

Appendix B2

Aboriginal Heritage Assessment

Xstrata Mangoola Pty Limited and
TransGrid

Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Relocation of 500 kV Electricity Transmission Line, Mangoola Coal

December 2010

Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Relocation of 500 kV Electricity Transmission Line, Mangoola Coal

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

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Executive Summary

Xstrata Mangoola Pty Limited trading as Mangoola Coal, has an existing Project Approval (PA06_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). PA06_0014 has since been subject to three modifications (MOD1, MOD2 and MOD3).

Mangoola Coal has fulfilled its pre-construction requirements and preparation of all pre-construction management plans, 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).

To improve the efficiency of mining on the site, it is proposed to remove an existing 500 kiloVolt electricity transmission line (ETL) that currently bisects the site (hereafter referred to as the existing ETL) and to relocate the ETL (hereafter referred to as the relocated ETL) to a route with the majority inside the southern and western boundaries of Mangoola Coal's approved project disturbance area. Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Xstrata Mangoola Pty Limited (trading as Mangoola Coal), on behalf of TransGrid, to undertake the necessary environmental assessments associated with the relocation of the ETL. The project is being assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Approximately 6 kilometres of the relocated ETL is contained within the approved project disturbance area where previous assessment and approval has assumed that there would be total disturbance and salvage works relating to Aboriginal heritage have already been conducted in accordance with an ACHMP (Umwelt 2008a and Umwelt in prep a). For this reason, the portion of the relocated ETL that is within the approved project disturbance area is not part of the current assessment. However, two sections of the relocated ETL and five associated designated access tracks lie outside the approved project disturbance area and are the subject of the current assessment. These areas (referred to as Assessment Area A and Assessment Area B) consist of a 3.4 kilometre section of easement (and four designated access tracks) extending from the south-east of the approved project disturbance boundary eastward to connect to the existing ETL, and a 1.9 kilometre long section of easement (with one designated access track) extending from the north-west corner of the approved project disturbance area across Big Flat Creek and an existing Aboriginal Cultural Heritage Offset Area (ACHOA) to connect to the existing 500kV ETL.

In recognition of the potential for the removal of the existing ETL and the construction of the relocated ETL to impact on Aboriginal cultural heritage, prior to the commencement of the Aboriginal cultural heritage assessment, Mangoola Coal identified a potential offset option in the form of a potential land-based offset. The potential land-based offset was also assessed for its potential Aboriginal heritage values but was found to not contain suitable qualities to comprise an Aboriginal cultural heritage offset. Following this recognition, it was no longer pursued as a suitable offset for this project and will remain as a Habitat Enhancement Area. The Habitat Enhancement Area was still subject to assessment to inform future ground disturbance works that may occur in this area if intensive tree planting occurs into the future.

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 (DEC – now 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).

A review was conducted of both the environmental and cultural context of the assessment areas and the Habitat Enhancement Area 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 would generally contain less than 10 artefacts and rarely more than 50 artefacts. Larger sites (in terms of artefact densities and site area) were more likely to be present in association with reliable water sources such as Sandy Creek and Big Flat Creek. However, artefact scatters and isolated finds were 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 remained extant.

The assessment areas were surveyed in their entirety whilst the Habitat Enhancement Area was subject to systematic survey to incorporate a representative sample of each of the major landform units present within this area. The survey was completed by two archaeologists and up to seven Aboriginal stakeholders. Fourteen sites (SC56, SC57, BFC69 to BFC73 and SC60 to SC66) were located within the assessment areas and consisted of five isolated finds and nine artefact scatters containing a total of 166 artefacts. The largest artefact scatter (SC56) contained 49 artefacts, followed by SC57 (36 artefacts) and BFC72 (31 artefacts). No areas of PAD were identified in association with the recorded sites or any other portion of the assessment areas.

A total of 15 new Aboriginal archaeological sites (BFC74 to BFC88) were recorded within the Habitat Enhancement Area however BFC49 (previously recorded site) could not be located. The sites consisted of six isolated finds and ten artefact scatters (including BFC49) containing a combined total of 44 artefacts. The largest artefact scatter was BFC75 (11 artefacts), followed by BFC 80, BFC 81 and BFC 87, all of which contained five artefacts each. No areas of PAD were identified in association with the recorded sites or any other portion of the Habitat Enhancement Area.

The Aboriginal significance and archaeological significance and research potential of the sites and landforms located within the assessment areas and the Habitat Enhancement Area 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 assessment areas and the Habitat Enhancement Area and the sites they contain are of low archaeological significance.

The archaeological and Aboriginal cultural significance of the assessment areas and Habitat Enhancement Area and the sites they contain formed the basis for the consideration of appropriate management and mitigation options for these areas. No impacts are proposed in the vicinity of sites SC56 and SC57 and it will be possible to protect these sites within demarcated areas. Similarly, there are currently no proposed impacts to sites BFC49 and BFC74 to BFC88 within the Habitat Enhancement Area. Conservation of these sites is therefore the most appropriate management option in relation to this assessment.

Conservation is also the preferred option for the sites within the Big Flat Creek ACHOA within Assessment Area B (BFC69 to BFC73) as these sites are located within an area conserved for its Aboriginal heritage values. Every effort will be made to reduce potential impacts to these sites by prohibiting vehicle impact to this area and hand-stringing

conductors within this area using a light draw wire. However, temporary surface impacts in this area may be unavoidable, requiring mitigation measures for these sites prior to long-term conservation.

In contrast, sites SC60 to SC66 are located on currently used access tracks that are proposed to be further modified and utilised to provide access to new tower locations for the relocated ETL. Sites SC56, SC57 and SC60 to SC66 are of low archaeological significance. However, they are of value to the Aboriginal stakeholders and can be incorporated into the analysis of the salvaged artefactual assemblage from the approved project disturbance area. Therefore, if impacts are necessary to these sites, conducting a surface collection of artefacts using the methodology approved by the relevant Aboriginal stakeholders and DECCW within the ACHMP (Umwelt 2008a) is an appropriate management option.

Potential offset options were also considered as part of this assessment. Based on feedback received from Aboriginal stakeholder representatives, the land-based offset (the Habitat Enhancement Area) was not considered suitable as an ACHOA. 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 recommendations in relation to the relocated ETL are provided below.

- Prior to the commencement of construction of the relocated ETL, sites SC56 and SC57 should be clearly designated (e.g. fencing) and should not be subject to any ground disturbance. Following the completion of the ETL relocation, SC56 and SC57 should be managed in a manner generally in accordance with the Mangoola Coal ACHMP. Although site SC55 is not within the proposed easement (see **Figure 5.3** in **Section 5.0**, given its proximity to Assessment Area A, these recommendations should also apply to SC55 and are consistent with those provided in the assessment associated with SC55 (Umwelt 2009b).
- Prior to any impacts associated with the development of the designated access tracks in Assessment Area A, surface artefacts within sites SC60 to SC66 should be subject to surface collection and analysis in accordance with the methodology approved by the relevant Aboriginal stakeholders and DECCW as part of the Mangoola Coal ACHMP (Umwelt 2008a). 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 the commencement of construction of the relocated ETL, sites BFC69 to BFC73 (located within the Big Flat Creek ACHOA) should be clearly designated (e.g. fencing). Every effort should be made to avoid impacts to these sites by hand-stringing conductors between towers T27 and T28 using a light-weight draw-wire and preventing vehicle access (including 4WD vehicles) in the easement area between towers T27 and T28 (within the Big Flat Creek section of the ACHOA). However, the draw-wire will still be in contact with the ground surface and may be required to pass through the site boundaries. Should this be the case, the MGA grid coordinates of artefacts subject to impact should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts should then be returned to their recorded location following the completion of stringing activities. Following the completion of stringing activities, BFC69 to BFC73 should be managed in accordance with the Mangoola Coal ACHMP.

- All site demarcation should be undertaken by a qualified archaeologist and at least two Aboriginal stakeholder representatives. Site demarcations will be permanent and will be marked on easement maintenance plans used by TransGrid when planning their maintenance activities.
- Machines/vehicles involved in works associated with the relocated ETL should utilise existing vehicle tracks within the approved project disturbance area, the five designated access tracks and/or move within the relocated ETL easement (within the assessment areas), avoiding the Big Flat Creek ACHOA, the SC10 Management Zone (with the exception of the crane and truck access discussed below) and the demarcated boundaries of sites SC55 and SC57.
- The two laydown areas for construction materials required for the relocated ETL should be located within the approved project disturbance boundary or within the relocated ETL easement but outside the ACHOA, SC10 Conservation Zone and the demarcated boundaries of sites SC55 and SC57.
- Between towers T27 and T28 (within the Big Flat Creek ACHOA), impact on vegetation should be limited to lopping and should not involve ground surface disturbance. Care should be taken to protect the riparian zone in this area.
- Vehicle access to the SC10 Management Zone and the Big Flat Creek ACHOA during dismantling and associated works for the removal of the existing ETL towers should be restricted to designated access areas and dismantling areas and vehicular traffic should be minimised as far as possible in accordance with the management options presented in **Section 11.2**.
- The crane and truck access to the tower locations within the SC10 Management Zone and the associated dismantling area should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of impacts associated with the removal of the existing ETL.
- The vehicle parking area and associated tower dismantling area within the Big Flat Creek ACHOA should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of impacts associated with the removal of the existing ETL.
- The dismantling of towers within the Big Flat Creek ACHOA and the SC10 Management Zone should be undertaken so that there is no need for additional subsurface disturbance in association with this activity. Where possible, a section of the base of the tower superstructure may be retained for the purposes of creating a shade structure.
- The remaining eleven existing towers outside the project disturbance boundary, the Big Flat Creek ACHOA and the SC10 Management Zone will be subject to a due diligence inspection prior to the commencement of any activities associated with the dismantling of the existing 500kV easement. The due diligence inspection will be undertaken at the tower location and any associated areas (including any additional heavy vehicle access tracks or equipment lay-down areas). Should the inspection identify any Aboriginal

objects or areas of PAD that will be impacted by the proposed dismantling works, the following management strategies will be employed:

- consultation will be undertaken with Mangoola Coal to determine whether dismantling works can be altered to avoid impacts to Aboriginal objects or areas of PAD and, if this is possible, all staff and contractors will be notified of their obligation to adhere to the altered work methodology;
- if it is not possible to alter the proposed dismantling works as discussed above, the management strategies will be determined based on site significance as outlined below:
 - surface impacts to recorded Aboriginal object(s) of low to moderate significance (as determined based on both Aboriginal cultural significance and archaeological significance) will be mitigated by surface collection conducted in accordance with the methodology provided in **Section 13.0**;
 - surface impacts to recorded Aboriginal object(s) of high significance (as determined based on both Aboriginal cultural significance and archaeological significance) will not be permitted until such time as consultation has been undertaken with the relevant Aboriginal stakeholders to develop specific management protocols, should this be possible and acceptable to the relevant Aboriginal stakeholders;
 - subsurface impacts to an area of PAD will be mitigated by conducting subsurface salvage using a methodology generally in accordance with that provided in the Mangoola Coal ACHMP and determined in consultation with the relevant Aboriginal stakeholders.
- Within the SC10 Management Zone and Big Flat Creek ACHOA, two areas of 20 metres in width along the length of the span within these sensitive areas will be designated by Downer EDI or their nominated representative as the areas within which the conductors may contact the ground surface during the dismantling process for the existing ETL. These designated areas will be inspected by at least two Aboriginal stakeholder representatives. Should any artefacts be present in these areas, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of the recoiling of the conductors in these areas. The recoiling of the conductors will not involve ground surface disturbance within the SC10 Management Zone and Big Flat Creek ACHOA outside of the designated areas discussed above.
- All personnel involved in works associated with the relocated ETL should undertake Aboriginal cultural heritage awareness training as part of their induction process.
- If artefacts are identified during tower construction activities, work should cease at that tower location and the DECCW and the relevant Aboriginal stakeholder groups contacted and appropriate management recommendations formalised.
- In the event that human skeletal material is uncovered during construction, work will cease and the NSW Police Department, DECCW and the relevant Aboriginal groups will be contacted and appropriate management recommendations formalised.
- DECCW/AHIMS site cards should be prepared within a reasonable time of the location of any Aboriginal object/s located during the construction of the relocated ETL (if any) (under Section 91 of the *National Parks and Wildlife Act 1974*).
- Sites BFC74 to BFC88, located within the Habitat Enhancement Area, will be managed in accordance with the Mangoola Coal ACHMP (Umwelt 2008a) which will be reviewed to

reference these sites and other sites identified in association with the relocation of the ETL.

In addition, 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 as part of the Mangoola Coal biannual stakeholder meetings (as scheduled for February 2011).

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1.0 Introduction

Xstrata Mangoola has approval for an open cut coal mine approximately 20 kilometres west of Muswellbrook and 10 kilometres north of Denman in New South Wales (**Figure 1.1**). To improve the efficiency of mining on the site, it is proposed to relocate an existing 500 kiloVolt (kV) electricity transmission line (ETL) that currently bisects the site (hereafter referred to as the existing ETL) and to relocate the ETL (hereafter referred to as the relocated ETL), with the majority of the relocated ETL inside the southern and western boundaries of Mangoola Coal's approved project disturbance area. Both the existing ETL and the relocated ETL are shown in **Figure 1.2**. The existing ETL is owned and operated by TransGrid and forms part of the Bayswater to Mount Piper 500 kV ETL.

Umwelt (Australia) Pty Limited (Umwelt) has been engaged by Xstrata Mangoola Pty Limited (trading as Mangoola Coal), on behalf of TransGrid, to undertake the necessary environmental assessments associated with the relocation of the ETL. The project is being assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and as part of this process, the Director-General of the Department of Planning (DoP) requires that the Environmental Assessment for the project considers the impacts of the relocated ETL on Aboriginal cultural heritage.

1.1 The Relocated ETL

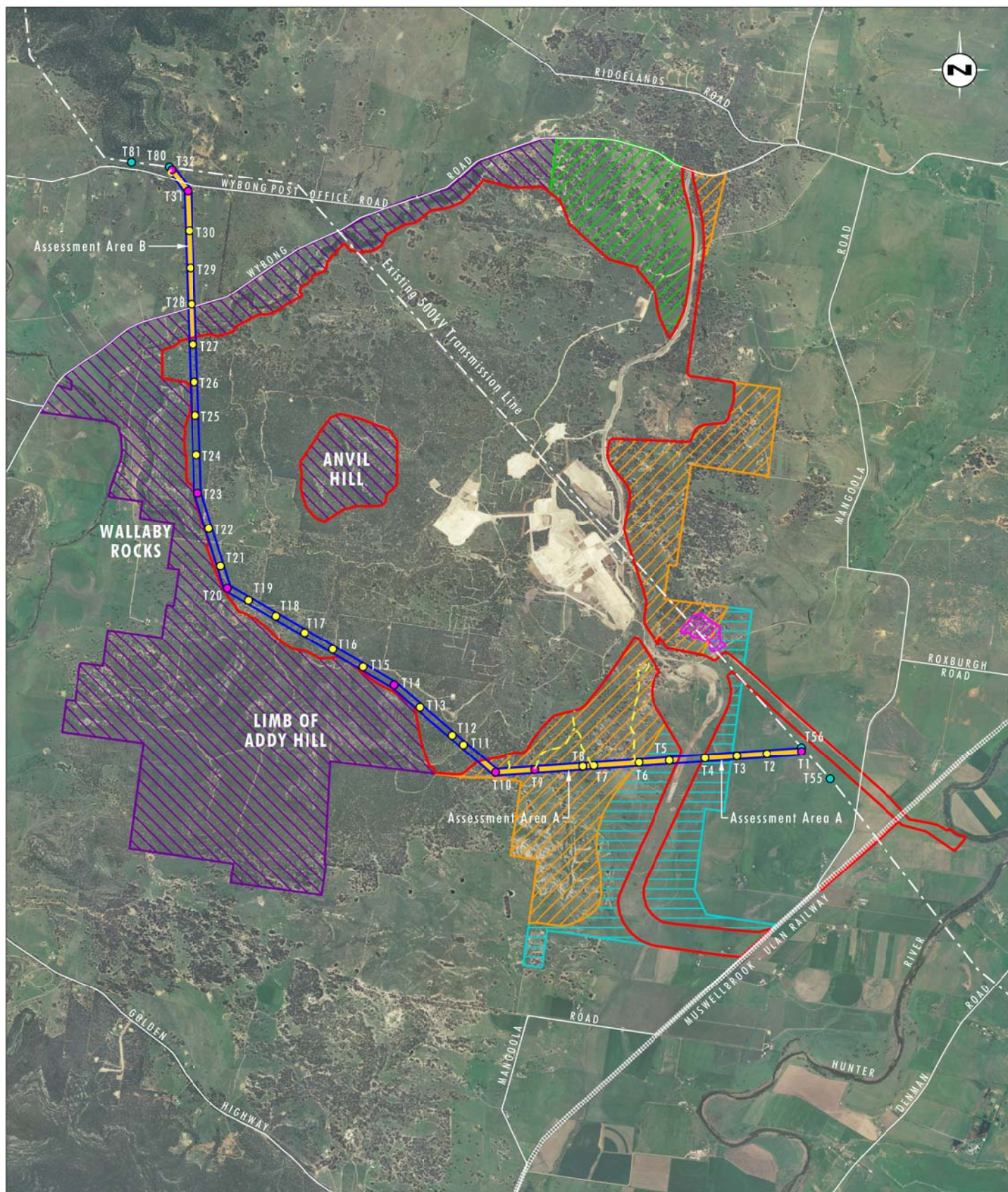
The relocated ETL easement will be approximately 70 metres wide, with a length of approximately 11 kilometres. As indicated in **Figure 1.2**, approximately 6 kilometres of the relocated ETL is contained within the approved project disturbance area where previous assessment and approval has assumed that there would be total disturbance. Within this area, salvage works relating to Aboriginal heritage have already been conducted in accordance with an Aboriginal Cultural Heritage Management Plan (ACHMP – Umwelt 2008a and Umwelt in prep a). For this reason, the portion of the relocated ETL that is within the approved project disturbance area is not part of the current assessment. However, two sections of the relocated ETL lie outside the approved project disturbance area, as shown in **Figure 1.2**. The first is a 3.4 kilometre section extending from the south-east of the approved project disturbance boundary eastward to connect to the existing ETL. This section also incorporates three off-easement access tracks totalling approximately 2.6 kilometres in length, with an approximate width of 5 metres. The second section is 1.9 kilometres long, extending from the north-west corner of the approved project disturbance area across Big Flat Creek and an existing Aboriginal Cultural Heritage Offset Area (ACHOA)¹ to connect to the existing 500 kV ETL. An access track of 150 metres in length with an approximate width of 5 metres also forms part of this section. These sections are the subject of the current assessment and are hereafter referred to as Assessment Area A and Assessment Area B respectively; or the assessment areas collectively (refer to **Figure 1.2**).

Xstrata Mangoola on behalf of TransGrid proposes to remove and dismantle the existing ETL. One of the towers that will be dismantled and removed is located within the approved Big Flat Creek ACHOA and another is within the SC10 Management Zone (refer to **Figure 1.2**). The removal of these towers has the potential to result in impacts to Aboriginal cultural heritage and therefore these areas (hereafter referred to as the sensitive tower removal areas) form part of the current assessment. An additional eleven towers within the existing ETL and outside the approved project disturbance boundary will also be dismantled and removed. These locations were not inspected as part of the current assessment. However, in recognition of the potential for dismantling and removal of these towers to

¹ The ACHOA area also forms part of a conceptual offsets to conserve ecological values.



FIGURE 1.1
Locality Plan



Source: Dept. of Lands (2003), Xstrata Mangooka (2010)

0 1 2 3 km

Legend

- | | |
|--|--|
| Approved Project Disturbance Boundary | Assessment Areas |
| Proposed 500kV Transmission Line Easement | Access Track |
| Sustainable Agriculture Offset Area | ● Existing Tower Location |
| Approved Aboriginal Cultural Heritage Offset Areas | ● Proposed Suspension Tower Location |
| Habitat Enhancement Area | ● Proposed Tension Tower Location |
| Surveyed Habitat Enhancement Area | |
| SC10 Management Zone | |

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FIGURE 1.2

Location of Assessment Areas
and Offset Areas

impact upon Aboriginal cultural heritage, this assessment incorporates management strategies for these works.

During the planning phase, it was recognised that the removal of the existing ETL and construction of the relocated ETL may result in impacts to Aboriginal cultural heritage. In order to minimise potential impacts on Aboriginal cultural heritage, a constraints analysis was undertaken during the route selection process. In addition, inspections of possible easement alignments were undertaken to locate the towers in areas where they would have the least impact on Aboriginal cultural heritage.

However, it is recognised that some impacts to Aboriginal cultural heritage may be necessary in association with the ETL relocation and an inter-related mine modification project (refer to Umwelt in prep b) and that it may be necessary to provide an offset for these impacts. The development of any such offset will take into account the extent of impacts to Aboriginal cultural heritage arising from both projects.

Prior to the commencement of the Aboriginal cultural heritage assessment, Mangoolia Coal identified a potential offset option in the form of a potential land-based offset. The possible land-based offset area was subject to survey and assessment in relation to its archaeological and Aboriginal cultural heritage value. This area has been designated as a Habitat Enhancement Area for its ecological values. It consists of approximately 165.5 hectares, including part of the upper catchment of Big Flat Creek (refer to **Figure 1.2**). During the course of the survey and assessment, the proposed land-based offset area was found to not contain suitable values to be recognised as an Aboriginal cultural heritage offset. Following this recognition, it was no longer pursued as a suitable offset for this project and will remain as a Habitat Enhancement Area (and is referred to as such for the remainder of this report). The archaeological survey of the Habitat Enhancement Area (refer to **Section 8.0**) will inform future ground disturbance works that may occur in this area if intensive tree planting occurs into the future. Other offset options are discussed in the latter sections of this report.

1.2 Assessment Objective

The main objective of this report is to assess the Aboriginal cultural and archaeological values of the assessment areas and the sensitive tower removal areas and to provide appropriate mitigation and management strategies for these areas. The secondary objective was to assess the archaeological and Aboriginal cultural heritage values of the Habitat Enhancement Area. In order to meet these objectives, the following tasks have been undertaken:

- consultation with Aboriginal stakeholders (in accordance with relevant requirements) regarding the Aboriginal significance of the assessment areas and sensitive tower removal areas, any actual or potential Aboriginal sites/artefacts that may be included within the areas and any proposed mitigation or management strategies for the 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 assessment areas and the Habitat Enhancement Area and surrounds;
- a discussion of the archaeological, cultural and environmental context of the assessment areas and Habitat Enhancement Area 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 assessment areas and the Habitat Enhancement Area (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 within the assessment areas; and
- the provision of appropriate strategies (developed in consultation with the relevant Aboriginal stakeholders) to mitigate and manage the impacts of the removal of the existing ETL and construction of the relocated ETL 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 DECCW) *Interim Community Consultation Requirements for Applicants* (2004) and the DEC *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (2005).

It is noted that Aboriginal Cultural Heritage and Archaeological Assessment reports frequently contain technical information and sensitive information regarding the location and nature of Aboriginal archaeological sites. The provision of such information is necessary to meet the relevant guidelines outlined above. However, in accordance with previous requests from Aboriginal stakeholders, this information will be incorporated in a Technical Data Attachment that will be provided only to the relevant Aboriginal stakeholders, agencies and the proponents and does not form part of the publicly exhibited document.

1.3 Structure of the Report

This report consists of the following sections:

Section 2.0 provides details of the relocated ETL and identifies potential impacts to Aboriginal heritage and archaeological sites/values.

Section 3.0 identifies the statutory requirements related to the management of Aboriginal archaeological sites assessed under Part 3A of the EP&A Act;

Section 4.0 identifies the Aboriginal stakeholders with a registered interest in the project, and details the Aboriginal stakeholder involvement in the assessment process, including survey strategy development, fieldwork participation, cultural significance assessment, and determination of management strategies.

Section 5.0 outlines the assessment context, reviewing available environmental, ethno-historic, archaeological and historic literature for the assessment areas and surrounds in order to develop an understanding of likely Aboriginal archaeological values associated with the relocated ETL.

Section 6.0 presents the predictive model for Aboriginal archaeological sites within the assessment areas and the Habitat Enhancement Area, considering site type occurrence, content, distribution and integrity.

Section 7.0 describes the aims, objectives, methods and results of the archaeological survey of the assessment areas, including survey coverage, effective coverage and recorded archaeological sites and Potential Archaeological Deposit (PAD). A review of survey results is undertaken and then compared with the predictive model to detect both local and/or regional variation/similarity at these scales.

Section 8.0 describes the aims, objectives, methods and results of the archaeological survey of the Habitat Enhancement Area, including survey coverage, effective visibility and recorded archaeological sites and PAD. A review of survey results is undertaken and then compared with the predictive model to detect both local and/or regional variation/similarity at these scales.

Section 9.0 reviews the assessment of the predictive model in relation to the results of the survey from all assessment areas with previous archaeological research.

Section 10.0 discusses the Aboriginal cultural heritage and archaeological significance of the sites/ PADs located during the survey.

Section 11.0 presents the Aboriginal and archaeological management options for the project which is guided by the archaeological and Aboriginal cultural heritage significance.

Section 12.0 presents the Aboriginal heritage and archaeological management strategy for the project, being the preferred management option for all identified Aboriginal archaeological sites within the assessment areas.

Section 13.0 provides a proposed surface collection methodology.

Section 14.0 contains a list of reports and publications referred to in the text.

1.4 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 Proposed Activity

The relocation of the ETL will be undertaken by Mangoola Coal on behalf of TransGrid. Mangoola Coal has commissioned Downer EDI to dismantle the existing ETL and to construct the relocated ETL.

The relocated ETL will comprise 32 new towers. Following completion of the new line, 24 towers comprising the existing ETL will be decommissioned, dismantled and removed. A 70 metre wide easement and five off-easement access tracks will be established for the relocated ETL, and the easement over the section of the existing ETL that is removed will be relinquished. The locations of the assessment areas comprising the relocated ETL easement and off-easement access tracks, and the existing ETL easement, are shown in **Figure 1.2**.

2.1 Establishment, Construction and Connection Works

The following activities undertaken during the establishment and construction of the relocated ETL have the potential to impact on archaeological materials:

- access track establishment within the easement and for five designated off-easement access tracks, involving vegetation clearance, topsoil removal and/or introduction of fill materials to create a suitable driving surface;
- vehicle movement within the easement and on access tracks (including light vehicles and a crane used during the process of tower erection and stringing);
- vegetation clearance and general construction impacts within a 40 metre by 60 metre area at each designated tower location, including the introduction of fill material (where required) to create a level working surface;
- vegetation clearance and vehicle movements at three or four stringing activity areas of approximately 100 metres by 70 metres (to be located within the approved project disturbance area or within the easement);
- vegetation clearance, construction activities and vehicle and equipment movements within one or two laydown areas of approximately 100 by 100 metres (or 100 metres by 70 metres if within the easement) located within the approved project disturbance boundary or the easement;
- excavation of foundations for tension towers (that is, a heavier tower used where the line changes direction but has the same visual appearance as other towers), with footings to be dug under each of the four tower legs to a depth of 15 to 20 metres and the resultant spoil will be spread over the 25 x 25 metre foundation disturbance area for that tower;
- excavation of foundations for suspension towers (that is, towers used on straight sections of the relocated ETL) using a boring machine;
- stringing of the conductors within the majority of the assessment areas in several sections necessitating equipment access to the end of each stringing section; and
- hand-stringing of the conductors within the Big Flat Creek ACHOA, using a small lighter weight draw-wire that will be pulled out by hand within the ACHOA in order to minimise ground surface disturbance.

The stringing process requires that the conductors are strung between towers and this is generally done using a 4WD vehicle that draws the conductors across the ground surface. However, in recognition of the sensitivity of the ACHOA, the conductors will be hand-strung in this area of approximately 400 metres in length in order to minimise ground surface impact.

Connection refers to the process where the relocated ETL conductors are connected to the existing Bayswater to Mount Piper 500 kV line. Ground surface impacts associated with the connection process are limited to the areas within the existing and proposed easements adjacent to the towers at either end (i.e. Towers T1 and T32).

2.2 Decommissioning and Removal of Existing ETL

Once the relocated ETL is connected and operational, the towers and conductors that form the existing ETL will be removed.

Dismantling the existing ETL initially involves accessing each tower location with a crane and associated support vehicles in order to remove the conductor and earthwire from the towers. The crane will be used to lower the conductor to the ground along the full length of the easement, stripping the fittings and recoiling the conductor slowly for safety reasons. In order to minimise impacts within the sensitive areas of the SC10 Management Zone and the Big Flat Creek ACHOA, where possible, the conductors will be recoiled within a defined area. Within the sensitive tower removal areas (SC10 Management Zone and the Big Flat Creek ACHOA), designated vehicle access tracks will be established and all vehicle movements will be confined to these designated areas.

Next, the towers are dismantled at each tower site, with a 100 tonne crane used to lower the tower to the ground for disassembly at each tower site. At the sensitive locations, towers will be cut off below the ground surface and the tower foundations will remain in the ground. In the sensitive areas, Aboriginal stakeholders have requested that the base of the tower structures remain intact to a height of approximately 2 metres and that they be converted to a shade structure to facilitate use of these areas for teaching purposes. Downer EDI have subsequently indicated that this may not be possible and that, at the sensitive tower removal areas, the tower will cut off up to 10 metres above the ground surface. The removal of these towers will not require excavation. The disassembled remains of the towers within the sensitive locations will be confined to designated disassembling areas and will be removed using designated access tracks, with this process being undertaken to avoid all ground surface impacts outside these designated areas.

2.3 Operation and Maintenance

After construction is completed and the new section is energised the new easement will revert to the responsibility of TransGrid as owners of the relocated ETL. This means that all maintenance of the relocated ETL will be undertaken by TransGrid in accordance with their maintenance procedures. The relevant policies are *Easement and Access Track Maintenance Policy* (Revision 5, 2008) and the *TransGrid Line Maintenance Policy* (Revision 7, 2009). Maintenance of ETLs is essential to ensure that there are safe clearances between conductors and vegetation to eliminate the risk of lines causing bushfires. This in turn ensures the safety of the public and assists in maintaining a high level of system reliability.

The preferred method of managing vegetation is through lopping or removal. In cases where stumps cannot be removed, herbicides may be used. Removed vegetation is mulched or

chipped and will be re-used on site in the designated rehabilitation areas, in accordance with the ROMP (Umwelt in prep c). Any habitat trees (e.g. trees with hollows) will be managed in accordance with Mangoolia Coal's hollow-bearing tree management procedures.

Easements and designated access tracks will be maintained such that access is available to all weather four wheel drive standard, whilst being mindful of minimising impacts on the land's existing use.

2.4 Discussion of Potential Impacts on Aboriginal Heritage and Archaeological Values

The activities associated with the relocated ETL and removal of the existing ETL that have the potential to impact on Aboriginal and archaeological sites/values are listed below:

- Surface and subsurface impacts to Aboriginal sites and areas of archaeological potential (should any be present) may occur as a result of:
 - vegetation clearance and creation of appropriate surfaces (where required) within the easement and on designated access tracks;
 - subsequent vehicle and equipment movement within the easement and on designated access tracks;
 - vegetation clearance and subsequent excavations at tower locations;
 - establishment of areas around the base of each tower for tower assembly and erection;
 - establishment of three to four stringing sites along the length of the relocated ETL;
 - vehicle and equipment movements and use of a draw wire to string the conductors within the portion of the easement not located within the ACHOA;
 - manual transport of a drawwire to string conductors within the ACHOA;
 - vehicle and equipment movements associated with the connection process at each end of the line (near Towers T1 and T32);
 - the establishment and use of laydown areas;
 - vegetation clearance and vehicle movements during maintenance of the relocated ETL following construction;
 - vehicle movements and ground surface impacts associated with dismantling of existing towers; and
 - ground surface impacts during recoiling of drawwires for conductors as part of dismantling of existing towers.
- It is noted that the impacts described above will occur either within the approved project disturbance boundary (where all required cultural heritage works have been completed in accordance with the relevant approval and ACHMP), the assessment areas, strictly defined sections of the Big Flat Creek ACHOA or SC10 Management Zone (which have already been subject to survey and assessment), or existing tower locations and associated impact areas.

3.0 Statutory Policy and Framework

The *National Parks and Wildlife Act 1974* (the NPW Act) is the primary statutory control protecting Aboriginal heritage within New South Wales. The EP&A Act is broader legislation that regulates development activity within New South Wales. The proposed relocation of the ETL and dismantling of the existing ETL is subject to approval under Part 3A of the EP&A Act.

3.1 Environmental Planning & Assessment Act 1979

The EP&A Act regulates development activity in New South Wales. Part 3A of the EP&A Act applies to projects that meet the requirements of Section 75B of the EP&A Act. This includes the ETL relocation. 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. As the proposed relocation of the ETL and dismantling of the existing ETL is subject to approval under Part 3A of the EP&A Act, this assessment was undertaken in accordance with the *DEC Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005).

3.2 National Parks and Wildlife Act 1974

The Department of Environment, Climate Change and Water (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 archaeological and cultural heritage assessment has been undertaken in accordance with the New South Wales National Parks and Wildlife Service (NPWS) *Cultural Heritage Guidelines* (NSW NPWS 1997), the Department of Environment and Conservation (DEC – now DECCW) *Interim Community Consultation Requirements for Applicants* (2004) and the DEC draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 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. 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. 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 outside impact areas.

4.0 Aboriginal Consultation and Involvement

As part of any Aboriginal heritage assessment, it is both a requirement of DECCW and best practice that consultation with the Aboriginal community be carried out as an integral part of assessing the significance of the assessment areas 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 an Aboriginal consultation log and copies of all correspondence discussed within **Section 4.0**.

4.1 Notification Process and Registration of Aboriginal Stakeholder Groups

The assessment areas are located within the Wanaruah Local Aboriginal Land Council (WLALC) 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's² *Interim Community Consultation Requirements for Applicants*, the following notification process was undertaken:

- On 7 April 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 27 April 2009, it would be assumed that the organisation was not aware of any additional Aboriginal stakeholder groups other than the ones specified within the correspondence (refer to **Appendix A**).

- A response was received from the Wanaruah Local Aboriginal Land Council (8 April 2009) and suggested that St Clair Singleton Aboriginal Corporation should also be considered as an Aboriginal organisation with an interest in the Upper Hunter. Mangoola Coal subsequently informed St Clair Singleton Aboriginal Corporation of the opportunity to become involved in consultation regarding the project. DECCW responded on 22 April 2009 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 (Lea-Ann Ball). 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 2009) informing that the subject land

² DECCW formerly DEC – Department of Environment and Conservation then DECC – Department of Environment and Climate Change

does not currently have any registered Aboriginal owners. No response was received from the New South Wales Native Title Services or the 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 transmission line 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 a 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
 - 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 for the assessment areas (excluding the off-easement access tracks) and the Habitat Enhancement Area was discussed by Jan Wilson (Manager Cultural Heritage, Umwelt). All stakeholder feedback received at this meeting was included in the draft survey strategy (refer to **Appendix A** for a transcript 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 Relocated ETL Inspection Day 11 September 2009

On Friday 11 September 2009, the opportunity was provided for all the Aboriginal stakeholder groups registered for the ETL project to visit a number of locations including (refer to **Figure 1.2**):

- the two sensitive tower removal areas where towers are proposed to be dismantled within areas designated for in-perpetuity conservation of Aboriginal cultural heritage sites and values; one within the SC10 Management Zone and one within the ACHOA near Big Flat Creek;

- a location where the relocated ETL will span the ACHOA (as noted in **Section 2.6** no towers are proposed within this area); and
- the Habitat Enhancement Area - this area is to the east of the existing ACHOA and includes part of the upper catchment of Big Flat Creek (refer to **Figure 1.2**).

The rationale for the inspection day was to explain the works proposed and to obtain feedback from the Aboriginal stakeholders on:

- appropriate methodologies for the dismantling of the towers (or leaving them *in situ* if this was the preferred outcome of discussions on the day);
- the aesthetic impact of the relocated ETL where it passes over the ACHOA and in proximity to rockshelter sites associated with Wallaby Rocks, Anvil Hill and Limb of Addy Hill; and
- the suitability of the Habitat Enhancement Area as a potential land-based offset area from an Aboriginal cultural perspective.

The inspection day was attended by the Aboriginal stakeholder representatives listed in **Table 4.1**. Jan Wilson (Manager Cultural Heritage, Umwelt) and Kym McNamara (Archaeologist, Umwelt) were present to provide information relevant to archaeological values. Toni Schneekloth (Environment and Community Coordinator, Xstrata Mangoola) was present to discuss project details and Bruce Russ (Senior Electrical Engineer, Downer EDI) was present to provide feedback to the Aboriginal stakeholders on tower construction and tower dismantling.

**Table 4.1 - Aboriginal Stakeholder Attendees – Inspection Day
11 September 2009**

Group	Representative
Muswellbrook Cultural Consultants	Donna Matthews
Hunter Valley Cultural Surveying	Luke Hickey
Giwiirr Consultants	Michelle Stair
Wattaka Wonnarua Cultural Consultants Services	Katrina Cavanagh
Wonn 1 Contracting	Arthur. Fletcher
Cacatua Culture Consultants	Maxine McCormick
Hunter Valley Cultural Consultants	John Matthews
Aboriginal Native Title Consultants	Margaret Matthews
Upper Hunter Heritage Consultants	Justin Matthews
Wonnarua Nation Aboriginal Corporation	Maree Waugh
Culturally Aware	Kirstin Berry
Hunter Traditional Owners	Paulette Ryan
Wanaruah Local Aboriginal Land Council	Norm Archibald
Gidawaa Walang Cultural H.C.	Ann-Marie Hickey
Wonnarua Culture Heritage	Todd Maley
Mingga Consultants	Cliff Matthews
Mingga Consultants	Tony Matthews
Upper Hunter Wonnarua Council Inc	Matthew Wells

4.2.1 Tower Location within the SC10 Management Zone

At this tower location discussions were held in relation to how the requisite crane and semi-trailer would access the tower, how the tower would be dismantled, and the area of ground surface that would be impacted by this operation (refer to **Section 4.2**). The option of leaving the tower *in situ* was also discussed, as was the methodology by which the existing ETL would be removed and whether there was potential for this operation to impact a broader area of the SC10 Management Zone than the immediate environs of the tower location.

The consensus of the Aboriginal stakeholder participants on the day was as follows:

- the tower is ugly;
- the tower should be removed as children visiting the SC10 Management Zone may climb it and fall;
- the tower footings should not be removed as this would cause further disturbance to the SC10 site. Instead a section of the base of the tower superstructure (approximately 2 metres in height) should be left and used to support a roof to provide a shady spot for people to use when they visit the SC10 Management Zone;
- the track to be used by the crane and semi-trailer to access the tower should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP - Umwelt 2008a) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates;
- similarly the impact area around the tower location should also be inspected, artefacts flagged and those not able to be avoided collected and stored in separate plastic bags marked with their MGA grid coordinates;
- following the dismantling of the tower the artefacts to be replaced at their individual find locations; and
- vehicle access to the area to be restricted to the crane and semi-trailer. All other vehicles to be parked outside the SC10 Management Zone.

On the day of the inspection the Downer EDI representative (Bruce Russ) did not have details of how the transmission lines would be removed and it was agreed that he would obtain this information for inclusion in this assessment report and for consideration by the Aboriginal stakeholders during the report comment period. This information is provided in **Section 2.0**.

At the conclusion of the visit to the tower location it was agreed that all participants would discuss the outcomes of the inspection with their broader group membership and provide their final comments as part of their response on the draft report.

4.2.2 Tower Location within the ACHOA near Big Flat Creek

The discussion held at the SC10 Management Zone tower location was repeated at the tower location within the ACHOA near Big Flat Creek. This tower location is in the area of the BFC01 site (AHIMS 37-2-2164).

The consensus of the Aboriginal stakeholder participants on the day was as follows:

- the tower is ugly;
- the tower should be removed as children visiting the ACHOA may climb it and fall;
- the tower footings should not be removed as this would cause further disturbance to the BFC01 site. Instead a section of the base of the tower superstructure (approximately 2 metres in height) should be left and used to support a roof to provide a shady spot for people to use when they visit the ACHOA;
- an area to be used for tower access by the crane and semi-trailer and to be used for parking other vehicles should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates;
- vehicle access to the tower should be restricted to the crane and semi-trailer. All other vehicles to be parked immediately to the east of the tower location in an area within the ACHOA that has been used for parking in the past;
- a temporary fence (iron posts and high visibility meshing) should be constructed prior to works commencing that demarcates the western limit of the area of ACHOA where vehicle impact is permissible (and the area that has been inspected and artefacts temporarily salvaged where required); and
- following the dismantling of the tower the artefacts to be replaced at their individual find locations.

At the conclusion of the visit to the tower location it was agreed that all participants would discuss the outcomes of the inspection with their broader group and provide their final comments within their response on the draft report.

4.2.3 Visit to Area where the Relocated ETL will span the ACHOA

The Aboriginal stakeholder representatives were driven through the area to be spanned by the relocated ETL and to the tower location closest to the Wallaby Rocks rockshelter sites.

Discussion at this location centred on the following:

- that no towers were proposed within the ACHOA;
- that no ground disturbance was proposed within the area of the ACHOA spanned by the relocated ETL other than described below;
- the methodology for taking the transmission lines across the ACHOA was to have a person walk from the last tower location within the approved project disturbance area and across the ACHOA pulling a wire that would then be attached to the next tower on the northern side of Wybong Road and outside the ACHOA. The wire would be attached to the transmission line and wound up so that the transmission line does not touch the ground within the ACHOA (for details refer to **Section 2.0**). However this will require that a 22 millimetre draw-wire be hand-pulled along the ground in the first instance;
- following construction, additional tree lopping may be required. If trees are found that do require lopping, all artefacts within the area to be accessed for lopping will be demarcated

by representatives of the Aboriginal stakeholders and in compliance with the ACHMP, and all impacts avoided;

- the visual impact of having the relocated ETL so close to a number of rockshelters and spanning the ACHOA; and
- the requirement for Mangoola Coal to limit impacts of vibration from blasting on the relocated ETL towers which will also provide an increased buffer zone between blasting and the rockshelter sites.

The consensus on the day was as follows:

- that the methodology for taking the transmission line across the ACHOA was appropriate;
- the methodology proposed to protect any artefacts within the ACHOA during tree lopping (if required) was appropriate;
- the request to assess the visual impact was seen as ironic considering that there would be an open cut mine visible for the next 20 years on the other side of the relocated ETL; and
- the additional buffer between the mining operations and the rockshelter sites provided by the relocated ETL realignment was seen as beneficial.

Discussions were also held in relation to alternative routes considered for the relocated ETL. However, it was noted that all were problematic and that the easement under consideration had the least impact on the ACHOA.

4.2.4 Inspection of the Habitat Enhancement Area

The Aboriginal stakeholder representatives were driven through an elevated area of the Habitat Enhancement Area that allowed a view to the north across the area. The Aboriginal stakeholder representatives who took part in the survey of this area were asked to share their views on its suitability as an offset (refer to **Figure 1.2**).

The following points of view were provided and discussed by the participating Aboriginal stakeholders.

Arthur Fletcher (WONN1) reported that:

- he believed the area to be very degraded;
- there was lots of rubbish dumped in the area near the existing homesteads;
- he had no feelings of connection when he was surveying the area that would lead him to think it had high cultural value; and
- there was not a reliable water supply that would enable its use for camping and/or for teaching.

Annie Hickey (Gidawaa Walang) reported that there were no Aboriginal resource plants in the area.

Paulette Ryan (Hunter Traditional Owners) reported that she felt it was not suitable.

John Matthews (ANTC) reported that for it to be useful for camping it would need reliable water.

John Matthews and Arthur Fletcher inquired about the three houses within the area and whether they could be used by Aboriginal people visiting the area.

Toni Schneekloth (Xstrata Mangoola) provided the following feedback to the groups:

- the houses had been condemned and they would be removed by Mangoola Coal;
- there were numerous dams in the area that provided water and that it was the intention that these would be rehabilitated to form natural wetlands as part of the Ecology Management Plan for the area; and
- that any rubbish in the area would be removed by Mangoola Coal.

Toni then requested that the Aboriginal stakeholders provide alternative suggestions for an offset. One suggestion put forward was that they may like the offset to be funding for some aspect of the Teaching/Keeping Place currently in the planning stage by XCN, Beltana Highwall Mining and others (several of the Aboriginal stakeholders present indicated support for this suggestion). Another suggestion was for 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.

The Aboriginal stakeholders requested time to have a meeting in private. Following the meeting it was reported by Luke Hickey (Hunter Valley Cultural Surveying) that they would go away and consider their options further and come back to Mangoola Coal with a united suggestion for a suitable offset.

4.3 Alternatives Considered

A general community information session was held in Denman in mid April 2009 and at Wybong on 21 October 2009 regarding the proposed relocation of the ETL. The Wybong Action Group raised a number of concerns to Mangoola Coal regarding the relocated ETL in a written submission in July 2009. The Wybong Action Group proposed an alternate route for the relocated ETL to mitigate potential environmental, ecological and, of relevance to this report, Aboriginal heritage impacts.

The issue concerning the location of the relocated ETL was raised earlier during Aboriginal stakeholder response to general management recommendations of rockshelter site AC38 on 23 February 2009 (Umwelt 2009a). Aboriginal stakeholder group representatives present during inspection of the rockshelter sites (Arthur Fletcher (Wonn 1) and Sue Cutmore (Yarrawalk)) considered a survey peg demarcating the relocated ETL too close to the location of AC38. At this stage the stakeholders had not taken into account the presence of an open cut mine 200 metres away or the buffering effect the relocated ETL offered for the rockshelter sites in terms of assisting with minimising blast impacts.

As noted in **Section 4.2**, during the visit to tower location T28, the closest proposed tower to Wallaby Rocks (on 11 September 2009), the Aboriginal stakeholder representatives were asked to comment on the visual impact of the relocated ETL. The response from Aboriginal stakeholders when questioned about the visual aspect was that considering the proximity of the open cut mine boundary only 200 metres away, the visual impact of the towers would make little difference. Some of the Aboriginal stakeholders stated, however, that the additional buffer zone created by the relocated ETL easement was a positive outcome in

relation to lessening the probability of impacts from blasting on the rockshelters, given the relatively close proximity of the western edge of the approved project disturbance boundary.

4.4 Survey of the Off-Easement Access Tracks

Following the completion of the initial survey of the assessment areas and subsequent inspection day, Downer EDI identified that off-easement access would be required for towers T6 to T10 within Assessment Area A and T32 within Assessment Area B. These access tracks were not included in the original survey methodology for these areas. Consequently, a second survey methodology pertaining to the survey of the access tracks was sent to the relevant Aboriginal stakeholders for comment on 8 December 2009. On behalf of Wanaruah Local Aboriginal Land Council, Noel Downs and Suzie Worth requested that an additional five day period be allowed for the provision of comment on the draft survey methodology. The Wanaruah Local Aboriginal Land Council sent a letter dated 6 January 2010 agreeing to the survey methodology. No additional comments on the survey methodology were received. Four Aboriginal stakeholder representatives participated in the survey of the access tracks on 13 January 2010.

4.5 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 11.2 (Preferred Option for sites to be Impacted by Tower Dismantling) and Offset Option 11.3.2 (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 primarily relates to a separate Aboriginal cultural heritage and archaeological assessment conducted for proposed modifications at Mangoola Coal (Umwelt in prep b). However, some of the issues raised are also relevant to this 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 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 ACHOA by the majority of the relevant Aboriginal stakeholder representatives.

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

Issue 2 - 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 ACHOA.

Mangoola Coal responded that Condition 40 of the current Mangoola Coal Project Approval (PA06_0014 MOD5) relates to the securing of offsets and provided Condition 40 in full (as 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 to be formalised in June 2010.

Issue 3 - 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.

4.6 Comments on Amendments to the Aboriginal Heritage and Archaeological Assessment

Following finalisation of the draft Aboriginal Heritage and Archaeological Assessment (including comments provided by the relevant Aboriginal stakeholders), minor amendments were made to address management strategies for the dismantling of the eleven existing towers outside the project disturbance boundary, the Big Flat Creek ACHOA and the SC10 Management Zone.

The amended sections of the assessment were provided to the relevant Aboriginal stakeholders in July 2010 with a request for comment on the preliminary recommendations regarding dismantling of the eleven towers that are outside the approved project disturbance boundary and were not inspected as part of the assessment (refer to **Appendix A**). A reminder letter regarding the request for comment was sent to the relevant Aboriginal stakeholder groups on 19 October 2010 (refer to attached correspondence) and a further verbal reminder was provided to all stakeholder groups in attendance at the biannual stakeholder consultation meeting on 28 October 2010. Two written responses were received (refer to **Appendix A**). Culturally Aware stated that there are no issues with the proposed recommendations incorporated within the Aboriginal Heritage and Archaeological Assessment. Wanaruah Local Aboriginal Land Council stated that it “does not concur, endorse or agree to or with any activity or action that requires modification to the ACHMP as approved on the 2nd Jan 2009... The only occasion where we would endorse a change at this time would be if it were to include an increase in size (of at least 50 meters) to the protection zone around Anvil Hill.” During the biannual stakeholder consultation meeting on 28 October 2010, several Aboriginal stakeholder representatives indicated that they wish to be consulted further about potential offset options associated with the proposed modifications and 500kV ETL relocation.

Mangoola Coal has provided a written response (see **Appendix A**) to the comments provided by Wanaruah Local Aboriginal Land Council indicating that the expansion of the Anvil Hill Aboriginal Cultural Heritage Offset Area is not possible. All aspects of mine planning have been developed and initiated on the basis of the current size of the Anvil Hill Aboriginal Cultural Heritage Offset Area and alterations to mine planning of the scale necessary to allow the expansion of this offset cannot be undertaken at this stage of the process. This has been previously discussed with a representative of the Wanaruah Local Aboriginal Land Council at a meeting conducted during the initial stages of the current assessments.

During the biannual stakeholder consultation meeting on 28 October 2010, a number of Aboriginal stakeholder representatives raised some questions regarding the previously discussed offset option. In recognition of this and the response from Wanaruah Local Aboriginal Land Council, Mangoola Coal will commit to the establishment of a suitable

culturally appropriate offset following additional consultation with the relevant Aboriginal stakeholders as part of the Mangoola Coal biannual stakeholder meetings, with the offset to be determined within two years of receiving project approval.

4.7 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.

5.0 Assessment Context

Review of environmental, ethnohistoric and archaeological literature is crucial to the Aboriginal heritage and archaeological assessment process, as it facilitates an understanding of past Aboriginal occupation and land use, archaeological site patterning, site survival and the likelihood that extant archaeological sites will be detected. This section provides a summary of available literature for the assessment areas, within a local and regional context, and discusses the implications of this information for the archaeological evaluation of the assessment areas.

5.1 Environmental Context

This section of the report describes the environmental context of the assessment areas and Habitat Enhancement Area spanning geology, soils, geomorphology, topography, hydrology, fauna and flora and land use history; all of which are important factors influencing Aboriginal use of the landscape, the resultant patterning of archaeological sites and the survival of sites in the modern landscape.

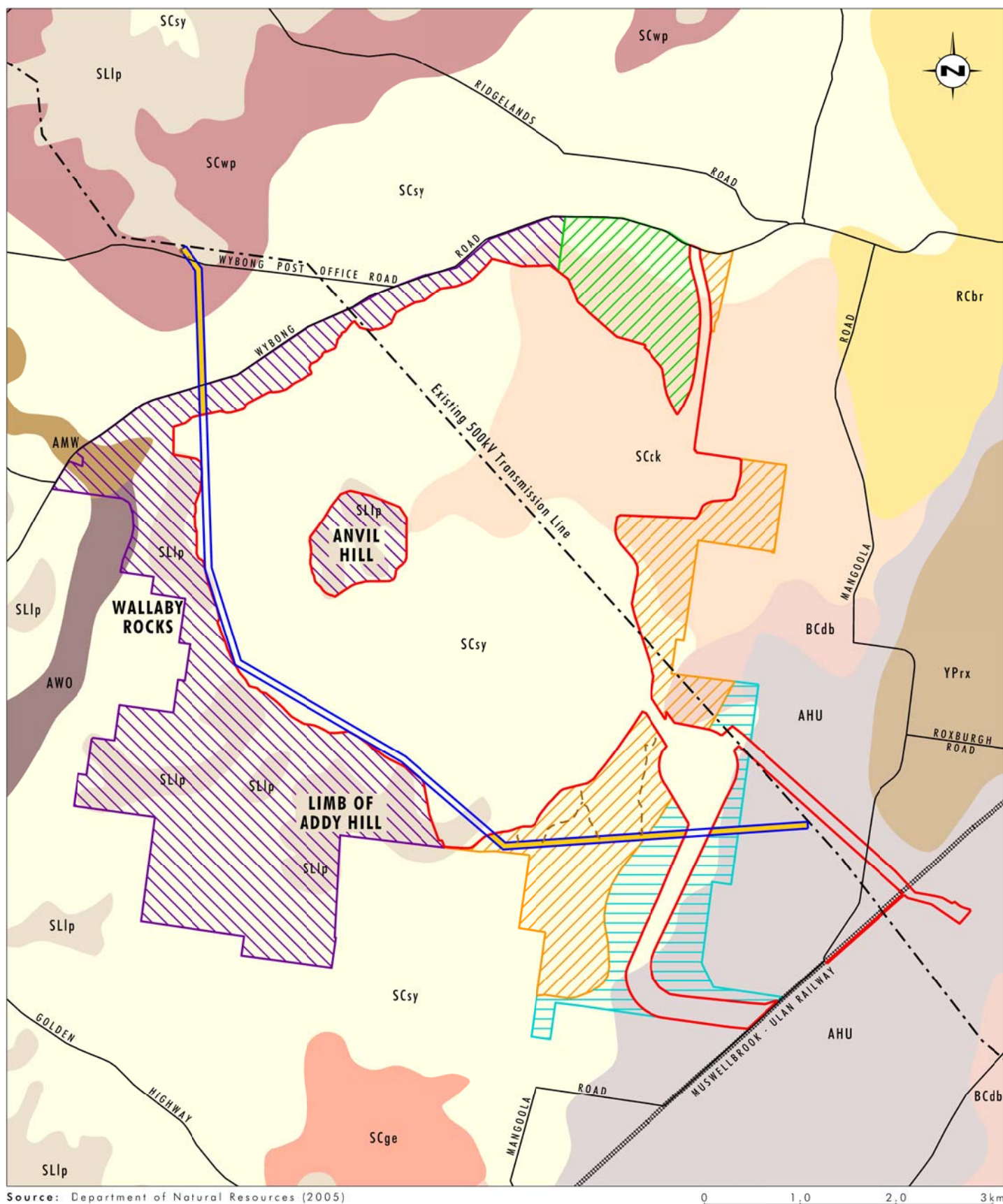
5.1.1 Geology and Soils

The Mangoola Coal Project site 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) in the east (Umwelt 2006a).

Quaternary alluvium is found within Assessment Area A and extends from the Hunter River west to Sandy Creek (between tower locations T1 to T7, although the boundaries between the Hunter River and Sandy Creek flood plains have not been clearly defined). The Hunter River, approximately 1 kilometre to the east of T1 is a known source for 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 areas such as Sandy Creek and Big Flat Creek. In an assessment of the Mangoola Coal project area, Mitchell (2006) identified that raw materials could be sourced from conglomerates of 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 relocated ETL crosses four soil landscape units: the Hunter soil landscape in the eastern section of Assessment Area A; the Sandy Hollow soil landscape that extends for the remainder of Assessment Area A and in the southern portion of Assessment Area B; the Wappinguy soil landscape extending from approximately halfway through Assessment Area B; and the Lees Pinch soil landscape for the remaining portion of Assessment Area B. The Sandy Hollow soil landscape is also present in the Habitat Enhancement Area but comprises a smaller proportion of this area than the Castle Rock soil landscape. The distribution of these soil landscapes is shown in **Figure 5.1** and their key characteristics are summarised in **Table 5.1**.

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 Assessment Areas A and B and the Habitat Enhancement Area. In general, stones larger than the diameter of burrowing agents will 'sink' through the soil over time, creating an artificial layer of stone material (potentially including stone artefacts) that originally was 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.



Source: Department of Natural Resources (2005)

0 1.0 2.0 3 km

Legend

- Approved Project Disturbance Boundary
- Proposed 500kV Transmission Line Easement
- Sustainable Agriculture Offset Area
- Approved Aboriginal Cultural Heritage Offset Areas
- Habitat Enhancement Area
- Surveyed Habitat Enhancement Area
- Assessment Areas
- Access Track

Soil Landscapes:

- | | |
|---|--|
| Castle Rock (SCck) | Growee (SCge) |
| Lees Pinch (SLlp) | Hunter (AHU) |
| Wappinguy (SCwp) | Sandy Hollow (SCsy) |
| Merriwa (AMW) | Roxburgh (YPrx) |
| Wollombi (AWO) | |
| 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)	Wappinguy Soil Landscape (p405-414)	Lees Pinch Soil Landscape	Castle Rock Soil Landscape (p147-150)
Terrain	Undulating rises, elevation ranges from 150-500 metres. Smooth and gentle slopes (<10%). Shallow valleys, 20-40 metres deep cut into hills. Terraced alluvium along major streams.	Level plains and river terraces, elevation ranges from 20-60 metres. Slopes <3%. Plains up to 3200 metres wide. Local relief less than 10 metres.	Rolling low hills with some rocky sandstone knolls, hills, escarpments, cliffs and some sandy benches. Broad shallow valleys with slopes less than 15%. Local relief 40-80 metres, with some hills up to 120 metres. Drainage lines at intervals of 700-1000 metres.	Rolling hills to steep mountains, some associated with sandstone cliffs. Steep slopes up to 90% and large sandstone outcrops on many hills. Escarpments up to 100 metres high. Drainage lines spaced 200-1800 metres.	Undulating low hills and footslopes on areas of colluvium. Elevation ranges from 240-460 metres. Slopes are 1-5% with slope lengths up to 1200 metres. Local relief is 40-80 metres
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.	Woodland dominated by narrow-leaved ironbark, with white box and Blakely's red gum. Other species include black cypress pine, forest red gum, brown bloodwood and wattles as the major shrub type.	Shrub woodland communities with species including broad leaved ironbark, black cypress pine, grey gum and narrow-leaved stringybark, wattles, red gum, brown bloodwood, scribbly gum.	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.	Red Solodic soils on upper to midslopes, Yellow Solodic and Grey Solodic soils on mid to lower slopes, Brown Solodic Soils and Euchrozems on midslopes, Greyed Soloths on lower slopes, Red Earths on upper slopes, Prairie Soils on open depressions, siliceous and Earthy Sands on slopes with shallow outcrops, Brown Clays on midslope in drainage line, alluvial soils on drainage depressions and alluvial flats.	Siliceous Sands on midslope, Yellow Soloths on poorly drained upper to midslopes, Grey Soloths on midslope, Brown Earths and Yellow Earths on lower slopes, Yellow Podzolics and Earthy Sands on upper slope.	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.

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

	Sandy Hollow Soil Landscape (p356-p353)	Hunter Soil Landscape (p212-p218)	Wappinguy Soil Landscape (p405-414)	Lees Pinch Soil Landscape	Castle Rock Soil Landscape (p147-150)
Depth to Bedrock	120 cm+.	300 cm+.	40 cm+	30 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.	7.0 on upper slopes, 6.5-7.5 on upper to midslopes, 5.5-8.5 on mid to lower slopes, 8.0 on open depressions, 8.5 on drainage depressions, 7.0 on slopes with shallow outcrops, 8.0 on alluvial flat	6.0 on midslope, 4.0-7.5 on upper to midslopes and 7.0-7.5 on lower slopes.	6.5 on topsoil and 7.0 in subsoil to 100 cm, 8.5 on alluvial soils.
Soil Erosion	Moderate gully erosion (<1.5 metres) 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 moderate gully erosion and minor to moderate sheet and rill erosion in cleared areas	Minor to moderate sheet and rill erosion associated with disturbance and major colluvial movement on steep slopes	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 assessment areas and the Habitat Enhancement Area. 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 these areas (such as between TL 30 to 34). Vegetation cover in all soil landscapes is likely to be the key constraint to ground surface visibility.

As noted above, the soil pH throughout the assessment areas and the Habitat Enhancement Area 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 assessment areas and Habitat Enhancement Area.

5.1.2 Topography and Geomorphology

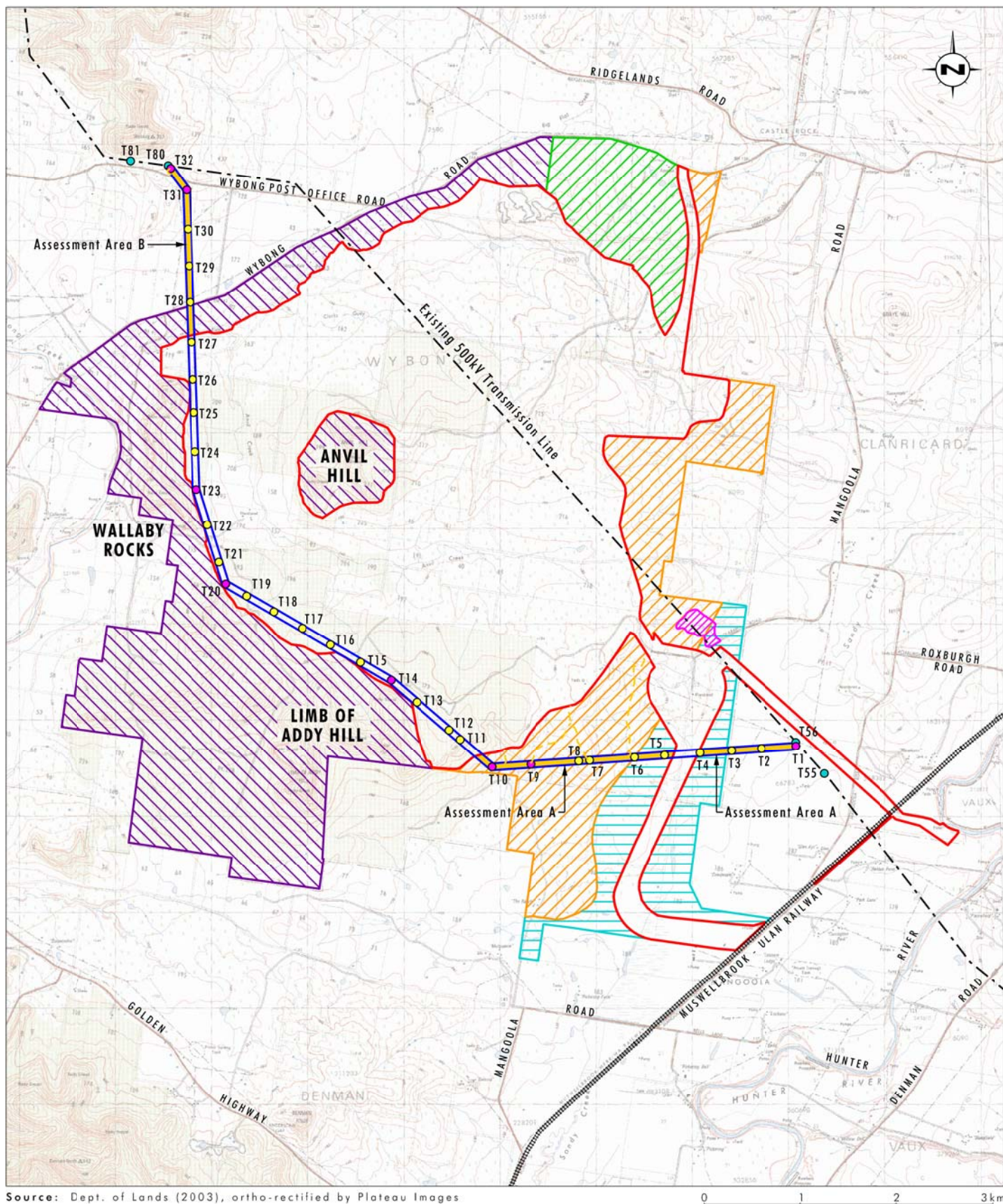
The assessment areas and the Habitat Enhancement Area lie within the Central Lowlands of the Upper Hunter Valley, one of the eight sub-regions of the Hunter Valley defined by Story *et al* (1963). ERM (2004) describes this sub-region as:

...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 assessment areas and the Habitat Enhancement Area reflects the broad characteristics of the region, comprising flats and/or gently undulating slopes bordering Sandy Creek, Big Flat Creek and their associated tributaries. Assessment Area A also contains more steeply inclined slopes leading to level spur crests that extend into Assessment Area A from Limb of Addy Hill. Similarly inclined slopes are present in the northern section of Assessment Area B and are associated with the elevated area containing the Wybong trig point to the north of the assessment area (refer to **Figure 5.2**).

The relocated ETL adjoins Sandy Creek in Assessment Area A and Big Flat Creek in Assessment Area B. Assessment Area A is crossed by five unnamed tributaries of Sandy Creek (five second order streams). A number of first and second order streams and drainage lines dissect alluvial land forms in Assessment Area B and relatively level land units dominate the assessment areas along the relocated ETL easement.

Both Sandy Creek and Big Flat Creek and their associated tributaries are ephemeral in nature and currently contain 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. Big Flat Creek contained pooled water in sections that were covered in reeds. Prior to European land clearance and subsequent entrenchment, it is likely that all of these watercourses had far shallower, grassy channels interspersed by chains of ponds; and their current morphology, even when mirroring this chains of ponds pattern, cannot be seen to reflect the past nature of Hunter Valley streams.



Source: Dept. of Lands (2003), ortho-rectified by Plateau Images

0 1 2 3 km

Legend

- | | |
|---|---|
| Approved Project Disturbance Boundary | Assessment Areas |
| Proposed 500kV Transmission Line Easement | Access Track |
| Sustainable Agriculture Offset Area | ● Existing Tower Location |
| Approved Aboriginal Cultural Heritage Offset Areas | ● Proposed Suspension Tower Location |
| Habitat Enhancement Area | ● Proposed Tension Tower Location |
| Surveyed Habitat Enhancement Area | |
| SC10 Management Zone | |

File Name (A4): R13_V1/2497_178.dgn

FIGURE 5.2
Topography

The Habitat Enhancement Area contains a number of first and second order drainage lines which constitute the upper catchment area of Big Flat Creek. It is assumed that these drainage lines would only hold surface water following heavy rain. None of the drainage lines in the Habitat Enhancement Area contained water at the time of the survey.

A geomorphic investigation of the Sandy Creek catchment was conducted for the Anvil Hill (now Mangoola) Coal project by Mitchell (2006). **Table 5.2** provides a summary of observed characteristics of the upper and lower Sandy Creek catchments from this report.

Table 5.2 – 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 litchi 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 millimetres to 30 millimetres. Minor rills to gullies 2 metres 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 – for details refer to **Section 5.2**), 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 (2006a) also discussed the integrity of the Sandy Creek floodplain 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 downstream. 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 (2006a) further notes 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.

Mitchell (2006: 8) further notes that 'the forested area would have had high value for food and fibre resources ... but the absence of water and stony ground suggest that it is unlikely that any important Aboriginal site is present ...'.

5.1.3 Flora and Fauna

An ecological survey of Mangoola Coal's approved project disturbance area (Umwelt 2006b) 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 assessment areas, with two variants observed. These variants occupy much of the assessment areas and are defined by an abundance of introduced grasses and herbs. The pasture variant occurs within the floodplain complexes of Sandy Creek and Big Flat Creek. These areas have been subject to grazing. Ironbark Woodland is the most widespread native vegetation community in the wider area and small copses of river red gum (*Eucalyptus camuldulensis*) and isolated river red gum trees punctuate the landscape along the margins of water corridors, especially within the vicinity of Big Flat Creek.

Umwelt (2006b) identified 116 floral species within Mangoola Coal's 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 5.3**.

Table 5.3 - Flora Species and Known Aboriginal Use

Scientific Name	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

Table 5.3 - Flora Species and Known Aboriginal Use (cont)

Scientific Name	Name	Known Aboriginal Use	Reference
<i>Melaleuca</i> spp	Melaleuca	Food, economic and medicine plant	Albrecht 2000 in ERM 2004:34 Royal Botanic Gardens 2007 Australian National Botanic Gardens Education Services 2000
<i>Notelaea microcarpa</i>	Native Olive	Medicine plant	pers. comm. Walhallow LALC (2007)
<i>Panicum</i> spp.	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 5.3 indicates that Aboriginal resource plants are found within the assessment areas, but clearance of vegetation since European 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 (2006b). **Table 5.4** lists these species.

Table 5.4 – 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

Table 5.4 – Aboriginal Hunter-Gatherer Fauna Species (cont)

Scientific Name	Name
<i>Macropus rufogriseus</i>	red-necked wallaby
<i>Petrogale penicillata</i>	brush-tailed rock wallaby
<i>Wallabia bicolor</i>	swamp wallaby

Although animal species diversity in the Hunter Valley has been reduced as a result of habitat clearance and hunting, **Table 5.4** indicates that a diverse range of faunal species used by Aboriginal people are found in the Wybong-Denman area and on this basis, Umwelt (2006a) identified that the entire area would have provided a diverse faunal resource base for Aboriginal hunter-gatherers. 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-tailed 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 focus point for faunal species in drier times.

5.1.4 Post Contact History and Landscape Disturbance

The following summary of the post contact history of the Mangoola area, in the context of upper Hunter Valley history, is sourced from Umwelt (2008b).

The Hunter Valley has seen European settlement and activity since 1801, with the establishment of a penal convict settlement at Newcastle for coal mining. 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 of the upper Hunter Valley, particularly cattle grazing, although agriculture, rabbiting, dairying and viticulture were also primarily activities of the nineteenth century. 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. Rabbiting was particularly important in the Muswellbrook area, where a rabbit canning and freezing works was established in the early twentieth century and remained a key industry until the introduction of myxomatosis in the 1950s. Roads were the most important means of transport in the Muswellbrook area until the Great Northern Railway reached Muswellbrook in 1869, and then later Denman in 1915 (Turner 1995:32).

The post-contact history associated with the southern part of the Mangoola Coal project area is directly linked to the 'Pickering' estate, one of the earliest land grants in the Hunter Valley. The Pickering estate was established in 1825 by Captain John Pike, and at this time the property totalled 2000 acres. The property increased in size to 8000 acres by the time it was purchased in 1859 by Archibald Bell Junior, the famous Blue Mountains explorer who also owned the 'Corinda' property in Singleton. In 1895, a large two storey Victorian Italianate stone house was built on the property that still stands today to the west of Mangoola Road. For the remainder of the nineteenth century, estate lands were primarily used for sheep raising and horse breeding, with limited areas also used for viticulture.

As a result of the above history, the landscape throughout the Wybong-Denman area has been modified, although the extent of this modification does vary. Sections of both assessment areas have been impacted by earthworks associated with road construction, particularly in relation to the section of Wybong Road within Assessment Area A. The impacts of road construction are also clearly evident within the low-lying areas of Assessment Area A, where fill has been introduced to raise the road level above flood prone lands. Much of the assessment areas and the Habitat Enhancement Area have been primarily used for pastoral grazing, and this has resulted in extensive tree clearance and isolated earthworks, such as for construction of stockyards and dams. The existing access tracks that will be widened to provide off-easement access are associated with previous farming activities and have been subject to impact as a result of vegetation clearance, vehicle movement, dumping of rubbish and ongoing erosion. Extensive tree clearance has affected the integrity of surface soil deposits throughout the assessment areas and Habitat Enhancement Area, and has also modified water flow within the landscape resulting in increased run off. Water management infrastructure (dams) dominates watercourses within the assessment areas and the Habitat Enhancement Area, with all streams containing natural or humanly modified drainage lines along their length. Numerous north-south oriented channels and/or natural drainage lines have been constructed or utilised to redirect water flow into existing dams.

5.1.5 Ethno-historic Accounts

Historical records, such as official records and personal observations recorded in diaries or publications, can provide information relevant to the Aboriginal history of a region. Although a valuable source of information, the limitations of these documents must be recognised as 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, early observations of the Hunter Valley tended to focus on coastal regions rather than inland areas. 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 (1966; 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 Wonnarua³ 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 the Europeans, it is likely that the Wonnarua people 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

³ 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. Also of importance when determining the location of camp sites, was 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 are frequently referred to, is well documented and is described by 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 involving 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) described 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 the most commonly recorded, although the placement of the body could be varied and could be extended or flexed, face down or 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) involves 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. Davidson and Lovell-Jones state that 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 – all within one generation. On the other hand, 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).

Since 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) argue 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 argue that shortly after non-Aboriginal settlement all that remained were isolated family groups of Wonnarua existing '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 date well into the twentieth century.

5.2 Archaeological Context

This section presents the archaeological context for the evaluation of the assessment areas and the Habitat Enhancement Area, specifically known archaeological sites identified by previous archaeological investigations, and the understanding of the archaeological context of the broader area developed through previous assessments.

5.2.1 Site Types

Aboriginal archaeological sites can be divided roughly into secular (concerned with worldly things) and non-secular (concerned with secret, sacred, ceremonial and ritual things) site types. This division is not made by archaeologists; it is strictly drawn from Aboriginal ideologies (manners of thinking, systems of belief). The division is not always clear cut as some site types may be secular in some circumstances and non-secular in others. The secular or non-secular nature of each of the site types is indicated below. Sites that are non-secular in nature generally have much higher Aboriginal cultural heritage significance than sites of a secular nature. 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, with comment on their secular/non-secular nature.

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. The vast majority of stone artefacts were tools used in day to day activities and were therefore secular in nature. There are some stone artefacts, however, that were used in special rituals/ceremonies that were non-secular in nature (that is, ceremonial axes, tjuringa [engraved or decorated stones], stone knives used in cicatrisation). Stone artefacts are robust and may be preserved in the archaeological record when other forms of evidence of Aboriginal exploitation 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. In general, artefact scatters and isolated finds are secular in nature.

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, and 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. Scarred trees are generally secular in nature.

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. Carved trees may have been non-secular, however, the information regarding this is little known.

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). Most rockshelter sites are secular in nature, however, those that also contain rock art or engravings are often believed to be non-secular in nature.

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). Engraving sites are generally believed to be non-secular in nature.

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 enhances the speed with which grinding proceeds. Less commonly, grinding grooves are located on rock surfaces away from water and on stone types other than sandstone. Grinding grooves appear to be secular in nature.

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. Grinding bowls appear to be secular in nature.

Waterholes/Wells

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

Stone Arrangements

The term stone arrangements refers to 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 generally unknown in modern

society, but they probably relate to ceremonial activities. Stone arrangements are found throughout inland New South Wales as well as 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 take the form of the flaking of rock from the outcrop, or scree from below the outcrop may be used instead. In some areas the stone may be dug from beneath the earth 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). Stone quarries can be either secular or non-secular in nature depending on the Dreaming with which they are associated (Jones and White 1988).

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. Ochre quarries can be either secular or non-secular in nature depending on local belief systems.

Ceremonial Grounds

In the Hunter region the main type of ceremonial ground recorded was the Bora. 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). Bora grounds are believed by many contemporary Aboriginal people to be non-secular in nature, 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. Burial sites are generally believed to be non-secular in nature by contemporary Aboriginal people. Post-contact burial sites refer to burials/interments that have taken place since European 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. They may be secular or non-secular depending on the status/position of the deceased.

Massacre Sites

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

5.2.2 Previously Recorded Sites

The Aboriginal Heritage Information Management System (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 sites identified in the site searches and the date that the search was undertaken are listed separately in Table 1 of a Technical Data

Attachment (in accordance with previous requests from Aboriginal stakeholder representatives not to publish specific site locations). The approximate location of these sites is illustrated on **Figure 5.3**. Of these sites, only one (except 37-2-1987) is listed as destroyed. However, a large number of these sites have been salvaged under approval in accordance with the Mangoola Coal ACHMP (Umwelt 2008a).

During review of AHIMS search results, three errors in recorded site locations were identified. Table 2 of the Technical Data Attachment 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 (2006a). Also, it was noted that the coordinates for a number of sites previously recorded by Umwelt (2006a) are listed on the database with a GDA datum. These sites were provided to DECCW with an AGD datum, as noted in Table 3 of the Technical Data Attachment. DECCW will be provided with the information to correct these errors in the AHIMS database. The approximate location of these sites (incorporating the corrections discussed above is shown in **Figure 5.3**.

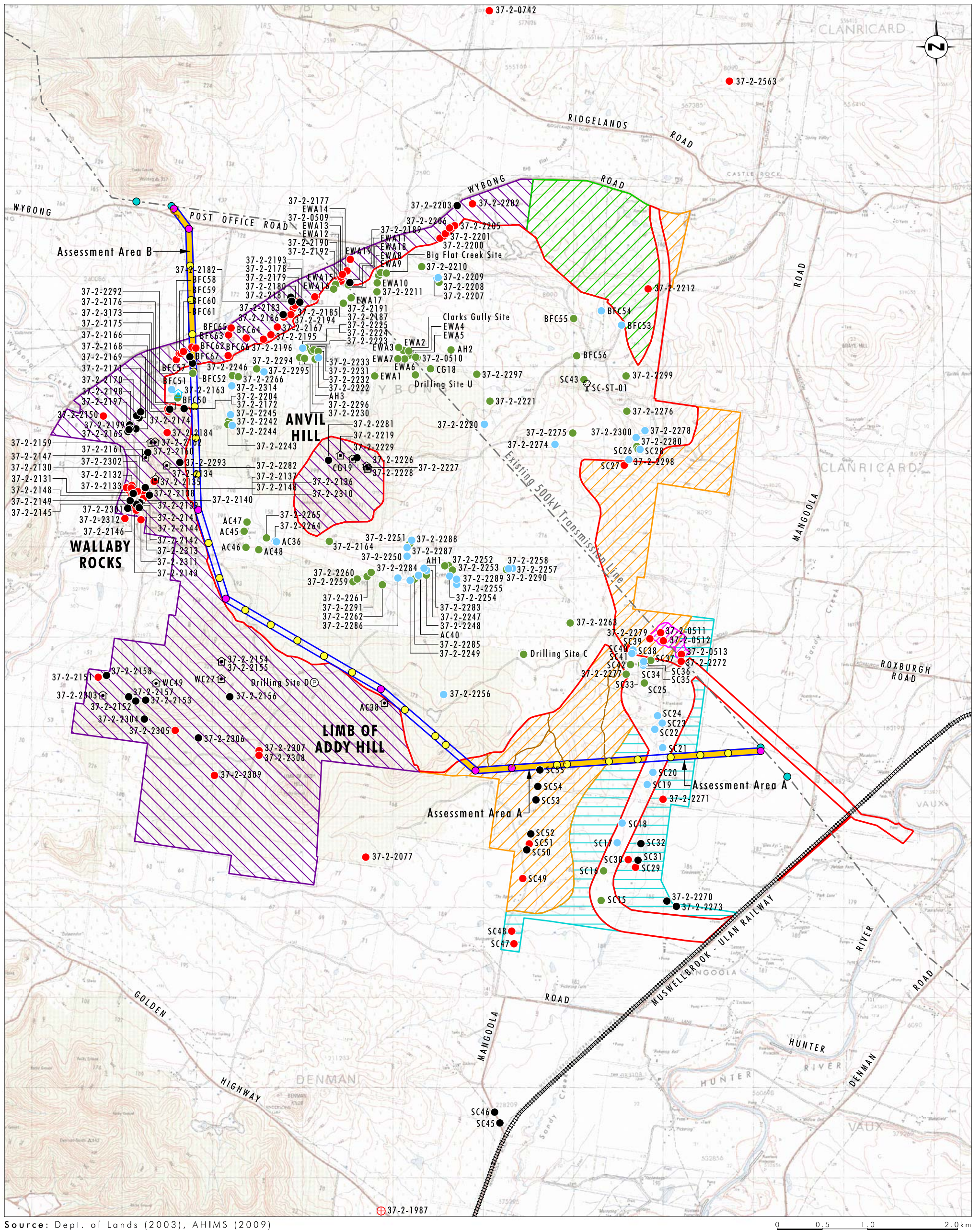
A series of sites (AH1-3, EWA1-19, Drilling Sites C, D, G and U, Clarks Gully Site and Big Flat Creek site) were recorded during previous archaeological investigations (refer to **Section 6.2.3.4** and **6.2.3.5** and Table 2 of **Appendix B**) but were not registered on the AHIMS database. Umwelt (2006a) reasoned that, given the proximity of these sites to AHIMS sites #37-2-0509 and #37-2-0510 (refer to **Figure 5.3**), 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 under the Mangoola Coal ACHMP (Umwelt 2008a). Table 3 of the Technical Data Attachment provides a list of these sites and indicates whether they have been subject to salvage.

The searches of the AHIMS databases also failed to identify a number of sites previously recorded by Umwelt within the search area. These sites are listed in Table 4 of the Technical Data Attachment and illustrated in **Figure 5.3**.

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, 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, one isolated find (BFC49) is recorded as being located within the Habitat Enhancement Area and has not been salvaged (refer to **Figure 5.3**). Site SC55 is located very close to Assessment Area A but is not actually located within this assessment area. SC55 has not been salvaged.

5.2.3 Previous Archaeological Research

Table 5.5 lists previous archaeological investigations conducted within the Wybong/Denman area, and provides a summary of key information on investigation area and type, and number of recorded archaeological sites.



Source: Dept. of Lands (2003), AHIMS (2009)

0 0.5 1.0 2.0 km

Legend

- | | | |
|---|---|---|
| Approved Project Disturbance Boundary | Assessment Areas | ⊙ PAD |
| Proposed 500kV Transmission Line Easement | Access Track | Ⓜ Rockshelter with PAD |
| Sustainable Agriculture Offset Area | ● Existing Tower Location | ● Salvaged Artefact Scatter |
| Approved Aboriginal Cultural Heritage Offset Areas | ● Proposed Suspension Tower Location | ● Salvaged Isolated Find |
| Habitat Enhancement Area | ● Proposed Tension Tower Location | Ⓜ Salvaged Rockshelter with PAD |
| Surveyed Habitat Enhancement Area | ● Artefact Scatter | Ⓜ Salvaged Scarred Tree |
| SC10 Management Zone | ⊕ Destroyed Artefact Scatter | ● Isolated Find |

File Name (A3): R13_V1/2497_182.dgn

FIGURE 5.3
Location of
Previously Recorded Sites

Table 5.5 – Previous Archaeological Research

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 area	Surface collection, subsurface testing, manual excavation and grader scrapes	2238	69
Umwelt	2009	Hunter River PAD subsurface investigation	Subsurface testing	NA	0

As detailed above, 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. One of these (Silcox 1984) was conducted in relation to the existing ETL. Archaeological investigations have predominantly been survey, although two areas have been the subject of subsurface excavations. These include site AC13 (refer to **Section 5.2.3.9** and Umwelt in prep b) and excavations on the Hunter River PAD (refer to **Section 5.2.3.11** and Umwelt in prep d).

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

5.2.3.1 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 (including the existing ETL). 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 further to the south-east near Assessment Area A (refer to **Figure 5.3**). 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).

5.2.3.2 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 approximately 6 kilometres south of the assessment areas, and was found 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, the Denman police in conjunction with NPWS ranger/s excavated human skeletal material (ribs and limb bones) from the cave, which were then sent to Sydney for forensic analysis. The AHIMS site card includes a recommendation that the remains be returned to the site and for the cave to be protected against animal movement, but it is unknown whether these works were carried out.

5.2.3.3 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 Aboriginal sites. The objective was to identify drilling sites that would not be constrained by Aboriginal archaeological material. The nearest proposed drill location where occupational material was located (location C) is approximately 1.5 kilometres north of Assessment Area A. 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.

5.2.3.4 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.

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

Witter (2002) conducted an archaeological survey for the Great Northern Coal Project, located within the approved Mangoola Coal project boundary, for inclusion in a Statement of Environmental Effects. 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 including 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 describes 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. The assemblages found at Anvil Vale and the nearby Big Flat Creek site, were reported by Witter to be dominated by tuff (mudstone) without cortex, whilst at the Clarks Gully site where tuff was also dominant, there was a greater number of artefacts with cortex (Witter 2002:30). Other material types found at these sites include quartz, silcrete and an orange chert.

Witter discusses two other sites of interest beyond the larger site groupings. One was a small microblade workshop (EWA 19) located in a small scald of the valley bottom north of Big Flat Creek. This workshop is isolated and consisted of five silcrete flakes, four of which were blades. Witter suggests 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 community involved placed a similar aesthetic importance on these artefacts.

5.2.3.6 Upper Hunter Valley Aboriginal Heritage Baseline Study (ERM 2004)

ERM (2004) undertook a review of the archaeology in the Upper Hunter Valley on behalf of Upper Hunter Aboriginal Heritage Trust. Following is a number of ERM's conclusions about archaeological sites in the Upper Hunter Valley of relevance to this assessment:

- artefact assemblages will typically be comprised of flaked stone with a component associated with the manufacture of backed artefacts. Backed artefacts typically make up less than 2 per cent (and up to 5 per cent in rare cases) of an assemblage;
- evidence of backed artefacts is generally found wherever large numbers of artefacts have been recorded;
- cores and flakes associated with backed artefact manufacture typically show evidence of platform modification to increase platform angles. This modification is sometimes referred to as faceting, and is typical of open site assemblages between Singleton and Muswellbrook;
- the backed artefact component may typically include a larger proportion of asymmetric, elongate 'Bondi point' forms and a smaller proportion of symmetric 'geometric microlith' forms in the same assemblage;
- eloueras occur occasionally and sometimes exhibit use-wear chipping and polishing along the chord;
- artefact assemblages have, on rare occasions, included small grindstones or fragments thereof, and ground-edge hatchet heads made on flat ovate water rolled small cobbles;

- hearths, comprising tight concentrations of heat-retainer stones clearly distinguishable from the natural environment are rare;
- sites along creek lines have potential for subsurface archaeological deposit. Topsoil is often quite deep, commonly between 100 and 300 millimetres;
- the small numbers of artefacts found on slopes and ridge crests generally do not allow identification of particular activities, but do provide evidence for occupation of these areas and at the very least transient movement over, and use of, all parts of the landscape;
- in areas close to the Hunter River (very likely to have been the major foci of occupation) alluvial deposits may have buried sites, or periods of flooding may have eroded and displaced archaeological material. Nevertheless excavations at a number of sites indicate that high density subsurface assemblages may occur in this context;
- sites on or within colluvial deposits are also rare, however they do occur and may represent stratified cultural deposits providing evidence of chronological change;
- archaeological sites other than artefact scatters or isolated artefacts are not common;
- quarry sites have been identified where silcrete outcrops; however the vast majority of raw material used in the manufacture of stone artefacts would have been derived (quarried/collected) from the Hunter River;
- axe-grinding grooves often occur where suitable sandstone is located in association with water or a creek line;
- scarred trees are rare, presumably because most trees that may be old enough to have been scarred have been cleared or died naturally (and rotted away or been burnt in fires); and
- art sites, ceremonial sites or Bora grounds are also rare and are either deteriorating or can no longer be located.

5.2.3.7 Aboriginal Archaeological Assessment - Anvil Hill Project (Umwelt 2006a)

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 (now the approved project disturbance area), 98 (including all rockshelter sites) which are now located in the ACHOA, 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. These sites constitute 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 5.3**).

The dominant artefact types within all sites were flakes (including retouched), followed by broken flakes and cores, dominantly manufactured on mudstone followed by silcrete, petrified wood and basalt.

Umwelt (2006a) states that survey results for the Mangoola Coal project area provide evidence for repeated use of the area by small groups of people over a long period of time, primarily in relation to reliable watercourses. The highest concentration of artefacts and sites were recorded at creek confluences or 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 located at a distance from reliable water, have minimal evidence of Aboriginal occupation. Umwelt (2006a) also notes 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 for 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 include AC13, AC38, AC42, BFC12, CG01, CG10, WC02, WC05, WC21, WC25, WC26, WC27, WC43, WC45, WC46, WC47.

5.2.3.8 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 project area (or which extended across the project disturbance boundary);
- grader scrapes of 29 sites within the project 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 project impact area will be deposited within the SC10 Management Zone when all post-excavation analysis is completed.

5.2.3.9 Proposed 66 kV Transmission Line, Denman to Mangoola Coal Mine (Umwelt 2009b)

The survey inspected 100 per cent of a proposed 66 kV transmission line easement located outside the approved project disturbance area and which totalled approximately 26 hectares and intersected with Assessment Area A. 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. 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 breakage was observed across all sites recorded, and many artefacts were heat affected.

Two areas of high archaeological potential were also identified along the alignment but are not located within Assessment Area A. 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 (refer to **Figure 5.3**). Beyond these areas, the easement area was considered to be of low archaeological potential, as a significant proportion of the alignment 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 2009b are summarised in **Table 5.6** below.

Table 5.6 - Summary of Recommendations (Umwelt 2009b)

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	✓			

Of these sites, SC55 is located immediately adjacent to Assessment Area A however the site does not fall within the assessment area.

5.2.3.10 Modification for Mangoola Coal Pipeline (2008c)

Mangoola Coal was given approval to construct 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 in June 2009 as Modification 2 to PA 06_0014. Prior to receiving this approval, 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 main waterway of this part of the Hunter Valley.

The proposed water pipeline survey covered all of the impact area that was accessible and not covered in dense, impenetrable vegetation. Known artefact scatter site SC03 was inspected and confirmed to extend into the impact area. An additional ten 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 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 overlapping alluvial/colluvial sequences that may retain archaeological material in a stratigraphic context were not present.

The majority of sites within the impact area were subject to surface collection under the Mangoola Coal ACHMP in 2009. 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 (refer to **Section 5.2.3.11** below).

5.2.3.11 Salvage Program on the Hunter River PAD and Surface Collection of SC03 (Umwelt in prep d)

Excavations were conducted within the area of the Hunter River PAD as a result of the recommendations put forward by the Aboriginal stakeholders as part of the assessment described above (**Section 5.2.3.10** and Umwelt 2008c). Excavations on the Hunter River PAD consisted of three 3 x 1 metre trenches that were mechanically excavated on three distinct landforms (refer to Umwelt in prep d).

- 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 2009d).

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, utilising the methodology approved under the Mangoola Coal 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 d).

6.0 Predictive Model

Predictive models are developed to indicate which site types are likely to be found in an area, and examine their likely distribution, content and integrity. 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 (2006a) for the Mangoola Coal project area which makes predictions about likely site type occurrence, site distribution, site content (such as artefact types and densities), and site integrity. This model was refined following extensive survey, during which 195 archaeological sites were recorded in a variety of landscape contexts. The following statements on likely site type occurrence, distribution, content and integrity are informed by the Umwelt (2006a) predictive model (which was based on all the prior archaeological investigation in the area), the results of subsequent surveys and subsurface investigations undertaken by Umwelt (2006a, 2008c, 2009a, 2009b and in prep a) and the specific landscape context of the assessment areas and Habitat Enhancement Area.

6.1 Site Type Occurrence

Section 5.2 defined the range of site types that may be found in the broader Hunter Valley region surrounding the assessment areas and Habitat Enhancement Area, as identified by previous archaeological research, namely: artefact scatters, isolated finds, scarred trees, carved trees, rockshelter sites, engraving sites, grinding groove sites, grinding bowls, waterholes/wells, stone arrangements, stone or ochre quarries, ceremonial grounds, burials and post-contact sites such as missions, reserves and massacre sites. Following review of environmental, ethno-historic and archaeological literature, the following statements are made about likely site type occurrence within the assessment areas and Habitat Enhancement Area:

- artefact scatters and isolated finds are predicted to occur within the assessment areas and Habitat Enhancement Area, being the dominant site type within the local area and in all landform contexts;
- scarred or carved trees may once have been present within the assessment areas and Habitat Enhancement Area. However, due to extensive historic tree clearance as well as bushfires they are now likely to be a rare occurrence. Scarred trees would once have been very common but now are only likely to be located where mature trees have survived European land clearance practices. Carved trees are very unlikely to occur within the assessment areas or Habitat Enhancement Area as they are highly recognisable, and consequently many carved trees have been removed for museum display purposes or destroyed by landholders;
- rockshelter sites (with deposit, engraving or art) are unlikely to occur within the assessment areas or Habitat Enhancement Area as no suitable outcrops containing overhangs or shelters are present;
- sandstone site types such as grinding groove sites, engraving sites, grinding bowls, water holes or wells have been recorded in sandstone landscapes of the Hunter Valley. However the dominant rock type within the assessment areas and Habitat Enhancement Area is conglomerate. Prior surveys in the area have failed to locate these site types and they are unlikely to occur within the assessment areas and Habitat Enhancement Area;
- stone arrangements are not predicted to occur within the assessment areas or Habitat Enhancement Area, being a rare site type in the Hunter Valley. The long history of

European activity within the assessment areas and the Habitat Enhancement Area also indicates stone arrangements are not likely to have survived;

- stone or ochre quarries are unlikely to occur within the assessment areas or Habitat Enhancement Area as the geology is unsuitable and as no source of stone or ochre is known within the broader area. Conglomerate gravels, if exposed, could have been a source of raw materials such as quartz and quartzite for implement manufacture, but quarrying is unlikely to be required to procure this material as it erodes from the subsoil; therefore making recognition of this source as a quarry impossible;
- ceremonial grounds are unlikely to occur within the assessment areas or Habitat Enhancement Area due to the general rarity of this site type, and the long history of European agricultural activity within these areas which would have most likely removed physical evidence such as bora grounds (raised earthen or stone rings connected by a pathway);
- burial sites are considered unlikely to occur within the assessment areas or Habitat Enhancement Area due to lack of suitable contexts, such as rockshelters or deep sandy deposits, although deep alluvial soils are present along Big Flat Creek. The cultivation of the alluvial deposits associated with Sandy Creek and Big Flat Creek and the acidic pH levels within the assessment areas indicate that if any human remains were interred in the area, they would be unlikely to have survived; and
- post-contact sites such as missions, reserves and massacre sites are considered unlikely to occur within the assessment areas and Habitat Enhancement Area as these sites are not indicated by ethno-historic or historic literature.

6.2 Site Content

The following predictions are made for likely content of artefact scatters and isolated finds within the assessment areas and Habitat Enhancement Area:

- artefact scatters will typically have assemblages with less than 10 artefacts and will rarely exceed 50 artefacts;
- the dominant raw material used in artefact manufacture and visible in surface scatters will be indurated mudstone followed by silcrete. The most likely source of these materials will be cobbles from the Hunter River;
- other raw materials such as quartz, quartzite, petrified wood, porcellanite, crystalline tuff, chalcedony and volcanics will commonly be located in the larger assemblages but always as a minor component of the assemblage. Of these materials, quartz and quartzite pebbles may be sourced from local conglomerates;
- the predominant artefact types will be flakes (broken or whole), with other artefact types likely to include cores, flaked pieces and retouched flakes. Freehand percussion will be the dominant knapping method; and
- large assemblages may contain minor components of retouched flakes and ground artefacts (grindstones and axes). A small component of the larger assemblages may also reflect microblade technology.

6.3 Site Distribution

The following predictions are made for likely distribution of artefact scatters and isolated finds within the assessment areas and Habitat Enhancement Area:

- sites are likely to occur in all landform contexts, but with increased frequency within 30 metres of watercourses. The majority of sites are therefore expected on footslopes and lower slopes associated with the tributaries of Sandy Creek and Big Flat Creek where they intersect the assessment areas and Habitat Enhancement Area;
- more reliable water sources – generally higher order streams – are more likely to have been intensively used in the past, suggesting site and artefact density will increase in these areas. Within the assessment areas the higher order Sandy Creek and Big Flat Creek may have been more intensively utilised than surrounding first and second order streams (as present within the Habitat Enhancement Area) due to the greater likelihood of water retention during the drier months. This further suggests that intensity of occupation and use would be expected to increase with the higher order streams of Sandy Creek and Big Flat Creek within Assessment Area A. However, in relation to Sandy Creek it should also be considered that the section of this watercourse that adjoins Assessment Area A passes through unconsolidated alluvium and could be subject to significant migration through time. It cannot therefore be assumed that Sandy Creek has also followed its current course and this may affect the likelihood that sites will be present or preserved in this area;
- ecotones may be the focus of more intensive Aboriginal use, as these areas (where vegetation communities meet) provide a higher diversity of flora resources and animal habitats for exploitation by Aboriginal hunter-gatherers. Extensive vegetation clearance within the assessment areas and Habitat Enhancement Area limits the understanding of past vegetation community boundaries, but ecotones within the vicinities of Sandy Creek and Big Flat Creek suggest these areas may have been more intensively used than surrounding areas for resource exploitation;
- creek confluences may also be the focus of more intensive Aboriginal use, as evidenced by larger archaeological sites. A number of minor drainage lines and their confluences exist within the Sandy Creek catchment within Assessment Area A but there are no major confluences. There are no confluences of Big Flat Creek within Assessment Area B or within the Habitat Enhancement Area; and
- low numbers of small, widely dispersed sites may also be located on spur crests, in saddles, and at the lower slope/footslope boundary, but less commonly on the upper slope and even less commonly on the midslope within Assessment Area A.

6.4 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.

The term 'potential archaeological deposit' (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 freshwater are the most likely landforms to meet the criteria outlined above, depending on previous impacts to the area (refer to **Section 6.5**).

6.5 Site Integrity

The following predictions are made for likely integrity of artefact scatters and isolated finds within the assessment areas and the Habitat Enhancement Area:

- all of the land units within these areas have undergone varying degrees of modification through a variety of natural and humanly induced disturbance;
- extensive clearance of vegetation to create grazing lands would have disturbed any archaeological deposits associated with tree bases and root zones, possibly displacing subsurface artefacts to the surface and vice versa. Loss of vegetation is also expected to have changed erosion patterns throughout the landscape, possibly creating higher exposures on hillslopes than previously known and possibly increasing sedimentation of creek lines and floodplains;
- water management infrastructure (dams and contour banks) associated with the drainage lines of Sandy Creek and Big Flat Creek affect both the lateral and vertical integrity of the soils in the areas. The installation of such infrastructure may have directly impacted archaeological sites during construction. Further, this infrastructure has altered water flow and erosion patterns associated with these watercourses, suggesting that erosion may act to expose and possibly redeposit archaeological materials;
- should areas have been subject to past cultivation within the assessment areas and Habitat Enhancement Area, surface archaeological materials present within the plough zone are expected to have no spatial integrity as a result of ploughing. However, archaeological deposits below the plough zone may retain some integrity;
- sites associated with ephemeral creeks are unlikely to retain integrity due to erosion, and sites associated with all creek lines are likely to be affected by higher levels of stock movement and therefore potentially higher rates of artefact damage; and
- overlapping colluvial and alluvial deposits along the floodplain/footslope boundary may sometimes have the potential to preserve sites with some integrity; however, Sandy Creek and Big Flat Creek floodplain areas are subject to channel migration, rill erosion, over bank flows, sheetwash and cultivation. Given the above, these areas, have little potential to retain archaeological deposits with any integrity. Similarly, the Big Flat Creek area where the relocated ETL spans it has been cleared of vegetation and has been subject to significant erosion including bank collapse, gully and sheetwash and recent fluvial sediment deposition. Consequently, it has little potential to retain archaeological

deposits with any integrity. Similarly, the Habitat Enhancement Area has undergone considerable natural erosion in the form of the processes outlined above. Considerable agricultural/cultivation activities have also directly affected the upper A1 soil horizon throughout this area.

6.6 Summary

In summary, site types most likely to occur in the assessment areas and Habitat Enhancement Area are artefact scatters and isolated artefacts, with these sites typically being of low density and containing less than 10 artefacts. It is possible that the portions of the assessment areas that adjoin the main channel of Big Flat Creek and Sandy Creek may contain artefact scatters with high numbers and densities of artefacts. The number of sites present in the vicinity of these major watercourses and associated tributaries and adjoining footslopes and lower slopes is also likely to be higher in comparison to the surrounding landforms. Should any sites be present, the impacts of both natural and anthropogenic processes may have significantly impacted on the archaeological integrity of these sites.

7.0 Survey – Relocated ETL

This section provides details of the fieldwork carried out as part of the Aboriginal heritage and archaeological assessment of the relocated ETL. Information is provided in relation to the survey strategy and methodology, effective coverage, archaeological sites recorded, and areas of archaeological potential identified.

The survey was conducted over three days (31 August to 1 September 2009 and 13 January 2010) with a minimum of four Aboriginal stakeholder representatives per day. **Table 7.1** lists the Aboriginal stakeholder representatives who participated in the survey.

Table 7.1 - Aboriginal Stakeholder Participation in the Survey

Survey Date	Group	Representative
31/08/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher
01/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Wonnarua Culture Heritage (Gordon Griffiths group) Culturally Aware Upper Hunter Wonnarua Council Incorporated	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Todd Maley Paulette Ryan Georgia Berry
13/01/10	Wonn 1 Consulting Upper Hunter Wonnarua Council Incorporated Hunter Valley Aboriginal Corporation Hunter Valley Traditional Owners	Arthur Fletcher Georgina Berry Gordon Swan Paulette Ryan

7.1 Survey Strategy and Methodology

The survey strategy involved the requirements for survey of the assessment areas and the requirements for inspection of a proposed offset area (**Section 8.0**).

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

- the need to sample all different environmental contexts and landforms within the assessment areas, not simply the watercourses;
- focusing on ground surfaces with higher archaeological visibility such as exposures and scalds, whilst still ensuring that all environmental contexts were sampled;
- 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 assessment areas supplied by the Aboriginal stakeholder groups.

As the assessment areas (both Assessment Area A and Assessment Area B) were relatively linear and total 5.3 kilometres in length along a 70 metre easement and approximately 2.8 kilometres of access track of approximately 6 metres in width, it was considered achievable to survey 100 per cent of the alignment.

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 the survey transect;
- any archaeological sites present (in accordance with DECCW standards and requirements);
- the likelihood that potential archaeological deposits were present within the assessment areas; and
- any information provided by Aboriginal stakeholders regarding the cultural significance of the assessment 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 removed or exposed 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), the area for effective coverage was calculated by multiplying the area of exposure by the percentage of visibility. Effective coverage was then expressed as a percentage of the survey transect.

Each entire assessment area was surveyed on foot by up to eight people spaced 10 metres apart to ensure coverage of the entire span of the easement. Survey transects were divided and recorded by landform following NPWS's *Cultural Heritage Guidelines* (NSW NPWS 1997) and MacDonald *et al.* (1998).

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).

7.2 Survey Coverage

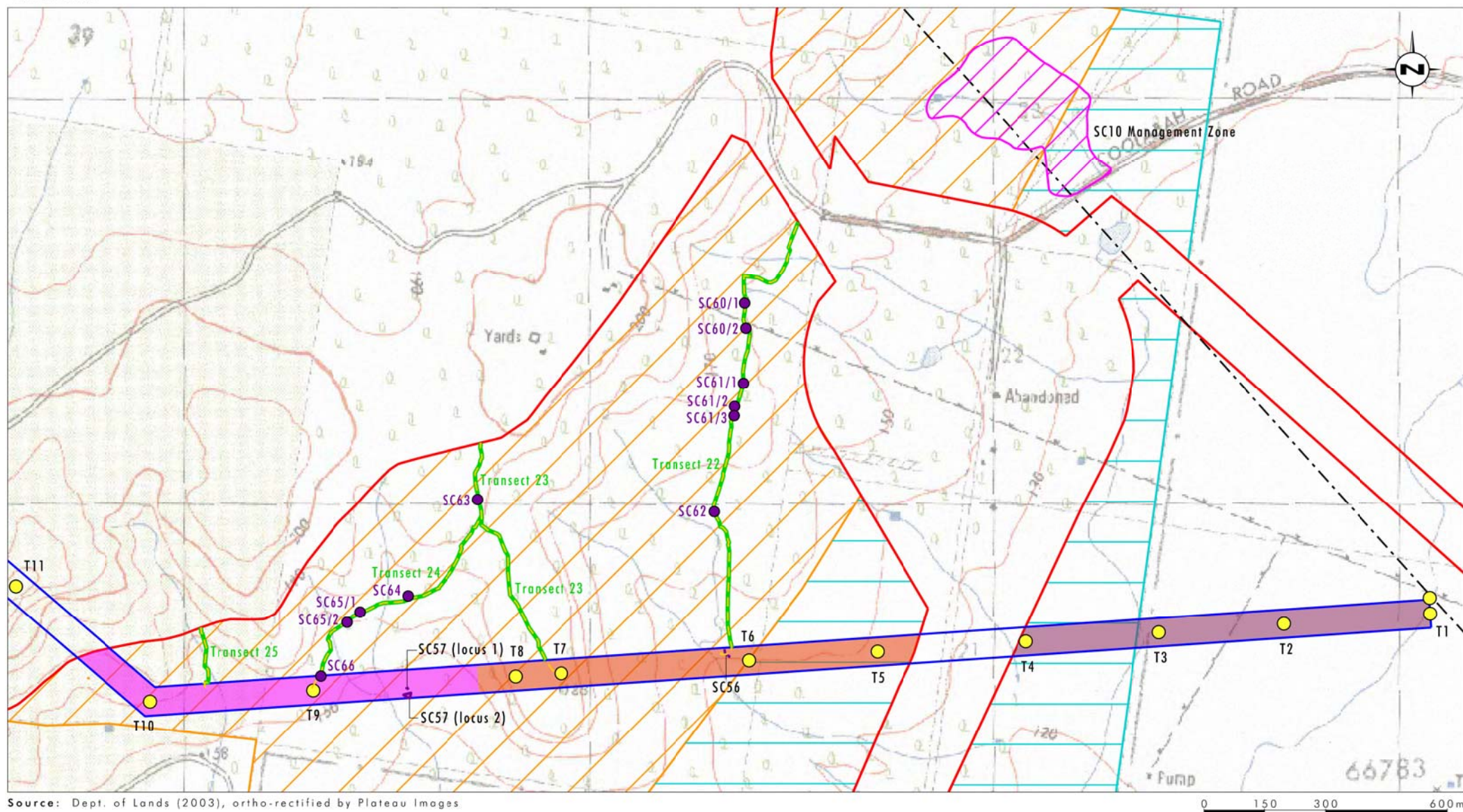
Prior to archaeological survey, the assessment areas (including proposed tower locations) were delineated. A member of the design team (Downer EDI) was present on day one of the survey (31 August 2009) to guide the survey team along Assessment Area B. Coordinates for proposed tower locations were also programmed into a GPS to aid with navigation.

Survey along the assessment areas consisted of linear transects of variable lengths. All transects along the easement within the assessment areas were approximately 70 metres wide and all transects along access tracks were approximately 6 metres wide in order to provide a small buffer outside the proposed access track width. The survey transects are shown in **Figures 7.1** and **7.2** and detailed information regarding the survey transects is provided in Tables 5 and 6 of the Technical Data Attachment. A brief summary of each of the survey transects is also provided below.

Transect 1 consisted of floodplain, drainage line and adjoining lower slope landforms. Where exposed, soils consisted of a mid-brown clay loam that was up to 2 metres deep in section. Slope landforms from Transect 1 extended into Transect 2, which also included a minor drainage line bordered to the west by slopes associated with an area of outcropping sandstone boulders. Soils on mid-upper slopes were skeletal, with soils on lower slopes consisting of a mid brown clay loam and soils associated with the drainage line consisting of a bleached grey brown fine sandy loam. Transect 3 began on lower slopes from Transect 2, which led to a minor drainage before ascending slopes to a spur. Soils consisted of a light grey sandy loam overlying decomposed bedrock. Soils were skeletal on the spur and associated slopes but soil depth of up to 20 centimetres was identified on the drainage line. Transect 5 incorporates the slopes leading to the major and minor channel of Big Flat Creek. Soils on the lower slopes to the north of the drainage lines consisted of a light brown sandy loam with a shift to sandier and more friable soil complexes along the drainage lines. These transects had all been subject to a relatively high level of disturbance as a result of agricultural activities including vegetation clearance, dam and contour construction and access track construction, maintenance and use.

Transects 22 to 26 followed existing vehicle access tracks and therefore had relatively high levels of exposure. These transects encompassed a variety of landforms but primarily consisted of slopes of moderate to low inclination, with spurs also comprising a large proportion of Transects 22 and 23. Soils within Transects 22 to 25 generally consisted of grey-brown clay loam which included large quantities of decayed bedrock material, and bedrock exposures occurred in many of these transects, indicating limited soil depth. Shallow soils were also identified in Transect 26, where the remaining soil consisted of red sandy loam with approximately 60 per cent pebble inclusions (decayed conglomerate components). The level of disturbance in these transects was also relatively high and was primarily associated with access track construction, maintenance and use.

Table 7.2 identifies each survey transect conducted within the assessment areas and calculates effective survey coverage for each.



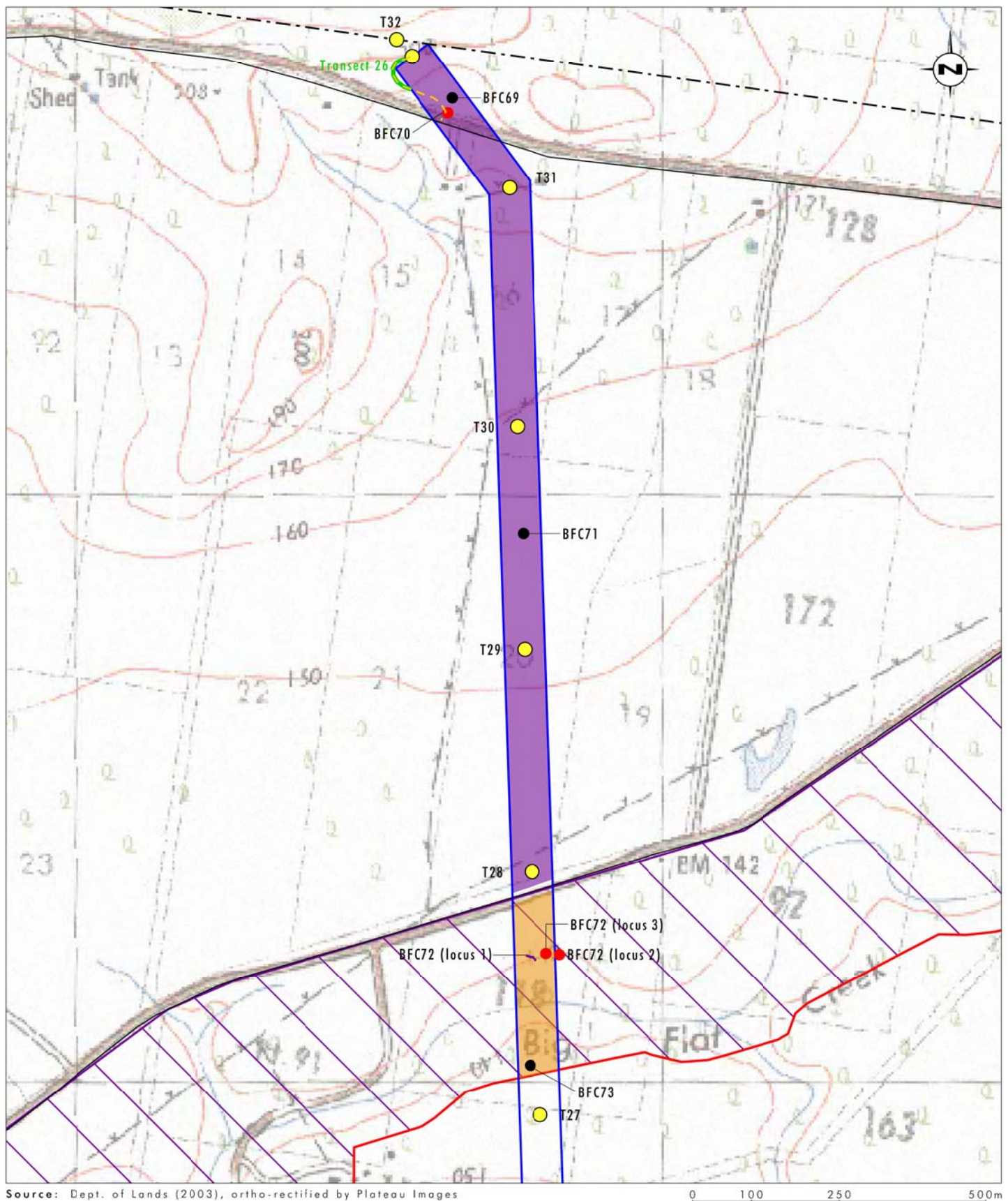
Legend

- | | |
|---|---|
| Approved Project Disturbance Boundary | Transect 2 |
| Proposed 500kV Transmission Line Easement | Transect 3 |
| Sustainable Agriculture Offset Area | Transect |
| Habitat Enhancement Area | Access Track |
| SC10 Management Zone | Proposed Tower Locations |
| Transect 1 | Site/Loci |

File Name (A4): R13_V1/2497_180.dgn

FIGURE 7.1

Location of Survey Transects
and Recorded Sites in
Assessment Area A



Legend

- | | |
|---|--|
| Approved Project Disturbance Boundary | ● Isolated Find |
| Proposed 500kV Transmission Line Easement | ● Artefact Scatter |
| Approved Aboriginal Cultural Heritage Offset Areas | ● Proposed Tower Locations |
| Access Track | — Site/Loci |
| Transect 4 | |
| Transect 5 | |
| Transect | |

FIGURE 7.2

Location of Survey Transects and
Recorded Sites in Assessment Area B

Table 7.2 - Effective Survey Coverage

Transect	Landform Element	Area of Landform Element in transect (m²)	General Visibility (%)	Area of Exposure (m²)	Effective Coverage (m²)	Effective Coverage (%)
1	Floodplain	63000	5	300	210	0.3
	Slope	23625	5	0	0	0.0
	Drainage Line	3375	5	2030	1526	45.2
2	Slope	84375	2	5510	1123	1.3
	Spur	14625	2	0	0	0.0
	Drainage Line	4500	2	2800	560	12.4
3	Slope	57375	10	2000	1567	2.7
	Spur	15750	10	0	0	0.0
	Drainage Line	7875	10	8900	3610	45.8
4	Modified	750	5	0	0	0.0
	Slope	123750	5	5585	2626	2.1
5	Slope	17250	10	0	0	0.0
	Drainage Line	10500	10	1775	1315	12.5
22	Slope	5424	10	1410	1109	20.4
	Drainage Line	630	10	415	329	52.2
	Spur	1188	10	495	324	27.3
23	Slope	810	5	370	230	28.4
	Spur	2718	5	800	460	16.9
24	Slope	3906	5	1280	741.2	19.0
	Drainage Line	168	5	122	122	72.6
25	Slope	1014	5	507	354.9	35.0
	Drainage Line	228	5	114	79.8	35.0
26	Slope	900	10	410	246	27.3
Totals		443736		34823		7.8

As shown in **Table 7.2**, visibility within the assessment areas was generally poor and did not exceed 10 per cent within any landform element. This is largely a reflection of vegetation coverage, within areas of enhanced visibility present in association with areas of exposure. Areas of exposure were most commonly associated with drainage lines, areas of erosion (generally also along drainage lines) and areas of disturbance such as vehicle access tracks. This is reflected in the effective coverage figures, with the highest levels of effective coverage all occurring on drainage lines and within Transects 22 to 25, which incorporate existing vehicle access tracks. As a result of the relatively high level of exposure in specific sections of the assessment areas, the effective coverage figure of 7.8 per cent is relatively high within the context of the Upper Hunter Valley.

7.3 Recorded Archaeological Sites within the Assessment Areas

Archaeological sites during the survey of the assessment areas and Habitat Enhancement Area (refer to **Section 8.0**) were numbered sequentially to previously recorded archaeological sites within the Wybong-Denman area (Umwelt 2006a, Umwelt 2008c, Umwelt 2009a, Umwelt 2009b). The letters represent the catchment area (i.e. Sandy Creek SC or Big Flat Creek BFC), and the number carries on from the last site number recorded within that catchment area. The same system of site numbering was applied to sites identified during the assessment of proposed modifications to the approved mine boundary (the latter is subject to a separate assessment – Umwelt in prep b) and therefore sites identified during the later survey of Transects 22 to 25 are not numbered sequentially from other sites in the assessment areas.

The survey identified 14 Aboriginal archaeological sites within the assessment areas, being 5 isolated finds and 9 artefact scatters containing a total of 166 artefacts. The largest artefact scatter (SC56) contained 49 artefacts (**Plates 1 and 2**), followed by SC57 which contained 36 artefacts (**Plate 3**). BFC72 contained a total count of 31 artefacts (**Plate 4**).

Table 7.3 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 **Figures 7.1 and 7.2**. AHIMS site cards for all sites will be submitted to DECCW in accordance with Section 91 of the NPW Act and were provided to the relevant Aboriginal stakeholders for their records. In accordance with previous requests from Aboriginal stakeholder representatives, coordinates for each site are not provided as part of the main text but are included in Table 7 in the Technical Data Attachment.

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. A high level of artefact breakage was observed across all sites recorded.



PLATE 1
SC56 northern perspective over site



PLATE 2
SC56 silcrete core



PLATE 3
SC57 artefact scatter indicated by flags
Eastern perspective



PLATE 4
BFC72 eastern perspective over site

Table 7.3 – Recorded Aboriginal Archaeological Sites

Site Name	Site Type	Location	Landform and disturbance factors	Site Contents	Area (m ²)
SC56	Artefact scatter	Assessment Area A (Transect 2)	Drainage line lower slope, sheetwash erosion	6 loci, total of 49 artefacts including flakes, broken flakes and cores produced from mudstone, silcrete and chalcedony	1660
SC57	Artefact scatter	Assessment Area A (Transect 3)	Lower slope near dam, sheetwash erosion	2 loci, total 36 artefacts, silcrete and mudstone, flakes, platform removal flake, broken flakes and cores	225
BFC69	Isolated find	Assessment Area B (Transect 4)	Lower slope on dam wall	1 mudstone broken flake	1
BFC70	Artefact scatter	Assessment Area B (Transect 4)	Lower slope near dam and vehicular access track	3 loci, 3 artefacts, mudstone flakes and a mudstone retouched flake	3
BFC71	Isolated find	Assessment Area B (Transect 4)	Lower slope on dam wall site used for grazing stock	1 mudstone flake	1
BFC72	Artefact scatter	Assessment Area B (Transect 5)	Drainage line, sheet wash and cattle grazing	3 loci, total 31 artefacts, mudstone, silcrete and quartz flakes, broken flakes, retouched flakes and cores	350
BFC73	Isolated find	Assessment Area B (Transect 5)	Lower slope, minor sheetwash and an ants nest	1 mudstone broken flake	1
SC60	Artefact Scatter	Assessment Area A (Transect 22)	Lower slope, access track affected by minor sheetwash	2 loci, 1 mudstone flake, 1 silcrete broken flake	420
SC61	Artefact scatter	Assessment Area A (Transect 22)	Spur, access track affected by sheetwash erosion	3 loci, 1 mudstone flake, 1 basalt ground-edge axe, 2 silcrete broken flake, 2 silcrete flaked pieces, 1 silcrete flake	285
SC62	Artefact scatter	Assessment Area A (Transect 22)	Lower slope, access track affected by sheetwash erosion	2 mudstone broken flakes	90
SC63	Isolated find	Assessment Area A (Transect 23)	Spur, access track affected by sheetwash erosion	1 mudstone broken flake	150
SC64	Artefact scatter	Assessment Area A (Transect 24)	Lower slope, access track affected by sheetwash erosion	12 mudstone broken flakes, 6 mudstone flakes (1 of banded mudstone), 3 mudstone heat shatter, 1 mudstone flaked piece, 1 mudstone retouched flake, 1 silcrete core, 1 mudstone core	260
SC65	Artefact scatter	Assessment Area A (Transect 24)	Lower slope, access track affected by sheetwash erosion	1 volcanic flake (with ground surface), 1 mudstone retouched flake	300
SC66	Isolated find	Assessment Area A (Transect 24)	Lower slope, access track affected by sheetwash erosion	1 mudstone heat shatter (showing negative flake scars)	100

SC56 Artefact Scatter

The SC56 artefact scatter site was located within Assessment Area A on the north-east bank of a drainage line in Transect 2 (**Plates 1 and 2**). The surrounding area is predominantly modified land impacted by the construction of a number of drainage lines and two nearby dams. The gradient in the area of the site was a gently inclined 2 degrees with outlook aspect to the south-west. Vegetation in the proximity of the site consisted of regrowth and occasional mature trees including acacia and grey gum.

Located within a drainage line the artefacts had been subject to heavy sheet wash erosion leading to an overall poor site condition. Six areas of exposure contained artefacts and were recorded as loci 1-6. Locus 1 measured 30 metres by 20 metres, Locus 2 measured 40 metres by 4 metres, Loci 3-5 measured 1 metre by 1 metre and Locus 6 measured seven metres by 3 metres. Visibility within the site was 20 per cent while the area beyond the site confines was assessed as having only 1 per cent to 2 per cent visibility.

A total of 49 artefacts were counted across the expanse of the site, with 24 located in Locus 1, 10 in Locus 2, 1 in each of loci 3-5 and 12 in Locus 6. Artefact types included flakes, cores and broken flakes with a high number noted as retaining cortex. Raw material types included mudstone, silcrete and chalcedony.

The artefacts were situated in a disturbed area subject to modification where only a thin layer of A₂ horizon soils were visible. Where A₂ was extant it was noted to be light grey sandy silt. The drainage lines themselves featured sections where all soil had been eroded to reveal sandstone bedrock at the base, however no grinding grooves or bowls were present.

It was assessed that the artefacts had been disturbed as a result of dam construction and ongoing erosion. Modification during the dam building process had also destroyed all potential for intact archaeological deposits within areas associated with the dam works.

Due to the ephemeral nature of the drainage line and the limited depth of remnant soils, it was considered highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC56.

The Aboriginal stakeholder participants in the survey assessed the site to have a low to moderate cultural significance, relative to other sites in the Mangoola area.

SC57 Artefact Scatter

Artefact scatter site SC57 was located within Assessment Area A on a drainage line with a very gentle gradient ranging from 1 to 2 degrees and has an aspect to the south-east (**Plate 3**). It was located in Transect 3 and is not located at a proposed tower location. Vegetation across the site consisted of scattered trees across an area that had been impacted by widespread clearance in the past. The vegetation types included grey gum and box trees, African box thorn and casuarina. The nearest water source was Sandy Creek to the east and its tributaries located to the north, north-east and south-east (refer to **Figure 7.1**).

The artefacts were located within two areas of exposure, the first (Locus 1) measuring 5 metres by 6 metres and the second (Locus 2) 15 metres by 5 metres. The total area encompassing the entire site was estimated at being 35 metres by 20 metres. The artefacts totalled 36 across the two loci, with 22 located in Locus 1 and 14 in Locus 2. The raw materials were mudstone and silcrete, with the silcrete noted as having a greasy lustre. Artefact types included flakes, cores and broken flakes. Some of the flakes were noted as

having overhang removal while most of the mudstone artefacts had evidence of heat shatter. The cores in Locus 2 were also noted as having cortex.

Clearance and dam construction have previously impacted on the area and the site condition has been further affected through sheet wash erosion, resulting in removal of much of the A soil horizon. Overall the site condition was assessed as poor with no potential for further subsurface material either within the site confines or in the surrounding landform. It was further assessed that there was no potential for spatial or stratigraphic integrity at the site. There is therefore no PAD associated with SC57.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC69 Isolated Find

BFC69 is an isolated find that was located within Assessment Area B on a modified area, a dam wall to the north of Wybong Road. It was located during Transect 4 and is not located at a proposed tower location. Visibility within the area containing the artefact and the surrounding landform was consistent at approximately 5 per cent. Vegetation was varied within proximity to the site, including fireweed, moss, both broad and narrow leaved ironbarks, white cypress, helichrysum, rasp fern and Kangaroo grass. The nearest water source was Big Flat Creek and its tributaries to the south and south-east (refer to **Figure 7.2**).

The artefact, situated on the dam wall, was a single mudstone broken flake. The construction of the dam wall had resulted in significant exposure and disturbance of the soil profile however no additional artefacts were present. The potential for further subsurface artefactual material was consequently considered to be low, as was the potential for both spatial and stratigraphic integrity. BFC69 is therefore not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have low cultural significance.

BFC70 Artefact Scatter

Artefact scatter site BFC70 was located in Assessment Area B on a lower slope with a very gently inclined gradient of 1 to 2 degrees and an aspect to the south-east. It was located during Transect 4 but is not located at a proposed tower location. Vegetation within the area consisted of fireweed, moss, both broad and narrow leaved ironbark, white cypress, helichrysum, rasp fern and Kangaroo grass. The nearest water source was Big Flat Creek and its tributaries located to the south and south-east (refer to **Figure 7.2**).

The site consisted of three loci, each containing a single artefact. All three artefacts comprising the total site assemblage were mudstone flakes, with the flake from Locus 2 noted as having cortex. The total site area was estimated as 10 metres by 1 metre, situated on a track next to a dam. Visibility within the exposure afforded by the track was 70 per cent while that of the surrounding landform was recorded as 5 per cent. Overall the site was considered to be in very poor condition.

Soils at the site consist of light reddish brown gravel. Although some remnant A₂ soil horizon was noted the area has predominantly been eroded down to the B horizon, with sandstone exposures noted at the start of the transect containing this site. Consequently, there is very limited potential for additional subsurface deposits to be present. Furthermore, past disturbance in the area, including track formation and use as well as dam construction, has resulted in significant disturbance of the area. Consequently, there is no PAD associated with BFC70.

The Aboriginal stakeholder participants in the survey assessed the site to have low cultural significance.

BFC71 Isolated Find

BFC71 was situated within a modified lower slope area on a dam wall in Assessment Area B. It was located within Transect 4 but not in a proposed tower location. Vegetation at the site consisted predominantly of grasses and weeds. Previous land use includes vegetation clearance and cattle grazing. Casuarina regrowth was also noted at the site. The closest water source is Big Flat Creek and its tributaries, located further to the south and south-east of the site.

The artefact was visible within an exposure of 1 metre square, with 40 per cent visibility. Soil in the site area consisted of a light brown sandy loam, with the artefact consisting of a single large mudstone flake. BFC 71 is located within a landform considered unlikely to be associated with extensive subsurface deposits. Furthermore, the area has been significantly disturbed as a result of past vegetation clearance and cattle grazing. BFC71 is therefore not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC72 Artefact Scatter

The BFC72 artefact scatter was located on the north-west bank of Big Flat Creek, within the ACHOA and Assessment Area B (**Plate 4**). The gradient in the area of the site was very gentle to gentle (1 to 2 degrees) and aspect was to the south-east. It was located within Transect 5 but is not in proposed tower location. Vegetation in the area consisted of casuarina, river red gum, grey box, Kangaroo grass and acacia. The creek line had no water at the time of recording.

The site incorporates three areas of exposure, classified as Locus 1, Locus 2 and Locus 3. The areas of exposure were caused by sheet wash erosion, with Locus 2 also impacted by an ants nest. The largest area of exposure (Locus 1) contained some patches of A₂ soil profile, while Locus 2 had been eroded to the A₂ horizon. The Locus 2 exposure extended across a total area of 3 metres by 2 metres with its associated artefacts contained within a section measuring 0.5 metre by 0.05 metre. Visibility within the Locus 2 exposure was 50 per cent, while that within Locus 1 was 75 per cent. Locus 3 consisted of a 1 metre by 1 metre area containing a single artefact, while visibility across the surrounding landform ranged between 2 per cent and 5 per cent. The total site size incorporating all three loci comprised an area of 70 metres by 5 metres.

A total of 31 artefacts were recorded within the site, with 1 identified in Locus 3, in Locus 2 and 28 within the larger sheet wash erosion area of Locus 1. The total assemblage consisted of retouched flakes (2), flakes, broken flakes and cores with raw materials including silcrete, quartz and mudstone. The retouched flakes (both of mudstone) exhibited cortex and were heat affected. Locus 2 featured mudstone flakes that were noted to be eroding out of the creek bank.

Sheet wash erosion has occurred across the site area, resulting in the removal of the majority of the upper soil unit. Some sections of the site retain less than 3 centimetres of A₂, with the B horizon exposed across the majority of the area. The eroded nature of the site and its proximity to Big Flat Creek suggests that at times of heavy rain or when the creek has flowed over its banks any artefacts that may have been present would have been washed into the creek channel. Whilst additional subsurface deposits may be associated with the site, the limited amount of upper soil unit remaining and the nature of the visible deposits indicate that any such deposits are unlikely to be extensive. Furthermore, due to the

disturbance outlined above there is only a very low likelihood for spatial integrity. Therefore there is no PAD recorded in association with BFC72.

The Aboriginal stakeholder participants in the survey assessed that the site had moderate cultural significance as it contained a number of artefacts situated within a landscape of connected sites (i.e. other sites located along Big Flat Creek).

BFC73 Isolated Find

The BFC73 isolated find was located within a very gently inclined lower slope with a gradient of 1 degree south towards Wallaby Rocks. It was identified within Transect 5 but is not in a proposed tower location. The aspect of the site was 180 degrees with Big Flat Creek located 100 metres distant. Vegetation in the surrounding area was a mix of native grasses, red gum, box and casuarina. Visibility across the surrounding landform was estimated at 15 per cent.

The isolated find consisted of a mudstone broken flake located within a 300 metre square exposure. It was noted that there was some potential for low density artefacts to be present in a subsurface context in the surrounding landscape. Overall the site was assessed as being in fair condition with limited disturbance caused by an ants' nest and minor sheetwash erosion.

The depth of remnant A₂ could not be determined, but erosion was of an extent to conclude there to be little potential for stratigraphic integrity at the site, although the gentle gradient and remaining intact soil profile meant that spatial integrity was a possibility.

The site is within a landform considered unlikely to contain high densities of artefacts and has further been affected by erosion of at least part of the upper soil units. For these reasons, the site and associated areas do not meet the criteria for PAD.

The Aboriginal stakeholder participants in the survey assessed the site had low cultural significance.

SC60 Artefact Scatter

The SC60 artefact scatter site was located within Assessment Area A on a gently inclined slope between two minor tributaries of Sandy Creek in the northern section of Transect 22. The site is present as two loci within a vehicle track exposure, with the loci separated by a small area of non-exposed ground surface. The total of exposed area containing the loci is 420 m² (Locus 1 being an area of 100 metres by 3 metres and Locus 2 being an area of 20 metres by 6 metres). It is, however, possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. These factors have resulted in significant disturbance of the site, which is consequently in poor condition.

The loci each contained a single artefact, with a mudstone flake at Locus 1 and a silcrete broken flake at locus 2. Soils visible within both loci (and in adjoining areas with lower levels of visibility) consist of a grey-brown clay loam (A₂ soil horizon) which included large quantities of decayed regolith material. Based on the presence of regolith material, it is likely that there is limited A horizon soil across this site and in the surrounding areas.

As mentioned above, it is possible that additional artefacts may be present outside the loci that comprise SC60. However, despite high levels of visibility and exposure at the site, the total density of surface artefacts was less than 0.005 artefacts per square metre. This is not unexpected given the nature of the landform (slope associated with ephemeral drainage lines) and the limited depth of remnant soils. Based on these factors and the low density of surface artefacts, it is considered highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC60.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC61 Artefact Scatter

The SC61 artefact scatter site was located within Assessment Area A on a relatively level spur extending south-east in the middle section of Transect 22. The site is present as three loci within a vehicle track exposure, with the loci dispersed across an area of continuous but patchy exposure with excellent visibility. The total of exposed area containing the three loci is 285 m² (being a total area of 95 metres by 3 metres). It is however possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. The site is in poor condition as a result of these disturbance factors.

Locus 1 contained a single mudstone flake, Locus 2 contained a volcanic ground-edge axe with evidence of flaking on one margin and Locus 3 contained two silcrete broken flakes, two silcrete flaked pieces and one silcrete flake. Soils visible within the loci (and in adjoining areas with lower levels of visibility) were consistent with those in SC60 and regolith material was also present. Consequently, it is likely that there is limited A horizon soil across this site and in the surrounding areas.

As with SC60, whilst it is possible that additional artefacts may be present outside the loci that comprise SC61, the same factors are relevant in considering the likely density and numbers of artefacts in any such deposit. The total density of surface artefacts in SC61 was less than 0.03 artefacts per square metre. This is not unexpected given the nature of the landform (spur) and the limited depth of remnant soils. It is considered highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC61.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC62 Artefact Scatter

The SC62 artefact scatter site was located on slope within the southern section of Transect 22 within Assessment Area A. The site is present within an area of continuous exposure associated with a vehicle track. The exposure extends for approximately 30 metres by 3 metres and visibility within the exposure is excellent. It is possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. The site is in poor condition as a result of these disturbance factors.

Artefacts within the site consisted of two mudstone broken flakes. Soils visible within the exposure (and in adjoining areas with lower levels of visibility) were consistent with those in SC60 and SC61 and it is similarly likely that there is limited A horizon soil across this site and in the surrounding areas.

As with SC60 and SC61, whilst it is possible that additional artefacts may be present outside the exposure containing SC62, the total density of surface artefacts in SC62 is low (0.02 artefacts per square metre), the landform context (slope associated with an ephemeral drainage lines) and the limited depth of remnant soils dictate that it is highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC62.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC63 Isolated Find

SC63 is a single mudstone broken flake located on a gently inclined slope in the northern section of Transect 23 within Assessment Area A. The site is present within an area of continuous exposure measuring 50 metres by 3 metres associated with a vehicle track. Visibility within the exposure is excellent but only one artefact was identified. It is possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey. Soils visible within the exposure (and in adjoining areas with lower levels of visibility) were consistent with those in SC60 to 62. It is similarly likely that there is limited A horizon soil across this site and in the surrounding areas.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. The site is in poor condition as a result of these disturbance factors.

As with SC60 to SC62, whilst it is possible that additional artefacts may be present outside the exposure containing SC63, the total density of surface artefacts in SC63 is low at less

than 0.007 artefacts per square metre. Furthermore, the landform context (a slope not associated with a reliable water source) and the limited depth of remnant soils dictate that it is highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. The level of disturbance at the site precludes the possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC63.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC64 Artefact Scatter

The SC64 artefact scatter site was located within Assessment Area A on a gently inclined lower slope leading to a first order tributary of Sandy Creek in the middle section of Transect 24. The site is present on a vehicle track exposure within an area of continuous exposure measuring approximately 130 metres by 2 metres. Visibility within the exposure was good and was notably better than the surrounding area. It is possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey. Soils visible within the site (and in adjoining areas with lower levels of visibility) consist of a grey-brown clay loam (A₂ soil horizon) which included large quantities of decayed regolith material. Based on the presence of regolith material, it is likely that there is limited A horizon soil across this site and in the surrounding areas.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. These factors have resulted in significant disturbance of the site, which is consequently in poor condition.

The site contained a total of 25 artefacts (12 mudstone broken flakes, 6 mudstone flakes (1 of banded mudstone), 3 mudstone heat shatter, 1 mudstone flaked piece, 1 mudstone retouched flake, 1 silcrete core, 1 mudstone core) clustered within an area of approximately 5 metres by 5 metres. The majority of mudstone artefacts were dark red in colour with a small proportion of cortex on their dorsal surface, although a core and flake of distinctive banded mudstone were also present. It is possible that the relatively high number of artefacts (when compared to the other sites within this transect) is a reflection of breakage of a smaller number of artefacts, thus inflating artefact numbers.

As mentioned above, it is possible that additional artefacts may be present outside of the area of exposure associated with SC64. As noted above, the artefacts are clustered within a small area within a much larger exposure that does not contain any additional artefacts. When artefact density is calculated for the entire exposure, it is low at less than 0.1 artefacts per square metre. Furthermore, the high level of breakage of artefacts of similar raw material at this site may indicate that artefact numbers are being artificially inflated by breakage. Finally, SC64 is within a landform context (slope associated with an ephemeral drainage line) that is not associated with extensive sites and the majority of the A horizon within the site and surrounding area is no longer extant. Based on these factors, it is considered highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC64.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC65 Artefact Scatter

The SC65 artefact scatter site was located within Assessment Area A on a gently inclined slope between two first order tributaries of Sandy Creek in the southern section of Transect 24. The site is present as two loci within a vehicle track exposure, with the loci dispersed across an area of continuous but patchy exposure with excellent visibility. The total of exposed area containing the two loci is 300 m² (being a total area of 100 metres by 3 metres). It is, however, possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts (primarily slaty box), native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. The site is in poor condition as a result of these disturbance factors.

Locus 1 contained a single volcanic flake with a ground dorsal surface whilst Locus 2 contained a mudstone retouched flake that exhibits evidence of tranchet retouch. Soils visible within the loci (and in adjoining areas with lower levels of visibility) were consistent with those in SC60 to 64 and regolith material was also present. Consequently, it is likely that there is limited A horizon soil across this site and in the surrounding areas.

As with SC60 to 64, whilst it is possible that additional artefacts may be present outside the loci that comprise SC61, total density of surface artefacts in SC65 was less than 0.007 artefacts per square metre. This is not unexpected given the nature of the landform and the limited depth of remnant soils. It is considered highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. Furthermore, as a result of disturbance to the site, there was no possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC65.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

SC66 Isolated Find

SC66 is a piece of mudstone that has been broken by heat but upon which several negative flake scars are detectable. The artefact was present within an area of continuous vehicle track exposure measuring 50 metres by 2 metres and located on a gentle lower slope in the southern section of Transect 24 within Assessment Area A. Visibility within the exposure is excellent but only one artefact was identified. It is possible that the site may extend into adjoining non-exposed areas where the lack of exposure and visibility dictates that any artefacts that may be present in these areas could not be detected during the survey. Soils visible within the exposure (and in adjoining areas with lower levels of visibility) were consistent with those in SC60 to 65. It is similarly likely that there is limited A horizon soil across this site and in the surrounding areas.

The site area and adjoining landform have been largely cleared of mature trees and vegetation consists of regrowth eucalypts, native grasses and weeds. Vegetation clearance has caused disturbance of the area, however the majority of disturbance associated with the site has occurred as a result of the construction, maintenance and use of the existing vehicle access track. The access track has been subject to significant sheetwash erosion, which has also increased the level of exposure. The site is in poor condition as a result of these disturbance factors.

As with other sites located within the designated access tracks, whilst it is possible that additional artefacts may be present outside the exposure containing SC66, the total density of surface artefacts in SC66 is low at 0.01 artefacts per square metre. Furthermore, the landform context (a slope not associated with reliable water source) and the limited depth of remnant soils dictate that it is highly unlikely that any subsurface deposits that may be associated with the site would contain high numbers or densities of artefacts. The level of disturbance at the site precludes the possibility for spatial or stratigraphic integrity within any subsurface deposits (if present). For these reasons, there is no PAD associated with SC66.

The Aboriginal stakeholder participants in the survey did not provide specific comment regarding the cultural significance of this site.

7.4 Potential Archaeological Deposit

Archaeological survey alone does not adequately investigate the potential occurrence of archaeological materials within an area, as surface artefacts can be obscured by vegetation cover and many may remain in subsurface context. This is particularly relevant given the low levels of effective coverage in some parts of the assessment areas. An evaluation of whether an area constitutes a PAD (in accordance with the definition provided in **Section 6.4**) is therefore necessary.

The assessment of whether any of the recorded sites contain areas of PAD has been addressed as part of the site descriptions and no areas of PAD were identified in association with the recorded sites. In terms of the portions of the assessment areas outside the recorded sites, the landforms within Assessment Area A did not generally provide access to reliable water sources, with the majority of drainage lines in this area being ephemeral at best. The exception to this is Sandy Creek. However as discussed in **Section 5.1.2**, this watercourse is likely to have undergone significant migrations over time and therefore may not have been present in its current location in prehistory.

Similarly, with the exception of Big Flat Creek, Assessment Area B is not associated with any watercourses of note. Within Assessment Area B it is apparent that Big Flat Creek has been subject to numerous flood events that have affected creek line morphology. Furthermore, despite good exposure and visibility on both banks of Big Flat Creek, the sites identified in this area consisted of a low density artefact scatter and an isolated find. For this reason, the section of Big Flat Creek within Assessment Area B is considered unlikely to contain archaeological deposits containing large numbers or densities of artefacts.

Furthermore, any archaeological material associated with watercourses within the assessment areas is likely to have been impacted by geomorphic processes including channel migration, erosion (both sheetwash and gully) and deposition and erosion during flood events. It is highly unlikely that archaeological material is preserved *in situ* along the bank or former bank margins given the amount of bank erosion that was observed along the watercourses during the pedestrian survey. The level of historical land use in relation to the construction and maintenance of water infrastructure (such as drainage channels and dams) is also likely to have resulted in significant disturbance of any archaeological deposits located along affected watercourses.

The remainder of both Assessment Area A and Assessment Area B is comprised of landforms predicted to have a low likelihood of containing subsurface deposits that are extensive in either artefact numbers or areal extent. These landforms have also been subject to significant disturbance as a result of historical land use.

For the reasons outlined above, no areas of PAD were identified within the assessment areas.

8.0 Survey – Habitat Enhancement Area

The Habitat Enhancement Area was surveyed and assessed for its potential use to offset impacts to Aboriginal cultural heritage associated with activities proposed by Mangoola Coal, and to understand any constraints presented to managing the land for ecological conservation purposes including ground disturbance for the purpose of tree planting and improved land management. This section describes the results of the survey of the Habitat Enhancement Area, as shown in **Figure 8.1**.

8.1 Survey Strategy and Methodology

The survey of the Habitat Enhancement Area was conducted on foot over a two day period (3 and 10 September 2009) by two Umwelt archaeologists and up to seven Aboriginal stakeholder representatives. **Table 8.1** lists the Aboriginal stakeholder representatives who participated in the survey.

Table 8.1 - Aboriginal Stakeholders Participating in the Survey

Survey Date	Group	Representative
03/09/09	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 Matt Wells
10/09/09	Gidawaa Walang Cultural Heritage Consultancy Aboriginal Native Title Consultants Muswellbrook Cultural Consultants Wonn 1 Consulting Culturally Aware Upper Hunter Wonnarua Council Incorporated	Annie Hickey Margaret Matthews John Matthews (volunteer) Arthur Fletcher Paulette Ryan Matt Wells

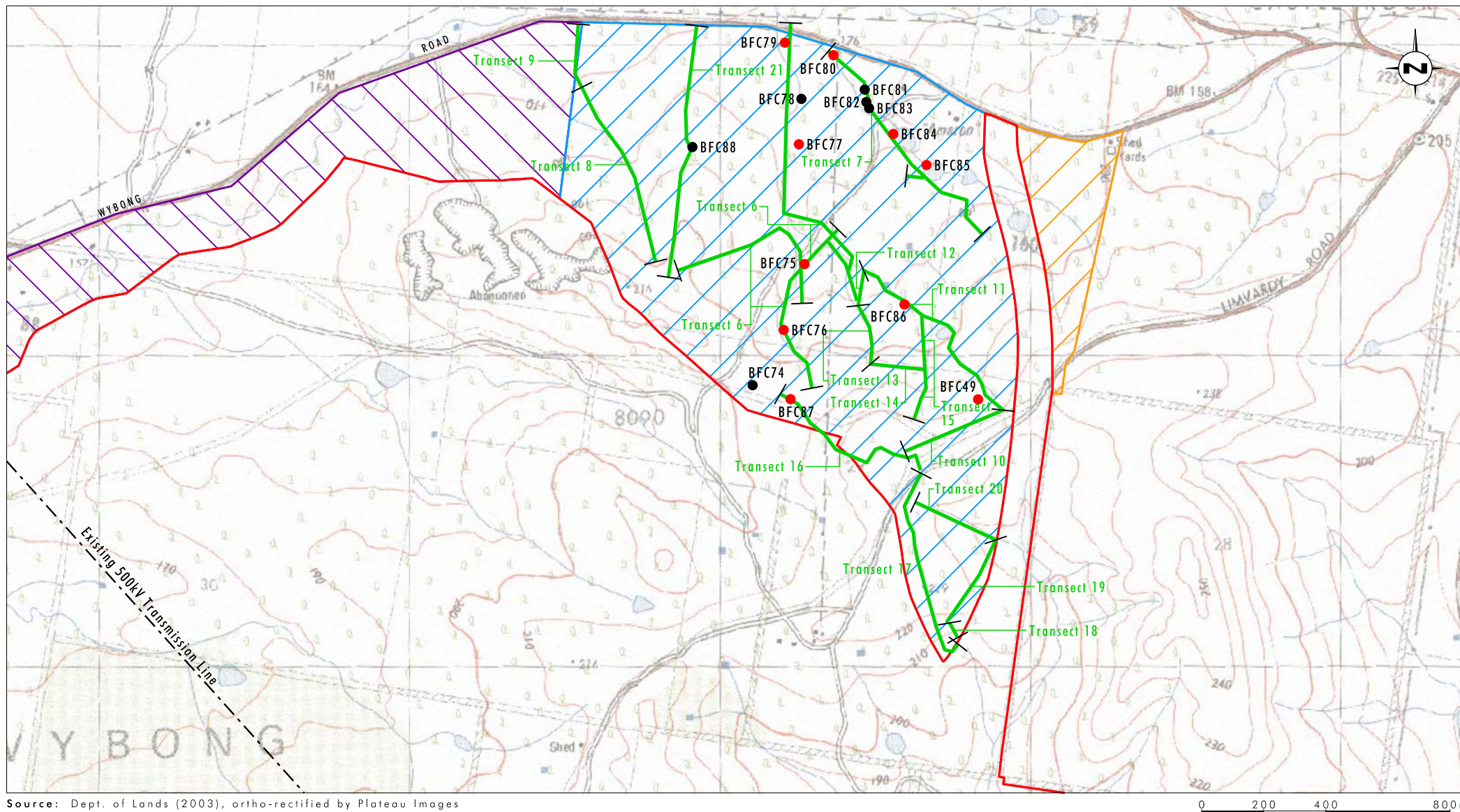
The purpose of the survey of the Habitat Enhancement Area as outlined in the methodology was:

to assess areas proposed by Xstrata Mangoola as possible options for an offset for any loss of cultural values arising from the realignment of the existing 500 kV transmission line and modifications to the approved mine boundary (Section 7.1).

The aims and objectives of the archaeological survey of the Habitat Enhancement Area are in accordance with those described in **Section 7.1**, as was the survey methodology.

8.2 Survey Coverage

The Habitat Enhancement Area was surveyed as a series of 16 transects, as shown in **Figure 8.1**. All survey transects were approximately 60 metres in width, with the exception of Transect 16, which followed a vehicle track exposure of 3 metres in width. A description of each of the survey transects is provided in Table 8 of the Technical Data Attachment.



Source: Dept. of Lands (2003), ortho-rectified by Plateau Images

Legend

- Approved Project Disturbance Boundary
- ▨ Approved Aboriginal Cultural Heritage Offset Areas
- ▨ Habitat Enhancement Area
- ▨ Surveyed Habitat Enhancement Area
- Transect
- Isolated Find

● Artefact Scatter

FIGURE 8.1

Location of Survey Transects and
Recorded Sites in Habitat Enhancement Area

Survey transects sampled all landforms within the Habitat Enhancement Area including slopes, spurs and drainage lines. The drainage lines consisted of minor tributaries of Big Flat Creek and comprised a relatively high proportion of the area. Levels of exposure and visibility were highest along the drainage lines as a result of ongoing sheetwash and gully erosion. Soils within the Habitat Enhancement Area generally consist of light grey or light yellow-grey brown sandy loam overlying decomposed bedrock material. Disturbance levels with all transects were relatively high, primarily as a result of agricultural activities including construction of dams and contours on drainage lines, vegetation clearance, dumping of rubbish and use of the area for grazing purposes. The drainage lines had also been heavily impacted by significant sheetwash and gully erosion, resulting in the removal of upper soil units. Several residences were also present in the area, as was an existing powerline easement.

The level of ground surface visibility, exposure and effective coverage within each of the landform units within the survey transects is provided in **Table 8.2**.

Table 8.2 - Effective Coverage

Transect	Landform Element	Area of Landform Element in transect (m ²)	General Visibility (%)	Areas of Exposure Area (m ²)	Effective Coverage (m ²)	Effective Coverage (%)
6	Slope	22506	10	0	0	0.0
	Drainage Line	113220	10	16385	10752	9.5
7	Drainage Line	54060	1	6660	4419	8.2
8	Drainage Line	37740	2	10440	7203	19.1
9	Slope	13794	5	800	560	4.1
10	Slope	21780	1	1	0.7	0.0
11	Drainage Line	41820	1	3606	2312.3	5.5
12	Slope	8712	1	300	120	1.4
13	Drainage Line	12240	1	475	220	1.8
14	Slope	11616	1	400	120	1.0
15	Drainage Line	16320	1	961	468.7	2.9
16	Slope	726	70	726	508.2	70.0
	Crest	544.5	70	544.5	381.15	70.0
17	Slope	23232	1	1001	665.9	2.9
	Crest	15972	1	150	60	0.4
18	Drainage Line	5100	1	30	12	0.2
19	Slope	9438	1	350	280	3.0
	Crest	7260	1	0	0	0.0
20	Drainage Line	22440	1	825	277.5	1.2
21	Slope	21780	1	400	220	1.0
	Crest	28314	1	4260	3358	11.9
Totals		313632		48314.5	31938.5	15.4

Effective coverage within the Habitat Enhancement Area was relatively high at 15.4 per cent. It is noted that this does not take into account general ground surface visibility (that is, in areas outside recorded exposures) and therefore is actually an underestimation of the potential to detect artefacts within the surveyed area.

When effective coverage is calculated on the basis of landform areas, it is highest within the drainage line landform (8.5 per cent), followed by crests (7.3 per cent) and slopes (1.9 per cent). This is a direct reflection of the high level of erosion (primarily gully and sheetwash) associated with the minor drainage lines present within the Habitat Enhancement Area. There was also notably higher than average levels of erosion exposure within the crest landform.

8.3 Recorded Archaeological Sites (Habitat Enhancement Area)

A total of 15 new Aboriginal archaeological sites were recorded within the Habitat Enhancement Area during the survey. BFC49 (previously recorded site) could not be located. **Table 8.3** 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 below. The location of all recorded sites is illustrated on **Figure 8.1**. AHIMS site cards for all sites will be submitted to DECCW in accordance with Section 91 of the NPW Act and were provided to the relevant Aboriginal stakeholders for their records. In accordance with previous requests from Aboriginal stakeholder representatives, coordinates for each site are not provided as part of the main text but are included in Table 9 in the Technical Data Attachment.

BFC 49 Isolated Find

A previously recorded site was recorded by Umwelt (2006a) within the Habitat Enhancement Area (BFC49). This site consists of four artefacts (2 flakes, one core and one broken flake) of which 3 are composed of silcrete and one of mudstone. The artefacts were identified within an area of approximately 60 metres by 20 metres and had been exposed as a result of cattle trampling. BFC49 was recorded as being associated with a crest approximately 5 metres from a tributary of Big Flat Creek. The site and surrounding landform were assessed as having low archaeological potential and stratigraphic integrity due to considerable natural erosion in the form of gully wash and sheet erosion. It was also noted that the exposure had undergone considerable surface disturbance from cattle treadage (Umwelt 2006a).

Significant vegetation regrowth had occurred in the vicinity of BFC49, thus impeding visibility and preventing recording of the site during the current survey.

BFC74 Isolated Find

The BFC74 isolated find was located on a midslope within the Habitat Enhancement Area but was identified in association with the survey of a proposed modification area (Umwelt in prep 2009b), hence it is not located on one of the current survey transects. The gradient of the site itself was a gently inclined 2 degrees and aspect was to the south-west. Vegetation in the area of the site consisted of casuarina, grey gum, lomandra, fireweed, kangaroo grass and grass trees. The nearest water source was Big Flat Creek and its tributaries located to the north of the site (refer to **Figure 8.1**).

The single artefact was contained within a 1 metre x 80 centimetre exposure. This exposure had been affected by sheetwash and was assessed as having 95 per cent visibility, in contrast to the 1 per cent visibility recorded in the surrounding landform.

This isolated find consisted of a silcrete core.

Past disturbance and ongoing land use in the site area includes vehicle movement, with the isolated find located on a vehicle track. Soils at the site consist of a light brown to cream coloured sandy loam. Sheetwash erosion has removed much of the upper soil units resulting in a low potential for subsurface artefactual material, either within the exposure or in the

surrounding area. There is no potential for spatial or stratigraphic integrity due to prior disturbance. The site is therefore not associated with PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC75

The BFC75 artefact scatter site was located within a drainage line in a modified area incorporating a dam wall and associated contour bank in Transect 6 (**Plate 5**). The gradient in the area of the site was gentle (2°) and aspect was to the north, north-east. Vegetation in the area of the site consisted of grey gum, box, fireweed, mistletoe, amulla (a known Aboriginal food plant) and a mixture of native and introduced grasses. Site BFC75 is approximately 80 metres west of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 600 metres to the north of the site.

The artefacts were visible eroding out of the dam wall and the contour bank. Two areas of exposure were identified which contained artefacts (a 5 metre by 5 metre area on the dam wall and a 3 metre by 1 metre area on the contour bank). There was evidence of sheetwash and gully erosion within the site area. Visibility within the site area was 90 per cent and was generally 10 per cent within the surrounding landform.

A total of 11 artefacts were recorded on the dam wall and associated contour bank with a maximum artefact density of two per metre square. These consisted of flakes, broken flakes, flaked pieces and one backed artefact (**Plate 6**). The artefacts were predominantly produced using silcrete and mudstone with all mudstone artefacts exhibiting signs of being heat affected. The backed artefact was produced using a dark banded petrified wood.

Soils in the area consist of a thin layer of fine light grey sandy loam (A₂) overlying a decayed, shaley substrate.

Past disturbance to the area includes tree clearance, agricultural use, dam and contour bank construction, all of which have acted to initiate and enhance erosion of the soil profile. It is likely that this level of disturbance would have caused the loss of artefacts down the drainage line as part of the erosion process during periods of heavy rain. This is supported by the skeletal nature of the A₂ soils within the site. It is therefore considered highly unlikely that the site may retain subsurface deposits that are extensive in terms of artefact number or areal extent.

In addition, it is unlikely that any artefacts that remain in a subsurface context within the site area would retain any spatial or stratigraphic integrity due to the earthworks associated with the construction of the dam and contour bank and the above mentioned disturbances. Therefore it is determined that there is no PAD associated with BFC75. Due to the extensive disturbance in the surrounding landform it is also considered that although there might be small numbers of artefacts in a subsurface context it is unlikely that they would retain any spatial or stratigraphic integrity. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density. For these reasons, there is no PAD identified in association with the site or the surrounding landform.

The Aboriginal stakeholder participants in the survey assessed the site as having low to moderate cultural significance.



PLATE 5
BFC75 site on bank of dam



PLATE 6
BFC75 artefacts

BFC76 Artefact Scatter

The artefact scatter site BFC76 is located on the south-east side of a drainage line next to a dam in Transect 6. The landform of the surrounding area consists of midslopes with a gently inclined 2 to 3 degree gradient and a northern aspect. The area itself has been modified through clearance and dam construction and vegetation in the area now comprises mostly grasses with some acacia and red gum. The closest water source consists of tributaries from Big Flat Creek located to the north of the site (refer to **Figure 8.1**).

The site consists of two loci, both areas of exposure measuring 1 metre square containing a single artefact. Locus 1 contains a mudstone broken flake that has been heat affected, while Locus 2 contains a mudstone broken flake. In both cases visibility within the exposure area was 95 per cent while the surrounding landform was estimated to have a 2 per cent visibility rating.

In addition to clearance and dam construction impacting upon the site, ongoing sheetwash and water runoff through the drainage line has resulted in the removal of much of the upper soil units and has left the site in very poor condition. The potential for further subsurface material was deemed to be low while there was considered no possibility for spatial or stratigraphic integrity at the site. Consequently, there are no areas of PAD associated with BFC76.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC77

The BFC77 artefact scatter site was located on the eastern side of a drainage line in Transect 6. The gradient in the area of the site was gentle (1°) and aspect was to the west. Vegetation in the area of the site consisted of *Eucalyptus* spp. and native and introduced grasses. Site BFC77 is approximately 15 metres east of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 450 metres to the north of the site.

The artefacts were distributed over an area of approximately 1 metre by 1 metre. There was evidence of sheetwash erosion within the site and surrounding landform. Visibility within the site area was 60 per cent and was generally 10 per cent within the surrounding landform. Soils in the area consist of a very thin fine light grey sandy loam (A₂) overlying a decayed shaley substrata.

A total of two artefacts were recorded with a maximum artefact density of 2 per metre square. These consisted of one mudstone flake and one mudstone broken flake.

Past disturbance to the area includes tree clearance, agricultural use, and sheetwash erosion which have acted to initiate and enhance erosion of the soil profile. The level of erosion is such that it has reduced the potential for subsurface deposits to be present. Furthermore, in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density. The site has also been subject to rubbish dumping and extensive disturbance and it is considered that although there might be small numbers of artefacts in a subsurface context it is unlikely that they would retain any spatial or stratigraphic integrity. For these reasons, the site (exposure) and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC78

The BFC78 isolated find site was located on the eastern side of a drainage line in Transect 6. The gradient in the area of the site was gentle (1°) and aspect was to the north-west. Vegetation in the area of the site consisted of *Eucalyptus* spp. and native and introduced grasses. Site BFC78 is on the east bank of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 300 metres to the north of the site.

The site consisted of a silcrete flake situated in an area of exposure measuring approximately 1 metre square surrounding an ants' nest. The site and surrounding landform have been affected by sheetwash erosion, however, visibility within the site area was 60 per cent and was generally 10 per cent in the surrounding landform.

Soils in the area consist of a very fine light grey sandy loam (A₂) overlying a decayed shaley substrata. The A₂ soil horizon was relatively thin. This is to be expected given that past disturbance to the area includes tree clearance, agricultural use and sheetwash erosion which have acted to initiate and enhance erosion of the soil profile. The site has also been subjected to rubbish dumping. These disturbances would have significantly impacted on the surface as well as upper soil layers, with an associated loss of the upper soil unit and a subsequent reduction in the likelihood that subsurface deposits may remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

Finally, the extensive disturbance in the site and surrounding landform dictates that although there might be small numbers of artefacts in a subsurface context it is unlikely that they would retain any spatial or stratigraphic integrity.

The site (exposure) and surrounding landform are therefore assessed as not being associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC79

The BFC79 artefact scatter site was located within a drainage line in a modified area on the northern dam wall on the southern side of Wybong Road in Transect 6 (**Plate 7**). The gradient in the area of the site was gentle (1°) and aspect was to the north. Vegetation in the area of the site consisted of introduced weed species. Site BFC79 is approximately 25 metres east of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 87 metres to the north of the site.

The artefacts were visible on the bank of a dam. One area of exposure was identified which contained artefacts (a 3 metre by 2 metre area on the dam wall). There was evidence of sheetwash and gully erosion within the site area. Visibility within the site area was 80 per cent and was generally 10 per cent within the surrounding landform.

A total of three artefacts were recorded on the dam wall with a maximum artefact density of 1 per metre square. These consisted of two mudstone flakes and one mudstone core. The artefacts did not appear to represent one knapping event as the raw material did not have the same hand specimen characteristics.

Soils in the area consist of a very fine light grey sandy loam (A₂) overlying a decayed shaley substrata and here been significantly disturbed as a result of dam construction.



PLATE 7
BFC79 site on bank of dam



PLATE 8
BFC85 site on bank of dam

Past disturbance to the area includes tree clearance, Wybong Road construction, agricultural use, dam construction, establishment and maintenance of residential establishments and sheetwash and gully erosion which have acted to initiate and enhance erosion of the soil profile. The site has also been subject to rubbish dumping. These disturbances would have significantly impacted on the surface as well as upper soil layers with an associated loss of the upper soil unit and a subsequent reduction in the likelihood that subsurface deposits may remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

The site and surrounding landform has been subject to significant disturbance and it is considered that although there might be small numbers of artefacts in a subsurface context it is unlikely that they would retain any spatial or stratigraphic integrity. For these reasons, the site is not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC80 Artefact Scatter

The artefact scatter site BFC80 was located next to a drainage line within a lower slope landform with a very gently inclined gradient of 1 degree and aspect to the north-west. It was identified in Transect 6. Clearance and nearby road construction (Wybong Road) have impacted upon the area. Weeds and grasses are the dominant vegetation. The nearest water source is a tributary of Big Flat Creek located to the north of the site (refer to **Figure 8.1**).

The site is located within a 5 metre square area of exposure that has been subject to sheet wash erosion leaving the site in a poor condition and resulting in the removal of much of the upper soil unit. A total of five artefacts were recorded, manufactured from mudstone and silcrete. The artefact types included flakes and cores with the highest density being one artefact per square metre.

Due to the level of erosion and ongoing disturbance within the site, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

Finally, due to the impacts of ongoing drainage, erosion and possible impacts from the Wybong Road construction, there is no potential for spatial or stratigraphic integrity at the site or within the surrounding landform. The site (exposure) and surrounding landform are therefore not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC81

The BFC81 isolated find site was located on a contour bank in Transect 7 within the Habitat Enhancement Area. The gradient in the area of the site was gentle (1°) and aspect was to the north-east. Much of the vegetation had been cleared, with weeds, pasture grass and native grasses dominant. Site BFC81 is approximately 30 metres east of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 270 metres to the north of the site.

The site consists of an exposure of approximately 1 metre square located on a contour bank. There was evidence of sheetwash erosion within the site and surrounding landform. Visibility within the site area was 80 per cent and was generally 1 per cent within the surrounding landform. The mudstone heat affected flake was recorded on a contour bank, thus it was in a secondary context.

Soils in the area consist of a thin layer of light grey-brown fine sandy loam overlying a decayed shaley substrata. The creation of the contour bank has exposed soils to ongoing erosion, resulting in the removal of much of the upper soil unit. Consequently, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

Past disturbance to the area includes tree clearance, agricultural use, rubbish dumping, contour bank construction, associated access track creation and use and sheetwash erosion.

Due to the disturbance in the site and surrounding landform it is considered that although there might be small numbers of artefacts in a subsurface context it is unlikely that they would retain any spatial or stratigraphic integrity.

For these reasons, the site (exposure) and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site as having low cultural significance.

BFC82 Isolated Find

The BFC82 isolated find was located within a disturbed area that has been impacted by past clearance and scraping. It was identified in Transect 7. The gradient of the site was very gently inclined 1 degree with an aspect to the north-west. Vegetation across the site was dominated by grasses and weeds. The closest water sources to the site were the tributaries of Big Flat Creek located to the west and north (refer to **Figure 8.1**).

The artefact was within an exposure of approximately 1 metre by 1 metre that exhibited a visibility of 85 per cent. The surrounding landform was assessed to have a visibility of only 2 per cent due to cover from grasses and weeds. The isolated find consists of a mudstone broken flake.

The area has been scraped (for a reason that is not clear), resulting in the removal of almost all of the upper soil unit and significant disturbance of the limited deposits that remain. Consequently, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density. Furthermore, due to the level of disturbance, there is no potential for stratigraphic or spatial integrity is highly unlikely. For these reasons, the site and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC83 Isolated Find

The BFC83 isolated find was located on a lower slope. The gradient was a very gentle 1 degree with an aspect to the north-west. The isolated find was identified in Transect 14. Vegetation predominantly consisted of grasses and weeds across the area. The nearest

water source consisted of Big Flat Creek and its tributaries located to the north of the site (refer to **Figure 8.1**).

The isolated find was situated in an area of exposure assessed to have 5 per cent visibility, with the surrounding landform's visibility ranging from between zero and 1 per cent. The isolated find consisted of a mudstone flake with cortex.

Due to the level of erosion and ongoing disturbance within the site, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density. The site has been significantly disturbed by vegetation clearance and is in very poor condition. Consequently, the site and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC84 Artefact Scatter

The BFC84 artefact scatter was located on a dam wall on a lower slope. It was identified in Transect 7. The nearest water sources were tributaries of Big Flat Creek located to the north (refer to **Figure 8.1**). Vegetation within the site was limited due to the location on a dam wall, with two individual *Eucalyptus* spp. within the area and grasses predominating outside the site boundaries.

The artefacts were visible within a highly disturbed dam bank. The area of exposure created by dam construction measured 35 metres by 2 metres. The site is in very poor condition. Visibility within the exposure was determined to be 65 per cent while that of the surrounding landform was between 1 per cent and 3 per cent.

A total of five artefacts were identified within the exposure, all mudstone flakes. The highest density per square metre was one artefact. All artefacts were in a secondary context.

The creation of the dam wall has exposed soils to ongoing erosion, resulting in the removal of much of the upper soil unit. Consequently, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

Past disturbance to the area includes clearance and modification of the land in the dam building process, with the highly modified nature of the area suggesting that little archaeological potential or spatial integrity can be expected. For these reasons, the site and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC85 Artefact Scatter

The BFC85 artefact scatter site was located on a dam wall (**Plate 8**) in Transect 7. The nearest water sources were tributaries of Big Flat Creek located to the north (refer to **Figure 8.1**). Vegetation within the site was limited due to the location on a dam wall, with weeds and grasses predominating outside the site boundaries.

The artefacts were visible within a disturbed area built up to act as a dam wall. Two areas of exposure within the area created by dam building were recorded, the first measured 2 metres

by 1 metre and the second being 1 metre square. The site area was determined by artefact distribution within the exposures and the overall site was assessed to be in a very poor condition, being situated on modified land. Visibility within the exposure was determined to be 15 per cent while that of the surrounding landform was classified as zero.

A total of three artefacts were identified within the site, all mudstone flakes. The highest density per square metre was one artefact, with two artefacts in exposure one and a single artefact in the second.

The creation of the dam wall has exposed soils to ongoing erosion, resulting in the removal of much of the upper soil unit. Consequently, it is considered unlikely that substantial subsurface deposits will remain. Also in consideration of the low complexity and low density of the surface artefact assemblage it is thought that the subsurface assemblage would reflect this with a similar low complexity and density.

Past disturbance to the area includes clearance and modification of the land in the dam building process. Old power poles were also noted in proximity to the site, demonstrating further disturbance in the area. As a result, there is very limited potential for any subsurface deposits that may be present to retain stratigraphic or spatial integrity.

For the reasons outlined above, the site and surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC86 Artefact Scatter

The BFC86 artefact scatter was located on a gently inclined landform with a 2 degree gradient and west-north-west aspect. It was identified during Survey Transect 18 within the Habitat Enhancement Area. Vegetation in the area was a mix of grasses with narrow leaved ironbark trees and box thorn also recorded. Site BFC86 is approximately 30 metres east of a first order stream that flows into Big Flat Creek. Big Flat Creek is approximately 270 metres to the north of the site.

The scatter consisted of two artefacts, each identified within a separate loci. The exposures containing the artefacts were caused by sheetwash erosion resulting in an 80 per cent visibility within the exposures as compared to a 1 per cent visibility rating within the surrounding landform.

The mudstone artefacts included a flake and flaked piece, with the flaked piece in Locus 2 featuring identifiable heat affect.

Soils in the area were noted as having eroded to the basal A₂ horizon with the overall site condition listed as poor. The soils were a light grey sandy loam, impacted both by ongoing erosion through sheet wash and past land use (tree clearance). This has resulted in an area with no further potential for subsurface artefactual material. The site and surrounding landform are therefore not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed the site to have a low cultural significance.

BFC87 Artefact Scatter

The BFC87 artefact scatter was located on a vehicle track on an upper slope with a very gentle gradient ranging from 1 to 2 degrees and an aspect to the north-west. It was identified in Transect 16. Vegetation in the area was a mixture of native and introduced grasses with some regrowth and occasional mature casuarina interspersed. Site BFC87 is approximately 1 kilometre south-east of the catchment area of Big Flat Creek.

The artefacts were located across five loci comprising the total site. Each locus contained a single artefact. Visibility was high (90 per cent) within the site exposures and the surrounding landform due to the presence of a vehicle track. Soils upon the track have been eroded down to the basal A₂ horizon.

The five artefacts comprising the scatter included 2 mudstone flakes, 1 silcrete flake, 1 broken mudstone flake and 1 mudstone core.

Due to the high level of erosion and the associated removal of the majority of the upper soil unit, the site and the surrounding landform are highly unlikely to contain substantial subsurface deposits. Furthermore, the site area and surrounding landform have been subject to significant disturbance in association with ongoing use and erosion of the vehicle track. For these reasons, the site and the surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed that the site had low cultural significance.

BFC88 Isolated Find

The BFC88 site is an isolated find located on a spur in Transect 21. The spur is very gently inclined with a gradient of 1 to 2 degrees and an aspect to the north-west. Vegetation in the area was a mixture of native and introduced grasses, with some regrowth and occasional mature casuarina interspersed. Site BFC88 is approximately 270 metres east of Big Flat Creek.

The isolated find was situated on a disused vehicle track in an area that had been previously impacted by clearance and cattle trampling as well as the construction and use of the track. The site area had 2 per cent visibility upon the disused track and zero visibility in the surrounding landform. Soil type was predominantly gravel with some grey sandy loam visible in patches, with sheetwash erosion having removed much of the upper soil unit.

Due to the high level of erosion and the associated removal of the majority of the upper soil unit, the site and the surrounding landform are highly unlikely to contain substantial subsurface deposits. Furthermore, the site area and surrounding landform have been subject to significant disturbance in association with ongoing use and erosion of the vehicle track. For these reasons, the site and the surrounding landform are not associated with any areas of PAD.

The Aboriginal stakeholder participants in the survey assessed that the site had low cultural significance.

Table 8.3 - Site Description Summary

#AHIMS	Site Type	Landform and Disturbance Factors	Site Contents	Area (m ²)
BFC49	Artefact scatter	Crest, erosion and cattle trampling.	2 flakes, 1 core and 1 broken flake, silcrete and mudstone	120
BFC74	Isolated Find	Lower slope, located on active vehicular track, some sheetwash.	1 silcrete core	1
BFC75	Artefact scatter	Drainage line. Dam wall and associated contour bank.	11 artefacts, flakes, broken flakes, flaked piece and 1 backed artefact (petrified wood), silcrete and mudstone	28
BFC76	Artefact scatter	Drainage line. Dam present and sheetwash erosion.	2 loci, both mudstone broken flakes	2
BFC77	Artefact scatter	Drainage line. Vegetation clearance and sheetwash erosion.	2 artefacts, both mudstone, flake and broken flake	1
BFC78	Isolated Find	Drainage line. Vegetation clearance and sheetwash erosion.	1 silcrete flake	1
BFC79	Artefact scatter	Drainage line. Vegetation clearance and Wybong Road construction.	3 artefacts, all mudstone, 2 flakes and 1 core	6
BFC80	Artefact scatter	Drainage line, lower slope. Wybong Road construction.	5 artefacts, flakes and 1 core, mudstone and silcrete	25
BFC81	Isolated Find	Drainage line with sheetwash erosion.	1 mudstone flake	1
BFC82	Isolated Find	Drainage line. Vegetation clearance.	1 mudstone broken flake	1
BFC83	Isolated Find	Drainage line on lower slope. Large scale vegetation clearance.	1 mudstone flake	1
BFC84	Artefact scatter	Drainage line on lower slope. Artefacts located on dam wall.	5 artefacts, all mudstone flakes	70
BFC85	Artefact scatter	Drainage line. Artefacts located on a dam wall.	3 artefacts, all mudstone flakes	3
BFC86	Artefact scatter	Drainage line. Considerable sheetwash erosion.	two loci, 2 artefacts, 1 mudstone flake, 1 mudstone flaked piece	2
BFC87	Artefact scatter	Upper to midslope. Vegetation clearance. Artefacts located on vehicular access track.	5 loci, total 5 artefacts, 3 flakes, 1 core, 1 broken flake, silcrete and mudstone	5
BFC88	Isolated Find	Spur. Artefact located on disused vehicular track. Stock movement (trampling).	1 mudstone broken flake	1

8.3.1 Discussion of Recorded Sites

The recorded sites in the context of the Habitat Enhancement Area consisted of six isolated finds and nine artefact scatters containing a combined total of 44 artefacts. The largest artefact scatter was BFC75 which contained 11 artefacts, followed by BFC80, BFC81 and BFC 87 all of which contained 5 artefacts each.

The dominant raw material observed was mudstone, with lesser quantities of silcrete, tuff, fine grained siliceous (FGS), quartz and chalcedony. One petrified wood artefact was also recorded. Artefacts observed were predominantly flakes and broken flakes, with a lesser numbers of cores, retouched artefacts, flaked pieces, blade flakes and a backed artefact. A high level of artefact breakage was observed across all sites recorded.

The majority of recorded sites are located on drainage lines, with only two sites (one isolated find and one artefact scatter) on slope landforms and one isolated find located on a crest. This is despite comparable levels of effective coverage for drainage line and crest landforms and therefore is not entirely a reflection of survey effort.

8.3.2 Possible Scarred Trees

Two possible scarred trees were also recorded as part of the Habitat Enhancement Area survey. However, it has since been established by an independent arboricultural assessment that the scars on these trees are not the result of resource extraction by Aboriginal people (refer to **Appendix C**). One of the scars on possible scarred tree 1 (PST 1) has been described by the arboriculturalist as a possible contemporary incision wound of cultural origin but most likely a laceration from abrasion impact, possibly from excavation equipment when the adjacent dam was being constructed. The scar on PST 2 has been described as a historical wound and is estimated to be between 50 and 75 years old. The shape of the wound and stepped incision are indicative of a surveyor's blaze (refer to **Appendix C**). These trees are therefore not recorded as Aboriginal archaeological sites and will not be assessed further.

8.4 Potential Archaeological Deposit

The definition of PAD and the criteria for the identification of PADs are provided in **Section 6.4**. The possibility that PADs may be associated with the identified sites has been addressed as part of the site descriptions and no such PADs were identified. However, the possibility that PADs may be present in other portions of the Habitat Enhancement Area also requires consideration.

The Habitat Enhancement Area includes a number of minor drainage lines that are ephemeral in nature and would contain water only immediately after lengthy periods of rain. As described in the survey transect information, these drainage lines have been significantly impacted by ongoing erosion, the construction of dams and access tracks 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 within the Habitat Enhancement Area 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 relatively high levels of visibility and exposure.

Exposures on both 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.

Based on the results of the survey, the results of previous archaeological investigations in the area, the general depth of soil and the level of disturbance across the Habitat Enhancement Area, it is highly unlikely that large subsurface archaeological deposits are present within the Habitat Enhancement Area; with any deposits that may be present being highly unlikely to retain archaeological integrity. Therefore, whilst it is possible that the Habitat Enhancement Area may contain limited numbers of additional artefacts in a subsurface context, it is not considered to contain any areas of PAD.

8.5 Potential as an Offset

Given the above, it is assessed that the Habitat Enhancement Area has undergone considerable disturbance as a result of natural processes, in particular, sheetwash and gully erosion. Vegetation clearance has also been widespread and the movement and/or grazing of stock has served to accelerate the erosion process, particularly along drainage lines.

The Habitat Enhancement Area contains a relatively small number of artefact scatters and isolated finds containing limited numbers of artefacts within a highly disturbed context. Furthermore, due to the skeletal nature of soils and the high levels of erosion and disturbance across the Habitat Enhancement Area, it does not contain any areas that satisfy the criteria for a PAD. The Habitat Enhancement Area therefore has limited archaeological value.

In considering its broader Aboriginal cultural value, it is noted that the Habitat Enhancement Area contains some mature native vegetation and may have the capacity to be rehabilitated to establish vegetation communities that resemble those that were present in the area prior to European land clearance. However, the Aboriginal stakeholder representatives participating in the survey clearly stated that they felt that the Habitat Enhancement Area had limited Aboriginal cultural value (refer to **Section 4.2**).

9.0 Assessment of Predictive Model

This section of the report assesses the survey results in view of the predictive model presented in **Section 6.0** to identify key consistencies and differences and therefore refine the current understanding of archaeological site patterning within the assessment areas.

The predictive model identified that artefact scatters and isolated finds were the only site types expected within the assessment areas, although the potential for scarred trees was noted but considered unlikely due to extensive tree clearance. Other site types such as rockshelter sites, grinding grooves, stone arrangements, quarries, burials or post-contact sites were not expected to occur within the assessment areas. Survey results conformed to these predictive statements, with all 23 sites recorded being artefact scatters and isolated finds. Two possible scarred trees were identified within the proposed ACHOA but were determined to be the result of factors other than scarring by Aboriginal people, as referred to in **Section 8.3.2** and discussed in detail in **Appendix C**.

The predictive model identified that the majority of sites were not expected to contain more than ten artefacts, and that sites will rarely contain more than 50 artefacts. Raw materials and artefact types were predicted to reflect regional trends, with mudstone and silcrete from the Hunter River dominating the assemblage and flakes and flaked pieces most common. Microblade technology, ground edge artefacts and evidence of retouch and use wear was only expected in larger assemblages. Survey results generally conformed to the model, with all 23 sites being small artefact scatters with a typical range of raw materials and artefact types. Nineteen of the 23 sites recorded contained no more than five artefacts. SC56 contained the densest concentration of artefacts with a count of 49. A site of this size is common at local and regional levels, for example, of the 195 sites recorded for the Mangoola Coal project site only three previously identified sites within Mangoola Coal's approved project disturbance area contain more than 100 surface artefacts.

The predictive model identified that sites were likely to be found in all landform contexts, but the majority would be within 30 metres of a watercourse, reflecting local and regional trends. Ecotones and creek confluences were also identified as key areas likely to contain higher site and artefact densities. The assessment areas contain a plethora of first order creeks and drainage lines and two third order creeks, Sandy Creek and Big Flat Creek. Of the 23 sites recorded, a total of 19 sites are located within 30 metres of streams. These sites are: SC56 (49 artefacts); SC57 (36 artefacts); BFC72 (31 artefacts); BFC73 (isolated find); and BFC 74-88 (low density scatters and isolated finds). No sites are located between 30 and 100 metres of streams and three are located over 100 metres from streams (BFC 69-71). Two of the three sites more than 100 metres from water are isolated finds, the remaining site is a low density scatter containing a total of three artefacts.

As a result, it is concluded that relatively low densities of Aboriginal artefacts are expected to be present on land units further than 100 metres from natural water corridors. This is in line with regional trends as outlined in the predictive model (**Section 6.0**).

As stated above, the largest sites (SC56 n=49 artefacts and SC57 n=36 artefacts) are situated on floodplains but within 30 metres of streams (in this instance Sandy Creek), and therefore conform to the predictive model.

The predictive model identified that sites within the assessment areas and Habitat Enhancement Area were expected to be of low integrity due to extensive post-contact land use, but sites on lesser used landforms such as ridges, crests, spurs, secondary spurs and saddles may have higher integrity. Sites on alluvial landforms were also likely to be of low integrity, due to geomorphic processes and stock movement. All sites recorded within the assessment areas and the majority of sites in the Habitat Enhancement Area were

associated with areas of human activity, which, for the most part consisted of either vehicular access tracks or dam construction. All 23 sites have also been disturbed by natural processes subsequent to human modification of the landscape.

Low integrity is typical of open landform contexts throughout the Hunter Valley where sites are not isolated from geomorphic processes and human action and therefore are subject to some level of disturbance.

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) Venice Charter. The assessment of significance assists in the determination of appropriate cultural heritage management procedures for sites/artefacts that may be threatened by development activities. Assessing the significance of Aboriginal archaeological sites is an extremely complicated process that must take into account the interests of many parties.

The Burra Charter defines cultural significance as the 'aesthetic, historic, scientific or social value for past, present or future generations' of a place. The DEC (NPWS Guidelines 1997) provides further discussion on the assessment of cultural significance for Aboriginal sites, and for artefact scatter sites 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 assessment areas and the Habitat Enhancement Area 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 10.3**. The archaeological significance assessment of the sites recorded in the assessment areas and Habitat Enhancement Area is discussed and justification for their significance ranking provided. In addition, the archaeological significance of the assessment areas and Habitat Enhancement Area (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 assessment areas and the Habitat Enhancement Area, Aboriginal stakeholder representatives were requested to provide comment on the cultural significance of any sites located and of the area as a whole and its surrounds. No areas of particular cultural significance were identified by the stakeholders participating in survey (refer to **Section 10.2** for field comments).

As part of the review of the draft report, Aboriginal stakeholders were invited to add to any comments made in the field regarding the significance of sites and the assessment areas and Habitat Enhancement Area more generally. On behalf of Wanaruah Custodians, Barbara Foot indicated that she could not recall any sites of particular significance in the

Mangoola area. No further comments were received from the relevant Aboriginal stakeholders.

10.2 Aboriginal Stakeholder Comments during Survey

Aboriginal Stakeholder participants were asked to rate the sites recorded according to their cultural significance value for both the relocated ETL survey and the Habitat Enhancement Area. These preliminary ratings are detailed in **Table 10.1** and **Table 10.2**.

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, as listed below.

Table 10.1 - Preliminary Aboriginal Cultural Significance Assessment for sites in Assessment Areas A and B (based on in-field comments)

Site	Aboriginal Cultural Significance
SC56	Low-Moderate
SC57	Low
BFC69	Low
BFC70	Low
BFC71	Low
BFC72	Moderate
BFC73	Low
SC60	No comment provided to date
SC61	No comment provided to date
SC62	No comment provided to date
SC63	No comment provided to date
SC64	No comment provided to date
SC65	No comment provided to date
SC66	No comment provided to date

Table 10.2 - Preliminary Aboriginal Cultural Significance Assessment for sites in Habitat Enhancement Area

Site	Aboriginal Cultural Significance
BFC74	Low
BFC75	Low-Moderate
BFC76	Low
BFC77	Low
BFC78	Low
BFC79	Low
BFC80	Low
BFC81	Low
BFC82	Low
BFC83	Low
BFC84	Low
BFC85	Low

Table 10.2 - Preliminary Aboriginal Cultural Significance Assessment for sites in Habitat Enhancement Area (cont)

Site	Aboriginal Cultural Significance
BFC86	Low
BFC87	Low
BFC88	Low

10.3 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 10.3**). 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 10.3 - 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 10.3 - 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 10.3 - 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.

10.3.1 Archaeological Site Significance

Table 10.4 provides a summary of the archaeological significance afforded to the seven Aboriginal archaeological sites located during the survey. If a site is considered 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 10.4 - Archaeological Site Significance (Assessment Areas A and B)

Site	Rarity		Represent- ativeness		Arch. Integrity		Connected- ness		Complexity		Potential for Archaeological Deposit		Overall Archaeological Significance	
	L*	R*	L	R	L	R	L	R	L	R	L	R		
SC56	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC57	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC69	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC70	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC71	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC72	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC73	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC60	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC61	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC62	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC63	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC64	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC65	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
SC66	1	1	1	1	1	1	1	1	1	1	1	1	12	Low

* L=local, R=regional.

All fourteen of the sites recorded in the assessment areas (nine artefact scatters and five isolated finds) are of low archaeological significance for the following reasons:

- artefact scatters and isolated finds 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 therefore they are not considered representative;
- integrity of the sites is very low, with all sites recorded in areas of disturbance resulting from human action and/or geomorphic processes. These processes have 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.

The sites identified within the Habitat Enhancement Area are assessed in **Table 10.5** against the significance criteria provided in **Table 10.3**.

Table 10.5 - Significance Assessment (Habitat Enhancement Area)

Site	Rarity		Represent- ativeness		Arch. Integrity		Connected- ness		Complexity		Potential for Archaeological Deposit		Overall Archaeological Significance	
	L	R	L	R	L	R	L	R	L	R	L	R		
BFC49	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC74*	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC75	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC76	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC77	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC78	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC79	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC80	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC81	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC82	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC83	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC84	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC85	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC86	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC87	1	1	1	1	1	1	1	1	1	1	1	1	12	Low
BFC88	1	1	1	1	1	1	1	1	1	1	1	1	12	Low

*Note, this site is outside the boundaries of the Habitat Enhancement Area

Of the sites (nine artefact scatters and six isolated finds) recorded during in the Habitat Enhancement Area, all are assessed as having low archaeological significance due to the following:

- artefact scatters and isolated finds are common site types at local and regional levels, and are not considered rare;
- similar sites are presently conserved within existing ACHOA (the Anvil Hill Aboriginal Cultural Heritage Offset Areas and SC10 Management Zone) therefore they are not considered representative;
- integrity of the sites is very low, with all sites recorded in areas of disturbance resulting from human action and/or geomorphic processes. These processes have 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.

10.3.2 Archaeological Significance of the Assessment Areas and Habitat Enhancement Area

Assessing the archaeological significance of the assessment areas and the Habitat Enhancement Area requires the consideration of the potential values of these areas outside the context of the identified sites. As discussed in **Sections 7.4, 8.4 and 8.5**, the majority of the assessment areas and the Habitat Enhancement Area 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 (both natural and as a result of 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 assessment areas and Habitat Enhancement 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 assessment areas and the Habitat Enhancement Area therefore have low archaeological significance when considered on a landscape basis.

10.3.3 Summary of Aboriginal and Archaeological Significance

The Aboriginal significance and archaeological significance and research potential of the sites and archaeological landforms located within the assessment areas and the Habitat Enhancement Area have been summarised in **Tables 10.1** and **10.2** and **10.4** and **10.5** respectively. The Aboriginal stakeholders participating in the survey did not identify any areas or sites of particular Aboriginal cultural significance and no further comments on the Aboriginal cultural significance were received in response to the provision of the draft Aboriginal archaeological and cultural heritage assessment. Both the broader landscape context of the assessment areas and the Habitat Enhancement Area and the sites they contain are of low archaeological significance.

11.0 Management Options

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

11.1 Options for Sites/Areas within the Relocated ETL Easement

11.1.1 Option 1 Site Conservation

This management option would involve the conservation of all or some of the sites within the assessment areas. The relocated ETL was designed to avoid impacts to known archaeological sites. No towers are proposed at any of the fourteen recorded sites and it will be possible to avoid impacts to these sites.

Sites BFC69 to BFC73 fall within an ACHOA, which is an area set aside for its Aboriginal heritage values. Conservation of these sites in compliance with Mangoola Coal's ACHMP (Umwelt 2008a) is the preferred option. These sites will therefore be demarcated to prevent incidental impacts. However it is recognised that there may be some temporary surface impacts associated with stringing of conductors in this area that are unavoidable. In this instance, it is considered appropriate to undertake actions to protect these artefacts from impact and ensure their ongoing *in situ* conservation. This may involve temporary collection and precise replacement of artefacts that may be subject to impact during hand-stringing of conductors in the area.

Sites SC56 and SC57 are between tower locations T8 and T9 and are not currently proposed for impact by construction or maintenance of the relocated ETL. To mitigate potential impacts during the stringing of the relocated ETL (refer to **Section 2.2.6**) and/or during vehicular/plant access it is considered appropriate that these sites be demarcated to ensure that there are no direct or indirect impacts during construction. It is not necessary to undertake any surface or subsurface impacts at SC56 and SC57 and therefore these sites can be conserved. Whilst the sites will be located on land which has an easement managed by TransGrid, given their proximity to the Mangoola Coal operations and the approved project disturbance boundary and the association between the relocated ETL and Mangoola Coal, it is considered appropriate that these sites be managed generally in compliance with Mangoola Coal's ACHMP whilst operations continue on site. In the long term, the management of these sites should include the identification of the sites on easement plans held by TransGrid for use in managing maintenance activities to avoid impacts to the sites.

The management of sites in accordance with Mangoola Coal's ACHMP is also appropriate for the sites in the Habitat Enhancement Area (BFC49 and BFC74-88), as they are not within areas currently proposed for impact by the project. These sites will be conserved and managed in compliance with the Mangoola Coal ACHMP (Umwelt 2008a).

11.1.2 Option 2 Site Destruction without Salvage

Option 2 would involve proceeding with the project and the subsequent destruction of all sites within the assessment areas without any further investigation/salvage. The identified sites represent tangible heritage that is valued by Aboriginal people. As discussed above, the project design is such that no impacts will be necessary within the recorded boundaries

of the identified sites. It is also noted that no impacts are allowed within the ACHOA (containing BFC69 to 73) under the ACHMP (Umwelt 2008a). However, should it become necessary to impact any of the sites recorded in the assessment areas (SC56-57, SC60 to 66 and BFC69 to 73) or the Habitat Enhancement Area (BFC49 and BFC74-88), it is not considered appropriate from an Aboriginal cultural heritage perspective to destroy the sites without undertaking some mitigative works.

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

Option 3 would involve the collection of all visible artefacts within sites to be impacted by the relocated ETL easement. As discussed above, the project design is such that no impacts will be necessary to SC56 and SC57 at this time. In contrast, sites SC60 to SC66 are located on currently used access tracks that are proposed to be further modified and utilised to provide access to new tower locations for the relocated ETL. Sites SC56 and SC57 and SC60 to SC66 are of low archaeological significance. However, they are of value to the Aboriginal stakeholders and can be incorporated into the analysis of the salvaged artefactual assemblage from the approved project disturbance area. Therefore, if impacts are necessary to these sites, conducting a surface collection of artefacts using the methodology approved by the relevant Aboriginal stakeholders and DECCW within the ACHMP (Umwelt 2008a) would be an appropriate management option. It is noted that the sites within Assessment Area A (i.e. SC56 and 57 and SC60 to SC66) are not within the area covered by the Mangoola Coal ACHMP. However the surface collection methodology provided in the ACHMP would be appropriate for these sites.

11.1.4 Option 4 Subsurface Testing

This management option would involve undertaking subsurface test excavations at one or more of SC56, SC57 and/or SC60 to SC66. Subsurface testing is only an appropriate option from an archaeological perspective when it is considered likely that the testing may locate areas suitable for further subsurface investigation. As no areas of PAD have been identified within these sites (or in any other area within the assessment areas or in the Habitat Enhancement Area) there is no justification for undertaking subsurface testing in these areas, should impacts be required in the future.

11.1.5 Option 5 Site Destruction with Salvage (Subsurface Salvage)

Option 5 would involve undertaking subsurface salvage (manual or mechanical excavations) at recorded sites subject to impact 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 **Sections 7.4 and 8.4** no sites or areas within the assessment areas or the Habitat Enhancement Area were identified as containing PAD. Consequently, there is no justification for undertaking subsurface salvage within these areas, should impacts be required in the future.

11.2 Preferred Option for Sites to be Impacted by Tower Dismantling

As noted in **Sections 4.3.1 and 4.3.2** various management options were discussed with the Aboriginal stakeholders in relation to the dismantling of two existing 500 kV towers (one in the ACHOA near Big Flat Creek and one in the SC10 Management Zone – refer to **Figure 1.2**).

The preferred management outcome as identified by the majority of the Aboriginal stakeholders taking part in the inspection of the two tower locations was as follows:

- the towers should be removed as children visiting the ACHOA/SC10 Management Zone may climb them and fall;
- the tower footings should not be removed as this would cause further disturbance to the BFC01/SC10 site. Instead a section of the base of the tower superstructure should be left and used to support a roof to provide a shady spot for people to use when they visit the ACHOA/SC10 Management Zone;
- an area to be used for access to and dismantling of the tower within the SC10 Management Zone by the crane and semi-trailer and areas outside the SC10 Management Zone that are to be used for parking other vehicles should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates;
- vehicle access to the towers within the Big Flat Creek ACHOA and the SC10 Management Zone should be restricted to the crane and semi-trailer along designated access tracks. All other vehicles to be parked as follows:
 - for the tower within the ACHOA - immediately to the east of the tower location in an area within the ACHOA that has been used for parking in the past and a temporary fence (iron posts and high visibility meshing) should be constructed prior to works commencing that demarcates the western limit of the area of ACHOA where vehicle impact is permissible (and the area that has been inspected and artefacts temporarily salvaged where required); and
 - for the tower in the SC10 Management Zone – outside the fenced Management Zone area;
- following the dismantling of the towers the artefacts will be replaced at their individual find locations; and
- as far as possible, the removal of the conductors should be undertaken in a fashion that avoids ground surface disturbance. Due to the potential impacts on surface artefacts of pulling 24 conductors or associated draw wires across the ground, it is not considered appropriate to de-string the conductors without devising an engineering solution that will prevent impacts to the ground surface.

11.3 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 relocated ETL, 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 relocated ETL are of low archaeological significance and comprise a relatively small number of sites and artefacts. However, the relocation of the ETL will involve impacts within an existing Aboriginal Cultural Heritage Offset Area and the SC10 Management Zone, therefore warranting consideration of an 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.

11.3.1 Proposed Land Based Offset

As previously discussed, Mangoola Coal identified a proposed land-based offset area (the Habitat Enhancement Area) on the grounds that impacts to Aboriginal cultural heritage associated with the ETL relocation (if any) and proposed modifications to the mine approval area (Umwelt in prep b) may require offsetting. The relocated ETL will not result in any direct impacts to sites or PADs. However, where the relocated ETL is in proximity to or spans the existing ACHOA (refer to **Figure 1.2**), the presence of towers and visible wiring will affect the aesthetic value of these areas. Furthermore, the tower removal areas will be subject to surface impacts that could have an impact on the Aboriginal heritage value of these areas.

As part of the conservation outcome for this project Mangoola Coal proposed adding to the area of the existing ACHOA to ensure the long term conservation of the Aboriginal sites in this area. Management of the sites within the ACHOA would be undertaken in compliance with the existing ACHMP (Umwelt 2008a). It should be noted that the proposed land-based offset already forms a conceptual Habitat Enhancement Area for the purposes of ecological conservation.

11.3.2 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, 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 (as scheduled for February 2011).

11.3.3 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 the remaining 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 Register and archaeological literature relating to the general locality of the project;
- the results of the surface survey;
- an evaluation of the impacts of the project on Aboriginal cultural heritage values;
- an evaluation of the impacts of the project on archaeological values;
- the assessment of the Aboriginal and archaeological significance of the sites and landforms within the project area;
- 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.

These recommendations have also been formulated on the basis that no impacts will be required to sites within the assessment areas (excluding the marked vehicle tracks) or Habitat Enhancement Area. The recommendations in relation to the relocated ETL are provided below:

- Prior to the commencement of construction of the relocated ETL, sites SC56 and SC57 should be clearly designated (e.g. fencing) and should not be subject to any ground disturbance. Following the completion of the ETL relocation, SC56 and SC57 should be managed in a manner generally in accordance with the Mangoola Coal ACHMP. Although site SC55 is not within the proposed easement, given its proximity to Assessment Area A, these recommendations should also apply to SC55 and are consistent with those provided in the assessment associated with SC55 (Umwelt 2009b).
- Prior to any impacts associated with the development of the designated access tracks in Assessment Area A, surface artefacts within sites SC60 to SC66 should be subject to surface collection and analysis in accordance with the methodology approved by the relevant Aboriginal stakeholders and DECCW as part of the Mangoola Coal ACHMP (Umwelt 2008a). 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 the commencement of construction of the relocated ETL, sites BFC69 to BFC73 (located within the Big Flat Creek ACHOA) should be clearly designated (e.g. fencing). Every effort should be made to avoid impacts to these sites by hand-stringing conductors between towers T27 and T28 using a light-weight draw-wire and preventing vehicle access (including 4WD vehicles) in the easement area between towers T27 and T28 (within the Big Flat Creek ACHOA). However, the draw-wire will still be in contact with the ground surface and may be required to pass through the site boundaries. Should this be the case, the MGA grid coordinates of artefacts subject to impact should be recorded and each artefact should be collected and placed in an individual bag marked with the

MGA coordinates. The artefacts should then be returned to their recorded location following the completion of stringing activities. Following the completion of stringing activities, BFC69 to BFC73 should be managed in accordance with the Mangoola Coal ACHMP.

- All site demarcation should be undertaken by a qualified archaeologist and at least two Aboriginal stakeholder representatives. Site demarcations will be permanent and will be marked on easement maintenance plans used by TransGrid when planning their maintenance activities.
- Machines and vehicles involved in works associated with the relocated ETL should utilise existing vehicle tracks within the approved project disturbance area, the five designated access tracks and/or move within the relocated ETL easement (within the assessment areas), avoiding the Big Flat Creek ACHOA, the SC10 Management Zone (with the exception of the crane and truck access discussed below) and the demarcated boundaries of sites SC55 to SC57.
- The two laydown areas for construction materials required for the relocated ETL should be located within the approved project disturbance boundary or within the relocated ETL easement but outside the ACHOA, SC10 Conservation Zone and the demarcated boundaries of sites SC55 to SC57.
- Between towers T27 and T28 (within the Big Flat Creek ACHOA), impact on vegetation should be limited to lopping and should not involve ground surface disturbance. Care should be taken to protect the riparian zone in this area.
- Vehicle access to the SC10 Management Zone and the Big Flat Creek ACHOA during dismantling and associated works for the removal of the existing ETL towers should be restricted to designated access areas and dismantling areas and vehicular traffic should be minimised as far as possible in accordance with the management options presented in **Section 11.2**.
- The crane and truck access to the tower locations within the SC10 Management Zone and the associated dismantling area should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of impacts associated with the removal of the existing ETL.
- The vehicle parking area and associated tower dismantling area within the Big Flat Creek ACHOA should be inspected by at least two representatives of the Aboriginal stakeholders (in compliance with the ACHMP) and any surface artefacts located within the area flagged. If the artefact locations cannot be avoided, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of impacts associated with the removal of the existing ETL.
- The dismantling of towers with the Big Flat Creek ACHOA and the SC10 Management Zone should be undertaken so that there is no need for additional subsurface disturbance in association with this activity. Where possible, a section of the base of the tower superstructure may be retained for the purposes of creating a shade structure.

- The remaining eleven existing towers outside the project disturbance boundary and the Big Flat Creek ACHOA and the SC10 Management Zone will be subject to a due diligence inspection prior to the commencement of any activities associated with the dismantling of the existing 500 kV transmission line. The due diligence inspection will be undertaken at the tower location and any associated areas (including any additional heavy vehicle access tracks or equipment lay-down areas). Should the inspection identify any Aboriginal objects or areas of PAD that will be impacted by the proposed dismantling works, the following management strategies will be employed:
 - consultation will be undertaken with Mangoola Coal to determine whether dismantling works can be altered to avoid impacts to Aboriginal objects or areas of PAD and, if this is possible, all staff and contractors will be notified of their obligation to adhere to the altered work methodology;
 - if it is not possible to alter the proposed dismantling works as discussed above, the management strategies will be determined based on site significance as outlined below:
 - surface impacts to recorded Aboriginal object(s) of low to moderate significance (as determined based on both Aboriginal cultural significance and archaeological significance) will be mitigated by surface collection conducted in accordance with the methodology provided in **Section 13.0**;
 - surface impacts to recorded Aboriginal object(s) of high significance (as determined based on both Aboriginal cultural significance and archaeological significance) will not be permitted until such time as consultation has been undertaken with the relevant Aboriginal stakeholders to develop specific management protocols, should this be possible and acceptable to the relevant Aboriginal stakeholders;
 - subsurface impacts to an area of PAD will be mitigated by conducting subsurface salvage using a methodology generally in accordance with that provided in the Mangoola Coal ACHMP and determined in consultation with the relevant Aboriginal stakeholders.
- Within the SC10 Management Zone and Big Flat Creek ACHOA where the existing ETL is to be decommissioned, two areas of 20 metres in width along the length of the span within these sensitive areas will be designated by Downer EDI or their nominated representative as the areas within which the conductors may contact the ground surface. These designated areas will be inspected by at least two Aboriginal stakeholder representatives. Should any artefacts be present in these areas, their MGA grid coordinates should be recorded and each artefact should be collected and placed in an individual bag marked with the MGA coordinates. The artefacts will then be returned to their recorded location following the completion of the recoiling of the conductors in these areas. The recoiling of the conductors will not involve ground surface disturbance within the SC10 Management Zone and Big Flat Creek ACHOA outside of the designated areas discussed above.
- All personnel involved in works associated with the relocated ETL should undertake Aboriginal cultural heritage awareness training as part of their induction process.
- If artefacts are identified during tower construction activities, work should cease at that tower location and the DECCW and the relevant Aboriginal stakeholder groups contacted and appropriate management recommendations formalised.
- In the event that human skeletal material is uncovered during construction, work will cease and the NSW Police Department, DECCW and the relevant Aboriginal groups will be contacted and appropriate management recommendations formalised.

- DECCW/AHIMS site cards should be prepared within a reasonable time of the location of any Aboriginal object/s during the construction of the relocated ETL (if any) (under *Section 91 of the National Parks and Wildlife Act 1974*).
- Sites BFC74 to BFC88, located within the Habitat Enhancement Area, will be managed in accordance with the Mangoola Coal ACHMP (Umwelt 2008) and the ACHMP will be reviewed to reference these sites and other sites identified in association with the relocation of the ETL.

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 as part of the Mangoola Coal biannual stakeholder meetings (as scheduled for February 2011).

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 2008), 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 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.

14.0 References

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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	Marree	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	Layer	Ungooroo 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	500kV	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 Vilet	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 (UHWCC)	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	Ungooroo 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	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Luke	Hickey	Hunter Valley Surveying (HVCs)	Greg Newton	Email	500kV	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Arthur	Fletcher	Wonn 1 Contracting (AF-WC)	Greg Newton	Email	500kV	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Des	Hickey	Wattaka Wonnarua CC Service (WWCCS)	Greg Newton	Email	500kV	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Barry	Anderson	Lower Wonnarua Tribal Consultancy Pty Ltd (LWTC)	Greg Newton	Email	500kV	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Laurie	Perry	Wonnarua Nation Aboriginal Corporation	Greg Newton	Email	500kV	Emailed through reminder for 500kV comments proforma	
07-Aug-09	Luke	Hickey	Hunter Valley Surveying (HVCs)	Greg Newton	Fax	500kV	Faxed through reminder for 500kV comments pro forma	
07-Aug-09	Rhonda	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.	
17-Aug-09	Kathy	Steward-Kinchella	Yinnarr 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	Yinnarr 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 (HVCs)	Toni Schneckloth	Site Visit		LH 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	Telephone		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 (UHWCC)	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	Ungooroo 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 messageback.	
24-Aug-09	Nicole	Smith	Hunter Valley Aboriginal Corporation (HVAC)	Toni Schneckloth	Telephone		Went to leave message on number of 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	Giwiir 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	Paget	Ungooroo Aboriginal Corporation (UAC)	Toni Schneckloth	Email	500kV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Michelle	Stair	Giwiir Consultants (GC)	Toni Schneckloth	Email	500kV	Email re confirmation of field work for 11/09/09.	
01-Sep-09	Marree	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 (HVCs)	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 (UWHC)	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 Matthews. 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 werent on the list for the 14th	
07-Sep-09	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHWCI)	Toni Schneckloth	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 Danny 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 (UHWCI)	Toni Schneckloth	Email	Extra Areas 500kV	Details for work 08/01/10.	
05-Jan-10	Victor	Perry	Upper Hunter Wonnarua Council Inc (UHWCI)	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 (UHWCI)	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 (UHWCI)	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 (UHWCI)	Toni Schneckloth	Fax	Meetings/500kV	Sent proforma for comments from meeting held 18/02/10. She will also send 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	Michelle	Stair	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 (HVS)	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	Clifford	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	Rhoda	Ward	Ungooroo Cultural & Community Services Inc (UCCS)	Elizabeth Brewer	Telephone	Comments on draft reports	Reminder for comments - no comments from Rhoda.	
30-Mar-10	Darrel	Mathews	Upper Hunter Heritage Consultants (UHHHC)	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 (UHWCI)	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 (D&C) 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	Bull	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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PO Box 838
Toronto NSW 2283



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Fax. 02 4950 5737

ABN 18 059 519 041

Our Ref: 2497C/JW/KM/070409

7 April 2009

COPY

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

POSTED

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

Dear Brett

Re: Stakeholder Consultation in Relation to the Relocation of 500kV Transmission Line associated with the Mangoola Coal, Wybong, NSW

Xstrata Mangoola Pty Limited (Mangoola Coal) is proposing to relocate an existing 500kV transmission line which currently dissects its approved development impact area. The new easement will incorporate two areas outside of the approved development impact area, these areas will require Aboriginal and archaeological survey and assessment.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment 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 **27 April 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

A handwritten signature in dark ink, appearing to read "J. Wilson", written in a cursive style.

Jan Wilson
Manager Cultural Heritage

enc

Attachment A

Name	Contact	Address	
Aboriginal Native Title Consultants (ANTC)	Margaret Matthews	16A Mahogany Crescent	Muswellbrook NSW 2333
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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
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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
Yarrowalk (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/070409

COPY

7 April 2009

POSTED

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

Dear Sir/Madam

Re: Stakeholder Consultation in Relation to the Relocation of 500kV Transmission Line associated with the Mangoola Coal, Wybong, NSW

Xstrata Mangoola Pty Limited (Mangoola Coal) is proposing to relocate an existing 500kV transmission line which currently dissects its approved development impact area. The new easement will incorporate two areas outside of the approved development impact area, these areas will require Aboriginal and archaeological survey and assessment.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if 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 Muswellbrook Shire 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 **27 April 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

A handwritten signature in dark ink, appearing to read "J. Wilson", is written over a horizontal line.

Jan Wilson
Manager Cultural Heritage

enc

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/070409

7 April 2009

COPY

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

POSTED

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

Dear Megan

Re: Stakeholder Consultation in Relation to the Relocation of 500kV Transmission Line associated with the Mangoola Coal, Wybong, NSW

Xstrata Mangoola Pty Limited (Mangoola Coal) is proposing to relocate an existing 500kV transmission line which currently dissects its approved development impact area. The new easement will incorporate two areas outside of the approved development impact area, these areas will require Aboriginal and archaeological survey and assessment.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if the Office of the Registrar of Aboriginal Owners 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 the Office of the Registrar of Aboriginal Owners could advise in writing, of any further stakeholder groups/individuals that may wish to be consulted as soon as possible and no later than **27 April 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

A handwritten signature in black ink, appearing to read "Jan Wilson", with a stylized flourish at the end.

Jan Wilson
Manager Cultural Heritage

enc

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/070409

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7 April 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 the Relocation of 500kV Transmission Line associated with the Mangoola Coal, Wybong, NSW

Xstrata Mangoola Pty Limited (Mangoola Coal) is proposing to relocate an existing 500kV transmission line which currently dissects its approved development impact area. The new easement will incorporate two areas outside of the approved development impact area, these areas will require Aboriginal and archaeological survey and assessment.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the necessary assessment 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 **27 April 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

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Jan Wilson
Manager Cultural Heritage

enc

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ABN 18 059 519 041

Our Ref: 2497C/JW/KM/070409

COPY

7 April 2009

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

POSTED

Dear Suzie

Re: Stakeholder Consultation in Relation to the Relocation of 500kV Transmission Line associated with the Mangoola Coal, Wybong, NSW

Xstrata Mangoola Pty Limited (Mangoola Coal) is proposing to relocate an existing 500kV transmission line which currently dissects its approved development impact area. The new easement will incorporate two areas outside of the approved development impact area, these areas will require Aboriginal and archaeological survey and assessment.

Mangoola Coal has commissioned Umwelt (Australia) Pty Limited (Umwelt) to undertake the archaeological assessment in consultation with Aboriginal stakeholders. The purpose of this notification is to ascertain if 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 **27 April 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

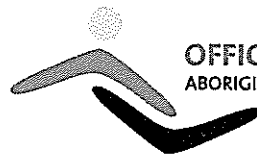
A handwritten signature in dark ink, appearing to read "J. Wilson", is written over a horizontal line.

Jan Wilson
Manager Cultural Heritage

enc

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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/070409
Our reference : DOC09/17497 Fil07/5627
Contact : Ciaron Dunn, (02) 6659 8221
Date : 22 April 2009

REC-
27 APR 2009

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

23 APR 2009

Dear Ms Wilson

**RE: STAKEHOLDER CONSULTATION IN RELATION TO THE RELOCATION OF
500kV TRANSMISSION LINE ASSOCIATED WITH MANGOOLA COAL, WYBONG,
NSW**

I refer to your correspondence to the Department of Environment and Climate Change (DECC), dated 7 April 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



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

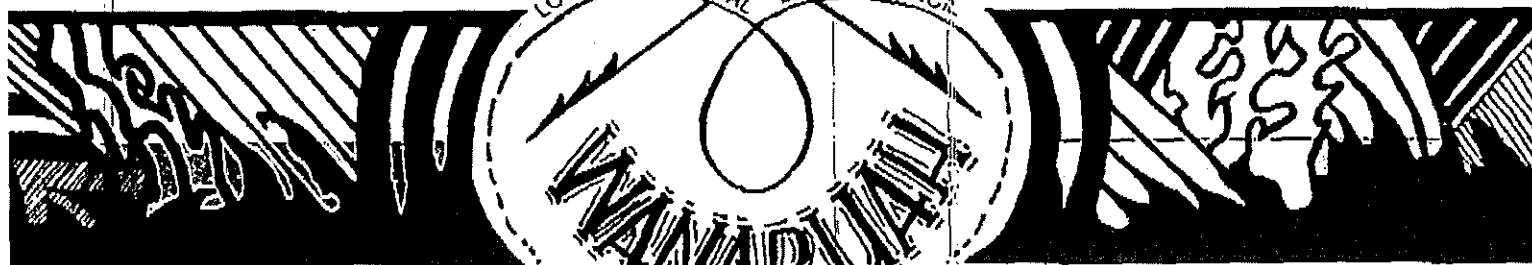
Encl: Attachment 1



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
Yarrowalk 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 Wonnaruah 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	



P.O. BOX 127
19 MAITLAND STREET,
MUSWELLBROOK 2333
ABN 33 251 730 169

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

8 April 2009

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

Dear Jan

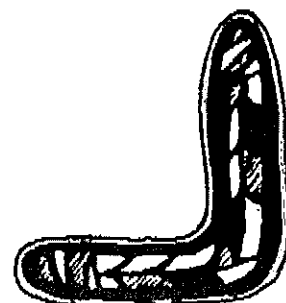
**RE: STAKEHOLDER CONSULTATION IN RELATION TO THE
RELOCATION OF 500kv TRANSMISSION LINE ASSOCIATED WITH
THE MANGOOLA COAL, WYBONG NSW**

Thank you for your letter dated 7 April 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:

Lea-Ann Ball
Lower Wonnarua Tribal Council
Shop 2, 145 Land Street
KURRI KURRI NSW 2327

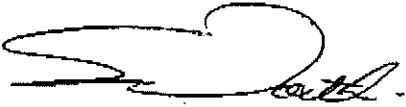
Rene Molincaux
St Clair Singleton Aboriginal Corporation
30 Carrington Street,
SINGLETON NSW 2330



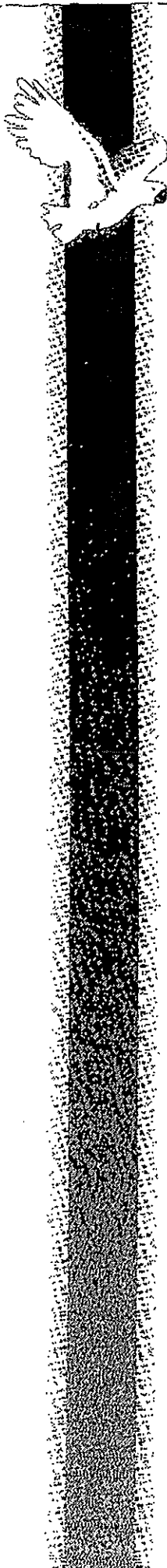
.... and we have included Bullen Bullen Heritage Consultants and Wanaruah Custodians to ours! Thank you.

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



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 anything 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 fully 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 EDI 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:

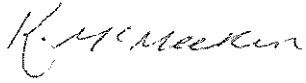
Register Type	NNTT Reference Numbers
National Native Title Register	Nil.
Register of Native Title Claims	Nil.
Unregistered Claimant applications	Nil.
Register of Indigenous Land Use Agreements	Nil.

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 tenure 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

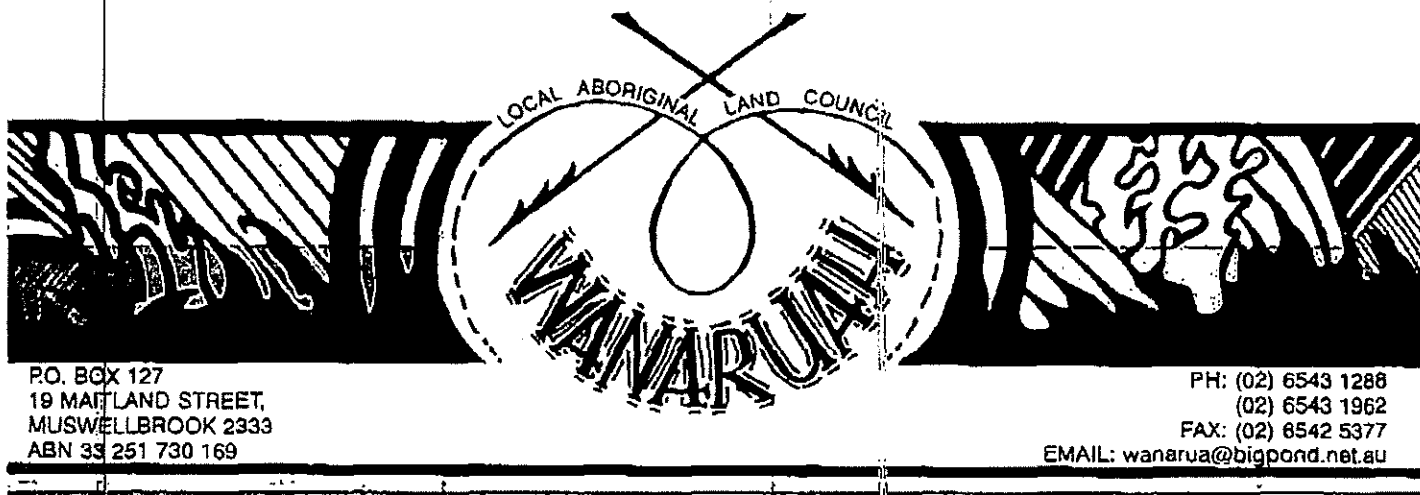
An application summary contains a description of the location, content and status of a native title claim.

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

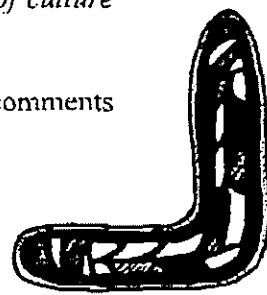
**RE: REVIEW OF DRAFT ABORIGINAL CULTURAL HERITAGE AND
ARCHAEOLOGICAL ASSESSMENT – PROPOSED MODIFICATION
TO PROJECT APPROVAL 06_0014, MANGOOLA COAL, NEAR
DENMAN**

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 piecemeal 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.

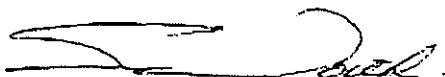
11.5.3 *Other Offset Option:* These could be seen as given in Options 11.5.1 and 11.5.2 above.

(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

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**



ENVIRONMENTAL MANAGEMENT SERVICES

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

xstrata
coal
Mangoola Coal

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

Xstrata Mangoola Pty Limited ABN 54 127 535 755
PO Box 495, Muswellbrook NSW 2333
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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.

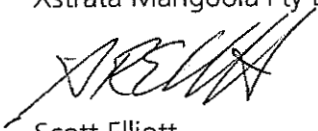
Umwelt (Australia) Pty Limited (Umwelt). 2008b. Aboriginal Archaeological Impact Assessment – Modification for Mangoola Coal Pipeline. Report to Xstrata Mangoola Pty Limited.

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', written over a horizontal line.

Scott Elliott

Project Manager

22 July 2010

98-XMC-510-0004-LEO-0448

Name
Organisation
Address 1
Address 2

Dear Name,

Re: Modifications to Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Relocation of Electricity Transmission Line, Mangoola Coal

As you are aware, Mangoola Coal has recently sought comment from the relevant Aboriginal stakeholder groups in relation to the above assessment. The period for comment on the draft assessment has now closed and all comments received have been incorporated into the assessment.

As part of the assessment, two existing tower locations within sensitive contexts (Big Flat Creek ACHDA and SCIO Management Zone) were inspected and specific mitigation and management recommendations were made for the dismantling of these towers. Following the closing date for comment, Mangoola Coal reviewed requirements associated with the dismantling of the eleven existing 500kV towers that are outside the approved project disturbance boundary and were not inspected as part of the assessment. On the basis of this review, Mangoola Coal recognises the importance of establishing appropriate mitigation and management recommendations for the dismantling of these eleven existing towers. This also reflects verbal comments made by some Aboriginal stakeholders during on-going meetings regarding the project.

Proposed Approach

In recognition of the above, Mangoola Coal proposes to modify the assessment in order to incorporate appropriate mitigation and management recommendations for the dismantling of the eleven existing 500kV towers. These recommendations will need to reflect both an Aboriginal cultural and archaeological perspective and remain in keeping with the approved Mangoola Coal Aboriginal Cultural Heritage Management Plan (ACHMP). As part of this process, Mangoola Coal requested Umwelt (Australia) Pty Limited (Umwelt) to prepare some preliminary mitigation and management recommendations from an archaeological perspective. It is emphasised by both Mangoola Coal and Umwelt that these are preliminary recommendations only and are subject to review following comment from the relevant Aboriginal stakeholders.

Preliminary Recommendations Regarding Dismantling of the Eleven Existing Towers

The preliminary recommendations regarding dismantling of the eleven existing towers are provided on the attached pages in blue text to show where these modifications fit with the existing assessment. In summary, it is proposed that each of the eleven towers (and any associated heavy vehicle access tracks or equipment lay-out areas) will be subject to due diligence inspection prior to the start of any activities associated with dismantling of the existing 500kV easement. If Aboriginal objects or areas of PAD are identified during the inspections, consultation will be undertaken to determine if the dismantling works can be modified to prevent impacts to the objects or areas of PAD. If this is not possible, additional management strategies will be developed based on site significance, as outlined below:

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- surface impacts to recorded Aboriginal object(s) of low to moderate significance (as determined based on both Aboriginal cultural significance and archaeological significance) will be mitigated by surface collection conducted in accordance with the methodology provided in Section 13 of the *Draft Aboriginal Cultural Heritage and Archaeological Assessment - Proposed Relocation of Electricity Transmission Line, Mangoola Coal, near Denman* (Umwelt, 2010) and the methodology outlined in the approved Mangoola Coal ACHMP;
- surface impacts to recorded Aboriginal object(s) of high significance (as determined based on both Aboriginal cultural significance and archaeological significance) will not be permitted until such time as consultation has been undertaken with the relevant Aboriginal stakeholders to develop specific management protocols, should this be possible and acceptable to the relevant Aboriginal stakeholders;
- sub-surface impacts to an area of PAD will be mitigated by conducting sub-surface salvage using a methodology generally in accordance with that provided in the Mangoola Coal ACHMP and determined in consultation with the relevant Aboriginal stakeholders.

Consultation Regarding Preliminary Recommendations Regarding Dismantling of the Eleven Existing Towers and Modification to the Assessment

As discussed above, the preliminary recommendations and modification of the assessment are subject to Aboriginal stakeholder review and comment. Mangoola Coal is seeking feedback from the relevant Aboriginal stakeholders regarding the preliminary recommendations and modification of the assessment that are discussed above and attached in full. In accordance with the DECCW *Interim Community Consultation Requirements for Applicants*, if your group wishes to comment on these recommendations and modification to the assessment, can you please ensure these comments are provided to Mangoola Coal by no later than close of business on 10, August 2010. Should you wish to discuss any aspect of this letter, please do not hesitate to contact Ben Clibborn on 6549 5503.

Yours sincerely,

Xstrata Mangoola Pty Limited

Scott Elliott

Project Manager



18 October 2010

Ref No. 98-XMC-510-0004-LEO-0512

Name
Organisation
Address 1
Address 2

Dear Name,

Re: Request for Comment Regarding Changes to Modifications to Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Relocation of Electricity Transmission Line, Mangoola Coal

As you aware, on 22 July 2010, Mangoola Coal sent you a letter outlining some changes to the above report. These changes related to mitigation and management recommendations associated with the dismantling of the eleven existing 500kV towers that are outside the approved project disturbance boundary that were not inspected as part of the assessment. It was requested that comment regarding these changes be provided by no later than 10 August 2010. This letter is to further request that your organisation provide comment on the changes for inclusion in the final assessment. For your reference, the changes are again outlined below and an extract of the preliminary recommendations are provided on the attached pages in blue text to show where these modifications fit with the existing assessment.

Summary of Preliminary Recommendations Regarding Dismantling of the Eleven Existing Towers

It is proposed that each of the eleven towers (and any associated heavy vehicle access tracks or equipment lay-out areas) will be subject to due diligence inspection prior to the start of any activities associated with dismantling of the existing 500kV easement. If Aboriginal objects or areas of PAD are identified during the inspections, consultation will be undertaken to determine if the dismantling works can be modified to prevent impacts to the objects or areas of PAD. If this is not possible, additional management strategies will be developed based on site significance, as outlined below:

- surface impacts to recorded Aboriginal object(s) of low to moderate significance (as determined based on both Aboriginal cultural significance and archaeological significance) will be mitigated by surface collection conducted in accordance with the methodology provided in Section 13 of the *Draft Aboriginal Cultural Heritage and Archaeological Assessment - Proposed Relocation of Electricity Transmission Line, Mangoola Coal, near Denman* (Umwelt, 2010) and the methodology outlined in the approved Mangoola Coal ACHMP;
- surface impacts to recorded Aboriginal object(s) of high significance (as determined based on both Aboriginal cultural significance and archaeological significance) will not be permitted until such time as consultation has been undertaken with the relevant Aboriginal stakeholders to develop specific management protocols, should this be possible and acceptable to the relevant Aboriginal stakeholders;

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- sub-surface impacts to an area of PAD will be mitigated by conducting sub-surface salvage using a methodology generally in accordance with that provided in the Mangoola Coal ACHMP and determined in consultation with the relevant Aboriginal stakeholders.

Request for Comments

As discussed above, Mangoola Coal recognises the integral need to provide Aboriginal stakeholders with the opportunity to provide input on the changes summarised above. Consequently, Mangoola Coal has extended the period for comment until close of business on 29 October 2010. Comment can be provided in writing or verbally to Ben de Somer. Ben's contact details are provided below.

Phone: 6549 5510

Email bdesomer@xstratacoal.com.au

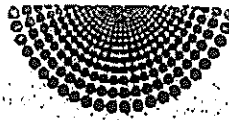
Should you also wish to discuss any aspect of this letter, please do not hesitate to contact Ben as above.

Yours sincerely,

Xstrata Mangoola Pty Limited

Scott Elliott

Project Manager



Culturally Aware

ABN: 75 379 659 080

Att: Mr. Scott Elliott
Project Manager
Xstrata Mangoolah Pty Ltd
Po Box 495, Muswellbrook 2333

**Re: Changes to Modifications to Aboriginal Cultural Heritage and
Archaeological Assessment**

To Whom It May Concern:

I have read the proposed changes to the Report for the above Project area and
Heritage Assessment.

Culturally Aware has no issues with the proposed Recommendations of the Report
that your Company has proposed for this area of Assessment and would like to be
consulted in regards to any future Field work that may arise in the near future.

Culturally aware is familiar with the Cultural Landscape of this area and its
surrounding cultural sites recorded and Un recorded.

Yours Sincerely
Tracey Skene
Culturally Aware

7 Crawford Place , Millfield NSW 2325

Phone/Fax 49980053 • Mob: 0458983941
Email: anigunya@hotmail.com

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ABN 33 251 730 169



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

Scott Elliot
Project Manager
Xstrata Mangoola Pty Ltd
P.O. Box 495
Muswellbrook NSW 2333

Re: Request for Comment Regarding Changes to modifications to ACH and AA – Proposed Relocation of Electricity Transmission Line Mangoola Coal.

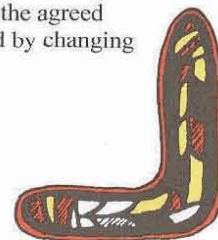
Dear Scott,

At the 5th 6 monthly meeting (held 28th October 2010) between Xstrata and the Aboriginal Stakeholders, it was implied by Umwelt staff that by our previous comments to the above ACH and AA we had already endorsed the proposed modification to the ACHMP approved on 2nd Jan 2009 to include impacts by this relocation. THIS IS NOT TRUE. Our position has been and remains there is to be No Change to the ACHMP as approved 2nd Jan 2009.

So before commenting on the above ACH and AA, we would like it made very clear, we DO NOT concur, endorse or agree to or with any activity or action that requires modification to the ACHMP as approved on the 2nd Jan 2009. This letter is not to be seen as an endorsement or concurrence to any proposed changes to the ACHMP as approved on the 2nd Jan 2009.

In 2009 after the ACHMP was approved, when WLALC suggested a need to modify some of the methodologies and protection zones in the ACHMP based on findings during excavations, the Aboriginal Community was informed by Xstrata and Umwelt staff that once an ACHMP was approved it could not be changed. So unless you wish to admit they lied to our community and make a public apology we expect you to stand by your employee's claims. The only occasion where we would endorse a change at this time would be if it were to include an increase in size (of at least 50 meters) to the protection zone around Anvil Hill.

With a slight shifting of the proposed route so it does not impact on the Conservation zones and instead of crossing the Conservation zone reconnecting with the existing transmission line where it already crosses the area will alleviate any unnecessary impacts on the agreed conservation zones while still achieving almost all of the cost benefits identified by changing its location without any major increase in the cost of relocation.



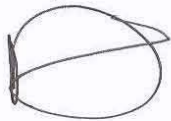
To comment on the changes proposed to the ACH and AA we do not concur with or agree to any activity that impacts Aboriginal Culture and Heritage outside of the approved disturbance area unless an acceptable Cultural or Socio Economic offset of similar or greater value and size is given to the local Aboriginal Community. To date, we have seen no offset offered of similar or greater value.

If such an acceptable offset is negotiated then we would also like to see that the methodology include the ability to be modified if deemed necessary by the Aboriginal Stakeholders to be expanded to include further research at Xstrata Mangoola Coal's expense based on the findings of the investigations.

This change will also need to be reflected in the "Assessment Objective" to include broader research in to the activities and uses of the area, not just community cultural values and rehearsed opinions of the consultants.

Thank you for this opportunity to comment

Yours truly

A handwritten signature in black ink, appearing to be 'Noel Downs', written over a circular stamp or seal.

Noel Downs
CEO

28. 10. 2010

On behalf of the 3000 Aboriginal community members who live in the boundaries of the Wanaruah Local Aboriginal Land Council and who have chosen not to represent themselves as an individual stakeholder.



2nd December 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 Request for Comment Regarding Changes to modifications to ACH and AA – Proposed Relocation of Electricity Transmission Line Mangoola Coal (dated 28 October 2010)

Thank you very much for taking the time to provide additional comment regarding the above project. Based on the information provided in the letter dated 28 October 2010 and verbal comments provided by Noel Downs at the fifth six-monthly stakeholder meeting at Mangoola on the same date, there appears to be a level of misunderstanding/miscommunication regarding the current project and previous cultural heritage works undertaken in association with Mangoola Coal. We would like to take this opportunity to explore and clear up as much of the misunderstandings/misconceptions as possible.

Your correspondence states that the Aboriginal community has previously been told by representatives of Mangoola Coal and archaeologists from Umwelt that it is not possible to modify the Mangoola Coal Aboriginal Cultural Heritage Management Plan (ACHMP). It is understood that this relates to discussions about altering the research design and methodology for salvage works at the AC13 site within the approved project disturbance boundary. It should be noted that the discussions at that time were actually about the Project Approval and not the ACHMP. The discussions with some Aboriginal participants in the subsurface testing and salvage of the AC13 site arose as some participants wanted to undertake excavations outside what was approved. Please note that these conversations related to excavating in locations outside those identified in the research design and methodology and not to the continuation of the final excavation. In this regard Mangoola Coal funded additional days of excavation beyond that required under the approval. Mangoola Coal was able to do this as it was not a compliance issue. Mangoola Coal also agreed to fencing this excavation area and allowing any interested Aboriginal stakeholders the opportunity to continue this particular excavation (in a non-paid context) if that was their desire. No Aboriginal stakeholders chose to take advantage of this offer.

It is important to note that the research design and methodology for the Mangoola Coal salvage works was determined in consultation with the relevant Aboriginal stakeholders (including the Wanaruah Local Aboriginal Land Council) as part of the Anvil Hill Environmental Assessment and the approved Anvil Hill (now Mangoola Coal) Aboriginal Cultural Heritage Management Plan. In accordance with the Environmental Planning and Assessment Act 1979 and the associated

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SAFECOAL

Conditions of Approval and Statement of Commitments, Mangoola Coal was required to undertake these salvage works in accordance with the approved research design and methodology. Non-compliance with this methodology would have placed Mangoola Coal, the archaeologists and the Aboriginal stakeholders participating in the salvage in breach of the Conditions of Approval. Variation to the methodology would have required modification of the Conditions of Approval. At the time of discussions with the Aboriginal stakeholders regarding the request to change the research design and methodology, the stakeholder representatives were told that all salvage works must be undertaken in accordance with the relevant approval. Discussions were not held in relation to modifying the Conditions of Approval as this was not feasible for Mangoola Coal in view of the timetable for commencement of infrastructure construction in the AC13 site area. At no time was it stated that the ACHMP could not be changed but rather that to do so would require a modification of approvals subject to review by the Department of Planning and Department of Environment, Climate Change and Water (DECCW). It is in fact a Condition of Approval that the ACHMP is subject to review and revision over the life of the mine. Mangoola Coal believe that is an accurate account of the information discussed with Aboriginal stakeholder representatives by both Mangoola Coal representatives and the relevant archaeologists, but we are happy to discuss further if you require any further clarification.

A lesson that should be learned by all parties from the issues that arose during the AC13 subsurface testing and salvage is that everyone involved in the preparation of the research design and methodology should be clear that once approved it becomes a non-compliance issue to do works outside the parameters of what has been approved and time constraints will rarely mean it will be feasible to have the Conditions of Approval modified. Therefore, Aboriginal stakeholders when discussing and reviewing research design and methodologies should ensure that they are fully informed and that they take the opportunity to provide advice and guidance.

Correspondence from Wanaruah Local Aboriginal Land Council in response to Mangoola Coal's request for comment on the draft Aboriginal Cultural Heritage and Archaeological Assessment – Proposed Relocation of Electricity Transmission Line, Mangoola Coal includes correspondence from the Wanaruah Local Aboriginal Land Council (dated 11 March 2010) stated that 'the only suitable 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.' The other potential offset option considered in the letter from Wanaruah Local Aboriginal Land Council dated 11 March 2010 was the funding of a culturally appropriate project and it was suggested that this should be discussed further at an Aboriginal stakeholder's workshop, facilitated and funded by Mangoola Coal. The more recent correspondence indicates that this is no longer the case in that the Wanaruah Local Aboriginal Land Council considers that the only suitable offset for impacts associated with the proposed 500kV electricity transmission line would be an extension to the Anvil Hill Aboriginal Cultural Heritage Offset Area. As discussed by Noel Downs, this suggestion was previously raised at the meeting on 18 June 2009 regarding the proposed survey strategy for the project, at which time Jane Yelland (then Health, Safety, Environment and Community Manager, Mangoola Coal) indicated that Mangoola Coal were not considering an increase in the size of the Anvil Hill Aboriginal Cultural Heritage Offset Area. This is primarily because all aspects of mine planning have been developed and initiated on the basis of the current size of the Anvil Hill Aboriginal Cultural Heritage Offset Area and alterations to mine planning of the scale necessary to allow expansion of this offset is not feasible at this stage of the process.

The letter from Wanaruah Local Aboriginal Land Council dated 28 October 2010 also suggests that Mangoola Coal consider altering the proposed route of the relocated 500kV electricity transmission line so that it does not impact on the existing offset areas. This option is not considered possible as the preferred route for the relocated ETL has been chosen to minimise

the impact on the environment and with consideration of the approved project disturbance area. The considerations used in determining the preferred route included:

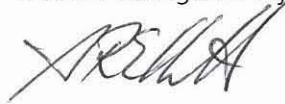
- situating the relocated ETL on the eastern side of Wallaby Rocks to effectively shield the relocated ETL for the majority of its route by either the natural landform on the south and western side, or by the mine itself when viewed from the north;
- keeping a majority of the relocated ETL (5.8 kilometres) within the approved project disturbance area, meaning that this area is already approved to be cleared and there are no additional ground disturbance related impacts from the currently approved project;
- undertaking a due diligence process prior to selection of tower locations outside the approved project disturbance area, to minimise impacts on archaeological sites and ecological species and communities; and
- siting two towers either side of the Big Flat Creek portion of the Conservation Offset Area to minimise potential impacts to this area. In addition, construction and associated activities will utilise existing access tracks to minimise vegetation clearance and ground disturbance..

As discussed in the Aboriginal stakeholder meeting on 28 October 2010, Mangoola Coal acknowledges and respects the perspectives of the Aboriginal stakeholders and, where possible, attempts to take Aboriginal cultural perspectives into account. Based on the opinions expressed by the majority of Aboriginal stakeholder representatives at this meeting, Mangoola Coal is willing to commit to the establishment of a suitable culturally appropriate offset to be determined on the basis of additional consultation with the relevant Aboriginal stakeholders as part of the Mangoola Coal biannual stakeholder meeting scheduled for February 2011. We look forward to further developing our working relationship with Wanaruah Local Aboriginal Land Council as part of this process.

If you require any further clarification, please contact our Ben de Somer on 65495510.

Yours sincerely,

Xstrata Mangoola Pty Limited



Scott Elliott

Project Manager

APPENDIX B

Effective Coverage Table

Transect	Discrete exp #	Landform	E (MGA)	N (MGA)	Length (m)	Width (m)	Area (m2)	Vis (%)	Effective coverage discrete areas (m2)	Type of exposure	Associated sites
	1	1 Flat	286162	6421916	30	10	300	70	210	Gullying - artificial associated with grazing	
	1	2 Drainage Line	285653	6421843	70	15	1050	80	840	Gullying - section of former tributary of Sandy Creek	
	1	3 Drainage Line	285507	6421833	70	14	980	70	686	Gullying - section of former tributary of Sandy Creek	
TOTAL (1)							2330		1736		
	2	1 Slope	284824	6421823	70	3	210	30	63	Vehicle track	
	2	2 Drainage Line	284439	6421814	70	40	2800	20	560	Gullying and sheetwash associated with dam construction	SC56
	2	3 Slope	284188	6421750	70	50	3500	20	700	Sheetwash on slope	
	2	4 Slope (lower)	283824	6421752	60	30	1800	20	360	Sheetwash on slope	
TOTAL (2)							8310		1683		
	3	1 Drainage Line	283710	6421728	70	20	1400	60	840	Bank collapse and gullying along minor drainage line	
	3	2 Slope (lower)	283664	6421712	40	35	1400	80	1120	Sheetwash erosion on small section of lower slope between 2 minor drainage lines	SC57
	3	3 Drainage Line	283574	6421728	20	10	200	30	60	Sheetwash erosion on bank of vegetated minor drainage	
	3	4 Drainage Line			60	40	2400	40	960	Sheetwash erosion on bank of vegetated minor drainage	
	3	5 Slope	280470	6423481	30	8	240	60	144	Ant bed with sheetwash erosion in surrounds	
	3	6 Drainage Line			70	40	2800	40	1120	Sheetwash erosion on bank of vegetated minor drainage	
	3	7 Drainage Line	283171	6421719	70	30	2100	30	630	Gullying and sheetwash along minor drainage	
	3	8 Slope (lower)			70	3	210	80	168	Vehicle track with sheetwash bordering minor drainage	
	3	9 Slope			10	15	150	90	135	Ant bed with sheetwash erosion in surrounds	
TOTAL (3)							10900		5177		
	4	1 Slope (mid)	279666	6427937	5	2	10	90	9	Animal burrow	
	4	2 Slope (lower)	279743	6427862	35	15	525	40	210	Dam bank affected by sheetwash erosion	BFC69
	4	3 Slope (lower)	279730	6427847	70	5	350	70	245	Access track and ant bed with associated sheetwash erosion	BFC70
	4 4a	Slope (lower)			60	1	60	80	48	Lap zone surrounding dam	
	4 4b	Slope (lower)			60	9	540	10	54	Dam bank affected by sheetwash erosion	
	4	5 Slope (lower)			20	10	200	60	120	Sheetwash within area of ironbark regrowth	
	4	6 Slope (lower)			40	30	1200	40	480	Animal burrows	
	4 7a	Slope (lower)	279857	6427152	80	10	800	80	640	Lap zone surrounding dam	
	4 7b	Slope (lower)	279857	6427152	80	20	1600	40	640	Dam bank affected by sheetwash erosion	BFC71
	4	8 Slope (lower)	279864	6427013	30	10	300	60	180	Animal burrows	
TOTAL (4)							5585		2626		
	5	1 Drainage Line	279851	6426385	35	10	350	80	280	Area of sheetwash erosion bordering minor channel BFC	BFC72 (locus 1)
	5 2a	Drainage Line			8	2	16	10	1.6	Ant bed with redeposited fine gravel obscuring visibility	
	5 2b	Drainage Line			8	3	24	90	21.6	Area surrounding ant bed (above)	BFC72 (locus 2)
	5	3 Drainage Line	279895	6426371	20	8	160	50	80	Area of gully erosion and bank collapse within minor channel BFC	
	5	4 Bar/flood deposit?	279888	6426350	20	30	600	60	360	Sheetwash erosion on area of deposit between 2 channels BFC	
	5	5 Drainage Line	279880	6426323	70	15	1050	50	525	Area of gully erosion and bank collapse on banks of main channel BFC	
	5	6 Slope (lower)	279898	6426219	60	60	3600	40	1440	Ant bed and sheetwash erosion	BFC73
TOTAL (5)							5800		2708.2		
	6	1 Drainage Line			20	10	200	10	20	Gully erosion	
	6	2 Drainage Line			30	25	750	60	450	Dam bank affected by sheetwash erosion	
	6	3 Drainage Line			90	20	1800	70	1260	Dam bank affected by sheetwash erosion	
	6	4 Drainage Line			60	40	2400	70	1680	Minor gullying and sheetwash erosion on drainage connecting dams	
	6	5 Drainage Line			50	20	1000	90	900	Dam bank affected by gullying and sheetwash erosion	BFC75
	6	6 Drainage Line			10	5	50	70	35	Sheetwash erosion on drainage	
	6	7 Drainage Line			30	20	600	30	180	Gullying and sheetwash erosion on banks of vegetated drainage	
	6	8 Drainage Line			60	8	480	40	192	Sheetwash erosion on drainage	
	6	9 Drainage Line			40	15	600	30	180	Sheetwash erosion on drainage connecting dams	
	6 10a	Drainage Line			60	5	300	80	240	Lap zone surrounding dam	
	6 10b	Drainage Line			30	15	450	80	360	Dam bank affected by sheetwash erosion	
	6	11 Drainage Line			50	20	1000	70	700	Sheetwash erosion on drainage connecting dams	BFC76
	6	12 Drainage Line			10	8	80	50	40	Sheetwash erosion on drainage	

Transect	Discrete exp #	Landform	E (MGA)	N (MGA)	Length (m)	Width (m)	Area (m2)	Vis (%)	Effective coverage discrete areas (m2)	Type of exposure	Associated sites
	6	13 Drainage Line			80	40	3200	70	2240	Minor gullying and sheetwash erosion on drainage	
	6	14 Drainage Line			20	25	500	60	300	Moderate-severe gullying and severe sheetwash on drainage	
	6	15 Drainage Line			60	15	900	60	540	Minor gullying and sheetwash on drainage	
	6	16 Drainage Line			60	5	300	40	120	Minor gullying and sheetwash on drainage	
	6	17 Drainage Line			20	10	200	80	160	Sheetwash erosion associated with fence and gate	
	6	18 Drainage Line			30	5	150	80	120	Bank collapse and gullying along minor drainage line	
	6	19 Drainage Line			35	15	525	60	315	Ant bed and sheetwash erosion	BFC77
	6	20 Drainage line			60	15	900	80	720	Dam bank affected by sheetwash erosion	BFC79
TOTAL (6)							16385		10752		
	7	1 Drainage line			10	2	20	40	8	Sheetwash erosion on drainage	BFC80
	7	2 Drainage line			15	4	60	40	24	Sheetwash erosion on drainage	
	7	3 Drainage line			60	15	900	80	720	Dam bank affected by sheetwash erosion	
	7	4 Drainage line			30	5	150	80	120	Sheetwash erosion on drainage	
	7	5 Drainage line			30	8	240	80	192	Sheetwash erosion on contour bank	BFC81
	7	6 Drainage line			15	4	60	60	36	Excavation of section of contour bank	
	7	7 Drainage line			30	15	450	70	315	Sheetwash erosion on drainage	BFC82
	7	8 Drainage line			20	5	100	80	80	Ant bed and sheetwash erosion	
	7	9 Drainage line			70	4	280	80	224	Dam bank affected by sheetwash erosion and ant bed	BFC84
	7	10 Drainage line			90	10	900	90	810	Dam bank affected by sheetwash erosion	BFC85
	7	11 Drainage line			60	5	300	70	210	Sheetwash erosion on contour bank and dam	
	7	12 Drainage line			40	20	800	50	400	Sheetwash erosion on drainage	
	7	13 Drainage line			100	20	2000	60	1200	Sheetwash erosion on drainage	
	7	14 Drainage line			20	20	400	20	80	Sheetwash erosion and deposition	
TOTAL (7)							6660		4419		
	8	1 Drainage line			20	4	80	30	24	Gully head erosion ast start of drainage	
	8	2 Drainage line			40	3	120	80	96	Vehicle track with sheetwash bordering minor drainage	
	8	3 Drainage line			20	4	80	70	56	Gully erosion along drainage leading to dam	
	8	4 Drainage line			60	7	420	50	210	Dam bank affected by sheetwash erosion	
	8	5 Drainage line			70	10	700	40	280	Disused vehicle track with sheetwash bordering minor drainage	
	8	6 Drainage line			30	3	90	80	72	Disused vehicle track with gullying and sheetwash bordering minor drainage	
	8	7 Drainage line			30	15	450	50	225	Gully erosion on drainage between access track and dam	
	8	8 Drainage line			50	10	500	40	200	Dam bank affected by sheetwash erosion	
	8	9 Drainage line			60	20	1200	50	600	Contour bank affected by sheetwash erosion	
	8	10 Drainage line			100	15	1500	80	1200	Gullying and sheetwash erosion on drainage leading to dam	
	8	11 Drainage line			100	25	2500	80	2000	Sheetwash erosion on drainage leading to dam	
	8	12 Drainage line			80	20	1600	80	1280	Dam bank affected by sheetwash erosion	
	8	13 Drainage line			40	30	1200	80	960	Sheetwash erosion adjacent to dam	
TOTAL (8)							10440		7203		
	9	1 Slope (lower)			50	10	500	70	350	Sheetwash erosion adjacent to dam	
	9	2 Slope (lower)			100	3	300	70	210	Vehicle track with sheetwash	
TOTAL (9)							800		560		
	10	1 Slope (upper)			1	1	1	70	0.7	Disused vehicle access track	
TOTAL (10)							1		0.7		
	11	1 Drainage Line			30	15	450	40	180	Access track (leading to dam) affected by sheetwash erosion	BFC49 (not found)
	11	2 Drainage Line			50	10	500	80	400	Lap zone surrounding dam	
	11	3 Drainage Line			10	5	50	60	30	Sheetwash erosion on drainage	
	11	4 Drainage Line			15	4	60	50	30	Bank collapse and gullying along minor drainage line	
	11	5 Drainage Line			10	3	30	60	18	Gullying on banks of drainage	
	11	6 Drainage Line			20	10	200	50	100	Sheetwash adjacent to Exp 5	
	11	7 Drainage Line			60	8	480	90	432	Lap zone surrounding dam	
	11	8 Drainage Line			25	5	125	70	87.5	Dam bank affected by sheetwash erosion	
	11	9 Drainage Line			10	8	80	70	56	Dam bank affected by sheetwash erosion	

Transect	Discrete exp #	Landform	E (MGA)	N (MGA)	Length (m)	Width (m)	Area (m2)	Vis (%)	Effective coverage discrete areas (m2)	Type of exposure	Associated sites
	11	10 Drainage Line			30	20	600	60	360	Dam bank affected by sheetwash erosion	
	11	11 Drainage Line			30	4	120	60	72	Gullying on banks of drainage	
	11	12 Drainage Line			1	1	1	80	0.8	Sheetwash erosion on drainage banks	BFC86 (locus 1)
	11	13 Drainage Line			40	10	400	60	240	Gullying and sheetwash erosion bordering drainage	BFC86 (locus 2)
	11	14 Drainage Line			15	3	45	40	18	Gullying and sheetwash erosion bordering drainage	
	11	15 Drainage Line			35	3	105	80	84	Lap zone surrounding dam	
	11	16 Drainage Line			30	5	150	60	90	Dam bank affected by sheetwash erosion	
	11	17 Drainage Line			30	5	150	60	90	Gullying and sheetwash erosion on drainage below dam	
	11	18 Drainage Line			30	2	60	40	24	Sheetwash erosion on drainage below dam	
TOTAL (11)							3606		2312.3		
	12	1 Slope (lower)			30	10	300	40	120	Sheetwash erosion adjacent to fence	
TOTAL (12)							300		120		
	13	1 Drainage Line			35	5	175	60	105	Gullying and sheetwash erosion on drainage	
	13	2 Drainage Line			10	5	50	40	20	Sheetwash erosion on drainage	
	13	3 Drainage Line			20	5	100	50	50	Gullying and sheetwash erosion on drainage	
	13	4 Drainage Line			30	5	150	30	45	Sheetwash erosion on drainage	
TOTAL (13)							475		220		
	14	1 Slope (upper)			20	20	400	30	120	Sheetwash erosion adjacent to fence and gate	
TOTAL (14)							400		120		
	15	1 Drainage Line			1	1	1	70	0.7	Sheetwash erosion on drainage	
	15	2 Drainage Line			60	3	180	30	54	Gullying and sheetwash erosion on drainage	
	15	3 Drainage Line			60	3	180	30	54	Gullying and sheetwash erosion on drainage	
	15	4 Drainage Line			40	15	600	60	360	Disused access track and area of soil removal	
TOTAL (15)							961		468.7		
	16	1 Slope (upper)			242	3	726	70	508.2		
	16	2 Crest			181.5	3	544.5	70	381.15		
TOTAL (16)							1270.5		889.35		
	17	1 Slope			10	5	50	40	20	Sheetwash erosion adjacent to Limvardy Rd	
	17	2 Slope			1	1	1	90	0.9	Ant bed	
	17	3 Crest			50	3	150	40	60	Sheetwash erosion on former vehicle track	
	17	4 Slope (mid)			60	5	300	20	60	Vehicle track and associated sheetwash	
	17	5 Slope (mid)			60	5	300	90	270	Vehicle track and associated sheetwash	
	17	6 Slope (lower)			70	5	350	90	315	Graded access track	
TOTAL (17)							1151		725.9		
	18	1 Drainage Line			2	15	30	40	12	Heavy vehicle (bulldozer?) tracks crossing drainage	
TOTAL (18)							30		12		
	19	1 Slope (lower)			70	5	350	80	280	Graded access track	
TOTAL (19)							350		280		
	20	1 Drainage Line			15	10	150	40	60	Sheetwash erosion on drainage	
	20	2 Drainage Line			15	5	75	50	37.5	Gullying and bank collapse on drainage	
	20	3 Drainage Line			30	20	600	30	180	Gullying on drainage	
TOTAL (20)							825		277.5		
	21	1 Spur			20	3	60	30	18	Access track and associated sheetwash erosion	
	21	2 Spur			800	5	4000	80	3200	Access track and associated sheetwash erosion	
	21	3 Spur			40	5	200	70	140	Contour bank affected by sheetwash erosion	
	21	4 Slope			50	5	250	40	100	Dam bank affected by sheetwash erosion	
	21	5 Slope			30	5	150	80	120	Access track and associated sheetwash erosion	
TOTAL (21)							4660		3578		

APPENDIX C

Arboricultural Assessment Report

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 Mangoola 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, Mangoola 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.

4.0 TREE ASSESSMENT

4.1 Assessment of Tree/s – Tree 1 / BFC88

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. %	WMZ Age, Vigour, Condition / Index Rating App A.
1 / BFC88 <i>Eucalyptus moluccana</i> Roxb. Grey Box	1. M 2. 80 - <150 3. 50 - <75	F	D	15 18x10 N/S	700 R	90 90	MGVF - 9

<u>Description</u>

Open grown tree situated in intermittent stream, has lost apical meristem, crown symmetrical, contains high volume large deadwood throughout with wound form surveyor's blaze on lower trunk to W.

Wound 1

Wound elliptical, containing an approximately gothic window shape as a surveyor's blaze where wound has died back proximally towards root crown as a consequence of wounding. Wound extending from 750 – 2000 mm and 450 mm at widest at base. Wound face extending from 750 – 1540 mm and 270 mm at widest at 1200 mm. Margins entire, apex rounded and base truncate. Wound margin depth: right 70 mm and left 40 mm. Wound face entire to dead heartwood with most sapwood sloughed away, no carved letters or numerals evident. A stepped incision was evident at 750 mm, 275 mm high, 200 mm wide at base and 45 mm deep (Photographs 1.1 and 1.2). Steel axe or chisel incisions in remaining sapwood near the apex and protected from weathering. One each adjacent to right and left margin, 30 mm from apex and 90 mm long and 35 mm and 50 mm long, respectively.

This wound is expected to have affected approximately 10% of trunk circumference *in situ* and be 50 - <75 years old approximately. The shape of the wound and stepped incision are indicative of a surveyor's blaze. Therefore it is likely that the wound is of historical origin.

Risks to tree

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



Photograph 1.0

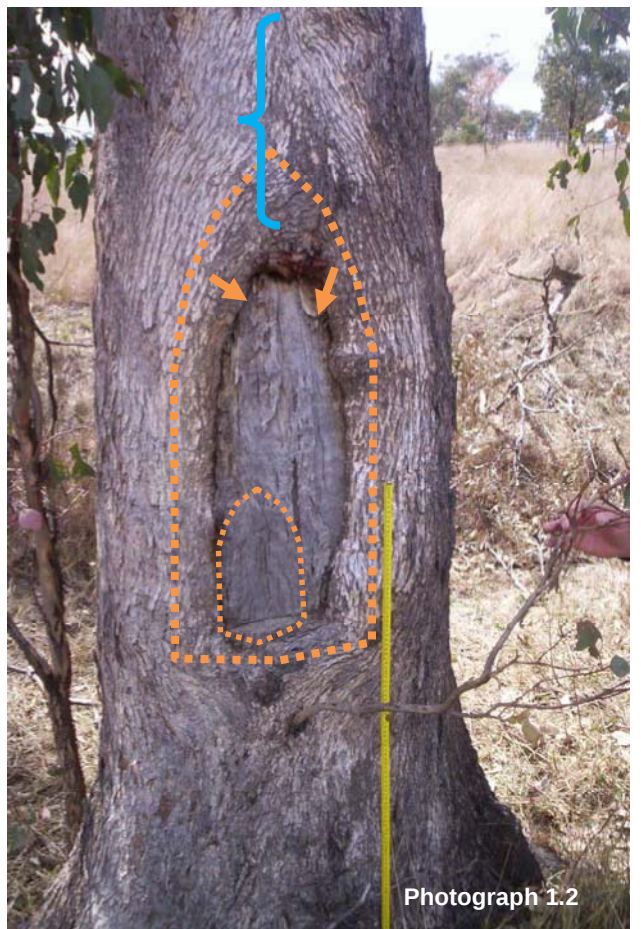
Photograph 1.0 View to east of Tree 1 / BFC88 *Eucalyptus moluccana* Roxb. – Grey Box, with wound on lower trunk from surveyor's blaze indicated by arrow.

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.

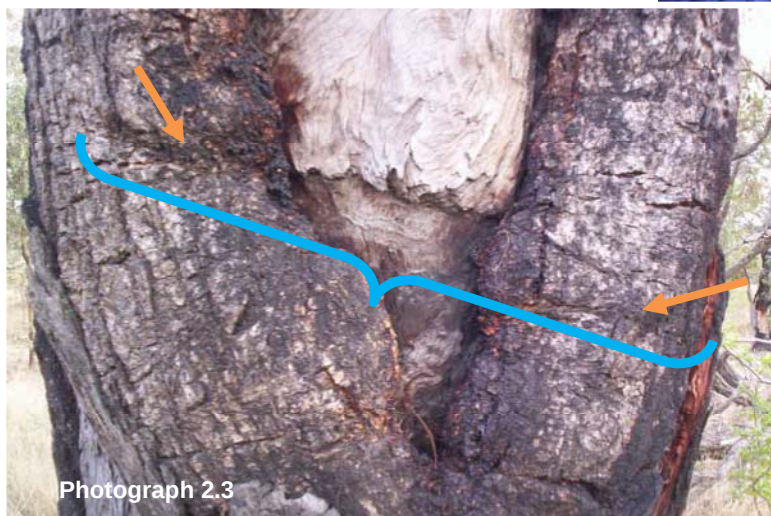
This wound is expected to have affected approximately 10 - 15% of branch circumference *in situ*. The wound is expected to be >40 - <75 years old as the exposed heartwood shows minimal signs of weathering as delignification and cracking. The sapwood while up to 20 mm wide (Bootle 1983, p. 289) appears 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\$ewh\$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 Zepi\$ 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 Zepi\$ 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 Zepi\$ 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 Zepi\$ 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 Zepi\$ 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 Zepi\$ 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 Zepi\$4\$ Retention potential - Medium - Long Term.	Mhi Zepi\$ Retention potential - Medium Term. Potential for longer with improved growing conditions.	Mhi Zepi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi Zepi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi Zepi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi Zepi\$ Retention potential - Likely to be removed immediately or retained for Short Term.
Over-mature (O)	Mhi Zepi\$ Retention potential - Medium - Long Term.	Mhi Zepi\$ Retention potential - Medium Term.	Mhi Zepi\$ Retention potential - Short Term.	Mhi Zepi\$ Retention potential - Short Term. Potential for longer with improved growing conditions.	Mhi Zepi\$ Retention potential - Short Term.	Mhi Zepi\$ 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.

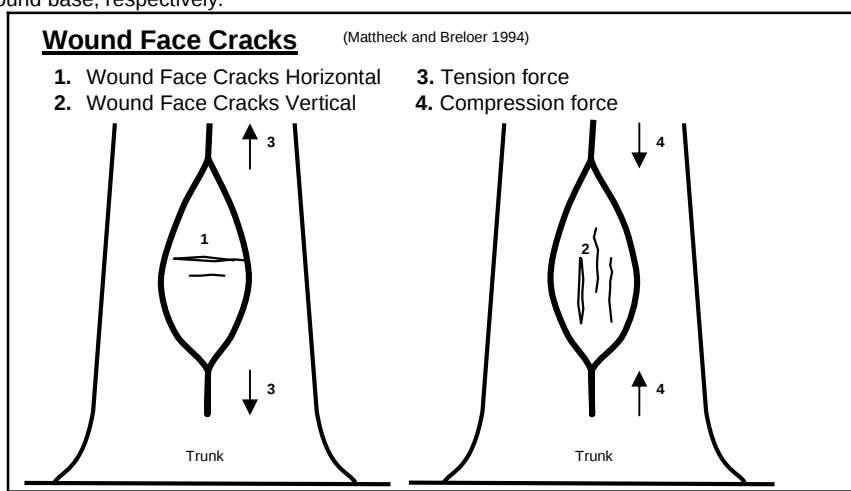
Wound Margin The left and right sides of a *wound* as bound by the alignment of fibres along a stem or root longitudinally, being either the remaining undamaged living cells and new *callus wood* and *wound wood* on older wounds. Here the fibres are usually formed from *meristematic* cells. A wound margin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



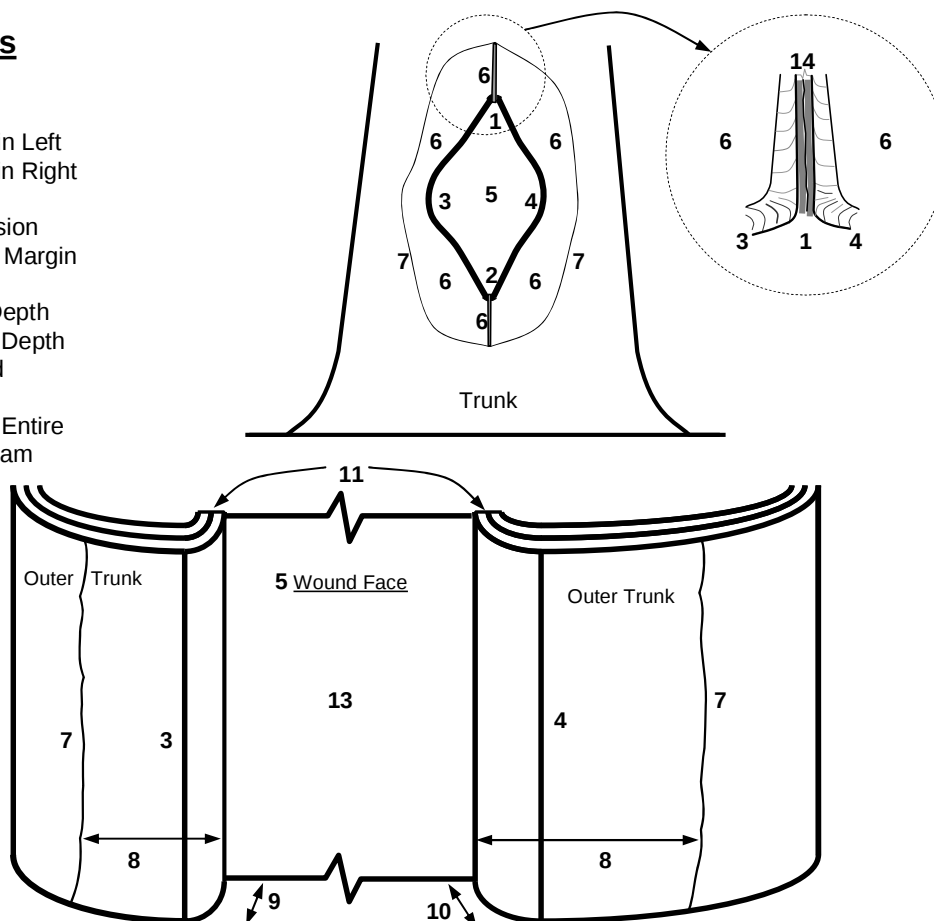
Wound Margin Width Distance from *wound margin* to the site of initial wounding. Where evident the *initial wound margin* may be identified by discoloured bark or bark of a different texture to adjacent undamaged trunk. This may also assist in determining the age of a wound.

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

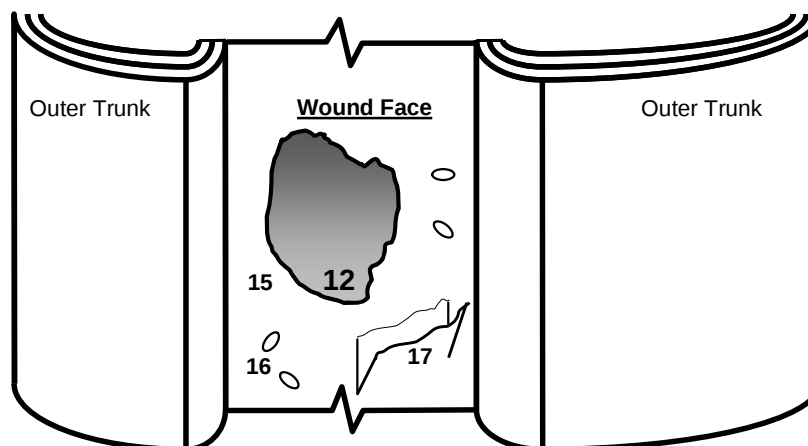


Examples of other Wound Faces

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

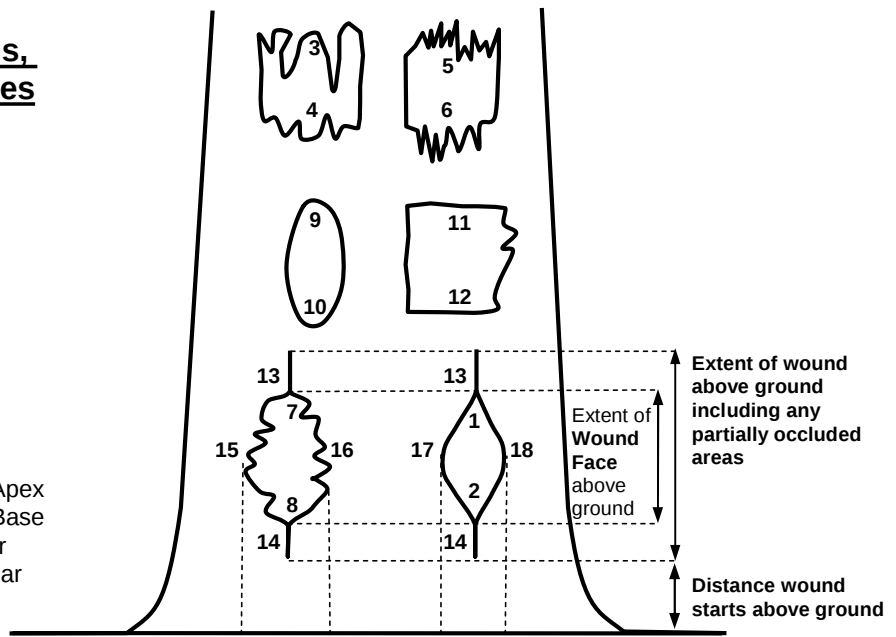
16. Oval shaped borer exit holes evident indicative of Longicorn Borer (Family Cerambycidae).

17. Linear laceration as made by an axe.



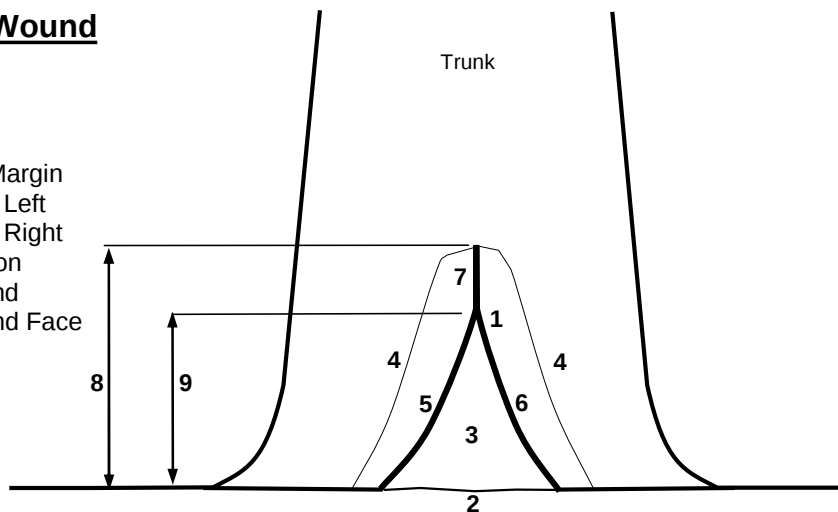
Wounds, Margins, Apexes and Bases

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



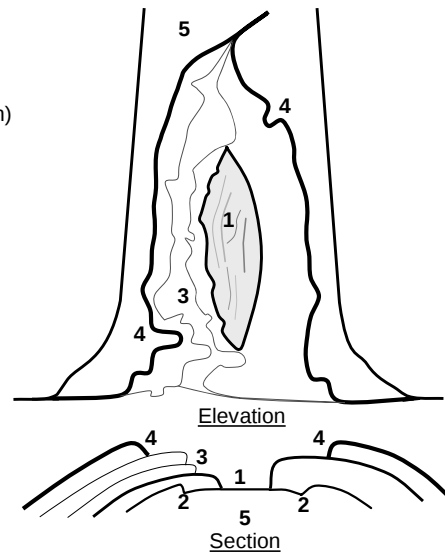
Basal Trunk Wound

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



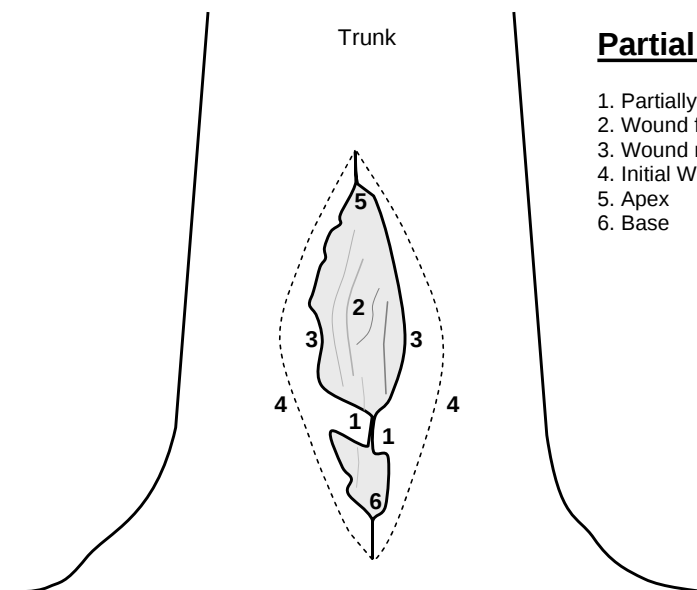
Successional Wound

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.

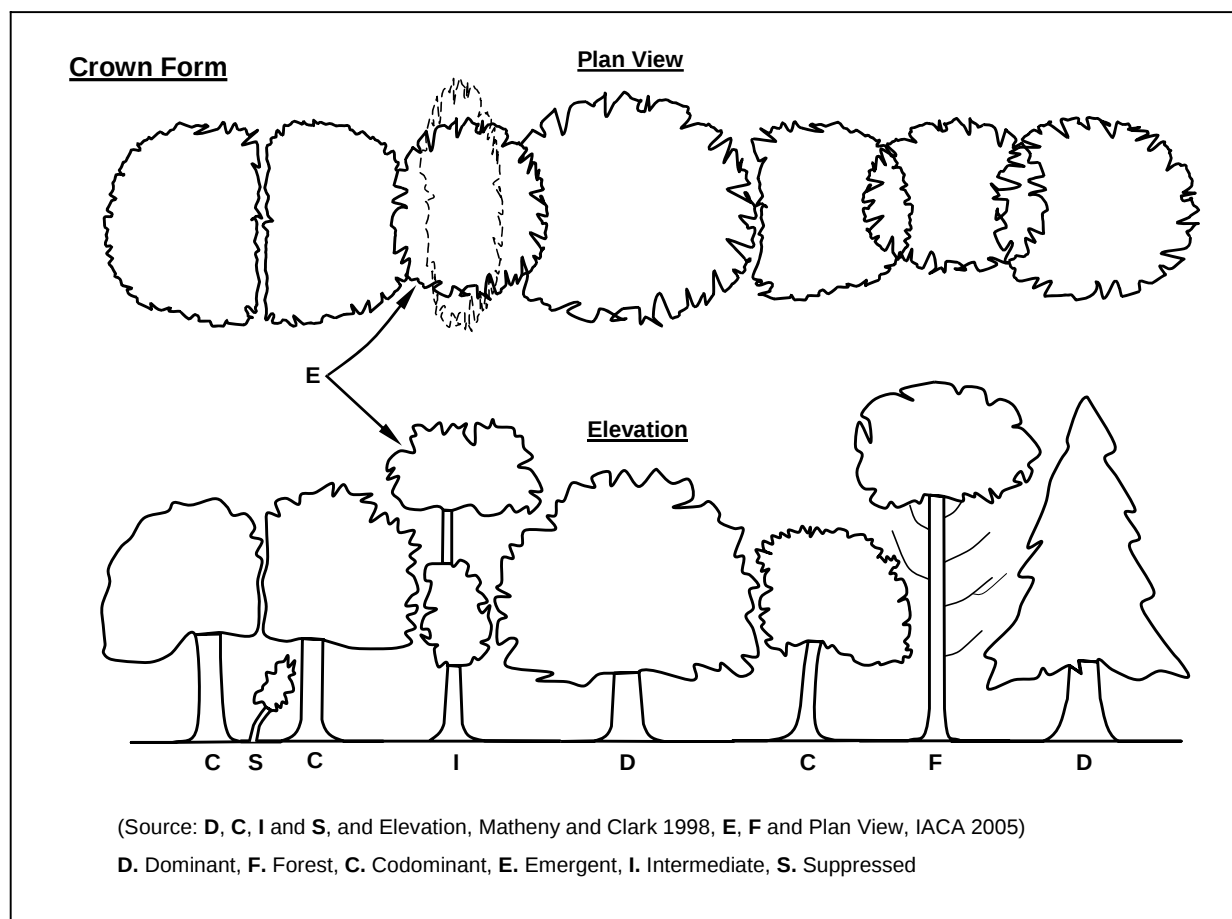
Sustainable Retention Index Value (SRIV) A visual tree assessment method to determine a qualitative and numerical rating for the viability of urban trees for development sites and management purposes, based on general tree and landscape assessment criteria using classes of *age*, *condition* and *vigour*. 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.