Centennial Hunter Pty Limited

ANVIL HILL PROJECT

environmental assessment

VOLUME 7 - APPENDICES 13b - 17

Umwelt
Environmental Consultants

AUGUST 2006

Volume 7

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Aboriginal Archaeological Assessment

Anvil Hill Project

Part B

Part A of the Anvil Hill Project Aboriginal Archaeological Assessment is located in Volume 6 of the Environmental Assessment

APPENDIX 8

Comments from the Aboriginal Community regarding review of draft Aboriginal Assessment

Giwiirr

Rodney Matthews
8 Fitzgerald ave
Muswellbrook N.S.W 2333

Ph: 65410506
Fax: 65410751
Mobile: 0421434590
ABN: 90505477543

2nd June 2006

Attention: Jan Wilson- Aboriginal Archaeology Manager

Reference: **Anvil Hill Project**

Dear Jan

Giwiirr Consultants have read the draft on the above project we would like to put forward and in support of a (**section 90**) to carry out a surface collection for these sites .

1. **Anvil Hill**
2. **Big Flat Creek**
3. **Clarks Gully**
4. **Sandy Creek**
5. **Grader Scrapes & excavation on site AC13**

We look forward to working with you on this project

Regards

Rodney Matthews
Manager
Giwiirr

Mingga Consultants

Clifford Matthews (Mick)
11 Coolibah Close
Muswellbrook
NSW 2333

PH:0431385573

Attention: Umwelt Australia

Regarding: Anvil Hill.

Jan,

We went for a bus tour to visit Anvil Hill on Thursday 11th May
What we thought of Anvil Hill would be a good place to do some
hand excavations, Test pits, and also some Grader scrapes on site A13.

Site sc10 would be a nice spot to Scatter the Artifacts so that people
can go and have a look at them.

Thank you

Clifford Matthews
M.C.

Upper Hunter Regional Library

126 Bridge Street
MUSWELLBROOK. NSW. 2333

Phone: 02 6543 1913
Fax: 02 6543 1325

FACSMILIE TRANSMITTAL SHEET

To: Jill **From: (Name)** BRIAN HORTON

Fax Number: 49505 737 **Date:** 1-6-06

If you have any enquiries in regard to this fax please call:-
Home Phone Number:

Total Number of Pages (including cover) 6.

Notes/ Comments:

Proforma for Aboriginal Stakeholder Group Comments – Anvil Hill Aboriginal Cultural Heritage Assessment

Apart from the sites located during the survey, are you aware of any cultural significance/values for the Anvil Hill Area (such as stories or mythological sites) that you would like to record as part of the Aboriginal cultural heritage assessment?

☐ Yes ☑ No

Comments: .....

The archaeological significance assessment of sites identified in the Proposed Disturbance Area and the Potential Offset Areas is discussed in Section 8 of the report and summarised in Table 8.3. How would your group assess the Aboriginal cultural heritage significance of these sites? (Attached is a table with all the sites listed - you may use this table to identify the significance of each of the sites if you wish.)

Comments: .....

The archaeological sensitivity assessment of the terrain units in the Proposed Disturbance Area and the Potential Offset Areas is discussed in Section 8 of the report and summarised in Table 8.5. How would your group assess the Aboriginal cultural heritage sensitivity of the terrain units within the Proposed Disturbance Area and the Potential Offset Areas? (Attached is a table with all the terrain units listed - you may use this table to identify the significance of each of the terrain units if you wish.)

Comments: .....

Do you have any other comments or general input you would like to provide regarding the cultural values of the Proposed Disturbance Area, the Potential Offset Areas and/or the identified sites?

☐ Yes ☑ No

Comments: .....

Is the proposed management strategy provided in Section 10 of the draft report and detailed in Table 10.1 a suitable strategy from an Aboriginal Cultural Heritage perspective?

☑ Yes ☐ No

Comments: .....

Is the Draft Research Design and Methodology for the salvage of the sites within the Proposed Disturbance Area detailed in Appendix 13 of the draft report suitable from an Aboriginal Cultural Heritage perspective?

☑ Yes ☐ No

Comments: .....

Do you think that the conservation of the 99 sites and the terrain units within the Potential Offset Areas will assist with compensating for the loss of the sites and terrain units within the Proposed Disturbance Area; if the sites within Proposed Disturbance Area are salvaged in the way discussed in Section 10 and Appendix 13 of the draft report?

☑ Yes ☐ No

Comments: .....

Due to a shortage of space for storage, the Australian Museum is presently not accepting artefact collections. In light of this, the DEC would prefer Aboriginal stakeholder groups agree to an alternative option for the ongoing care of the artefacts collected during salvage programs. If the Anvil Hill Project is approved, would your group prefer the artefacts salvaged go into the care of a specified group, or would you prefer to see them placed in the SC10 site (a site that will be easily accessed for teaching purposes and which is unlikely to be overgrown when stock are removed) or within another site/area within the Offset Areas following recording and analysis? Or, do you have another option for their care?

Comments: If the Anvil Hill Project is approved I would prefer the artefacts placed SC10 site for teaching purposes and place some artefacts at local [redacted] lands council.

Are there any other matters you would like discussed within the draft report or that you would like to discuss with us further before the report is finalised?

☑ Yes ☐ No

Comments: Not only sites we got to protect what about the wildlife, Trees, land, Plants and the air that we breath.

If you would like to discuss any matters relating to the provision of comments, or would like to provide verbal comment please call either Mary-Jean Sutton or Jan Wilson at Umwelt on 49505322.

Please post or fax ((02)4950 5737) your comments to
Mary-Jean Sutton or Jan Wilson
at Umwelt (Australia) Pty Limited
PO Box 838 Toronto NSW 2283
by close of business on 2 June 2006.

UNGOOROO
ABORIGINAL CORPORATION

PO Box 3095
Singleton N S W 2330
Ph 02 65 715111
Fax 02 65 715777

Mobile 0418 696 821
ABN: 64 020 872 467

For The Attention Of:
Jillian Ford Archeologist
Umwelt Australia Pty Ltd
2/20 the Boulevard
Toronto 2283 NSW

June 2, 2006

RE; ANVIL HILL PROJECT

Dear Jillian

Thank you for the report regarding the above project, we at Ungooroo Aboriginal Corporation singleton have reviewed the report extensively with the field worker.

We wish to bring to your attention the letter dated March 31 from W.A.N.C we state that Ungooroo Aboriginal Corporation is not a private enterprise as intimated in that letter.

Ungooroo Aboriginal Corporation is a registered Aboriginal corporation under the Aboriginal Corporations Act. Further more the parties nominated as members of W.A.N.C & W.L.A.L.C (Paget & Ward) have never made written application to become members of those organisations, and therefore they have no authority to speak or act on their behalf or any of the members of U.A.C.

We suggest you request a copy of the formal WRITTEN MEMBERSHIP APPLICATION FORM, SIGNED BY BOTH PARTIES TO CLARIFY THIS MISCONCEPTION.

Please find attached legal letter sent to NSW Native Title Services (attached)

As stated the project was attended by U.A.C, the area is of high importance to the Aboriginal community. (Culturally)

What we do wish to bring to the attention of Umwelt Australia Pty Ltd, and Centennial Coal is the omission regarding employment opportunities for Aboriginal people, that was discussed at the first meeting conducted regarding the project, to date no written response has been forthcoming from Centennial Coal.

As the survey was undertaken on a roster system due to the large number interested parties U.A.C will only concur on the area's that was undertaken by our field workers, on the 18 – 19 May 2006, and trust that the area's undertaken by other parties, was completed with diligence and professionalism.

We also agree that the areas nominated should have grader scrapes undertaken, as you are aware we do not rate Aboriginal Artefacts as high or low as we feel all Artefacts are of significance to the aboriginal community.
Not only as teaching aids, but also the connection to the Wanaruah people that walked the land, and utilised the materials given by mother earth.

We at Ungooroo Aboriginal Corporation therefore reluctantly, agree with the Anvil Hill report and have no objections to the project proceeding.

Yours

Graham Ward CEO

Smith Dunlop Lawyers

ATTACHMENT (1)

2 December 2003

Our Ref: DDW
Your Ref:

The Chief Executive Officer
National Native Title Services
PO Box 2105
STRAWBERRY HILLS NSW 2012

Attention: Mr Warren Mundine

Dear Sir,

Representation of Interests of the Wanaruah Descendants

We act for the Ungooroo Aboriginal Corporation and the members of the Wanaruah Families.

Our clients have grounds for certain concern that other organisations may be intentionally or unwittingly misrepresenting their interests. Many of the Wanaruah descendants are members and clients of Ungooroo Aboriginal Corporation.

The purpose of this letter is to inform you that we are instructed to advise you that no organisation, Aboriginal or Non-Aboriginal other than the Ungooroo Aboriginal Corporation is authorised to speak, represent, perform site work, or negotiate on behalf of the Wanaruah members of the Ungooroo Aboriginal Corporation.

The Wanaruah descendants are a separate and distinctive traditional group. We also advise that all matters relating to Wanaruah land, culture and the subsequent negotiations are to be conducted on their behalf by the Ungooroo Aboriginal Corporation.

Furthermore, Ungooroo Aboriginal Corporation does not give any authorisation to any other organisation or individuals to speak on behalf of it unless authorised in writing.

At present the Wanaruah descendants have authorised Mr Graham Ward who is the CEO of Ungooroo Aboriginal Corporation and he is vested with the powers to conduct negotiations relating to the interests of the Wanaruah descendants as well as their well being.

Any decisions or negotiations conducted by any other organisation to the exclusion of the Ungooroo Aboriginal Corporation would be open to re-negotiation or subsequent legal action to set aside matters which were decided in the absence of consultation with the Ungooroo Aboriginal Corporation.

Yours faithfully,
Smith Dunlop Lawyers

Denis A. Whiteman

P.3.

Upper Hunter Heritage Consultants

ABN: 47136930759

150 Sydney Street
Muswellbrook
NSW 2333
PH: 0265413532

MOBILE: 0422910898
EMAIL: UHHC@BIGPOND.COM

Attention: Umwelt Australia

Regarding: Anvil Hill project.

Mrs Jan Wilson,

We find Anvil Hill to be a signifigant place for our ansestors as they would have used the high ground that Anvill Hill provides as a place where they could oversee protentual threats approaching so they could warned the rest of thetribe on lower ground of any danger that may have been approaching. They could have alos used the high ground as a place where they could spot the best place to hunt for their food and the rock shelters would have provided them with shelter from rough weather.

There for i agree with any measures taking place to protect the rock shelters from any damage that may take place in the course of blasting and any other mining activities that could affectively damage or course these shelters to collapse.

We of Upper Hunter Heritage Consultants are against the destruction of any of our Culture and Heritage.
But we can't stand in the way of the future, so we would like to salvage what we can in this progress for future generations to look back and learn from.
U.H.H.C. Are pushing for the conservation of site SC10 as it holds a hugh site of over 300 artifacts, A site of this size holds great signifigance to the aboriginal community.

U.H.H.C.

Upper Hunter Heritage Consultants

ABN: 47136938783

150 Sydney Street
Muswellbrook
NSW 2333
PH: 0265413532

MOBILE: 0422910898
EMAIL: UHHC@BIGPOND.COM

Attention: Umwelt Australia

Regarding: Anvil Hill project. (continued p2)

U.H.H.C. Recommendations:

* Surface Collection on sites that are within the proposed impactarea of Anvil Creek Catchment.

- Tests pits on sited AC05, AC11-12,& AC37.

- On site AC13 we would like to see a series of Test pits, Hand excavations, & grader scrapes all along the chain of ponds.

* Surface Collections to be done at all sites within the Impact zone of Big Flat Creek Catchment.

- Test pits to be done on sites BFC30, & BFC47.

* Surface Collection on all sites that are in the impact zone of Clarks Gully catchment.

- Test pits on Site CG18.

U.H.H.C.

Upper Hunter Heritage Consultants

ABN: 47136935789

160 Sydney street
Muswellbrook
NSW 2333
PH: 0265413532

MOBILE: 0422910898
EMAIL: UHHC@BIGPOND.COM

Attention: Umwelt Australia

Regarding: Anvil Hill project. (continued p3)

* Surface Collections to be done on all sites within the impact zone of Sandy Creek.

If Centenial Coal is prepaired to set aside site SC10 for Conservation we would like all artifacts Collected on this project to be returned to this site after anylisation.
How ever if Centenial Coal is not prepaired to conserve this site then we should also have a surface Collection and subserface Investigation.
We are in compleat favor of this site being conserved and keept as a teaching place for our future generations.

* As there is no sites on the impact zone of Wybong Creek that will be impacted upon there is no need for further investigation.

During any of the test pits / Hand excavations or Grader scrapes if something of significance is uncovered eg:Burial site ect work should be stopped and the appropriate measures are to be put in place to protect such a site.

U.H.H.C. Would like to take the time to thank Centennial Coal for the measures the have taken to give us to offset areas that are already in place.

Thank you!
Darrel & Melissa Matthews

U.H.H.C.

Upper Hunter Wonnarua Council Inc

PO BOX 184 SINGLETON NSW 2330
PHONE: 02 6571 4888 FAX: 02 6571 4889

ABN: 24 070 620 198

Umwelt Australia Pty Ltd
PO Box 838
TORONTO NSW 2283

2nd June 2006

Attention: Jillian Ford Archeaologist

Ref: Draft Cultural Heritage Assessment
ANVILL HILL

Dear Jillian

The Upper Hunter Wonnarua Council has read and understood the Draft Archeaological Cultural Heritage Assessment.

This Draft is written as per the NSW / DEC Legislation which would satisfy the requirement for the need to record all Scientific Data related to Aboriginal Heritage such as, where individual artefact's are in the landscape, their shape, size, colour, etc.

This information is real and relevant but, does not record any Aboriginal significance. Under the current guidelines there is room for an Aboriginal Heritage Assessment which could properly provide the Aboriginal significance.

Their is no proper research Aboriginal evaluation of this proposed Coal Mining Project, without this Aboriginal assessment included in this report then how can our people make a judgement on the Aboriginal sites within this report.

Furthermore, any Aboriginal assessment must be done by an Aboriginal group or person with knowledge of the area.

It is not acceptable to have an Archaeologist provide this information, after all, with no offence to the profession Archaeologist are mainly trained to assess the stone's and bones of Aboriginal Culture and not our interlectual knowledge or Cultural knowledge.

Upper Hunter Wonnarua Council Inc

PO BOX 184 SINGLETON NSW 2330
PHONE: 02 6571 4888 FAX: 02 6571 4889

ABN: 24 070 620 198

Until an Aboriginal Cultural Heritage Assessment is included in this report. Our Council can not support the Draft Archaeological Heritage Assessment.

Could you please inform the Developer and the D.E.C. Manager of our request also, that we would need to talk with both party's in regards to this issue.

Yours sincerly
UHWC
V. Perry

Signed on Behalf.
V. Perry

Attention: Jan Wilson.

Terrain Units: Aboriginal Cultural Heritage Sensitivity

Modified	Simple Slope	Ridge Crest	Spur Crest	Riparian Corridor	Rocky Plateau

For Anvill Hill Project. 29.5.2006.

Further Comments:

Valley Culture agree to the draft report and would like to continue to be apart of any future work.

Because of the areas surrounding Anvill Hill such as Castlerock, Sandy Hollow, Denman, Mt Arthur North, Darkbrook and other areas where mining or any type of development has taken place there has always been large numbers of cultural sites located, all these areas would have been within walking distance for any cultural activity.

The carved trees associated with a ceremonial Bora ground identified along Spring Creek in the vicinity of castle rock 14 Kms west of Muswellbrook indicate as such.

When Anvil Hill and surrounding areas were first settled a lot of carved and scared trees would have been cut down for farming and grazing.

If at any time during a grader scrape anything is unearthed I would like to see further investigation into that area.

Thankyou

Ben Winkler

To Umwelt Australia Pty Ltd
Jillian Ford
From Mrs. Barbara Foot
Wanaruah Elder

June 2, 2006

Dear Jillian
The report was informative, and understandable, the concepts of all the groups nominated in the report are indorsed by me.

As you know Wanarauh Custodians took part in the Anvil Hill Project for only one day. David and I have examined the report and agree to the job going ahead.

We wish to bring to your attention comments of Mr Lester in the report, Mr. Lester is not authorised to represent myself of my family members.

I have resigned in writing from the Wanaruah Nation Aboriginal Corporation, on several occasions.

I am insulted that this information has been placed in the report, as I feel it is misleading, as my name and my son's name should have long ago been removed from the members list of Wanaruah Nation.

I feel this information should be removed from the report because Mr. Lester or the Wanaruah Nation is not authorised as my representative

Yours

Barbara. Foot
Wanaruah. Elder.

Wonnarua Nation Aboriginal Corporation

ABN No 50 012 829 925.

1 June 2006

Umwelt Environmental Consultants
2/20 The Boulevarde
PO Box838
Toronto NSW 2283

Attention: Mary-Jean Sutton, Archaeologist.

Fax No: 0249 505737

Subject: Responses to Anvil Hill draft report.

Dear Mary-Jean,

This response is provide collectively from WNAC, Yarrawalk & Wattaka. We have read and evaluated your draft report and make the following comments and recommendations.

The first point we make is, the practise introuducted by Umwelt Environmental Consultants of dividing a study area into separate portions, and having different Aboriginal consultants from different Aboriginal groups surveying these different portions is in our view, in particular if some of those representatives from other groups are not of Wonnarua descent we believe is tantamount to Unwelt treating Wonnarua Peoples Heritage in a ad hoc manner demeaning its intregrety. Do Umwelt use this practice throughout its operations outside of the Hunter Valley?

The fact that Umwelt make an attempt to bring all the groups together after a survey to hold discuss purportedly to satisfy any particular groups concerns is again in our view, an ad hoc process, which contaminates the outcome of any discussions when the number of groups involved are private business with vested interests that out number community organisations that provide communal benefits.

Statement: We consider the whole of the study area to be of high signifcants to the Wonnarua People and strongly object to our Country being considered as insignificant by the proposed recommendation to have it managed by Aboriginal people this is Wonnarua Country and should only be managed by Wonnarua people or their authorised nominees established under the Aboriginal Councils and Association Act 1976, to deal with Land and Native Title management matter.

We request a meeting with the proponent to discuss our concerns and offset arrangements for the destruction of our lands before this development proceeds any further, we will also provide further comments at that meeting regarding the study area.

Yours sincerely

Robert J. Lester
Chairperson.

Scott Franks
Acting Director Yarrawalk

WONNARUA NATION ABORIGINAL CORPORATION
PO Box 3066 Singleton Delivery Centre NSW 2330
Ph: 02 6572 1077 Fax: 02 6571 4364 Email: wnac@bigpond.com

APPENDIX 9

Detailed Site Descriptions

Definition of Terms and Coding used in Site Description Tables 1 and 2

Outlook	Outlook should be measured in degrees. Refers to the amount of view that can be seen from site over landscape.
Visibility % Inside Exposure	Ground surface visibility for archaeological site detection expressed as a percentage within exposure.
Visibility % Outside Exposure	Ground surface visibility for archaeological site detection expressed as a percentage outside exposure.
Slope	Slope to be characterised as one of the following: 1.Upper Slope 2.Mid Slope 3.Lower Slope **(see definitions of landform elements)** 4. Foot Slope
Outlook	Outlook should be measured in degrees. Refers to the amount of view that can be seen from site over landscape.
Erosion/type/extent	Refers to a comment on the following: **State of erosion:** Active: One or both of the following conditions apply: evidence of sediment movement; sides and/or floors of erosion form are relatively bare of vegetation. Stabilised: One or both of the following conditions apply: no evidence of sediment movement; sides and/or floors of erosion form are revegetated. Partly stabilised: Evidence of some active erosion and some evidence of stabilisation. **Form of erosion:** Wind erosion; *Scald erosion* which is the removal of surface soil by water and/or wind, often exposing a more clayey subsoil which is devoid of vegetation and relatively impermeable to water. Scalds are most common in arid or semi-arid lands. *Water erosion* which is defined under several types of erosion which are defined below. Sheet erosion which is the uniform removal of soil from an area without the development of conspicuous channels. Indicators of sheet erosion include soil deposits in downslope sediment traps such as fencelines or farm dams, and pedestalling, root exposure or exposure of subsoils. *Rill erosion*. A rill is a small channel up to 0.3 m deep, which can be largely obliterated by tillage operations (Houghton and Charman 1986). *Gully erosion.* A gully is a channel more than 0.3 m deep. *Tunnel erosion.* This is the removal of subsoil by water while the surface soil remains relatively intact (Crouch 1976). Streambank erosion. This is the removal of soil from a stream bank, typically during periods of high stream flow. Mass movement which includes all relatively large downslope movement of soil, rock or mixture of both for example, landslides, slumps, earth flows, debris avalanches and soilifluxion. **Extent of erosion:** Some comment needs to be made about how much erosion and the extent it has impacted the site in terms of area (an estimate) (length, width and depth).

Disturbance	Disturbance to make a comment about whether it's high, moderate or low disturbance. Also to state whether there is disturbance from animals, vehicle track, erosion, etc in comments field at end. 1. High 2. Moderate 3. Low
Site Condition	Site condition refers to the physical integrity of the site whether it is high, moderate or low.
Site condition	Comment on physical integrity 1. Low 2. Moderate 3. High
Site Area	An estimate of the area that the site is (i.e. like 20 m by 3 m).
Area Defined by	Area defined by refers to what is defining the visible site area i.e. is it a vehicle track bordered by grass or gravel, a salt scour etc
PAD	PAD refers to potential archaeological deposit. This field should provide comment on whether the site has potential archaeological deposit and the extent of this deposit.

Table 1: Environmental Description of Archaeological Sites

Final Name	Co-ordinate System	Easting	Northing	Site type	Archaeological Terrain Unit	Landform Element	Aspect	Slope	Outlook	Visibility Inside Exposure	Visibility Outside Exposure	Soils	Erosion State	Erosion Form	Erosion Extent	Vegetation
AC01	AMG 56	280182	6425392	Artefact Scatter	Riparian Corridor	Western side of Footslope	NE	1	360	25	10	Fine grey light coloured sand	Active	Gully erosion.	3 m by 5 m	Melaleucas, paperbarks and gum trees
AC02	AMG 56	280171	6425349	Isolated Find	Riparian Corridor	Western side of Footslope	NE	1	360	8	0	Fine light grey sandy silt	Partly stabilised	Gully erosion and sheet wash.	1 m by 1 m	Paperbarks and Casuarina
AC03	AMG 56	280220	6425339	Isolated Find	Riparian Corridor	Western side of Footslope	NW	1	360	30	10	Brown sand	Active	Gully erosion and mass movement from sheet wash.	50 cm by 50 cm	Casuarina, Eucalypts and Melaleuca
AC04	AMG 56	280201	6425495	Isolated Find	Riparian Corridor	Creek bed	S	0	360	30	10	Brown sand and river gravels	Active	Gully erosion and mass movement from sheet wash.	50 cm by 50 cm	Casuarina Eucalypts, Narrow leaved Ironbark
AC05	AMG 56	280221	6425893	Artefact Scatter	Riparian Corridor	Eastern side of Footslope	W	2	360	30	5	Grey sandy silt	Active	Gully erosion and scalding from vehicle track adjacent.	25 m by 20 m	Casuarina Eucalypts, Narrow leaved Ironbark
AC06	AMG 56	280287	6425880	Artefact Scatter	Riparian Corridor	Eastern side of Footslope	E	0	360	90	5	Grey sandy silt	Active	Scalding from use as a vehicle track nearby.	4 m by 10 m	Eucalypts
AC07	AMG 56	282375	6423732	Isolated Find	Riparian Corridor	Northern side of Footslope	SE	0	360	40	5	Dark brown sandy silt	Partially stabilised	Scalding from cattle treadage and wind erosion.	5 m by 3 m	Casuarina, bull rush and sedge
AC08	AMG 56	282372	6423679	Artefact Scatter	Riparian Corridor	Southern side of Footslope	NW	0	360	30	5	Light grey sandy silt	Partially stabilised	Slope wash and gullying erosion from side of creek bank.	3 m by 2.5 m	Casuarina Eucalypts, Narrow leaved Ironbark
AC09	AMG 56	282192	6423621	Isolated Find	Riparian Corridor	Northern side of Footslope	W	0	360	5	0	Light grey sandy silt	Partially stabilised	Slope wash and gullying erosion from side of creek bank.	1 m by 2 m	Casuarina and Eucalypt
AC10	AMG 56	282158	6423888	Isolated Find	Riparian Corridor	North Eastern side of Footslope	SW	0	360	3	0	Light brown sandy silt	Partially stabilised	Scald from cattle treadage and adjacent animal track.	50 cm by 50 cm	Casuarina and Eucalypt
AC11	AMG 56	282188	6424027	Artefact Scatter	Riparian Corridor	North Eastern side of Footslope	SW	0	360	20	10	Light grey sandy silt	Active	Gullying erosion and scalding from an ants nest and slope wash-mass movement of creek bank into creek.	6 m by 18 m	Casuarina and Ironbarks
AC12	AMG 56	282180	6424000	Artefact Scatter	Riparian Corridor	North Eastern side of Footslope	SW	0	360	20	10	Light grey sandy silt	Partially stabilised	Gullying erosion which is extensive to the creek bank.	43 m by 103 m	Pasture grasses and regrowth Eucalypts
AC13	AMG 56	282662	6423735	Artefact Scatter	Riparian Corridor	West Footslope	NE	0	360	50	5	Black sandy silt	Partially stabilised	Gullying erosion which is extensive to the creek bank. Evidence of rill erosion - cracking in soil profile and scouring and scalding from wind and water.	85 m by 12 m	Regrowth Casuarina, Pasture grasses, tea tree swamp and paperbarks, Eucalypts
AC14	AMG 56	282631	6423668	Isolated Find	Riparian Corridor	West of Creek terrace	E	0	360	3	0	Light grey sandy silt	Partially stabilised	Scalding from cattle treadage.	30 cm by 30 cm	Casuarina and Eucalypts
AC15	AMG 56	282708	6423576	Isolated Find	Riparian Corridor	West of Creek terrace	SW	0	360	5	10	Grey brown sandy silt	Partially stabilised	Scalding from wind erosion and treadage as an animal track.	90 cm by 5 m	Casuarinas, Paperbarks
AC16	AMG 56	282563	6422354	Isolated Find	Riparian Corridor	East Footslope	W	0	360	10	5	Fine grey sandy loam	Partially stabilised	Slope wash into the creek.	7 m by 4 m	Ironbarks, Casuarina and Eucalypts

Final Name	Co-ordinate System	Easting	Northing	Site type	Archaeological Terrain Unit	Landform Element	Aspect	Slope	Outlook	Visibility Inside Exposure	Visibility Outside Exposure	Soils	Erosion State	Erosion Form	Erosion Extent	Vegetation
AC17	AMG 56	283328	6423754	Artefact Scatter	Riparian Corridor	North of Creek terrace	SE	0	360	90	5	Light grey sandy silt	Active	Gully erosion and some slope wash moving materials down into the creek.	2 m by 3 m	Casuarina forest
AC18	AMG 56	281287	6424953	Isolated Find	Anvil Hill Plateau	Scree slope	NW 290	3	360	10	0	Sandy silt	Stabilised	Rocky outcrop.	Not applicable	Bull oak forest
AC19	AMG 56	279638	6424929	Isolated Find	Simple slope	Mid moderate slope	-	3	-	100	100	B horizon obvious	Active	Modified partially by a vehicle track.	Track is 1.5 m wide	Open pasture grass
AC20	AMG 56	280214	6425779	Isolated Find	Riparian Corridor	East Footslope	-	0	-	100	4	A horizon exposed	Active	Gully erosion associated with a drainage line in the creek.	40 to 60 cm	Open woodland
AC21	AMG 56	282346	6423755	Isolated Find	Riparian Corridor	North Footslope	-	0	-	5	4	Silt	Partially stabilised	Ants nest and steep gully erosion circa up to 2.5 m high sheer walls in creek bank.	50 cm by 50 cm	Tall open forest gums, pines and understorey grass
AC22	AMG 56	282285	6423677	Isolated Find	Riparian Corridor	North Footslope	-	0	-	100	4	Silt with lots of pebble gravel.	Active	Scald from animal track.	Up to 20 cm wide patchy exposures	Lomandra, grasses, gums, ironbarks, regeneration gums and cypress pines
AC23	AMG 56	282241	6423635	Artefact Scatter	Riparian Corridor	South Footslope	-	0	-	100	0	Silt with lots of pebble gravel.	Active	Gully erosion all along the creek bank.	Up to 20 cm wide patchy exposures	Lomandra, grasses, gums, ironbarks, regeneration gums and cypress pines
AC24	AMG 56	282056	6423647	Isolated Find	Riparian Corridor	North Footslope	-	0	-	100	0	Silt with lots of pebble gravel	Stabilised	Some minor scalding from wind erosion and water due to cattle treadage.	50 cm by 50 cm	-
AC25	AMG 56	282158	6423985	Isolated Find	Riparian Corridor	West Footslope	-	0	-	100	0	Dry hard packed silt	Stabilised	Some minor scalding from animal tracks with a width of 35 cm.	35 cm width animal track	-
AC26	AMG 56	282209	6424066	Isolated Find	Riparian Corridor	NorthWest Footslope	-	0	-	100	0	Silt	Stabilised	Gully erosion and slope wash due to mass movement.	Erosion limited to animal track	Tall open forest, iron barks, pines, gums, paperbark
AC27	AMG 56	282707	6423633	Isolated Find	Riparian Corridor	South Footslope	-	0	-	100	0	Silty clays with pebbles	Active	Gully erosion in the creek bank.	Erosion has impacted on B horizon of creek bank	Pines, paperbark understorey and grasses
AC28	AMG 56	283260	6423740	Artefact Scatter	Riparian Corridor	North Footslope	-	0	360	100	0	Silty clays with pebbles	Active	Gully erosion and slope wash.	Erosion has impacted on B horizon of creek bank	Grasses, Ironbarks and Pines
AC29	AMG 56	283283	6423750	Isolated Find	Riparian Corridor	North Footslope	E	0	-	60	4	Light grey sandy silt	Partially stabilised	Gully erosion and eroded A unit.	Eroded A unit	Casuarina forest
AC30	AMG 56	281558	6423606	Artefact Scatter	Riparian Corridor	South Footslope	E	0	90	3	0	Light grey sandy silt	Partially stabilised	Gully erosion, rill and slope wash.	Eroded down to A/B horizon	Regrowth Eucalypt
AC31	AMG 56	281605	6423636	Artefact Scatter	Riparian Corridor	South Footslope	SE	0	90	20	5	Dark brown sandy silt	Partially stabilised	Gully erosion, rill and slope wash.	Eroded down to A/B horizon	Regrowth Eucalypt
AC32	AMG 56	281715	6423664	Artefact Scatter	Riparian Corridor	South Footslope	NE	0	360	30	0	Light grey sandy silt	Partially stabilised	Ants nest, slope wash and gully erosion and small scalds from cattle treadage.	Eroded down to A/B horizon	Regrowth Eucalypt, Casuarina and Melaleuca
AC33	AMG 56	281884	6423572	Artefact Scatter	Riparian Corridor	South Footslope	NE	0	360	20	0	Light brown sandy silt	Active	Active gully erosion which is down to B horizon.	60 m by 5 m	Paperbarks, Casuarina, tea tree, regrowth Eucalypts

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AC34	AMG 56	283967	6423148	Artefact Scatter	Simple slope	Mid moderate slope	SE	0	360	5	3	Light grey sandy silt	Stabilised	Patches in A horizon from cattle treadage.	50 m by 20 m	Edge of regrowth Casuarina forest, cleared pasture grass and some Eucalypts
AC35	AMG 56	280695	6424057	Artefact Scatter	Riparian Corridor	Footslope	NW	0	90	100	0	Light grey sandy silt	Active	Scalding due to wind erosion and slope wash.	6 m by 2 m	Mature age Eucalypts and regrowth Eucalypts
AC36	AMG 56	280709	6424049	Isolated Find	Riparian Corridor	East Footslope	S	0	90	3	0	Light grey silt	Partially stabilised	Eroded down to A unit and there is slope wash running off creek bank.	A unit	Mature age Eucalypts and regrowth Eucalypts
AC37	AMG 56	280599	6424092	Artefact Scatter	Riparian Corridor	West Footslope	N	0	360	10	3	Orange sandy silt	Active	Scalding due to wind erosion and slope wash.	Eroded to B horizon	Regrowth Eucalypts and pasture grasses
AC38	MGA	282013.03	6422460.4	Rockshelter with PAD	Limb of Addy Hill Plateau	Spur Crest	S	4	360	20	0	Light grey sandy silt	Active	Slope wash moving materials down slope.	Shelter deposit is beginning to erode out	Fish Poison Tree, Kurrajongs, Cypress Pines and Red ash
AC39	AMG 56	281760	6423709	Artefact Scatter	Riparian Corridor	North Footslope	S	0	-	60	1	Sandy degrading soils	Partially stabilised.	Sheet wash, rill and gully erosion	Down to B horizon	Cypress pines, grey box, Casuarina, melaleuca, iron barks and mistletoe
AC40	AMG 56	282285	6423669	Artefact Scatter	Riparian Corridor	North Footslope	S	0	360	30	0	Sandy degrading soils	Active	Sheet wash, active bank collapse in creek.	Down to B horizon	Regrowth Casuarina, Some ironbarks, gums, open undergrowth, native blue bell and spiky rush
AC41	AMG 56	280062	6426104	Artefact Scatter	Simple slope	Lower slope	NE	1	360	20	0	Silty sand degrading with conglomerate inclusions	Partially stabilised.	Sheet wash, rill and gully erosion	Down to B horizon	Regrowth Casuarina, ironbarks, gums, mistletoe and open grass
AC42	AMG 56	279493	6424894	Rockshelter with PAD	Wallaby Rocks Plateau	Saddle ridgeline	NW	4	60	100	0	In situ weathered conglomerate	Partially stabilised	Some slope wash and mass movement down slope of shelter deposit.	Not applicable	Shrubby vegetation outside shelter
AC43	AMG 56	280490	6425967	Artefact Scatter	Simple slope	Lower slope	NW	1	360	70	0	Sandy degrading soils	Partially stabilised.	Ant hill scald and sheet wash.	Down to A/B	Regrowth Casuarina, Gums and open grassland
AC44	AMG 56	280571	6425934	Isolated find	Simple slope	Lower slope	NW	1	360	15	0	Silty sandy degrading	Partially stabilised.	Pasture and a vehicle track.	Down to B horizon	Open grassland, regrowth gums and Casuarina
BFC01	AMG 56	281296	6427054	Artefact Scatter	Modified	Modified	NE	1	360	25	5	Light brown sandy silt alluvium	Partly stabilised	Scald and vehicle track	20 m by 2.25 m	Cleared. Regrowth Casuarina, Pasture grasses
BFC02	AMG 56	279062	6425271	Isolated Find	Riparian Corridor	East Footslope	N	1	360	40	10	Brown sandy silt	Partly stabilised	Stream bank and gully erosion.	50 cm by 50 cm	Mistletoe, sedge, lilies, bulrushes, Eucalypts smooth barked and Narrow leaved ironbark
BFC03	AMG 56	279152	6425302	Isolated Find	Modified	Modified	NW	2	360	40	5	Mid brown sandy silt	Active	Scald	2.5 m by 1 m	Pasture grasses and Eucalypt
BFC04	AMG 56	279186	6425424	Isolated Find	Modified	Modified	N	1	360	80	5	Brown sandy clay	Active	Scald from track	3 m by extent of track	Pasture grasses, cleared of mature trees
BFC05	AMG 56	279159	6425448	Isolated Find	Modified	Modified	N	1	360	80	5	Brown sandy silt	Active	Scald from track	3 m by extent of track	Pasture grasses, cleared of mature trees
BFC06	AMG 56	279204	6425490	Isolated Find	Modified	Modified	N	1	360	60	5	Brown sandy silt	Active	Scald from track	3 m by extent of track	Pasture grasses, cleared of mature trees
BFC07	AMG 56	279686	6425526	Isolated Find	Wallaby Rocks Plateau	Spur crest	E	4	360	20	0	Light grey-dark sandy silt	Partly stabilised	Mass movement/slope wash	50 cm by 50 cm	Eucalypts, Ironbarks, Native Olive
BFC08	AMG 56	279510	6425495	Artefact Scatter	Wallaby Rocks Plateau	Scree slope	W	4	360	5	0	Sandy black silt	Partly stabilised	Mass movement/slope wash	1 m by 1 m	Eucalypts, Ironbarks, Native Olive

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BFC09	AMG 56	279520	6425518	Artefact Scatter	Wallaby Rocks Plateau	Scree slope	NE	4	360	8	5	Sandy black silt	Partly stabilised	Mass movement/slope wash	5 m by 3 m	Eucalypts, Ironbarks, Native Olive
BFC10	AMG 56	279521	6425534	Artefact Scatter	Wallaby Rocks Plateau	Scree slope	N	4	360	8	5	Sandy black silt	Partly stabilised	Mass movement/slope wash	4 m by 2 m	Eucalypts, Ironbarks, Native Olive, Mistletoe
BFC11	AMG 56	279505	6425523	Artefact Scatter	Wallaby Rocks Plateau	Scree slope	NW	3	360	8	5	Sandy black silt	Partly stabilised	Mass movement/slope wash	5 m by 3 m	Eucalypts, Ironbarks, Native Olive
BFC12	AMG 56	279686	6425526	Rockshelter with PAD	Wallaby Rocks Plateau	Scree slope	N	4	360	90	8	Sandy black silt	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Strangling Fig, Narrow Leaved Ironbark
BFC13	AMG 56	279527	6425519	Isolated Find	Wallaby Rocks Plateau	Scree Slope	SW	4	360	5	0	Black sandy silt	Partly stabilised	Mass movement/slope wash	Slope wash	Narrow leaved Ironbark and Eucalypts
BFC14	AMG 56	279408	6425260	Artefact Scatter	Wallaby Rocks Plateau	Scree Slope	NW	4	280	5	0	Black sandy silt	Partly stabilised	Mass movement/slope wash	Slope wash	Narrow leaved Ironbarks
BFC15	AMG 56	281492	6427054	Artefact Scatter	Riparian Corridor	North Footslope	W	0	360	50	0	Light brown sandy silt	Active	Gully erosion with slope wash and scalding from cattle treadage.	5 m by 7 m	Casuarina forest and regrowth grasses
BFC16	AMG 56	280969	6426707	Isolated Find	Riparian Corridor	North Footslope	W	0	360	5	0	Brown silt	Partially stabilised	Slope wash and mass movement of materials down slope.	3 m by 50 cm	Casuarina regrowth forest
BFC17	AMG 56	280955	6426717	Artefact Scatter	Riparian Corridor	North Footslope	W	0	360	30	5	Mid brown silt	Partially stabilised	Slope wash and mass movement of materials down slope.	10 m by 1 m	Casuarina regrowth forest
BFC18	AMG 56	280935	6426686	Artefact Scatter	Riparian Corridor	North Footslope	SW	0	360	15	5	Brown silt	Active	Slope wash and mass movement of materials down slope.	7 m by 2 m	Casuarina regrowth forest
BFC19	AMG 56	280896	6426638	Artefact Scatter	Riparian Corridor	North Footslope	NW	0	360	20	5	Brown sandy silt	Active	Gullying and slope wash.	73 m by 35 m	Bull rush
BFC20	AMG 56	280869	6426762	Isolated Find	Riparian Corridor	North Footslope	SE	0	360	25	5	Grey mid brown sandy silt	Active	Slope wash, grader construction of channel causing scalding and slope wash.	5 m by 2 m	Regrowth Casuarina and Eucalypts
BFC21	AMG 56	280878	6426717	Isolated Find	Riparian Corridor	West flood plain	W	0	360	10	5	Light grey brown sandy loam	Active	Slope wash, grader construction of channel causing scalding and slope wash.	2 m by 50 cm	Cleared pasture grasses
BFC22	AMG 56	280784	6426569	Isolated Find	Riparian Corridor	North Footslope	S	0	360	20	5	Brown sand	Active	Wind erosion causing scalding and also due to fence line and movement of materials downstream - slope wash.	6 m by 10 m	Regrowth Casuarina forest
BFC23	AMG 56	280793	6426540	Isolated Find	Riparian Corridor	West Footslope	SE	0	360	20	5	Fine grey-mid brown sand	Partially stabilised	Cattle treadage causing scalding and also slope wash.	5 m by 10 m	Regrowth Casuarina forest
BFC24	AMG 56	280719	6426431	Artefact Scatter	Riparian Corridor	West Footslope	SW	0	360	30	5	Fine grey-mid brown sand	Partially stabilised	Cattle treadage causing scalding and also slope wash.	20 m by 2 m	Regrowth Casuarina forest and pasture grasses
BFC25	AMG 56	280915	6426670	Artefact Scatter	Riparian Corridor	Floodplain North	SW	0	360	15	5	Mid brown sandy loam	Partially stabilised	Cattle treadage causing scalding and also slope wash.	3.5 m by 4.5 m	Regrowth Casuarina forest and pasture grasses

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BFC26	AMG 56	281582	6426938	Artefact Scatter	Riparian Corridor	South Footslope	NW	0	360	20	5	Light grey sandy clay	Partially stabilised	Small scald caused by wind erosion from cattle treadage.	4 m by 2 m	Regrowth Casuarina forest and regrowth Eucalypt forest
BFC27	AMG 56	281523	6426924	Isolated Find	Riparian Corridor	South Footslope	N	0	360	10	5	Light brown silty sand	Partially stabilised	Small scald caused by wind erosion from cattle treadage.	4 m by 1.5 m	Regrowth Casuarina forest and regrowth Eucalypt forest
BFC28	AMG 56	281419	6426941	Artefact Scatter	Riparian Corridor	South Footslope	SW	0	360	50	5	Light brown sandy loam	Partially stabilised	Small scald caused by wind erosion from cattle treadage.	23 m by 30 m	Regrowth Eucalypt
BFC29	AMG 56	281451	6426995	Artefact Scatter	Riparian Corridor	South Footslope	NE	0	360	30	3	Mid brown sandy loam	Partially stabilised	Scald from felling of trees and adjacent to track and transmission line.	9 m by 6 m	Casuarina regrowth forest
BFC30	AMG 56	281377	6426906	Artefact Scatter	Riparian Corridor	South Footslope	SW	0	360	20	5	Mid brown sandy loam	Partially stabilised	Scalds associated with big ants nests along creek bank.	25 m by 35 m	Casuarina regrowth forest
BFC31	AMG 56	281135	6426766	Artefact Scatter	Riparian Corridor	South Footslope	SE	0	360	20	5	Mid brown sandy loam	Active	Extensive gullying and slope wash.	20 m by 15 m	Casuarina regrowth forest and Eucalypts
BFC32	AMG 56	280869	6426569	Artefact Scatter	Riparian Corridor	South Footslope	NW	0	360	30	2	Mid brown silty sand	Active	Extensive gullying and slope wash.	12 m by 25 m	Casuarina regrowth forest
BFC33	AMG 56	280648	6426345	Artefact Scatter	Riparian Corridor	South Footslope	SW	0	360	15	5	Light brown sandy loam	Partially stabilised	Some gullying and slope wash.	20 m by 5 m	Casuarina regrowth forest
BFC34	AMG 56	280565	6426294	Artefact Scatter	Riparian Corridor	South Footslope	NW	0	360	10	5	Brown sandy loam	Active	Some gullying and slope wash.	25 m by 55 m	Casuarina regrowth forest
BFC35	AMG 56	279082	6425345	Isolated Find	Riparian Corridor	North Confluence major/Footslope	S	0	210	10	5	A horizon exposed only	Active	Gully erosion and scalding from cattle treadage.	Not given	Open pasture grass
BFC36	AMG 56	279087	6425301	Isolated Find	Riparian Corridor	North Creek terrace	E	0	290	9	9	Exposed A horizon adjacent	Partially stabilised	Scalding from ants nest.	2 m by 3 m	Open pasture grass
BFC37	AMG 56	279074	6425293	Isolated Find	Riparian Corridor	North Confluence major/Footslope	S	0	290	100	4	A horizon exposed	Partly stabilised	Cattle track scald.	40 cm to 60 cm wide	Open pasture grass and Narrow leaved peppermint
BFC38	AMG 56	282525	6427423	Artefact Scatter	Riparian Corridor	South Footslope	-	0	-	90	0	Silty sediments with conglomerate pebbles	Partially stabilised	Gully erosion, ants nest and scalding.	15 m by 10 m	Grasses, Ironbarks and Pines
BFC39	AMG 56	282582	6427466	Artefact Scatter	Riparian Corridor	South Footslope	-	0	-	90	0	Silty sediments with conglomerate pebbles	Partially stabilised	Gully erosion, ants nest and scalding.	15 m by 10 m	Grasses, Ironbarks and Pines
BFC40	AMG 56	282883	6427798	Artefact Scatter	Riparian Corridor	North East Footslope	-	0	-	90	0	Silty	Partially stabilised	Gully erosion, ants nest and scalding.	20 m by 110 m	Open some pasture grasses
BFC41	AMG 56	282714	6427780	Isolated Find	Modified	Modified	-	0	-	100	4	Silty clay	Partially stabilised	Gully erosion and slope wash.	Eroded to B horizon	Some pasture grasses, rushes
BFC42	AMG 56	282685	6427555	Artefact Scatter	Riparian Corridor	South Footslope	-		-	8	5	Silt with small pebbles	Partially stabilised	Gully erosion and slope wash.	Eroded to A2 horizon only	Some pines, grasses mostly open pasture
BFC43	AMG 56	282630	6427530	Artefact Scatter	Riparian Corridor	South Footslope	-		-	8	5	Silt with small pebbles	Partly stabilised	Gully erosion and slope wash.	1 m by 5 m	Pasture grasses and Cypress pines
BFC44	AMG 56	282489	6426972	Isolated Find	Riparian Corridor	South Footslope	-		-	100	4	Silt with small pebbles	Partly stabilised	Gully erosion and slope wash.	50 cm by 50 cm	Pasture grass
BFC45	AMG 56	282512	6426927	Artefact Scatter	Riparian Corridor	South Footslope	-	0	-	100	4	Silt with small pebbles	Partly stabilised	Gully erosion and slope wash.	5 m by 15 m	Pasture grass
BFC46	AMG 56	282503	6426979	Isolated Find	Riparian Corridor	South Footslope	-	0	-	=	0	No description	Partly stabilised	Gully erosion and slope wash.	5 m by 15 m	Pasture grass
BFC47	AMG 56	282320	6427101	Artefact Scatter	Riparian Corridor	North Footslope	-	0	-	100	0	Silt	Partially stabilised	Rill and gully erosion	Rill erosion is 6 m by 7 m	Pasture grasses

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BFC48	AMG 56	281284	6426822	Artefact Scatter	Simple slope	Lower slope	-	0	-	90	0	Silty clay with pebbles	Active	Site is located on a dam. Erosion includes mass movement from slope wash.	No integrity	Pasture grasses - exotics
BFC49	AMG 56	284831	6426854	Artefact Scatter	Simple slope	Mid slope	N	4	360	20	5	Dark brown silty loam	Partially stabilised	Rill and scalds from cattle treadage.	Eroded to A/B horizon	Box Gum and Pasture grasses
CG01	AMG 56	281419	6425006	Rockshelter with PAD	Anvil Hill Plateau	Spur saddle	N	4	360	90	15	Light grey sandy silt	Partly stabilised	Slope wash of deposit in shelter		Eucalypts
CG02	AMG 56	283015	6425352	Isolated Find	Simple slope	Upper slope	N	3	360	100	20	Light grey sandy silt	Partly stabilised	Mass movement/slope wash	Slope wash	Narrow leaved Ironbarks and Casuarina
CG03	AMG 56	283077	6425609	Artefact Scatter	Simple slope	Mid moderate slope	N	2	360	35	10	Fine grey silt	Partly stabilised	Mass movements/slope wash	33 m by 30 m	Casuarina
CG04	AMG 56	281177	6426090	Isolated Find	Riparian Corridor	South Footslope	N	1	360	30	10	Fine grey silt	Active	Mass movements, slope wash and gullying erosion and scalding nearby vehicle track.	1 m by 1 m	Casuarina, Gum Trees, Narrow leaved ironbark
CG05	AMG 56	281029	6426201	Artefact Scatter	Riparian Corridor	North Footslope	S	0	360	10	5	Grey sandy silt	Active	Gully erosion and slope wash due to mass movement	14 m by 2 m	Casuarina, Eucalypts (smooth barked and rough barked)
CG06	AMG 56	281000	6426197	Isolated Find	Riparian Corridor	North Footslope	W	0	360	5	0	Grey sandy silt	Partly stabilised	Scalding from cattle treadage	15 cm by 5 cm	Casuarina, Eucalypts (smooth barked and rough barked)
CG07	AMG 56	282005	6426062	Isolated Find	Riparian Corridor	Creek bed	SW	0	360	30	10	Grey-red coarse sand	Active	Stream bank erosion	-	Casuarina and narrow leaved ironbarks
CG08	AMG 56	281709	6424885	Rockshelter with PAD	Anvil Hill Plateau	Spur saddle	NE	3	120	40	90	Black sandy silt	Partly stabilised	Mass movements, slope wash and sheet erosion from movement of sediment down slope.	-	Narrow leafed Ironbarks, bush with red berries, Gum trees
CG09	AMG 56	281726	6424861	Rockshelter with PAD	Anvil Hill Plateau	Secondary Spur	NE	3	270	40	90	Black sandy silt	Partly stabilised	Mass movements, slope wash and sheet erosion from movement of sediment down slope.	-	Narrow leafed Ironbarks, bush with red berries, Gum trees
CG10	AMG 56	281717	6424858	Rockshelter with PAD	Anvil Hill Plateau	Secondary Spur	SE	4	270	40	90	Dark grey sand	Partly stabilised	Mass movements, slope wash and sheet erosion from movement of sediment down slope.	-	Narrow leafed Ironbarks, bush with red berries, Gum trees
CG11	AMG 56	281603	6424981	Isolated Find	Anvil Hill Plateau	Spur saddle	N	4	360	70	30	Sandy silt	Stabilised	Scald from wind on top of ridgeline crest.	Localised	Thick Eucalypt scrub and stringy barks
CG12	AMG 56	280968	6426092	Artefact Scatter	Riparian Corridor	South Footslope	NE	1	360	40	10	Fine light powdery silt	Partly stabilised	Sheet wash movement of materials down into the creek.	25 m by 20 m	She oak and Bull oak Casuarina
CG13	AMG 56	281101	6426165	Artefact Scatter	Riparian Corridor	North Footslope	SE	1	360	30	10	Light grey sandy silt	Partly stabilised	Slope wash movement of materials into creek from creek bank and also evidence of rill and gully erosion.	4 m by 6 m	Regrowth Eucalypt and Casuarina
CG14	AMG 56	281124	6426179	Artefact Scatter	Riparian Corridor	North Footslope	SE	1	360	30	10	Light grey sandy silt	Partly stabilised	Slope wash movement of materials into creek from creek bank and also evidence of gully erosion.	30 m by 10 m	Regrowth Eucalypt and Casuarina

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CG15	AMG 56	281173	6426162	Artefact Scatter	Riparian Corridor	North Footslope	SW	1	360	30	10	Fine grey silt	Partly stabilised	Slope wash movement of materials into the creek bed.	4 m by 2.5 m	Regrowth Eucalypt and Casuarina; Smooth barked Angophora (Native Apple)
CG16	AMG 56	281021	6426083	Artefact Scatter	Riparian Corridor	South Footslope	ENE 55	0	360	100%	4	light brown to red fine silty sediments with small <5 mm diameter) pebbles where to A horizon is left over the B. The A is generally pretty shallow (>10 cm) and the site has a lot of exposed B horizon	Partially stabilised	scald and disturbance (animal track)	two areas of scald (0.5 m x o.75 m and 3 m x 2 m), there is also an animal track through the northern edge of the site	Fairly dense Bull oak
CG17	AMG 56	282931	6425907	Isolated find	Simple slope	Lower slope	W	0	360	70	0	Sandy silt with pebbles	Active	Scalding on vehicle track.	Down to B horizon	Casuarina, Yellow box, and regrowth Eucalypts
CG18	AMG 56	282417	6425967	Artefact Scatter	Riparian Corridor	Footslope	NE	0	-	20	5	Silt	Partially stabilised	Gully erosion and mass movement from sheet wash.	Eroded down to approximately 3 cm	Pasture grasses
SC01	AMG 56	285039	6420063	Isolated Find	Riparian Corridor	North Floodplain	N	0	360	3	0	Dark brown silty loam	Stabilised	Patches in A horizon from cattle treadage.		Pasture grass
SC02	AMG 56	284996	6421192	Artefact Scatter	Riparian Corridor	North Floodplain	N	0	360	3	0	Dark brown silty loam	Stabilised	Patches in A horizon from cattle treadage.		Pasture grass
SC03	AMG 56	285197	6422722	Artefact Scatter	Modified	Modified	SE	0	360	30	10	Light grey sandy silt	Stabilised	Patches in A horizon from cattle treadage.		Pasture grass and remnant scattered Eucalypt
SC04	AMG 56	285144	6420004	Isolated Find	Riparian Corridor	North Floodplain	S	0	360	1	0	Brown loam	Stabilised	Patches in A horizon from cattle treadage.		Pasture grass
SC05	AMG 56	283798	6425129	Isolated find	Riparian Corridor	North Footslope	E	0	360	10	0	Light grey sandy silt	Partially stabilised	Scald from ants nest.	Eroded to A/B horizon	Mature Ironbarks
SC06	AMG 56	283995	6425255	Artefact Scatter	Riparian Corridor	North Footslope	W	0	360	40	3	Light grey sandy silt	Active	Gully erosion which is active on creek banks.	Eroded to B horizon	Pasture, Mature and regrowth Ironbarks
SC07	AMG 56	284595	6425497	Artefact Scatter	Riparian Corridor	North Footslope	NE	0	360	40	40	Orange clay	Active	Slope wash and scalding from wind and water erosion.	Eroded to B horizon	pasture grasses
SC08	AMG 56	284587	6425793	Artefact Scatter	Riparian Corridor	North Footslope	NE	0	360	30	0	Orange sandy clay	Active	Slope wash and scalding from wind and water erosion.	Eroded to B horizon	Scribbly Gums and Angophoras
SC09	AMG 56	284796	6425282	Isolated find	Riparian Corridor	North Footslope	N	0	360	10	0	Light grey sandy silt	Partially stabilised	Scald from cattle treadage.	Eroded to A/B horizon	Pasture grasses
SC10	AMG 56	284850	6422973	Artefact Scatter	Riparian Corridor	Footslope and edge of floodplain	S	0	360	10	5	Light brown sandy silt	Active	Slope wash moving materials down slope and scalding associated with disturbance underneath transmission line, gully erosion.	Down to B horizon in many cases	Remnant woodland and eucalypt
SC11	AMG 56	284517	6424961	Isolated find	Simple slope	Mid slope	S	0	360	10	0	Sandy silt	Partially stabilised	Scalding due to cattle treadage.	Down to B horizon	Rough barked Apple tree, Box Gums and regenerated grass
SC12	AMG 56	284586	6425388	Artefact Scatter	Riparian Corridor	Footslope	E	0	360	15	0	Light grey brown sandy silt	Partially stabilised	Erosion from slope wash and rill.	Down to A/B	Eucalypt and grasses
SC13	AMG 56	284698	6425202	Isolated find	Riparian Corridor	Footslope	NW	0	360	14	0	Dark silt	Partially stabilised	Erosion from slope wash and rill.	Down to A/B	Eucalypt and Bull oak

Final Name	Co-ordinate System	Easting	Northing	Site type	Archaeological Terrain Unit	Landform Element	Aspect	Slope	Outlook	Visibility Inside Exposure	Visibility Outside Exposure	Soils	Erosion State	Erosion Form	Erosion Extent	Vegetation
SC14	AMG 56	284706	6425106	Artefact Scatter	Riparian Corridor	Footslope	-	0	-	40	0	Dark silt with bits of shale	Active	Erosion from rill and gully erosion.	Down to B horizon	Eucalypt and Bull oak
WC01	AMG 56	279095	6424616	Artefact Scatter	Riparian Corridor	East Footslope	W	0	360	10	1	Brown sandy silt	Partly stabilised	Stream bank erosion	18 m by 6.5 m	Cleared, Regrowth Casuarina, Pasture grasses
WC02	AMG 56	279071	6424623	Artefact Scatter	Riparian Corridor	East Footslope	N	0	360	10	1	Brown sandy silt	Partly stabilised	Stream bank and gully erosion	14 m by 7 m	Cypress Pines, Ironbarks, Eucalypts, Pasture Grasses, partially cleared
WC03	AMG 56	279106	6424674	Artefact Scatter	Riparian Corridor	East Footslope	SW	1	360	8	5	Brown sandy silt	Partly stabilised	Stream bank and gully erosion	7 m by 3 m	Cypress Pines, Ironbarks, Eucalypts, Pasture Grasses, partially cleared
WC04	AMG 56	279046	6424650	Artefact Scatter	Riparian Corridor	Floodplain	N	0	45	40	5	Brown sandy silt	Partly stabilised	Stream bank and gully erosion	20 m by 7 m	Mistletoe, sedge, lilies
WC05	AMG 56	279379	6424747	Rockshelter with PAD	Wallaby Rocks Plateau	Scree Slope	W	4	270	90	5	Yellow light grey sand	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Narrow leaved Ironbarks and Eucalypts
WC06	AMG 56	279354	6424718	Artefact Scatter	Wallaby Rocks Plateau	Scree Slope	SW	4	360	10	0	Mid brown sandy silt	Active	Mass movement/slope wash	Slope wash	Narrow leaved Ironbarks and Eucalypts
WC07	AMG 56	279255	6424650	Isolated Find	Simple slope	Mid slope	NW	1	360	15	5	Brown sandy silt	Active	Mass movement/slope wash and scalding from cattle treadage.	Slope wash	Cleared pasture grass and some Narrow leaved Ironbarks
WC08	AMG 56	279236	6424604	Artefact Scatter	Simple slope	Mid slope	SE	1	360	50	20	Brown sandy silt	Partly stabilised	Mass movement/slope wash and scalding from cattle treadage.	50 m by 13 m	Cleared pasture grass and some Narrow leaved Ironbarks
WC09	AMG 56	279236	6424531	Artefact Scatter	Simple slope	Mid slope	SW	1	360	20	5	Brown sandy silt	Partly stabilised	Scalding associated with cattle treadage and slope wash and mass movement.	34 m by 21 m	Cleared pasture grass and some Narrow leaved Ironbarks
WC10	AMG 56	279208	6424484	Isolated Find	Simple slope	Mid slope	S	1	360	10	5	Brown sandy silt	Partly stabilised	Scalding associated with cattle treadage and slope wash and mass movement.	50 cm by 50 cm	Cleared pasture grass and some Narrow leaved Ironbarks
WC11	AMG 56	279206	6424478	Isolated Find	Simple slope	Mid slope	S	2	360	20	5	Brown sandy silt	Partly stabilised	Scalding associated with cattle treadage and slope wash and mass movement.	50 cm by 50 cm	Cleared pasture grass and some Narrow leaved Ironbarks
WC12	AMG 56	279195	6424480	Isolated Find	Simple slope	Mid slope	SE	2	360	30	5	Brown sandy silt	Partly stabilised	Scalding associated with cattle treadage and slope wash and mass movement.	50 cm by 50 cm	Cleared pasture grass and some Narrow leaved Ironbarks
WC13	AMG 56	279195	6424462	Isolated Find	Simple slope	Mid slope	SE	2	360	30	10	Brown sandy silt	Partly stabilised	Scalding associated with cattle treadage and slope wash and mass movement.	50 cm by 50 cm	Cleared pasture grass and some Narrow leaved Ironbarks
WC14	AMG 56	279155	6424399	Artefact Scatter	Modified	Modified	N	2	360	50	5	Brown sandy silt	Active	Scalding associated with use of track as road.	50 cm by 10 cm	Cleared pasture grass
WC15	AMG 56	279155	6424466	Artefact Scatter	Modified	Modified	W	2	360	70	5	Orange Sandy Clay	Active	Scalding associated with use of track as road.	3 m by 7 m	Cleared pasture grass, smooth barked Angophora and Narrow leaved ironbarks
WC16	AMG 56	279087	6424505	Isolated Find	Modified	Modified	W	2	360	70	5	Brown sandy silt	Active	Scalding associated with use of track as road.	2 cm width	Cleared pasture grass, Eucalypts, Narrow leaved Ironbarks
WC17	AMG 56	279216	6424561	Artefact Scatter	Simple slope	Mid slope	N	2	360	40	5	Orange Sandy Clay	Active	Scalding associated with use of track as road.	2 m by 5 m	Cleared, pasture grasses, Cypress pines and Eucalypts

Final Name	Co-ordinate System	Easting	Northing	Site type	Archaeological Terrain Unit	Landform Element	Aspect	Slope	Outlook	Visibility Inside Exposure	Visibility Outside Exposure	Soils	Erosion State	Erosion Form	Erosion Extent	Vegetation
WC18	AMG 56	279169	6424608	Artefact Scatter	Simple slope	Mid slope	S	2	360	40	10	Mid brown sandy silt	Active	Scalding associated with use of track as road.	3 m by 50 cm	Cleared, pasture grasses, Cypress pines and Eucalypts
WC19	AMG 56	279122	6424584	Isolated Find	Riparian Corridor	West Footslope	SW	1	360	20	5	Brown sandy silt	Partly stabilised	Gully erosion and slope wash due to mass movement	50 cm by 1 m	Cleared, pasture grasses, Cypress pines and Eucalypts
WC20	AMG 56	279107	6424568	Artefact Scatter	Riparian Corridor	West Footslope	W	0	360	10	0	Mid brown sandy silt	Active	Scalding due to mass movement/slope wash and active gully erosion and scalding from cattle grazing on edges of creek	63 m by 13 m	Prickly Pear, Narrow leaved Ironbarks, Eucalypts
WC21	AMG 56	278790	6425444	Artefact Scatter	Riparian Corridor	Footslope	N	0	360	10	0	Black chocolate alluvium silt	Stabilised	Scalding in patches due to cattle treadage.	1 km by 1.5 km	Cleared Pasture and some mature Eucalypts
WC22	AMG 56	278733	6422546	Artefact Scatter	Spur crest	Spur Crest	SE	2	360	5	3	Brown sandy silt	Active	Cleared pasture, scalding from vehicle track and slope wash.	4 m by 2 m	Narrow leafed ironbarks, Eucalypts, grasses
WC23	AMG 56	279149	6422282	Isolated Find	Western Rocks Plateau	Upper slope	N	2	360	3	0	Humic brown silt	Partially stabilised	Slope wash movement of materials down slope.	50 cm by 50 cm	Narrow leaved Ironbarks
WC24	AMG 56	279259	6422292	Isolated Find	Western Rocks Plateau	Upper slope	E	2	270	5	0	Brown sandy silt	Active	Slope wash movement of materials down slope.	50 cm by 50 cm	Narrow leaved Ironbarks, Cypress Pines, tea trees
WC25	AMG 56	280101	6422719	Rockshelter with PAD	Wallaby Rocks Plateau	Mid slope	SW	3	180	20	1	Brown silty sand	Partially stabilised	Some slope wash and movement of materials down slope and wombat burrows.	10 m by 4 m	Ironbarks, Casuarina, Cycads and Acacia
WC26	AMG 56	280101	6422719	Rockshelter with PAD	Wallaby Rocks Plateau	Upper slope	SW	4	180	90	5	Light grey sand	Partially stabilised	Some slope wash and movement of materials down slope but it is moderate.	21 m by 3 m	Ironbarks, Box Gums and Saplings
WC27	MGA	280518.02	6423101.4	Rockshelter with PAD	Western Rocks Plateau		W	4	270	60	5	Light grey silt	Partially stabilised	Some slope wash but it is not extensive.	24 m by 4 m	Box Gum, Ironbarks and Angophora
WC28	AMG 56	280192	6422329	Isolated Find	Western Rocks Plateau	Saddle ridgeline	SE	1	360	10	0	Brown sandy silt	Active	Some slope wash and scald erosion associated with clearing.	50 cm by 30 cm	Box Gum, Ironbarks and Cypress Pines
WC29	AMG 56	279071	6422329	Isolated Find	Modified	Modified	NE	1	360	80	20	Brown silty sand	Partially stabilised	Some slope wash associated with use as a vehicle track and associated scalding.	2 m by 1 m	Mistletoe, Ironbark and Box Gum
WC30	AMG 56	278825	6422566	Isolated Find	Spur crest	Spur Crest	E	2	360	10	5	Brown silty sand	Active	Some slope wash and scalding associated with use of vehicle track.	50 cm by 1 m	Native Willow, Cleared pasture grasses and mistletoe
WC31	AMG 56	279060	6424420	Isolated Find	Modified	Modified	W	3	360	100	7	A horizon exposed only	Active	Modified part of a vehicle track.	Track is 1.5 m wide	Open pasture grass
WC32	AMG 56	279099	6424645	Artefact Scatter	Riparian Corridor	East Footslope	W	0	-	95	5	Silty coarse grained sands	Active	Gully erosion and slope wash due to mass movement	Not given	Open pasture grass
WC33	AMG 56	278785	6422344	Rockshelter with PAD	Western Rocks Plateau	Saddle ridgeline	W	2	290	100	40	Silty sediments	Active	Erosion from slope wash-mass movement of materials down slope from shelter.	20 m by 17 m	Tall open forest
WC34	AMG 56	279232	6422086	Isolated Find	Ridgeline Crest	Mid slope	-	3	-	100	0	Silty loamy sands with pebbles	Active	Erosion from slope wash - mass movement from materials on vehicle track.	Extent of track	Forest, dense spiky shrub understorey.

Final Name	Co-ordinate System	Easting	Northing	Site type	Archaeological Terrain Unit	Landform Element	Aspect	Slope	Outlook	Visibility Inside Exposure	Visibility Outside Exposure	Soils	Erosion State	Erosion Form	Erosion Extent	Vegetation
WC35	AMG 56	279587	6421956	Artefact Scatter	Simple slope	Mid slope	-	3	-	100	0	No description.	Active	Erosion from slope wash - mass movement from materials on vehicle track.	3 m by 2 m	Forest, dense spiky shrub understorey
WC36	AMG 56	279844	6421873	Isolated Find	Spur crest	Spur Crest	-	3	-	100	0	Brown silty sands with conglomerate pebbles	Active	Erosion from slope wash - mass movement from materials on vehicle track.	-	Melaleucas, pine things, spring moss off, grasses
WC37	AMG 56	280517	6421732	Artefact Scatter	Modified	Modified	-	3	-	100	0	Hard packed silts	Active	Erosion from slope wash - mass movement from materials on vehicle track.	25 m by 3 m	Melaleucas, pine things, spring moss off, grasses
WC38	AMG 56	280516	6421680	Artefact Scatter	Modified	Modified	-	3	-	100	0	Dry hard packed silt with pebbles and sandy surface	Active	Erosion from slope wash - mass movement from materials on vehicle track.	-	Melaleucas, pine things, spring moss off, grasses
WC39	AMG 56	280022	6421457	Artefact Scatter	Modified	Modified	-	3	-	100	9	Silty sediments	Active	Site is located on a dam. Erosion includes mass movement from slope wash.	150 m by 100 m	Pasture grasses - exotics
WC40	AMG 56	279197	6424376	Isolated Find	Modified	Modified	E	3	90	95	5	Orange light brown silty sand	Partially stabilised	Modified part of a vehicle track.	50 cm by 50 cm	Open pasture grass
WC41	AMG 56	279207	6424293	Artefact Scatter	Modified	Modified	E	3	90	15	15	No description	Active	Modified part of a vehicle track.	5 m by 2 m	Open pasture grass
WC42	AMG 56	279029	6424307	Artefact Scatter	Modified	Modified	W	3	360	100	7	Stable A horizon only	Active	Modified part of a vehicle track.	Track is 1.5 m wide	Open pasture grass
WC43	AMG 56	279319	6425147	Rockshelter with PAD	Wallaby Rocks Plateau	Spur Crest	NW	4	270	80	10	Light grey sandy silt	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Narrow leaved Ironbark and Eucalypts
WC44	AMG 56	279283	6425039	Isolated Find	Wallaby Rocks Plateau	Spur Crest	N	4	360	5	0	Light grey sandy silt	Partly stabilised	Mass movement/slope wash	Slope wash	Narrow leaved Ironbark and Eucalypts
WC45	AMG 56	279317	6424983	Rockshelter with PAD	Wallaby Rocks Plateau	Mid slope	SW	4	180	20	3	Light brown sandy silt	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Narrow leaved Ironbarks, Native Olive, Red Ash, Kangaroo Grass
WC46	AMG 56	279317	6424963	Rockshelter with PAD	Wallaby Rocks Plateau	Scree Slope	SW	4	300	90	5	Black sandy silt	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Narrow leaved Ironbarks, Eucalypts, Kurrajong, Cobbler's Pebble
WC47	MGA	279620.03	6425688.4	Rockshelter with PAD	Wallaby Rocks Plateau	Scree Slope	NW	4	270	80	8	Sandy black silt	Partly stabilised	Mass movement/slope wash	Some movement of rock shelter deposit on floor down slope	Narrow leaved Ironbark and Eucalypts
WC48	AMG 56	279195	6424424	Isolated Find	Simple slope	Mid slope	-	3	360	-	-	Silt	Partially stabilised	Scalding due to an ants nest	25 cm wide track from animal	Open pasture grass

APPENDIX 10

Geomorphological Assessment

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6 July 2006

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Geomorphological assessment of Aboriginal sites, Anvil Hill Project

Introduction.

Umwelt (Australia) Pty Limited (Umwelt) has been commissioned by Centennial Hunter Pty Limited to carry out an Aboriginal cultural heritage assessment for the Anvil Hill Project, a proposal for an open cut coal mine near Wybong in the Hunter coalfield of NSW.

Numerous Aboriginal heritage sites have been identified in the field and relocated from previous work and the brief for this report was to place these sites in their geomorphic and pedological context. In particular assessment of the main sites was required to consider their potential to contain buried archaeological deposits.

Fieldwork was undertaken on March 6, 2006 in company with Ms Mary-Jean Sutton and Ms Jillian Ford, (Umwelt archaeologists) and nine parts of the project area were examined. These locations are shown on Figure 1 and are discussed below. Umwelt provided scanned copies of air photographs taken in the 1938, and 1967, plus a recent rectified colour image of the area. This material was used in assessing landscape change and the effects of past land management but the density of the scanned images was insufficient to identify some important features such as former chains of ponds along the creeks.

No excavation was undertaken as natural soil exposures were sufficient to assess all locations.

Location, topography and geology.

Centennial Hunter Pty Limited (Centennial) propose to establish an open cut coal mine in the Wybong area, 20km west of Muswellbrook and approximately 10 km north of Denman in the Hunter Valley.

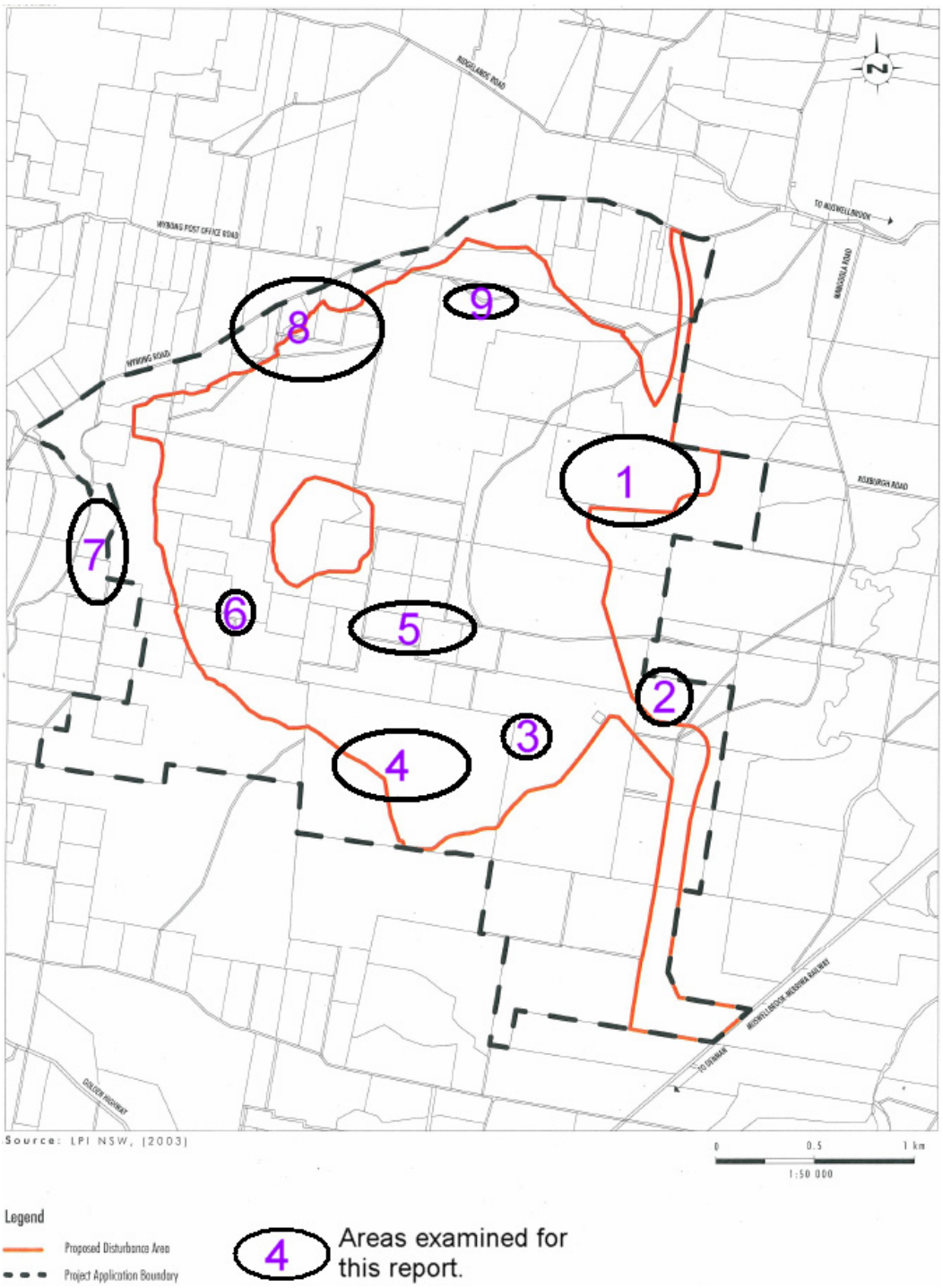

Figure 1. General location of areas examined for this report in relation to property and project boundaries.

Base map from Umwelt.

Dominant topographic features include three groups of rocky hills with steep escarpments; the central Anvil Hill, a southern complex known as the Limb of Addy Hill, and a prominent rocky ridge adjacent to Wybong creek that is not named but is locally known as Wallaby Rocks (Figure 2). Local relief is 60 to 90m with the top of Anvil Hill rising to 280m ASL. None of the rocky hills are to be mined but their proximity to the proposed open cut suggests that they may be affected by excavation and blasting vibration.

Geologically Anvil Hill and the other high peaks and ridges are residual outcrops of massive Narrabeen Group conglomerates and quartz sandstones of Triassic age (Dept. of Mines 1988). On the air photos three important joint sets are seen to control cliff orientation. These strike at approximately 140^0 to 160^0m, 045^0 to 070^0m, and 005^0 to 020^0m. These joint planes appear to be near vertical. In the field an oblique low angle set was also noted along with sub-horizontal bedding. All of these planes of weakness are important in defining the cliff lines and benches on the rocky ridges and in controlling the location of shallow fretted cavities in the cliffs that sometimes served as rock shelters for Aboriginal people.

Figure 2. Western face of Wallaby Rocks showing typical shallow fretted overhangs (rock shelters) and strong structural control of the cliff face. The exposed colluvium in the foreground is described in the text under Area 7.

Most of the project area is country of lower relief drained by the tributaries of Big Flat Creek, Anvil Creek and an un-named drainage system on the eastern side that flows into Sandy Creek. Topographic relief ranges from 140m to approximately 200m ASL and ground slope rarely exceeds 5^0 with the wider valley floors being as flat as 0.5^0. Anvil Creek is probably a third order stream from below Area 5, and Big Flat Creek is a fourth order stream in its lower reaches. Stream order cannot be reliably determined from the 1:25,000 topographic map (CMA 1978), as the small tributary channels have not been consistently mapped.

The project area is underlain by the Wollombi Coal Measures of Permian age (Dept. of Mines 1988) but rock only outcrops as low benches on the lower slopes above the floodplain of the creeks and in a few location in the headwaters of streams. The most common rock types observed are lithic sandstone, quartz sandstone, shale, and some cherty shale or tuff. None of the rock types seen *in situ* during fieldwork were suitable for artifact manufacture but components of the conglomerates and scattered clasts of silicified wood probably are. Indurated volcanic ash (tuff) is known to be widespread through the Hunter coalfield (Creech 2002) and outcrop of these rocks may have been locally important to Aboriginal people. If further archaeological work is undertaken on this Project then Centennial should consider attempting to provenance artifact lithologies.

Land systems, soil landscapes and past land use.

The only previous descriptions of the geomorphology and soil in this region were made by Story *et al.,* (1963) as part of a Land System survey and more recently by Kovac and Lawrie (1991) as a Soil Landscape survey. These documents are useful as general descriptions of the environment but both maps were produced at too coarse a scale to be applied to the analysis of Aboriginal sites or site patterns.

Story *et al.*, (1963) mapped the sandstone ridges as part of their Lee's Pinch land system, and the surrounding lower slopes as part of their Killarney land system. The eastern edge of the project area falls into their Glendower land system but the local characteristics of this are essentially the same as part of the Killarney land system. The main properties of these systems are summarized in Table 1.

Land System name	General description
Lee's Pinch	Unit 3 applies to the Project Area. Stony hilly plateau on Triassic sandstone with ridges to 60m high. Coarse textured skeletal soils with yellow earths on stable surfaces. Poor ground cover, high proportion of bare rock and open cover of ironbark, gum and black pine.
Killarney	Undulating lowlands on Permian shale, sandstone and conglomerate. Local relief less than 30m with widespread podzolic and solodic soils supporting a woodland of box, gum and ironbark. Terraced alluvium in the valleys with extensive sheet erosion.
Glendower	The description of unit 3 of this system is very similar to that of the Killarney system.

Table 1. General properties of the Land Systems found in the project area. Summarised from Story *et al*. (1963).

The Soil Landscape mapping by Kovac and Lawrie (1991) uses some of the same names and has comparable descriptions. More descriptive detail of soil material is provided and this work is a useful guide to site conditions when carefully interpreted. Table 2 summarizes the main properties listed.

General description	General description
Lees Pinch	Sandstone cliffs formed on Triassic Narrabeen Group sandstones and conglomerates. Stony plateau and narrow gorges with ironbark and black cypress pine. Shallow skeletal, siliceous sands and loams some gradational yellow and brown earths on lowers slopes merging to yellow texture contrast profiles on adjacent Sandy Hollow Soil Landscape.
Sandy Hollow	Slopes below the Lees Pinch Soil Landscape constructed of colluvium derived from Triassic sandstone and conglomerate hills. Benched slopes with low rock outcrops. Red texture contrast soils (solodics) on higher, better drained ground and yellow texture contrast soils with strongly bleached A_2-horizon and columnar B-horizons on poorly drained lower slopes and valley floors. Uniform loams or clays in drainage lines. Most slopes are extensively sheet eroded and gully erosion is common. Yellow box, forest red gum, narrow leaved apple and black cypress pine.
Merriwa	Alluvial sands and loams along Wybong Creek. Gradational chernozems, prairie soils, and some uniform cracking clays (black earths) on first terraces, gradational red earths and solodic texture contrast soils on the higher terraces up to 12m above the creeks merging into the Sandy Hollow Soil Landscape.

Table 2. General properties of the soil landscapes found on the project area. Summarised from Kovac and Lawrie (1991).

The project area has been used for grazing and limited agriculture since the mid-1800s. The 1938 air photos show that almost all of the lower slope units and stream lines had been cleared or substantially thinned of timber but only a few blocks had been cultivated. The 1967 photos show evidence of timber regeneration on the foot slopes of the rocky ridges and the beginning of dense regeneration of swamp oak along stream channels. Almost none of the ground with the project area was being cultivated at that time. By 2006 areas of timber regeneration had increased again and the total area now covered by trees is approximately twice that evident in the 1938 photographs.

One consequence of the partial land clearing and grazing in the early 20th Century was that runoff from the hill slopes increased and all the stream lines have been gullied and widened with active headwalls extending up the catchment into first order streams. A second, later consequence is that landowners in the 1960s and 1970s constructed gully stabilization works and contour banks to slow runoff and reduce erosion. In places these works have both exposed and partially destroyed some Aboriginal sites.

Wherever Aboriginal artifacts have been located some degree of soil disturbance and sheet erosion is present and this is clearly a factor in the visibility of sites. Other sites can be expected, especially along the terraces of the main streams but these will be difficult to locate without exposing the lower parts of the biomantle (see area descriptions and discussion below).

In an attempt to gain more information about the original (19th Century) vegetation cover and stream form, a selected number of Portion Plans (Crown Land surveys) were obtained from the Department of Lands. Portion Plans of the mid-19th Century often record considerable detail of the landscape but later plans are more often limited to basic information about marked corner trees, the value of improvements, and the presence of permanent water on any block (Jeans 1978). Unfortunately the plans relevant to Anvil Hill fit the latter description and they did not reveal very useful information. The little that was obtained is incorporated in the area descriptions.

More detailed description of the field areas. (Refer to Figure 1 for locations).

Area 1. Un-named creek system on Woolumbin property.
Aboriginal site numbers 169, 170,171,173,178, 179,180 181.
General grid references (AMG 1984): 6424092E 284450N, 6424939E 284341N, and 6424796E 284669N.

Wide alluviated valleys that contain shallow gravel deposits over quartz and lithic sandstones, some conglomerate and shale. Ground slope 3 to 5^0, partly vegetated by regenerating ironbark, gum and swamp oak. Stony uniform cracking black clay profiles on the creek flats with no evidence of any buried land surfaces. Shallow texture contrast soils on the terrace and slopes with a variable A-horizon generally being a hard-setting sandy loam but occasionally more sandy when adjacent to sandstone bedrock. Shallow uniform stony loams on the higher slopes (Figure 3).

Throughout the project area and particularly in Area 1 all ground surfaces are sheet eroded to an average depth of 20 to 30mm. Tree bases and surface rocks are pedestalled, and litter dams and micro-terraces are common (Figure 4). See Mitchell and Humphreys (1987) for the genesis of these micro-landforms. Both of these features are evidence of progressive soils stripping by rainwash processes. Minor rills lead to defined gullies 1 to 2m deep even in wooded areas. Active headwalls and sandstone outcrops occur in first order streams (Figure 5). There is one low terrace about 2m high along the main stream. Extensive earthworks and gully shaping by bulldozers included attempts to armour the banks with sandstone boulders have extensively disturbed the ground. Aboriginal sites originally present are likely to have been very damaged.

Prospects for the recovery of intact Aboriginal sites in Area 1 are low.

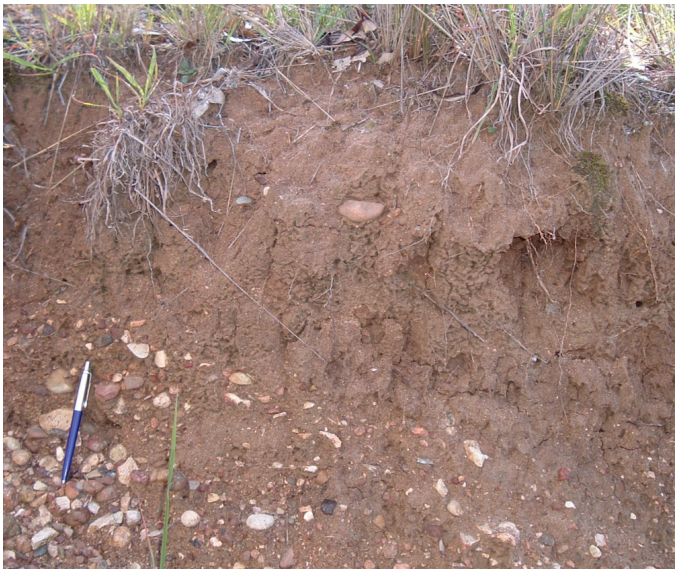

Figure 3. Typical shallow stony loam on the higher slopes of Area 1. Note the clear boundary to deeper pebble layers. The surface layer is a biomantle and the B-horizon is barely developed in this slope colluvium.

The pen is 12cm long.

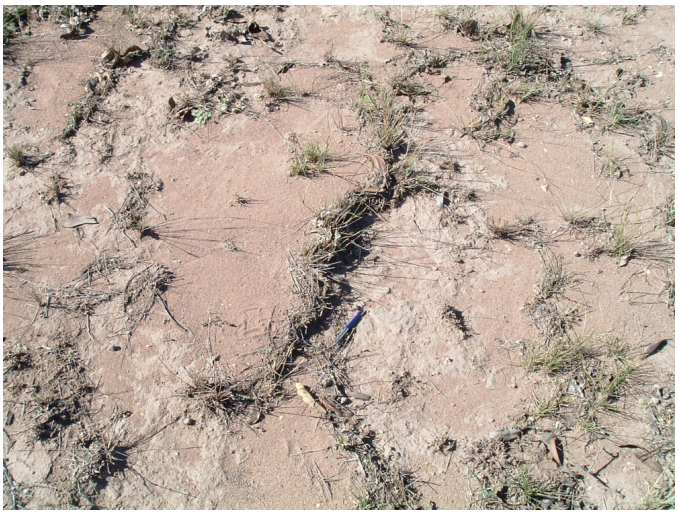

Figure 4. Well developed litter dams and microterraces indicative of extensive surface disturbance by rainwash processes. Such erosion is evident in most parts of the project area even under moderate tree cover.

The pen is 12cm long.

Figure 5. Sub-horizontal lithic sandstone exposed in a first order stream in Area 1. This rock appears to be suitable for axe grinding but no grooves are present and it is likely that the rock was not exposed at the time of Aboriginal occupation.

Area 2. Un-named left bank tributary of Sandy Creek beneath the power line on the railway access route north of Coolabah Rd.
Aboriginal sites 176 and 259
Grid reference 6422899E 285113N.

This area is also disturbed by sheet erosion and visibility of the ground surface was high. The main concentration of artifacts appears to be near the intersection point of shallow gullies with the higher parts of the Sandy Creek floodplain just upstream of the point where the tributary stream breaks into shallow distributary channels. The upper slope of 3^0 carries a yellow brown texture contrast soil and the lower slope of between 1 and 2^0 has a brown alluvial clay with very low amplitude gilgai micro-relief supporting scattered swamp oak. There is no obvious sign of past waterholes or ponds along the stream that might explain the presence of the Aboriginal sites but the gilgai area (outside of the project area) could have provided attractive food resources after flooding.

As this area is adjacent to the proposed railway loop it may be preserved by small adjustments in the project layout. Centennial may consider further testing to define the site limits, in which case a combination of grader scrapes and hand excavation would be appropriate.

Area 3. Around a shallow dam at 6422867E 283589N on a poorly defined headwater tributary of Anvil Creek.

Ground slope less than 1^0 with a shallow yellow texture contrast soil over cherty shale. isolated artefacts are exposed in the A-horizon (biomantle).

The shallow soil on this site and its location high in the catchment suggests that this area is unlikely to be archaeologically significant.

Area 4. In the vicinity of an isolated find near an abandoned quarry at 6422113E 282509N and around the base of the sandstone ridge below Aboriginal site 175.

A geotechnical report indicated that deep sounds were present in this area and it was specifically examined to test this statement as a such a sand body could be important for Aboriginal camp sites or burials. The quarry is located in gravelly colluvium and *in situ* weathered conglomerate. The entire forested slope below the sandstone ridge is a gravelly colluvial mantle that does become finer toward the base of the slope but there is no evidence of any sand sheet.

The forested area would have had high value for food and fibre resources to Aboriginal people but the absence of water and stony ground suggest that it is unlikely that any important Aboriginal site is present in this area other than the rock shelter.

Area 5. On Anvil Creek in the vicinity of 6423830E 282561N, near on old stockyard and earth dam. Some 25 artefact scatters or isolated finds have been located along this central

portion of Anvil Creek where some original geomorphic elements of the stream system appear to be reasonably intact (Figures 6 and 7).

In this sector the channel is probably a 3rd order stream although the 1:25,000 topographic map does not depict all the tributaries. The channel has a low gradient and is incised about 1m below a clearly defined sedimentary unit of post-European fine gravels. Along the length of the creek sub-circular depressions 12 to 25m long and 3 to 5m wide are the remnants of an original 'chain of ponds' streamline (see Eyles 1977a and 1977b for definition). The floor of the former pools is dark cracking clay that is now seen as a buried soil beneath the post-European sediments (Figure 8). Several ponds have been gullied (Figure 9), another is isolated from the present channel, and some were probably located in the bed of an old earth dam. On the margin of the floodplain a low terrace feature about 1m high grades back to the hillslope (Figure 10). These areas have a strongly developed harsh texture contrast soil profile with a hardsetting A-horizon and a bleached A_2-horizon over columnar yellow grey clay. Artefacts are being eroding from the A_2-horizon.

The dam wall about 2.5m high was originally constructed across the creek. It had a stone lined spillway on the northwestern corner but the dam has been breached in the centre of the embankment and a large volume of fill shifted down stream into the original ponds.

The age of the European structures is unknown. Portion Plans 190 and 191 were surveyed in 1887 and they describe the area as undulating country with poor soil, timbered with oak, box, gum, ti tree (paperbark) and ironbark. The plans make no mention of the presence or absence of permanent water and do not mark ponds along the creek. Plans for Portions 40 and 45 were not obtained as the plan numbers duplicated those of a nearby Parish and the wrong plans were delivered. The dam and the stockyard are just visible in the scanned 1938 air photos. In the 1967 photo there appears to be some other structure in the creek adjacent to the stockyards and the dam is holding a small amount of water. This implies that it was breached sometime later and that would be consistent with the apparent age of the trees now growing on the dam wall that are estimated to be about 30 years old.

The presence of these old European structures suggests that the ponds in the original creek may have been important to early graziers and reinforces the idea that the site was also important to Aboriginal people for perhaps the same basic reason – availability of water.

The Aboriginal sites along this part of the creek contain a relatively large number of artifacts and where they are seen to be eroding from the biomantle it is likely that more remain intact within the soil. The suspected presence of original ponds that can be identified and mapped provides a rare opportunity for a more detailed archaeological investigation that may reveal a great deal about Aboriginal activities at a central water resource.

Any further investigation of this site should be preceded and guided by detailed geomorphic mapping of the area and stratigraphic analysis of the soils and sediments exposed in the valley.

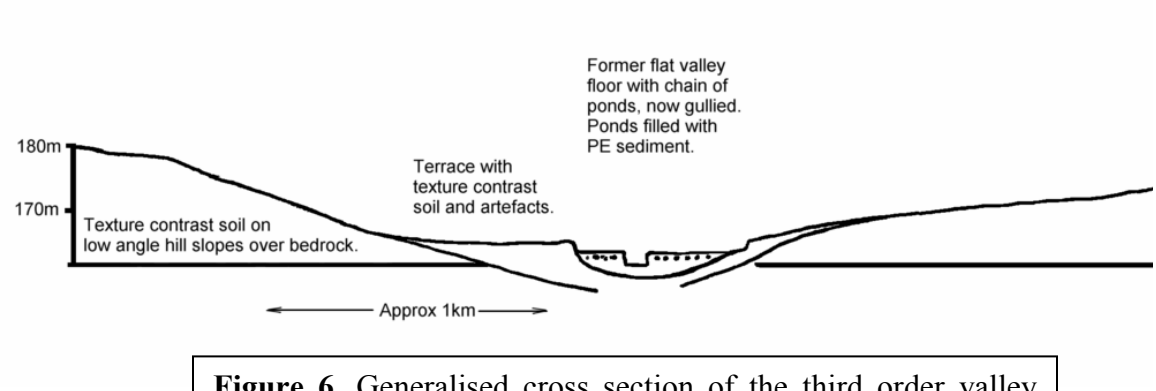

Figure 6. Generalised cross section of the third order valley floors in the Project Area, such as Area 5.

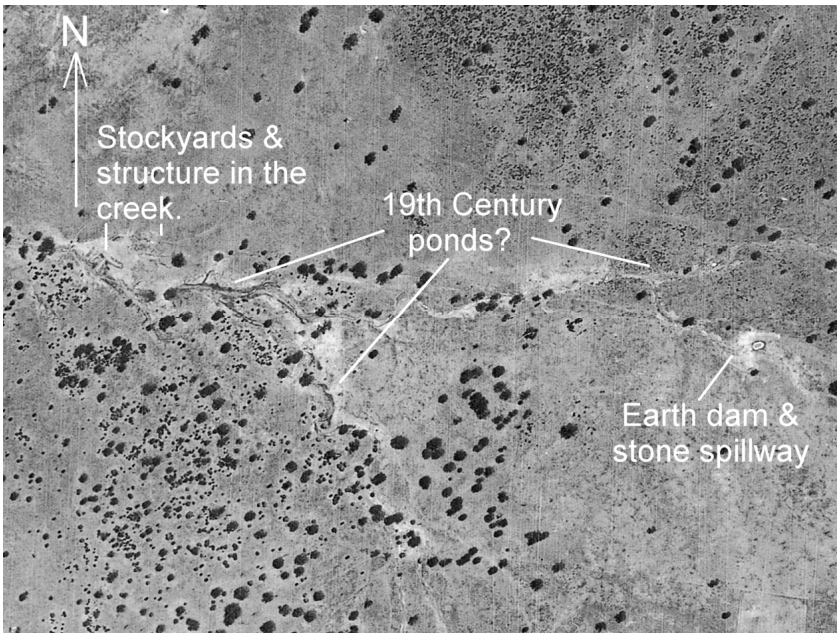

Figure 7. Enlarged view of Anvil Creek between Aboriginal sites 76 and 89 taken from the 1967 air photo. Although image quality is limited the old stockyards and dam are visible near the traces of an original chain of ponds along the stream.

Figure 8. Post-European sediments (bedded fine gravel and loam) above original topsoil in the bed of a suspected 19th Century pond in Anvil Creek in Area 5.

The 12cm pen is at the level of the buried soil.

Figure 9. Suspected site of one of the 19th Century ponds in Anvil Creek in Area 5.

The discontinuous gully headwall has incised post-European sediments and reveals the dark clay bed of the pond.

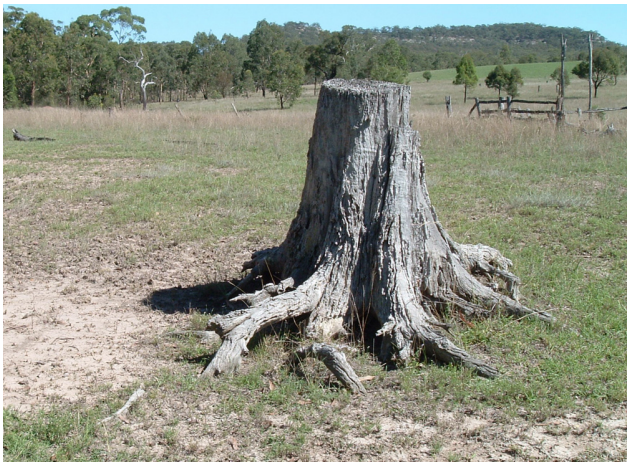

Figure10. Pedestalled tree stump on the stream terrace in Anvil Creek in Area 5, revealing some loss of soil and exposure of Aboriginal artifacts from the biomantle.

Part of the old stockyard in the background.

Area 6. On Anvil Creek approximately 2km downstream from Area 4.
At Aboriginal sites 166, 167 and 168, grid reference 6424083E 280606N.

The stream bed in this area has a steeper gradient than Area 5 and the stream carries a bedload of fine gravel. The bed and banks are eroded; the channel has been widened and up to 50cm of post-European gravels mantle the modified bed. The original early 19th Century channel is evident in places and has a shallow dished cross section. The present stream bed lies about 2.5m below a terrace carrying the usual harsh texture contrast soil (Figure 11). Aboriginal artefacts are eroding from the exposed A_2-horizon. Much of the terrace is covered by old paper-barks (the ti tree of the Portion Plans) indicating that this land is poorly drained and can be intermittently flooded by heavy rain. The presence of ironstone pisolites (nodules) and cemented zones in the A_2-horizon confirm this view. Generally speaking such damp sites were not favoured as Aboriginal camp sites and no further work is indicated here.

Figure 11. Harsh texture contrast soil (solodic) on the stream terrace in Area 6. The A_1 and A_2-horizons are a biomantle over domed yellow brown pedal clays with moderate amounts of pisolitic ironstone gravel. Similar soils are found over most of the project area on bedrock, on colluvium, and on older alluvial deposits.

The pen is 12cm long.

Area 7. On the right bank of Wybong Creek below the high rocky ridge of Wallaby Rocks (Figures 2 and 12) where numerous Aboriginal sites have been recorded. This area lies outside of the project area and will not be directly affected by development of the mine.

Near vertical cliffs of sandstone and conglomerate with numerous fretted hollows. Lower examples have sometimes been used as rock shelters. As noted above the cliff line is strongly controlled by rock structure and there is some potential for collateral damage to these features from blasting in the open cut.

The cliffs have a maximum relief of 80m and are flanked by 15^0 colluvial slopes with large scatttered boulders. This slope is concave and flattens to about 6^0 where it merges with a high terrace along Wybong Creek. At about the mid-slope position the gravel mantle is 2.5 to 3m deep and consists of crudely bedded sandstone and conglomerate gravels 5 to 10cm in diameter. A few larger boulders lie embedded in this mantle. Where

exposed in a small quarry at 6424774E 279295E (Figure 13) the sequence represents continuous accumulation of slope debris with no evidence of any buried land surface or soil formation.

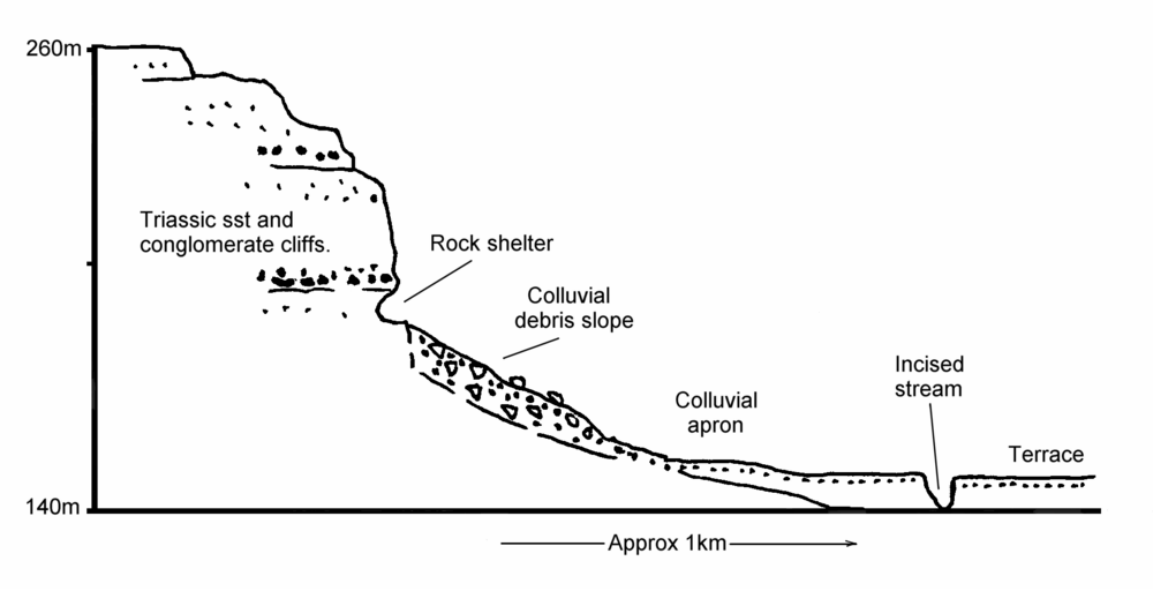

Figure 12. Generalised cross section of a rocky ridge and valley floor such as Area 7 at Wallaby Rocks.

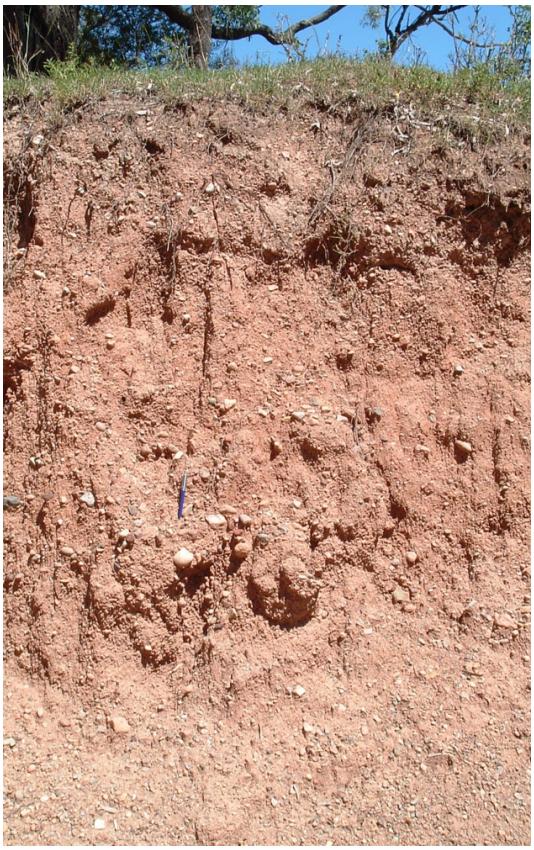

Figure 13. More than 2.5m of rubbly colluvium on the apron below the sandstone cliffs in Area 7. The rubble is bedded indicating episodic deposition but it contains no buried soil profiles and the modern profile is very poorly developed suggesting that it is a young feature.

The pen is 12cm long.

Area 8. On the terrace of Big Flat Creek (referred to as Dry Sandy Creek on the Portion Plans) in the vicinity of Clarkes Gully junction. A large number of artefact scatters and isolated finds have been recorded in this section.
General location 6426871E 281117N and 6426196E 280988N.

Artefacts are mainly found within the topsoil (biomantle) of a harsh texture contrast profile where it is exposed and eroding on the edge of a stream terrace. The soils is similar to that seen along the terrace of Anvil Creek (Figure 11) and it has a hardsetting A-horizon with a strongly bleached A_2-horizon.

The creek is lined by patches of dense regeneration of swamp oak with scattered mature rough-barked apple. Some parts of the stream bed carry dense *Juncus* sp. indicative of brackish soil or water conditions. The stream channel is incised 2 to 2.5m below its estimated 19th Century level and the bed of the stream is covered with post-European gravels including an occasional sandy point bar. Small relic point bars of coarse sand also occur on the margin of the terrace as a poorly formed levee. These do not show artifacts at the surface but may contain material at shallow depth.

There is no permanent water in the creek at present but there is some evidence that the original channels had a chain of ponds form and water may have been more commonly (but not permanently) available to Aboriginal people. In an attempt to confirm this suggestion the Portion Plans upstream and downstream of the Clarkes Gully junction were obtained. That is, Portion numbers; 43, 62, 63, 67, 92, 162 and 163. These were surveyed in 1872, 1873 and 1891. The land use was then described as best suited for grazing with possible cultivation of parts of Portions 67 and 92. The original vegetation was ironbark, apple, gum, ti tree (paperbark) and oak scrub with some parts being well grassed. No permanent water was noted and no waterholes are depicted on the plans. Although this description is limited it does not preclude the possibility that ephemeral ponds did exist. A large example of an original pond can be seen in Clarkes Gully immediately upstream of its junction with Big Flat Creek. Sediments exposed in the wall of this pond reveal a buried land surface with a weakly developed topsoil. No artefacts were seen in any exposure of the material, but the total length of the visible section was only a few metres.

Most of the known Aboriginal sites in Area 8 are on the margin of the project area. If further archaeological investigation is undertaken then this should be guided by detailed geomorphic mapping and interpretation of soil stratigraphy. Testing of these larger areas might be most effectively done by grader scrapes or equivalent.

Area 9. Sormaz Gully in the vicinity of 6426873E 283722N.

In this partly cleared landscape a deeper gully section exposes a well developed harsh texture contrast soil over 3m of sandy colluvium above a base of weathered sandstone and conglomerate (Figure 14). The biomantle is hardsetting and is strongly bleached. No buried soils or land surface features are evident in the gully walls. The adjacent ground

slope is steeper than in most other parts of the project area and the gully has been incised and extended during the period of European land management.

No artifacts were observed along the section examined and the area does not warrant any further work.

Figure 14. Harsh texture contrast soil similar to that in Figure 11 developed on deep colluvium and exposed in a gully wall in Area 9. This section is about 2.5m deep.

Discussion – potentially important sites, significance of the texture contrast soils and the biomantle.

Experience elsewhere in the Hunter Valley and on the Cumberland Plain of western Sydney (Mcdonald and Mitchell 1994) has suggested that stream order is a reasonable indicator of the likely size of open Aboriginal campsites. The Anvil Hill Project area appears to confirm this model.

Stream order is a surrogate for catchment size and stream discharge. Threshold values of catchment size, valley forms and discharge might be expected in any particular landscape. For example in the Hunter Valley, first and second order streams do not have permanent flow, but third order streams may. Third order streams usually have wider floodplains containing billabongs, swamps or ponds and thus would have provided different resources to Aboriginal people in the past. The junctions of larger streams (third order and above) commonly have permanent water, and experience shows that these places tend to be the location of larger open sites. In other words, stream order can be used as a coarse tool for the prediction of the location of Aboriginal sites. It is not

infallible and it should be emphasised that the actual numeric order obtained in any study depends on the scale and reliability of the map used. In practice 1:25,000 maps are usually the best available but in this particular case there is reason to doubt the quality of the Sandy Hollow map as not all first order streams are depicted.

On the face of it, the larger concentrations of Aboriginal sites within the project area are found in the vicinity of Areas 2, 5, 7 and 8. All of these places seem to be on third order (or higher) streams and all have some supporting evidence for the original presence of ponds or permanent water (Area 7). None of the sites show any evidence of older preserved land surfaces or buried soils that might extend archaeological knowledge into the Pleistocene.

If further archaeological work is to be conducted these areas appear to have the greatest potential. There are some conditions however, as all of the sites are open surface scatters in texture contrast soil mantles.

Texture contrast soils consist of an active biomantle (Johnson 1989, 2002, Paton *et al*., 1995) over clay subsoil that has weathered *in situ*. On higher slopes these profiles have red clay B-horizons, on the lower slopes the colour shifts to yellow tones indicating poorer drainage, and in places on the valley floor drab brown or grey tones are seen where the soil is sometimes saturated. Typically the A-horizon is hard-setting and the intensity of bleaching in the A_2-horizon increases down slope. The B-horizon clays are well structured and friable on upper slopes but more poorly structured and dispersible on the mid and lower slopes.

The biomantle can be shown to be a separate stratum in that it crosses several substrates without significant change and it has all the archaeological properties described for such units by Dean-Jones and Mitchell (1993). Specifically these properties are:

- Open sites on texture contrast soils are unlikely to be stratified in a chronologically useful sense.
- Artefacts will be confined to the biomantle.
- Artefacts will have been subject to surface dispersion, limited down slope movement, and differential burial or exposure by bioturbation agents and they will contribute to a stone layer between the A and B-horizon where artefacts of all ages accumulate.
- Despite the taphonomic processes affecting artefact distribution in the soil some site use patterns, such as knapping floors, may survive in plan form but with an extended vertical distribution of their components and possible mixing with artefacts from other events. For examples of the complexities of this process see Cahen and Moeyersons (1977), and Balek (2002).
- Because artefact burial is an ongoing process their surface visibility will be poor except where material has been exposed by erosion.
- The only means of dating any sites in this landscape will be by recognition of cultural sequences of artefacts, or from the recovery of intact ‘hearths’ or burials. Hearths are not common in the Hunter Valley and burials are not likely in these shallow soils. All other dates, especially those based on detrital charcoal, and

including those based on thermo-luminescence, will be spurious because artefacts can move through soil material of any age.

Report distribution.
Umwelt should provide full copies of this report to their client Centennial Hunter Pty Limited, and all of the participating Aboriginal groups.

Dr P.B. Mitchell

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APPENDIX 11

Research Design and Methodology

Research Design and Methodology

1.0 INTRODUCTION

The purpose of this Appendix is to provide a research design and methodology for the proposed surface collection and sub-surface investigations and sub-surface salvage recommended in the attached report and outlined in **Section 10**.

1.1 DESCRIPTION OF THE AREAS OF SUB SURFACE INVESTIGATIONS

Surface collection, sub-surface investigations and sub-surface salvage are required for archaeological sites shown on **Figure 9.2** which are within the Anvil Hill Proposed Disturbance Area. This area includes archaeological sites identified within the Umwelt (2005) survey area and sites recorded by previous archaeological investigations including Witter (2003), Russell (2002) and Silcox (1983). The site history of these previously recorded sites is outlined in **Section 5** and **Appendix 9**.

The purpose of the sub-surface investigations is to provide testing of the nature and extent of selected archaeological sites within the Proposed Disturbance Area and/or to further our knowledge of their geomorphic history. This information will be used to determine the most appropriate locations within sites for sub-surface salvage using manual excavation.

1.2 LOCATION AND NATURE OF THE ARCHAEOLOGICAL SITES SUBJECT TO SURFACE SALVAGE AND FURTHER SUB SURFACE INVESTIGATION

The locations of all sites identified during fieldwork are shown on **Figures 6.2** and **6.3**. The location of all sites assessed as requiring surface salvage and further sub-surface investigation/salvage is shown on **Figure 9.2**. **Table 10.1** in the attached report provides details of the relevant sites that are the subject of this Research Design and Methodology.

1.3 PROPOSED IMPACTS TO ARCHAEOLOGICAL SITES

The area to be impacted by the proposed development is identified on **Figures 1.2** and **2.1** in the attached report for the Anvil Hill Project. The potential impacts to archaeological sites are discussed in **Section 2** of the attached report. Affected sites and mitigation measures for management of these sites are outlined in **Table 10.1** of the attached report.

The current research design and methodology applies to the salvage of archaeological material evidence associated with the sections of the landform units/sites that will be impacted by open cut mining and other ancillary mining activities (refer to **Figure 9.2**) within the Anvil Hill Project disturbance area (refer to **Figure 1.2**).

1.3.1 Why is Impact Necessary

The proposed impact area is within the proposed 20 year mining footprint and is required to be disturbed to allow extraction of coal.

2.0 ARCHAEOLOGICAL CONTEXT

The archaeological context for the survey area which provides a background for this research design is located in **Section 5** of the attached report. **Appendix 9** provides a detailed analysis of previous archaeological research in and near the survey area.

3.0 RESEARCH DESIGN

The following research questions have been formulated to direct the sub-surface investigations/salvage within the Proposed Disturbance Area. The research questions provided below are those approved for prior salvage programs in the Hunter Valley by the majority of the Aboriginal stakeholder groups involved in this project. It is appropriate that the same research questions are addressed for the Anvil Hill area for comparative purposes. Please note that Sandy Creek has only been included in this research design in the event that further sub surface investigation is considered warranted as a management outcome after the survey of the modifications to the rail loop. This methodology will be finalised for any additional sites that may be identified during this survey in consultation with the 18 Aboriginal stakeholder groups.

3.1 RESEARCH QUESTIONS

1. What resources were available to the Aboriginal people using Anvil Creek, Big Flat Creek, Clarks Gully and Sandy Creek (food, stone and water)?

2. What resources were transported to the area and from where?

3. How do the artefact assemblages from the sites along Anvil Creek, Big Flat Creek, Clarks Gully and Sandy Creek differ from each other and from those on the slopes and ridge crests in the same area?

4. What tasks were the Aboriginal people undertaking at the sites in these areas?

5. Which food resources were they using?

6. Did they use the Anvil, Big Flat Creek, Clarks Gully and Sandy Creek areas at any particular time of the year?

7. Were Aboriginal people heat treating stone in the area?

8. Are there hearths in the area?

9. If there are hearths, do they contain remains (animal/plant) that may indicate what people were cooking/eating?

10. Are there burials in the area?

11. Is there evidence to suggest that Aboriginal people where using the area earlier than the mid to late Holocene?

12. Can dates be obtained for the Aboriginal use of the area?

The questions orient the research firmly in the direction of addressing a landscape use/resource-based model of Aboriginal occupation of the Anvil Creek, Big Flat Creek,

Clarks Gully and Sandy Creek catchments which will be impacted by the Proposed Disturbance Area.

4.0 METHODOLOGY

The methodology presented in this section relates specifically to the Proposed Disturbance Area where surface collections, grader scrapes and manual excavations are proposed. Methodology is also provided for manual excavations to be undertaken should hearths; heat treatment pits or areas with significant numbers of artefacts be uncovered by the grader scrapes. Geomorphic investigation has also been proposed for several sites/areas detailed in **Figure 9.2** and summarised in **Table 10.1**.

4.1 METHODOLOGY FOR THE SURFACE COLLECTION OF ARTEFACTS

It is intended to collect as many as possible of the surface artefacts recorded during the survey that are within the Anvil Hill Proposed Disturbance Area. The collection methodology will include flagging of artefacts so that their distribution can be photographed - detailed survey plans are not warranted for the majority of the 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. Detailed site plans will be made of the larger/more complex surface artefact scatters prior to the commencement of sub-surface investigation/salvage.

4.2 METHODOLOGY FOR THE GRADER SCRAPES

Sites/areas within the Proposed Disturbance Area that require grader scrapes are shown on **Figure 9.2**. The following methodology applies to these sites/areas:

- the grader scrapes will be of varying length depending on the nature of the topography and the area to be impacted by the mine or its associated infrastructure;
- the grader scrapes will be undertaken wherever possible:
  - within the landform occupied by the site; and
  - within adjacent landforms where soils depths are adequate;
- the grader scrapes will be removed as 5 cm scrapes;
- the scrapes will be continued to the clay or to a depth approved by the archaeologist and representatives of the Aboriginal groups monitoring the grader scraping process;
- after each pass the scrape and windrow will be inspected for artefacts;
- the location of isolated artefacts or groups of artefacts uncovered by the grader will be recorded using a GPS so that the data is available for the spatial analysis;
- in areas where artefacts are located in the scrape or artefacts are located within the windrow, a section of the windrow will be sieved through nested 5 mm and 2 mm sieves. The length of windrow to be sieved will be determined in the field in consultation with the grader driver (who will be able to give expert advice on the manner in which the soil

will be placed in the windrow - this will be dependent on factors such as angle of the grader blade and depth of the soil) and the Aboriginal group members;

- if features such as hearths, heat treatment pits or significant artefact densities are located, the grader scraping will be halted until the area is excavated manually. The size of the excavation to be determined in consultation with the relevant Aboriginal groups; and

- following the final scrape the windrow will be replaced.

Table 10.1 in the attached report indicates the sites/areas targeted for grader scrapes.

4.3 METHODOLOGY FOR SUB-SURFACE TESTING

One site has been assessed to date as requiring sub-surface testing by manual test-pitting. This site is AC13. During consultation with the Aboriginal community in relation to the draft report, it was considered that sub-surface testing of site SC10 may have been required, dependent on potential for relocation of the rail loop. Since that time, the rail loop alignment has been modified to avoid SC10. SC10 will be conserved and managed in accordance with an Aboriginal Heritage Management Plan.

4.3.1 AC13

The AC13 site will be the target of large area manual excavation(s). The location of the excavation(s) will be assessed through systematic sub-surface test-pitting of the general site area. The sub-surface test pits will form part of the geomorphic analysis of the area which will also include grader scrapes. As it is not thought appropriate to grader scrape the site area prior to the large area manual excavation(s), it is proposed that the grader scraping commence after the completion of the large area manual excavation (s).

The following methodology for test pitting applies to AC13:

- 50 cm spade test pits will be excavated every 10 metres for a length of 350 metres along both sides of Anvil Creek in the area of the site. Test pits will be excavated at 5, 10 and 15 metre intervals back from the creek (where possible) to delineate the area of greatest artefact concentration;

- all deposits will be removed as 5 cm arbitrary spits;

- if hearths, heat treatment pits, suspected knapping floors and/or artefact concentrations are located manual excavation will be employed and the area of the excavation increased to salvage the whole feature/artefact concentration (#see below);

- XYZ coordinates will be recorded within the manual excavations for features and for artefacts associated with features;

- all deposits excavated will be sieved through 5 mm and 2 mm nested sieves;

- at least one soil sample will be collected from each spit of each 50 cm square for Munsell and pH analysis. Further samples will be collected if features are observed. For consistency the Munsell and pH readings will all be undertaken by one person under the same light conditions after the completion of the test pits excavations; and

- all artefacts salvaged (if any) will be subject to attribute analysis.

#If test pits are located with hearths, heat treatment pits, suspected knapping floors and/or artefact concentrations these areas may or may not become one of the large area manual excavations proposed for the site. The choice of area(s) for manual excavation will be made following the completion of the test pitting program and in consultation with the Aboriginal stakeholder groups and the geomorphologist.

4.4 METHODOLOGY FOR THE MANUAL EXCAVATION(S)

Site AC13 is the only site currently proposed for manual excavation. Based on the results of the test pitting program and geomorphic analysis and in consultation with the Aboriginal stakeholder groups, an area/areas will be chosen for large area manual excavation. The methodology for the manual excavation presented below has been kept as general as possible as it will be guided by the outcomes of the detailed geomorphic investigation.

The rationale for the manual excavation(s) is to salvage the area(s) of the site with the greatest potential to provide large and statistically meaningful assemblages which can provide detailed information in relation to the Aboriginal use of the Anvil Creek/Anvil Hill landscape and which will also allow comparative analysis with other sites in the locality and region.

The following methodology for manual excavation applies to AC13:

- the excavation(s) will be undertaken as 1 metre squares excavated as 50 cm quadrats and arbitrary 5 cm spits. Stratigraphic excavation will be employed if features are located;

- at least one soil sample will be collected from each spit of each 1 metre square for Munsell and pH analysis. Further samples will be collected if features are observed. For consistency the Munsell and pH readings will all be undertaken by one person under the same light conditions after the completion of the excavations;

- XYZ coordinates will be recorded within the manual excavations for features and for artefacts associated with features (e.g. artefacts associated with a possible heat treatment pit or burnt stump, hearth etc.); and

- sediments will be collected from hearths/heat treatment pits for radiocarbon or thermoluminescence dating where applicable, using the techniques recommended by the dating laboratories.

After the completion of the manual excavation(s), grader scrapes will be carried out in accordance with the recommendations of the geomorphology report (refer to Section 5 and Appendix 9 of the main report). If grader scrapes identify additional features, these features will be further explored by manual excavation.

4.5 METHODOLOGY FOR THE MANUAL EXCAVATIONS (SHOULD ARCHAEOLOGICAL FEATURES BE IDENTIFIED DURING GRADER SCRAPES)

If hearths, heat treatment pits or areas with significant numbers of artefacts are uncovered by the grader scrapes, manual excavation of these features/areas will be undertaken using the methodology outlined in **Section 4.4**. The size of the excavation will be determined in the field in consultation with the participating Aboriginal groups and will be sufficient to fully investigate and salvage the features/artefact concentration identified.

4.6 ARTEFACT ANALYSIS

All artefacts will be analysed using at least x10 magnification. Edges and artefacts suspected of having use-wear or residues will be inspected using at least x30 magnification. At least 50 artefacts will be subject to residue and use-wear analysis.

The artefact analysis will contain intra and inter-assemblage analysis for those assemblages located during the surface collections, grader scrapes and manual excavations. Inter-assemblage comparisons will be undertaken with assemblages from other areas in the Hunter Valley where comparable data is available. Full details of the artefact data for all of the assemblages will be presented within a report, so that the data will be available for other analysts.

5.0 DISCUSSION OF ATTRIBUTES TO BE RECORDED FOR ANALYSIS

The attributes to be recorded for the artefacts recovered from the project disturbance area are outlined below. A discussion follows each attribute, detailing the proposed method of recording, potential problems with the method proposed, and the possible behavioural implications of each attribute.

Not all attributes can be measured on all artefacts (e.g. termination type cannot be measured on proximal flake pieces). Therefore, after a discussion of the most basic common attributes, subsequent attributes are divided into sections, with subsections for categories.

5.1 COMMON ATTRIBUTES

Artefact Type

Description: Artefact class is a technological category reflecting the mechanical processes which resulted in the physical form of the artefact at the time of recovery. Classes used will include flakes, broken flakes, retouched flakes, flaked pieces, cores, flake-cores, hammerstones, grindstones, ground-edge axes, heat-shattered fragments, and non-diagnostic fragments.

Problems: Classing artefacts does not usually entail significant problems, other than occasional ambiguities between flaked pieces and broken flakes, and between (retouched) flakes and flake-cores (refer to **Retouch** for a further explanation).

Uses: This category will be used to assess differences in provisioning strategies (e.g. core provisioning vs flake provisioning), differences in site function/use (e.g. presence/absence of grindstones), and the taphonomic effects of fire on site integrity (e.g. differences in the ratio of heat-shattered fragments: other artefact classes).

Raw Material

Description: A largely self-explanatory attribute, raw materials expected to be present include silcrete, indurated mudstone/tuff, quartz, crystalline tuff, quartzite, petrified wood, porcellanite and basic volcanics.

Problems: This category is usually without problems, though it is acknowledged that some disagreement exists as to the appropriate nomenclature for the material most frequently referred to as ‘indurated mudstone’. Strong arguments have been made for replacing the

term with indurated rhyolitic tuff, however, as the category is nominal and not technical or geological the only criteria guiding the choice of term here are that the meaning of the term be understandable to others and that it be applied consistently. For these reasons, the term indurated mudstone will be used to make the class more easily compared with other studies and to differentiate this raw material from other tuffs that will have different sources.

Uses: Raw material is an important attribute, which may broadly indicate the place of origin of an artefact. The dominance of one raw material or another may also be used to group or differentiate sites. Raw material is also frequently used in concert with attributes in the creation of analytic units for more in-depth inter and intra site comparisons.

Artefact Weight

Description: Artefact weight will be measured for all artefacts to one tenth of a gram.

Problems: This attribute does not entail any difficulties.

Uses: One of the most useful artefact attributes, weight is the most effective approximation of volume for a given raw material. As such it most accurately reflects the amount of stone being brought to a site. Average weight within a given artefact class is also a good indication of the amount of 'stress' that has been placed on the provisioned material. Large pieces of stone still retaining usable potential are unlikely to be discarded when people are conserving their technological resources (for example, as they move increasingly away from places where replacement material is available). Alternatively, when people are close to the raw material source, or when they are provisioning larger amounts of material to a site, the pressure on the 'exhaustion threshold' is relieved and there should be a resultant rise in the average weight of discarded artefacts.

Dimensions

- **Percussive Dimensions**

Description: Percussive dimensions measure the length of the flake in the direction of force application from the point that force was applied. In this regard it relates to the length of core face that was removed during the manufacture of the artefact. Width is oriented across the face of the flake from the mid-point of length, and thickness from the mid-point of length and width of the ventral to the corresponding point on the ventral.

Problems: While not as arbitrary as maximum dimensions, there is some uncertainty as to what these attributes are actually measuring in terms of the flake manufacturing process.

Use: Variations in average flake dimensions, and in the distribution of flake sizes in histograms, are expected to correlate with differences in the provisioning and reduction strategies at different places. For example, the reduction of cores at a site will produce a large number of moderate to small flakes and some larger flakes. As a result the histogram of flake length will show a relatively consistent increase in number of flakes from large to small. Contrastingly, when most flakes are the result of retouching or maintenance tasks on other flakes, the majority of the flakes remaining should be very small, with comparably few large to moderate flakes. However, it may be the case that a few moderate to large flakes will be discarded at the site as they are exhausted through excessive/heavy retouch or simply thrown away prior to a reprovisioning event. In such a case, a histogram of artefact size should show a bimodality in regard to length (a small peak in the moderate range and a large peak in the small range), and an even more pronounced bimodality in regard to thickness (most retouching flakes being very thin).

- **Maximum Dimensions**

Description: Maximum length, width and thickness will be measured on all artefacts. 'Length' will arbitrarily be measured along the longest plain, with width the longest of the plains at 90° to length, and thickness measured at 90° to both.

Problems: There are no problems associated with taking this measurement, although it needs to be noted that the definitions of length, width and thickness are entirely arbitrary and do not reflect any aspect of artefact manufacture.

Uses: This measure is most useful as a broad measure of size, and may have a role in assessing fragmentation rates (particularly in the case of heat-shattered fragments) and calculating Minimum Numbers of Artefacts (MNA).

Cortex – Amount and Type

Description: Cortex refers to the 'skin' of a rock – the surface that has been weathered to a different texture and colour by exposure to the elements over a long period. The amount of cortex as a percentage of surface area will be measured on all artefacts (in relation to flakes, cortex can, by definition only occur on the dorsal and platform surfaces). The nature of cortex – its shape and texture – will vary depending on where the raw material was sourced. Cortex will be recorded in all instances where cortex is present.

Problems: This is a relatively unambiguous descriptive category.

Use: When a natural cobble is first selected it will usually be covered in cortex. Therefore the first artefacts produced from it will have a complete coverage of cortex on the dorsal side (primary reduction). As the cobble is increasingly reduced the amount of cortex on each artefact will rapidly decrease (secondary reduction) until it ceases to be present on artefacts (tertiary reduction). As a result of this trend, it should be possible to determine how early in the reduction sequence the artefact was produced. If large numbers of artefacts or a high proportion of the artefacts of a raw material retain cortex it may indicate that the site is located in close proximity to the source. Differences between the proportions of artefacts retaining cortex between different raw material sites indicates relative differences in distance to source. This does not necessarily mean distance in terms of measurable distance across the landscape, it may also reflect length of time since leaving the source. For example, the last campsite when a group is returning to the source of the raw material may be very close to the source in terms of distance, but distant in terms of time elapsed since the group left the source. If artefacts with cortex are occurring in sites a long distance from the place of origin of the natural cobble, them it is likely that cobbles were being transferred to the site when still only slightly reduced. This would imply an attempt to maximise the amount of stone being provisioned with the weight of transported material being a relatively minor concern.

Cortex type may help to clarify the source of the raw material (e.g. from river gravels [rounded, cortex many microscopic conchoidal fractures], surface scree [cortex weathered, porous, often oxidised, can be angular or rounded] or from outcrops [dependent on raw material type, more likely to have flat angular surfaces or recorticated flake scars]).

5.2 ATTRIBUTES TO BE RECORDED ON FLAKES

In most circumstances flakes, whether broken or whole, will account for the majority of artefacts in an assemblage. Flakes are frequently produced in large numbers during reduction events, though most are never subject to use. Flakes are generally inferred to be the most utilitarian of the basic artefact categories, usually possessing a sharp edge along the

entire circumference when whole and amenable to reworking patterns which may yield formal 'implements' or 'tools', such as backed artefacts and scrapers.

Knapping Type

Description: Three main knapping methods are used in the production of flakes, resulting in flakes with distinctive characteristics. The first is freehand percussion, where the objective piece is held in the hand and struck with a hard hammer (e.g. a hammerstone), resulting in 'classic' flakes with a single bulb, and a ringcrack/PFA. The second is bipolar, where the objective piece is rested against an anvil and struck. This results in flakes that have straight sheer faces and crushing at both ends. The third is pressure flaking, where an indenter is placed against the edge from which the flake is to be removed and force is applied. The resulting flakes have a characteristically diffuse bulb, with no errailure scar and no PFA.

Problems: Ambiguities do exist in this classification, and the identification of pressure flakes in particular may be difficult, however difficulties are expected to be relatively infrequent.

Use: Freehand percussion, bipolar and pressure flaking are all different approaches to reduction, with different advantages and disadvantages. Pressure flaking is the most controlled method, in terms of how much force is applied and to where. However pressure flaking does not produce large flakes and is usually associated with fine retouching work. Bipolar reduction is usually viewed as a system employed to increase core use-life. As cores become small their inertia thresholds drop making it difficult to reduce flakes via the freehand method. Resting the core and applying bipolar technique allows flakes to be reduced from a core too small to hold or from small round pebbles with no platform angle to initiate reduction. Pressure flaking when undertaken using an anvil often results in a form of bipolar reduction. Patterns in the distribution of flakes resulting from backing may be used to locate areas of backed artefact manufacture. Patterns in the distribution of flakes produced by bipolar knapping maybe used to indicate where there was pressure to maximise core potential.

Artefact Type

Description: Artefact type is a formal (e.g. less strictly technological), nominal category, similar to artefact class. Artefact types expected to be located include bondi points, microliths, scrapers, and adzes.

Problems: Ambiguity is an inherent feature of artefact typology, with the lines between different types frequently imprecise. Working definitions for each class used will be specified in the text of the analysis.

Use: Despite the problem discussed above, typology proceeds on the basis that at different places and at different times people manufactured artefacts with specific shapes and characteristics. As a result, the general period during which an artefact was made can be inferred if it is of a specific form. It is also not uncommon to infer that a given artefact form implies a given artefact function, and that from the shape of the artefact the activities taking place at the site can be specified, though these suggestions so far lack archaeological support. The problems with both of these uses are well documented, and any such inferences drawn here will be sparing. There is, however, some potential benefit in approaches based on subsistence patterns and the organisation of technology. On this basis, it may be possible to make some assertions from artefact typology as to the way subsistence may have been organised at different places through the landscape.

Artefact Breakage

Description: At a basic level, flakes break in six different ways. Three are transverse (at 90° to the direction of percussion) – proximal, medial, distal; two are longitudinal (along the plane of percussion) – left, right (oriented from the ventral view); and one ambiguous – marginal (where dorsal and ventral can be clearly distinguished, but the margin from which the piece has detached is uncertain). All such breaks will be recorded.

Problems: It is occasionally difficult to be certain of the breakage on an artefact. In most cases, however, the kind of breakage can be ascertained.

Use: It is important to differentiate broken from complete flakes for the purposes of analysis, as the two are not comparable in regard to a number of measures. The amount of artefact breakage in an assemblage also indicates the degree of fragmentation to which the assemblage has been subject. In highly fragmented assemblages, the actual number of artefacts represented may be significantly exaggerated. Quantifying breakage allows a more accurate approximation of artefact numbers to be made.

Heat Affect

Description: Heat will affect artefacts in different ways, depending on the way it has occurred. Most heat-affected flakes on fine-grained material will reveal a greasy surface lustre on newly flaked surfaces and some discoloration (e.g. porcellanite turns from white to blue), however as heat becomes excessive signs such as potlidding (the 'popping' of small plate-like pieces off the flake) or crazing (multiple fracture lines in multiple directions across the face of the flake) will occur. The presence of any of these features will be recorded.

Problems: This is a relatively unambiguous descriptive attribute for fine-grained materials – its application to coarse-grained materials is perhaps less certain.

Use: Trends in the spatial distribution of heat-affected artefacts may be used to indicate either heat-treatment (the controlled application of heat to improve flaking qualities) or post depositional burning (uncontrolled heating through bush-fires or stump burning) depending on the signs of heating and associated archaeological features (e.g. hearths).

Platform Size – Width and Thickness

Description: The platform is the surface into which force is applied in the formation of a flake. Platform width is measured across the platform in the same direction as flake width, while platform thickness follows flake thickness.

Problems: Some ambiguity exists on 'where to stop measuring' platform width and thickness, particularly on primary cortical flakes on rounded cobbles (the first flakes removed from a natural cobble), and platform surfaces comprised of multiple flake scars. Despite this the measure appears to work quite well for the majority of flakes.

Use: Platform size is expected to decrease under two circumstances. The first is when flakes are produced from small cores. The second is somewhat more speculative and based on the premise of a correlation between very small (focalised) platforms and the production of parallel-sided flakes (blades) associated with backed artefact manufacture.

Differences in platform size averages within and between sites will be examined to test these correlations and to infer what these mean in terms of human behaviour patterns e.g. curation of stone, expedient use of stone.

Platform Surface

Description: Platform surface will be recorded as one of the following: cortical, single flake scar, multiple flake scars, or facetted.

Problems: This is a largely unambiguous descriptive attribute.

Use: The surface of a platform provides information about the history of the core prior to the detachment of the flake, and also about methods employed to control the flaking process. Faceting in particular has been linked to the systematic production of 'blades'. Patterns in the spatial distribution of these attributes may be used to infer differences in reduction strategies.

Overhang Removal

Description: Frequently prior to the detachment of a flake from a core, the thin overhanging 'lip' of the core was removed in order to stop 'crushing' or force dissipation at the point of force application. This process is known as overhang removal.

Problems: This is a largely unambiguous descriptive attribute.

Use: Overhang removal is often seen as a form of raw material conservation. If a knapper desires to remove thin flakes from the face of the core by striking close to its edge, overhang removal may avoid the platform crushing and the resultant flake ending in a step termination which must be removed from the face of the core before flake production can continue. Thus, raw materials within assemblages, that have high relative proportions of overhang removal, or total assemblages that have high relative proportions of overhang removal, will be used to indicate raw material conservation, which can then be interpreted in relation to human resource use patterns/preferences.

Dorsal Scar Count

Description: The dorsal face of a flake provides a partial record of previous flaking episodes to have occurred down the core face at or near the same point. The number of flake scars on the dorsal surface of a flake which can be oriented relative to their direction of percussion and which are clearly discernable will be recorded.

Problems: There is some ambiguity in this measure, hence the use of the term 'clearly discernable' above. Furthermore, by the nature of the flaking process, each subsequent scar will remove traces of the previous scars, resulting in an incomplete record. For these reasons, this measure needs to be treated with some caution.

Use: Dorsal scar count is a rough indication of how much flaking has occurred prior to the detachment of the flake in question. It also provides a maximum against which to form ratios of 'aberrant to non-aberrantly terminating scars', 'parallel to non-parallel scars' and 'number of scars per rotation' (refer to next three attributes), all of which may assist in clarifying the reduction process and assist in understanding differences in the Aboriginal use of raw materials and sites (within the Proposed Disturbance Area).

Number of Aberrantly Terminating Dorsal Scars

Description: Aberrant terminations are further discussed below under **Terminations**. For the purposes of this description it is sufficient to say that flake scars terminating as steps and hinges will be recorded as aberrant in this assessment.

Problems: The problem(s) with this count are the same as those for the previous.

Use: As cores become smaller and more heavily reduced, the inertia threshold will fall and platform angle will increase, resulting in an increase in the number of aberrant terminations as a percentage of the number of flakes removed. Flakes which have a high number of aberrantly terminating flake scars as a percentage of the total are expected to have been produced towards the exhaustion threshold of the core. This measure will be used to indicate pressure on raw material availability and provisioning strategies.

Number of Parallel Flake Scars

Description: A basic count of the number of parallel flake scars.

Problems: As previous.

Use: Examining the ratio of parallel to non-parallel scars on the dorsal surface of flakes may help to clarify the prevalence of 'blade' production in the reduction systems at different places. It may also be possible from examining this ratio in relation to flake size to test whether blade production occurred at a specific stage in the reduction sequence, or whether it was present throughout the complete reduction sequence.

Presence of Parallel Arrises

Description: Arrises or dorsal ridges are a way of controlling artefact morphology. Flakes struck down an existing ridge will tend to follow the direction that the ridge takes. This attribute will involve noting the presence or absence of dorsal ridges that run parallel to the length of the flake.

Problems: Unlike the previous measures, this attribute is largely unambiguous.

Use: Like faceting, the presence of parallel arrises is associated with more controlled flaking methods such as blade production. The relationship between flake size and the presence of parallel arrises may provide similar information to the previous attribute (while at a lower resolution, being presence/absence based, this attribute is less ambiguous than number of parallel scars), as well as helping clarify the spatial distribution of different reduction strategies.

Dorsal Scar Rotation Count

Description: As a core is reduced it may be turned or rotated to provide new platforms or overcome problems with increasing platform angles. As a result, flakes may be detached which cut across old flake scars. The result should be apparent as dorsal scars in different direction to the direction of percussion of the flake being recorded.

Problems: The problem with this measure is the same as that for dorsal scar counts in general.

Use: Core rotation is increasingly likely towards the exhaustion threshold of cores, when platform angles increasingly approach or exceed 90° (it becomes very difficult to remove flakes from platforms with angles exceeding 90°). If it is possible to show a correlation between flake size and number of dorsal scar rotations then it will become possible infer from differences in the spatial distribution of this data that core exhaustion was more frequently approached in some areas than in others. If it is not possible to show this correlation, then it may be taken to suggest that core rotation was part of the reduction strategy throughout the reduction continuum.

Termination

Description: Termination refers to the way in which force leaves a core during the detachment of a flake. Every complete flake has a termination. There are patterns in the form which terminations will take, with the four major categories (those to be used here) being: feather, hinge, step, and outrepasse (or plunging).

Problems: This is a largely unambiguous descriptive attribute. The only point at which uncertainty does enter is in differentiating some transversely snapped flakes from step terminated flakes. In the majority of cases, however, this problem does not arise.

Use: Different terminations have different implications both for flake and core morphology. A flake with a feather termination (in which force exits the core at a low or gradual angle) will have a continuous sharp edge around the periphery beneath the platform. This has advantages in terms of the amount of the flake edge which can be used for cutting, and also makes the flake far more amenable to subsequent retouching or resharpening activities. Detaching flakes with feather terminations also has minimal impact on the effective platform angle of the core, and so platform angle thresholds are reached relatively slowly while feather terminating flakes continue to be produced.

Hinge and step terminating flakes have none of these advantages. They result in edges which are amenable neither to cutting nor to retouching. Furthermore, hinge and step terminations lead to rapidly increasing effective platform angles, leading to a requirement for core rejuvenation and core exhaustion. For these reasons, such terminations are considered undesirable or *aberrant*. The number of aberrant flake terminations is expected to increase towards the end of a core's uselife, as reduction in core size and increase in core platform angle make it increasingly difficult to detach feather terminating flakes. In areas where aberrantly terminating flakes are relatively common it may be inferred that core potential was more thoroughly exploited. From this it may in turn be inferred that the pressure to realise core potential (e.g. a strategy of heavy raw material conservation) was greater. Increased mobility/emphasis on portability is one possible explanation of such a pattern.

Outrepasse flakes have the opposite effect on core morphology to step and hinge flakes, in that they remove the entire core face and part of the core bottom. As a result, such flakes may be used to rejuvenate cores in which core angles have become high but which still retain useable potential (e.g. are still quite large). The presence of outrepasse flakes may be taken to indicate core rejuvenation and the requirement to increase core use-life.

Retouch

Description: Retouch is the term given to alterations made to a flake by the striking of subsequent flakes from its surface. Retouching may be done either to alter artefact form or to rejuvenate (resharpen) dulled edges, and possibly both. Degree/amount of will be recorded as presence/absence.

Problems: This is a largely unambiguous descriptive attribute. The only area in which difficulty may arise is in instances where edge damage cannot be differentiated from retouch. This occurs infrequently, as edge damage is usually a modern alteration to artefact form which can be noted through differences in surface colour between the flake scar and the rest of the artefact surface.

Use: The two main uses of retouch need to be separated for the purposes of this discussion. Retouch to achieve form (for example, artefact backing) is distinct from retouch for the purposes of edge rejuvenation. 'Formally retouched' artefacts are anticipated to occur at places of manufacture and places of discard. Importantly, such artefacts will be manufactured prior to use as part of a gearing up or preparation for activities such as hunting.

The presence of concentrations of such artefacts, including incomplete specimens may indicate the base-camp locations from which mobile subsistence activities were conducted. Such artefacts are also expected to be present among very small assemblages at distances from occupational foci, as the result of discard, loss, or breakage.

Edge rejuvenation retouch is expected to increase as the availability of replacement materials decreases. Such artefacts are expected to represent 'personal gear', an implement carried with a person and maintained for repeated use. Unlike formally retouched pieces, artefacts with edge rejuvenation will not be produced *in preparation for* activities. The sharpest and most useful edge is a fresh edge. Rather, rejuvenation will occur as need arises. The presence of such artefacts at occupational foci is likely to represent discard following use and prior to reprovisioning/retooling. The percentage of artefacts exhibiting retouch is expected to increase in systems where large amounts of replacement raw material are not available.

It needs to be noted that a third type of retouch also occurs, aimed at neither formalisation of shape or edge rejuvenation. This is when a flake (usually a large to very large flake) has been used for the subsequent production of utilitarian flakes (e.g. when it has been used as a core). This strategy is quite prevalent in the Hunter Valley. Differentiating such artefacts from other retouched artefacts is empirically difficult, however, is intuitively quite easy. Any such intuitive judgements can, however, be tested during the analysis phase, as such flakes are expected to be quite distinct from other retouched artefacts in size and weight.

Retouch Type

Description: Retouch type is a technological attribute relating the way in which retouch was carried out. Categories to be used are steep, acute, unifacial, bifacial, tranchet and/or used as core.

Problems: This is a largely unambiguous descriptive attribute.

Use: Whether retouch results in a steep or acute edge is important in relation to the possible functions of those edges. Acute retouch results in sharp edges suitable for cutting whilst steep retouch can be used to totally remove a sharp edge (to blunt as in backed artefacts) or to produce thick strong edges suitable for adzing or scraping. Thus, artefact function can be suggested by recording this attribute (residue and use-wear analysis is also planned to substantiate these interpretations). The recording of the technique used for retouch addresses questions related to techniques of implement manufacture and thus another form of human behaviour that can be analysed within and between assemblages.

Retouch Location

Description: Each flake will be divided into eight segments: proximal end, proximal left, proximal right, marginal left, marginal right, distal left, distal right, and distal end; with the presence or absence of retouch in each to be recorded.

Problems: Apportioning sections relies on a visual division of the flake, which may be slightly inaccurate. This is not expected to be a significant effect.

Use: An examination of retouch location may reveal trends in distance decay (e.g. increasing number of margins retouched over distance, or may simply reveal non-random patterns in the way retouching was carried out. If the former, then the trend may be used to suggest trajectories along which flakes were being carried as personal gear. In the case of the latter, the information would provide an insight into the manufacturing/reduction systems being employed.

5.3 ATTRIBUTES TO BE RECORDED ON CORES

The following attributes are to be recorded on cores. Most information taken from cores concerns the way in which they were reduced – what pressures, controls and systems were applied.

Percentage of Surface Flaked

Description: This attribute involves an estimate of the percentage of the outer surface of the core which has had flake scars removed from it.

Problems: This is a visual estimate and liable to prove reasonably inaccurate and coarse. Nevertheless, it remains useful.

Use: This measure can be useful in assessing degree of core reduction. In particular, it can be useful in locating areas of heavy core reduction, particularly when used in concert with the following two measures.

Number of Flake Scars

Description: This measure mirrors **dorsal scar count** from the previous section. All scars over the length of 10 mm will be measured (there are usually large numbers of flake scars between 10-3 mm, which relate more to platform preparation than flake production.

Problems: Most of the problems with this measure arise from fact that subsequent scars remove traces of former scars, leaving an incomplete record of the past. As a result, this measure will always underestimate the number of flakes removed from the core.

Use: Dorsal scar count provides an estimate of the amount of reduction to which a core has been subject. Used in concert with measures such as **number of rotations** and **percentage of surface flaked**, it may be help to locate differences in the degree of core reduction at different locations.

Number of Rotations

Description: This measure mirrors **dorsal scar rotation count** as discussed above.

Problems: This measure has the same problems as **number of flake scars**.

Use: Different reduction systems use core rotation in different ways. In some systems, cores are rotated only once, after the striking of the initial flake to form a platform. All subsequent scars are removed in one direction from that platform. Other systems will involve repeated rotations between two platforms, or may involve continuous core rotation and numerous platforms. It may be the case that through the use-life of a core a number of different strategies will be used.

Assessing core rotation may help to clarify reduction systems, and the stage in the reduction system at which the individual core was discarded. This can be used to indicate differences in use of raw materials both within assemblages and between assemblages.

Number of Aberrantly Terminating Scars

Description: Flake scars terminating as steps and hinges will be recorded as aberrant in this assessment.

Problems: There should be no problems with this simple count.

Use: As cores become smaller and more heavily reduced, the inertia threshold will fall and platform angle will increase, resulting in an increase in the number of aberrant terminations as a percentage of the number of flakes removed. Flakes which have a high number of aberrantly terminating flake scars as a percentage of the total are expected to have been produced towards the exhaustion threshold of the core. This measure will be used to indicate pressure on raw material availability and provisioning strategies.

Number of Parallel Flake Scars

Description: A basic count of the number of parallel flake scars.

Problems: There should be no problems with this simple count.

Use: Examining the ratio of parallel to non-parallel scars on cores may help to clarify the prevalence of 'blade' production in the reduction systems at different places. It may also be possible from examining this ratio in relation to flake size to test whether blade production occurred at a specific stage in the reduction sequence, or whether it was present throughout the complete reduction sequence.

5.4 COMMENTS

Description: A column will be supplied in the data base for recording comments. This may include comments on attributes such as artefact colour, granularity, presence and nature of inclusions, or other comments that do not fit snugly inside one of the attribute classes.

Problems: There should be no problems.

Use: Descriptions of artefacts can sometimes be useful for assisting in locating conjoins.

6.0 CARE OF ARTEFACTUAL MATERIAL

As no consensus could be reached on "care" of the artefacts, it is proposed that following analysis the artefacts will be placed in a fenced area within the SC10 site where they will be used for teaching purposes.

The majority of the groups approved of this outcome during the site visit on 11 May 2006 and this was the only option that received support in the written comments.