene	Molineaux	St Clair Singleton Aboriginal Corporation	Toni Schneckloth	Telephone	Consultation	Spoke with Irene regarding consultation for Mangoola Project. All the group is represented in other groups. She is not keen to be consulted.	TS to call on Monday 15/06/09.
15-Jun-09	Irene	Molineaux	St Clair Singleton Aboriginal Corporation	Toni Schneckloth	Telephone	Meeting	Confirmed that she will attend the meeting.	TS to call by 4.30pm Tues 16/06/09
16-Jun-09	Maree	Waugh	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Sandra	Miller	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Tracey	Skene	Culturally Aware	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Luke	Hickey	Hunter Valley Cultural Surveying	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Barry	McTaggart	Yarrawalk	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09 - 3 different email addresses.	
16-Jun-09	Barry	Stair	Hunter Valley Aboriginal Corporation	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Des	Hickey	WWCCS	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
16-Jun-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy	Toni Schneckloth	Email	Meeting	Email to confirm attendance for meeting 18/06/09.	
18-Jun-09	Taasha	Layr	Ungoroo Aboriginal Corporation	Toni Schneckloth	Telephone	500KV	Replying to email & phone message. If Allen wishes to discuss the modification - I can meet him in Singleton - no probs.	
18-Jun-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy	Toni Schneckloth	Telephone		Replying phone message. If Barry wishes to discuss the modification - I can meet him in Singleton - no probs.	
03-Aug-09	Noel	Downs	Wanaruah Local Aboriginal Land Council	Toni Schneckloth	Telephone	500KV	Spoke with Noel re comments from 500KV strategy, will drop in a copy of EA to WLALC today 03/08/09.	
07-Aug-09	Lloyd	Mathews	Bullen Bullen Heritage Consultants	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Des	Hickey	Wattaka Wonnarua CC Service (WWCCS)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Barbara	Foot	Wanaruah Custodians (WC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Larry	Van Vleet	Valley Culture (VC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHW)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Clifford	Mathews	Mingga Consultants (MC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Julie	Griffiths	Hunter Valley Aboriginal Corporation (HVAC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Rhonda	Ward	Ungoroo Cultural & Community Services Inc (UCCS)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Julie	Griffiths	Hunter Valley Aboriginal Corporation (HVAC)	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Luke	Hickey	Hunter Valley Surveying (HVC)	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Des	Hickey	Wattaka Wonnarua CC Service (WWCCS)	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Iaurie	Perry	Wonnarua Nation Aboriginal Corporation	Greg Newton	Email	500KV	Emailled through reminder for 500KV comments proforma	
07-Aug-09	Luke	Hickey	Hunter Valley Surveying (HVC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Rhoda	Perry	Wonnarua Elders Council (WEC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Laurie	Perry	Wonnarua Nation Aboriginal Corporation	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
07-Aug-09	Joseph	Griffiths	Wonnarua Culture Heritage (WCH)	Greg Newton	Fax	500KV	Faxed through reminder for 500KV comments pro forma	
17-Aug-09	Gordon	Griffiths	Wonnarua Culture Heritage (WCH)	Toni Schneckloth	Telephone	500KV	Discussion on 500KV survey. Explained roster based on rotational work.	
18-Aug-09	Kathy	Steward-Kinchella	Yinnar Culture Services	Toni Schneckloth	Telephone	500KV	Discussion on 500KV survey. Explained roster based on rotational work.	
19-Aug-09	Annie	Hickey	Gidawaa Walang Cultural Heritage Consultancy	Toni Schneckloth	Fax	500KV	Information for survey work - accepted invitation.	
19-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Fax	500KV	Information for survey work - accepted invitation.	
19-Aug-09	Kathy	Steward-Kinchella	Yinnar Culture Services	Toni Schneckloth	Fax	500KV	Information for survey work - accepted invitation.	
19-Aug-09	Barry	McTaggart	Yarrawalk (Y)	Toni Schneckloth	Fax	500KV	Information for survey work - accepted invitation.	
19-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone		Confirmed with Arthur all faxes had arrived.	
19-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone		Arthur left message re faxes. On arrival at office (3.25pm) all faxes arrived.	
19-Aug-09	Luke	Hickey	Hunter Valley Cultural Surveying (HVC)	Toni Schneckloth	Site Visit		UW gave new contact details. Gave him return to sender mail. This was scanned.	
20-Aug-09	Donna	Sampson	Cacatus Culture Consultants (CCC)	Toni Schneckloth	Telephone	Contact Details	Confirming I had received email. Confirmed new email address as per email received.	
20-Aug-09	Gordon	Griffiths	Wonnarua Culture Heritage (WCH)	Toni Schneckloth	Telephone		Rang Gordon back re message. Good to work on 11th Sept. Will fill out form and fax tomorrow.	
20-Aug-09	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Telephone	Group Registration	She rang the wrong number for DECC. Must have pressed wrong number she said.	
20-Aug-09	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Telephone		Message left to call Cheryl back - I was on phone. Wrong number for DECC.	
20-Aug-09	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Telephone		Message left at reception to call her back.	
20-Aug-09	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Telephone		Rang home number as per our contacts - disconnected.	
20-Aug-09	Donna	Sampson	Cacatus Culture Consultants (CCC)	Toni Schneckloth	Email		Acceptance on work for 11/09/09 for 500KV Survey.	
20-Aug-09	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Telephone	Group Registration	Her son Justin is registering as a group.	
21-Aug-09	Theresa	Smith		Toni Schneckloth	Site Visit		Requesting info of Mangoola. Does not identify with any registered stakeholders. Was original secretary of WLALC in 1984.	
24-Aug-09	Gordon	Griffiths	Wonnarua Culture Heritage (WCH)	Toni Schneckloth	Telephone		Due to HVNCRM not available, asked WCH to participate. They will.	
24-Aug-09	Le-Ann	Ball	Lower Hunter Wonnarua Council Inc	Toni Schneckloth	Telephone		Landline disconnected.	
24-Aug-09	Le-Ann	Ball	Lower Hunter Wonnarua Council Inc	Toni Schneckloth	Telephone		Confirmed contact details as all mail has been returned to Mangoola Coal. Different address.	
24-Aug-09	Jamie Lee	Stair	Wanaruah Local Aboriginal Land Council (WLALC)	Toni Schneckloth	Telephone		Tried to contact David French through WLALC. Jamie Lee couldn't offer anywhere or any number.	
24-Aug-09	David	French	Hunter Valley Natural and Cultural Resources Management (HVNCRM)	Toni Schneckloth	Telephone		Rang his parents house as I cannot contact him any other way. No mail/phone.	
24-Aug-09	Rhoda	Perry	Upper Hunter Wonnarua Council Inc (UHW)	Toni Schneckloth	Telephone		Spoke with Mrs Perry re work next week. Will get back to her with induction times for refreshers.	
24-Aug-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Toni Schneckloth	Telephone		Confirmed that he & LWTC are not available for works at present.	
24-Aug-09	Rhonda	Ward	Ungoroo Cultural & Community Services Inc (UCCS)	Toni Schneckloth	Telephone		Work - why do some groups have work and not me. Explained that it is based on roster.	
24-Aug-09	David	French	Hunter Valley Natural and Cultural Resources Management (HVNCRM)	Toni Schneckloth	Telephone		Left free text message (only leaves phone no.) about work - no response to date.	
24-Aug-09	Nicole	Smith	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Telephone		Tried the number of the lady who called yesterday from HVAC. No messagebank.	
24-Aug-09	Nicole	Smith	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Telephone		Went to leave message on number in our stakeholder contact list - led to private number.	
24-Aug-09	Nicole	Smith	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Telephone		Spoke and arranged documentation update.	
28-Aug-09	Brian	Horton	Muswellbrook Cultural Consultants (MCC)	Toni Schneckloth	Telephone		Confirming work - thought MCC should be on 31/08/09. Explained only required 11/09/09.	
01-Sep-09	Rodney	Mathews	Giwiirr Consultants (GC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Noel	Downs	Wanaruah Local Aboriginal Land Council (WLALC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Suzie	Worth	Wanaruah Local Aboriginal Land Council (WLALC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Laurie	Perry	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Allen	Page	Ungoroo Aboriginal Corporation (UAC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Michele	Stair	Giwiirr Consultants (GC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Maree	Waugh	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Luke	Hickey	Hunter Valley Surveying (HVC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Sandra	Miller	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Donna	Sampson	Cacatus Culture Consultants (CCC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Barry	Stair	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Tracey	Skene	Culturally Aware (CA)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Cara	Coles	Hunter Traditional Owners	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Darrel	Mathews	Upper Hunter Heritage Consultants (UHH)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Toni Schneckloth	Telephone	Contact Details	Rang MM to get updated details for Lloyd Mathews. New home ph 6742 0568.	
01-Sep-09	Lloyd	Mathews	Bullen Bullen Heritage Consultants	Toni Schneckloth	Telephone		Rang the contact number - disconnected.	
01-Sep-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Barry	McTaggart	Yarrawalk (Y)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	George	Sampson	Cacatus Culture Consultants (CCC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Christine	Archbold	Hunter Valley Cultural Consultants (HVCC)	Toni Schneckloth	Email	500KV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Various	Various	Various	Toni Schneckloth	Fax	500KV	Fax re confirmation of field work for 11/09/09.	

Date	First_Name	Surname	Group	MC_Contact_Host	Communication_Method	Topic	Details	Follow_Up_Actions
07-Sep-09	Tracey	Skene	Culturally Aware (CA)	Toni Schneckloth	Fax		RSVP for 500kv survey (11/09/09).	
07-Sep-09	Cara	Coles	Hunter Traditional Owners	Greg Newton	Email	500kv	Email sent regarding cancellation of field work 9 September 2009	
07-Sep-09	David	French	Hunter Valley Natural and Cultural Resources Management (HVNCRM)	Greg Newton	Telephone	500kv	attempted to speak about cancellation of field work on Wednesday 9 September 2009 phone disconnected	
07-Sep-09	Annie	Hickey	Gidawaa Walang Cultural Heritage Consultancy	Greg Newton	Telephone	500kv	spoke with Annie re cancellation of field work on Wednesday 9 September 2009	
07-Sep-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Greg Newton	Telephone	500kv	spoke with Arthur re cancellation of field work on Wednesday 9 September 2009	
07-Sep-09	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Greg Newton	Telephone	500kv	Spoke with Margaret re cancellation of field work on Wednesday 9 September 2009	
07-Sep-09	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Greg Newton	Telephone	500kv	Spoke with Margaret re work on the 14/09/09 she was phoning on behalf of UHHC why they weren't on the list for the 14th	
07-Sep-09	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Greg Newton	Telephone	500kv	spoke with Victor re cancellation of field work on Wednesday 9 September 2009	
09-Sep-09	Tracey	Skene	Wonnarua Nation Aboriginal Corporation	Toni Schneckloth	Fax		RSVP for 500kv Modification.	
07-Oct-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone	Scarred Tree	Invitation extended to Arthur to come along whilst UTM are inspecting potential scarred trees. Explained that it would not be paid work but is more than welcome to accompany Darryn from UTM and Greg Newton.	
27-Oct-09	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Toni Schneckloth	Telephone		Rang as to why she did not have work tomorrow. I replied about the rotational roster. She asked about her nephew. I replied that I had tried to contact Justin.	
23-Dec-09	Scott	Franks	Yarrawalk (Y)	Greg Newton	Telephone	extra areas 500kv	no support for email from WLALC re survey methodology timings, wanted to reaffirm their position and offer services to fill any field work gaps	
23-Dec-09	Noel	Downs	Wanaruah Local Aboriginal Land Council (WLALC)	Greg Newton	Telephone	extra areas 500kv	not enough time to comment on the methodology, provide comment that the timings are to short. if the survey goes ahead he would "do everything in his power to slow or stop the process"	
04-Jan-10	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone	Extra Areas 500kv	Confirmation of work on Friday and timings...	
05-Jan-10	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Toni Schneckloth	Email	Extra Areas 500kv	Details for work 08/01/10	
05-Jan-10	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Toni Schneckloth	Telephone	Extra Areas 500kv	Confirmation of work on Friday and timings. Will send Victor an email with the details.	TS to send email with details.
06-Jan-10	Larry	Van Vliet	Valley Culture (VC)	Toni Schneckloth	Returned Mail	Extra Areas 500kv	Returned registered mail - unclaimed.	
06-Jan-10	David	French	Hunter Valley Natural and Cultural Resources Management (HVNCRM)	Toni Schneckloth	Returned Mail	Extra Areas 500kv	Returned registered mail - unclaimed.	
06-Jan-10	Justin	Mathews	Carrawonga Consultants	Toni Schneckloth	Returned Mail	Extra Areas 500kv	Returned registered mail - unclaimed.	
07-Jan-10	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
07-Jan-10	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
07-Jan-10	Barry	French	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
07-Jan-10	Matt	Wells	Upper Hunter Wonnarua Council Inc (UHCW)	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
07-Jan-10	Rhoda	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
07-Jan-10	Cara	Coles	Hunter Traditional Owners	Toni Schneckloth	Telephone	Extra Areas 500kv	Cancellation of fieldwork due to rain, date changed to 13/01/10.	
20-Jan-10	Des	Hickey	Wattaka Wonnarua CC Service (WWCCS)	Toni Schneckloth	Returned Mail	Extra Areas 500kv	Returned registered mail - unclaimed.	
01-Mar-10	Gordon	Griffiths	Wonnarua Culture Heritage (WCH)	Toni Schneckloth	Phone	Insurance/500kv	Request to send through insurance for payment of invoice to occur. Also asked if read the 500kv report for comments due.	
01-Mar-10	Cheryl	Mathews	Mingga Consultants (MC)	Toni Schneckloth	Phone	Insurance/500kv	MESSAGE - re insurance & comments for 500kv report for both Mingga and Carrawonga Consultants.	
01-Mar-10	Kathie	Steward-Kinchella	Yinarr Culture Services	Toni Schneckloth	Phone	Insurance/Comments/500kv	Request to send through insurance for payment of invoice to occur. Request for comments from meeting and 500kv report too. Will fax through to site office. Gave new fax number.	
01-Mar-10	Rhoda	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Toni Schneckloth	Fax	Meetings/500kv	Sent proforma for comments from meeting held 18/02/10. She will also sent through any comments she feels necessary for the 500kv	
02-Mar-10	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Toni Schneckloth	Phone	Insurance/500kv	Request to send through insurance for payment of invoice to occur. Asked for 500kv comments - she hasn't read the report yet but will get to it.	
19-Mar-10	Various		All groups with fax numbers (as listed on contacts database)	Toni Schneckloth	Fax	Comments on draft reports	Reminder for comments	
19-Mar-10	Various		All groups with an email address (as listed on contacts database)	Toni Schneckloth	Email	Comments on draft reports	Reminder for comments	
30-Mar-10	Margaret	Mathews	Aboriginal Native Title Consultants (ANTC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - reply - no comments at this stage, will send documentation next week (starting 29/03/10).	
30-Mar-10	Lloyd	Mathews	Bullen Bullen Heritage Consultants	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - phone disconnected.	
30-Mar-10	Donna	Sampson	Cacatus Culture Consultants (CCC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message with son to give comments.	
30-Mar-10	Tracey	Skene	Culturally Aware (CA)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message on answering machine.	
30-Mar-10	Annie	Hickey	Gidawaa Walang Cultural Heritage Consultancy	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - faxed through.	
30-Mar-10	Michele	Star	Giwiirri Consultants (GC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no message bank.	
30-Mar-10	Elaine		Hunter Valley Aboriginal Corporation (HVAC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no message bank.	
30-Mar-10	Christine	Archbold	Hunter Valley Cultural Consultants (HVCC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - she will fax through comments today. (None received).	
30-Mar-10	David	French	Hunter Valley Natural and Cultural Resources Management (HVNCRM)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - phone disconnected.	
30-Mar-10	Luke	Hickey	Hunter Valley Surveying (HVCS)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - will fax through Monday 5/04/10 (not received).	
30-Mar-10	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no comments.	
30-Mar-10	Gifford	Mathews	Mingga Consultants (MC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message.	
30-Mar-10	Brian	Horton	Muswellbrook Cultural Consultants (MCC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no answer, left message.	
30-Mar-10	Allen	Paget	Ungooroo Aboriginal Corporation (UAC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message with Denise for Allen.	
30-Mar-10	Rhonda	Ward	Ungooroo Cultural & Community Services Inc (UCCS)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no comments from Rhonda.	
30-Mar-10	Darrel	Mathews	Upper Hunter Heritage Consultants (UHC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message as there was no answer.	
30-Mar-10	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHCW)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no comments.	
30-Mar-10	Larry	Van Vliet	Valley Culture (VC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message.	
30-Mar-10	Barbara	Foot	Wanaruah Custodians (WC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - as Toni (XMC) will be there on 08/04/10 - will give comments then.	
30-Mar-10	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message with Arthur's wife.	
30-Mar-10	Gordon	Griffiths	Wonnarua Culture Heritage (WCH)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - phone rang out.	
30-Mar-10	Rhoda	Perry	Wonnarua Elders Council (WEC)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no comments.	
30-Mar-10	Laurie	Perry	Wonnarua Nation Aboriginal Corporation	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - rang and left message.	
30-Mar-10	Barry	McTaggart	Yarrawalk (Y)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - agree with the proposal, no comments at this stage.	
30-Mar-10	Kathie	Steward-Kinchella	Yinarr Culture Services	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message.	
30-Mar-10	Lea-Ann	Ball	Lower Hunter Wonnarua Council Inc	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message.	
30-Mar-10	Rene	Molineaux	St Clair Singleton Aboriginal Corporation	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - agree with the proposal.	
30-Mar-10	Justin	Mathews	Carrawonga Consultants	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - left message.	
14-Apr-10	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Toni Schneckloth	Telephone	Comments on draft reports and last meeting	Asked if we had received his comments - I replied no - left message with him on 30th March for response.	

Umwelt (Australia) Pty Limited
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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/250509

26 May 2009

POSTED

Brett Nudd
Acting Manager
Planning & Aboriginal Heritage Section
North East Climate Change & Environmental Protection Group
Department of Environment and Climate Change
Locked Bag 914
COFFS HARBOUR NSW 2450

Email: brett.nudd@environment.nsw.gov.au

Dear Brett

Re: Stakeholder Consultation in Relation to Modifications to the Approved Project Disturbance Area for the Mangoola Mine, Wybong, NSW

Mangoola Coal is proposing to apply for a modification to their approved project disturbance area. The modification will include a number of small areas around the approved project disturbance boundary. These include:

- an extension to the area associated with the Raw Water Dam. It is proposed that when this dam is at full capacity the water contained behind the dam wall will extend slightly beyond the approved project disturbance area;
- a minor modification to the approved disturbance boundary to allow for maximum reserve recovery where drilling has established that the coal crop line extends beyond the existing disturbance boundary; and
- modification to the rail loop design to incorporate four small areas where drainage works will be required to extend slightly beyond the overall approved footprint of the rail loop.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment of the area proposed for impact by the modifications in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the Department of Environment and Climate Change (DECC) is aware of any Aboriginal stakeholder groups/individuals with an interest in the Wybong area that may wish to be consulted in relation to the project. **Attachment A** provides a list of the Aboriginal stakeholders currently registered with Mangoola Coal. In order to facilitate the consultation process, Umwelt would be grateful if DECC could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **8 June 2009**.

Should you have any queries or wish to discuss this matter, please do not hesitate to call Jan Wilson or Kym McNamara on 4950 5322.

Yours faithfully

Jan Wilson
Manager Cultural Heritage

enc

Attachment A

Name	Contact	Address
Aboriginal Native Title Consultants (ANTC)	Margaret Matthews	16A Mahogany Crescent Muswellbrook NSW 2333
Black Creek Aboriginal Corporation (BCAC)		PO Box 168 Kurri Kurri NSW 2327
Bullen Bullen Heritage Consultants	Lloyd Matthews	16B Mahogany Crescent Muswellbrook NSW 2333
Cacatua Culture Consultants (CCC)	George Sampson	22 Ibis Parade Woodberry NSW 2322
Culturally Aware (CA)	Tracey Skene	7 Crawford Place Millfield NSW 2325
Gidawaa Walang Cultural Heritage Consultancy	Annie Hickey	76 Lang Street Kurri Kurri NSW 2327
Giwiirr Consultants (GC)	Rodney Matthews and Michelle Stair	8 Fitzgerald Avenue Muswellbrook NSW 2333
Hunter Traditional Owners (HTO)	Cara Coles	PO Box 1042 Singleton NSW 2330
Hunter Valley Aboriginal Corporation (HVAC)	Julie Griffiths	PO Box 579 Muswellbrook NSW 2333
Hunter Valley Cultural Consultants (HVCC)	Christine Matthews/Archbold	40 Humphries Street Muswellbrook NSW 2333
Hunter Valley Natural and Cultural Resources Management (HVNCRM)	David French	Flat 3, 60 Tindale Street Muswellbrook NSW 2330
Hunter Valley Surveying (HVCS)	Luke Hickey or Pansey Hickey	297 Pioneer Road Singleton NSW 2330
Lower Hunter Wonnarua Council Inc (LHWC)		Shop 2, 145 Lang St Kurri Kurri NSW 2327
Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Barry Anderson	156 The Inlet Road Bulga NSW 2330
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Muswellbrook Cultural Consultants (MCC)	Brian Horton	10 Scott Street Muswellbrook NSW 2333
Ungooroo Aboriginal Corporation (UAC)	Allen Paget (Chairperson) and Dahlene Hall	PO Box 3095 Singleton NSW 2330
Ungooroo Cultural & Community Services Inc (UCCS)	Rhonda Ward	8 Blaxland Avenue Singleton NSW 2330
Upper Hunter Heritage Consultants (UHHC)	Darrel Matthews	14 Edinglassie Drive Muswellbrook NSW 2333
Upper Hunter Wonnarua Council Inc (UHWC)	Victor Perry	PO Box 184 Singleton NSW 2330
Valley Culture (VC)	Larry Van Vliet	140 Sydney Street Muswellbrook NSW 2333
Wanaruah Custodians (WC)	Barbara Foot	35 Acacia Circuit Singleton NSW 2330
Wanaruah Local Aboriginal Land Council (WLALC)	Noel Downs and Suzie Worth	PO Box 127 Muswellbrook NSW 2333
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Wonnarua Elders Council (WEC)	Rhoda Perry/Tom Miller	PO Box 184 Singleton NSW 2330
Wonnarua Nation Aboriginal Corporation	Laurie Perry	PO Box 3066 Singleton NSW 2330
Yarrawalk (Y)	Scott Franks & Barry McTaggart	913 Wollombi Road Broke NSW 2330
Yinarr Culture Services	Kathleen Steward-Kinchella	7 Cypress Place Muswellbrook NSW 2333

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/250509

26 May 2009

POSTED

The General Manager
Muswellbrook Shire Council
157 Maitland Street
MUSWELLBROOK NSW 2333

Dear Sir/Madam

Re: Stakeholder Consultation in Relation to Modifications to the Approved Project Disturbance Area for the Mangoola Mine, Wybong, NSW

Mangoola Coal is proposing to apply for a modification to their approved project disturbance area. The modification will include a number of small areas around the approved project disturbance boundary. These include:

- an extension to the area associated with the Raw Water Dam. It is proposed that when this dam is at full capacity the water contained behind the dam wall will extend slightly beyond the approved project disturbance area;
- a minor modification to the approved disturbance boundary to allow for maximum reserve recovery where drilling has established that the coal crop line extends beyond the existing disturbance boundary; and
- modification to the rail loop design to incorporate four small areas where drainage works will be required to extend slightly beyond the overall approved footprint of the rail loop.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment of the area proposed for impact by the modifications in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the Muswellbrook Shire Council is aware of any Aboriginal stakeholder groups/individuals with an interest in the Wybong area that may wish to be consulted in relation to the project. **Attachment A** provides a list of the Aboriginal stakeholders currently registered with Mangoola Coal. In order to facilitate the consultation process, Umwelt would be grateful if Council could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **8 June 2009**.

Should you have any queries or wish to discuss this matter, please do not hesitate to call Jan Wilson or Kym McNamara on 4950 5322.

Yours faithfully

Jan Wilson
Manager Cultural Heritage

enc

Attachment A

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Gidawaa Walang Cultural Heritage Consultancy	Annie Hickey	76 Lang Street	Kurri Kurri NSW 2327
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Ungooroo Cultural & Community Services Inc (UCCS)	Rhonda Ward	8 Blaxland Avenue	Singleton NSW 2330
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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/250509

26 May 2009

POSTED

Office of the Registrar of Aboriginal Owners
Department of Aboriginal Affairs
Level 13, Tower B
Centennial Plaza
280 Elizabeth Street
SYDNEY NSW 2000

Email: megan.mebberson@daa.nsw.gov.au

Dear Megan

Re: Stakeholder Consultation in Relation to Modifications to the Approved Project Disturbance Area for the Mangoola Mine, Wybong, NSW

Mangoola Coal is proposing to apply for a modification to their approved project disturbance area. The modification will include a number of small areas around the approved project disturbance boundary. These include:

- an extension to the area associated with the Raw Water Dam. It is proposed that when this dam is at full capacity the water contained behind the dam wall will extend slightly beyond the approved project disturbance area;
- a minor modification to the approved disturbance boundary to allow for maximum reserve recovery where drilling has established that the coal crop line extends beyond the existing disturbance boundary; and
- modification to the rail loop design to incorporate four small areas where drainage works will be required to extend slightly beyond the overall approved footprint of the rail loop.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment of the area proposed for impact by the modifications in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the Department of Aboriginal Affairs (DAA) is aware of any Aboriginal stakeholder groups/individuals with an interest in the Wybong area that may wish to be consulted in relation to the project. **Attachment A** provides a list of the Aboriginal stakeholders currently registered with Mangoola Coal. In order to facilitate the consultation process, Umwelt would be grateful if DAA could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **8 June 2009**.

Should you have any queries or wish to discuss this matter, please do not hesitate to call Jan Wilson or Kym McNamara on 4950 5322.

Yours faithfully

Jan Wilson
Manager Cultural Heritage

enc

Attachment A

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2497C

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/250509

26 May 2009

POSTED

New South Wales Native Title Services
PO Box 2105
STRAWBERRY HILLS NSW 2012

To Whom It May Concern

Re: Stakeholder Consultation in Relation to Modifications to the Approved Project Disturbance Area for the Mangoola Mine, Wybong, NSW

Mangoola Coal is proposing to apply for a modification to their approved project disturbance area. The modification will include a number of small areas around the approved project disturbance boundary. These include:

- an extension to the area associated with the Raw Water Dam. It is proposed that when this dam is at full capacity the water contained behind the dam wall will extend slightly beyond the approved project disturbance area;
- a minor modification to the approved disturbance boundary to allow for maximum reserve recovery where drilling has established that the coal crop line extends beyond the existing disturbance boundary; and
- modification to the rail loop design to incorporate four small areas where drainage works will be required to extend slightly beyond the overall approved footprint of the rail loop.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment of the area proposed for impact by the modifications in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the New South Wales Native Title Services is aware of any Aboriginal stakeholder groups/individuals with an interest in the Wybong area that may wish to be consulted in relation to the project. **Attachment A** provides a list of the Aboriginal stakeholders currently registered with Mangoola Coal. In order to facilitate the consultation process, Umwelt would be grateful if New South Wales Native Title Services could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **8 June 2009**.

Should you have any queries or wish to discuss this matter, please do not hesitate to call Jan Wilson or Kym McNamara on 4950 5322.

Yours faithfully

Jan Wilson
Manager Cultural Heritage

enc

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/250509

26 May 2009

POSTED

Ms Suzie Worth
Wanaruah Local Aboriginal Land Council
PO Box 127
MUSWELLBROOK NSW 2333

Dear Suzie

Re: Stakeholder Consultation in Relation to Modifications to the Approved Project Disturbance Area for the Mangoola Mine, Wybong, NSW

Mangoola Coal is proposing to apply for a modification to their approved project disturbance area. The modification will include a number of small areas around the approved project disturbance boundary. These include:

- an extension to the area associated with the Raw Water Dam. It is proposed that when this dam is at full capacity the water contained behind the dam wall will extend slightly beyond the approved project disturbance area;
- a minor modification to the approved disturbance boundary to allow for maximum reserve recovery where drilling has established that the coal crop line extends beyond the existing disturbance boundary; and
- modification to the rail loop design to incorporate four small areas where drainage works will be required to extend slightly beyond the overall approved footprint of the rail loop.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment of the area proposed for impact by the modifications in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the Wanaruah Local Aboriginal Land Council is aware of any Aboriginal stakeholder groups/individuals with an interest in the Wybong area that may wish to be consulted in relation to the project. **Attachment A** provides a list of the Aboriginal stakeholders currently registered with Mangoola Coal. In order to facilitate the consultation process, Umwelt would be grateful if Wanaruah Local Aboriginal Land Council could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **8 June 2009**.

Should you have any queries or wish to discuss this matter, please do not hesitate to call Jan Wilson or Kym McNamara on 4950 5322.

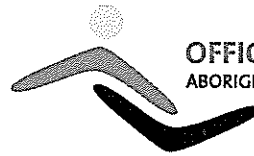
Yours faithfully

Jan Wilson
Manager Cultural Heritage

enc

Attachment A

Name	Contact	Address	
Aboriginal Native Title Consultants (ANTC)	Margaret Matthews	16A Mahogany Crescent	Muswellbrook NSW 2333
Black Creek Aboriginal Corporation (BCAC)		PO Box 168	Kurri Kurri NSW 2327
Bullen Bullen Heritage Consultants	Lloyd Matthews	16B Mahogany Crescent	Muswellbrook NSW 2333
Cacatua Culture Consultants (CCC)	George Sampson	22 Ibis Parade	Woodberry NSW 2322
Culturally Aware (CA)	Tracey Skene	7 Crawford Place	Millfield NSW 2325
Gidawaa Walang Cultural Heritage Consultancy	Annie Hickey	76 Lang Street	Kurri Kurri NSW 2327
Giwiirr Consultants (GC)	Rodney Matthews and Michelle Stair	8 Fitzgerald Avenue	Muswellbrook NSW 2333
Hunter Traditional Owners (HTO)	Cara Coles	PO Box1042	Singleton NSW 2330
Hunter Valley Aboriginal Corporation (HVAC)	Julie Griffiths	PO Box 579	Muswellbrook NSW 2333
Hunter Valley Cultural Consultants (HVCC)	Christine Matthews/Archbold	40 Humphries Street	Muswellbrook NSW 2333
Hunter Valley Natural and Cultural Resources Management (HVNCRM)	David French	Flat 3, 60 Tindale Street	Muswellbrook NSW 2330
Hunter Valley Surveying (HVCS)	Luke Hickey or Pansey Hickey	297 Pioneer Road	Singleton NSW 2330
Lower Hunter Wonnarua Council Inc (LHWC)		Shop 2, 145 Lang St	Kurri Kurri NSW 2327
Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Barry Anderson	156 The Inlet Road	Bulga NSW 2330
Mingga Consultants (MC)	Clifford (Mick) Matthews	11 Coolibah Close	Muswellbrook NSW 2333
Muswellbrook Cultural Consultants (MCC)	Brian Horton	10 Scott Street	Muswellbrook NSW 2333
Ungooroo Aboriginal Corporation (UAC)	Allen Paget (Chairperson) and Dahlene Hall	PO Box 3095	Singleton NSW 2330
Ungooroo Cultural & Community Services Inc (UCCS)	Rhonda Ward	8 Blaxland Avenue	Singleton NSW 2330
Upper Hunter Heritage Consultants (UHC)	Darrel Matthews	14 Edinglassie Drive	Muswellbrook NSW 2333
Upper Hunter Wonnarua Council Inc (UHC)	Victor Perry	PO Box 184	Singleton NSW 2330
Valley Culture (VC)	Larry Van Vliet	140 Sydney Street	Muswellbrook NSW 2333
Wanaruah Custodians (WC)	Barbara Foot	35 Acacia Circuit	Singleton NSW 2330
Wanaruah Local Aboriginal Land Council (WLALC)	Noel Downs and Suzie Worth	PO Box 127	Muswellbrook NSW 2333
Wattaka Wonnarua CC Service (WWCCS)	Des Hickey	4 Kennedy Street	Singleton NSW 2330
Wonn 1 Contracting (AF-WC)	Arthur Fletcher	619 Main Road	Glendale NSW 2285
Wonnarua Culture Heritage (WCH)	Joe Hampton or Joseph Griffiths or Gordon Griffiths	19 O'Donnel Crescent	Metford NSW 2323
Wonnarua Elders Council (WEC)	Rhoda Perry/Tom Miller	PO Box 184	Singleton NSW 2330
Wonnarua Nation Aboriginal Corporation	Laurie Perry	PO Box 3066	Singleton NSW 2330
Yarrawalk (Y)	Scott Franks & Barry McTaggart	913 Wollombi Road	Broke NSW 2330
Yinarr Culture Services	Kathleen Steward-Kinchella	7 Cypress Place	Muswellbrook NSW 2333



OFFICE OF THE REGISTRAR
ABORIGINAL LAND RIGHTS ACT 1983 (NSW)

RECEIVED

1 JUN 2009

11-13 Mansfield Street
Glebe NSW 2037
PO Box 112, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Jan Wilson
Manager, Cultural Heritage
Umwelt (Australia) Pty Limited
PO Box 838
Toronto NSW 2283

Dear Jan

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter dated 26 May 2009 regarding the proposed modifications to the approved project disturbance boundary in the Wybong area.

I have searched the Register of Aboriginal Owners and the subject land does not appear to have Registered Aboriginal Owners pursuant to Division 3 of the *Aboriginal Land Rights Act 1983*.

I trust you are in contact with the Wanaruah Local Aboriginal Land Council. The land council may be able to assist you with information and contact details for other interested groups.

Regards,

Megan Mebberson
Senior Project Officer
Office of the Registrar, *Aboriginal Land Rights Act 1983*

3 June 2009

Your reference : 2497C/JW/KM/250509
Our reference : DOC09/25359 F1107/5627
Contact : Ciaron Dunn, (02) 6659 8221
Date : 4 May 2009

Jan Wilson
Manager Cultural Heritage
Umwelt (Australia) Pty Ltd
PO Box 838
Toronto NSW 2283

Dear Ms Wilson

**RE: STAKEHOLDER CONSULTATION IN RELATION TO MODIFICATIONS TO THE
APPROVED PROJECT DISTURBANCE AREA FOR MANGOOLA COAL, WYBONG,
NSW**

I refer to your correspondence to the Department of Environment and Climate Change (DECC), dated 26 May 2009 regarding the above matter.

Please find attached a list of known Aboriginal parties that DECC feels is likely to have an interest in your development. I note this is not necessarily an exhaustive list of all interested Aboriginal parties and receipt of this list does not remove the requirement of a proponent/consultant to advertise the proposal in the local print media and contact other bodies and community groups seeking interested Aboriginal parties, in accordance with DECC's *Interim Community Consultation Requirements for Applicants (2004)*.

If you encounter any changes to the contact details of interested Aboriginal parties or become aware of additional parties, we encourage you to forward this information to the Department so we can update our records.

If you have any further question regarding this matter, please contact Ciaron Dunn, Aboriginal Heritage Planning Officer on (02) 6659 8221.

Yours sincerely



BRETT NUDD

**A/Manager Planning and Aboriginal Heritage – North East
Environment Protection & Regulation Group**

Encl: Attachment 1



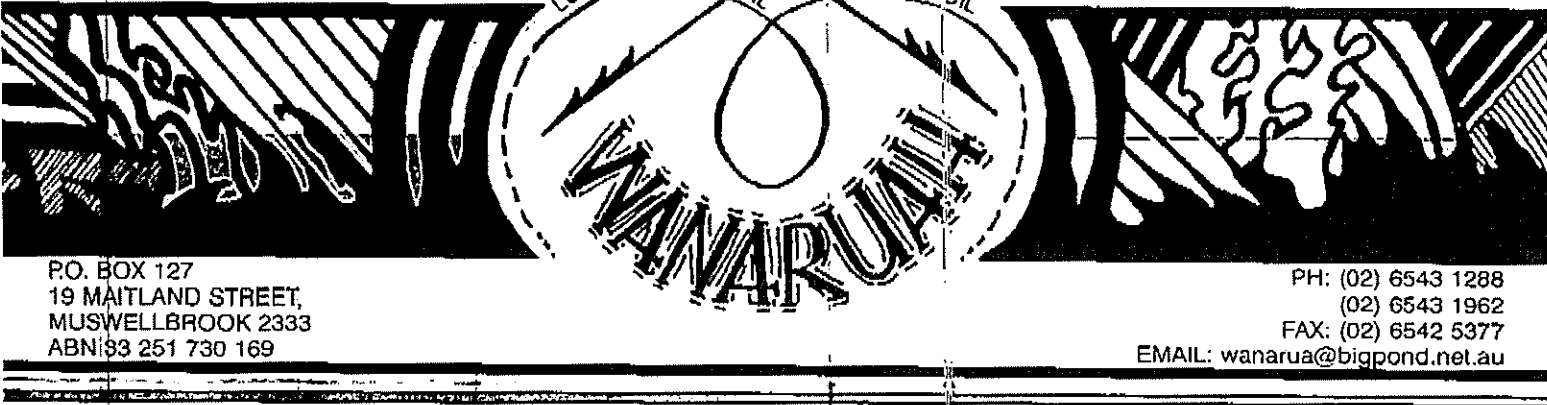
ATTACHMENT 1

**ABORIGINAL STAKEHOLDER GROUPS (OTHER THAN LOCAL ABORIGINAL
LAND COUNCILS) ON HUNTER VALLEY AREA THAT DECC HAS IN REGARD TO
THE 'INTERIM COMMUNITY CONSULTATION REQUIREMENTS FOR
APPLICANTS'.**

Black Creek Aboriginal Corporation PO Box 168 KURRI KURRI NSW 2328	St Clair Singleton Aboriginal Corporation PO Box 710 SINGLETON NSW 2330
Aboriginal Native Title Elders Consultants 16A Mahogany Crescent MUSWELLBROOK NSW 2333 Margaret Mathews	Gidawaa Walang 76 Lang Street KURRI KURRI NSW 2327 Anne Hickey
Wonnaruah Elders Council PO Box 184 SINGLETON NSW 2330 Rhoda Perry/Tom Miller	Ungooroo Aboriginal Corporation PO Box 3095 Singleton NSW 2330 Allen Paget
Yarrawalk 913 Wollombi Road BROKE NSW 2330 Scott Franks	Valley Culture 140 Sydney Street MUSWELLBROOK NSW 2333 Larry Van Vliet
Giwiirr Consultants 8 Fitzgerald Avenue MUSWELLBROOK NSW 2333 Rodney Mathews & Michelle Stair	Wanaruah Custodians 35 Acacia Circuit SINGLETON NSW 2330 Barbara Foot
Hunter Valley Aboriginal Corporation PO Box 579 MUSWELLBROOK NSW 2333 Julie Griffiths	Wattaka Wonnarua C.C. Service 4 Kennedy Street SINGLETON NSW 2330 Des Hickey
Hunter Valley Cultural Consultants 40 Humphries Street MUSWELLBROOK NSW 2333 Christine Mathews	Wonnarua Culture Heritage 19 O'Donnell Crescent METFORD NSW 2323 Joseph Griffiths

Lower Hunter Wonnarua Council Inc. Shop 2 145 Lang St Kurri Kurri NSW 2327	Upper Hunter Wonnarua Council Inc 124 George Street SINGLETON NSW 2330 Victor Perry
Lower Wonnarua Tribal Consultancy Pty Ltd 156 The Inlet Road BULGA NSW 2330 Barry Anderson	Yinarr Cultural Services 7 Cypress Place MUSWELLBROOK NSW 2333 Kathleen Steward/Kinchella
Muswellbrook Cultural Consultants 10 Scott street MUSWELLBROOK NSW 2333 Brian Horton	Wonn1 Contracting 619 Main Road GLENDALE NSW 2285 Arthur Fletcher
Hunter Valley Natural & Cultural Resources 10 Mill Street MUSWELLBROOK NSW 2333 David French	Mingga Consultants 11 Coolibah Close MUSWELLBROOK NSW 2333 Clifford Mathews
Ungooroo Cultural & Community Services 8 Blaxland Ave SINGLETON NSW 2330 Rhonda Ward	Cacatua Culture Consultants 22 Ibis Pde WOODBERRY NSW 2322 George Sampson
Culturally Aware 7 Crawford Pl Millfield NSW 2325 Tracey Skene	Bullen Bullen 16B Mahogany Ave Muswellbrook NSW 2333 Lloyd Mathews
Upper Hunter Heritage Consultants 14 Edinglassie Drive Muswellbrook NSW 2333 Darrel Mathews	

Copy emailed
to xMangoola



P.O. BOX 127
19 MAITLAND STREET,
MUSWELLBROOK 2333
ABN 83 251 730 169

PH: (02) 6543 1288
(02) 6543 1962
FAX: (02) 6542 5377
EMAIL: wanarua@bigpond.net.au

9 June 2009

Ms J Wilson
Manager Cultural Heritage
Umwelt (Australia) Pty Limited
PO Box 838
TORONTO NSW 2283
(Sent by fax: 4950 5737)

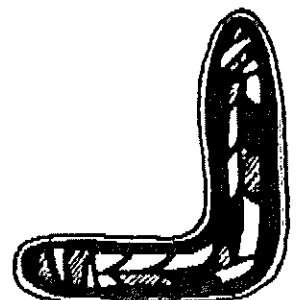
Dear Jan

**RE: STAKEHOLDER CONSULTATION IN RELATION TO
MODIFICATIONS TO THE APPROVED PROJECT DISTURBANCE
AREA FOR THE MANGOOLA MINE, WYBONG NSW**

Thank you for your letter dated 26 May 2009 inviting expressions of interest to be consulted and to participate in the above project, the Land Council takes this opportunity to register its interest in participating in this project by providing a skilled field worker. We shall provide comments on the recommendations, as required, following the review of the draft Aboriginal and Archaeological Assessment, provided that participation in the fieldwork has been undertaken.

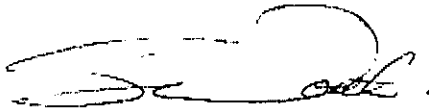
With regard to other Aboriginal stakeholder groups in the Upper Hunter area, to be added to your list:

Rene Molineaux
St Clair Singleton Aboriginal Corporation
30 Carrington Street,
SINGLETON NSW 2330



We look forward to working with you on this project in due course. Should you wish to discuss any of the above issues, please do not hesitate to contact me on 02-6543 1288.

Kind regards



Suzie Worth
Cultural Heritage Officer
Wanaruah Local Aboriginal Land Council



Cacatua Culture Consultants

Entity of Cacatua General Services

ABN 83 774 580 518

23 April 2009

Greg Newton

Xstrata Coal

Mangoola Coal

PO Box 495

MUSWELLBROOK NSW 2333

**RE: Aboriginal Cultural Heritage and Archaeological Assessment
relating to the proposed relocation of a 500kV transmission line
for Mangoola Coal**

Greg,

We would like to express our interest in being involved in the above
Aboriginal Cultural Heritage and Archaeological Assessment relating to
the proposed relocation of a 500kV transmission line for Mangoola Coal
that was advertised in Muswellbrook Chronicle on Friday 17th April 2009.

Our Organisation is fully insured and registered with DECC/EPRG to
undertake work in this area. Our staff has experience working on all
types of sites and carry Construction Induction Cards (Green cards).
When choosing a staff member to undertake this work we try where
possible to use staff local to the area.

Yours truly

A handwritten signature in black ink that reads "George Sampson".

George Sampson

Manager

22 Ibis Parade, Woodberry NSW 2322

Ph: 02 4964 4685 • Fax: 02 4964 4635

500kV Aboriginal Stakeholders Meeting Thursday 18 June 2009 – Muswellbrook PCYC

Mangoola Coal Representatives: J. Yelland (JY), T. Schneekloth (TS), G. Newton (GN), E. Hendry (EH)

Umwelt Representative: Jan Wilson (JW)

Meeting opened at 10:00 am with Welcome to Country - Arthur Fletcher

Issue/Question	Raised by (where known)	Response given by	Response	Action
How many months will it take to relocate the transmission line?	Rhoda Perry	JY	They advise that it will take approximately 6 months – but we need to negotiate the timing with Transgrid to coordinate the outage to occur either Spring or Autumn.	
What Aboriginal offsets will there be?	Rhoda Perry	JY	Offsets are as per the EA.	
When can we put a plan in to use the offset areas?	Rhoda Perry	JY/JW	This needs to be discussed with the group as this will be an active mine – although you can go into Wallaby Rocks now with permission from Mangoola Coal.	
When the mine is in operation we will not be able to get access?	Rhoda Perry	JY	There are areas that you can access without going through the mine – but you must let us know and all groups need to be happy with the activity.	
Looking at the picture showing the crane – the construction footprint will be more than what you say 20 mtrs.	Noel Downs	JY	No, this is the information we have.	
To clarify Rhoda's question – can we get more information regarding access – we need to keep a diary of areas we can visit	Arthur Fletcher	JY	We can provide you with this updated information at our next 6 monthly meeting.	Updated map showing areas that can be accessed.
Muswellbrook Coal had the same issue and they would send out a fax giving the grid reference of areas to be avoided.	Noel Downs	JY	You can access Wallaby Rocks via Anvil Hill Right of Way now with permission from Mangoola Coal – but we will provide updated information on where you can get onto site.	
Can we go to your office and get the paperwork?	Arthur Fletcher	JY	Yes.	
Can the Land Council have these forms and can you put them on your website?	Kathy Steward-Kinchella	JY	Yes we can do this but we will need a couple of days to process any application to access site.	Forms sent to Land Council and placed on internet site.
We need to deal with what access is appropriate – men's and women's business etc.	Arthur Fletcher	JY	You must seek approval before you access the site as you need keys and we need to inform security.	
Is the area easy to access – not too rocky or too much dense bush?	Rhoda Perry	JY	No it is quite accessible.	
We need maps (mud maps would be good) so we know to stay on the tracks.	Arthur Fletcher	NOTE		Provide maps at the next 6 monthly meeting.
Who does the weed management on the site?	Rhoda Perry	JY/JW	We do this – we have a weed management plan and it is done in consultation with the Aboriginal groups at the 6 monthly meeting.	
Anyone interested in getting some of this work should contact Mangoola Coal.	Arthur Fletcher	NOTE	As per discussion at 6 monthly meeting 13/02/09.	
We won't put the map on the website as this would allow the wider community to have access to this sensitive information.	JY	NOTE		
Will the area to be surveyed be pegged before we go out there?	Noel Downs	JW	Yes – the centreline and each side will be pegged for tower locations there will also be a Downer EOI rep with us when we do this who can make decisions to move a tower if needs be if there is an something that needs to be avoided but	

Issue/Question	Raised by (where known)	Response given by	Response	Action
			cannot guarantee this will be possible in all cases. If this happens we will need to discuss on the day what to do.	
If we do find stuff what options are there?	Arthur Fletcher	JW	If in the offset areas there will be no digging holes - outside the offset area need to assess what we will do at the time.	
I want to see wet and/or dry sieving used.	Arthur Fletcher	JW	There will be another round of consultation at that time to discuss the salvage methodology. At this point it will be appropriate to discuss issues around wet or dry sieving - we need to take these things into consideration based on the area we are in if we are near a creek then wet sieving is not appropriate - we will have an opportunity to discuss these issues later.	
You mentioned that the increase in dam height, won't have an impact how are you building the wall for the dam	Arthur Fletcher	JY	The wall is inside the project boundary and the material will be sourced from site depending on the make up of the material we might need to add other material to it to ensure it is suitable.	
There are two issues here - the higher wall and the disturbance of material from on site.	Arthur Fletcher	JY	We already have approval for this dam. Any suitable material in the footprint of the dam will be used - any other material will come from other areas on site.	
The reason I raise this is in my experience when dams have been built there are artefacts in the material used to build them.	Arthur Fletcher			
How long and high is the dam wall?	Lloyd Matthews	JY	We will get back to you on the details but it will be quite high due to the topography.	Details of dam length and height.
Where will all the artefacts go that are collected?	Rhoda Perry	JW	Umwelt have the ones collected so far - we are washing, tagging and analysing them - then they will go back to SCIO.	
Can we have Aboriginal involvement in this process?	Arthur Fletcher	JW/JY	We have only done the washing - we agreed at the last 6 monthly meeting (13/02/09) that if the groups wanted to they could participate in this process Mangoola also agreed that they would fund a training day as well. This will be discussed at the next 6 monthly meeting.	6 monthly meeting agenda add discussion on training day.
Can you please go over the offset map much more slowly and in detail?	Arthur Fletcher	NOTE		
Are you looking at increasing offset options for Anvil Hill?	Noel Downs	JY	Not at this time.	
We know high places are very important areas and we need time to look at these areas.	Arthur Fletcher	JW	We understand this but don't think we need to do a transect - its not about the time involved just be more targeted if we finish earlier we can use this time in the offset areas. We can drive and then get out of the vehicles.	
I am dead set against driving around.	Arthur Fletcher			
How does driving over a site impact it - what are the implications?	Noel Downs	JW	The only problem is if you intentionally drive over an artefact - if we stick to the roads and only get out to walk around this won't be a problem.	
Happy for this to happen but need to have an escort to ensure protection of any artefact.	Noel Downs	JW	We can facilitate transport for anyone not able to walk.	
		TS	I think it is important to remember that not all members of the community are able-bodied. If someone like Barbara Foot wanted to visit these areas, we would facilitate driving to sites/offset areas. We (Mangoola Coal) are taking many precautions so that this did not happen on site. You need to appreciate that in the past this area	

Issue/Question	Raised by (where known)	Response given by	Response	Action
			has been driven over by pastoralists and farmers for many years. We use the tracks to move around site as per Mangoola Coal procedures and induction.	
I would like to be driven around.	Rene Molineaux	NOTE		
Can we have this presentation information on a CD?	Arthur Fletcher	NOTE		Provide presentation on CD for group.
Are there any contaminants involved in the removal of the towers?	Arthur Fletcher	JY	We have done a risk assessment and the only contaminant identified is diesel but I can check this again.	Check with Transgrid re any contaminants involved in the removal of the towers.
Figure 1 shows 'drilling site 1 etc'	Noel Downs	JW	This is an old map and there will be no drilling this is just the name of the historical archaeological site called Drill Site 1.	Umwelt rename the se
Are you including new groups in this work?	Rhoda Perry	TS	We now have 31 registered groups and we have to work with all registered groups.	
Are there be opportunities for employment with Mangoola Coal?	Rhoda Perry	JY	Yes everyone has same opportunity - you can put in an EOI and register a business interest. If you have a business send us your statements of capabilities we will put them on our register as per discussion at the 6 monthly meeting held 13/02/09.	
Would it be possible to use the metal from the towers for the community - can the community use the metal to build things?	Arthur Fletcher	JY	That needs to be determined - XMC owns the old towers.	Seek advice from Management re use of metal by Aboriginal community for projects.
When all the information it sent to you do you want to write a letter back or would you like us to provide a pro-forma for you to complete?	JW		Group decided they would like the pro-forma sent out and they will decide what they do.	Send Pro-forma to groups.
Indicates action item				



National
Native Title
Tribunal



2 October 2009

Amanda Reynolds
Archaeologist
Umwelt (Australia) Pty Ltd
PO Box 838
Tornonto NSW 2283

New South Wales and
Australian Capital Territory
Registry

Level 25, 25 Bligh Street
Sydney NSW 2000
GPO Box 9973
Sydney NSW 2000

Telephone (02) 9235 6300
Facsimile (02) 9233 5613

Our Reference: 2982/09kc

Your Reference: 2497F

Dear Ms Reynolds

Native Title Search Results of Muswellbrook Local Government Area

Thank you for your letter of 30 July 2009.

My search on 2 October 2009 found:

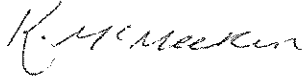
Register Type	NNTT Reference Numbers
National Native Title Register	Nil.
Register of Native Title Claims	Nil.
Unregistered Claimant applications	Nil.
Register of Indigenous Land Use Agreements	Nil.

I have included a NNTT Registers fact sheet to help you understand the search result.

Please note that there may be a delay between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. As a result, some native title determination applications recently filed in the Federal Court may not appear on the Tribunal's databases.

If you need more information please call me on 1800 640 501.

Yours sincerely

A handwritten signature in black ink, appearing to read 'K. Cohen-McMeekin', written in a cursive style.

Kashana Cohen-McMeekin
Trainee

Telephone (02) 9235 6371

Facsimile (02) 9235 5613

Email kashanac@nntt.gov.au

Encl



Searching the NNTT Registers in New South Wales

Search service

On request the National Native Title Tribunal will search its public registers for you. A search may assist you in finding out whether any native title applications (claims), determinations or agreements exist over a particular area of land or water.

In New South Wales native title cannot exist on privately owned land including family homes or farms.

What information can a search provide?

A search can confirm whether any applications, agreements or determinations are registered in a local government area. Relevant information, including register extracts and application summaries, will be provided.

In NSW because we cannot search the registers in relation to individual parcels of land we search by local government area.

Most native title applications do not identify each parcel of land claimed. They have an external boundary and then identify the areas not claimed within the boundary by reference to types of land feature e.g., freehold, agricultural leasehold, public works.

What if the search shows no current applications?

If there is no application covering the local government area this only indicates that at the time of the search either the Federal Court had not received any claims in relation to the local government area or the Tribunal had not yet been notified of any new native title claims.

It does not mean that native title does not exist in the area.

Native title may exist over an area of land or waters whether or not a claim for native title has been made.

Where the information is found

The information you are seeking is held in three registers and on an applications database.

National Native Title Register

The National Native Title Register contains determinations of native title by the High Court, Federal Court and other courts.

Register of Native Title Claims

The Register of Native Title Claims contains applications for native title that have passed a registration test.

Registered claims attract rights, including the right to negotiate about some types of proposed developments.

Register of Indigenous Land Use Agreements

The Register of Indigenous Land Use Agreements contains agreements made with people who hold or assert native title in an area.

The register identifies development activities that have been agreed by the parties.

Application summaries

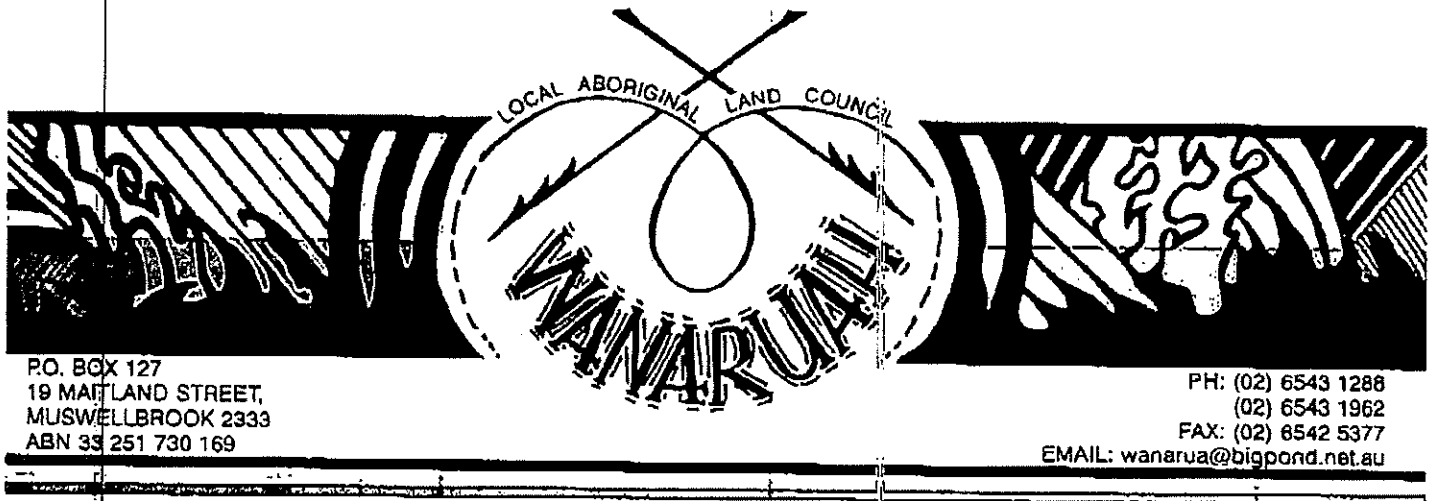
An application summary contains a description of the location, content and status of a native title claim.

This information may be different to the information on the Register of Native Title Claims, e.g., because an amendment has not yet been tested.

How do you request a search?

A search request form is available on the Tribunal's web site at:
<http://www.nntt.gov.au/registers/search.html>
This form says how much searches cost.
Mail, fax or email your request to the Tribunal's Sydney registry, identifying the local government area/s you want searched.

Email: SydneySearch@nntt.gov.au
Fax: (02) 9233 5613
Address: GPO Box 9973, Sydney NSW 2001
Phone: (02) 9235 6300



11 March 2010

Ms T Schneekloth
Environment and Community Co-ordinator
Xstrata Mangoola Pty Ltd
PO Box 495
MUSWELLBROOK NSW 2333
(Sent by fax: 6549 5599)

Dear Toni

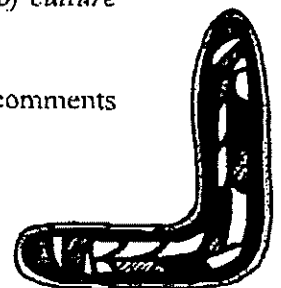
**RE: REVIEW OF DRAFT ABORIGINAL CULTURAL HERITAGE AND
ARCHAEOLOGICAL ASSESSMENT – PROPOSED MODIFICATION
TO PROJECT APPROVAL 06_0014, MANGOOLA COAL, NEAR
DENMAN**

Thank you for the opportunity to comment on the draft report from Umwelt Environmental Consultants dated February 2010.

The Wanaruah LALC (LALC) was not included in the fieldwork undertaken on 1 and 2 September 2009. However we are prepared to express our comments on the project generally.

This letter from the Wanaruah LALC does not express the views of any other Aboriginal stakeholder group or groups (whether their representatives are members of the LALC or not) who have chosen to speak in their own right. The comments provided are considered appropriate under Clause No. 42(4) (a) and (b) of the Aboriginal Land Rights Act (1983) (and its amendments) in relation to the role of the LALC in the protection and the promotion of awareness in the community of culture and heritage for Aboriginal people within its boundary.

Having reviewed the draft report, the LALC wants to make the following comments and recommendations:



(1) This modification project The LAIC does not give their support to the proposed piece-meal extensions to the previously approved disturbance areas. Especially when they encroach on conservation/preservation areas eg. the Habitat Enhancement Areas and the SC10 Management Zone shown on Figure 6.1. The boundaries of these areas should be fenced (particularly SC10 Management Zone) with no disturbance to occur within at least 100m of them. This also applies to approved Aboriginal Cultural Heritage Offset Areas.

(2) Section 11.0

11.1 *Option 1 Site Conservation – Preferred.*

11.2 *Option 2 Site Destruction without Salvage - No*

11.3 *Option 3 Site Destruction with Salvage (Surface Collection Only) - No* – prior to any destruction of sites within the vicinity of drainage lines, these sites should be excavated as an Aboriginal cultural heritage salvage exercise to recover any subsurface artefacts.

11.4 *Option 4 Site Destruction with Salvage (Subsurface Investigation) - Yes* – for the reasons above regardless of any ‘low scientific significance’ of the areas.

11.5 *Offset Options:*

11.5.1 *Land Based Offset:* If Xstrata Mangoola cannot guarantee that there will be no impact to the SC10 Management Zone or the approved Aboriginal Cultural Heritage Offset Areas for perpetuity (not ‘long term conservation’), then the only land based offset that would come anything near being suitable for the loss of the Aboriginal cultural heritage and cultural landscape within the Anvil Hill mine site would be outside the area altogether. Xstrata Mangoola should purchase land of equivalent quality and size (acre for acre) and give it back to the Aboriginal people with funding to maintain it by the Aboriginal people.

11.5.2 *Funding of a Culturally Appropriate Project:* Any funding to compensate for the loss of the Aboriginal cultural heritage and cultural landscape would need to be discussed further in an Aboriginal stakeholder’s workshop, funded and facilitated by Xstrata Mangoola. The funding and how it should be used should be determined by representatives of the Aboriginal stakeholders in consultation with the management of Xstrata Mangoola and the finances and projects decided under this funding compensation be controlled by an existing Aboriginal community based organization eg. Wanaruah LALC.

11.5.3 *Other Offset Option:* These could be seen as given in Options 11.5.1 and 11.5.2 above.

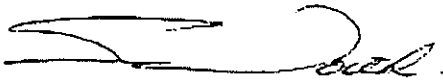
(3) Section 12.0 Management Recommendations The LALC's views on the recommendations in relation to the proposed modification to the mining plan (given based on the draft report's dot-points representing 1 to 7):

1. The above response to Options 11.3 and 11.4 would be preferred.
2. Agreed
3. Agreed, only if this area is retained for perpetuity not 'long term conservation'.
4. Agreed. It is also recommended that the fencing of this tree is to be inspected by the Aboriginal stakeholders' following the protection measures being approved. Where fencing of sites has been recommended in archaeological reports, Aboriginal stakeholders' should also have the opportunity to inspect that this recommendation has been carried out.
5. Agreed, provided the Options 11.3 and 11.4 suggested by the LALC are addressed.
6. Agreed. However prior to any work in Modification Area 3:
 - the LALC would recommend that the artefacts at site SC03 be salvaged or protected by temporary fencing and signage during any work performed nearby in the Modification Area 3 to prevent any disturbance to the site.
 - the LALC also recommends that the entire perimeter of SC10 Management Zone be permanently fenced for the entire life of the mine and then for perpetuity.

7. Agreed.

Thank you once again for the opportunity to comment on the draft report. We look forward to continuing the consultation process with you.

Yours sincerely



Suzie Worth
Cultural Heritage Officer/Indigenous Archaeologist
Wanaruah Local Aboriginal Land Council
Mobile: 0457 707 565

Wanaruah Local Aboriginal Land Council

Barkuma Neighbourhood Centre Trading as...

ABN: 58 290 659 800

Gidawaa Walang

*Wiradjuri Meaning - Goanna Turning the Stone***Cultural Heritage Consultancy**

...To keep our Culture...

Fax Cover

To: Toni

From: Mangoola Coal

Date: 18/3/10

No. of Pages: 1

Dear Toni,

RE: Draft 500kv Relocation Modification Aboriginal Heritage Reports

Draft Aboriginal Cultural Heritage and Archaeology Assessment- Proposed
Relocation of Electricity Transmission Line, Mangoola Coal

Gidawaa Walang Cultural Heritage Consultancy agrees with 11.3 Option 3 Site
Destruction with Salvage (Surface Collection Only) and in the Offset Option 11.5.2-
Funding of a culturally Appropriate Project.

Draft Aboriginal Cultural Heritage and Archaeological Assessment -- Proposed
Modification to Project Approval 06-0014, Mangoola Coal near Denman

Gidawaa Walang Cultural Heritage Consultancy agrees with 11.2 Preferred Options
for Sites to be Impacted by Tower Dismantling and the Offset Option 11.3.2 -
Funding of a Culturally Appropriate Project.

Yours Sincerely


Annie Hickey
Project Officer

**76 Lang Street
Kurri Kurri
NSW 2327**



**Phone: 4937 1094
Fax: 4936 4449
Mob: 0411 196 991**



RE 500KV Report

Dear Toni

After reading the report I can see that you have covered all the relevant issues raised in previous meetings and surveys.

I have no objections to any issues and would like to congratulate you & your team on a job well done.

Regards Rick Coles
HTO manager



18 May 2010

Our Ref: 98-XMC-510-0004-LEO-0353

Wanaruah Local Aboriginal Land Council
PO Box 127
Muswellbrook NSW 2333

Dear Sir/Madam

RE: Response to Comments on Review of Draft Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Modification to Project Approval 06-0014, Mangoola Coal, near Denman

Fencing of SC10 Management Zone and Habitat Enhancement Areas

The response from WLALC indicates that it is considered that the proposed modifications encroach on the SC10 Management Zone and the Habitat Enhancement Area as indicated on Figure 6.1 of the draft report and that these areas should be fenced, with no disturbance to occur within 100 metres of the defined areas.

In accordance with the Mangoola Coal Aboriginal Heritage Management Plan (ACHMP – Umwelt 2008a), the boundaries of the SC10 Management Zone are demarcated by permanent fencing and clear signage as shown below.



The boundaries of the SC10 Management Zone were determined in consultation with the relevant Aboriginal stakeholder groups, an archaeologist and a geomorphologist, with the fenced area including all of SC10 and the associated area of PAD. This process was undertaken

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to ensure the protection of SC10 and associated PAD in its entirety. When marking this boundary in the field with Aboriginal stakeholders, the boundary was extended in order to provide adequate fencing of natural features. In this respect, Mangoola Coal has entirely met its commitment regarding the SC10 Management Zone and it is not feasible to provide an additional 100 metre buffer surrounding the agreed-upon extent of the SC10 Management Zone.

The Habitat Enhancement Area has been identified on the basis of its ecological values and was not considered suitable as an Aboriginal Cultural Heritage Offset Area (ACHOA) by the majority of the relevant Aboriginal stakeholder representatives present on the inspection day (11th September 2009). The Habitat Enhancement Area will be fenced and therefore will be managed in accordance Section 7.3.5 of the ACHMP.

Salvage of Sites within the Vicinity of Drainage Lines

The response from WLALC indicates that site destruction with surface collection is not considered suitable for sites within the vicinity of drainage lines and that these sites should be subject to excavation as an Aboriginal cultural heritage salvage exercise. It is assumed that this recommendation relates to the three artefact scatter sites discussed in the draft report; namely SC03, SC58 and SC59. The site cards for these sites (including plates) are provided for reference.

The portion of SC03 associated with Modification Area 3 was identified as part of an assessment relating to a proposed modification associated with a water pipeline (refer to Umwelt 2008b). As part of this assessment, it was recommended that SC03 be subject to surface salvage on the basis that the site is highly disturbed, lacks integrity and has only very low potential for artefacts in a sub-surface context. This modification to the Mangoola Project approval (including the water pipeline) was approved by the Department of Planning (PA06_0014 MOD2) on 23rd June 2009.

As stated in Section 9.1 of the draft report, four loci of SC03 were recorded in association with Modification Area 3, of which only one is located within the modification area. These loci were situated in areas of significant disturbance with excellent exposure and visibility. However, despite the high levels of disturbance and the excellent visibility only 13 artefacts were located. Soils within the SC03 site area generally consisted of a thin layer of A2 soil over a clay B horizon. The level of disturbance, lack of integrity and low likelihood of potential for artefacts within a sub-surface context were consistent with those discussed above and there were no grounds to modify this recommendation. Site SC03 was consequently subject to surface collection in accordance with the methodology approved under the Mangoola Coal ACHMP (Umwelt 2008a). The surface collection was completed in association with excavations within the Hunter River PAD. The results of the collection of SC03 and subsequent post-excavation artefact analysis will be detailed in Umwelt (in prep a).

As discussed in Section 9.1 of the draft report, SC58 consists of four artefacts located on an eroded ephemeral drainage line within Modification Area 4 and SC59 consists of two artefacts located on a heavily eroded and incised second order tributary of Sandy Creek. Due to the ephemeral nature of the drainage lines, the limited depth of remnant soils and the low numbers of artefacts despite the presence of a large exposures with excellent visibility within both these sites, it was considered highly unlikely that any sub-surface deposits that may be associated with SC58 or SC59 would contain high numbers or densities of artefacts. Furthermore, due to the level of erosion at the site, it is highly unlikely that any sub-surface deposits that may be present will retain spatial or stratigraphic integrity. For these reasons, there is no PAD associated with SC58 and SC59 and there are no archaeological grounds for undertaking sub-surface salvage at this site.

It is noted that extensive sub-surface salvage has already been completed within the approved project disturbance boundary and resulted in the salvage of approximately 11,000 artefacts, with this large number of artefacts considered to comprise a representative sample of sub-surface artefacts within the approved project disturbance boundary. Excavations would only occur where PAD's are identified.

Commitment to In-Perpetuity Conservation of the SC10 Management Zone and the Aboriginal Cultural Heritage Offset Areas

Condition 40 of the current Mangoola Coal Project Approval (PA06_0014 MOD5 relates to the securing of offsets and is provided in full below.

Long Term Security of Offset

40. Within 3 years of this approval, the Proponent shall make suitable arrangements to provide appropriate long term security for the offset areas to the satisfaction of the Director-General.

As stated in the Mangoola Coal ACHMP, Mangoola Coal is committed to the in perpetuity conservation of the ACHOAs and the SC10 Management Zone, with these commitments expected to be formalised in June 2010.

Proposal for Aboriginal Stakeholder Workshop Regarding Funding of a Culturally Appropriate Project

Mangoola Coal is proposing an offset option of the development of a shelter adjacent to the SC10 area. This shelter would add to the educational value of the SC10 site. As such a workshop will not be held.

Monitoring of Fencing of SC-ST-02

As recommended in the draft report, a fence will be erected to enclose SC-ST-02 incorporating a ten metre buffer around the tree itself. Although SC-ST-02 is not subject to impact by the modifications it is located within Modification Area 2 and therefore will be managed in accordance with the Mangoola Coal ACHMP. The proposed fencing of SC-ST-02 will be in accordance with Section 7.3.5 of the ACHMP and will include provision of a gate within the fence to allow access to the site.

References

Umwelt (Australia) Pty Limited (Umwelt). 2008a. Anvil Hill Coal Mine Aboriginal Cultural Heritage Management Plan. Report to Xstrata Mangoola Pty Limited.

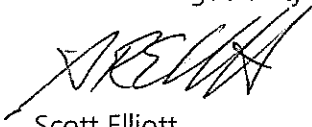
Umwelt (Australia) Pty Limited (Umwelt). 2008b. Aboriginal Archaeological Impact Assessment – Modification for Mangoola Coal Pipeline. Report to Xstrata Mangoola Pty Limited.

Umwelt (Australia) Pty Limited. In prep a. Salvage Program on the Hunter River PAD and surface collection of SC03. Unpublished report to Xstrata Mangoola Pty Limited.

If you require any further clarification, please do not hesitate to contact Toni Schneekloth, Environment & Community Coordinator, on (02) 6549 5500.

Yours sincerely,

Xstrata Mangoola Pty Limited

A handwritten signature in black ink, appearing to read 'S. Elliott', is written over the company name.

Scott Elliott

Project Manager

APPENDIX B

AHIMS Registered Sites

Table 1 - AHIMS Registered Sites

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-0067	Castle Rock; Spring Creek	286854	6432138	Carved tree	Valid		18/08/2009
37-2-0107	Rocky Ground; Myabat	280850	6415652	Burial	Valid		03/08/2009
37-2-0509	Sandy Hollow, Singleton 1	281430	6426990	Artefact scatter	Valid		18/03/2009
37-2-0510	Sandy Hollow, Singleton 2	282270	6426090	Artefact scatter	Valid		18/03/2009
37-2-0511	Sandy Hollow, Singleton 3	284970	6423040	Artefact scatter	Valid		15/04/2008
37-2-0512	Sandy Hollow, Singleton 4	285000	6422950	Artefact scatter	Valid		15/04/2008
37-2-0513	Sandy Hollow, Singleton 5	285200	6422800	Artefact scatter	Valid		15/04/2008
37-2-0517	Denman 1	281360	6412830	Artefact scatter	Valid		15/04/2008
37-2-0518	Denman 2	280260	6413320	Artefact scatter	Valid		15/04/2008
37-2-0519	Denman 3	281710	6413280	Artefact scatter	Valid		15/04/2008
37-2-0567	Castle Rock; Muswellbrook 1	289410	6427880	Artefact scatter	Valid		18/08/2009
37-2-0568	Castle Rock; Muswellbrook 2	290010	6428130	Artefact scatter	Valid		18/08/2009
37-2-0569	Castle Rock; Muswellbrook 3	290240	6428880	Artefact scatter	Valid		18/08/2009
37-2-0742	Manoblai- Castle Rock5	283070	6429940	Artefact scatter	Valid		18/08/2009
37-2-1878	V5	280970	6412830	Artefact scatter	Valid		15/04/2008
37-2-1879	V4	280894	6412766	Artefact scatter	Valid		15/04/2008
37-2-1880	V3	281040	6412630	Artefact scatter	Valid		15/04/2008
37-2-1881	V2	280612	6412412	Isolated find	Valid		15/04/2008
37-2-1882	V1	280713	6412281	Isolated find	Valid		15/04/2008
37-2-1883	V6	280970	6412740	Artefact scatter	Valid		15/04/2008
37-2-1987	MR-OS-1	281870	6416625	Artefact scatter	Destroyed - permits 1447, 1646		03/08/2009
37-2-2077	Lot 168 DP 750968	281700	6420550	Artefact scatter	Valid		03/08/2009
37-2-2087	BMRA1	292790	6425589	Isolated find	Valid		18/08/2009
37-2-2088	BMRA2	292802	6426004	Isolated find	Valid		18/08/2009
37-2-2089	BMRA3	292761	6426498	Isolated find	Valid		18/08/2009
37-2-2090	BMRA4	292583	6426881	Isolated find	Valid		18/08/2009
37-2-2091	BMRA5	292094	6427550	Isolated find	Valid		18/08/2009
37-2-2092	BMRA6	291883	6427699	Isolated find	Valid		18/08/2009
37-2-2130	WC01*	279095	6424616	Artefact scatter	Valid		15/04/2008
37-2-2131	WC02*	279071	6424623	Artefact scatter	Valid		15/04/2008

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2132	WC03*	279106	6424674	Artefact scatter	Valid		15/04/2008
37-2-2133	WC04*	279046	6424650	Artefact scatter	Valid		15/04/2008
37-2-2134	WC05*	279367	6424739	Rockshelter with PAD	Valid		15/04/2008
37-2-2135	WC06*	279354	6424718	Artefact scatter	Valid		15/04/2008
37-2-2136	WC07*	279255	6424650	Isolated find	Valid		15/04/2008
37-2-2137	WC08*	279236	6424604	Artefact scatter	Valid		15/04/2008
37-2-2138	WC09*	279236	6424531	Artefact scatter	Valid		15/04/2008
37-2-2139	WC10*	279208	6424484	Isolated find	Valid		15/04/2008
37-2-2140	WC11*	279206	6424478	Isolated find	Valid		15/04/2008
37-2-2141	WC12*	279195	6424480	Isolated find	Valid		15/04/2008
37-2-2142	WC13*	279195	6424462	Isolated find	Valid		15/04/2008
37-2-2143	WC14*	279155	6424399	Artefact scatter	Valid		15/04/2008
37-2-2144	WC15*	279155	6424466	Isolated find	Valid		15/04/2008
37-2-2145	WC16*	279087	6424505	Isolated find	Valid		15/04/2008
37-2-2146	WC17*	279126	6424456	Artefact scatter	Valid		15/04/2008
37-2-2147	WC18*	279169	6424608	Artefact scatter	Valid		15/04/2008
37-2-2148	WC19*	279122	6424584	Isolated find	Valid		15/04/2008
37-2-2149	WC20*	279107	6424568	Artefact scatter	Valid		15/04/2008
37-2-2150	WC21*	278790	6425444	Artefact scatter	Valid		18/03/2009
37-2-2151	WC22*	278733	6422546	Artefact scatter	Valid		03/08/2009
37-2-2152	WC23*	279149	6422282	Isolated find	Valid		03/08/2009
37-2-2153	WC24*	279259	6422292	Isolated find	Valid		03/08/2009
37-2-2154	WC25*	280101	6422719	Rockshelter with PAD	Valid		03/08/2009
37-2-2155	WC26*	280101	6422719	Rockshelter with PAD	Valid		03/08/2009
37-2-2156	WC28*	280192	6422329	Isolated find	Valid		03/08/2009
37-2-2157	WC29*	279071	6422329	Isolated find	Valid		03/08/2009
37-2-2158	WC30*	278825	6422566	Isolated find	Valid		03/08/2009
37-2-2159	WC43*	279319	6425147	Rockshelter with PAD	Valid		18/03/2009

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2160	WC44*	279283	6425039	Isolated find	Valid		18/03/2009
37-2-2161	WC45*	279259	6424983	Rockshelter with PAD	Valid		18/03/2009
37-2-2162	WC46*	279364	6425152	Rockshelter with PAD	Valid		18/03/2009
37-2-2163	WC47*	279620	6425688	Rockshelter with PAD	Valid		18/03/2009
37-2-2164	BFC01*	281296	6424054	Artefact scatter	Valid		18/03/2009
37-2-2165	BFC02*	279062	6425271	Isolated find	Valid		18/03/2009
37-2-2166	BFC09*	279520	6425518	Artefact scatter	Valid		18/03/2009
37-2-2167	BFC24*	280719	6426431	Artefact scatter	Valid		18/03/2009
37-2-2168	BFC03*	279152	6425302	Isolated find	Valid		18/03/2009
37-2-2169	BFC04*	279186	6425424	Isolated find	Valid		18/03/2009
37-2-2170	BFC05*	279159	6425448	Isolated find	Valid		18/03/2009
37-2-2171	BFC06*	279204	6425490	Isolated find	Valid		18/03/2009
37-2-2172	BFC07*	279686	6425526	Isolated find	Valid		18/03/2009
37-2-3173	BFC10*	279521	6425534	Artefact scatter	Valid		18/03/2009
37-2-2174	BFC08*	279510	6425495	Artefact scatter	Valid		18/03/2009
37-2-2175	BFC11*	279505	6425523	Artefact scatter	Valid		18/03/2009
37-2-2176	BFC13*	279527	6425519	Isolated find	Valid		18/03/2009
37-2-2177	BFC15*	281492	6427054	Artefact scatter	Valid		18/03/2009
37-2-2178	BFC16*	280969	6426707	Isolated find	Valid		18/03/2009
37-2-2179	BFC17*	280955	6426717	Artefact scatter	Valid		18/03/2009
37-2-2180	BFC18*	280935	6426686	Artefact scatter	Valid		18/03/2009
37-2-2181	BFC20*	280869	6426762	Isolated find	Valid		18/03/2009
37-2-2182	BFC21*	280878	6426717	Isolated find	Valid		18/03/2009
37-2-2183	BFC22*	280784	6426569	Isolated find	Valid		18/03/2009
37-2-2184	BFC14*	279498	6425260	Artefact scatter	Valid		18/03/2009
37-2-2185	BFC19*	280896	6426638	Artefact scatter	Valid		18/03/2009
37-2-2186	BFC23*	280793	6426540	Artefact scatter	Valid		18/03/2009
37-2-2187	BFC25*	280915	6426670	Artefact scatter	Valid		18/03/2009
37-2-2188	BFC26*	381582	6426938	Artefact scatter	Valid		18/03/2009

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2189	BFC27*	281523	6426924	Isolated find	Valid		18/03/2009
37-2-2190	BFC28*	281419	6426941	Artefact scatter	Valid		18/03/2009
37-2-2191	BFC29*	281451	6426695	Artefact scatter	Valid		18/03/2009
37-2-2192	BFC30*	281377	6426906	Artefact scatter	Valid		18/03/2009
37-2-2193	BFC31*	281135	6426766	Artefact scatter	Valid		18/03/2009
37-2-2194	BFC32*	280869	6426569	Artefact scatter	Valid		18/03/2009
37-2-2195	BFC33*	280648	6426345	Artefact scatter	Valid		18/03/2009
37-2-2196	BFC34*	280565	6426295	Artefact scatter	Valid		18/03/2009
37-2-2197	BFC35*	279082	6425345	Isolated find	Valid		18/03/2009
37-2-2198	BFC36*	279087	6425301	Isolated find	Valid		18/03/2009
37-2-2199	BFC37*	279074	6425293	Isolated find	Valid		18/03/2009
37-2-2200	BFC38*	282523	6427416	Artefact scatter	Valid		18/03/2009
37-2-2201	BFC39*	282582	6427466	Artefact scatter	Valid		18/03/2009
37-2-2202	BFC40*	282883	6427798	Artefact scatter	Valid		18/03/2009
37-2-2203	BFC41*	282714	6427778	Isolated find	Valid		18/03/2009
37-2-2204	BFC12*	279686	6425526	Artefact scatter	Valid		18/03/2009
37-2-2205	BFC42*	282685	6427555	Artefact scatter	Valid		18/03/2009
37-2-2206	BFC43*	282630	6427530	Artefact scatter	Valid		18/03/2009
37-2-2207	BFC44*	282489	6426972	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2208	BFC45*	282512	6426927	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2209	BFC46*	282503	6426979	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2210	BFC47*	282320	6427101	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2211	BFC48*	281824	6426822	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2212	BFC49*	284831	6426854	Artefact scatter	Valid		18/08/2009
37-2-2219	CG01*	281419	6425006	Rockshelter with PAD	Valid		18/03/2009
37-2-2220	CG02*	283015	6425352	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2221	CG03*	283077	6425609	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2222	CG04*	281177	6426090	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2223	CG05*	281029	6426201	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2224	CG06*	281000	6426197	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2225	CG07*	281000	6426197	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2226	CG08*	281709	6424885	Rockshelter with PAD	Valid		15/04/2008
37-2-2227	CG09*	281726	6424861	Rockshelter with PAD	Valid		15/04/2008
37-2-2228	CG10*	281717	6424858	Rockshelter with PAD	Valid		15/04/2008
37-2-2229	CG11*	281603	6424981	Isolated find	Valid		15/04/2008
37-2-2230	CG12*	280968	6426092	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2231	CG13*	281101	6426165	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2232	CG14*	281124	6426179	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2233	CG15*	281173	6426162	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2242	AC01*	280182	6425392	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2243	AC02*	280171	6425349	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2244	AC03*	280220	6425339	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2245	AC04*	280201	6425459	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2246	AC05*	280221	6425893	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2247	AC07*	282375	6423732	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2248	AC08*	282372	6423679	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2249	AC09*	282192	6423621	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2250	AC10*	282158	6423888	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2251	AC11*	282188	6424027	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2252	AC12*	282618	6423785	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2253	AC13*	282662	6423735	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2254	AC14*	282631	6423668	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2255	AC15*	282708	6423576	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2256	AC16*	282563	6422354	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2257	AC17*	283328	6423754	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2258	AC29*	283283	6423750	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2259	AC30*	281558	6423606	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2260	AC31*	281605	6423636	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2261	AC32*	281715	6423664	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2262	AC33*	281884	6423572	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2263	AC34*	283967	6423148	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2264	AC35*	280695	6424057	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2265	AC37*	280599	6424092	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2266	AC06*	280287	6425880	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2009
37-2-2270	SC01*	285039	6420063	Isolated find	Valid		15/04/2008
37-2-2271	SC02*	284996	6421192	Artefact scatter	Valid		15/04/2008
37-2-2272	SC03*	285197	6422722	Artefact scatter	Valid		15/04/2008
37-2-2273	SC04*	285144	6420004	Isolated find	Valid		15/04/2008
37-2-2274	SC05*	283798	6425129	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2275	SC06*	283995	6425255	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2276	SC07*	284595	6425497	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2277	SC08*	284587	6422579	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2278	SC09*	284796	6425282	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2279	SC10*	284850	6422973	Artefact scatter	Valid		15/04/2008
37-2-2280	SC13- Sandy Hollow*	284698	6425205	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2281	AC18*	281287	6424953	Isolated find	Valid		15/04/2008
37-2-2282	AC19*	279638	6424929	Isolated find	Valid		15/04/2008
37-2-2283	AC21*	282346	6423755	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2284	AC22*	282285	6423677	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2285	AC23*	282241	6423635	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2286	AC24*	282056	6423647	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2287	AC25*	282158	6423985	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2288	AC26*	282209	6424066	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2289	AC27*	282707	6423633	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2290	AC28*	283260	6423740	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	15/04/2008
37-2-2291	AC39*	281760	6423709	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	03/08/2009
37-2-2292	AC41*	279781	6425918	Artefact scatter	Valid		18/03/2009
37-2-2293	AC42*	279493	6424894	Rockshelter with PAD	Valid		15/04/2008
37-2-2294	AC43*	280490	6425967	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2008
37-2-2295	AC44*	280571	6425934	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2008
37-2-2296	CG16*	281021	6426083	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2008
37-2-2297	CG17*	282931	6425907	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2008
37-2-2298	SC11*	284617	6424961	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2299	SC12*	284586	6425888	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2300	SC14*	284706	6425106	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008	18/08/2009
37-2-2301	WC31*	279060	6424420	Isolated find	Valid		15/04/2008
37-2-2302	WC32*	279099	6424645	Artefact scatter	Valid		15/04/2008
37-2-2303	WC33*	278785	6422344	Rockshelter with PAD	Valid		03/08/2009
37-2-2304	WC34*	279245	6422082	Isolated find	Valid		03/08/2009
37-2-2305	WC35*	279587	6421956	Artefact scatter	Valid		03/08/2009
37-2-2306	WC36*	279844	6421873	Isolated find	Valid		03/08/2009
37-2-2307	WC37*	280517	6421732	Artefact scatter	Valid		03/08/2009
37-2-2308	WC38*	280516	6421680	Artefact scatter	Valid		03/08/2009
37-2-2309	WC39*	280022	6421457	Artefact scatter	Valid		03/08/2009
37-2-2310	WC40*	279301	6424566	Isolated find	Valid		15/04/2008

AHIMS #	Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?	Search Date
37-2-2311	WC41*	279207	6424293	Artefact scatter	Valid		15/04/2008
37-2-2312	WC42*	279029	6424307	Artefact scatter	Valid		15/04/2008
37-2-2313	WC48*	279188	6424427	Isolated find	Valid		15/04/2008
37-2-2314	AC20*	280214	6425779	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008	18/03/2008
37-2-2319	EA2*	282870	6414980	Artefact scatter	Valid		03/08/2009
37-2-2320	EA1*	283151	6414935	Isolated find	Valid		15/04/2008
37-2-2563	Mount Pleasant 705	285732	6429159	Artefact scatter	Valid		18/08/2009
37-2-2628	BMRA7	241388	6427569	Isolated find	Valid		18/08/2009
37-2-2629	BMRA8	291754	6428128	Isolated find	Valid		18/08/2009
37-2-2630	BMRA9	291687	6428113	Isolated find	Valid		18/08/2009
37-2-2684	SC44 (Denman)*	282813	6415621	Isolated find	Valid		03/08/2009

* Sites listed on AHIMS database with GDA datum but coordinates are actually for AGD datum

Table 2 - Unregistered Sites Not Recorded by Umwelt

Site	E_AMG	N_AMG	Site Type	Site Status	Salvaged?
AH1	282576	6423782	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AH2	282645	6426177	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AH3	281138	6426075	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA1	281799	6425888	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA2	282117	6426172	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA3	282064	6426204	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA4	282184	6426120	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA5	282254	6426096	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA6	282132	6426077	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA7	282055	6426079	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA8	281843	6427003	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA9	281865	6427035	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA10	281827	6426921	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA11	281517	6426915	Artefact scatter	Valid	
EWA12	281425	6426941	Artefact scatter	Valid	
EWA13	281425	6426985	Artefact scatter	Valid	
EWA14	281440	6427015	Artefact scatter	Valid	
EWA15	281365	6426904	Artefact scatter	Valid	
EWA16	281344	6426852	Artefact scatter	Valid	
EWA17	281538	6426755	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
EWA18	281506	6426898	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008 - Relocated section that extends into approved project disturbance boundary but no artefacts were found
EWA19	281528	6427181	Artefact scatter	Valid	
Drilling site C	283450	6422800	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
Drilling site D	280950	6422250	PAD	Valid	
Drilling site U	282250	6425900	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
Clarks Gully Site	282177	6426165	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
Big Flat Creek Site	281928	6427029	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008

Table 3 - Umwelt sites not identified in site searches

Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?
AC36	280709	6424049	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
AC38	281906	6422259	Rockshelter with PAD	Listed as valid but has been salvaged under approval	Salvaged 2008
AC40	282285	6423669	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AC45	280351	6424165	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AC46	280371	6423987	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AC47	280383	6424267	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
AC48	280513	6423961	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
CG18	282418	6425968	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
CG19	281552	6424962	Rockshelter with PAD	Listed as valid but has been salvaged under approval	Salvaged 2008
SC15	284310	6420069	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC16	284337	6420398	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC17	284488	6420710	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC18	284543	6420928	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC19	284821	6421356	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC20	284884	6421491	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC21	284992	6421765	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC22	284905	6421968	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC23	284987	6422037	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC24	284936	6422119	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC25	284789	6422482	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC26	284720	6425077	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC27	284566	6424898	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC28	284742	6425073	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC29	284691	6420437	Artefact scatter	Valid	
SC30	284611	6420522	Artefact scatter	Valid	
SC31	284719	6420516	Isolated find	Valid	
SC32	284751	6420700	Isolated find	Valid	
SC33	284757	6422691	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC34	284777	6422679	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC35	284779	6422704	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008

Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?
SC36	284782	6422720	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC37	284860	6422733	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC38	284666	6422819	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC39	284657	6422841	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC40	284663	6422848	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC41	284651	6422810	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
SC42	284635	6422686	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC43	284119	6425848	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
SC45	283187	6417601	Isolated find	Valid	
SC46	283129	6417721	Isolated find	Valid	
SC47	283343	6419589	Artefact scatter	Valid	
SC48	283318	6419729	Artefact scatter	Valid	
SC49	283441	6420313	Artefact scatter	Valid	
SC50	283485	6420631	Isolated find	Valid	
SC51	283513	6420697	Artefact scatter	Valid	
SC52	283530	6420808	Isolated find	Valid	
SC53	283587	6421185	Isolated find	Valid	
SC54	283608	6421334	Isolated find	Valid	
SC55	283631	6421517	Isolated find	Valid	
SC-ST-01	284153	6425746	Scarred tree	Listed as valid but has been salvaged under approval	Salvaged 2008
WC27	280097	6422526	Rockshelter with PAD	Valid	
WC49	279374	6422478	Rockshelter with PAD	Valid	
BFC50	279614	6425645	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC51	279547	6425738	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC52	279778	6426029	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC53	284536	6426452	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC54	284312	6426611	Isolated find	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC55	284005	6426525	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC56	284039	6426112	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008
BFC57	279599	6426070	Artefact scatter	Valid	
BFC58	279632	6426137	Artefact scatter	Valid	
BFC59	279652	6426139	Artefact scatter	Valid	

Site Name	E_AMG	N_AMG	Site Type	Site Status	Salvaged?
BFC60	279678	6426159	Artefact scatter	Valid	
BFC61	279772	6426208	Artefact scatter	Valid	
BFC62	279816	6426198	Artefact scatter	Valid	
BFC63	280179	6426343	Artefact scatter	Valid	
BFC64	280374	6426309	Artefact scatter	Valid	
BFC65	280207	6426421	Artefact scatter	Valid	
BFC66	280174	6426114	Artefact scatter	Valid	
BFC67	279749	6426101	Isolated find	Valid	
BFC68	289430	6426679	Artefact scatter	Listed as valid but has been salvaged under approval	Salvaged 2008

APPENDIX C

Exposure Information and Calculations

Table 1 - Exposure Calculations

Modification Area	Discrete exp #	Landform	Length (m)	Width (m)	Area (m ²)	Vis (%)	Effective coverage area (m ²)	Type of exposure	Associated sites
1	1	Slope (lower)	70	3	210	90	189	Access track with severe sheetwash erosion	
1	2	Slope (mid)	15	10	150	40	60	Sheetwash erosion under trees	
1	3	Slope (mid)	10	1	10	90	9	Sheetwash erosion under trees	
1	4	Crest	50	20	1000	10	100	Sheet wash erosion associated with gravel quarry	
1	5	Crest	100	25	2500	80	2000	Gravel quarry	
1	6	Slope (lower)	50	3	150	40	60	Sheetwash erosion under trees	
1	7	Slope (lower)	30	20	600	40	240	Sheetwash erosion under trees	
1	8	Slope (lower)	50	3	150	40	60	Access track with sheetwash erosion	
1	9	Slope (lower)	40	20	800	40	320	Sheetwash erosion under trees	
1	10	Slope (lower)	120	3	360	30	108	Access track with sheetwash erosion	
1	11	Slope (lower)	40	20	800	80	640	Area of sheetwash erosion associated with fence and gate	
TOTAL (1)					6730		3786		
2	1	Drainage line	15	5	75	60	45	Gully and sheetwash erosion along drain	
2	2	Drainage Line	30	10	300	70	210	Gully and sheetwash erosion along drain	
2	3	Drainage Line	50	15	750	40	300	Gully and sheetwash erosion along drain	SC59 (locus 2)
2	4	Drainage Line	20	40	800	60	480	Gully and bank collapse along drain	SC59 (locus 1)
2	5	Slope (lower)	2	1	2	80	1.6	Ant bed with sheetwash erosion in surrounds	
TOTAL (2)					1927		1036.6		
3	1	Slope (lower)	5	2	10	80	8	Sheetwash erosion	SC03 (locus 3)
3	2	Slope (lower)	50	5	250	30	75	Sheetwash erosion	
TOTAL (3)					260		83		

Modification Area	Discrete exp #	Landform	Length (m)	Width (m)	Area (m ²)	Vis (%)	Effective coverage area (m ²)	Type of exposure	Associated sites
4	1	Drainage Line	10	6	60	80	48	Area of sheetwash erosion bordering minor drainage line	
4	2	Drainage Line	20	10	200	60	120	Area of sheetwash erosion bordering minor drainage line	SC58
TOTAL (4)					260		168		
5	1	Slope (lower)	70	4	280	30	84	Area of excavated soil associated with contour banks/channeling to nearby dam	
TOTAL (5)					280		84		
6	1	Floodplain (Hunter)	1	1	1	85	0.85	Ant bed	
TOTAL (6)					1		0.85		

APPENDIX D

Arboriculturalist Report

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REPORT:

ARBORICULTURAL ASSESSMENT

OF

Scarred Trees

AT

Mangoola Coal
Mangoola
New South Wales

FOR

Xstrata Mangoola Pty Ltd (Xstrata)

Prepared 9 October 2009
Reference 12061

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Appendices

Appendix A	Sustainable Retention Index Value (SRIV) Version 3 (IACA 2009)
Appendix B	References
Appendix C	Glossary of terminology (IACA 2009)

SUMMARY

This report examines three (3) trees (*the trees*), including two (2) live and one (1) dead trees. The Trees summarized in Table 1.0 were located within or adjacent to the area of Xstrata Mangoola Pty Ltd, Mangoola NSW. Of the three (3) trees examined the wounds on one (1) was considered to be of cultural origin.

Table 1.0 Summary of each tree including likely age, wounding and cause of wounding.

Tree No. / Archaeological No.	Genus and species	Common name	1. Age range of tree in yrs. approx. / 2. Age range of wound in yrs. approx.	Likely origin of wound/s	Photograph of tree
1 / BFC88	<i>Eucalyptus moluccana</i> Roxb.	Grey Box	1. 80 - <150 2. 1. 50 - <75	surveyor's blaze, historical 	
2 / BFC86	<i>Eucalyptus crebra</i> F. Muell.	Narrow-leaved Red Ironbark	1. 150 - <200 2. >40 - <75	possible contemporary incision wound of cultural origin but most likely a laceration from abrasion impact event from excavation equipment when adjacent dam being built and of non- cultural origin 	 
3 / SC59	<i>Eucalyptus crebra</i> F. Muell.	Narrow-leaved Red Ironbark	1. 150 - <250 2. 150 - <200	cultural origin 	

1.0 PREFACE

URBAN TREE MANAGEMENT © was engaged to prepare this report for Umwelt (Australia) Pty Ltd, 2/20 The Boulevard, Toronto NSW 2283 on behalf of Xstrata Mangoolo Pty Ltd, PO Box 495 Muswellbrook NSW 2333. This report has been undertaken to assist in determining the following information for *each tree* examined: age of tree, age of wounding event/s, likely causation, condition of each tree, possible remaining lifespan or risk to live/dead tree/s and risks to conservation of each scarred section. This to include possible further consultation with the registered Aboriginal stakeholder groups regarding preservation of the fragile tree remains on or off site and likely remaining lifespan of scarred tree/s if conservation measures undertaken.

This report considers 3 trees to assist in determining whether their wounds were of *cultural* or *non-cultural* origin.

2.0 INTRODUCTION

Mr Danny Draper (*the author*) attended the site containing the scarred trees, Mangoolo NSW (*the site*), on 9th October 2009 and the trees and their growing environment and wounding were examined to determine the likely cause and estimated age of scarring and the wounds longevity subject to proposed works nearby.

The dimensions of the tree wound/s were recorded and the wound/s photographed by the author. The age of each tree provided is an estimate only and offered within a range due to the uncertainty of such unsubstantiated field observations without the application of Dendrochronology or other records. Without such precise data the age of trees are usually considered in stages of life span against their biomass *in situ* as Young (0-20%), Mature (20-80%) and Over-mature (senescent) (80-100%).

3.0 METHODOLOGY

The trees are recorded using Global Positioning System (GPS) coordinates by the Archaeologist/s and each tree identified by a unique code number. Here for ease of reference each tree was assigned a sequential number by UTMA Pty Ltd followed by the code assigned by the Archaeologists, e.g. 3 / Scarred Tree 3.

The inspection/s was undertaken by a visual assessment conducted from the ground and considers as part of the assessment/s the remaining lifespan of a live tree or durability of the remains of a dead tree where the scarred section is to be preserved.

A glossary of terms is included as Appendix C covering the description of the tree/s.

Assessment of Trees

The following criteria were recorded to reflect the current status of the trees being: Age class, Condition class, Form class, Dimensions, Crown cover (live foliage as %), Crown density (density of live foliage evident as %), vigour class and Sustainable Retention Index Value (SRIV) version 3 (IACA, 2009) of each live tree (Appendix A), where appropriate.

The age of the trees was estimated from a sound professional knowledge or research of the individual tree taxa, growth of trees within the region based on habitat, rainfall, soil type and land use practices and considered against the dimensions of each tree encountered and the limitations of its growing environment *in situ*. A tree may be described in greater detail than others where it was considered appropriate to more accurately describe the location of the wound or the circumstances which may have lead to its formation.

Assessment of Wounds to determine Archaeological status as Scarred Trees

As a tree grows vascular cambium as a thin layer of dynamic cells close to the surface produces xylem to form wood on the inner side, and phloem to form bark on the outer side. The cambium grows as a continuous ring and is laid down as fibres along the trunk, stems and roots when a new growth increment layer is developed. The vascular cambium translocates nutrients in solution through the fibres from the roots to the leaves through the xylem and sugars produced in the leaves as photosynthates through the phloem and ray cells and to the roots. Their structural importance allows for strength and flexibility as energy from loading forces from the trees mass and wind movement stimulates adaptive growth and reactive growth. The shape and form of a tree is affected as wind moves along stems from the distal to proximal end dissipating and diminishing through damping through the trunk and roots and out into the ground (James et al 2006, Mattheck & Breloer 1994, pp. 14-19).

When the vascular cambium is disrupted a wound occurs. If the vascular cambium is severed to a sufficient depth fibres above and below will become desiccated and die forming a wound with the extent of tissue dieback often unpredictable and extending beyond the initial point of wounding. The coating of live tissue allows for a uniform distribution of loading forces over the entire tree – the *axiom of uniform stress* (Mattheck & Breloer 1994, p. 183), with additional or less wood produced depending on loading forces of compression, tension, shear and torsion. The stimulus of wounding usually changes the distribution of loading forces and the growth responses from the tree which can manifest as altered growth patterns as the load bearing capacity of the tree is modified and the crown and growing conditions alter over the life of the tree. Such changes may be caused by shedding branches, hollowing from termites, fungal decay or fire, clearing of nearby trees increasing exposure to winds, branch shedding, further wounding, and root damage from excavation, soil cultivation or erosion.

When wounding occurs the trees biomechanics predispose it to attempt to restore the alignment of its fibres and to protect it from pathogens by the growth of new wood and to isolate the wound through 4 walls of defence as provided by (CODIT) Compartmentalization of Decay In Trees (Shigo 1989, p. 45) by chemically altering surrounding wood and walling off the damage using barriers provided by existing cellular structures as Walls 1-3 and finally to conceal the wound separating it from the damage caused at the time of wounding beneath layers of new wood as Wall 4. At the time of wounding Wall 1 is formed by plugging xylem vessels vertically above and below the wound. Wall 2 is formed tangentially in growth rings by the concentration of lignin in the cells of late season's growth acting to prevent the inward spread of pathogens. Wall 3 forms at the sides of the wound from ray cells producing toxins which limits spread laterally. Wall 4 is the new wood separating the initial wound site from new growth and forms the *wound margin*.

The sides of the wound are *wound margin left* and *wound margin right* which slowly converge and usually form an oblong, circular or elliptic shape (Draper and Richards 2009). The distal and proximal ends of a wound are the *wound apex* and *wound base* respectively and may be irregular, jagged, obtuse, rounded, truncate to acute ($<90^{\circ}$) where the margins converge often forming a wound seam or partial occlusion (Draper and Richards 2009). The wood exposed by the removal of the bark is the *wound face* although this may be absent if a void is evident as a *cavity* or a larger void as a *hollow* (Draper and Richards 2009).

No matter what the shape of the wound the tree will ultimately attempt to align the fibres to grow over and conceal the wound to restore the cover of living wood around and along the stem to return the stem to its structural optimum, capable of receiving a uniform stress loading (Mattheck and Breloer 1994, pp. 12-16). Ultimately most margins converge and graft to conceal the *wound face* and it is then that the tree has achieved wound *occlusion* (Draper and Richards 2009). The living tissue disrupted at the time of wounding will always die, remain damaged and continue to deteriorate even when a wound is occluded by successive growth rings because trees do not heal they can only conceal the damaged cells with consecutive layers formed by each seasons growth (Mattheck and Breloer 1994, pp. 12-16).

Wound margins encroach over the wound face as new growth ring increments are added around the tree. The *wound margin depth* on the left and right sides usually deepens over time before the wound is occluded and can be measured perpendicular from the wound face to the outer edge of the trunk, or from the outer edge of the trunk to the inner edge of the void if the wound face is absent (Draper and Richards 2009). It is not uncommon for the depth of the *wound margin right* and *wound margin left* or the distances from the *initial wound margin* to the *wound margin* to be different because of reactive growth stimulated by differential loading along the stem in compression, tension, torsion or shear stimulating more wood to be laid down on the side bearing the greatest load (Mattheck and Breloer 1994, pp. 12-16). Where margins are of a similar width and depth they are usually equally loaded or may both be neutrally loaded (Mattheck 2004, p. 17).

As the wound wood margins grow across the wound face from the point of initial wounding a general differentiation in the colour of bark and its texture from surrounding unwounded tissue will sometimes be evident and can assist to indicate the extent of the width of the wound and the approximate location or extent of the *initial wound margin* (Draper and Richards 2009). However this may become less apparent over time with wounds that have been *occluded* for long periods due to the successive growth increments added sometimes concealing the wound entirely, or on trees with thick bark.

By measuring the width of the wound between the left and right *initial wound margin* the diameter of the trunk at the time of wounding and the approximate age of the tree can be estimated. The location of a wound on a trunk is static although the diameter of the stem is increased circumferentially by rings as growth increments, hence the wound margins and wound occlusion. The circumference of the trunk and stems of large old trees increases with age and the layers may be slightly thinner over a radial distance where such growth has slowed, than for younger trees or where they are not stimulated by loading.

The trees in the area are expected to grow at a relatively medium pace due to an average rainfall of 722.3 mm as mean average annual rainfall recorded at the nearby Singleton Army Base, collected from 1969-1990, Latitude: 32.61 °S Longitude: 151.17 °E, Elevation: 73 m (Australian Government Bureau of Meteorology 2009), approximately 30 km away.

To differentiate between cultural scarring, historical scarring, recent mechanical damage or natural causes, the following were considered:

1. Age class
2. Ease of access to the location of wounding
3. Tree and its dimensions at the time of wounding
4. Extent of wounding, its symmetry (symmetrical / asymmetrical)
5. Extent of growth around wound site since initial wounding whether tree alive/dead
6. Impact of that wounding on the tree since the wounding event
7. Land use history
8. Condition class
9. Vigour class
10. Influence of its growing environment and its constraints
11. Proximity to other trees, shape and growth habit
12. Crown form
13. Shading
14. Rainfall
15. Insect damage
16. Fire
17. Soil
18. Aspect
19. Slope
20. Drainage

This Arboricultural assessment will assist Archaeologists and Aboriginal community members determine the status of scarred trees and to manage the tree, by eliminating natural or mechanical causes of wounding and determining the estimated remaining safe life span or works to prolong a live tree *in situ* or to conserve and protect the remaining dead tree or relevant section/s where required.



Photograph 1.0

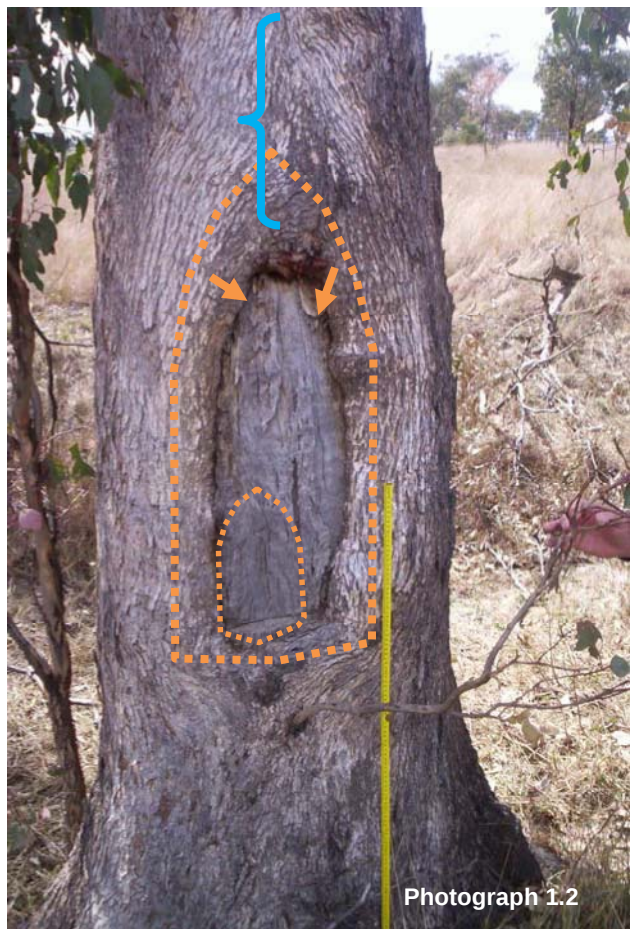
Photograph 1.0 View to east of Tree 1 / BFC88 *Eucalyptus moluccana* Roxb. – Grey Box, with wound on lower trunk from surveyor's blaze indicated by arrow.

Photograph 1.1 View to east of Tree 1 with surveyor's blaze on west side of lower trunk shown with folding ruler extended to 1 m.



Photograph 1.1

Photograph 1.2 View to east of Tree 1 with surveyor's blaze on west side of lower trunk shown with folding ruler extended to 1 m. Bold dotted line shows expected outline of incisions forming initial wound margins. Fine dotted line shows extent of stepped incision. Blue bold brace shows extent of partial occlusion seam of wound apex. Arrows indicate location of steel axe or chisel marks in remaining sapwood near the apex and protected from weathering.



Photograph 1.2

4.1 Assessment of Tree/s – Tree 2 / BFC86

Tree No. / Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound in yrs. approx.	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co- dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation.	Crown cover / Crown density approx. %	WVNZ Age, Vigour, Condition / Index Rating App A.
2 / BFC86 <i>Eucalyptus crebra</i> F. Muell. Narrow-leaved Red Ironbark	1. O 2. 150 – <200 3. >40 - <75	F	D	20 18x18 R	850x800, 825 Av. at 300 E/W	80 80	OGVF - 5

Description

The tree is located at the toe of an earthen dam wall which was expected to have been constructed approximately >40 - <75 years ago. The tree contains high volume large deadwood throughout and has shed some possibly second or third order dead branches. The encroachment by the dam is expected to have buried and killed all upslope roots approximately 50% of the rootplate and the tree undergone a period of stress and dieback but stabilised in the long term due to increased soil moisture from the dam allowing new roots to develop.

Tree acaulescent, crown deliquescent, comprised of 2 codominant first order structural branches (FOSB); orientation E/W; 1 superior to W, erect; 1 inferior to E, acutely divergent and ascending. Inferior FOSB expected to have formed from an epicormic shoot after a stress event up to 100 years ago. The tree has multiple recent wounds from insect borers and fire with an older wound evident by weathering of the exposed wood, located on the E side of the inferior FOSB.

Wound 1

Approximately oval, narrow, asymmetrical, located proximally on E side of the inferior basal first order structural branch. Wound extending from 650 - 1900 mm and 540 at widest at center. Wound face extending from 720 – 1830 mm and 400 mm at widest at 1350 mm (see Photograph 2.2). Wound margins entire, apex and base acute. Wound face entire to dead heartwood. A laceration as a shallow wedge, near horizontal, is evident in the wound face proximally and continuous as shallow indents in the adjoining wound margins (Photographs 2.2 and 2.3). Depth of margins: right 50 mm and left 70 mm. Width of margins: right 70 mm and left 70 mm.

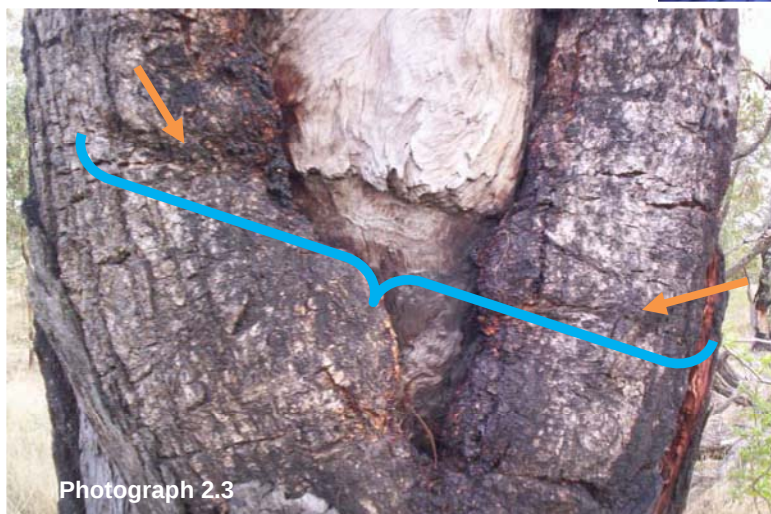
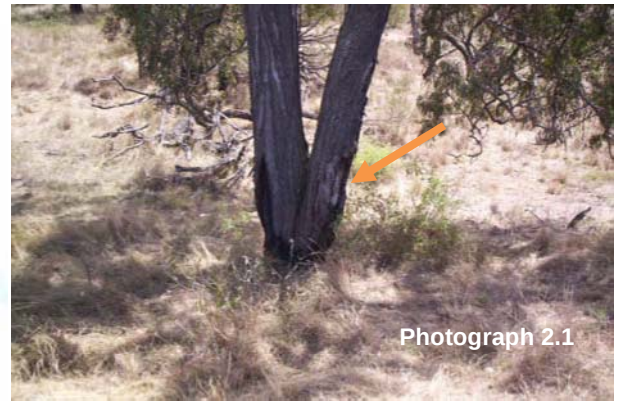
This wound is expected to have affected approximately 10 - 15% of branch circumference *in situ*. The wound is expected to be >40 - <75 years old as the exposed heartwood shows minimal signs of weathering as delignification and cracking. The sapwood while up to 20 mm wide (Bootle 1983, p. 289) appears to have been sloughed away with heartwood remaining. The heartwood has a high density 890-1200 kg / m³ and is resistant to termites (Boland *et al*, 2006, p. 482) or air dry density (ADD) 1090 kg / m³ and is slow drying and durable (Bootle 1983, p. 289).

The area of the branch where the wound occurs is curved upwards and the tissues due to loading as compression can be expected to bulge and be curved, providing a possible dish shape if the bark and sapwood were extracted (Photographs 2.1 and 2.2). From the age of the wound the extraction if of cultural origin would have to be contemporary and undertaken approximately >40 - <75 years ago. However on a wound with minimal weathering, incisions from tools such as steel axes, chisels or chain saws should be evident but none were observed. In the wound face located above the wound base (Photographs 2.2 and 2.3) a ragged line consistent with a laceration is evident extending as a shallow wedge into the heartwood with the line approximately 15 degrees above horizontal. This line and the angle and depth of the laceration are indicative that this hard timber was most likely inflicted by an abrasion impact event by earth moving equipment at the time the dam was being constructed. Most likely when it was almost constructed hence the angle of the laceration above horizontal as the machine worked at the angle of the dam wall's batter.

The wound is expected to have caused a partial delamination with the sapwood and displaced bark sloughed away. While it is possible that the wound is contemporary and cultural in origin, its creation on a farm is unlikely and the laceration forming a deeper ragged wedge across the wound face proximally and an asymmetrical wound is aberrant. Therefore it is likely that the wound is non-cultural in origin.

Risks to tree

Damage from fire, fungal decay, and physical damage from abrasion or collision impact events as relict tree remains.



Photograph 2.0 View to southwest of Tree 2 / BFC86 *Eucalyptus crebra* F. Muell. – **Narrow-leaved Red Ironbark**, arrow indicated location of Wound 1 at base of an inferior first order structural branch.

Photograph 2.1 View to northwest of Tree 2, showing the 2 first order structural branches, 1 inferior (right) with arrow showing location of Wound 1 at base of an inferior first order structural branch.

Photograph 2.2 View to west of Tree 2, Wound 1, shown with a folding ruler extended to 1 m. Blue brace showing the extent and orientation of a laceration as a shallow wedge across the wound face.

Photograph 2.3 View to west of Tree 2, Wound 1 detail, with blue brace showing the extent and orientation of a laceration as a shallow wedge across the wound face extending across the stem indicative as indents in the margins as shown by the arrows.

4.1 Assessment of Tree/s – Tree 3 / SC59

Tree No. / Genus & species Common Name	1. Age Class Y = Young M = Mature O = Over-mature (Senescent) 2. Age range of tree in yrs. approx. 3. Age range of wound in yrs. approx.	Condition G = Good F = Fair P = Poor D = Dead	Form D = Dominant C = Co- dominant I = Intermediate S = Suppressed F = Forest E = Emergent	Height in metres approx. / Crown spread approx. length x breadth metres / Crown spread orientation.	Trunk diameter in mm @ 1.4m, or as stated / Trunk diameter orientation.	Crown cover / Crown density approx. %	WVNZ Age, Vigour, Condition / Index Rating App A.
3 / SC59 <i>Eucalyptus crebra</i> F. Muell. Narrow-leaved Red Ironbark	1. M 2. 150 - <250 3. 150 - <200	D	F	20 N/A	650, R	N/A	N/A

Description

Dead tree with 1 wound on lower trunk on S side. Trunk is slightly leaning to N and the wood on the side of the wound subject to tension. Tree appears to have died >25-<75 years ago.

Wound 1

Narrow linear, symmetrical, lower trunk to S, extending from 280 – 1900 mm and 70 mm at widest at 14000 mm (see Photograph 3.1). Wound face absent extending to hollow with humic mud evident at wound base. Margins entire, apex and base acute. Depth of margins: right 290 mm and left 170 mm. Width of margins: right 100 mm and left 130 mm. Trunk is slightly leaning to N and the wood on the side of the wound subject to tension with the fibres stretched and the bark generally thin and the area flat in its location between two root buttresses (Photograph 3.1).

From the age of the tree and large proportions of the wound its origin could be from an abrasion impact event from collision with a falling tree or a branch tear wound. However this is unlikely as the tree is forest form with no lower branches expected due to competition for space and light and the size of the initial wound would be generally larger than expected from an abrasion impact event from a falling tree or branch and is therefore an unlikely cause.

Initial wound is expected to have affected approximately 10% of trunk circumference *in situ*. The wound is expected to be >150 - <200 years old. From the age of the tree and its form, size of the wound, depth of its margins and its location in a readily accessible position on the lower trunk it is likely of cultural origin.

Risks to tree

Damage from fire, fungal decay, termites, and physical damage from abrasion or collision impact events.

The mass of the trunk above the wound will continue to have loading impact and could be reduced to a stump to 2 m above the wound preserving that wood and reducing the loading on the tension side where the wound provides weakness as a notch. The area of soil around the wound could be treated for termites and the wood protected within a shelter and treated with fungicide to assist in its preservation.



Photograph 3.0



Photograph 3.1

Photograph 3.0 View to north of Tree 3 / SC59 *Eucalyptus crebra* F. Muell. - **Narrow-leaved Red Ironbark**, arrow showing location of Wound 1 with retractable ruler (left of wound) extended to 1 m.

Photograph 3.1 View to north of Tree 3 / SC59 showing Wound 1 with retractable ruler extended to 1 m. Arrows indicate location of root buttresses.

5.0 CONCLUSION

This is provided in table form and summarizes the key information

Tree No.	Age of Tree Age range of tree in yrs. approx.	Age of Scar Age range of wound in yrs. approx.	Likely cause of Scar
1 / BFC88	80 - <150	1) 50-<75	1) Laceration as surveyor's blaze of historical origin.
2 / BFC86	150 - <200	1) >40 - <75	1) Possible contemporary incision wound of cultural origin but most likely laceration from abrasion impact event from excavation equipment when the adjacent dam was being built and of non-cultural origin.
3 / SC59	150 - <250	1) 150 - <200	1) Incision of cultural origin.



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Appendix A

Matrix - Sustainable Retention Index Value (S.R.I.V.)©

Version 3, 2009

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au

To be used with the values defined in the Glossary.
An Index value as indicated where ten (10) is the highest value.

Ek G	Zksy\$ew\$rh\$srhnr\$ew\$					
	Good Vigour & Good Condition (GVG)	Good Vigour & Fair Condition (GVF)	Good Vigour & Poor Condition (GVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
	Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions.
Young (Y)	Mhi \$epi\$ Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5m. High potential for future growth and adaptability. Retain, move or replace.	Mhi \$epi\$ Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium-high potential for future growth and adaptability. Retain, move or replace.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium potential for future growth and adaptability. Retain, move or replace.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.	Mhi \$epi\$ Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5m. Low potential for future growth and adaptability.
Mature (M)	Mhi \$epi\$ Retention potential - Medium - Long Term.	Mhi \$epi\$ Retention potential - Medium Term. Potential for longer with improved growing conditions.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi \$epi\$ Retention potential - Likely to be removed immediately or retained for Short Term.
Over-mature (O)	Mhi \$epi\$ Retention potential - Medium - Long Term.	Mhi \$epi\$ Retention potential - Medium Term.	Mhi \$epi\$ Retention potential - Short Term.	Mhi \$epi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi \$epi\$ Retention potential - Short Term.	Mhi \$epi\$ Retention potential - Likely to be removed immediately or retained for Short Term.

Appendix B

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Appendix C

Glossary

From
Dictionary for Managing Trees in Urban Environments
Institute of Australian Consulting Arboriculturists (IACA) 2009.

Wounds

Abrasion Wound *Mechanical wound* causing *laceration* of tissue by an abrasive impact *episode* e.g. grazed by a motor vehicle or the continuous action of the rubbing of *crossed branches* or stems where no graft has formed.

Basal Trunk Wound A wound on the trunk extending to the *root crown* where the base of the wound is open at the ground and usually truncated. Dependant upon the width of its base such a wound may not become *occluded*.

Blaze A wound cut into a tree usually to the sapwood and sometimes extending to heartwood to create a marker point e.g. by a surveyor, the *wound face* may be further incised or painted to denote additional information.

Branch Tear See *Branch Tear Out*.

Branch Tear Out Dislodging of a branch from its point of attachment where it is torn away from the *branch collar* snapping the *branch tail* causing a *laceration*, usually to the underside of the *branch union* of the branch or trunk to which it was attached forming a *tear out wound*.

Branch Tear Wound See *Tear Out Wound*.

Callus Wood Undifferentiated and unlignified wood that forms initially after wounding around the margins of a wound separating damaged existing wood from the later forming lignified wood or *wound wood*.

Canker A *wound* created by repeated localised killing of the *vascular cambium* and bark by wood *decay* fungi and bacterium usually marked by concentric disfiguration. The wound may appear as a depression as each successive *growth increment* develops around the *lesion* forming a *wound margin* (Shigo 1991, p. 140, Keane *et al* 2000, p. 332).

Cavity A usually shallow void often localized initiated by a *wound* and subsequent *decay* within the trunk, branches or roots, or beneath bark, and may be enclosed or have one or more opening.

Decay Process of degradation of wood by microorganisms (Australian Standard 2007, p. 6) and fungus.

Delaminate A *mechanical wound* caused when the bark is stripped from a tree, usually from the trunk as a continuous sheet back to the vascular cambium. This may occur from an impact or abrasion *episode* such as a collision with a motor vehicle and the tree may become *ringbarked*. See also *Partially Delaminated*.

Delamination The separation of fibres often evident as longitudinal splitting of wood (Lonsdale 1999, p. 313).

Delignification The decomposition of *lignin* from *wood* by chemical deterioration, resulting in loss of strength, evident by separation of fibres into hair like strands. See also *Lignification*.

Depth of Margin Distance from outer trunk perpendicular to the *wound face*. This may assist in determining the age of a wound.

Dieback Wound Wounding where *dieback* extends beyond a branch collar as with *natural pruning* and extends to other branches, trunk or roots. See also *Secondary Crown* and *Stag-headed*.

Enclosed Wound Wound with a perimeter of *wound wood* with a well-defined apex, base and margins and often evident on an older wound. On a pruned branch that is rounded the enclosing wound wood from the branch collar may be circular with no definite apex or base evident. However, on a pruned branch where the *wound face* is oval in shape due to *reaction wood*, the enclosing *wound wood* from the branch collar may form a definite apex, base or margins.

Environmental Wounding/Damage Wounding inflicted by environmental factors or modifications to the growing *environment* of a tree, e.g. sun-scald, drought, fire, water logging, wind damage to leaves, branches, bark or roots, phytotoxic damage from chemicals, or air, soil or water pollution.

Fire Wound Wounding caused by fire. Such wounds may cause initial damage or may be secondary from a previous wounding *episode/s*. Some fire damage may be superficial or may destroy a tree in full or part rendering it potentially vulnerable to failure. Note: fire damaged trees can be potentially hazardous and should be assessed carefully.

Hollow A large void initiated by a *wound* forming a *cavity* in the trunk, branches or roots and usually increased over time by *decay* or other contributing factors, e.g. fire, or fauna such as birds or insects e.g. ants or termites. A hollow can be categorized as an *Ascending Hollow* or a *Descending Hollow*.

Horizontal Wound Usually superficial horizontal wounding from insects burrowing between bark layers and revealed by decorticating bark. Often evident on smooth bark Eucalypts.

Impact Wound *Mechanical wound* caused by an impact *episode* e.g. collision by a motor vehicle.

Incision Wound caused by cutting or engraving. See also *Laceration*.

Increment strip A linear, usually narrow, *fluted* section of *adaptive wood*, forming in a place of high *stress* indicating the pattern of *force flow* (Mattheck 2004, p. 140). Evident as lighter coloured bark usually occurring around the edges of a *notch* or *branch stub*, along a *buttress*, or along a *sharp-edged rib*.

Initial Wound Margin The site of initial wounding often evident as a faint line of discoloured bark or bark of a different texture to adjacent undamaged trunk. This may assist in determining the age of a wound.

Insect Wound Wounding to any part of a tree caused by insect activity, e.g. borers and termites.

Laceration Wound caused by tearing. See also *Incision*.

Lightning Strike Wound A wound from a lightning strike. Such a wound may kill a tree outright or cause it to catch fire, or may destroy the tree in full or part, or no injury may be evident and a tree gradually declines through resulting *stress*. Bark may be exploded from the tree by pressure radiating from the core of the lightning path resulting in further compounded damage through water heating and steam explosions in the tissues and the electrical disruption of living cells (Coder 2004, pp. 35-44).

Mechanical Wound Wounding inflicted by abrasion e.g. by motor vehicles, grass mowing equipment, grazing by horses, cows or birds (parrots); impact e.g. by motor vehicle collisions; drilling e.g. with increment cores, resistographs, cable bracing, hanging pots, hammocks etc.; branch tearing e.g. from wind damage, collision from falling branches, vandalism; and root severance e.g. root pruning for excavation for building or utility services or for agricultural cultivation.

Open Wound Wound with poor to non-existent perimeter or *callus wood* or *wound wood* on an older wound without well-defined apex, base or margins and often this will be associated with a recent wounding *episode* or an older episode on a senescent tree or a tree in *poor condition* or of *low vigour*, or where repeated wounding episodes such as inflicted by ongoing borer activity damages and continually alters wound perimeters, or repeated scalping of exposed roots by lawn mowing equipment.

Occlusion Growth processes where *wound wood* develops to enclose the *wound face* by the merging of *wound margins* concealing the *wound* and restoring the growing surface of the structure with each *growth increment* gradually realigning *fibres* in the wood longitudinally along the stem to maximise uniform stress loading. See also *Axiom of Uniform Stress*.

Partial Occlusion *Wound wood* growth that encloses some of the *wound face* by the merging and *grafting* of some sections of the *wound margins*. Usually evident by reduced *wound face* width and indicated where an *apex* or *base* is *acute* with the vertical extent often indicated by the length of an *occlusion seam*.

Partially Bridged Occlusion *Wound wood* partly forming an *occlusion* by joining areas of the *wound margins* across the *wound face* at point/s other than the base or apex and may form an *occlusion seam*.

Pruning Wound A wound created by the act of *pruning*.

Ram's Horning *Wound wood* that becomes curled inward and can wrap around itself as it crosses a void such as a *cavity* and may succumb to cracking with those wounds susceptible to further infestation by *decay* pathogens.

Scarred Tree A tree containing a wound of cultural or scientific interest, inflicted initially for a specific purpose, e.g. by indigenous people to extract implements or carved as a marker or with a pattern for ceremonial purposes, or as a marker and *blaze* by a surveyor or explorer, or from an accidental *wound* that has not *occluded*.

Stepped Incision A localised area of deeper wounding often extending to the heartwood, usually proximally within a *blaze*, removing a vertical semi-circular wedge like section from the *wound face* with a horizontal bench like structure formed by deep cuts as its base. Such wound sections usually taper distally and may be cut around the outer edges to assist removal of the semi-circular wedge, and likely undertaken to inhibit regrowth.

Structural Wound Any wound occurring on a tree as a result of a structural failure e.g. branch splitting or *hazard beam*, diminishing its stability in full or part.

Succession Wound Preceding layers of failed wound margin/s forming a step like sequence away from the *wound face*, where present, to the current wound margin/s indicating repeated cycles of formation and failure of *CODIT Wall 4*.

Sun Scald Wounding usually on the upper side of branches after sudden exposure to sunlight especially in summer e.g. after excessive pruning of the upper crown, or following storm damage stripping foliage or branches e.g. *Ficus spp*.

Survey Marker Wound See *Blaze*.

Tear Out See *Branch Tear Out*.

Tear Out Wound A wound of usually concave shape created by a *branch tear out*.

Wound Damage inflicted upon a tree through injury to its living cells, from biotic or abiotic causes, e.g. where *vascular cambium* has been damaged by branch breakage, impact or insect attack. Some wounds *decay* and cause *structural deterioration* or *defects*. Trees of *normal vigour* are able to resist and contain infection by walling off areas within the wood by *compartmentalization*. See *Compartmentalization Of Decay In Trees (CODIT)*. An *occlusion* may eventually conceal a wound but the enclosed *defect* remains internally and *decay* may continue to develop further weakening the *heartwood* and *sapwood* compromising the tree's *structural integrity*. The cause of a wound may be accidental e.g. *branch tear out* or deliberate e.g. *carved tree*.

Wound Apex The distal end of a wound. The shape may be acute, irregular, jagged, obtuse, rounded, or truncate.

Wound Apex Acute Apex of a wound that is tapering and the *occlusion* interface angle is less than $<90^{\circ}$.

Wound Apex Irregular The *wound wood* growth at the apex mostly interrupted forming an edge that is not uniform or jagged. Often this may be influenced by a *successional wound* resulting in disproportionate development of *callous wood* and *wound wood*.

Wound Apex Jagged The *wound wood* growth or tissue damaged initially at the apex that is uneven and likely to have been caused by laceration.

Wound Apex Obtuse Apex of a wound that is tapering and the *occlusion* interface angle is greater than $>90^{\circ}$.

Wound Apex Rounded The *wound wood* growth at the apex that is curved.

Wound Apex Truncate The *wound wood* growth or tissue damaged initially at the apex that is even and likely to have been caused by incision.

Wound Base The proximal end of a wound. The shape may be acute, irregular, jagged, obtuse, rounded, or truncate.

Wound Base Acute Base of wound that is tapering and the *occlusion* interface angle is less than $<90^\circ$.

Wound Base Irregular The *wound wood* growth at the base mostly interrupted forming an edge that is not uniform or jagged. Often this may be influenced by a *successional wound* resulting in disproportionate development of *callous wood* and *wound wood*.

Wound Base Jagged The *wound wood* growth or tissue damaged initially at the base that is uneven and likely to have been caused by laceration.

Wound Base Obtuse Base of wound that is tapering and the *occlusion* interface angle is greater than $>90^\circ$.

Wound Base Rounded The *wound wood* growth at the base that is curved.

Wound Base Truncate The *wound wood* growth or tissue damaged initially at the base that is even and likely to have been caused by incision.

Wound Face Surface area of tissue exposed by injury, e.g. bark, sapwood, heartwood.

Wound Face Cracks Horizontal Transverse cracks in a *wound face* indicative of failure from *tension* force (Mattheck & Breloer 1994, p. 183).

Wound Face Cracks Vertical Longitudinal cracks in a *wound face* indicative of failure from *compression* force (Mattheck & Breloer 1994, p. 183).

Wound Face Entire Surface of exposed tissue is uniform without damage extending to a different layer or unaffected by borers or decay, e.g. possibly described as *wound face entire* to dead sapwood.

Wound Face Incomplete Surface of exposed tissue is not uniform with damage extending to different layers or affected by borers or decay, e.g. possibly described as *wound face incomplete* with cavity at apex. See also *Wound face entire*.

Wound Face Exposed Heartwood Wound extending to reveal the *heartwood*, or has deteriorated through *decay* to reveal this layer of wood.

Wound Face Exposed Sapwood Wound extending to reveal the sapwood, or has deteriorated through *decay* to reveal this layer of wood.

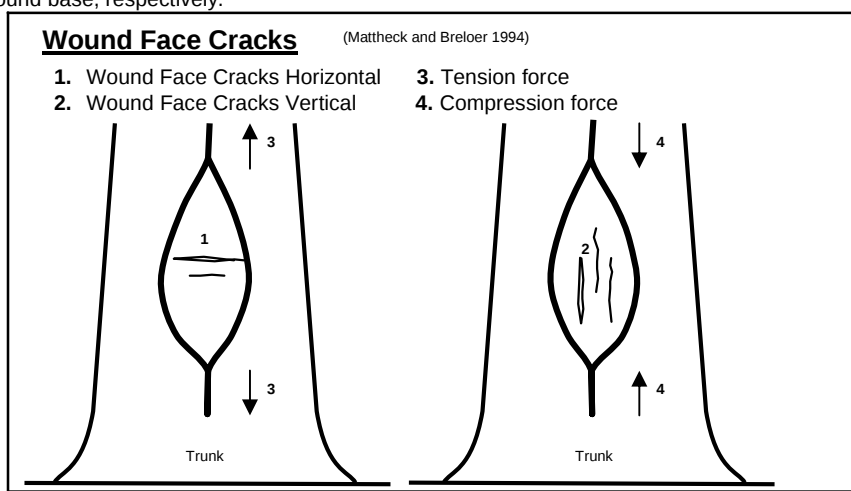
Wound Margin The left and right sides of a *wound* as bound by the alignment of fibres along a stem or root longitudinally, being either the remaining undamaged living cells and new *callus wood* and *wound wood* on older wounds. Here the fibres are usually formed from *meristematic* cells. A wound margin may be circular on a *pruning wound* or form around the perimeter of a *canker*.

Wound Margin Entire The *wound wood* growth in the margin is mostly uninterrupted forming a uniform edge.

Wound Margin Irregular The *wound wood* growth in the margin is mostly interrupted and forms an edge that is not uniform e.g. where repeated wounding *episodes* such as inflicted by ongoing borer activity damages and continually alters the *wound perimeter* with *callus wood* and *wound wood*. See also *Successional Wound*.

Wound Margin Left The left side of a wound margin when the distal and proximal ends of the wound is known, to determine the *wound apex* and *wound base*, respectively.

Wound Margin Right The right side of a wound margin when the distal and proximal end of the wound is known, to determine the *wound apex* and *wound base*, respectively.



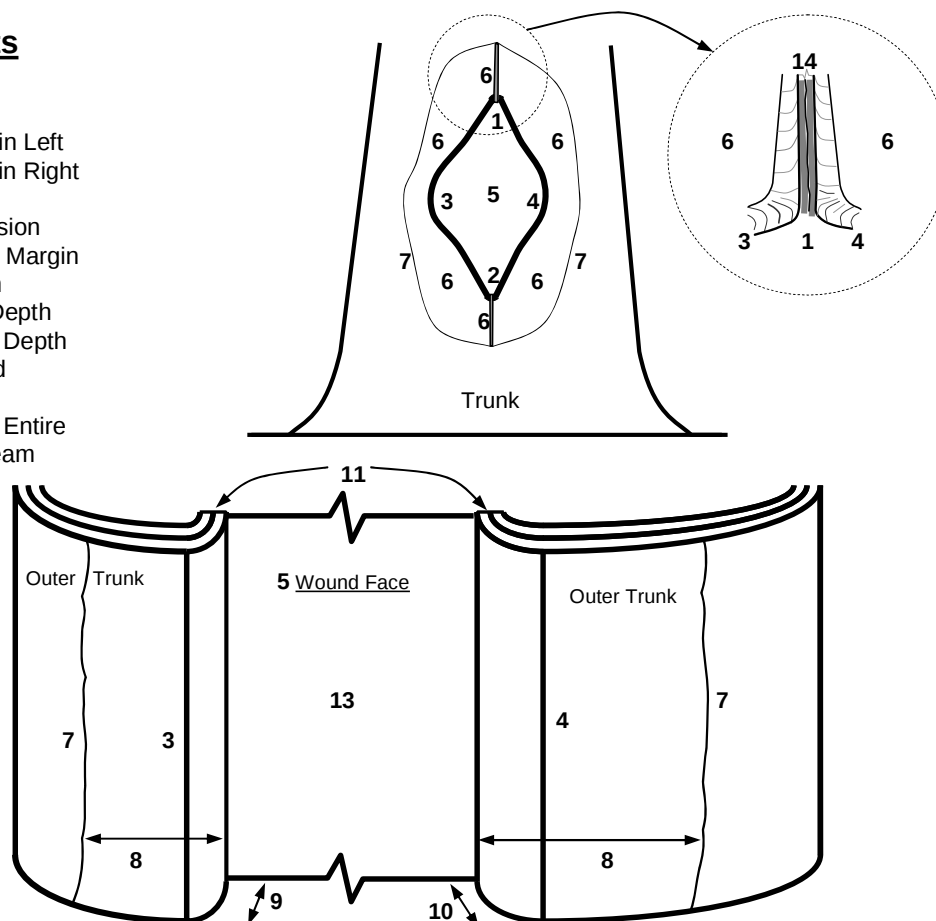
Wound Margin Width Distance from *wound margin* to the site of initial wounding. Where evident the *initial wound margin* may be identified by discoloured bark or bark of a different texture to adjacent undamaged trunk. This may also assist in determining the age of a wound.

Wound Wood Aged *callus wood* around the margins of a wound that becomes differentiated to form *CODIT Wall 4* producing new lignified wood. This wood may grow to surround a wound and may eventually develop to enclose the wound by *occlusion*.

Wound Diagrams

Wound Parts

1. Apex
2. Base
3. Wound Margin Left
4. Wound Margin Right
5. Wound Face
6. Partial Occlusion
7. Initial Wound Margin
8. Margin Width
9. Left Margin Depth
10. Right Margin Depth
11. Wound Wood
12. Cavity
13. Wound Face Entire
14. Occlusion Seam

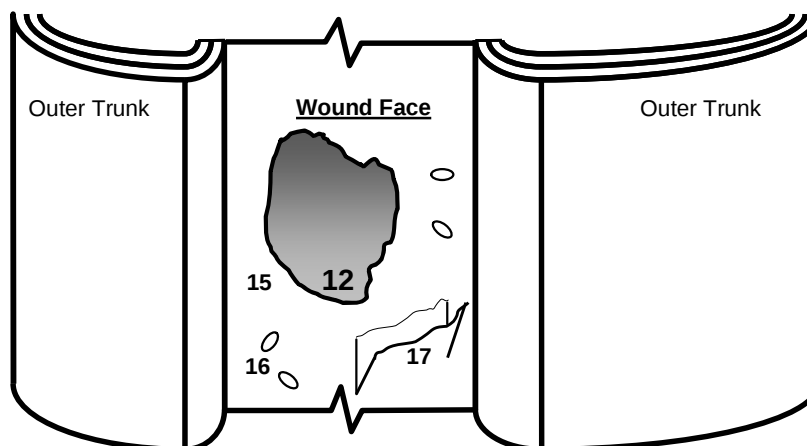


Examples of other Wound Faces

15. Wound face extending from dead sapwood to cavity in heartwood.

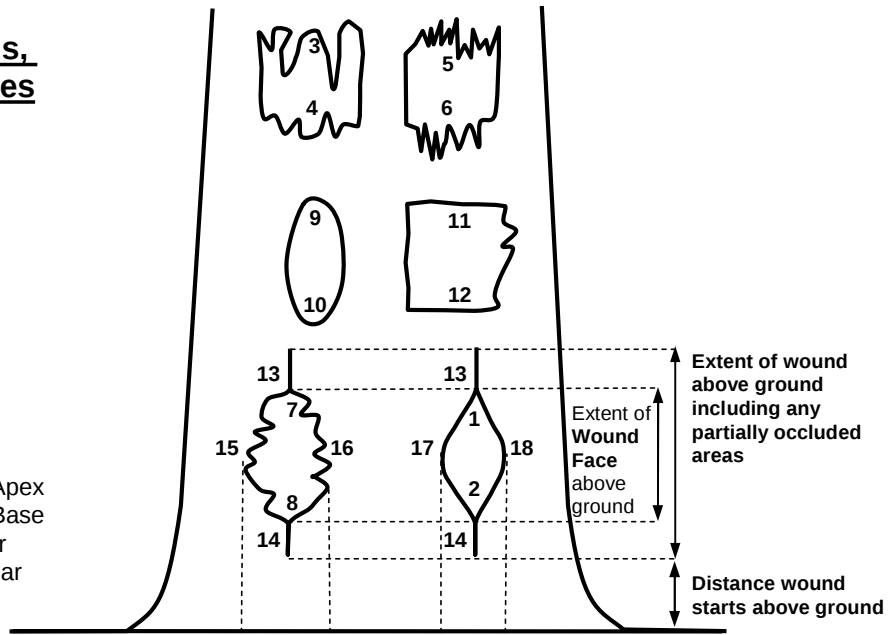
16. Oval shaped borer exit holes evident indicative of Longicorn Borer (Family Cerambycidae).

17. Linear laceration as made by an axe.



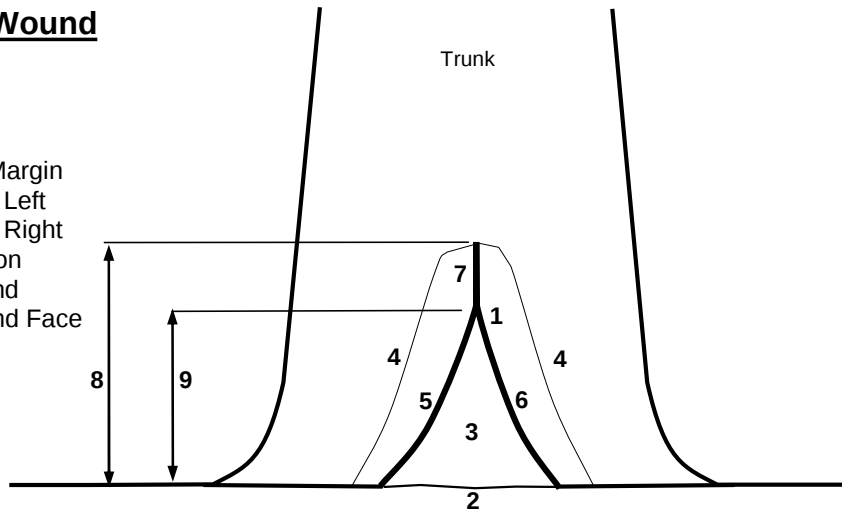
Wounds, Margins, Apexes and Bases

1. Apex Acute
2. Base Acute
3. Apex Irregular
4. Base Irregular
5. Apex Jagged
6. Base Jagged
7. Apex Obtuse
8. Base Obtuse
9. Apex Rounded
10. Base Rounded
11. Apex Truncate
12. Base Truncate
13. Partially Occluded Apex
14. Partially Occluded Base
15. Left Margin Irregular
16. Right Margin Irregular
17. Left Margin Entire
18. Right Margin Entire



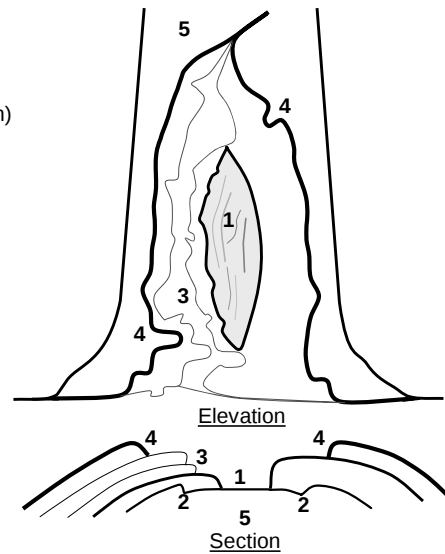
Basal Trunk Wound

1. Apex
2. Base
3. Wound Face
4. Initial Wound Margin
5. Wound Margin Left
6. Wound Margin Right
7. Partial Occlusion
8. Extent of Wound
9. Extent of Wound Face



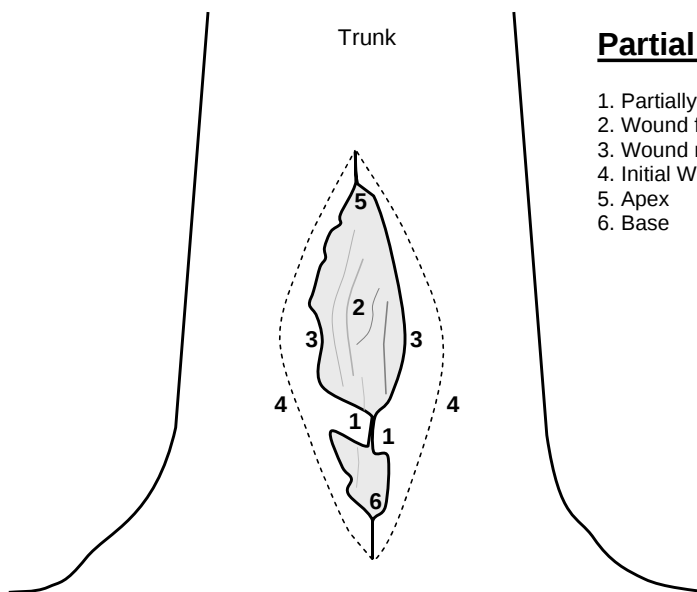
Successional Wound

1. Initial wound face
2. Initial wound margins (concealed when viewed in Elevation)
3. Successive wound margins
4. Wound margins (current)
5. Trunk



Partially Bridged Occlusion

1. Partially Bridged Occlusion
2. Wound face
3. Wound margins
4. Initial Wound Margins
5. Apex
6. Base



Condition of Trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Fair Condition* and *Poor Condition*.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Good Condition* and *Poor Condition*.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good to fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in *vigour* but may be independent of a change in *vigour*, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by *vigour*. See also *Condition*, *Good Condition* and *Fair Condition*.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);

Osmosis (the ability of the root system to take up water);

Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);

Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Periods of Time

Periods of Time The life span of a tree in the urban environment may often be reduced by the influences of encroachment and the dynamics of the environment and can be categorized as *Immediate*, *Short Term*, *Medium Term* and *Long Term*.

Immediate An *episode* or occurrence, likely to happen within a twenty-four (24) hour period, e.g. tree failure or collapse in full or part posing an imminent danger. See also *Short Term*, *Medium Term* and *Long Term*.

Short Term A period of time less than <1 – 15 years. See also *Periods of Time*, *Immediate*, *Medium Term* and *Long Term*.

Medium Term A period of time 15 – 40 years. See also *Periods of Time*, *Immediate*, *Short Term* and *Long Term*.

Long Term A period of time greater than >40 years. See also *Periods of Time*, *Immediate*, *Medium Term* and *Short Term*.

Vigour

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour*, *High Vigour*, *Low Vigour* and *Dormant Tree Vigour*.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the *typical* growth of leaves, *crown cover* and *crown density*, branches, roots and trunk and *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation. See also *Vigour*, *Low Vigour* and *High Vigour*.

High Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the *atypical* growth of leaves, reduced *crown cover* and reduced *crown density*, branches, roots and trunk, and a deterioration of their functions with reduced *resistance* to *predation*. This is independent of the *condition* of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation. See also *Vigour*, *Normal Vigour* and *High Vigour*.

Dormant Tree Vigour Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last *extension growth* is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.

Good Vigour See *Normal Vigour*.

Poor Vigour See *Low Vigour*.

Health A tree's *vigour* as exhibited by *crown density*, *crown cover*, leaf colour, presence of epicormic shoots ability to withstand *predation* by pests and diseases, *resistance* and the degree of *dieback*.

Age of Trees

Age Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa *in situ* divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown and can be categorized as *Young*, *Mature* and *Over-mature* (British Standards 1991, p. 13, Harris *et al*, 2004, p. 262).

Young Tree aged less than <20% of life expectancy, *in situ*. See also *Age*, *Mature* and *Over-mature*.

Mature Tree aged 20-80% of life expectancy, *in situ*. See also *Age*, *Young* and *Over-mature*.

Over-mature Tree aged greater than >80% of life expectancy, *in situ*, or *senescent* with or without reduced *vigour*, and declining gradually or rapidly but irreversibly to death. See also *Age*, *Young* and *Mature*.

Premature Aging Apparent hastened aging and deterioration of a tree where it has been subject to conditions or practices adverse to expected normal growth, resulting in a *spiral of decline*. The following are examples of processes that may start such cycles:

- Top lopping of a mature tree
- In a new car park, the excavation of soil severing the roots of a tree close to its trunk and then sealing the soil surface with asphalt or concrete up to the trunk
- Open trenching alongside a street tree severing all roots in the trench, then top lopping it for power line clearance, and then extensive damage to bark by abrasion by trucks and excavation equipment as tree is adjacent to a construction site
- Root damage from *soil compaction* to substantial areas of the root plate.

Prolonged Senescence A phenomenon in an *over-mature* tree or tree with *structural deterioration* in its *condition* and often *vigour* as *abnormal vigour* as a result of modifications to the tree or the growing environment essential for its survival where it is sustained beyond the *typical* extent of its life cycle, or prevented from failing in full or part from *structural deterioration* by a beneficial artificial modification to its growing environment either by deliberate or incidental intervention, e.g. water from a leaking tap, water and nutrients from a leaking sewer pipe creating a *hydroponic* environment, or by physically propping up a tree with *structural deterioration* as with a *veteran tree*, or by it *leaning* or growing against another tree or structure for support.

Axiom of Uniform Stress The principle that a tree is mechanically optimized growing only sufficient wood for support and loading. As a result, no area is under-loaded to breaking point or over-loaded with excess material (Mattheck & Breloer 1994, pp. 12-13).

Visual Tree Assessment (VTA) A visual inspection of a tree from the ground based on the principle that, when a tree exhibits apparently superfluous material in its shape, this represents repair structures to rectify *defects* or to reinforce weak areas in accordance with the *Axiom of Uniform Stress* (Mattheck & Breloer 1994, pp. 12-13, 145). Such assessments should only be undertaken by suitably competent practitioners.

Drop Zone The distance away from a tree that may be physically influenced by a falling branch.

Fall Zone The distance away from a tree that may be physically influenced if it was cut down or subject to *collapse*.

Leaning Trees

Leaning A tree where the *trunk* grows or moves away from upright. A lean may occur anywhere along the *trunk* influenced by a number of contributing factors e.g. genetically predetermined characteristics, competition for space or light, prevailing winds, aspect, slope, or other factors. A *leaning* tree may maintain a *static lean* or display an increasingly *progressive lean* over time and may be hazardous and prone to *failure* and *collapse*. The degrees of leaning can be categorized as *Slightly Leaning*, *Moderately Leaning*, *Severely Leaning* and *Critically Leaning*.

Slightly Leaning A leaning tree where the trunk is growing at an angle within 0°-15° from upright.

Moderately Leaning A leaning tree where the trunk is growing at an angle within 15°-30° from upright.

Severely Leaning A leaning tree where the trunk is growing at an angle within 30°-45° from upright.

Critically Leaning A leaning tree where the trunk is growing at an angle greater than >45° from upright.

Progressively Leaning A tree where the degree of *leaning* appears to be increasing over time.

Static Leaning A leaning tree whose lean appears to have stabilized over time.

Windthrow Tree failure and collapse when a *force* exerted by wind against the *crown* and *trunk* overcomes resistance to that force in the *root plate*, such that the *root plate* is lifted from the soil on one side as the tree tips over.

Symmetry

Symmetry Balance within a *crown*, or *root plate*, above or below the *axis* of the trunk of branch and foliage, and root distribution respectively and can be categorized as *Asymmetrical* and *Symmetrical*.

Asymmetrical Imbalance within a crown, where there is an uneven distribution of branches and the foliage *crown* or *root plate* around the vertical *axis* of the trunk. This may be due to *Crown Form Codominant* or *Crown Form Suppressed* as a result of natural restrictions e.g. from buildings, or from competition for space and light with other trees, or from exposure to wind, or artificially caused by pruning for clearance of roads, buildings or power lines. An example of an expression of this may be, crown asymmetrical, bias to west. See also *Symmetrical* and *Symmetry*.

Symmetrical Balance within a crown, where there is an even distribution of branches and the foliage *crown* around the vertical *axis* of the trunk. This usually applies to trees of *Crown Form Dominant* or *Crown Form Forest*. An example of an expression of this may be crown symmetrical. See also *Symmetry* and *Asymmetrical*.

Crown Spread Orientation Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.

Crown Spread Orientation Non-radial Where the crown extent is longer than it is wide, e.g. east/west or E/W. Further examples, north/south or N/S, and may be *Crown Form Codominant*, e.g. **A** or **B**, *Crown Form Intermediate* e.g. **A**, or *Crown Form Suppressed* e.g. **B**, and crown symmetry is *symmetrical* e.g. **A**, or *asymmetrical* e.g. **B**.

Crown Spread Orientation Radial Where the *crown spread* is generally an even distance in all directions from the trunk and often where a tree has *Crown Form Dominant* and is *symmetrical*.

Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk length*. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.

Significant Important, weighty or more than ordinary.

Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or *in situ*, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, *crown form*, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as *remnant vegetation*, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.

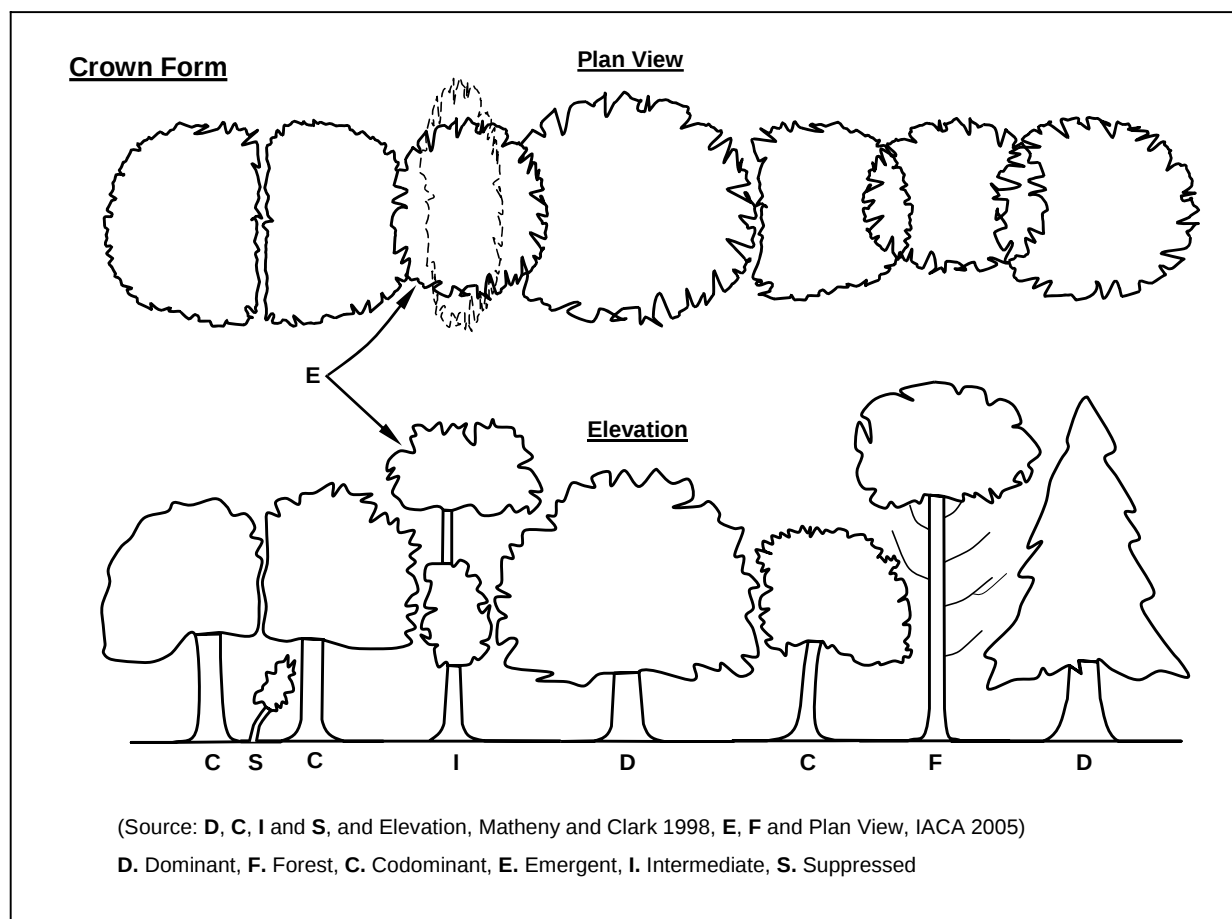
Sustainable Retention Index Value (SRIV) A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. SRIV is for the professional manager of urban trees to consider the tree *in situ* with an assumed knowledge of the *taxon* and its growing environment. It is based on the physical attributes of the tree and its response to its environment considering its position in a matrix for age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property. This also factors the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. SRIV is supplementary to the decision made by a tree management professional as to whether a tree is retained or removed (IACA - Institute of Australian Consulting Arboriculturists 2005).

Form of Trees

Crown Form The shape of the crown of a tree as influenced by the availability or restriction of space and light, or other contributing factors within its growing environment. Crown Form may be determined for tree shape and habit generally as *Dominant*, *Codominant*, *Intermediate*, *Emergent*, *Forest* and *Suppressed*. The habit and shape of a *crown* may also be considered qualitatively and can be categorized as *Good Form* or *Poor Form*. See also *Forest Grown* and *Open Grown*.

Good Form Tree of *typical* crown shape and habit with proportions representative of the taxa considering constraints such as origin e.g. indigenous or exotic, but does not appear to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, or cultural practices such as lopping and competition for space and light. See also *Poor Form*.

Poor Form Tree of *atypical* crown shape and habit with proportions not representative of the species considering constraints and appears to have been adversely influenced in its development by environmental factors in situ such as *soil water* availability, prevailing wind, cultural practices such as lopping and competition for space and light; causing it to be *misshapen* or disfigured by disease or vandalism. See also *Good Form*.



Crown Form Codominant Crowns of trees restricted for space and light on one or more sides and receiving light primarily from above e.g. constrained by another tree/s or a building.

Crown Form Dominant Crowns of trees generally not restricted for space and light receiving light from above and all sides. See also *Crown Form Emergent* and *Open Grown*.

Crown Form Emergent Crowns of trees restricted for space on most sides receiving most light from above until the *upper crown* grows to protrude above the canopy in a stand or forest environment. Such trees may be *crown form dominant* or transitional from *crown form intermediate* to *crown form forest* asserting both *apical dominance* and *axillary dominance* once free of constraints for space and light.

Crown Form Forest Crowns of trees restricted for space and light except from above forming tall trees with narrow spreading crowns with foliage restricted generally to the top of the tree. The trunk is usually erect, straight and continuous, tapering gradually, crown often excurrent, with first order branches becoming structural, supporting the live crown concentrated towards the top of the tree, and below this point other first order branches arising radially with each *inferior* and usually temporary, divergent and ranging from horizontal to ascending, often with internodes exaggerated due to competition for space and light in the *lower crown*.

Crown Form Intermediate Crowns of trees restricted for space on most sides with light primarily from above and on some sides only.

Crown Form Suppressed Crowns of trees generally not restricted for space but restricted for light by being *overtopped* by other trees and occupying an understorey position in the canopy and growing slowly.

Forest Grown A tree with *crown form forest grown* in a group with competition for space and light protected from wind, often resulting in a taller tree with a narrow spreading crown that is concentrated towards the top of the tree (Matheny & Clark 1998, p. 18).

Open Grown A tree with *crown form dominant*, grown singly without competition for space and light, exposed to wind, often resulting in a shorter tree with a broad spreading crown that extends towards the ground (Matheny & Clark 1998, p. 18).

Deadwood

Deadwood Dead branches within a tree's crown and considered quantitatively as separate to *crown cover* and can be categorised as *Small Deadwood* and *Large Deadwood* according to diameter, length and subsequent *risk* potential. The amount of dead branches on a tree can be categorized as *Low Volume Deadwood*, *Medium Volume Deadwood* and *High Volume Deadwood*. See also *Dieback*.

Deadwooding Removing of dead branches by *pruning*. Such pruning may assist in the prevention of the spread of *decay* from *dieback* or for reasons of safety near an identifiable target.

Small Deadwood A dead branch up to 10mm diameter and usually <2 metres long, generally considered of low *risk* potential.

Large Deadwood A dead branch >10mm diameter and usually >2 metres long, generally considered of high *risk* potential.

Low Volume Deadwood Where <5 dead branches occur that may require *removal*.

Medium Volume Deadwood Where 5-10 dead branches occur that may require *removal*.

High Volume Deadwood Where >10 dead branches occur that may require *removal*.

Dieback

Dieback The death of some areas of the *crown*. Symptoms are leaf drop, bare twigs, dead branches and tree death, respectively. This can be caused by root damage, root disease, bacterial or fungal canker, severe bark damage, intensive grazing by insects, *abrupt changes* in growth conditions, drought, water-logging or over-maturity. Dieback often implies reduced *resistance*, *stress* or *decline* which may be temporary. Dieback can be categorized as *Low Volume Dieback*, *Medium Volume Dieback* and *High Volume Dieback*.

Low Volume Dieback Where <10% of the *crown cover* has died. See also *Dieback*, *High Volume Dieback* and *Medium Volume Dieback*.

Medium Volume Dieback Where 10-50% of the *crown cover* has died.

High Volume Dieback Where >50% of the *crown cover* has died.

Epicormic Shoots

Epicormic Shoots Juvenile shoots produced at branches or trunk from *epicormic strands* in some Eucalypts (Burrows 2002, pp. 111-131) or sprouts produced from dormant or latent buds concealed beneath the bark in some trees. Production can be triggered by fire, pruning, wounding, or root damage but may also be as a result of *stress* or *decline*. Epicormic shoots can be categorized as *Low Volume Epicormic Shoots*, *Medium Volume Epicormic Shoots* and *High Volume Epicormic Shoots*.

Low Volume Epicormic Shoots Where <10% of the *crown cover* is comprised of live *epicormic shoots*.

Medium Volume Epicormic Shoots Where 10-50% of the *crown cover* is comprised of live *epicormic shoots*.

High Volume Epicormic Shoots Where >50% of the *crown cover* is comprised of live *epicormic shoots*.

Epicormic Strands In some taxa of the Myrtaceae family narrow bands of meristematic tissue radiate in stems from pith extending to the outer bark containing bud primordia evident as small prickle or dimple structures up to 10 mm diameter, that after the stimulus of a trauma event such as fire or defoliation develop to form new buds allowing *crown regeneration* (Burrows 2001, Pp. 111-131).

Trunk

Acaulescent A *trunkless* tree or tree growth forming a very short *trunk*. See also *Caulescent*.

Caulescent Tree grows to form a *trunk*. See also *Acaulescent*.

Trunk A single stem extending from the *root crown* to support or elevate the *crown*, terminating where it divides into separate *stems* forming *first order branches*. A trunk may be evident at or near ground or be absent in *acaulescent* trees of *deliquescent* habit, or may be continuous in trees of *excurrent* habit. The trunk of any *caulescent* tree can be divided vertically into three (3) sections and can be categorized as *Lower Trunk*, *Mid Trunk* and *Upper Trunk*. For a *leaning* tree these may be divided evenly into sections of one third along the trunk.