7.0 APPENDICES

7.1 Appendix 1 – Consultation Log

Aboriginal Group	Type of Consultation	Date/Time of Consultation	Response
Part 6 Consultation Notifications – August 2009			
Tharawal Local Aboriginal Land Council	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	Written response
The Registrar of Aboriginal Owners	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	Written response
Native Title Services	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	No response
Camden Council	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	Written response
Campbelltown City Council	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	Written response
The NSW Department of Environment and Climate Change	Written Notification of Proposed Northern Expansion Project	Letter sent March 2009	No response
Part 6 Consultation Media Advertisements – Biosis Research September 2008			
Tharawal Local Aboriginal Land Council	Advertisement place in Campbelltown-Macarthur Advertiser on the 11 and 18 March 2009	11 and 18 March 2009	Responded in writing
Cubbitch Barta Native Title Claimants Aboriginal Corporation	Advertisement place in Illawarra Mercury on the 11 and 18 March 2009	11 and 18 March 2009	Response in writing
Part 6 Consultation Methodology – Biosis Research October 2008			
Tharawal Local Aboriginal Land Council	Proposed Methodology for Reporting of results and consultation sent via registered post	25 March 2009	No response

Cubbitch Barta Native Title Claimants Aboriginal Corporation	Proposed Methodology for Reporting of results and consultation sent via registered post	25 March 2009	No response
Part 6 Consultation – Meetings to discuss Cultural Values			
Tharawal Local Aboriginal Land Council	Consultation meeting to discuss cultural values of the Project Area	12 May 2009	Verbal communication of any issues or comments
Cubbitch Barta Native Title Claimants Aboriginal Corporation	Consultation meeting to discuss cultural values of the Project Area	12 May 2009	Verbal communication of any issues or comments
DRAFT Report – Comments			
Tharawal Local Aboriginal Land Council	Copy of DRAFT report sent	18 November 2009	No response
	Meeting and copy of updated report provided	19 September 2012	Glenda Chalker was satisfied with the recommendations and management actions as discussed in the meeting and previously discussed in the field. Glenda will review and provide comment.
Cubbitch Barta Native Title Claimants Aboriginal Corporation	Copy of DRAFT report sent	18 November 2009	No response
	Meeting and copy of updated report provided	19 September 2012	Elwyn Brown did not raise any objections to the report during the meeting and will review and provide comment.

Public Notices

1817615

AGL GAS PRODUCTION (CAMDEN) PTY LIMITED CAMDEN GAS PROJECT - NORTHERN EXPANSION ABORIGINAL CULTURAL HERITAGE IMPACT ASSESSMENT NOTIFICATION AND REGISTRATION OF ABORIGINAL INTERESTS

AGL is seeking approval under Part 3A of the Environmental Planning and Assessment Act 1979 (NSW) for further development of the Camden Gas Project. The proposed Northern Expansion project area is located within the Camden and Campbelltown local government areas, approximately 60 km south west of Sydney.

As part of the Part 3A application process, AGL will be preparing an Aboriginal Cultural Heritage Impact Assessment in respect of the area. AGL invites groups and individuals to register their interest in the Aboriginal Cultural Heritage Impact Assessment.

For more information or to register in writing please contact:

Melanie Thomson
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong NSW 2500
Tel: 02 4229 5222
Fax: 02 4229 5500

REGISTRATIONS MUST BE RECEIVED BEFORE 5.00pm, 25 March 2009

Child Care

1811611

CHILDMINDING Exp'd, to look after your children in your own home any time, day or night. Ph 0419 482 335.

Public Notices

1826056

NOTICE OF AGM
Macarthur Touch Association
7:30pm Mon 20th Apr 2009 at Narellan Hotel. 279 Camden Valley Way, Narellan 2567 ***Enquries:*** **0403 345 993, 0424 326 097**

Psychic Notices & Clairvoyants

1825717

CLAIRVOYANT, Tarot Card, Palm & Angel Card Readings. By appointment only. Call Alisha 0401 849 890.

1788172

CLAIRVOYANT and healer, 30 yrs exp. Removal of obstacles on your path. Priv. & ph. readings. Ph Kathy 9727 5618 or 0416 000 535.

1825483

CLAIRVOYANT/ Psychic/ Medium. Positive guidance & contact with passed loved one's. Readings, parties & development classes. Call Jenny 0434 840 262.

1820069

FORTUNE Told by 2 sisters Thurs 3 Tulloch Cl, Casula 9602 4382 or Sat 48 Stockton Ave, M'bank 9601 5640

1825167

PSYCHIC reader 25 years exp. Relationships, work & finances. Please Ph 0401 3999 28.

Birth Notices

1825118

Ella Louise Fraley

12.3.09

First child for Julie and Brett Fraley of Camden.
Congratulations
Welcome to the world!
With love from the McCormick and Fraley families.

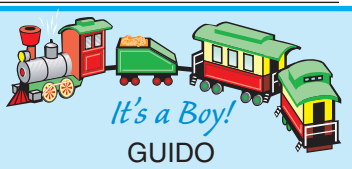
1821968

Simpson
Tim and Clare
are proud to announce the birth of their 3rd son
Harry Lee
On 22nd February 2009
11:24am - 8lbs 9oz
Brother to Jack and Stuart
3rd Grandchild to Bruce and Jean Watson
6th Grandchild to Michael and Carolyn Simpson

1822827

Martin
Adam and Lisa are proud to announce the birth of their daughter,
Madison Lee
Born on the 28/2/09.
Proud Grandparents of Pete and Viv Hamilton and Bill and Lyn Martin.
A dainty 6lb 10oz of pure perfection, born to the luckiest parents on earth.

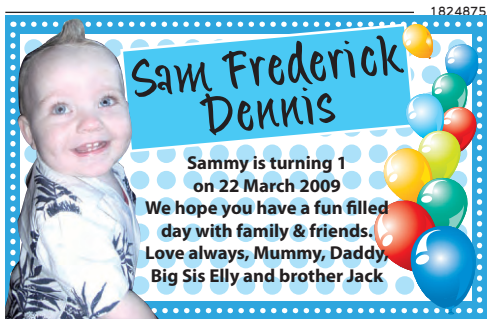
1822982



It's a Boy!
GUIDO
John and Geraldine are proud to announce the arrival of
Oliver Dimitri
Born Tuesday 10 February at 1:05am at Bowral Hospital.
Proud big brothers Dominic 3yrs and Sebastian 23mths.
Proud grandparents
Rosemary and Terry Graham of Narellan and Luigi and Mari-Angela Guido of Corrimal.

Birthday Greetings

1824875



Legal Notices

1824683

IN THE SUPREME COURT OF NEW SOUTH WALES SYDNEY REGISTRY PROBATE DIVISION

After 14 days of publication of this notice an Application for Administration of the Estate of Robert Lee, late of 7 Kooloona Crescent, Bradbury NSW, Lift Mechanic, will be made by Kristy Riley, the daughter of the deceased. Creditors are required to send particulars of their claims upon his estate to:

Marsdens Law Group
49 Dumaresq Street
Campbelltown NSW 2560
DX 5107 CAMPBELLTOWN
Ph: 02 4626 5077
Fx: 02 4626 4826
Ref: 96 34 5403 MJR

Legal Notices

1825594

IN THE SUPREME COURT OF NEW SOUTH WALES SYDNEY REGISTRY PROBATE DIVISION

After 14 days of publication of this notice an Application for Probate of the Will dated 16 October, 2001 of Phyllis Irene Clark, late of Liverpool Aged Care Facility, Liverpool, NSW, Retired Shopkeeper, will be made by Christine Maree Warner. Creditors are required to send particulars of their claims upon her estate to:

Marsdens Law Group
49 Dumaresq Street
Campbelltown NSW 2560
DX 5107 CAMPBELLTOWN
Ph: 02 4626 5077
Fx: 02 4626 4826
Ref: 96 34 5293 MJR

Lost & Found

1825293

LOST CAT. Medium length, grey/white fur, ragdoll cross blue collar. Precious and valued family member. reward for return. **Pls call 0402 616 070 or 0425 314 191**

1825373

★REWARD★
Gold Necklace with 11 linked gold hearts. **GREAT Sentimental value. Lost on Friday, 13/3 Campbelltown. 9618 3963 or 0410 646 635.**

Birth Notices

1802366

It's a girl!
To place your birth announcement call
13 24 25

Wedding Anniversaries

1802343

Special Anniversary?
To place your announcement call
13 24 25

Engagements

1802353

Newly engaged?
To place your announcement call
13 24 25

Deaths & Funerals

1825766

IRELAND
Brian Thomas
March 16, 2009

Loved husband of Annette, cherished father of Amanda and Nicole, loved brother, uncle and good old mate. He will be sadly missed and lovingly remembered.

Aged 59 Years
At Rest

A celebration of the life of Brian will be held at the family property on Saturday 21 March, 2009 at 25 Wedderburn Road, St Helens Park to commence at 12 noon.

Jeffrey Family Funerals
Ph 9798 9266

1826637

THOMSON
John Alexander

14/05/1942-15/03/2009

Much loved father of Ted and Michael, beloved Poppy to his five grandchildren. Will be sadly missed by all his family and friends.

The family extends an invitation to John's relatives and friends especially Campbelltown Junior AFC, Liverpool Foster and Tuncurry Lawn Bowling Clubs and Liverpool & Campbelltown hospital staff to attend his Funeral Service to be held in the North Chapel of Forest Lawn Crematorium, Camden Valley Way, Leppington on Thursday, 19th March, 2009 commencing at 2:00pm.

A viewing will be held at the Macarthur Lady Funerals Office on Thursday, 19th March, 2009 commencing at 10:00am.

In the care of
Macarthur Lady Funerals
100% Aust Family Owned and Operated
Narellan/Camden
4647 9294
Campbelltown 4648 4388
NSW FDA

Public Notices

1825113

ARTC

AUSTRALIAN RAIL TRACK CORPORATION LTD

Southern Sydney Freight Line
IMPORTANT COMMUNITY INFORMATION

Liverpool Area

Australian Rail Track Corporation (ARTC) will be undertaking construction works within the rail corridor in your area over the weekend of 21st and 22nd March 2009.

These works are part of the construction of the Southern Sydney Freight Line (SSFL). The works will be at the following locations:

Glenfield Flyover: ARTC will be working with in the rail corridor and will begin preparation and piling works for the Glenfield Flyover. The equipment being used at this work location will be an excavator, tray trucks, tipper trucks, roller and a bulldozer. The works will be conducted between 7.00am on Saturday and 10.00pm on Sunday, so will include night works.

Casula Station - They will be doing piling works at the station. The equipment being used at this work location will be piling rigs, tippers and a concrete pump. The works will be conducted between 7.00am and 6.00pm on Saturday and Sunday.

Shepard Street - There will be foundation and piling works taking place at this location. Equipment: piling rig, mini excavator, concrete trucks, franna crane, tray trucks and tipper trucks. The works will be conducted between 7.00am and 10.00pm on Saturday and Sunday.

Mill Park Bridges - There will be foundation and piling works taking place at this location. Equipment: piling rig, mini excavator, concrete trucks, franna crane, tray trucks and tipper trucks. The works will be conducted between 7.00am and 10.00pm on Saturday and Sunday.

Woodbrook Road Bridge - There will be foundation and piling works taking place at this location. Equipment: piling rig, mini excavator, concrete trucks, franna crane, tray trucks and tipper trucks. The works will be conducted between 7.00am and 10.00pm on Saturday and Sunday.

We appreciate everyone's patience while we build this important project for Sydney, NSW and the nation.

Further information:

Please call: **COMPLAINTS HOTLINE 1800 182 543**

Email ssfl@artc.com.au or visit www.ssfl.artc.com.au

Public Notices

1738770

CONDITIONS OF ACCEPTANCE CLASSIFIED, TRADES & SERVICES ADVERTISEMENTS

TRADES & SERVICES

All advertisements must comply with the current regulations of the Building Services Corporation.

Directory advertisements must commence with

a) The registered Name of the company or
b) The surname of the proprietor

CLASSIFIED AND TRADES & SERVICES

Minimum advertisement for Trades & Services 3 lines, for Classifieds 4 lines.

Advertisements may be charged on a 7 day invoice, Visa Card, MasterCard, American Express, Diners Club or an approved FCN 30 day account. (Certain classifications require pre-payment).

Where credit is extended to an advertiser certain items of information permitted to be kept on a credit information file might be disclosed to a credit reporting agency.

The company reserves the right to alter or omit advertisements and while every care is exercised, is not responsible for error, mis-classification or non-insertion. No allowance will be made for errors unless the Company's attention is drawn to them within 7 days of publication. Credit will not be given for typographical errors which do not lessen the effectiveness of the advertisement.

Cancellation of any current advertisement will result in the issuing of a cancellation number. No credits will be given for non-cancellation of advertisements unless this cancellation number is quoted.

No responsibility is accepted for advertisements not appearing in strict alphabetical order.

Advertisements may be lodged by telephone, with the exception of those "Family Announcements" requiring authentication. Where photographs are submitted for publication, every care will be taken but return of photographs cannot be guaranteed.

Advertisements that require a photo are not available to be made during Weekend shifts. These are only available Monday to Friday between 8am and 6pm and subject to paper deadline.

1739547

Photo Advertisements

Advertisements that require a photo are not available during weekend shifts and are only available Monday to Friday between 8am and 6pm and subject to paper deadline.

For further queries regarding advertisements such as these, please call

13 24 25

Public Notices

1820521

First Day of School.... They're all grown up!

FAIRFAX COMMUNITY CLASSIFIEDS WILL BE PUBLISHING A SPECIAL FEATURE FOR CHILDREN STARTING SCHOOL THIS YEAR.

You can place a photo, child's name, age & 10 word message for only $66.

This will appear week commencing March 23th, 2009 and will be a special keepsake for the families and friends of those little cuties starting school! Simply follow the directions below.

LAST WEEK! DON'T MISS OUT!

(Example actual size)

James Howard
5 years

Enjoy school,
we hope you
have a blast.
Love Mum & Dad.

Paper in which ad is to appear:

- ❍ Penrith City Star/ Hawkesbury Courier
- ❍ St Marys Star ❍ Blacktown City Sun ❍ Hills/Northern News
- ❍ Parramatta Sun ❍ Fairfield Champion ❍ Wollondilly Advertiser
- ❍ Liverpool Champion / South Western Rural Advertiser
- ❍ Campbelltown-Macarthur Advertiser / Camden Advertiser
- ❍ St George & Sutherland Shire Leader

You can lodge your photo & text by mail to: **First Day Of School, Locked Bag 7010, Liverpool 1871** (unfortunately photos are unable to be returned) or by email to **fcnfeatures@fairfaxmedia.com.au.**
The email photographs must be in jpeg format. For further information phone the **Classified Features Team on 13 24 25.**
Deadline for photo & text, Wednesday March 18th 2009

Childs Name: _____(To be printed in paper)
Childs Age: _____
10 Word Message: _____
_____
Your Name: _____
Your Address: _____
Your Phone Number: _____
Payment: ❒ Chq ❒ M/O ❒ C/Card Amount: ❒ $66
Cheques/Money Orders to be made payable to Fairfax Community Newspapers Visa ❒ Mastercard ❒ American Express ❒ Diners Club ❒
Card No: _____ Exp Date:_____

THARAWAL
LOCAL ABORIGINAL LAND COUNCIL

Biosis Research
Melanie Tompson
8 Tate Street,
WOLLONGONG NSW 2500

6th of March 2009

Dear Melanie,

RE: AGL Camden Gas Project

Tharawal Local Aboriginal Land Council wishes to be recognised as a stake holder and be consulted for the further development of the Camden Gas Project for AGL. Thankyou for your invitation on this survey.

Yours in Indigenous Unity,

per.

Donna Whillock
Cultural Heritage Representative
Tharawal Local Aboriginal Land Council
Mobile No: 040 99 66 372

P.O. BOX 20, BUXTON NSW 2571
220 WEST PARADE COURIDJAH NSW 2571
TELEPHONE: (02) 4681 0059 FAX: (02) 4683 1375
EMAIL: tharawal@ideal.net.au http://www.tharawal.com.au

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

11-13 Mansfield Street
Glebe NSW 2037
PO Box 113, Glebe NSW 2037
P. 02 9562 6327 F. 02 9562 6350

Melanie Thompson
Biosis Research Pty. Ltd.
8 Tate Street
WOLLONGONG NSW 2500

Dear Melanie,

Re: Request - Search for Registered Aboriginal Owners

I refer to your letter dated 4 March 2009 regarding the proposed Aboriginal Cultural Heritage Impact Permit Assessment and Cultural Heritage Management Plan for the Camden Gas Project in the Camden and Campbelltown LGAs.

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

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

Regards

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

9 March 2009

Camden Council
37 John Street, Camden NSW 2570 DX 25807
PO Box 183, Camden 2570 ABN: 31 117 341 764
Telephone: 02 4654 7777 Fax: 02 4654 7829
Email: mail@camden.nsw.gov.au

Binder: Camden Gas Project – Stage 3

10 March 2009

Melanie Thompson
Biosis research Pty Ltd.
8 Tate Street
Wollongong NSW 2500

Dear Melanie

AGL Gas Project Stage 3 – Cultural Heritage Assessment

Reference is made to your letter dated 6 March 2009 in relation to your company's preparation of the Aboriginal Cultural Heritage Impact Assessment for the subject project.

Camden Council wishes to be involved in the project and nominates Ms Jodi Ayre, Council's Heritage Officer, as it's representative. Jodi can be contacted on 4654 7806.

Yours faithfully

CHRIS LALOR
Team Leader Land Use and Planning

campbelltown
city council

RECEIVED
- 1 APR 2009
BY:

30 March 2009

Ms Melanie Thomson
Senior Archaeologist
Biosis Research P/L
8 Tate Street
WOLLONGONG NSW 2500

Dear Ms Thomson,

Re: AGL Gas Production (Camden) P/L - Camden Gas Project

Thankyou for your letter dated 4 March 2009 advising Campbelltown City Council of proposed works known as the 'Camden Gas Project' by AGL Gas Production (Camden) Pty Limited.

In response to your request, Campbelltown City Council would like to formally register as an interested party in the Aboriginal cultural heritage assessment and management program for the subject project.

Council appreciates being kept informed of the subject proposal and the opportunity for further consultation on the matter.

Should you have any further enquiries on the above, please contact Jeff Burton of Council's Planning and Environment Division on 4645 4842.

Yours sincerely

Renee Winsor
Environmental Planning Coordinator

Civic Centre Queen Street Campbelltown PO Box 57 Campbelltown NSW 2560 DX5114
Telephone 02 4645 4000 Facsimile 02 4645 4111 TTY 02 4645 4615
Email council@campbelltown.nsw.gov.au Web www.campbelltown.nsw.gov.au
ABN 31 459 914 087

Cubbitch Barta Native Title Claimants
Aboriginal Corporation,
55 Nightingale Road,
PHEASANTS NEST. N.S.W. 2574.
20th March, 2009.

Biosis Research
8 Tate Street,
WOLLONGONG. N.S.W. 2500.

Dear Melanie,

RE; AGL ABORIGINAL CULTURAL
HERITAGE IMPACT ASSESSMENT.

Cubbitch Barta would like to take this opportunity of registering an interest in the above project. We have participated in the AGL and Sydney Gas projects now for many years, and because of our local knowledge, believe that our input should be ongoing.

We have traditional connection to the land where the project is taking place, therefore we have a responsibility given to us by our forefathers , hopefully to manage the outcomes for the conservation of our sites and places.

Yours faithfully,

G. Chalker.

Glenda Chalker
Hon. Chairperson
Phone/Fax 02 46 843829 0427218425

7.2 Appendix 2 – Project Methodology Pack

BIOSIS
RESEARCH

AGL – Camden Gas Project: Proposed Methodology for Cultural and Archaeological Impact Assessment

April 2009

Natural & Cultural Heritage Consultants 8 Tate Street Wollongong NSW 2500

Ballarat:
449 Doveton Street North Ballarat3350
Ph: (03) 5331 7000 Fax: (03) 5331 7033
email: ballarat@biosisresearch.com.au

Melbourne:
38 Bertie Street Port Melbourne 3207
Ph: (03) 9646 9499 Fax: (03) 9646 9242
email: melbourne@biosisresearch.com.au

Queanbeyan:
55 Lorn Road Queanbeyan 2620
Ph: (02) 6284 4633 Fax: (02) 6284 4699
email: queanbeyan@biosisresearch.com.au

Sydney:
18-20 Mandible Street Alexandria 2015
Ph: (02) 9690 2777 Fax: (02) 9690 2577
email: sydney@biosisresearch.com.au

Wollongong:
8 Tate Street Wollongong NSW 2500
Ph: (02) 4229 5222 Fax: (02) 4229 5500
email: wollongong@biosisresearch.com.au

***BIOSIS** RESEARCH Pty. Ltd. A.C.N. 006 075 197*
Natural & Cultural Heritage Consultant

Project no: s5252

Author:

Melanie Thomson

Reviewer:

Jamie Reeves

Mapping:

Robert Suansri

CONTENTS

FIGURES

1.0 INTRODUCTION

AGL is continuing to develop the coal seam methane resource in the Shires of Camden, Wollondilly and Campbelltown, known as the Camden Gas Project. AGL currently operates approximately 120 gas wells, gas gathering lines and a gas plant at Rosalind Park. AGL is seeking approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) for further development of the Camden Gas Project. The proposed Northern Expansion project area is located within the Camden and Campbelltown local government areas, approximately 60 km south west of Sydney.

The New South Wales Department of Environment and Climate Change (DECC) (2005) defines Aboriginal cultural heritage as consisting of places and items that are of significance to Aboriginal people because of their traditions, observances, customs, beliefs and history. This cultural heritage is evidence of the lives of Aboriginal people right up to the present. Cultural heritage may comprise of physical (or tangible) or non-physical (intangible) elements. As such, it includes things made and used in earlier times, such as stone tools, art sites and ceremonial or burial grounds, as well as more recent evidence such as old mission buildings and cemeteries.

This document presents a methodology for the Aboriginal cultural and archaeological assessment of the Northern Expansion Area for the Camden Gas Project. The methodology has been designed to conform to the requirements of the relevant advisory documents and guidelines. These guidelines and documents include:

- Draft guidelines for Aboriginal Cultural Impact Assessment and Community Consultation (DECC, July 2005), for assessing potential impacts on Aboriginal cultural heritage for development applications assessed under Part 3A of the Environmental Planning and Assessment Act 1979 [hereafter referred to as 'DECC Part 3A Guidelines'].

- *National Parks and Wildlife Act* 1974: Part 6 Approvals – Interim Community Consultation Requirements for Applicants (DEC, 2004) [hereafter referred to as 'DECC Part 6 Guidelines'].

- The Australia ICOMOS Burra Charter [hereafter referred to as 'the Burra Charter'].

- Aboriginal Cultural Heritage Standards and Guidelines Kit (NPWS, 1997) [hereafter referred to as 'DECC Standards and Guidelines Kit'].

2.0 PROJECT SUMMARY

AGL is continuing to develop the coal seam methane resource in the Shires of Camden, Wollondilly and Campbelltown, known as the Camden Gas Project. AGL currently operates approximately 120 gas wells, gas gathering lines and a gas plant at Rosalind Park. AGL is seeking approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) for further development of the Camden Gas Project. The proposed Northern Expansion project area is located within the Camden and Campbelltown local government areas, approximately 60 km south west of Sydney. The proposed project area is situated east of the Camden By-Pass extending from Narellan Road in the south and Denham Court Road to the north and generally west of the M5. The current Northern Expansion Project will include the development of:

- Up to 20 well surface locations (up to six wells co-located at each);
- Gas plant; and
- Gas gathering lines and access roads.

The information provided in the Archaeological and Cultural Heritage Impact Assessment will support the DGR Application to the Department of Planning, in accordance with the requirements of the Part 3A of the *NSW Environmental Planning and Assessment Act 1979* (EPA Act). Under this part of the Act, the project does not have to comply with requirements under Part 6 of the NPWS Act. Instead, conditions outlined by the Director-General on approval of the Development Consent will require commitments regarding cultural heritage, including consideration of DECC and NPW Act guidelines and processes for the purposes of 'best practice' heritage management.

3.0 ABORIGINAL CONSULTATION AIMS

The aims of the Aboriginal community consultation to be undertaken by Biosis Research, and outlined in this methodology, are to:

- Gain the Aboriginal community's view on the methodology for cultural and archaeological impact assessment;
- Gain the Aboriginal community's views and determinations of value for the Study Area and any cultural heritage sites therein;
- Gain the Aboriginal community's views about potential impacts on the cultural heritage values of the Study Area and the wider landscape;
- Discuss with the Aboriginal community mitigation and management strategies for sites that may potentially be impacted (including the requirement for statutory approvals);
- Discuss with the Aboriginal community mitigation and management strategies for potential impacts to the cultural landscape;
- Discuss with the Aboriginal community their views regarding employment opportunities within the ambit of future mitigation and management works (if required) relating to cultural heritage impacts;
- Provide comprehensive and realistic management recommendations to ENSR and AGL. These recommendations will integrate the Aboriginal communities' views and current cultural heritage management best practice;
- Comply with and satisfy the requirements of relevant cultural heritage legislation, guidelines, policies and procedures.

4.0CONSULTATION TO DATE

The earliest stages of consultation have begun, and the process that has taken place to date is outlined below.

4.1 Notification and Advertising

Following the *DECC Draft guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (July 2005), Biosis Research notified the following bodies regarding the Northern Expansion Study Area for the Camden Gas Project:

- *Tharawal Local Aboriginal Land Council*
- *Registrar of Aboriginal Owners*
- *Native Title Services*
- *The Camden Council*
- *The Campbelltown City Council*
- *The NSW Department of Environment and Conservation*

In addition to the written notifications, advertisements seeking registrations from interested parties were published in the following local print media:

- *Campbelltown-Macarthur Advertiser* (11 and 18 March 2009)

A register for interested parties was opened on 11 March 2009 and registrations were received by Biosis Research until 25 March 2009.

In addition to the above, written notification (and a copy of the advertisement) was also provided to those Aboriginal stakeholders currently involved in cultural heritage management of all previous Camden Gas Project stages.

4.2 Registered Stakeholders

The following bodies responded to the above calls for registrations. These bodies are referred to below as ‘the registered stakeholders’.

- Tharawal Local Aboriginal Land Council (Donna Whillock)
- Cubbitch Barta Native Title Claimants Aboriginal Corporation (Glenda Chalker)
- Camden City Council (Chris Lalor)

- Campbelltown Council (Renee Winsor)
- Registrar of Aboriginal Owners (Megan Mebberson)

DECC's Guidelines requires the registered stakeholders are to be provided with a methodology for the proposed cultural assessment and given at least 21 days to review the methodology and provide feedback.

4.3 Field Work Participation

Subsequent to the close of the registration period, consultation meetings will be undertaken with all registered stakeholders following the consultation process outlined in Section 6.0 below.

Aboriginal stakeholders currently involved in the management of cultural heritage within existing stages of the Camden Gas Project will be invited to participate in all field survey within the proposed Northern Expansion Study Area.

Based on the outcomes of this initial consultation meeting, those registered stakeholders to be involved in field work will be determined.

5.0 PROPOSED METHODOLOGY

The following sections outline the proposed methodology for The Northern Expansion Study Area for the Camden Gas Project.

5.1 Guiding Principals

In line with the relevant advisory documents and guidelines outlined in Section 1, the following methodology adheres to the following principals:

- Input from those Aboriginal people with a cultural association to the land is an essential part of assessing the significance of Aboriginal heritage objects and values that could be impacted by an activity.
- Aboriginal heritage can have both cultural and scientific/archaeological significance and both should be the subject of assessment.
- Aboriginal people are the primary determinants of the significance of their heritage.
- Aboriginal community involvement needs to take place early in the assessment process to ensure that their values and concerns are fully taken into account, and so that their own decision-making structures are able to function.
- Consideration should be given to measures that could be implemented to avoid, mitigate or offset likely impacts.

The DECC Guidelines note that the community consultation process ensures that Aboriginal communities have the opportunity to positively influence assessment outcomes by:

- Influencing the design of the impact assessment of cultural and scientific significance;
- Providing relevant information in relation to cultural significance values, and contributing to the development of cultural heritage management recommendations.

5.2 Cultural Assessment Methodology

The objectives of the consultation process are to ensure that an opportunity is given to a broad range of Aboriginal stakeholders to express their cultural heritage values of the Study Area, including spiritual connections, recorded archaeological sites, and the natural environment and landscape values (see Section 3). The cultural assessment and consultation process will involve the following:

- Distribution of this draft methodology to registered stakeholders.
- Face to face meetings with registered stakeholders regarding the draft methodology and field work requirements.

- Provision of relevant background information to registered stakeholders sourced from AHIMS searches and existing relevant reports.
- Discussions regarding the field survey design with the aim of identifying Aboriginal heritage sites or areas of particular cultural significance to be included in the field survey program.
- Discussions during field work regarding Aboriginal cultural heritage.
- Identification of spiritual, traditional, historical or contemporary associations and attachments through face to face meetings, during field surveys and through written comment on the draft report following completion of the field surveys.
- Provision of a draft Aboriginal Cultural Heritage Assessment report to registered stakeholders including an assessment of cultural significance and proposed mitigation and management measures for Aboriginal heritage based on information provided by Aboriginal stakeholders throughout the assessment process.
- Face to face meetings with registered stakeholders regarding the draft Aboriginal Cultural Heritage Assessment report, the assessment of cultural significance and the proposed mitigation and management measures for Aboriginal heritage.
- Consideration and/or incorporation of comments received on the draft report into the final Aboriginal Cultural Heritage Assessment report.

5.3 Archaeological Methodology

The archaeological assessment will involve the following:

- A search of the DECC's AHIMS database.
- Literature review of all relevant cultural heritage and archaeological reports and publications for the local area and region.
- A search of the Heritage Branch NSW State Heritage Inventory and State Heritage Register.
- A search of the national Heritage List, Commonwealth Heritage List and register of the National Estate.
- Review of historical source material (including historical maps and aerial photography) to determine land-use history.
- Conduct of an initial archaeological significance assessment (based on available published information) to assist in the field survey design.
- Representative archaeological survey and site inspections of the Study Area.

- Review of the archaeological significance assessment based on additional information collected during the field surveys and consultation with Aboriginal stakeholders.

- Preparation of an Aboriginal Cultural Heritage Impact Assessment report.

Many sections of the Study Area have been subject to previous archaeological surveys. Information from these surveys will be used to inform the field survey design and will also be incorporated into the archaeological significance assessment. The AHIMS search has shown there are 48 previously registered sites within the current Study Area. The location of these sites is shown in Figure 2.

5.4 Assessment of Significance

The NSW DECC recognises that 'Aboriginal community are the primary determinants of the significance of their heritage' (NSW DEC 2004). Biosis Research recognises that our role in the cultural heritage assessment process is to provide specialist skills, particularly in regard to archaeological and heritage management expertise. These specialist skills can be articulated and enhanced through consultation with the Aboriginal community, with the aim of providing a holistic assessment of cultural heritage significance.

Archaeologists study the material cultural heritage—artefacts, sites and structures—of past peoples and societies. However, not all places and sites of cultural heritage value and significance have material evidence. Places, sites and things have heritage value because of what they mean to people, and because of the values they represent for people. Places, sites and things will have different heritage values for different people. These different values may require negotiation among various stakeholders and can shape what decisions are made about conservation. Cultural heritage management is the process of investigation, consultation and making decisions about the conservation of heritage places through the assessment of heritage values.

Heritage management is based on the principle that the heritage significance of a place will guide all future decisions that affect the place. The determination of cultural heritage significance relies on a comprehensive approach to heritage assessments and to the values that are attached to heritage places. Cultural heritage significance can be considered to be the importance of a place, site or object arising from the combination of values attributed to it. These values determine the 'what' and 'how' of conservation and direct management decisions. The categorisation and significance of a place or site will also determine the statutory protection that may be afforded to it.

This approach is laid out in the Australia ICOMOS Burra Charter (1999), which has been adopted by cultural heritage managers and government agencies as the set of guidelines for best practice heritage management in Australia. The Burra Charter identifies the following categories of values: aesthetic, historic, scientific and social. Most assessment approaches also include a ranking of significance – high, moderate or low for example. For each value associated with a place, an attempt is made to assess the degree or level of significance in terms such as *unique, important, representative, rare* and so on – which relies on a comparison of that value in relation to other places. One of the more common applications of the significance assessment process is to mitigate

or control landscape modifying activities, including the protection or conservation of identified heritage values.

Both professional and community understandings are important when determining heritage and its significance. 'Expert' interpretation will often need to be integrated with other understandings and assessments of heritage. This is particularly relevant in a discussion of Aboriginal cultural heritage, where there can be differences in the way places are valued and in understandings of how knowledge can be used. As a consequence, outcomes should rely on processes and practices that promote integration and an effective incorporation of different values in decision making.

For example, an 'archaeological' site can be of broader interest to groups other than archaeologists. There are additional scientific interests in archaeological sites than those that arise through archaeology alone. Many types of scientific research or 'informational' interests can use data from archaeological sites, and these can all contribute the 'scientific value' of a place or site. Also, the wider interests of the general community can be complementary to archaeological values. In terms of Aboriginal communities, heritage places – including those that are otherwise defined as 'archaeological sites' – will attract differing values. These may include custodianship obligations, education, family or ancestral links, identity, and symbolic representation.

History and traditions are important: this generation has an obligation to future generations to retain certain things as they are currently seen and understood. This includes retaining alternative understandings to those that come through scientific assessments. Heritage places are often more complex than is identified through the scientific determination of value. Cultural and social values can be complex and rich - the past is a vital component of cultural identity. Feelings of belonging and identity are reinforced by knowledge of the existence of a past, and this is further reinforced and maintained in the protection of cultural heritage.

Assessment of Cultural Heritage Significance

As well as the ICOMOS Burra Charter, DECC has issued the *Guidelines for Aboriginal Impact Assessment*. The relevant sections of the *Guidelines* are presented and discussed below.

The *Guidelines* state that an area may contain evidence and associations which demonstrate one or any combination of the following Aboriginal heritage values. The values described by the *Guidelines* are drawn from the Burra Charter.

Social value (sometimes termed Aboriginal value) refers to the spiritual, traditional, historical or contemporary associations and attachment that the place or area has for the present-day Aboriginal community. Places of social significance have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be determined through consultative processes with one or more Aboriginal communities.

Historic value refers to the associations of a place with a person, event, phase or activity of importance to the history of an Aboriginal community. Historic places may or may not

have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). Gaining a sufficient understanding of this aspect of significance will often require the collection of oral histories and archival or documentary research, as well as field documentation. These places may have 'shared' historic values with other (non-Aboriginal) communities. Places of post-contact Aboriginal history have generally been poorly recognised in investigations of Aboriginal heritage, and the Aboriginal involvement and contribution to important regional historical themes is often missing from accepted historical narratives.

Scientific value refers to the importance of a landscape, area, place or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or object and will consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

Aesthetic value refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.

All Aboriginal sites and places, including those that are considered to be 'archaeological' – for example, middens or artefact scatters – may have a particular value and meaning to Aboriginal people.

Cultural Landscapes

In addition to these four definitions of value, the *Guidelines* also specify the importance of considering cultural landscapes when determining and assessing Aboriginal heritage values. The principle behind a cultural landscape is that 'the significance of individual features is derived from their inter-relatedness within the cultural landscape'. This means that sites or places cannot be 'assessed in isolation' but must be considered as parts of the wider cultural landscape. Hence the site or place will possibly have values derived from its association with other sites and places. By investigating the associations between sites, places, and (for example) natural resources in the cultural landscape the stories behind the features can be told. The context of the cultural landscape can unlock 'better understanding of the cultural meaning and importance' of sites and places.

Determination of Cultural Heritage Significance

The Burra Charter suggests that heritage practitioners 'should prepare a succinct statement of cultural significance, supported by, or cross referenced to, sufficient graphic material to help identify the fabric of cultural significance'. The statement must be clear and concise, and must not simply restate the physical or documentary evidence presented as part of the assessment.

This study will present determinations of cultural heritage significance as *statements of significance* that preface a concise discussion of the contributing factors to the cultural heritage significance.

Reference to each of the categories defined above will be made when evaluating cultural significance for sites and places. Nomination of the level of value—high, moderate, low or not applicable—for each relevant category will also be proposed. Consideration of the thresholds for each level of value for the categories will be guided by the contributing factors defined above for each category. The categories are:

- *Social value*
- *Historic value*
- *Scientific value*
- *Aesthetic value*
- *Cultural landscape value*

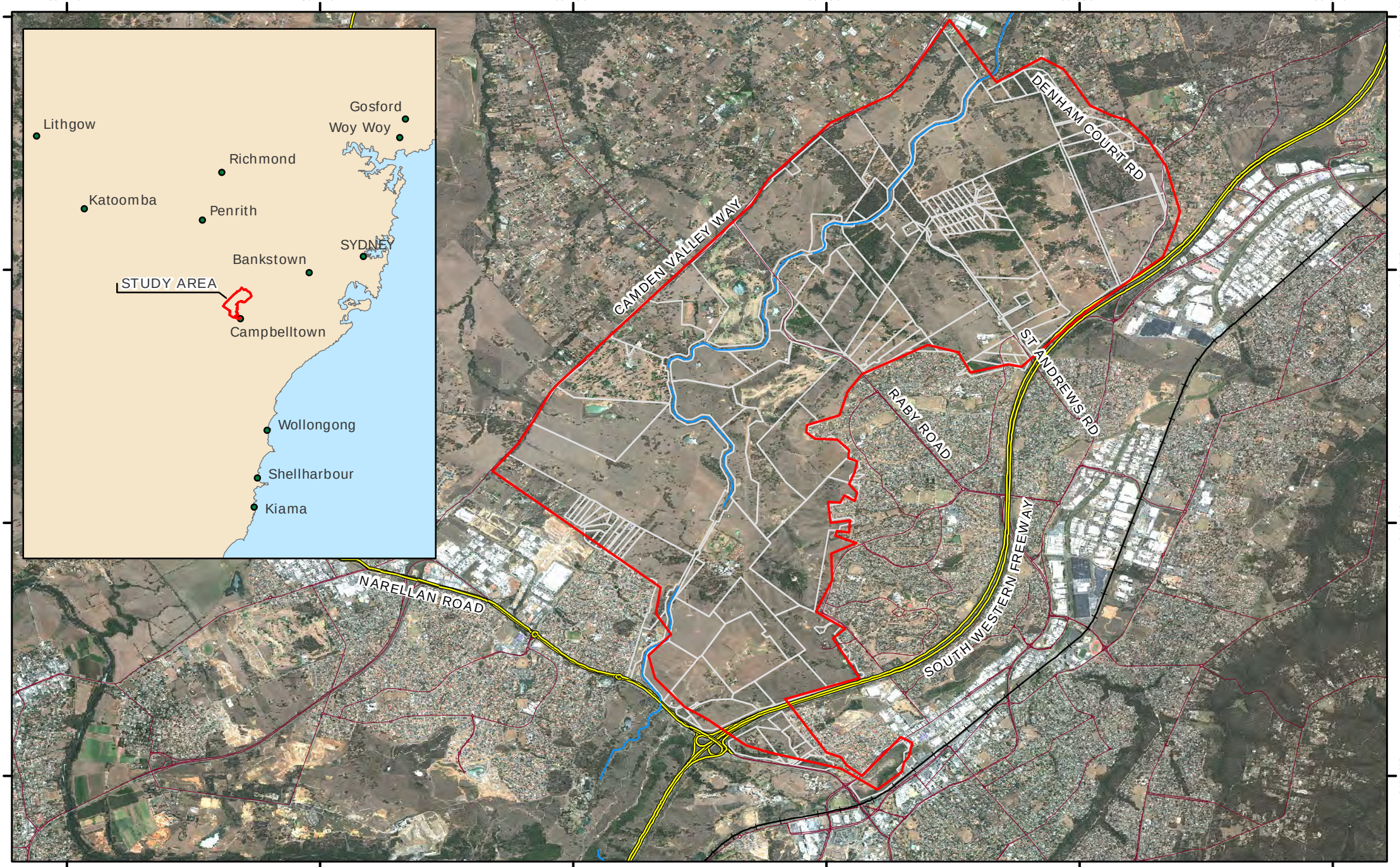
The determination of cultural landscape value will be applied to both individual sites and places (to explore their associations) and also, to the Study Area as a whole.

6.0 CULTURAL HERITAGE PROJECT SHEDULE

The cultural heritage assessment project is planned to follow the schedule outlined below.

Project Phase	Activity	Begin Date	End Date	Duration
Distribution of methodology and draft impact assessment report	Review Methodology	21/04/2009	15/05/2009	21 days
Community Consultation	Meeting - Project background and scope - Identification of values; -Community Consultation Agreements.	TBA	TBA	1-2 days
Field Work	Detailed assessment of those properties accessible within the proposed Northern Expansion Study Area.	TBA	TBA	5 days
Community Consultation	Meeting - Confirmation of values - Discuss management options	TBA	TBA	1 day

FIGURES



Energy in action.™

AGL

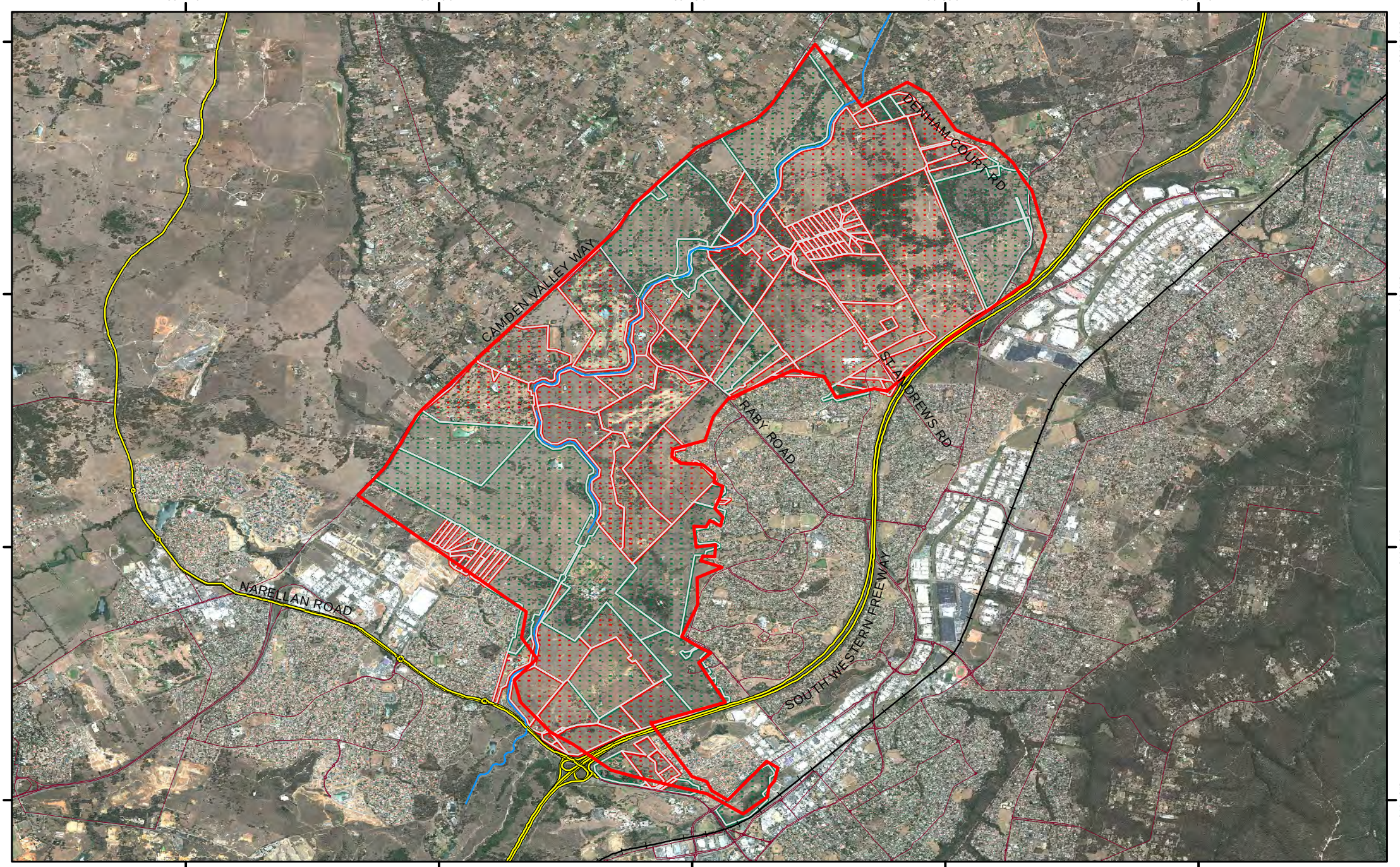
Author:	Upstream Gas
Date:	May 2009
Ref:	1968R1

Location of the Study Area in regional context

Kilometres
0 1.5 3
Scale 1:70,000

Legend
- Study Area
- Canal
- Railway
- Major Highways
- Major Roads

N



Energy in action.™

AGL

Author:	Upstream Gas
Date:	April 2009
Ref:	1970

Location of Accessible Properties identified for archaeological survey

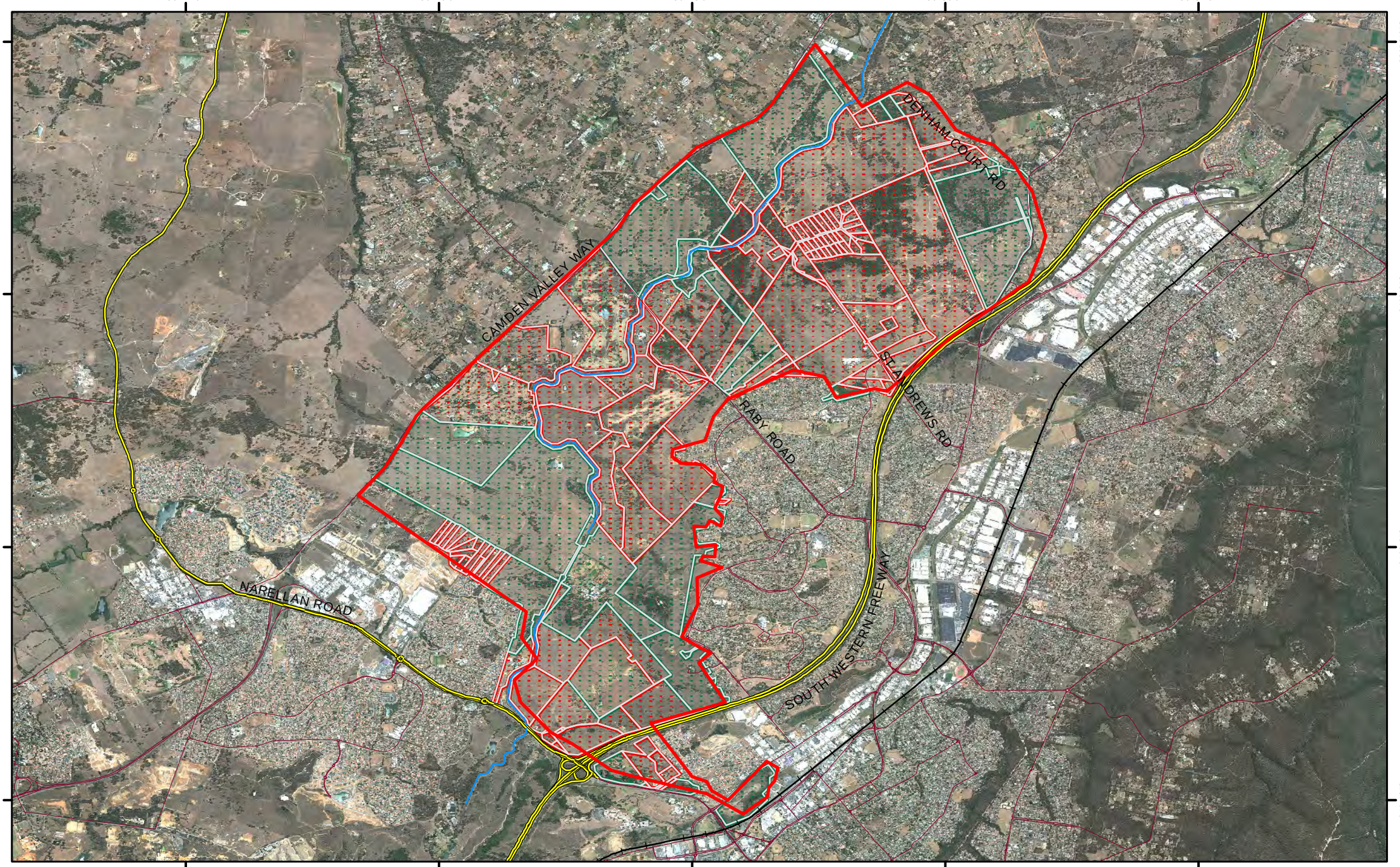
Kilometres
0 1.5 3
Scale 1:70,000

Legend

Acessible Properties
- Yes
- No
- Project Area

- Canal
- Railway
- Major Highways
- Major Roads

N



Energy in action.™

AGL

Author:	Upstream Gas
Date:	April 2009
Ref:	1970

Location of Accessible Properties identified for archaeological survey

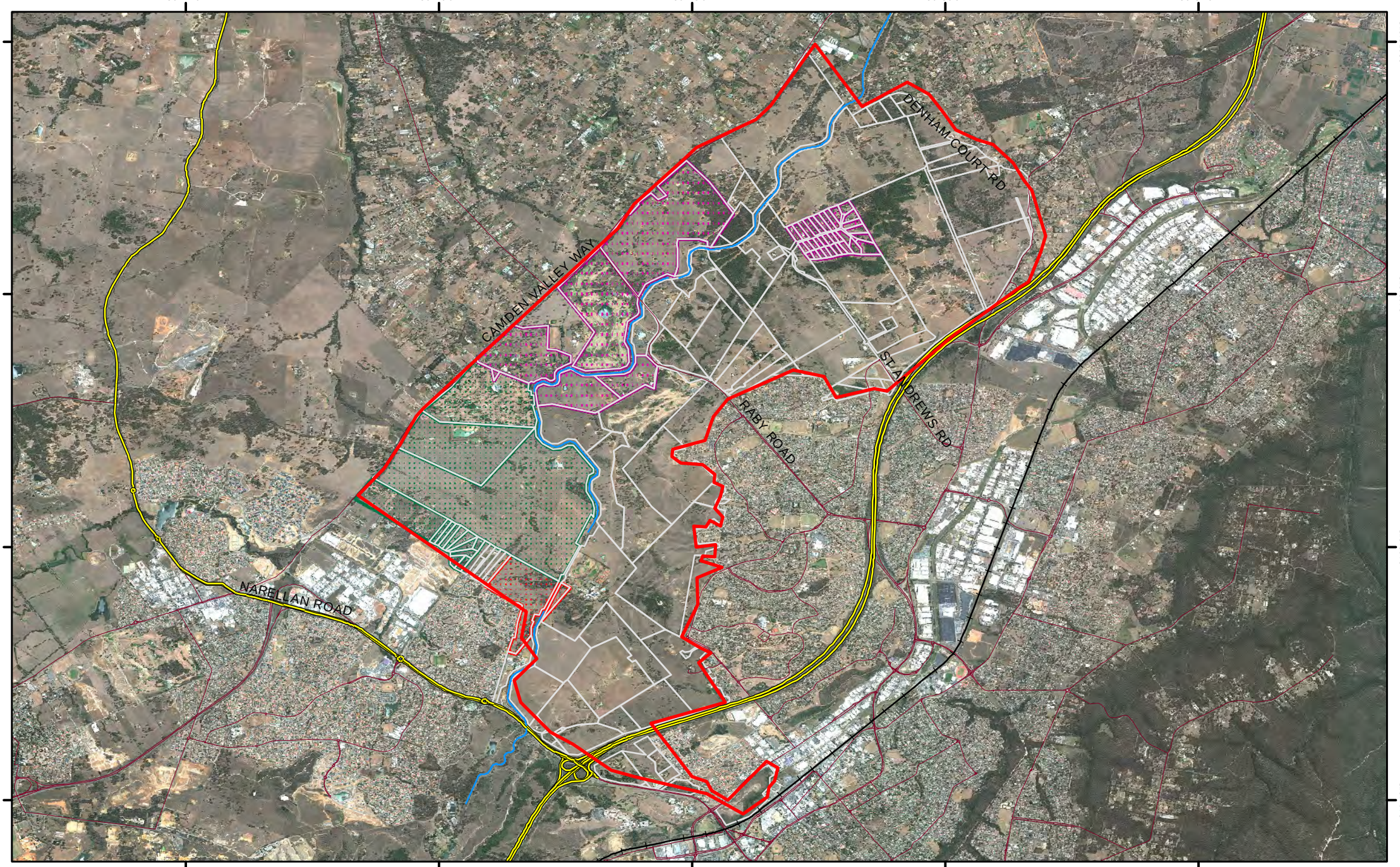
Kilometres
0 1.5 3
Scale 1:70,000

Legend

Acessible Properties
- Yes
- No
- Project Area

- Canal
- Railway
- Major Highways
- Major Roads

N



Energy in action.™

AGL

Author:	Upstream Gas
Date:	April 2009
Ref:	1969

Previous Archaeological Survey

Kilometres
0 1.5 3
Scale 1:70,000

Legend
- Heritage Concepts 2008
- JMCHM 2000
- JMCHM 2007
- Project Area
- Canal
- Railway
- Major Highways
- Major Roads

N

REFERENCES

Australia ICOMOS 1999, *Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter), revised edition*, Australia ICOMOS, Canberra.

NSW NPWS 1997, *Aboriginal Cultural Heritage Standards & Guidelines Kit.* NSW National Park and Wildlife Service.

NSW DECC 2004. *National Parks and Wildlife Act 1974: Part 6 Approvals. Interim Community Consultation Requirements for Applicants.* Department of Environment and Conservation, NSW.

NSW DECC 2005. *DRAFT Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation.* Department of Environment and Conservation, NSW.

7.3 Appendix 3 - Archaeological Report

BIOSIS
RESEARCH

Camden Gas Project Amended Northern Expansion: Archaeological Report

Report for AGL Upstream Investments Pty. Ltd.

October 2012

Natural & Cultural Heritage Consultants 8 Tate Street Wollongong 2500

BIOSIS
RESEARCH

Ballarat:
506 Macarthur Street Ballarat, VIC, 3350
Ph: (03) 5331 7000 Fax: (03) 5331 7033
email: ballarat@biosisresearch.com.au

Brisbane:
72A Wickham Street, Fortitude Valley, QLD, 4006
Ph: (07) 3831 7400 Fax: (07) 3831 7411
email: brisbane@biosisresearch.com.au

Canberra:
Unit 16 / 2 Yallourn Street, Fyshwick, ACT, 2609
Ph: (02) 6228 1599 Fax: (02) 6280 8752
email: canberra@biosisresearch.com.au

Melbourne:
38 Bertie Street, Port Melbourne, VIC, 3207
Ph: (03) 9646 9499 Fax: (03) 9646 9242
email: melbourne@biosisresearch.com.au

Sydney:
18-20 Mandible Street, Alexandria, NSW, 2015
Ph: (02) 9690 2777 Fax: (02) 9690 2577
email: sydney@biosisresearch.com.au

Wangaratta:
26a Reid Street, Wangaratta, VIC, 3677
Ph: (03) 5721 9453 Fax: (03) 5721 9454
Email: Wangaratta@biosisresearch.com.au

Wollongong:
8 Tate Street Wollongong, NSW, 2500
Ph: (02) 4229 5222 Fax: (02) 4229 5500
email: wollongong@biosisresearch.com.au

Project no: 14975

Authors:

Renée Regal,
Melanie Thomson &
Asher Ford

Reviewer:

Melanie Thomson and

Nathan Garvey

Mapping:

Ashleigh Pritchard

LGA:

Camden Council and

Campbelltown City Council

DOCUMENT CONTROL SHEET

PROJECT	Camden Gas Project Amended Northern Expansion Aboriginal Cultural Heritage Assessment.

PROJECT NO	14975.

REPORT TO	AGL Upstream Investments Pty Limited.

REPORT TITLE:	Camden Gas Project Amended Northern Expansion: Archaeological Report.

AUTHOR(S):	Renée Regal, Melanie Thomson & Asher Ford.

REVISION	***PREPARED***	***INTERNAL REVIEW***	***EXTERNAL REVIEW***	***AMENDED***
A	Asher Ford	Melanie Thomson	Alexander Frolich, AGL	9 August 2012
B	Asher Ford	Nathan Garvey	Alexander Frolich, AGL	12 September 2012
C	Asher Ford	Melanie Thomson	Alexander Frolich, AGL	08 October 2012
D	Asher Ford	Melanie Thomson	Alexander Frolich, AGL	

REVISION	***ISSUED***	***NAME***	***SIGNED***
A	19 July 2012	Asher Ford	
B	9 August 2012	Asher Ford	
C	12 September 2012	Asher Ford	
D	25 October 2012	Asher Ford	

ACKNOWLEDGEMENTS

Biosis Research gratefully acknowledges the contributions of the following people and organisations (listed alphabetically) in preparing this report: Biosis Research acknowledges the contribution of the following people and organisations in preparing this report:

- Adam Lollback, Natalie Leighton, Aaron Clifton, Siobhan Barry, Tom Lawler, Kevin Rofe and Courtney Collins (AGL)
- Erin Saunders, Duncan Peake, Schandel Jefferys and Alexandra Frolich (AECOM)
- Donna Whillock, Robyn Straub and Neale Sampson (Tharawal Local Aboriginal Land Council)
- Glenda Chalker and Rebecca Chalker (Cubbitch Barta Native Title Claimant Aboriginal Corporation)
- Robert Suansri, Ashleigh Pritchard and Sarah Tsesmetzis (Biosis Research)

ABBREVIATIONS

AECOM	AECOM Australia Pty Ltd
AHIMS	Aboriginal Heritage Information Management System
AGL	AGL Upstream Gas Investments Pty Limited
BP	Before Present
CGP	Camden Gas Project
DEC	Department of Environment and Conservation
DECCW	Department of Environment, Climate Change and Water NSW (formerly Department of Environment and Climate Change)
DGR	Director-General's Requirements
EA	Environmental Assessment
EP& A Act NSW	*Environmental Planning and Assessment Act* 1979 (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1979 (Cth)
ESC	Effective Survey Coverage
GGL	Gas Gathering Lines
ICOMOS	International Council on Monuments and Sites
LGAs	Local Government Areas
MSEC	Mine Subsidence Engineering Consultants
NPWS	National Parks and Wildlife Service (now part of DECCW)
NTCAC	(Cubbitch Barta) Native Title Claimants Aboriginal Corporation
OEH	Office of Environment and Heritage
PAD	Potential Archaeological Deposit
PPL	Petroleum Production Lease Area
RAPs	Registered Aboriginal Parties
RPGP	Rosalind Park Gas Plant
WSL	Well Surface Locations
Upper Canal	Sydney Upper Canal Water Supply

CONTENTS

TABLES:

FIGURES:

EXECUTIVE SUMMARY

Biosis Research Pty. Ltd. has been commissioned by AECOM Australia Pty. Ltd. (AECOM) on behalf of AGL Upstream Investments Pty. Ltd. (AGL) to undertake an Aboriginal archaeological and cultural heritage assessment for the proposed Camden Gas Project (CGP) Northern Expansion (Northern Expansion Project) to inform the Environmental Assessment (EA) (Figure 1). The CGP involves the extraction of gas from the Illawarra Coal Measures, within the Southern Coalfield of the Sydney Basin (AECOM 2010).

The project area for the Northern Expansion Project, as amended having regard to the submissions received by AGL during the public exhibition (Amended Project), has been separated into two distinct areas known as the Subsurface Project Area (within which project works are limited to subsurface drilling activities only) and the Surface Project Area. The Surface Project Area will include the construction and operation of gas wells at up to 11 well surface locations (WSLs), gas gathering lines (GGLs), water lines with central water storage tanks where feasible and access roads. Archaeological field surveys were confined to the Surface Project Area.

The Northern Expansion Project is development to which Part 3A of the *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act) applies. Under the (now repealed) clause 6 of Schedule 1 of the *State Environmental Planning Policy (Major Development) 2005* (SEPP 2005), the Northern Expansion Project is development, which in the opinion of the Minister for Planning, is development of a kind that is described in Schedule 1 of SEPP 2005 (that is, development for the purpose of drilling and operation of petroleum wells that is within a specified local government area) and is a project to which Part 3A of the EP&A Act applies. Part 3A of the EP&A has been repealed, In accordance with Schedule 6A of the EP&A Act, the Northern Expansion Project is a 'transitional Part 3A project', and Part 3A of the EP&A Act continues to apply to in respect of the Northern Expansion Project.

Under the EP&A Act, specified development on specified land may be declared to be State significant development (SSD). On 19 October 2012, the project was declared to be SSD by an order of the Minister for Planning and Infrastructure published in the NSW Gazette on 26 October 2012.

By virtue of the operation of clause 6(3)(b), Schedule 6A of the EP&A Act, previous steps taken under Part 3A (including issue of Director-General's Requirements (DGRs) and public exhibition of the EA) are now taken to have been completed under Division 4.1, Part 4 of the EP&A Act. AGL has prepared a Submissions Report to which this report is appended. The Submissions Report also addresses the amendments made to the Northern Expansion Project which has reduced the environmental impact of the development as a result of the issues raised during submissions.

In response to the submissions, AGL made changes to the Northern Expansion Project, including in relation to the route for GGLs and main gas gathering spine, and WSL. For

purposes of this report, the Northern Expansion Project, as amended, will be referred to as the Amended Project. The Amended Project comprises:

- construction and operation of eleven WSL containing up to six well heads each;
- construction and operation of associated GGLs including interconnection with the existing CGP network, along with central water storage points where required;
- construction of access roads and ancillary infrastructure, including storage yard(s), where required; and
- subsurface drilling of lateral in-seam well paths within the bounds of the Subsurface Project Area (Figure 2).

The assessment of the Amended Project utilised an "envelope" approach to impact assessment, meaning that a wider area or "envelope" around surface components was assessed to allow the final infrastructure sites to move within the assessed parameters, subject to the recommended environmental management measures and consultation with the landowner. This "Project Envelope" includes a 200 metre radius for a WSL and 25 metres either side of GGLs and access roads.

Detailed Aboriginal archaeological and cultural heritage assessment, impact assessment and management recommendations have been undertaken for the "Project Envelope", as the potential impact activities to Aboriginal heritage are limited to this area. However, the wider Surface Project Area has been used as the 'Study Area' for the purposes of understanding past Aboriginal land use and predictive modelling (see Figure 2).

Searches were carried out of relevant heritage registers and databases. A number of previously recorded Aboriginal archaeological sites are registered within the Surface Project Area, and within the 'envelopes' of proposed WSL, GGLs and access tracks. Several previous Aboriginal archaeological studies have been undertaken in response to housing developments associated with the South West Growth Centres (SWGC), commercial development, golf courses and linear infrastructure within the Surface Project Area. This work has involved both surface survey and subsurface investigation, resulting in the identification of numerous Aboriginal archaeological sites, the majority of which comprise stone artefact sites.

The environmental context of the Surface Project Area, and regional patterning, suggest that the area is likely to have been visited by Aboriginal people, and that this visitation has left observable marks. Predictive site modelling suggests that there is high potential for open campsites, artefact scatters or isolated finds, and scarred trees to be identified within the Surface Project Area. In some areas, where previous land use has resulted in high levels of disturbance, archaeological sites will have low integrity.

The field survey focussed on identifying Aboriginal archaeological sites and areas of previously identified archaeological potential within the Project Envelope, determined

through predictive site modelling. The field survey therefore focussed on creeks, drainage features and prominent rises, and any previously recorded sites. Ground surface visibility varied, with exceptional visibility in the Sydney Upper Canal Water Supply (Upper Canal) easement, to poor visibility in open grassed paddocks.

There are 28 identified Aboriginal sites and additional areas of moderate and high archaeological sensitivity inside the 'Project Envelope'. Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Amended Project and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
    - Ethos of the Australia International Council on Monuments and Sites (ICOMOS) Burra Charter; and,
    - *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010).

Recommendations

The management recommendations formulated for the Amended Project are provided below, and a break down of management actions by project component is shown in Table 4 and on the Figure 5 series:

Recommendation 1: *Conservation through Avoidance*

In the first instance, where practicable, AGL should avoid impact to *all* registered Aboriginal archaeological sites, potential archaeological deposits (PAD), and areas of high and moderate archaeological sensitivity by adjusting the alignment of GGLs and well heads at the design stage, prior to the commencement of ground disturbance works within the Project Envelope.

Where works are to be undertaken in close proximity to registered Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity the following should occur:

- Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity that will not be subject to direct impacts should be fenced with temporary above ground fencing. If Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity are separated from works by existing property boundary fencing then no further fencing is required; and

- Clear mapping and identification of Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity must be provided to personnel undertaking works so that they can identify and avoid these areas during works.

Recommendation 2: *Requirements of Further Archaeological Work - Direct Impacts to known Archaeological sites and areas of potential*

Where registered Aboriginal archaeological sites, PADs and areas of high and moderate archaeological likelihood cannot be avoided, additional archaeological work will be required. These additional works may include:

- RAPs to be given an opportunity to undertake a surface collection of artefacts at CG-OCS-01 and CG-OCS-09 and to relocate the material outside of the construction area. If possible the artefacts should be relocated within the current site boundaries. Updated Aboriginal Heritage Information Management System (AHIMS) site cards updating the location of any relocated artefacts should be submitted to the AHIMS register;

- An excavation strategy should be developed for PAD 2061-6 and PAD 2062-6 and incorporated in the Aboriginal Cultural Heritage Management Plan (ACHMP) (which forms part of the overall Environmental Management System for the CGP) in consultation with Registered Aboriginal Parties (RAP) and should take into account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works; and

- Detailed archaeological excavation and recording to recover relevant information should be undertaken at areas of moderate and high archaeological sensitivity prior to the commencement of construction. An excavation strategy should be developed and incorporated in the ACHMP in consultation with RAPs. The excavation strategy should take into account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works, taking into account any relevant conditions of the Turner Road North Precinct and Turner Road South Precinct Aboriginal Heritage Impact Permits.

Recommendation 3: *Requirements of Further Archaeological Work – Variation to the Surface Project Area Layout*

If there are any variations to the Project Envelope, additional archaeological survey and assessment by a qualified heritage consultant and the RAPs will be required.

Recommendation 4: *Registered Aboriginal Parties Consultation*

All aspects of management and mitigation should be developed and implemented in consultation with the RAPs and a qualified Aboriginal heritage consultant.

Recommendation 5: *Ongoing Management*

To successfully manage and mitigate Aboriginal cultural heritage within the Project Envelope, the existing ACHMP should be updated based on the findings of this study and in consultation with relevant Aboriginal stakeholder groups and Office of Environment and Heritage (OEH). This would consider the management and mitigation of Aboriginal cultural heritage at all stages of the Amended Project, including construction, production, post development activities, closure and final rehabilitation. The ACHMP should include a Trigger Action Response Plan for management of Aboriginal heritage in the Project Envelope.

Recommendation 6: *Unanticipated Aboriginal Sites*

Should unanticipated Aboriginal archaeological material be identified during any works of each component, works should cease in the vicinity of the find and a qualified archaeologist should be contacted to assess the find. OEH and Aboriginal stakeholders will also require notification.

Human Remains

In the case of any skeletal remains, suspected of being human, being found during any works of each component, the following process will be required:

- Immediately cease all work at that location and do not further move or disturb the remains;
- Report the find to the NSW Police and State Coroner;
- Notify AGL of the find;
- Notify Aboriginal stakeholders of the find;
- Notify OEH of the find;
- If the skeletal remains are of Aboriginal ancestral origin, develop an appropriate management strategy in consultation with the Aboriginal stakeholders;
- Record the find in accordance with the OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010); and
- Amend the ACHMP to include the newly discovered Aboriginal ancestral remains in the management regime established by the plan.

1.0 INTRODUCTION

1.1 Project Background

AGL Upstream Investments Pty. Ltd. (AGL) is continuing to develop the coal seam methane (CSM) resource in the local government areas (LGAs) of Camden and Campbelltown, known as the Camden Gas Project (CGP). The current CGP operations consist of 143 existing CSM wells, access roads, a high pressure sales pipeline, underground gas gathering lines (GGLs) and the Rosalind Park Gas Plant (RPGP), forming Stages 1 and 2 of the CGP. The CGP involves the extraction of gas from the Illawarra Coal Measures, within the Southern Coalfields of the Sydney Basin, approximately 700 metres below the surface (AECOM 2012).

In 2010, AGL lodged an application for the Northern Expansion of the CGP (Northern Expansion Project) under Part 3A of *the Environmental Planning and Assessment Act* 1979 (NSW) (EP&A Act). Having regard to the submissions receiving during the public exhibition of the environmental assessment (EA) for the Northern Expansion Project, AGL amended the Northern Expansion Project.

AGL is seeking planning approval for the Amended Project which comprise:

- construction and operation of eleven well surface locations (WSL) containing up to six well heads each;

construction and operation of associated GGLs, including interconnection with the existing CGP network, along with central water storage points where required;

- construction of access roads and ancillary infrastructure, including storage yard(s), where required; and,

- aubsurface drilling of lateral in-seam well paths within the bounds of the Subsurface Project Area (Figure 2).

Biosis Research Pty. Ltd. was commissioned by AECOM Australia Pty Limited (AECOM) on behalf of AGL to undertake an Aboriginal cultural heritage assessment (ACHA) for the Northern Expansion of the CGP (Northern Expansion Project) to inform the EA. Biosis was also commissioned by AECOM on behalf of AGL to undertake further Aboriginal cultural heritage assessment of the Amended Project.

1.2 Northern Expansion Project Area Definitions

The Northern Expansion Project area, now the Amended Project area, has been divided into two separate areas known as the 'Subsurface Project Area' (within which project works are limited to subsurface drilling activities only) and the 'Surface Project Area' where proposed surface infrastructure would be located (see Figures 1 and 2). Both areas are situated within

the boundaries of the existing Petroleum Production Lease 5 (PPL5) and the proposed Petroleum Production Lease (referred to as the PPL Area).

1.2.1 Surface Project Area

The 'Surface Project Area' refers to the area in which all proposed surface components of the project sit as shown in Figure 1 and 2. The surface components of the project include up to 11 WSL, GGLs, water lines with central water storage tanks and access roads.

1.2.2 Subsurface Project Area

The 'Subsurface Project Area' refers to the wider area where project works are limited to subsurface drilling activities only. The Subsurface Project Area includes subsurface drilling of lateral well paths beyond the 'Surface Project Area' (see Figure 2). No surface infrastructure would be located within the Subsurface Project Area.

1.2.3 Project Envelope

The "Project Envelope" is a 200 metre radius for a WSL and 25 metres either side of GGLs and access roads. The assessment of the Amended Project utilised an "envelope" approach to impact assessment, meaning that a wider area or "envelope" around surface components was assessed to allow the final infrastructure sites to move within the assessed parameters, subject to the recommended environmental management measures and consultation with the landowner. Detailed Aboriginal archaeological and cultural heritage assessment, impact assessment and management recommendations have been undertaken for the "Project Envelope", as the potential impact activities to Aboriginal heritage will be limited to this area. However, the wider Surface Project Area has been used as the 'Study Area' for the purposes of understanding past Aboriginal land use and predictive modelling (see Figure 2).

1.3 Surface Project Area Description

The 'Surface Project Area' is situated in the vicinity of Campbelltown, within the Camden and Campbelltown LGAs. The Surface Project Area is located within the suburbs of Currans Hill, Varroville, Raby and Denham Court. The suburbs of Catherine Field, Eagle Vale, Claymore, Mount Annan and Leppington are in close proximity to the Surface Project Area. The Surface Project Area is generally bound by Narellan Road to the south, Camden Valley Way to the west, the M5 to the east and Denham Court Road to the north (Figure 1 and Figure 2).

The land within the Surface Project Area is largely rural and used for agricultural purposes, such as grazing, with some rural-residential properties scattered throughout the area. Large areas of land in the west of the Surface Project Area have been earmarked for future urban development. In general, the rural landscape consists of open or cleared land with some scattered stands of Cumberland Plain Woodland. Australian Botanic Gardens (Mount Annan)

is also situated within the lower elevations of the Surface Project Area. The topography is predominately undulating plain with gentle rolling hills and ridgelines, and only a few steep slopes evident.

The Surface Project Area is traversed by the Upper Canal with several watercourses and small dams spread across the area. The drainage systems throughout the Surface Project Area comprise ephemeral creek systems, flowing only after sufficient rainfall. The main catchment is the South Creek tributary system, which drains into the Nepean River (Hawkesbury/Nepean Catchment), with some waterways draining into the Georges River Catchment via the Bow Bowing/Bunbury Currans Creek tributary system (AECOM 2012).

This assessment will consider the broad scale Aboriginal cultural heritage of the region and the results of specific investigation through field survey of the proposed works. The overall Surface Project Area and the specific Study Area are clearly indicated on Figure 2.

1.4 Planning Approvals

The Northern Expansion Project is development to which Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) applies. Under the (now repealed) clause 6 of Schedule 1 of the State Environmental Planning Policy (Major Development) 2005 (SEPP 2005), the Northern Expansion Project is development, which in the opinion of the Minister for Planning, is development of a kind that is described in Schedule 1 of SEPP 2005 (that is, development for the purpose of drilling and operation of petroleum wells that is within a specified local government area), and is a project to which Part 3A of the EP&A Act applies. Part 3A of the EP&A has been repealed, but the Northern Expansion Project is a 'transitional Part 3A project' under Schedule 6A of the EP&A Act, and Part 3A of the EP&A Act continues to apply to and in respect of the Northern Expansion Project.

Under the EP&A Act, specified development on specified land may be declared to be State significant development (SSD). On 19 October 2012, the project was declared to be SSD by an order of the Minister for Planning and Infrastructure published in the NSW Gazette on 26 October 2012.

Under clause 6(3)(B) of Schedule 6A of the EP&A Act, previous steps taken under Part 3A (including issue of DGRs and public exhibition of the EA) are taken to have been completed under Division 4.1, Part 4 of the EP&A Act. AGL has prepared a Submissions Report to which this report is appended. The Submissions Report also addresses the amendments made to the Northern Expansion Project (now called the Amended Project) which has reduced the environmental impacts of the development as a result of the issues raised in the submissions.

1.4.1 Director-General's Requirements

The Director-General's Requirements (DGRs) for the Northern Expansion Project identify Aboriginal Heritage as a key issue to be considered in the EA. The DGRs requires AGL to

address Aboriginal Heritage in accordance with the *Aboriginal Heritage Standards and Guidelines Kit (DECC-EPA)*.

1.4.2 OEH Environmental Assessment Requirements

The Department of Planning and Infrastructure (DoPI) requested that the then Department of Environment, Climate Change and Water NSW (formerly Department of Environment and Climate Change) (DECCW) identify key requirements for the EA for the Surface Project Area. DECCW replied to the request with the following requirements with respect to Aboriginal Cultural Heritage:

> *The EA should address and document the information requirements set out in the draft "Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation" involving surveys and consultation with the Aboriginal community.*
>
> *The nature and extent of impacts on Aboriginal cultural heritage values across the Project Area must be identified in the EA, as well as a description of actions that will be taken to avoid or mitigate impacts or compensate to prevent unavoidable impacts of the project on Aboriginal cultural heritage values during all stages of the project. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.*
>
> *The EA needs to clearly demonstrate that effective community consultation with Aboriginal communities has been undertaken in determining and assessing impacts, developing options and making final recommendations.*

The requirements listed above have been considered in conjunction with the DGRs and the following guidance material identified by DECCW:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECC, 2005);
- *DECCW Aboriginal Heritage Standards and Guidelines Kit*; and,
- *Interim Community Consultation Requirements for Applicants* (DEC 2004).

1.4.3 Other Relevant Legislation and Guidelines

Other relevant legislation and planning instruments that will inform this assessment include:

- *Environmental Protection and Biodiversity Conservation Act 1999;*
- *Environmental Planning and Assessment Act 1979* (NSW);
- *National Parks and Wildlife Act 1974* (NSW);
- *National Parks and Wildlife Amendment Act 2010* (NSW);

- *State Environmental Planning Policy (Infrastructure) 2007 (NSW)*;
- *Campbelltown Local Environmental Plan 2002*; and,
- *Camden Local Environmental Plan 2010*.

OEH released the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) after the archaeological investigation for the Northern Expansion Project had commenced.

Archaeological investigation of Aboriginal heritage has been undertaken in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECC 2005) as per initial OEH requirements. However, where possible, the 2010 OEH guidelines have been considered and applied.

1.5 Assessment Objectives

The following is a summary of the major objectives of this archaeological assessment:

- Identify and consult with any RAPs and the Local Aboriginal Land Council.
- Conduct additional background research in order to recognise any identifiable trends in site distribution and location.
- Search statutory and non-statutory registers and planning instruments to identify listed Aboriginal cultural heritage sites within the Surface Project Area.
- Highlight environmental information considered relevant to past Aboriginal occupation of the locality and associated land use and the identification and integrity/preservation of Aboriginal sites.
- Summarise past Aboriginal occupation in the locality of the project area using ethnohistory and the archaeological record.
- Formulate a model to broadly predict the type and character of Aboriginal sites likely to exist throughout the Surface Project Area, their location, frequency and integrity.
- Conduct a field survey of the Project Envelope to locate unrecorded or previously recorded Aboriginal sites and to further assess the archaeological potential of the project area
- Assess the significance of any known Aboriginal sites in consultation with the Aboriginal community.
- Identify the impacts of the Amended Project on any known or potential Aboriginal sites within the Project Envelope.

- Recommend strategies for the management of Aboriginal cultural heritage within the context of the proposed development.

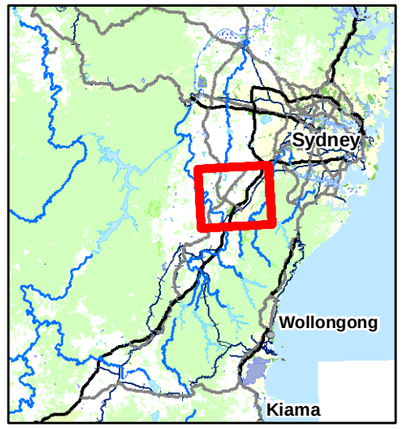
1.6 Investigators and Contributors

The roles, previous experience and qualifications of the Biosis Research project team involved in the preparation of this archaeological report are described below in Table 1. Due to the extended life of the project, the roles of some staff have changed from primary investigators to technical reviewers, such as Melanie Thomson.

Table 1: Investigators and Contributors

Melanie Thomson	BSc (Hons)	11 years experience
Melanie Thomson has over eleven years experience as an archaeologist with application to cultural heritage management for various projects throughout Queensland, New South Wales and Victoria. Melanie has acquired extensive experience working as a consulting archaeologist for Biosis Research over the past nine years as both a project archaeologist and project manager. During this time, she has developed skills in both Aboriginal and historical archaeological research, survey, excavation, monitoring, and reporting. She also has technical skills to undertake the analysis of Aboriginal stone tools and historical artefacts. Melanie specialises in assessing the Social Value of Cultural Landscapes in association with Aboriginal and Historical sites. Melanie has authored and / or co-authored over 60 consultant reports.		Project Roles • Technical review; • Aboriginal community consultation; • Field survey; and, • Report preparation.
Renèe Regal	**BA (Hons)**	**6 years experience**
Renée Regal worked with Biosis Research as an archaeologist between 2008 and early 2011. Renée has 6 years archaeological consulting experience in New South Wales, Victoria and the Australian Capital Territory. Renée has extensive experience in both Aboriginal and heritage impact assessments, archaeological excavations, monitoring, artefact analysis and reporting.		Project Roles • Aboriginal community consultation; • Field survey; and, • Report preparation.
Asher Ford	**BA (Hons)**	**5 years experience**

Asher is a Consultant Archaeologist with the Wollongong office of Biosis Research. Asher has over five years experience as a consultant archaeologist, with application to cultural heritage management for various projects throughout Victoria, New South Wales and South Australia. Asher has acquired extensive experience over the past four years as both a project archaeologist and project manager. His skills include Aboriginal and non-Aboriginal archaeological assessments, Aboriginal and historical site recording, survey, sub surface testing and excavation, project research, geographic information systems (GIS), graphics and report writing. Asher has technical experience in recording artefact scatters, scarred trees, middens, axe grinding grooves, rock shelters, art sites and stone features across a range of Australian environments including the Victorian Western Volcanic Plains, Gippsland, the Victorian High Country, the Murray River, the Cumberland Plains, the Illawarra region, the Hunter Valley, the NSW Southern Tablelands and the Woomera Prohibited Area. Asher has authored and / or co-authored over 30 consultant reports.	Project Roles • Aboriginal community consultation; • Field survey; and, • Report preparation.
Ashleigh Pritchard — **Diploma of Spatial Information Services**	**4 years experience**
Ashleigh is a GIS Consultant with the Wollongong office of Biosis Research Pty Ltd. She has four years experience in the field of mapping, having previously worked for the Wollongong City Council as apart of the Stormwater Data Collection team for the Stormwater Infrastructure Asset Data Collection Project. This involved identifying stormwater assets located in the Local Government Area of Wollongong and incorporating data into a GIS by use of a GPS and ArcPad. More recently with Biosis Research she has utilised the functionality of GIS to undertake spatial analysis projects such as calculations of habitat loss as well as geo-referencing and digitising. Ashleigh has utilised a variety of software packages to create map products throughout her career including MapInfo Professional, ArcMap and AutoCad.	Project Roles • Mapping and graphics preparation.



Legend

Subsurface Project Area

Surface Project Area/Study Area

Figure 1: The location of the Surface Project Area in a regional context.

0 0.65 1.3 1.95 2.6 3.25

Kilometers

Scale: 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 30 August 2012, File number: 15282
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F1 AR_Locality_20120830.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

Figure 2: Aerial of the Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F2 AR_Overview_20120830.mxd

0 0.6 1.2 1.8 2.4 3
Kilometers
Scale 1:60,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

2.0 DEVELOPMENT PROPOSAL

The construction works on the Surface Project Area are discussed below for the purpose of giving consideration to the potential impacts on Aboriginal archaeological sites or places within the Study Area.

2.1 Well Surface Locations

The WSLs have been determined following extensive geological exploration and analysis. The final WSLs may be adjusted within the 200m assessment 'envelope' during detailed design based on consideration of the environmental and social constraints including land use (existing and future), topography, subsurface geology, flora and fauna, archaeological constraints and noise impacts. Up to six (6) well heads may be installed in the WSLs (AECOM 2012). Examples of an operating and rehabilitated WSL are shown in Plates 1 and 2.

	
Plate 1: Operating well surface location	**Plate 2:** Well surface location following construction and rehabilitation

Site preparation and construction works would be generally carried out in accordance with the following sequence.

- Identify biodiversity and heritage exclusion zones.
- Installation of silt fences and other environmental controls as required.
- Installation of approved road opening to property where necessary.
- Upgrade or installation of access roads where required.
- Removal of topsoil over access ways and store for initial rehabilitation.

- Truck in hard surface (typically shale) for access road base and drill pad where required.
- Install drain culverts, cattle grids, fencing, gates, bed level crossing and other works as necessary.
- Earthworks as required on a site-specific basis.
- Construct drilling compound (up to 10,000 m^2) and fence the perimeter as required by the existing Environmental Management Systems (EMS), and other requirements.
- Strip topsoil and stockpile, then cut and fill as required for a level drill pad area.
- Dig and line drill pit(s) with polyethylene non-permeable liner (typically up to 25 x 25 m and 2-3 m deep). The drill pit(s) are provided to retain and recycle drilling debris and associated water for the drilling process.
- Create a cut-back, flat operating area where WSLs are located on slopes. This construction generally includes an up-slope diversion drain around the site to manage excessive surface flow. The surface profile is returned (as near as possible) to the original profile during rehabilitation.
- Rehabilitation of the surplus construction area when construction is complete.

2.2 Access Roads

Access to the WSLs would be provided along existing public roads and private tracks within the relevant property boundary. Earthworks may be required to construct or upgrade access roads to new WSLs to enable the drilling rig and support equipment to access the sites. Where practicable, existing road and track access would be utilised to minimise construction activity and environmental disturbance.

2.3 Gas Gathering Lines

The GGLs system would be buried to a minimum depth of 750 mm and up to 1,200 mm in some areas, including unsealed and sealed road crossings, and creek and drainage line crossings (Figure 2). Further detailed engineering and design would be required for crossing other infrastructure, including the Upper Canal and existing high pressure interstate gas pipelines. The route of the gas gathering system for the Surface Project Area would utilise previously or currently disturbed land areas wherever possible (AECOM 2012).

	
Plate 3: Gas gathering line under construction involving the excavation of a narrow trench	**Plate 4:** Location of a gas gathering line next to an access post-construction showing limited disturbance

The construction of the GGLs would typically involve the following works:

- Clear and grade pipeline route including stripping of topsoil (where required);
- Trenching and underboring where necessary;
- Lowering-in of pipe strings (including trench preparation and padding);
- Installation of tracer lines (for pipe tracing) as polyethylene (PE) pipe is non conductive;
- Backfilling and compaction of trench;
- Rehabilitation of ground along pipeline route;
- Installation of gas line signposts to mark and identify gathering line location; and,
- Register gas gathering line on 'Dial before you dig'.

The GGLs would typically be buried in sections of approximately 100 metres in length at any one time. This would ensure minimal disturbance and reduce impacts on soil erosion and potential run on effects as a result of unanticipated rainfall events or other variables.

2.4 Subsurface Development

The Subsurface Project Area is predominately residential, varying from rural-residential to residential housing. The Subsurface Project Area comprises rural and agricultural land located to the west near Kirkham and Harrington Park, industrial land to the north east near Ingleburn, and Defence land to the far south east extent of the Subsurface Project Area. Several golf courses, sporting complexes and recreational reserves are spread throughout the Subsurface Project Area (AECOM 2012). The Mount Annan Botanical Gardens is located in the south of the Surface Project Area.

The Subsurface Project Area includes subsurface drilling activities and lateral well paths within the bounds of the Subsurface Project Area (Figure 2). The subsurface drilling activities relate to all vertical, directional and SIS well paths. No surface infrastructure would be located within the Subsurface Project Area. For directional and SIS wells, the continued

penetration of the underling geology can be defined as subsurface drilling where the drilling deviates from a central point on the surface and continues along a subsurface path some distance from its origin. These drilling techniques minimise the surface impacts and allow access to areas laterally remote from the drilling origin, which would normally not be possible due to surface constraints.

Based on the depth of cover within the Surface Project Area and the Subsurface Project Area and observed subsidence impacts within the existing CGP well field, it is considered unlikely that there would be any subsidence related impacts to the Aboriginal archaeological site types that occur within the current Subsurface or Surface Project Areas.

2.5 Summary - Development Construction Works

The proposed construction and operation of gas wells at up to 11 WSL, GGLs, water lines with central water storage tanks where feasible and access roads within the Study Area will have minimal overall impact on archaeological values. However, where impacts on known Aboriginal archaeological sites and areas of high and moderate archaeological sensitivity cannot be avoided, management and mitigation measures will be employed. The following assessment will aim to identify potential archaeological sites and assess such potential impacts and determine the appropriate mitigation and management measures for these potential impacts.

Legend

Well Locations
- Well Surface Location

Gas Gathering Lines
- Gas Gathering Line
- Main Gas Gathering Spine

Access Tracks
- Access Track

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Bellfield Avenue
Eighth Avenue
Austral
Prestons
Robinson Road
Bringelly Road
Polo Road
Barry Avenue
Camden Valley Way
CABRAMATTA CREEK
Edmondson Park
Eastwood Road
Heath Road
RILEYS CREEK
Denham Court Road
England Road
George Road
RA09
Oran Park
Deepfields Road
Leppington
Ingleburn
St Andrews Road
RA03
Cobbitty
The Northern Road
Springfield Road
Catherine Field
Varroville
VV03
Ingleburn Road
BUNBURY CURRAN CREEK
Raby Road
COBBITTY CREEK
Oran Park Drive
SOUTH CREEK
CU22
CU02
Kirkham
Kearns
Raby
CU31
CU26
Minto
NARELLAN CREEK
Macquarie Grove Road
Gregory Hills
CU29
THOMPSON CREEK
BOW BOWING CREEK
MYRTLE CREEK
CONDRON CREEK
KENNY CREEK
CU06
MCBARRON CREEK
Dobell Road
CU10
CU14
Camden Bypass
THORNLEIGH GULLY
OXLEY RIVULET
PETER MEADOWS CREEK
SMITHS CREEK
BIRIWIRI CREEK
ANNAN CREEK
River Road
Narellan Road
Old Hume Highway
Richardson Road
Macquarie Avenue
Georges River Road
Ruse
Kentlyn
JACKS GULLY
NEPEAN RIVER
KEANES GULLY
BIRUNJI CREEK
GEORGES RIVER
St Johns Road
Camden Park Road
Racecourse Avenue
Hume Highway
SPRING CREEK
Derwin Road
Airds
MATAHIL CREEK
Camden Park
St Helens Park
Holsworthy
Menangle
MENANGLE CREEK
Wedderburn Road
Finns Road
Woodbridge Road
Gilead
Aberfoyle Road
Wedderburn

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

BIOSIS

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

Figure 3: Proposed Amended Project

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 12 September 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F3 AR_Development_20120830.mxd

0 0.6 1.2 1.8 2.4 3
Kilometers
Scale 1:60,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

3.0 DESKTOP ASSESSMENT

A desktop assessment has been undertaken to review existing archaeological studies for the Surface Project Area and surrounding Camden and Campbelltown regions. This information has synthesised to develop an Aboriginal site prediction model for the Surface Project Area and identify known Aboriginal sites and/or Places recorded in the Surface Project Area.

3.1 Landscape Context

It is important to consider the local environment in any heritage assessment. The local environmental characteristics can influence human occupation and associated land use and consequently the distribution and character of cultural material. Environmental characteristics and geomorphological processes can affect the preservation of cultural heritage materials to varying degrees or even destroy them completely. Lastly landscape features can contribute to the cultural significance that places can have for people.

3.1.1 Topography and Hydrology

The topography of the Surface Project Area is predominately undulating plain with gentle rolling hills and ridgelines, and only a few steep slopes evident. The Surface Project Area is traversed by the Upper Canal with several watercourses and small dams spread across the area. The drainage systems throughout the Surface Project Area comprise ephemeral creek systems, flowing only after sufficient rainfall. The majority of the Surface Project Area is within the South Creek tributary system sub-catchment and a minor portion is within the Nepean River sub-catchment, both which drains into the Nepean River (Hawkesbury/Nepean Catchment), with some waterways also draining into the Georges River Catchment via the Bow Bowing/Bunbury Currans Creek tributary system (AECOM 2012).

The undulating plain, gentle rolling hills and ridgeline landform patterns of the Surface Project Area can be broken down into landform elements as described by Speight (Speight 1990). Landform elements present in the Surface Project Area include drainage depressions, hillslopes, hillcrests, plains and lakes. Some of these landforms elements, are man made, such as lakes which are the result of damming swamps or drainage depressions and creating large closed depressions. Mapping of landforms in the Surface Project Area is provided in Figure 4.

3.1.2 Soil Landscapes

The Surface Project Area is located on the eastern margin of the Cumberland Plain and is formed on the sediments of the Wianamatta Group (Hazleton & Tille 1990). They comprise shale, with occasional calcareous claystone, laminate and coal. More recent Tertiary and Quaternary sediments overlie the shales along river and creek beds, including South Creek. The Cumberland Plain generally comprises gently undulating plains and low rolling hills, rising gradually from the flat, low-lying areas just above sea level in the north, to an altitude of around 300 metres on the hills of the Razorback Range in the south (Hazelton and Tille 1990).

The Surface Project Area comprises different soil landscapes, with distinct morphological and topological characteristics. Due to topological and morphological variation, each soil landscape may have differing potential for Aboriginal heritage. Within the present Surface Project Area, there are three distinct types of soil landscape types: residual, erosional and fluvial (Figure 5). Residual soil landscapes are characterised by areas where soils are derived from the long-term, *in situ w*eathering of parent materials. Examples of these types of soil landscapes are flats and plains, with poorly defined drainage lines. Erosional soil landscapes comprise soils that are derived from the erosive action of running water, primarily well defined streams that have the ability to transport their sediment load. Soils may be either absent, derived from water-washed parent materials or derived from *in situ* weathered bedrock. Fluvial soil landscapes are characterised by alluvium that has been transported and then deposited on terraces along creeks floodplains.

The **Blacktown** Soil Landscape (residual) covers much of the Surface Project Area, particularly throughout the central and northern sections. It comprises gently undulating rises without rock outcrops (local relief to 30 m with slopes less than 5% grade). Broad rounded crests and ridges with gently inclined slopes are the dominant topography of this landscape (Hazelton and Tille 1990:27). The soils consist of shallow to moderately deep podzols. Due to their age and slow accumulation residual soil landscapes have reasonable potential to contain archaeological deposits in an open context, such as stone artefacts derived from occupation sites. Other occupation evidence might include scarred trees where remnant vegetation survives. However, the slow accumulation and high impact of extensive land clearing (usually associated with pastoral and housing development) during more recent times often results in poor preservation of archaeological material.

The **Luddenham** Soil Landscape (erosional) occurs in small pockets along the length of the Surface Project Area. It comprises undulating rolling hillslopes and may include tors, benches and areas of rock outcrop. These soils may be derived from water-washed parent materials or derived from *in situ* weathered bedrock. The soil consists of shallow sandy clay on crests, and loamy sand on lower slopes and along drainage features (Hazelton & Tille 1990:72). In many instances, subsoils have formed *in situ* while topsoils have formed from materials washed from further up-slope. It is highly likely therefore that the lower, accumulated deposits that have not been subject to erosion may contain archaeological material. Other sites include scarred trees where remnant vegetation survives.

The **Picton** soil landscape (erosional) is dominated by mass movement processes and is made up of narrow hills with steep to very steep side slopes with highly erodible shaly soils. The local relief within the landscape is 90 m – 300 m, and the steep hills have concave upper slopes and irregular lower slopes. This soil landscape occurs solely in the western domains of the Surface Project Area and is characterised by the Razorback Range (Hazelton and Tille 1990). Only two sites have been recorded previously on this soil landscape. This landscape is considered to be of some Aboriginal archaeological potential, with likely site types being small low density stone artefact sites and possibly scarred trees.

The **South Creek** soil landscape (fluvial) consists of alluvial soils derived from deposits of the Wianamatta Group shale and Hawkesbury sandstone parent materials. The topography is predominantly flat to gently sloping active floodplain with occasional terraces or levees providing low relief. Incised river beds and banks are present; in this case Lowes Creek, which dissects the northern section of the Surface Project Area (Bannerman & Hazelton 1990). Frequent flooding and high creek bank erosion commonly occur. This landscape is an active floodplain presently being reworked by fluvial processes. According to the soil landscape information, soils are deep from the depositional processes of the river, increasing in depth from the riverbank to its outer terraces (up to 2 metres on terraces). The dominant soil material is layered plastic clays and loams over rock or residual soils (Bannerman & Hazelton 1990). Archaeological sites that occur within this landscape may become buried or exposed and washed away depending on the level of water flow in the creek or river.

The **Berkshire** Park Soils Landscape (fluvial) consist of mottled heavy clays and sandy clays that occur on dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system (Bannerman and Hazleton 1990:81). The soils derive from three depositional phases of Tertiary alluvial/colluvial origin and often contain ironstone nodules. Archaeological sites that occur within this landscape may become buried or exposed and washed away depending on the level of water flow in the creek or river.

3.1.3 Landscape Resources

Based on the previous research and histories of the Camden and Campbelltown region, it is possible to speculate on what resources would have been available for Aboriginal exploitation. Silcrete is the main stone raw-material type suitable for Aboriginal tool manufacture that is likely to occur in the vicinity of the Surface Project Area in any abundance. It would have been available in the form of rock outcrops exposed on the Cumberland Plain. Silcrete cobbles are known to occur at the confluence of South and Badgerys Creek, another along a ridge near Riverstone and Eastern creeks, as well as an important outcrop at Plumpton Ridge (Dallas 1982; Dallas & Whitter 1983; McDonald 1986; ERM 2006:11). Sources of indurated mudstone/silicified tuff are also known to occur at the nearby Cranebrook and Rickaby's Creek formations (ERM 2006, JMCHM 2007e:17). Elsewhere in the region, the potential raw materials for stone artefact making include silicified wood, siliceous tuff, mudstone, quartz, quartzite and basalt. River gravels and cobbles containing silcrete, chert, and other fine grained volcanic rocks were also used (Attenbrow 2002, Dallas 1984).

The year-round water supply from nearby South Creek and its tributaries would have provided a reliable source of water, while the diverse natural environment would have provided vast and plentiful flora and faunal resources. Prior to settlement, the dominant vegetation community of the Surface Project Area would have consisted of Cumberland Plain Woodland, that included Grey Box (*Eucalyptus moluccana)* and Forest Red Gum (*E. tereticornis)*, with Narrow-leaved Ironbark (*E. crebra)*, Spotted Gum (*Corymbia maculate)* and Thin-leaved Stringybark (*E. eugenioides)* occurring less frequently. The shrub layer is

dominated by Blackthorn (*Bursaria spinosa)*, and it is common to find grasses, such as Kangaroo Grass (*Themeda australis)* and Weeping Meadow Grass (*Microlaena stipoides var stipoides)* (NSW NPWS 2002).

Vegetation communities across the Surface Project Area supported a range of faunal species that would have been utilised by Aboriginal peoples. Terrestrial, aquatic and avian resources were not only used for food, but also provided a significant contribution to the social and ceremonial aspects of Aboriginal life through their use as ritual implements or even simply though fashioning personal adornments (Attenbrow 2002). Many of the plants found within the area were important to Aboriginal people and could be used for numerous purposes. These include using wood to make tools and implements; gathering berries, leaves and tubers for food and medicines; and using bark for shelter waterproofing and to make implements such as shields. Eucalypt species in the local area in particular are know to have been utilised for a range of purposes, leaves can be crushed and used for medicinal purposes, sap can be used as a sweet sugary food source and the bark could be used to make bowls and shelters (Rhoads and Dunnet 1985).

3.1.4 Land Use History

The Camden region is situated on the northern margin of what was historically known as the 'Cowpastures'. The fertile soils of the low-lying plains ensured that this land was sought after by early pastoralists and cultivators, and following extensive clearing and burning, agriculture was developed along this fertile corridor from the early 1800's onwards despite the constant threat of flooding (Mylrea 2002; Liston 1988a). Farming practices included grain crops, orchards, beef cattle and dairying. Likely impacts from past farming practices to archaeological sites would have occurred through direct processes, such as vegetation clearance, ploughing, trenching, dam construction, road building, urban development and infrastructure construction.

The oldest public utility within the Surface Project Area is the Upper Canal, a component of the Upper Nepean Scheme. The Upper Nepean Scheme was Sydney's fourth source of water supply and was designed to provide a secure source of water for the growing population of Sydney. Constructed between 1880 and 1888, "the scheme diverted water from the Cataract, Cordeaux, Avon and Nepean rivers to Prospect Reservoir via 64 kilometres of tunnels, canals and aqueducts known collectively as the Upper Canal" (www.sca.nsw. gov.au/dams/history.html).

The Upper Canal was designed and built in response to the conditions of the surrounding countryside. Section profiles were varied according to local conditions. In areas where the ground was soft, the Upper Canal was V-shaped and the sides were pitched with shale or sandstone slabs. In other areas, the Upper Canal was U-shaped and in these sections it was either cut directly into bedrock or the sides were walled with sandstone masonry. Tunnels were used under hills, unlined through bedrock or lined with brick or stone through softer

materials. At the creek crossings (valleys) the water was carried across via wrought iron inverted syphons resting on stone piers (Higginbotham & Assoc Aug 2002:8).

Modifications were also made to the surrounding landscape to prevent the entry of contaminated water into the supply system. These included the creation of bunds and drainage channels to direct water to culverts (carrying water under the canal) or flumes (carrying water over the canal). The flumes were mainly originally constructed from timber, but these were gradually replaced with wrought iron, and later, concrete flumes. Bridges carried public traffic over the Upper Canal, while smaller 'occupation bridges' allowed land owners with land on each side of the Upper Canal access to both parts of their holdings.

After travelling a distance of 39 ¾ miles (64 kilometres) from Pheasants Nest, water entered the Trafalgar Tunnel, where it passed over a measuring or gauging weir and then along the inlet race into Prospect Reservoir. This is the end of the Upper Canal System; the Prospect Reservoir and the Lower Canal comprising the remaining components of the Upper Nepean Scheme (Higginbotham & Assoc Aug 2002). Standard maintenance of the system has been an ongoing and integral component of the Upper Canal and Upper Nepean Scheme since construction. The construction of the Upper Canal has extensively modified some sections of the Surface Project Area and will have resulted in significant disturbance to archaeological deposits within its earthworks footprint.

Other utilities in the Surface Project Area that would have involved significant earthworks and disturbance to archaeological deposits include high pressure gas pipes and telecommunication connections. Mapping of past areas of disturbance in the Surface Project Area is provided in Figure 6.

3.2 Review of Previous Archaeological Work

A large number of cultural heritage surface (surveys) and sub-surface (excavations) investigations have been conducted throughout the Camden and Campbelltown regions of New South Wales in the past 30 years. There has been an increasing focus on cultural heritage assessments in NSW due to ever increasing development, particularly residential developments in these regions, along with the legislative requirements for this work and greater cultural awareness of Aboriginal cultural heritage.

The timing for the human occupation of the Sydney Basin is still uncertain. Whilst there is some possible evidence for occupation of the region around 40,000 years ago, the earliest undisputed radiocarbon date from the region comes from a rock shelter site north of Penrith on the Nepean River, known as Shaws Creek K2, which has been dated to 14,700 +/- 250 Before Present (BP) (Attenbrow 1987, 2002: 20). The site was interpreted and it is suggested that the people living in the shelter exploited the food and resources from nearby creeks and rivers, as well as the surrounding country side. East of Campbelltown, a sandstone rock shelter site (known as Bull Cave) was excavated and yielded a basal date of 1820 $\pm$ 90 BP (Koettig 1985). In general, the majority of both open and rock shelter sites in the Sydney

region date to within the last 3,000 to 5,000 years. Dibden (2003) attributes the increase in apparent occupation intensity to sea level stabilisation after the last ice age at around 5,000 years ago. She states that,

> *'Following the stabilisation of seal levels, the development of coastal estuaries, mangrove flats and sand barriers would have increased the resource diversity, predictability, and the potential productivity of coastal environments for Aborigines.'* (Dibden 2003: 27)

Archaeological evidence of Aboriginal occupation of the Cumberland Plain indicates that the area was intensively occupied from approximately 4,000 years BP (JMCHM 2007a). Such 'young' dates are probably more a reflection of conditions of archaeological site preservation and sporadic archaeological excavation, rather than actual evidence of the presence or absence of an Aboriginal population prior to this time.

3.2.1 Regional overview

A large number of Aboriginal cultural heritage investigations have been conducted for the Camden, Campbelltown regions and the wider Cumberland Plains in which these regions sit. Models for predicting the location and type of Aboriginal sites with a general applicability to the Camden region and thus relevant to the Surface Project Area have also been formulated, some as a part of these investigations and others from cultural heritage investigations for relatively large developments.

Results of archaeological work completed in the northern, central and southern Cumberland Plain region have clearly identified that the predominant recorded sites are open camp sites and isolated artefact occurrences (Kohen 1986; Smith 1989; Haglund 1989; McDonald 1992; JMCHM 2006, 2007a, d & e; Dibden 2003). Towards the peripheries of the plain, on Hawkesbury sandstone, shelters with art and/or deposit and grinding grooves have been recorded.

JMCHM (1996; 2000) has developed a predictive model for Aboriginal site distribution on the Cumberland Plain that will be applicable to the Surface Project Area. This has been developed using the Aboriginal occupation models proposed for the Camden area by Haglund (1989) and data collected from other areas of the Cumberland Plain where trends in the distribution of archaeological sites have been apparent. The following predictive model for the Cumberland Plain has been taken from JMCHM (2000) and will be used to devise the site prediction model for the Surface Project Area (Section 6.5).

1. The size (density and complexity) of archaeological features will vary according to permanence of water, landscape unit and proximity to stone resources in the following way:

- At the headwaters of upper tributaries (first order creeks) archaeological evidence will be sparse and will comprise little more than background scatters of stone artefacts;

- At the middle reaches of minor tributaries (second order creeks) archaeological evidence will be sparse but indicate focussed activity;

- At the lower reaches of tributary creeks (third order creeks) archaeological evidence will indicate more frequent occupation and evidence of repeated, more concentrated activities;

- On major creek lines and rivers (fourth order creeks) archaeological evidence will indicate more permanent occupation, which is of greater complexity;

- Creek junctions and swamps may provide foci for site activity; and,

- Ridgetop locations between drainage lines will usually contain limited archaeological evidence.

2. Where sandstone features occur (overhangs or platforms), these may have provided a focus for a number of activities including camping or art production or the sharpening of axes. Sandstone platforms may also have been used for the production of art (engravings), although these are very rare on the margins of the Cumberland Plain.

An examination of lithic artefact distribution, the most common physical evidence of open camp sites and isolated artefacts, was undertaken for the Rouse Hill development Area in the Cumberland Plain by White and McDonald in 2010. White and McDonald examined a number of factors that potentially influenced artefact density including stream order (as per Strahler 1952 method), landform, distance to water, aspect, geology and distance to raw materials. Of these factors it was determined that stream order, landform, aspect on some landforms and distance to water appeared to have the highest influence on artefact density (White and McDonald 2010: 36).

While flaked stone artefacts are typically found in all landforms in the Cumberland plans, findings from White and McDonald indicated that elevated lower slopes (particularly with a northern aspect) in close proximity to water were more likely to have higher artefact densities than upper slopes/crests or flats and drainage depressions surrounding creek lines. Artefact densities were highest in proximity (50-100m) to 4th order and 2nd order streams, and white and McDonald suggest this may be linked to reliability of water sources (White and McDonald 2010: 36). In summarising artefact density trends White and McDonald stated that:

> *The identified trends indicate that people preferred slightly elevated, well drained locations in the lower parts of valleys; such locations would have been drier, received winter sun and been sheltered from southerly and southwesterly winds* (White and McDonald 2010: 36).

The conclusions that White and McDonald drew are indicative of general trends in the Rouse Hill and wider Cumberland Plains landscape, however they cautioned that variation is likely to be encountered in individual areas of the Cumberland Plain (White and McDonald 2010: 36). This has been confirmed by more recent archaeological work within the Surface Project Area, concluding that while most recognised Cumberland Plain predictive modelling is most relevant, it is not always typical. Archaeological material tends to occur anywhere on the Cumberland Plain and that while the size and frequency of sites can be linked with stream order, the complexity of sites is not (ENSR / AECOM 2009).

3.2.2 Local Overview

A significant amount of archaeological work has been undertaken across the Cumberland Plain region and a number of development driven survey assessments have been undertaken within and immediately surrounding the Surface Project Area. The findings from this work have contributed to a more informed understanding of Aboriginal cultural heritage across the Cumberland Plains on the margin of the Cumberland Lowlands (Hanrahan 1981, 1982a, 1982b; Bonhomme 1986; Haglund 1989; McDonald 1992; English 1994, English & Gay 1994; Jo McDonald Cultural Heritage Management 1996, 2007a; AMBS 2006a; ENSR / AECOM 2009; Heritage Concepts 2008). Those most relevant to the current Surface Project Area have been summarised below.

Hanrahan (1981; 1982a, 1982b) completed an initial archaeological assessment of Narellan Creek, that resulted in the identification of one low density stone artefact scatter site, immediately west of the current Surface Project Area. During a second assessment of Currans Hill and Menangle Park, a further eight Aboriginal archaeological sites were recorded along Narellan Creek, one of which (N2) was a high density stone artefact scatter site that comprised a large number of stone tools and extended over a 100 m^2 area. The site predominately comprised flaked silcrete artefacts, including backed blades and scrapers. In addition, a hammer stone and two axe fragments of basalt were also recovered. Although the other seven sites were considered minor scatters, site N5 was also considered to have potential to yield reasonable archaeological deposits.

Bonhomme (1986) completed an archaeological test excavation for the development of housing, through Landcom, south of Narellan Road on the east and west sides of Narellan Creek. This study was a follow-up to the survey completed by Hanrahan (1982a). All 8 previously recorded sites were re-surveyed. Water had covered both Sites 6 and 8 as the level of the lagoon had fluctuated to cover them. Sites 1 and 7 were effectively destroyed by erosion. Shovel probe test excavations were conducted at Sites 5 and 2 to determine the nature and extent of each site. The results identified undisturbed archaeological deposit at both sites.

Haglund (1989) subsequently undertook archaeological test excavations at both Site 2 and Site 5, resulting in the collection of 259 artefacts from Site 2, and a total of 41 artefacts from Site 5. Although the densities of Site 2 and Site 5 differ greatly, the types of artefacts and raw

materials are similar. Haglund (1989:19-20) identified Site 2 as being an important focus for Aboriginal activity, in an area where ridges and minor valleys meet, while the other site was interpreted to be a temporary campsite only.

Brayshaw & McDonald (1990) were commissioned by Travers Morgan Pty. Ltd. on behalf of the Department of Housing and Campbelltown City Council to conduct an archaeological survey on an area of land that was to be developed for residential purposes. This study area is approximately 6 kilometres south-west of the current Surface Project Area. Two previously unrecorded open camp sites were identified during this survey, situated on the crest of a ridge spur, above minor drainage features that flow south into the Nepean River. Menangle Park 1 (52-2-1597) consisted of two red silcrete flakes that have focal platforms, whilst Menangle Park 2 (52-2-1598) was made up of seven artefacts that were located over an area of approximately 40 m x 10 m. These artefacts consisted of a backed blade, a thumbnail scraper with retouch, and five flakes.

Brayshaw & McDonald (1991) conducted some sub-surface testing and surface collection at three Aboriginal archaeological sites near Menangle. Two of these sites were those that were identified during the Brayshaw & McDonald's survey of 1990. The third -Menangle Park 3 - consisting of seven artefacts, was located 300 metres from Menangle Park 1. However there were few stone artefacts and the presence of glass and ceramics from the same levels, which points to recent disturbances (Brayshaw & McDonald, 1991; 1).

English (1994) identified three open lithic scatters and seven isolated stone artefact occurrences during the archaeological survey of the proposed Harrington Park housing estate near Narellan. All of these sites were assessed as having low archaeological significance due to heavy disturbance from natural erosional processes. Open campsite HP1 is situated on elevated ground, well placed to provide a vantage of the surrounding region, while HP2 and HP3 occur along the banks of Narellan Creek. Silcrete was the dominant raw material type, followed by mudstone, chert and quartz. English (1994) noted that while these sites do not allow analysis that will identify the activities that occurred at each site, they do contribute to the overall understanding of site distribution of the wider Cumberland Plain region.

Jo McDonald Cultural Heritage Management Pty. Ltd. (1996) conducted an archaeological survey just south of the Surface Project Area. This survey was commissioned by EDAW, who were preparing a management plan regarding the proposed Camden Bush. Five previously unrecorded sites were identified during this survey. These new sites consisted of two open camp sites (Clutha 1 and Clutha 2) that occur on exposures caused by vehicle access. Four new isolated artefacts were also identified; all but IF4 was located on vehicular access tracks that occurred within the base of a tributary of Narellan Creek.

Crew Archaeological Consultant (1998) conducted an archaeological survey of a proposed subdivision of Lot 204 at Mount Annan located immediately west of the current Surface Project Area. The proposed development was situated around a small gully that was associated with Narellan Creek. This survey focused on a number of exposures that were

located within the study area however no new aboriginal or heritage sites were relocated during this survey.

Dibden (2002a, 2002b, 2002c) conducted an Aboriginal and heritage assessment as part of the Glenlee Coal Bed and Methane Project. This work was commissioned by Sydney Gas Operations Pty. Ltd. (SGO). This study area was located south-west of the current proposed development area. During the initial desktop survey several previously recorded sites were identified using AHIMS. These sites consisted of isolated artefacts and open camp sites. One previously unrecorded site was identified near the proposed GL 3 gas well site. This site comprised an open camp site of seven flakes: lithic fragments and backed blades made from silcrete and chert.

Dibden (2003) undertook an archaeological and cultural heritage assessment for Stage 2 of the CGP. This involved a survey of almost 80 proposed gas well site locations and associated gathering systems to determine the presence and significance of Aboriginal heritage at each location (Dibden 2003: 3). This field survey resulted in the identification of 20 previously unrecorded Aboriginal archaeological sites, primarily comprising isolated artefact occurrences. In most cases, the artefacts were noted to be in their original depositional contexts. The majority of these sites are also considered to be of low significance, as these sites have low research potential, have been subject to high levels of disturbance, have low aesthetic value and are representative of a common site type of the Cumberland Plain.

Central West Archaeological and Heritage Services (2004) undertook the first stage of the Harrington Park 2 and Mater Dei proposed development area, involving desktop assessment and site inspections. Subsequently, **AMBS (2006a)** completed the second stage of assessment for the same study area. Both studies resulted in the identification of 30 sites and 6 PADs, comprising open camp sites, isolated artefact occurrences and scarred trees. All sites were low density, with most sites comprising no more than three artefacts. Areas of high sensitivity were highlighted along creeks lines, while areas of moderate sensitivity were identified on adjacent creek spurs and ridge crests.

Steele (2005) completed an archaeological survey of the Elizabeth Macarthur Agricultural Institute for Sydney Gas Limited as part of their CGP Stage II proposal of fifteen new gas well and gathering systems to extract methane for the Illawarra coal measures. This survey was approximately 7 km south-west of the current Surface Project Area. During this survey fifteen previously unregistered sites were identified. These site types consisted of open camp sites, scarred trees, isolated artefacts and PADs. Seven of these sites were to be affected by the proposed development. Sites were located in proximity to creek and drainage features or along ridge spurs and hill crests.

Jo McDonald Cultural Heritage Management Pty. Ltd. (2007a) completed large scale staged assessments for the South West Growth Centre (SWGC) of the Oran Park and Turner Road Precincts near Camden. The Oran Park Precinct located to the west of the proposed Surface Project Area, while the Turner Road Precinct is located in the south west corner of

the Surface Project Area. The details of the Tuner Road Precinct are included in the following section of this report.

The initial archaeological investigations involved detailed background research to identify knowledge gaps and highlight areas within both precincts where further work would be required (JMCHM 2007a). The work identified the need for field survey to identify the presence of surface archaeological sites, and that the field survey should focus on:

- Areas of good to high potential for archaeological deposit identified through sensitivity mapping;
- Water holes at the junction of higher order streams; and,
- Fluvial erosional benches above third and fourth order streams.

Based on the initial assessment findings **JMCHM (2007b&c)** undertook more detailed archaeological work on the Oran Park Precinct that involved identifying and assessing Aboriginal cultural heritage values. As a result, a total of 44 new Aboriginal archaeological sites and four areas of good archaeological potential were recorded. Despite finding a high number of archaeological sites within the Oran Park Precinct, there is limited potential for understanding occupation patterns or site use based on the surface evidence (JMCHM 2007c:71). However, the results revealed a number of trends including:

- A focus on occupation at the junction of first and second order tributaries as well as along higher order creeks;
- The occurrence of low density artefact sites located some distance from water that represent a background scatter of artefactual material; and,
- Ridge tops, hill crests and low order creeks flats were the focus of some occupation activities within the Oran Park Precinct.

Further, an understanding of site types, their content and arrangement across the study area was limited by the lack of archaeological subsurface investigation in the immediate region. Due to previous land use activities in the region however, only some areas were expected to exhibit intact archaeological deposits from which contextual information could be gathered.

Mary Dallas Consulting Archaeologists (2007) undertook an Aboriginal archaeological sub-surface test excavation at Spring Farm, south of the current Surface Project Area. This test excavation was conducted in four areas of Aboriginal archaeological sensitivity; within areas proposed for residential redevelopment within the Spring Farm Urban Release Area. During this excavation small numbers and very low densities of Aboriginal stone artefacts were recorded within all four areas. A summary report of these finds had previously been prepared in support of a NPW Action Section 90 Heritage Impact Permit (Mary Dallas Consulting Archaeologists 2006).

HLA- Envirosciences Pty Limited (2007) was commissioned to undertake an Aboriginal heritage assessment as part of the Camden Gas Stage 2 Concept Plan for the Spring Park and Menangle Park Surface Project Areas, which is just south of the current Surface Project Area. This development involved the construction of four gas WSLs, access roads, GGLs and water transfer pipelines. This survey revealed 21 previously unregistered sites, all of which were either isolated artefacts or open camp sites.

3.2.3 Archaeological surveys undertaken within the current Surface Project Area

Haglund (1985) conducted an archaeological assessment of the area proposed for the Mt Annan Botanic Garden and Native Arboretum. During this survey six isolated artefacts and one open camp site were identified. These sites were located on the flat crest of small spur lines. These artefacts were manufactured from red silcrete, greyish mudstone and yellowish silcrete.

This survey location had been highly disturbed by the Sydney Water Supply Canal, the natural gas pipeline and the 330 kV Transmission Line and access tracks, all which aligned roughly north-south and bisected the area. Several other transmission lines cut across the site west to east. Further, its use as a riding school has also created a number of denuded tracks and bare patches that have been churned up by horses, leading Haglund (1985:9) to believe that it would be unlikely for any archaeological deposits in the area to remain undisturbed. No areas were identified for further archaeological investigation.

Therin Archaeological Consultant (1998) was commissioned by the Department of Public Works and Services to conduct an archaeological survey of the proposed Currans Hill Public School site, situated in the southern part of the current Surface Project Area. A total 13 linear transects were surveyed. No new Aboriginal artefact sites were identified; however, one possible scarred tree was located 20 metres north of the study area. It had been predicted that there was moderate potential for open camp sites to occur within this study area due to its close proximity to an unnamed creek.

Jo McDonald Cultural Heritage Management (2000) was commissioned by Landco Pty. Ltd. to undertake an archaeological survey as part of the "Manooka Valley" subdivision. This survey lies within the current Surface Project Area. During this survey a total of four previously unregistered archaeological sites were identified. Only three of these sites were located within the current Surface Project Area. These sites consist of one open camp site (MV3; 52-2-2222) and two isolated artefacts (MV 1; 52-2-2221 and MV 4; 52-2-2223). MV 3 (52-2-2222) consisted of two stone artefacts located on a lower hill slope/creek bank. One of these artefacts was a quartz flake fragment whilst the other was a silcrete backed artefact. MV 1 (52-2-2221) was an isolated silcrete flake fragment which was relocated on an area of sheet wash erosion adjacent to an unsealed vehicle track. Site MV 4 (52-2-2223) was an isolated silcrete artefact recorded also on an unsealed vehicle track underneath the transmission line.

Jo McDonald Cultural Heritage Management (2001) completed an archaeological survey for Aboriginal archaeological sites of the proposed extension area to the "Manooka Valley" rural residential subdivision at Currans Hill. During this survey one open camp site was identified - MV 5 (52-2-2122). This site consisted of 8 stone artefacts that were located on the lower slope of a hill side. The artefacts were located in two small clusters on an area of sheet wash erosion and along a horse track (JMCHM 2001: 18). Seven of the artefacts were made of silcrete whilst the remaining artefact was a flaked piece of silicified tuff.

JMCHM concluded that if you consider the degree of previous land use disturbance in the area and the predictive model, the potential for intact, sub-surface archaeological deposit in the vicinity of this site is low to moderate (JMCHM 2001: 18).

Australian Museum Business Services (2006b) completed an Aboriginal Heritage Assessment of land referred to as Central Hills to inform the draft local environmental plan . A number of properties within the three Survey Units were assessed, all of which are located in the north western portion of the Surface Project Area. One scarred tree, 9 open campsites and four isolated artefact occurrences were recorded. Three PAD areas were identified, with the low number being attributed to high levels of ground disturbance. These are situated on ridge crests and spurs adjacent to drainage features where limited or no disturbance has occurred. The results of the survey concurred with the predictive archaeological model for the area.

Jo McDonald Cultural Heritage Management (2007 d & e) has undertaken a number of staged assessments for the South West Growth Centre (SWGC) of the Turner Road and Oran Park precincts near Camden (JMCHM 2007a). The Turner Road Precinct is located within the south-western corner of the present Study Area. The initial archaeological investigations involved detailed background research to identify knowledge gaps and highlight areas within both precincts where further work would be required (JMCHM 2007a). The work identified the need for field survey to identify the presence of surface archaeological sites, and that the field survey should focus on:

- Areas of good to high potential for archaeological deposit identified through sensitivity mapping;
- Water holes at the junction of higher order streams; and,
- Fluvial erosional benches above third and fourth order streams.

Based on the initial assessment findings **JMCHM (2007b&c)** undertook more detailed archaeological work on the Turner Road Precinct that involved identifying and assessing Aboriginal cultural heritage values. As a result, a total of 14 new Aboriginal archaeological sites and two areas of good archaeological potential were recorded. Despite finding a high number of archaeological sites within the Turner Road Precinct, it was considered that there

was limited potential for understanding occupation patterns or site use based on the surface evidence (JMCHM 2007d:71). However, the results revealed a number of trends including:

- A focus on occupation at the junction of first and second order tributaries as well as along higher order creeks;
- The occurrence of low density artefact sites located some distance from water that represent a background scatter of artefactual material; and,
- Ridge tops, hill crests and low order creeks flats were the focus of some occupation activities within the Turner Road Precinct.

Further, an understanding of site types, their content and arrangement is limited by the lack of archaeological subsurface investigation in the immediate region. Due to previous land use activities in the region however, only some areas will exhibit intact archaeological deposits from which contextual information could be gathered.

Navin Officer (2008) conducted a cultural heritage assessment for a proposed 66kV power line construction at Mount Annan, in the southern arm of the Surface Project Area. There were two new sites (MA1 and MA2) and one Potential Archaeological deposit (PAD MA1) within the study area, however there were five previously registered sites within the Mount Annan Botanic Garden and a further nine sites located within the University of Western Sydney property.

Heritage Concepts Pty. Ltd. (2008) completed a large-scale assessment at East Leppington, in the northern west corner of the current Surface Project Area. Fifty isolated artefact occurrences, six open campsites and four scarred trees were identified during the field surveys. In addition, five areas of PAD were identified in associated with recorded stone artefact sites. The findings of the assessment generally conformed with the predictive modelling on the Cumberland Plain, with open campsites and isolated artefact occurrences increasing in frequency with proximity to water (Heritage Concepts 2008:75).

ENSR / AECOM (2009) subsequently completed archaeological sub-surface investigations within the Turner Road Precinct area. Four Transect Areas (E, F, G & H) were excavated within the Turner Road Precinct area (Table 2). Transect G is situated within CU02 200m envelope on the eastern margin; on a spur within an area of previously identified PAD (JMCHM 2007b). A total of 169 stone artefacts were recovered from 40 test pits within Transect G (Table 2). AHIPs have since been issued for these areas and are discussed in more detail in Section 7.2.

Table 2: Results of archaeological excavation at Turner Road Precinct (ENSR / AECOM 2009:33).

TRANSECT	*LOCATION*	*NO. TEST PITS*	*FINDINGS*	*COMMENTS*
Transect E	Transect E was located either side of South Creek near a confluence of the creek and feeder drainage lines	30	Total of 106 artefacts Majority were recovered from 3 test pits	Transect E demonstrates the relative paucity of artefacts at this creek flat location with minor concentrations evident within mostly barren topsoil. Test pits with larger artefact numbers are located well back (~50 m) from the creek channel
Transect F	Transect F is located on crest and slope landform situated well away from the creek and without good outlook directly over the South Creek Valley	40	Total of 10 artefacts Recovered from 9 of the 40 test pits excavated	Transect F demonstrates the absence of artefact concentrations. Archaeological evidence is limited to isolated random artefact occurrences within a predominantly archaeologically barren area
Transect G	Transect G was located on a spur crest and upper slope facing the South Creek Valley. Test pit sets were arranged along the Northing lines	40	Total of 169 artefacts Only 13 of the 40 test pits did not contain stone artefacts	Transect G demonstrates the presence of significant camp site concentrations in areas of good outlook over major watercourse on elevated ground at 200 m distance from the creek. Once one moves away from this view, artefact frequency drops off to practically nothing
Transect H	Transect H was located on the slope and creek side flat next to a second order creek	30	Total of 179 artefacts Only 8 of the 30 test pits did not contain stone artefacts	Transect H demonstrates the presence of significant camp site concentrations in areas of good outlook over second order watercourse on elevated ground at 120 m distance from the creek. There is no evident trend of increased artefact density nearer to the creek

The results of the archaeological sub-surface investigations demonstrate that (AECOM 2010: 63-67):

- The majority of stone artefacts recovered were manufactured from silcrete;
- Site complexity did not necessarily increase with proximity to water;
- Raw material procurement and use is related to distance from raw material sources and social behaviours. This was identified through the comparison of core reduction methodologies; with a heavier reliance on recycling of cores at sites that were located at a greater distance from known raw material sources on the Cumberland Plain;

- No distinction could be made between the stone artefact assemblages at waterway confluence and non-confluence locations; and,

- Across upper slopes, ridges and crests more than 300 m from major creeks, artefacts are so rare that there is no discernible archaeological deposit.

3.2.4 AHIMS site analyses

A search of the OEH AHIMS database was conducted on 2 November 2009 and updated on 4 September 2012. The search results listed 101 (excluding sites identified as part of this assessment) previously identified Aboriginal archaeological sites located within the Surface Project Area. These are summarised below in Table 3 below.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic, archaeological survey; hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area. The updated AHIMS search results are provided in Appendix 1.

Table 3 provides details of the registered sites located within the Surface Project Area. Details of specific site locations are considered sensitive and have not been included in this report. The mapping coordinates recorded for these sites were checked for consistency with their descriptions and location on maps from Aboriginal heritage reports where available. These descriptions and maps were relied where notable discrepancies occurred.

Table 3: Known Aboriginal archaeological sites listed on the AHIMS Register located within the Surface Project Area.

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
52-2-1725	IF 2	Isolated Artefact	Ridge crest – 50m from nearest creek line	Disturbed – existing track
52-2-2115	TLC3	Isolated Artefact	Hill slope adjacent to drainage line	Partially disturbed – grazing and land clearance
52-2-2122	MV5 - “Manooka Valley 5”	Open Camp Site	Lower hill slope 80m from creek line	Disturbed – grading and clearing
52-2-2220	BRINGELLY SHALE (RWB)	Isolated Artefact	Ridge mid-slope – 140m from 2nd order tributary	Disturbed – fence line, vehicle movement and land clearance
52-2-2221	MV1 - “Manooka Valley 1”	Open Camp Site	Ridge mid-slope – 140m from 2nd order tributary	Disturbed – fence line, stock movement and land use
52-2-2222	MV3 - “Manooka Valley 4”	Open Camp Site	Lower hill slope – 10m from 1st order tributary	Disturbed – stock movement and erosion

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
52-2-3058	IF 7	Isolated Artefact	Mid slope – 150m from ephemeral creek	Disturbed – fence line and stock movement
52-2-3296	CH (1)	Open Camp Site	Slope of adjacent ephemeral drainage line	Disturbed – excavated embankment small dam
52-2-3297	CH11	Open Camp Site	Lower slopes – adjacent to ephemeral drainage line	Disturbed – located in raised railway track bed
52-2-3299	CH 13 IF 4	Isolated Artefact	Lower slope – 30m from ephemeral drainage line	Disturbed – grading and clearing
52-2-3300	CH12 IF 3	Isolated Artefact	Lower slope – 1st order tributary of Rileys Creek	Disturbed – construction of dam
52-2-3301	CH4 IF 2	Isolated Artefact	Flat ridge crest – 150 to 200m from ephemeral drainage	Relatively undisturbed
52-2-3307	CH10	Open Camp Site	Mid slope – 50m from ephemeral drainage	Weathering
52-2-3308	CH9	Open Camp Site	Flat area at base of slope – 100m from Rileys Creek	Weathering
52-2-3309	CH7	Open Camp Site	Alluvial flat immediately adjacent to ephemeral drainage	Partially destroyed by construction of drain and dam
52-2-3310	CH6	Scarred Tree	Lower slope - 10m from ephemeral drainage	Weathering
52-2-3311	CH 5	Open Camp Site	Alluvial flat – on ephemeral drainage	Relatively undisturbed
52-2-3312	CH 2	Open Camp Site	Lower slope – 1st order creek bank – 50m from where in meets Rileys creek	Relatively undisturbed
52-2-3314	MV2 - “Manooka Valley 2”	Open Camp Site	Mid slope – 140m from the confluence of 2 temporary first order tributaries	Disturbed – fence line and erosion
52-2-3315	CH 8	Open Camp Site	Hill crest – 200-300m from ephemeral creek	Weathering – erosion and veg clearance
52-2-3557	TR- 1	Open Camp Site	Creek bank – 100m from 2nd order creek	Relatively undisturbed – veg clearance
52-2-3558	TR- 2	Open Camp Site	Hill crest – 245m from 1st order tributary	Relatively undisturbed – veg clearance
52-2-3559	TR- 3	Scarred Tree	Flat plain – 285m from 2nd order tributary	Relatively undisturbed – grazing

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
52-2-3560	TR-4	Isolated Artefact	Creek bank – 70m ephemeral creek bank	Disturbed – vehicle track and grazing
52-2-3561	TR- 5	Open Camp Site	Creek bank – 1m to 1st order tributary of South Creek	Disturbed – modification of tributary channel
52-2-3562	TR- 6	Open Camp Site	Lower slope – 100m from South Creek	Disturbed – cattle track and grazing
52-2-3563	TR- 7	Open Camp Site	Drainage junction – head of South Creek	Disturbed – construction of dam
52-2-3564	TR- 8	Scarred Tree	Lower hill slope – 75m from 1st order tributary	Relatively undisturbed – grazing
52-2-3565	TR- 9	Open Camp Site	Lower hill slope – 150m from 3rd order tributary	Disturbed – construction of dam
52-2-3566	TR- 10	Open Camp Site	Creek bank – 250m from 2nd order tributary	Relatively undisturbed – grazing
52-2-3567	TR- 11	Open Camp Site	Upper hill slope – 140m from 1st order tributary	Disturbed – construction of golf course
52-2-3568	TR- 12	Open Camp Site	Upper hill slope – 15m from 1st order tributary	Disturbed – construction of golf course
52-2-3569	TR- 13	Scarred Tree	Lower hill slope - 360m from 1st order tributary	Some surrounding veg clearance
52-2-3570	TR- 14	Open Camp Site	Lower hill slope - 20m from 1st order tributary	Relatively undisturbed – veg clearance
52-2-3724	TR1 (Campbelltown)	Open Camp Site	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
52-2-3725	OP Transect E	Open Camp Site	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
52-2-3726	TR Transect F	Open Camp Site	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
52-2-3727	TR Transect G	Open Camp Site	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
52-2-3728	TR Transect H	Open Camp Site	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
52-2-3816	CF-2	Open Camp Site	Crest – 240m to water	Some surrounding veg clearance
45-5-2403	Varroville Open Site	Open Camp Site	Ridge top – upper reaches of Cottage Creek	Relatively undisturbed – veg clearance and grazing

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
45-5-2558	TLC2	Isolated Artefact	Alluvial terrace – on ephemeral drainage	Some surrounding veg clearance
45-5-3258	CH3 IF1	Open Camp Site	Alluvial terrace – 30m from ephemeral drainage	Disturbed – vehicle track
45-5-3440	East Leppington AS1	Open Camp Site	Mid slope – 120m to water	Some surrounding veg clearance
45-5-3441	East Leppington AS2	Open Camp Site	Alluvial terrace - on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3442	East Leppington AS3	Open Camp Site	Alluvial Terrace – on creek line	Some surrounding veg clearance
45-5-3443	East Leppington AS4	Open Camp Site	Alluvial Terrace – on creek line	Some surrounding veg clearance
45-5-3445	East Leppington AS6	Open Camp Site	Ephemeral Drainage	Some surrounding veg clearance
45-5-3448	East Leppington IF1	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3447	East Leppington IF2	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3448	East Leppington IF3	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3449	East Leppington IF4	Isolated Artefact	Mid slope – 120m to water	Some surrounding veg clearance
45-5-3450	East Leppington IF5	Isolated Artefact	Mid slope – 120m to water	Some surrounding veg clearance
45-5-3451	East Leppington IF6	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3452	East Leppington IF7	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3453	East Leppington IF8	Isolated Artefact	Mid slope – 120m to water	Some surrounding veg clearance
45-5-3454	East Leppington IF9	Isolated Artefact	Lower slope – 60m to water	On edge of ploughed area and track
45-5-3455	East Leppington IF10	Isolated Artefact	Lower slope – 20m to water	On edge of ploughed area
45-5-3456	East Leppington IF11	Isolated Artefact	Mid slope – 300m to water	On edge of ploughed area
45-5-3457	East Leppington IF12	Isolated Artefact	Alluvial terrace – on edge of creek line	On edge of ploughed area

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
45-5-3458	East Leppington IF13	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3458	East Leppington IF14	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3461	East Leppington IF16	Isolated Artefact	Alluvial terrace – on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3462	East Leppington IF17	Isolated Artefact	Mid slope – 100m to water	Weathering on vehicle track
45-5-3463	East Leppington IF18	Isolated Artefact	Alluvial Terrace – on creek line	Some surrounding veg clearance
45-5-3464	East Leppington IF19	Isolated Artefact	Alluvial Terrace – on creek line	Some surrounding veg clearance
45-5-3465	East Leppington IF20	Isolated Artefact	Upper slope – 200m to water	Weathering on vehicle track
45-5-3466	East Leppington IF21	Isolated Artefact	Mid slope – 200m to water	Disturbed – ploughed and grazed
45-5-3467	East Leppington IF22	Isolated Artefact	Upper slope – 200m to water	Disturbed – ploughed and grazed
45-5-3468	East Leppington IF23	Isolated Artefact	Creekline	Some surrounding veg clearance
45-5-3469	East Leppington IF24	Isolated Artefact	Break of slope – 50m from water	Relatively undisturbed – grazing
45-5-3472	East Leppington IF27	Isolated Artefact	Crest – 220m to water	Ploughed and located on track
45-5-3473	East Leppington IF28	Isolated Artefact	Mid slope – 260m to water	Ploughed
45-5-3474	East Leppington IF29	Isolated Artefact	Mid slope – 260m to water	Ploughed
45-5-3475	East Leppington IF30	Isolated Artefact	Mid slope – 260m to water	Ploughed
45-5-3476	East Leppington IF31	Isolated Artefact	Lower slope – 40m to water	Ploughed
45-5-3477	East Leppington IF32	Isolated Artefact	Lower slope – 40m to water	Ploughed
45-5-3478	East Leppington IF33	Isolated Artefact	Alluvial terrace - on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3479	East Leppington IF34	Isolated Artefact	Lower slope – 40m to water	Ploughed
45-5-3480	East Leppington IF35	Isolated Artefact	Mid slope – 115m to water	Ploughed
45-5-3481	East Leppington IF36	Isolated Artefact	Lower slope – 40m to water	Ploughed
45-5-3482	East Leppington IF37	Isolated Artefact	Alluvial terrace - on edge of ephemeral drainage	Some surrounding veg clearance

AHIMS Site No.	Site Name	Site Type	Landform Location	Site Integrity
45-5-3483	East Leppington IF38	Isolated Artefact	Ephemeral drainage	Some surrounding veg clearance
45-5-3484	East Leppington IF39	Isolated Artefact	Ephemeral drainage	Some surrounding veg clearance
45-5-3485	East Leppington IF40	Isolated Artefact	Mid slope – 200m from water	Weathering on vehicle track scour
45-5-3489	East Leppington IF44	Isolated Artefact	Ephemeral drainage	Ploughed and on track
45-5-3490	East Leppington IF45	Isolated Artefact	Upper slope – 400m to water	Ploughed
45-5-3491	East Leppington IF46	Isolated Artefact	Mid slope – 260m to water	Ploughed
45-5-3492	East Leppington IF47	Isolated Artefact	Mid slope – 90m to water	Ploughed
45-5-3493	East Leppington IF48	Isolated Artefact	Mid slope – 250m from water	Disturbed – recently ploughed
45-5-3494	East Leppington IF49	Isolated Artefact	Ephemeral drainage	Ploughed
45-5-3496	East Leppington ST1	Scarred Tree	Upper slope – 500m from water	Some surrounding veg clearance
45-5-3497	East Leppington ST2	Scarred Tree	Mid slope – 300m to water	Some surrounding veg clearance
45-5-3498	East Leppington ST3	Scarred Tree	Alluvial terrace - on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3499	East Leppington ST4	Scarred Tree	Mid slope – 260m to water	Some surrounding veg clearance
45-5-3945	CF-1	Isolated Artefact	Alluvial terrace - on edge of ephemeral drainage	Some surrounding veg clearance
45-5-3949	LP-6	Open Camp Site	Upper slope – 150m to water	Some surrounding veg clearance
45-5-3958	LP-5	Open Camp Site	Mid slope – 300m from water	Edge of ploughed area
45-5-4053	PAD 2059-6	PAD	Upper slope – 130m from water	Some surrounding veg clearance
45-5-4054	PAD 2060-6	PAD	Mid Slope – 140m to water	Some surrounding veg clearance
45-5-4128	LP-07	Open Camp Site	Lower slope – 60m from water	Ploughed area and track

Stone artefact sites are the most abundant site type identified within the Surface Project Area and throughout the wider Cumberland Plain region. Of the 101 registered sites within the Surface Project Area, 38 are open camp sites (38%), 53 are isolated artefact occurrences (53%), eight are scarred trees (8%) and two are PADs (2%). Within the Surface Project Area

there are no registered burials, shelters with art and/or deposit, or middens. Further details of known sites and predictive modelling for the likely distribution of archaeological sites are discussed below.

Legend

Landform
- Hillslope
- Hillcrest
- Flat

Drainage Channel by Stream Order
- Stream Order 1
- Stream Order 2
- Stream Order 3
- Stream Order 4

Well Locations
- Well Surface Location

Gas Gathering Lines
- Gas Gathering Line
- Main Gas Gathering Spine

Access Tracks
- Access Track

Survey Area
- Surface Project Area/Study Area

Anthony Road
Heath Road
Byron Road
Fox Valley Road
Eastwood Road
Denham Court Road
Zouch Road
George Road
RILEYS CREEK
RA09
Brooks Road
COTTAGE CREEK
RA03
Springfield Road
Camden Valley Way
St Andrews Road
Stennett Road
VV03
BUNBURY CURRAN CREEK
Raby Road
BOW BOWING CREEK
Oran Park Drive
CU22
Gregory Hills Drive
CU02
Epping Forest Drive
Spitfire Drive
Kent Street
CU31
Turner Road
CU26
THOMPSON CREEK
NAREL LAN CREEK
CU29
Eagle Vale Drive
Eagleview Road
KENNY CREEK
CU06
McBARRON CREEK
Gould Road
CU10
Camden Bypass
THORNLEIGH GULLY
ANNAN CREEK
Dobell Road
SMITHS CREEK
CU14
BIRIWIRI CREEK
Blaxland Road
Welling Drive
Stenhouse Drive
LEUMEAH CREEK
Junction Road
Queen Street
Narellan Road
Hume Highway
Broughton Street
Oberon Road
Caley Drive
Georges River Road
JACKS GULLY
KEANES GULLY
Guise Road
BIRUNJI CREEK
GEORGES RIVER
Briar Road
St Johns Road
Hume Highway

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

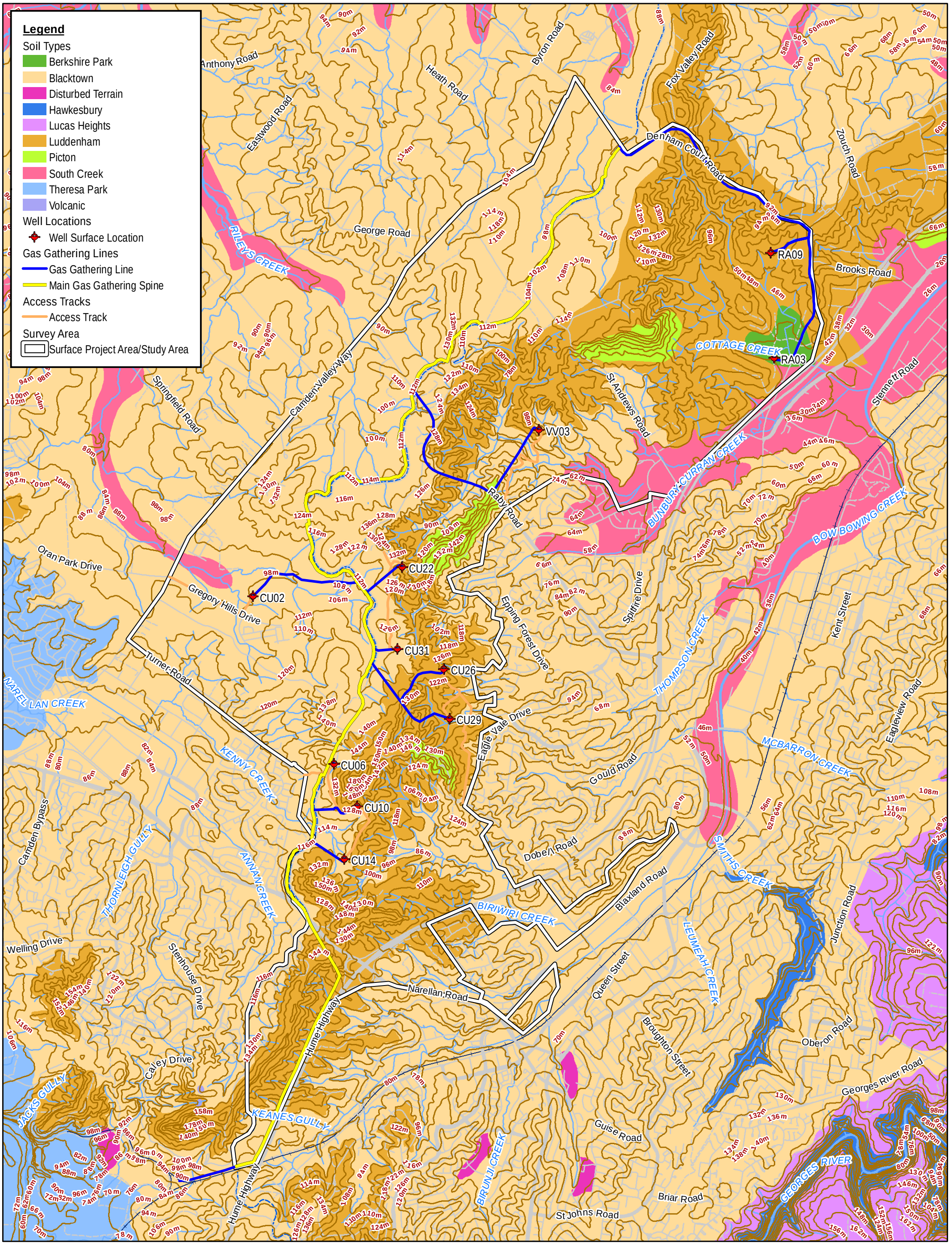
Figure 4: Landform Mapping of the Surface Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F4 AR_Landforms_20120830.mxd

0 0.4 0.8 1.2 1.6 2
Kilometers
Scale 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N



Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

Figure 5: Soil Landscapes of the Surface Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F5 AR_Soils_20120830.mxd

0 0.4 0.8 1.2 1.6 2
Kilometers
Scale 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Legend

Disturbance
- Botanical Gardens
- Farming Practices
- Golf Course/Landscaping
- Remnant Veg/Regrowth
- Road Construction
- Upper Canal
- Urban/Industrial Construction

Well Locations
- Well Surface Location

Gas Gathering Lines
- Gas Gathering Line
- Main Gas Gathering Spine

Access Tracks
- Access Track

Survey Area
- Surface Project Area/Study Area

Anthony Road
Heath Road
Byron Road
Fox Valley Road
Eastwood Road
Denham Court Road
Zouch Road
George Road
RILEYS CREEK
RA09
Brooks Road
COTTAGE CREEK
RA03
Springfield Road
Camden Valley Way
St Andrews Road
Stennett Road
VV03
CURRAN CREEK
Raby Road
BUNBURY
BOW BOWING CREEK
Oran Park Drive
CU22
Gregory Hills Drive
CU02
Epping Forest Drive
Spitfire Drive
Kent Street
CU31
CU26
Turner Road
THOMPSON CREEK
NAREL LAN CREEK
CU29
Eagle Vale Drive
Eagleview Road
KENNY CREEK
CU06
Gould Road
MCBARRON CREEK
CU10
Camden Bypass
THORNLEIGH GULLY
ANNAN CREEK
CU14
Dobell Road
SMITHS CREEK
BIRIWIRI CREEK
Blaxland Road
Welling Drive
Stenhouse Drive
Junction Road
Narellan Road
Queen Street
Broughton Street
Oberon Road
Caley Drive
Hume Highway
JACKS GULLY
KEANES GULLY
Georges River Road
Guise Road
BIRUNJI CREEK
GEORGES RIVER
Briar Road
St Johns Road

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

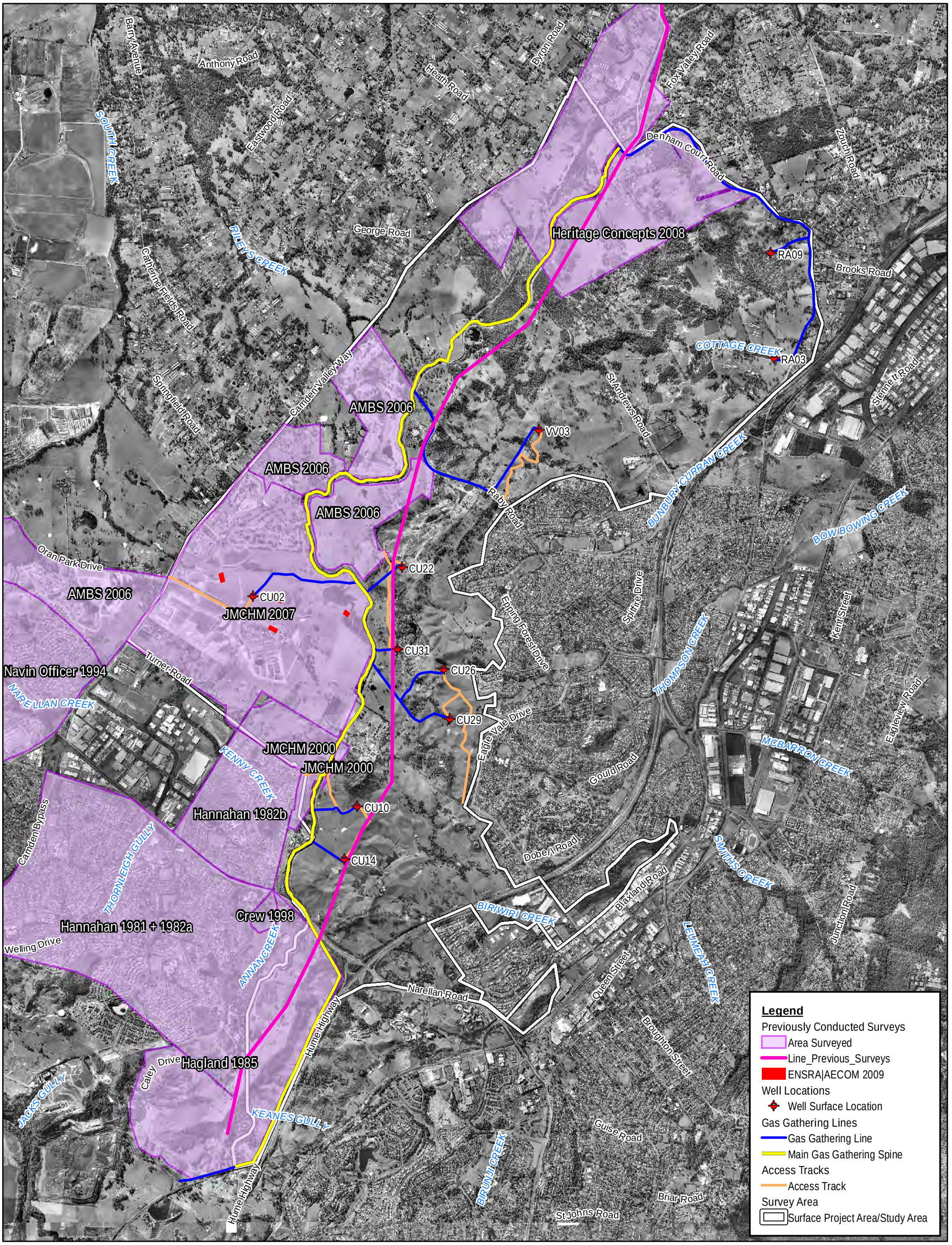
Figure 6: Landscape Disturbance of the Surface Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F6 AR_Disturbance_20120830.mxd

0 0.4 0.8 1.2 1.6 2
Kilometers
Scale 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N



Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

BIOSIS RESEARCH

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

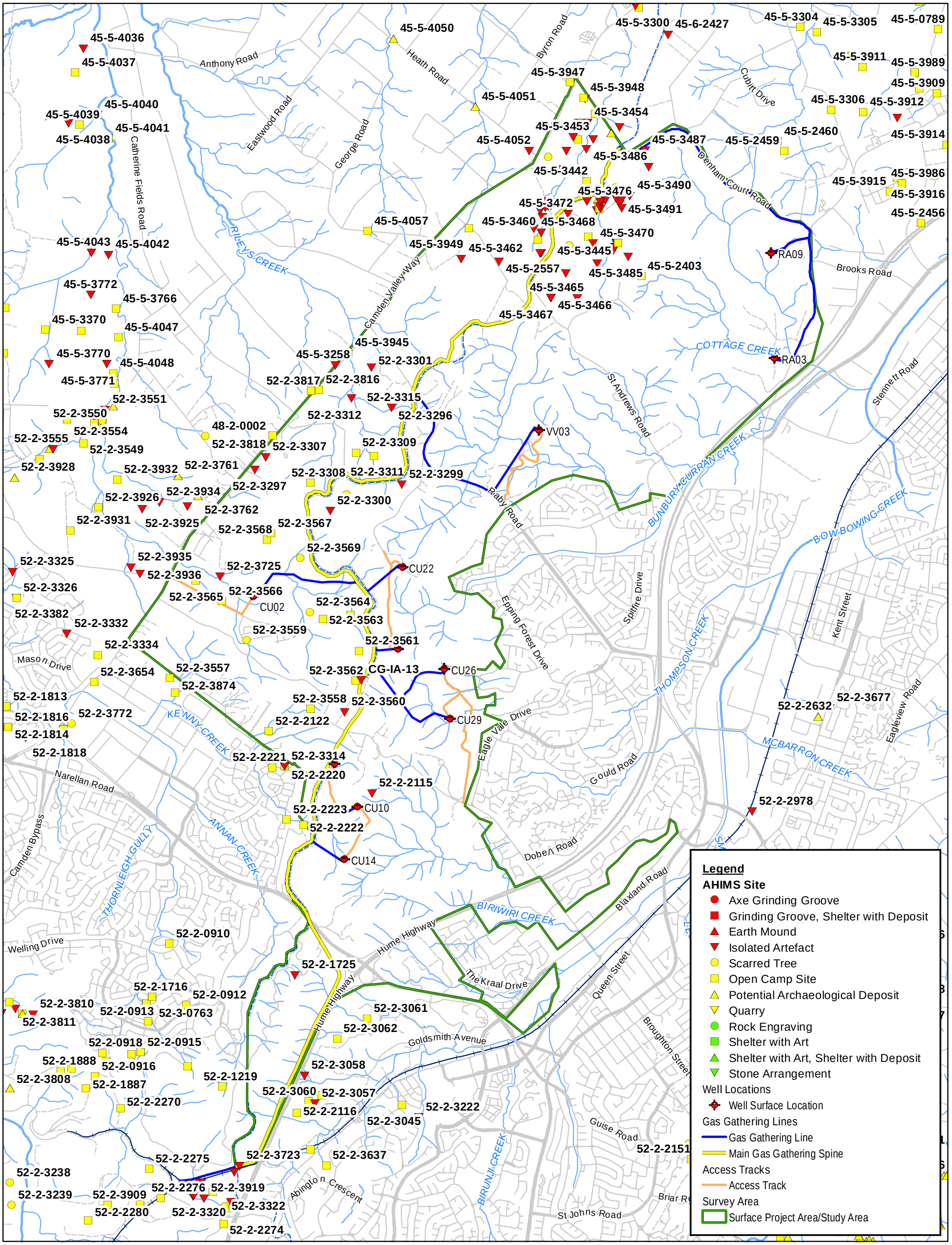
Figure 7: Previous Archaeological Surveys of the Surface Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F7 AR_PrevSurveys_20120830.mxd

0 0.4 0.8 1.2 1.6 2
Kilometers
Scale 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N



Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

Figure 8: AHIMS Search Results

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 09 October 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F8 AR_AHIMS_20121009.mxd

0 0.4 0.8 1.2 1.6 2
Kilometers
Scale 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

3.3 Discussion

The Surface Project Area would have provided many natural resources for the local Aboriginal inhabitants to exploit. Ethno-historical information regarding the Surface Project Area indicates that the region was intensively occupied by up to three separate language groups. Tangible evidence of such occupation will be present across the landscape in the form the remains of open stone artefact sites, isolated artefact occurrences and scarred trees.

The current Surface Project Area is characterised by the open undulating plain and distinctive ridge lines typical of the Cumberland Plain. Most of the Surface Project Area occurs within erosional or residual soils landscapes. The depths of these soils are generally shallow across ridge lines and associated slopes and therefore subject to erosional processes, resulting in the exposure or movement of archaeological material. Disturbance related to land use history has greatly increased the likelihood of exposure and movement of cultural material across these landforms. Low lying areas along drainage features and creeks would be favourable for soil accumulation, preserving archaeological material. These areas are rare within the Surface Project Area.

Previous archaeological work within or close to the Surface Project Area has been development-driven and, as such, it tends to focus primarily on the specific impact footprints of each particular project. However, when assessed together, these studies provide a general overview of Aboriginal archaeological site modelling and predictive behaviour within the current Surface Project Area. In general, previous archaeological work indicates that areas of archaeological potential will occur where disturbance has been limited, the most likely site type to be encountered will be open camp sites or isolated artefact occurrences.

The identification of each site type will depend greatly upon permanence of water (stream-order analysis), landform and proximity to lithic sources (JMCHM 2000). However, more recent work indicates that while the frequency and density of cultural material increases with proximity to water, site complexity does not (ENSR / AECOM 2009). Although previous land use history has affected the integrity of archaeological material, it is likely that cultural material will be present across all landforms within the Cumberland Plain landscape. The integrity of these sites will relate directly to previous land use. In summary, the site types which are likely to be identified during the archaeological field survey include:

- Surface occurrences of stone artefacts, as isolated incidences or low-medium density scatters;
- Areas of PADs where sub-surface cultural material is likely to occur – generally in close proximity to water sources or on high points where disturbance has been minimal; and
- Mature trees that exhibit cultural scarring.

3.3.1 Predictive Model

A model has been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist(ed) throughout the Surface Project Area and where they are more likely to be located.

This model is based on:

- Site distribution in relation to landscape descriptions within the Surface Project Area;
- Consideration of site type, raw material types and site densities likely to be present within the Surface Project Area;
- Findings of the ethnohistorical research on the potential for material traces to present within the Surface Project Area;
- Potential Aboriginal use of natural resources present or once present within the Surface Project Area; and,
- Consideration of the temporal and spatial relationships of sites within the Surface Project Area and surrounding region.

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the survey and subsequent sub-surface investigations across the present Surface Project Area (
Table 4). The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the Surface Project Area.

Table 4: Aboriginal Site Prediction Statements

Site Type	Site Description	Potential
Flaked Stone Artefact Scatters and Isolated Artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density 'background' scatters and isolated finds.	**High:** Stone artefact sites that have been previously recorded in the region have been located on upper hill slopes and ridgelines, and in close proximity to water sources, including swamps and drainage lines. The general predictive model for the Cumberland Plain region indicates that the frequency, density and complexity of stone artefact sites will vary depending on the permanence of the water course or the 'stream order' (Haglund 1989; JMCHM 2000; McDonald & Mitchell 1994; JMCHM 2007a, b and c), although more recent archaeological work indicates that this is not necessarily the case in the south west Cumberland Plain / Cumberland Lowlands region (ENSR/AECOM 2009).

Site Type	Site Description	Potential
Quarries	Raw stone material procurement sites.	**Low:** No known raw material outcrops suitable for quarrying are recorded within the Surface Project Area, however raw materials suitable for tool manufacture have been identified in the region, south from the St Mary's Formation and from terraces along the Nepean River. The geology of the Surface Project Area would not provide suitable rock types for the manufacture of stone artefacts, and therefore any artefacts recorded within the Surface Project Area will be made from imported, regionally available material.
PADs	Potential sub surface deposits of cultural material.	**High:** A number of PAD areas have been previously identified within the Surface Project Area, and are situated adjacent to water courses in depositional soil landscapes or on high points, such as hills and ridge crests. It is likely that within the Surface Project Area these will occur where previous disturbance has been minimal.
Scarred Trees	Trees with cultural modifications	**Low:** Land clearance for early agricultural purposes, including grazing, will have removed most large trees, as have periodic bush fires. Although a number of larger trees survive within the Surface Project Area, the likelihood that any of these trees contain cultural scarring is considered to be low, in view of the factors indicated.
Axe Grinding Grooves	Grooves created in stone platforms through ground stone tool manufacture.	**Low:** The geology of the Surface Project Area does not indicate that suitable horizontal sandstone rock outcrops will occur. Therefore there is very low potential for axe grinding grooves to occur.
Burials	Aboriginal burial sites.	**Low:** The lack of soft alluvial soils within the Surface Project Area suggests there is only a very low chance of burials to occur. There is, moreover, a generally low potential for burials to be preserved in this area because of extensive land clearance and agricultural practices.

Site Type	Site Description	Potential
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	**Low:** There are no topographical features suitable for the formation of rock shelters or overhangs within the Surface Project Area. It is therefore unlikely that rock shelters with art and/or deposit occur within the Surface Project Area.
Aboriginal Ceremony and Dreaming Sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	**Low:** A Bunan site and associated ceremony was recorded by R. H. Mathews (1896) in the county of Camden. The Bunan ceremony is recorded as occurring throughout the south-east coast of New South Wales, from the Victorian border to Bulli (Mathews 1896). He described the ceremonial ground as being in a suitable location, on level ground close to a small watercourse. The ceremonial site covers an area of approximately 290 sq. m and comprises two circular features of mounded loose soil. The exact location of this feature is unknown. None of the local Aboriginal groups or stakeholders was aware of the location of this site. The site is not registered on the DECC AHIMS register and it is unlikely that this site will occur within the Surface Project Area.
Post-Contact Sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	**Low:** Liston (1988) recounts a period of conflict in the general region, including incidents near Camden and Bringelly. It is however, considered highly unlikely that any additional, unregistered post-contact sites are present within the Surface Project Area. Aboriginal representatives will be consulted regarding their knowledge of such events.

Site Type	Site Description	Potential
Aboriginal Places	Aboriginal places may not contain any "archaeological" indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	**Low:** There are currently no known Aboriginal 'Places' within the Surface Project Area. The likelihood of Aboriginal Places occurring will be identified through consultation with the local Aboriginal community and RAPs.
Aboriginal Resource and Gathering Sites	Aboriginal Resource and Gathering Sites are sites where there is ethnographic, oral, or other evidence to suggest that natural resources have been collected and utilised by Aboriginal people. These natural resources have a cultural significance and connection for the Aboriginal community, such as ochre outcrops that were used for art or ceremonial purposes. These sites are still considered important places today.	**Low:** There are no such known sites within the Surface Project Area however the likelihood of these sites occurring will be further identified through a separate Aboriginal Cultural Assessment involving consultation with the local Aboriginal community.

4.0 ARCHAEOLOGICAL SURVEY

Field surveys of the Surface Project Area were undertaken between May 2009 and June 2012. The field survey sampling strategy, methodology and a discussion of results are provided below.

4.1 Archaeological Survey Aims

The principle aims of the survey were to:

- Provide RAPs an opportunity to view the Surface Project Area and to discuss previously identified Aboriginal archaeological sites and cultural values in or within close proximity to the Surface Project Area;
- To attempt to re-identify Aboriginal archaeological sites previously identified in the Surface Project Area;
- To undertake a systematic survey of the Surface Project Area targeting areas with the potential for Aboriginal heritage;
- Identify and record Aboriginal archaeological sites visible on the ground surface; and
- Identify and record areas of PADs.

4.2 Archaeological Survey Methodology

The survey methods were intended to assess and understand the landforms and to determine whether any archaeological material from Aboriginal occupation or land use exists within the Surface Project Area.

4.2.1 Sampling Strategy

The aim of the investigation was to assess Aboriginal archaeological sites situated within the Surface Project Area and determine if the Amended Project will impact on known and unknown Aboriginal archaeological sites. The field survey focussed on the following development components (see Figure 3):

- Proposed WSL locations that includes a 200m radius ‘envelope’ around each location;
- A 25m ‘envelope’ on either side of proposed GGL that connect each WSL, including the Main Spine Line; and,
- Proposed and existing access tracks to each WSL for construction purposes.

This ‘envelope’ approach, as outlined in Section 1.2, was taken to the assessment of the proposed development components to allow for each component to be moved within the

assessed areas if needed. This decreases the likelihood of impact to previously identified Aboriginal archaeological sites, cultural values, and other environmental constraints.

The sampling strategy was designed to locate archaeological sites within the Surface Project Area with reference to the following information:

- The proposed development 'envelopes' surrounding each project component, including the WSL, GGLs and access roads;
- Previously recorded sites within the assessed 'envelopes'; and,
- Areas of archaeological sensitivity and potential, known and unknown, based on the background research predictive model (regional site patterns, overlain on the physical environment of the Surface Project Area).

Within the identified development 'envelopes' targeted pedestrian survey methods were employed for the archaeological assessment. The survey team members (minimum of 3 people at all times) surveyed each 'envelope' area; based on previous archaeological assessment within the region, particular attention was paid to key sensitive landforms or features (creek banks and remnant vegetation) with a high likelihood for the presence of Aboriginal archaeological sites. All identified areas of ground surface exposure, regardless of archaeological potential, were inspected within the identified 'envelopes'. Where vegetation remained, old growth trees for scarring or other culturally manufactured features or cultural markers relating to burials were closely examined.

Notable features and Aboriginal archaeological sites within the Surface Project Area were recorded using a GPS. A GPS 'track' was also recorded and stored showing all survey movements within the Surface Project Area, effectively serving as continuous 'survey transects'. Survey conditions and variables were recorded for the Surface Project Area, whilst the extent of survey was determined after downloading the GPS data into a GIS. Topographic and aerial maps and a GPS were used to navigate across the Surface Project Area and to areas of identified archaeological sensitivity. Survey data was recorded on Transect Data Sheets and Site Plans drawn for each gas well envelope, the information from which is summarised in Appendix 2.

4.2.2 Survey Methods

The archaeological survey was conducted on foot with a field team of between two and three members. Information recorded during the survey included:

- Aboriginal objects or sites present in the study area during the survey;
- Survey coverage;
- Any resources that may have potentially have been exploited by Aboriginal people;

- Landform;
- Photographs of the site indicating landform;
- Evidence of disturbance; and,
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the Surface Project Area was undertaken. Photographs and recording techniques were incorporated into the survey including representative photographs of survey units, landform, vegetation coverage, ground surface visibility and the recording of soil information for each survey unit were possible. Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal cultural heritage and points marking the boundary of the landform elements were recorded using a hand-held Global Positioning System and the Map Grid of Australia (94) coordinate system.

Archaeological survey was conducted on the following dates with between two and three team members on each day:

- Tuesday 26 May 2009;
- Friday 12 June 2009 and Monday 15 June 2009;
- Thursday 6 August 2009, Friday 7 August 2009 and Wednesday 26 August 2009;
- Thursday 24 September 2009 and Wednesday 30 September 2009;
- Monday 20 June 2011 and Tuesday 21 June 2011; and,
- Thursday 21 June 2012 and Tuesday 26 June 2012.

The field survey was undertaken by Renée Regal, Melanie Thomson, Fenella Atkinson and Asher Ford (Biosis Research); Donna Whillock and Neale Sampson (Tharawal LALC); and Glenda Chalker and Rebecca Chalker (Cubbitch Barta NTCAC).

4.3 Survey Results

A total of 69 transects were walked across the Surface Project Area with the two to three surveyors walking two metres apart (Figure 9A to Figure 9O). This follows the methodology set out in Burke and Smith (2004: 65) which states that a single person can only effectively visually survey an area of two linear metres. 39 Aboriginal sites and two PADs were identified in the Surface Project Area that are in close proximity to planned works, however of these sites only 28 are located in the project "envelope" and are discussed in detail in Sections 4.3.1, 4.3.2 and 4.3.3. New sites were recorded as part of the survey, but due to layout revisions are no longer within the project envelope. These sites include CG-OCS-07,

CG-OCS-08, CG-OCS-12, CG-TRE-03 and CG-TRE-04. These sites are included in the overall analysis and discussion of the assessment results in Section 5.0 but detailed descriptions for each site are not provided. Site cards for all sites recorded as part of the survey effort for this assessment are provided in Appendix 2.

The results from the field surveys have been summarised in Table 5 and 6.

The survey was constrained by several factors, including:

- Poor ground surface visibility e.g. areas where grass obscured the ground surface;
- Severe landform modification reducing archaeological potential e.g. Upper Canal construction;
- Severe landform modification obscuring archaeological potential e.g. playing fields built up on introduced fill deposits; and,
- Land access restraints to properties adjacent to the Upper Canal. Therefore, the entire 25m buffer of the Upper Canal was not entirely assessed, and was limited to the Upper Canal easement only, where the main spine gathering line will be constructed.

In such areas, pedestrian survey was reduced, targeted or not undertaken. This is not to suggest that these areas do not have Aboriginal objects or places within them, only that the likelihood of detecting such objects or places by means of ground survey was greatly reduced and not an effective use of survey time.

4.3.1 Previously Recorded Sites

The following Aboriginal archaeological site was identified as a result of previous archaeological assessment work (AMBS 2006b; JMCHM 2007a, d & e).

TR-5 (52-2-3561) **Open Camp Site**

E: 295640 N: 6232668 Grid Coordinates (Datum: GDA) Zone 56

Description: The site comprises a low density open lithic scatter covering an area of approximately 50 x 200 metres along on the creek banks of South creek. Three flaked stone artefacts were recorded in the original 2007 survey. Although in close proximity to the proposed Main Gas Gathering Spine along the Upper Canal, the site is separated from the proposed works area by a boundary fence (Figure 9I).

Condition: The site has not substantially changed since its original recording in 2007 and is part of an Aboriginal Conservation Area.

4.3.2 Previously Recorded Potential Archaeological Deposits

The following two recorded PADs were identified as a result of previous archaeological assessment work (AMBS 2006b; JMCHM 2007d & e).

PAD 2061-6 (45-5-4054)

E: 298716 N: 6238399 Grid Coordinates (Datum: GDA) Zone 56

PAD 2061-6 was recorded by AHMS near Denham Court Road as a flat area with views over watercourses to the west and northeast (Figure 9C). It is not clear if artefacts where found at the site or references are to surrounding isolated artefacts, no artefacts were identified in the current survey effort.

PAD 2062-6 (45-5-4055)

E: 299141 N: 6238607 Grid Coordinates (Datum: GDA) Zone 56

PAD 2062-6 was recorded by AHMS near Denham Court Road, east of PAD 2061-6, as a crest area with views over watercourses to the west and northeast (Figure 9C).

4.3.3 New Site Recordings

A total of twenty-five (25) new Aboriginal archaeological sites were identified within the proposed development 'envelopes'. These include fourteen (14) isolated stone artefacts, two (2) possible scarred trees and nine (9) open camp sites that consisted of low to moderate density stone artefact scatters. The following gives a brief description of each site, the extent of cultural material, details of the artefacts and the levels of disturbance.

CG-IA-01 (52-2-3736) Isolated Stone Artefact

E: 298441 N: 6237993 Grid Coordinates (Datum: GDA) Zone 56

Site CG-IA-01 is located on the exposed access track located on the eastern side of the Upper Canal channel (Figure 9D, Plate 7). The site is situated on flat lower slopes of a hill, 165 m from a 1st order creek. The site comprises a single silcrete flake. Once the artefact was examined it was moved to the edge of the track so as to not be further damaged by vehicles using the access track. The immediate area has been disturbed by its continual use as an access road and from exposure to the elements. No further cultural material was identified and there is limited likelihood for sub-surface cultural material.

Plate 5: Red silcrete flake from CG-IA-01

CG-IA-02 (52-2-3780) **Isolated Stone Artefact**

E: 297903 N: 6237628 Grid Coordinates (Datum: GDA) Zone 56

Site CG-IA-02 is located on the exposed access track located on the eastern side of the Upper Canal channel (Figure 9D, Plates 8 and 9). The site is situated flat open plain 65 m from the 1st order creek. The single artefact was moved to the edge of the access track so as to not be further damaged by vehicles using the track. The immediate area has been disturbed by its continual use as an access road and from exposure to the weather. It is unlikely that further sub-surface cultural material remains undetected within the Upper Canal easement.

Plate 6: Single stone artefact at CG-IA-02

Plate 7: Location of CG-IA-02 on Upper Canal access track

CG-IA-03 (52-2-3781) **Isolated Stone Artefact**

E: 300547 N: 6235920 Grid Coordinates (Datum: GDA) Zone 56

CG-IA-03 is situated on an undulating plain 50m from a 1st order creek (Figure 9A). This artefact has been exposed by the cattle that currently graze the paddock. The single quartz

artefact was relocated to next to the gate post to reduce potential damage from vehicles and stock (Plate 10 and 11). The artefact was identified on the eroding ground surface due to these factors. It is evident that the site has been significantly disturbed by grazing cattle and the movement of farm equipment. Other notable disturbances can be associated with the construction of fencing and the excavation of a drain. No further cultural material was identified at the sites, however, there is high likelihood for sub-surface cultural material further north of the site.

Plate 8: Broken quartz artefact at site CG-IA-03

Plate 9: CG-IA-03 artefact located near the right fence post

CG-IA-04 (52-2-3737) **Isolated Stone Artefact**

E: 295280 N: 6231233 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an access track adjacent to the Upper Canal across the back paddocks of St Gregory's School (Figure 9M, Plate 12 and 13). This site is situated on the flat lower slopes of a hill, 250 m from a 1st order creek. The single artefact has been exposed in an area of patchy grass close to the property boundary fence line. The immediate area is exposed due primarily to farm vehicles and stock movement. The property is currently used for dairy farming. The paddock appears to have been subject to tilling. Although ground surface visibility was not high, the site is not situated on an area considered to be of archaeological sensitivity.

	
Plate 10: Single artefact at CG-IA-04	**Plate 11:** Site CG-IA-04 located along existing boundary fence line

CG-IA-05 (52-2-3738) **Isolated Stone Artefact**

E: 295268 N: 6230653 Grid Coordinates (Datum: GDA) Zone 56

This site is located on a cattle track that runs parallel to a vehicle track (Figure 9N). The site is situated on open, undulating plain, 100 m from a 1st order creek. The single stone artefact was identified in an area of exposure on the track (Plate 14 and 15). It has been exposed by stock and vehicle traffic. The immediate area has been partially disturbed by grazing. The immediate area has been disturbed by its continual use and it is unlikely that further sub-surface cultural material will be encountered in the immediate vicinity.

	
Plate 12: Artefact found at CG-IA-05	**Plate 13:** CG-IA-05 located on existing dirt track

CG-IA-06 (52-2-3739) **Isolated Stone Artefact**

E: 295 132 N: 6228 982 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an existing access road at Mt Annan Botanical Gardens (Figure 9O). It is situated on the mid slope of a hill, 250 m from a 1st order creek (Plate 16 and 17). The artefact appears to have been washed down the slope, north of where isolated artefact occurrence CG-IA-07 was identified. The area has been highly disturbed as it has been used for some time as an access road and has had a high level of weathering from exposure. Prior to the area being reserved for the Mount Annan Botanic Gardens, it was used as a dairy farm. Good ground surface visibility was encountered along the existing dirt road and no further cultural material was identified. It was therefore determined that there is limited likelihood for sub-surface cultural material in the immediate vicinity.

Plate 14: Single artefact at CG-IA-06

Plate 15: Site CG-IA-06 located on eroded access track

CG-IA-07 (52-2-3740) **Isolated Stone Artefact**

E: 295 170 N: 6228 923 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the mid slope of a hill, 250 m from a 1st order creek, on a frequently used vehicle access track at Mount Annan Botanic Gardens close to the property boundary fence line (Figure 9O). The single artefact was identified in the middle of the existing access track (Plate 18 and 19). The immediate area has been disturbed by its continual use as an access road and from exposure to the weather. Ground surface visibility was considered to be high along the track and no further cultural material was identified. It was therefore determined that there is limited likelihood for sub-surface cultural material.

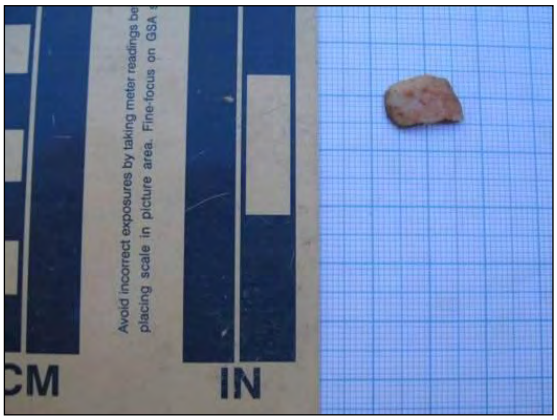


Plate 16: CG-IA-07 stone artefact

Plate 17: Location of CG-IA-07 along an existing access track

CG-IA-08 (52-2-3741) **Isolated Stone Artefact**

E: 295 094 N: 6228 196 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an existing road at Mount Annan Botanic Gardens (Figure 9P). It is situated on the western side of the road (Plate 20). The artefact was located on the mid slope of a hill, 250 metres from a 1st order creek. The immediate area has been highly disturbed as it has been continually used as an access track. Prior to being the Mount Annan Botanic Gardens this area was used as a dairy farm. Ground surface visibility was good along the access track and no further cultural material was identified. It was therefore determined that there is limited likelihood for sub-surface cultural material in the immediate vicinity.

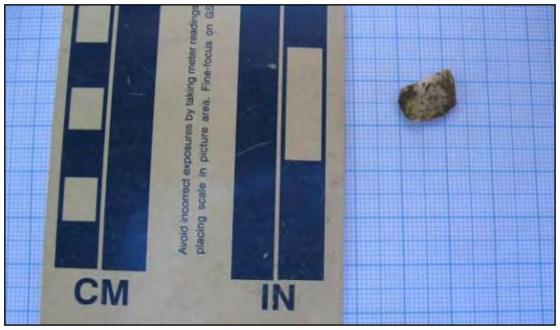


Plate 18: Single quartz artefact at CG-IA-08

CG-IA-09 (52-2-3742) **Isolated Stone Artefact**

E: 294 892 N: 6227 751 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the mid slope of a hill, 25 m north of a 1st order tributary, on an existing track at Mount Annan Botanical Gardens (Figure 9P). It is situated on the western side of the track (Plate 21 and 22). Exposure extended along the entire length of the existing dirt access track. The area has most likely been exposed due to vehicle traffic, as well as weather exposure. Prior to becoming part of the Mount Annan Botanic Gardens, the property was used as a dairy farm. Good ground surface visibility was encountered along the existing dirt road and no further cultural material was identified. It was therefore considered unlikely that intact cultural material would be present in the immediate vicinity.

Plate 19: Single silcrete artefact at CG-IA-09

Plate 20: Location of site CG-IA-09 on the western side of the road

CG-IA-10 (52-2-3743) **Isolated Stone Artefact**

E: 294 858 N: 6227 665 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the crest of a ridge, 25 m from a 1st order creek of Bow Bowling Creek, on an existing track at Mount Annan Botanical Gardens (Figure 9P). It is situated on the western side of the existing access track (Plate 23 and 24). The area has most likely been exposed due to vehicle movement. Prior to the development of the Mount Annan Botanic Gardens, the property was used as a dairy farm. Ground surface visibility was encountered along the existing dirt road and no further cultural material was identified. It was therefore determined that there is limited likelihood for intact, sub-surface cultural material in the immediate vicinity.

Plate 21: Single stone artefact at CG-IA-10

Plate 22: Location of site CG-IA-10 located on the western side of access road

CG-IA-11 (52-2-3744) **Isolated Stone Artefact**

E: 294 790 N: 6227 496 Grid Coordinates (Datum: GDA) Zone 56

This site is situated on the crest of a ridge, 25 m from a 1st order creek of Bow Bowling Creek, on an existing track at Mount Annan Botanical Gardens (Figure 9P). It is located on the western side of the track (Plate 25 and 26). The area has most likely been exposed due to vehicle movement and weather exposure. The property was used as a dairy farm prior to its use as the Mount Annan Botanic Gardens. Good ground surface visibility was encountered along the existing dirt road and no further cultural material was identified. It was therefore determined that there is limited likelihood for sub-surface cultural material.

Plate 23: CG-IA-11 stone artefact

Plate 24: Location of site CG-IA-11 located on the western side of the track

CG-IA-12 (52-2-3745) **Isolated Stone Artefact**

E: 295568 N: 623213 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the crest of a ridge, 25 m from a 1st order creek of Bow Bowling Creek, on an existing track at Mount Annan Botanical Gardens (Figure 9P). It is situated on the western side of the track (Plate 27 and 28). Exposure extended along the existing dirt access track, but no additional material was identified despite high ground surface visibility. The area has most likely been exposed due to vehicle and cattle movement, as well as weather exposure. The property was used as a dairy farm before becoming the Mount Annan Botanical Gardens. Ground surface visibility was high and it was considered unlikely for further archaeological material to occur along the track.

Plate 25: Single stone artefact at CG-IA-12

Plate 26: CG-IA-12 site located on the western side of the dirt access track

CG-IA-13 **Isolated Stone Artefact**

E: 298 441 N: 6234 141 Grid Coordinates (Datum: GDA) Zone 56

Site CG-IA-13 is located on an exposed track on a lower hillslope overlooking a drainage feature (Figure 9K, Plate 29). The site comprises a single silcrete flake. The immediate area has been disturbed by its use as walking track and from exposure to the elements. No further cultural material was identified and there is limited likelihood for further sub-surface cultural material.

Plate 27: Looking north at CG-IA-13, identified within area of exposure along track

CG-IA-16 (52-2-3723) **Isolated Stone Artefact**

E: 294120 N: 6226374 Grid Coordinates (Datum: GDA) Zone 56

Site CG-IA-16 is located on an exposed track just east of the Upper Canal (Figure 9K, Plate 29). The site comprises a single stone artefact. No further cultural material was identified and there is limited likelihood for further sub-surface cultural material

CG-OCS-01 (52-2-3782) **Open Camp Site**

E: 298 538 N: 6238 336 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the existing access road for the Upper Canal (Figure 9D), on open flat plain, 280 m from a first order creek. Two stone artefacts were identified at this site (Plate 30 and 31). The artefacts have been exposed through continual vehicle movement and initial ground surface disturbances associated with the construction of the Upper Canal. The site is considered to be eroding from the shallow, residual soils. High levels of previous disturbance have occurred within the Upper Canal easement. There is low potential for further cultural material to occur and if it is present, it will be in a disturbed context.

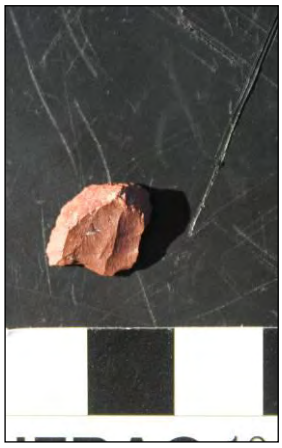


Plate 28: Photo of artefacts CG-OCS-1

Plate 29: Artefacts located on existing Upper Canal Access track

CG-OCS-02 (52-2-3783) **Open Camp Site**

E: 298 461 N: 6238 113 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an area of exposure that runs parallel along the eastern side of the Upper Canal access track, 65m from a 1st order creek (Figure 9D). The artefacts are located off the access track and are eroding from the spoil of track construction and drain excavation. There were three stone artefacts recorded along with exposure (Plate 32 and 33). No further cultural material was identified despite good ground surface visibility. High levels of previous disturbance have occurred within the Upper Canal easement, from construction and continued access. There is low potential for further cultural material to occur and if it is present, it will be in a disturbed context.

Plate 30: CG-OCS-02 stone artefacts

Plate 31: CG-OCS-02 artefacts located on an exposure adjacent to the Upper Canal access track

CG-OCS-03 (52-2-3784) **Open Camp Site**

E: 300 540 N: 6237 332 Grid Coordinates (Datum: GDA) Zone 56

This site is located beside a gate (upslope and to the east of RA09), on the mid slopes of a hill and 165 m from a 3rd order creek (Figure 9B). The artefacts are under a tree in a small area of exposure within a grassy area (Plate 34 and 35). The exposure area is less then 20 x 20 cm, and there is a low potential for further cultural material to occur here, as it has been highly disturbed by cattle grazing and is not located on an area of moderate or high archaeological sensitivity.

Plate 32: Photo of artefacts at CG-OCS-03

Plate 33: Site CG-OCS-03 located on small exposure at base of tree

CG-OCS-04 (52-2-3785) **Open Camp Site**

E: 297 845 N: 6237 515 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an area of exposure that runs parallel along the eastern side of the Upper Canal access track, 60m from a 1st order creek (Figure 9D). The artefacts are located off the track and are eroding from the spoil of drain excavation close to the fence line. There were three stone artefacts recorded along with exposure (Plate 36 and 37). No further cultural material was identified despite good ground surface visibility. High levels of previous disturbance have occurred within the Upper Canal easement, from construction and continued access. There is low potential for further cultural material to occur and if it is present, it will be in a disturbed context.

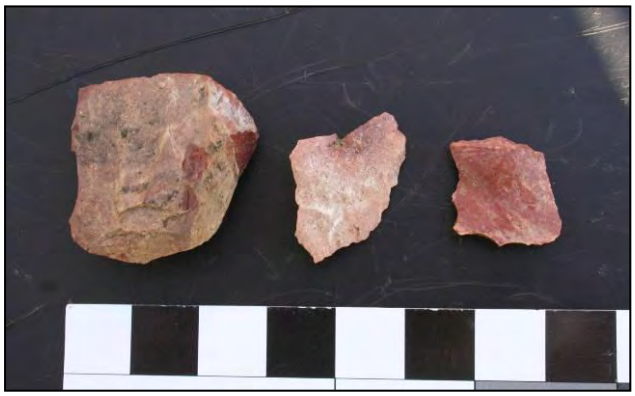


Plate 34: Stone artefacts located at CG-OCS-04

Plate 35: CG-OCS-04 artefacts located on exposure between access track and cut drain along the fence line

CG-OCS-05 (52-2-3786) **Open Camp Site**

E: 297 838 N: 6237 242 Grid Coordinates (Datum: GDA) Zone 56

Site CG-OCS-05 is located on an area of exposure between the Upper Canal access track and the fence line, situated on lower slopes 250m from a 1st order creek (Figure 9D). The artefacts are located off the track and are eroding from the spoil of drain excavation close to the fence line. There were three stone artefacts recorded along with exposure (Plate 38). No further cultural material was identified along the spoil heap. High levels of previous disturbance have occurred within the Upper Canal easement, from construction and continued access. There is low potential for further cultural material to occur and if it is present, it will be in a disturbed context.

Plate 36: General shot of artefacts CG-OCS-05

CG-OCS-06 (52-2-3792) **Open Camp Site**

E: 297 650 N: 6236 957 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an area of exposure on the eastern side of the Upper Canal access track, situated on the flat crest of low rise, 80m from a 1st order creek (Figure 9E). The artefacts are located on the access track and along an eroding spoil from the excavation of a drain close to the fence line. There were at least 50 stone artefacts identified along with exposure, and due to time constraints, only a selection of varying materials and artefact types were recorded in detail (Plate 39 and 40). Cultural material extended for 100m along the spoil heap and track. High levels of previous disturbance have occurred within the Upper Canal easement, from construction and continued access. While disturbance levels are high, and archaeological material is unlikely to remain in context, there is moderate likelihood of further cultural material to be present within the vicinity of this site. Material located on the track was moved to the spoil heap to ensure vehicle traffic did not further damage these.

Plate 37: General shot of some of the artefacts CG-OCS-06

Plate 38: General shot of some of the artefacts CG-OCS-06

CG-OCS-09 (52-2-3788) **Open Camp Site**

E: 297 650 N: 6236 367 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an area of exposure on the eastern side of the Upper Canal access track, situated on an open flat ridge crest, 200m from the confluence of two 1st order creeks (Figure 9E). The artefacts are located on the access track and along an area of erosion, between the Upper Canal channel and access track. A total of seven stone artefacts were recorded at this site (Plate 39 and 40). Cultural material extended for 60m along the areas of exposure. High levels of previous disturbance have occurred within the Upper Canal easement, from construction and continued access. While disturbance levels are high, and archaeological material is unlikely to remain in context, there is moderate likelihood of further cultural material to be present within the vicinity of this site. Material located on the track was moved off the track to ensure vehicle traffic did not further damage these.

Plate 39: CG-OCS-09 artefacts

Plate 40: CG-OCS-09 artefacts located on flat area adjacent to Upper Canal

CG-OCS-10 (52-2-3748) **Open Camp Site**

E: 295 189 N: 6228 881 Grid Coordinates (Datum: GDA) Zone 56

This site is located on the upper ridge crest, 300 metres from a 1st order creek of Bow Bowling Creek, at the cross roads of two access tracks at Mount Annan Botanical Gardens (Figure 9O). Once the seven stone artefacts were recorded they were moved to the edge of the road to avoid further damage by vehicles using the access road (Plate 41 and 42). High ground surface visibility was encountered along the existing dirt road and no further cultural material was identified. The immediate area has been disturbed by its continual use as an access road and from exposure to the weather. It was therefore determined that there is limited likelihood for intact, sub-surface cultural material in the immediate vicinity.

Plate 41: Artefacts at CG-OCS-10 site

Plate 42: Location of artefacts at site CG-OCS-10

CG-OCS-11 (52-2-3749) **Open Camp Site**

E: 294 871 N: 6227 709 Grid Coordinates (Datum: GDA) Zone 56

This site is located on an access track at Mount Annan Botanical Gardens, on the mid slope of a ridge and 25m from a 1st order creek of Bow Bowling Creek (Figure 9P). Two stone artefacts were identified at this site were moved to the edge of the road to avoid further damage by vehicles using the access road (Plate 43 and 44). High ground surface visibility was encountered along the dirt track and no further cultural material was identified. The immediate area has been disturbed by its continual use as an access road and from exposure to the weather. It was therefore determined that there is limited likelihood for intact, sub-surface cultural material in the immediate vicinity.

Plate 43: Artefacts at CG-OCS-11

Plate 44: CG-OCS-11 site located on existing access track

CG-TRE-01 (52-2-3790) **Possible Scarred Tree**

E: 300 484 N: 6237 352 Grid Coordinates (Datum: GDA) Zone 56

This scarred tree is situated on a flat open crest of a moderate rise and 140m from a first order creek (Figure 9B). It was difficult to assess the extent of the scar due to the prickly undergrowth that was surrounding the Ironbark. One long scar is evident and is approximately 1 metre long and 30cm wide, at its widest point (Plate 45 and 46). The immediate area surrounding the scarred tree has been disturbed through clearance for stock grazing.

Plate 45: Possible scarred tree CG-TRE-01

Plate 46: Possible scarred tree CG-TRE-01 located in sparse woodland

CG-TRE-02 (52-2-3791) **Possible Scarred Tree**

E: 300 482 N: 6237 345 Grid Coordinates (Datum: GDA) Zone 56

This scarred tree is located on a flat open crest of a small rise, 140 m from a first order creek. It was difficult to assess the extent of the scar due to the prickly undergrowth that was surrounding the Ironbark (Figure 9B, Plate 47). This site is just down slope from CG-TRE-01. This scar is very small approximately 30 cm long and 3 cm wide. It does not appear to be of indigenous origin, as the scar, perhaps, was caused from a small branch tear. The immediate area surrounding the scarred tree has been disturbed through clearance for cattle grazing.

Plate 47: Scarred tree CG-TRE-02

4.4 Survey Results Discussion

In general, the Surface Project Area comprises undulating hills and ridges, surrounded by open floodplain on a number of minor and major creek lines and drainage features, including Rileys Creek, Kemps Creek, South Creek feeder drainage lines, Bunbury Curran Creek, Cottage Creek and Bow Bowing Creek. The area has been cleared of most indigenous vegetation; however there are localised pockets of Cumberland Plain Woodland vegetation that contains some surviving old growth trees. Most of the Surface Project Area is vegetated with pasture grasses.

The majority of the proposed infrastructure components of the Amended Project occur on open flat ground on ridge tops and hill crests. These landforms comprise residual and erosional soils landscapes that are subject to:

1) erosion of limited surface soils that exposes and reduces the survival of cultural material, or

2) mass movement of soils down slope as a result of land use practices destabilising soil profiles.

Limited alluvial soils occur along the water courses within the Surface Project Area as many of these are first and second order creek, on moderate and gentle slopes in the upper reaches of the South Creek catchment.

Disturbances associated with the Surface Project Area include the original land clearance and pastoral use (including tilling and grazing), construction of the farm vehicle tracks and dams, construction of the Upper Canal and natural erosion and scouring processes throughout the Surface Project Area on hill slopes and along drainage features. Exposures in these areas have

occurred as a result of these disturbances and account for the exposure and visibility within the Surface Project Area (Plate 48). Elsewhere survey exposure and visibility was low as pasture grasses obscure much of the ground surface (Plate 49). Where natural exposures occurred, more detailed inspection was undertaken. Overall exposure and visibility throughout the Surface Project Area was low-moderate.

Plate 48: Typical view along the Upper Canal easement, offering exceptional GSV.

Plate 49: Hill and ridge slopes typical within the Project Surface Area, offering limited GSV.

Areas of good ground surface visibility occurred primarily along stock tracks, unsealed tracks, erosion on slopes and creek banks, farm dams, sheet wash and patchy grass cover. Based on this information, the overall Effective Survey Coverage (ESC) of the Surface Project Area is considered to be low. This can be attributed to pasture grasses and road reserve vegetation. It should be noted however that this growth is a direct result of high seasonal rainfall. At other times of the year, larger areas of ground surface would be visible.

An approximate total of 27 ha was surveyed, of which, only 3 ha (11%) was effectively surveyed, a breakdown of the ESC by landform is provided in Table 6. This indicates that the ESC within the assessed Surface Project Area was low overall. Despite this, the survey effort was considered to be adequate to demonstrate the archaeological resource within the Surface Project Area.

Table 5: Survey Coverage

Survey Unit	Landform	Survey Unit area (m²)	Visibility %	Exposure %	Effective Coverage Area (m²)	Effective Coverage %
1 - RA09 WSL & access	Hillslope	5250	15%	30%	236	4.5
2 – RA03 WSL & access	Plain	4050	15%	50%	304	7.5
3 – CU29 & CU26 access	Hillslope	6054	20%	30%	363	6
4 – CU29 & CU26 access	Hillcrest	720	20%	30%	43	6
5 – CU29 & CU26 access	Hillslope	930	20%	30%	55	6
6 – CU29 WSL	Hillslope	3408	20%	30%	204	6
7 – CU29 WSL	Hillcrest	1632	20%	30%	98	6
8 – CU29 WSL	Hillslope	474	20%	30%	28	6
9 – CU29 WSL	Hillcrest	588	20%	30%	35	6
10 – CU29 WSL	Hillslope	6678	20%	30%	400	6
11 – CU26 WSL	Hillslope	726	2%	10%	0.14	0.02
12 – CU26 WSL	Hillcrest	480	2%	10%	0.09	0.02
13 – CU26 WSL	Hillslope	6780	2%	10%	1.35	0.02
14 – CU26 WSL	Hillcrest	546	2%	10%	0.11	0.02
15 – CU26 WSL	Hillslope	930	2%	10%	0.18	0.02

Survey Unit	Landform	Survey Unit area (m²)	Visibility %	Exposure %	Effective Coverage Area (m²)	Effective Coverage %
16 – Main Spine Line GGL	Hillslope	19704	70%	90%	12413	63
17 – Main Spine Line GGL	Hillcrest	972	70%	90%	612	63
18 – Main Spine Line GGL	Hillslope	12846	70%	90%	8092	63
19 – CU10 WSL, GGL & access	Hillslope	5478	25%	5%	68	1.2
20 – CU14 WSL & access	Hillcrest	2118	10%	10%	21	1
21 – CU14 WSL & access	Hillslope	2334	10%	10%	23	1
22 – CU10 & CU6 access	Hillslope	4644	10%	10%	46	1
23 – CU06 WSL	Hillcrest	858	20%	30%	51	6
24 – CU06 WSL & Access	Hillslope	1824	20%	30%	109	6
25 – CU06 WSL	Hillslope	672	20%	30%	40	6
26 – Main Spine Line GGL	Hillslope	3870	20%	30%	232	6
27 – *Potential WSL*	Hillslope	1188	20%	30%	71	6
28 – *Potential WSL*	Hillcrest	174	20%	30%	10	6
29 – *Potential WSL*	Hillslope	2724	20%	30%	163	6
30 – Main Spine Line GGL	Hillslope	702	20%	30%	42	6
31 – Main Spine Line GGL	Hillslope	2088	20%	30%	125	6

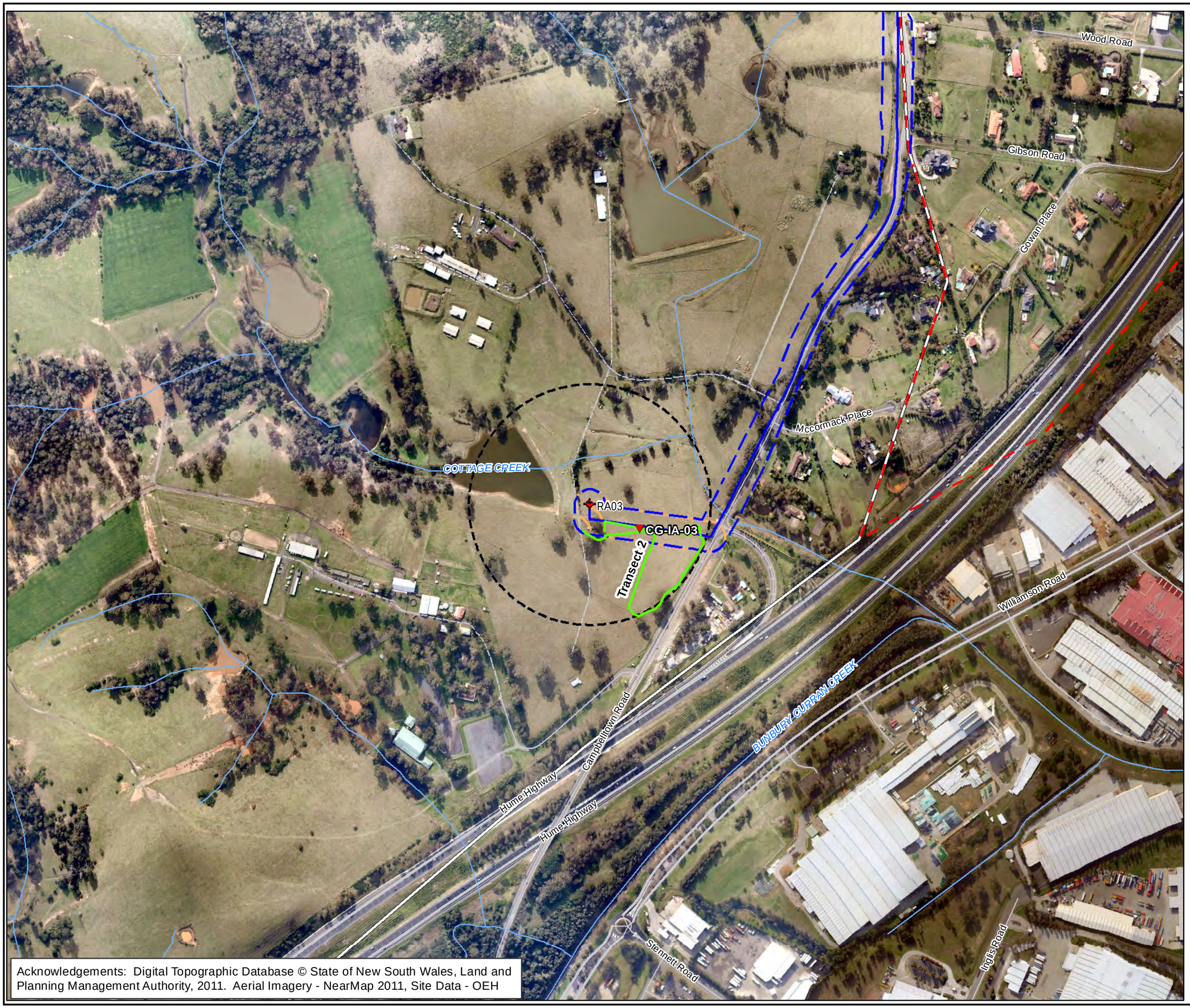
Survey Unit	Landform	Survey Unit area (m²)	Visibility %	Exposure %	Effective Coverage Area (m²)	Effective Coverage %
32 – Main Spine Line GGL	Hillslope	2328	20%	30%	139	6
33 – Main Spine Line GGL	Hillslope	3306	20%	30%	198	6
34 – CU26 & CU 29 GGL	Hillslope	3912	10%	30%	117	3
35 – Main Spine Line GGL	Hillslope	13854	20%	30%	831	6
36 – Main Spine Line GGL	Plain	17454	20%	30%	1047	6
37 – Main Spine Line GGL	Plain	3840	20%	30%	230	6
38 – Main Spine Line GGL	Hillslope	8526	20%	30%	521	6
39 – Main Spine Line GGL	Plain	15066	20%	30%	903	6
40 – *Potential WSL*	Hillslope	960	20%	30%	57	6
41 – Main Spine Line GGL	Plain	1470	10%	10%	15	1
42 – Main Spine Line GGL	Plain	966	10%	10%	10	1
43 – Main Spine Line GGL	Plain	222	10%	10%	2	1
44 – Main Spine Line GGL	Plain	2016	20%	10%	40	3.75
45 – Main Spine Line GGL	Hillslope	654	10%	0%	0	0
46 – Main Spine Line GGL	Plain	972	20%	30%	58	6
47 – Main Spine Line GGL	Hillslope	1008	10%	0%	0	0

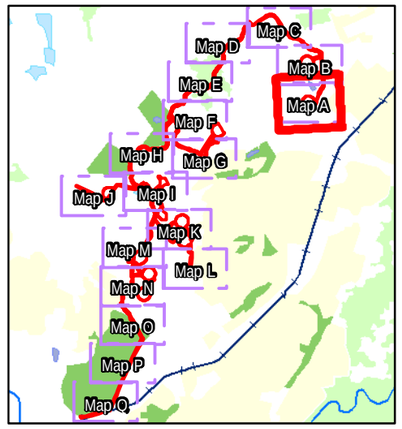
Survey Unit	Landform	Survey Unit area (m²)	Visibility %	Exposure %	Effective Coverage Area (m²)	Effective Coverage %
48 – Main Spine Line GGL	Hillslope	2064	10%	0%	0	0
49 – Main Spine Line GGL	Hillslope	3234	10%	10%	32	1
50 – Main Spine Line GGL	Hillslope	792	10%	10%	8	1
51 – CU22 WSL, GGL & access	Hillslope	10092	10%	10%	101	1
52 –CU22 & CU31 access	Hillslope	3846	10%	10%	38	1
53 –CU22 & CU31 access	Hillcrest	306	10%	10%	3	1
54 –CU22 & CU31 access	Hillslope	2196	10%	10%	21	1
55 – CU31 WSL & GGL	Hillslope	5856	10%	10%	58	1
56 – CU31 WSL	Hillcrest	492	10%	20%	10	2
57 – VV03 WSL	Hillslope	2034	10%	10%	20	1
58 – VV03 WSL	Hillcrest	168	0%	0%	0	0
59 – VV03 WSL	Hillslope	1092	0%	0%	0	0
60 – VV03 WSL	Hillcrest	210	0%	0%	0	0
61 – VV03 WSL & access	Hillslope	3402	10%	20%	68	2
62 – *Potential access*	Hillcrest	522	0%	0%	0	0
63 – VV03 access	Hillslope	810	0%	0%	0	0

Survey Unit	Landform	Survey Unit area (m²)	Visibility %	Exposure %	Effective Coverage Area (m²)	Effective Coverage %
64 – VV03 access & GGL	Drainage Depression	8700	20%	20%	348	4
65 – VV03 access & GGL	Hillslope	3330	0%	0%	0	0
66 – VV03 access & GGL	Hillslope	3849	80%	80%	2463	64
67 – CU02 GGL	Plain	6702	10%	10%	67	1
68 – CU06 access	Hillslope	1524	10%	10%	15	1
69 – CU02 WSL	Hillslope	2910	10%	10%	29	1

Table 6: Landform Summary – Sampled Areas

Landform	Landform Area (m²)	Area effectively surveyed (m²)	% of Landform Effectively Surveyed	Number of Aboriginal Sites	Number of Artefacts or Features
Hillslope	170749	27437	15	20	2 – Scarred trees 8 – Isolated stone artefacts 8 – Open camp sites
Hillcrest	9786	883	8.5	9	2 – Scarred trees 3 – Isolated stone artefacts 3 – Open camp sites 1 – PAD
Plain	52758	2676	5	8	1 – Scarred tree 3 – Isolated stone artefacts 4 – Open camp sites
Drainage Channel	8700	348	4	4	3 – Open Camp sites 1 - PAD





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9A: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

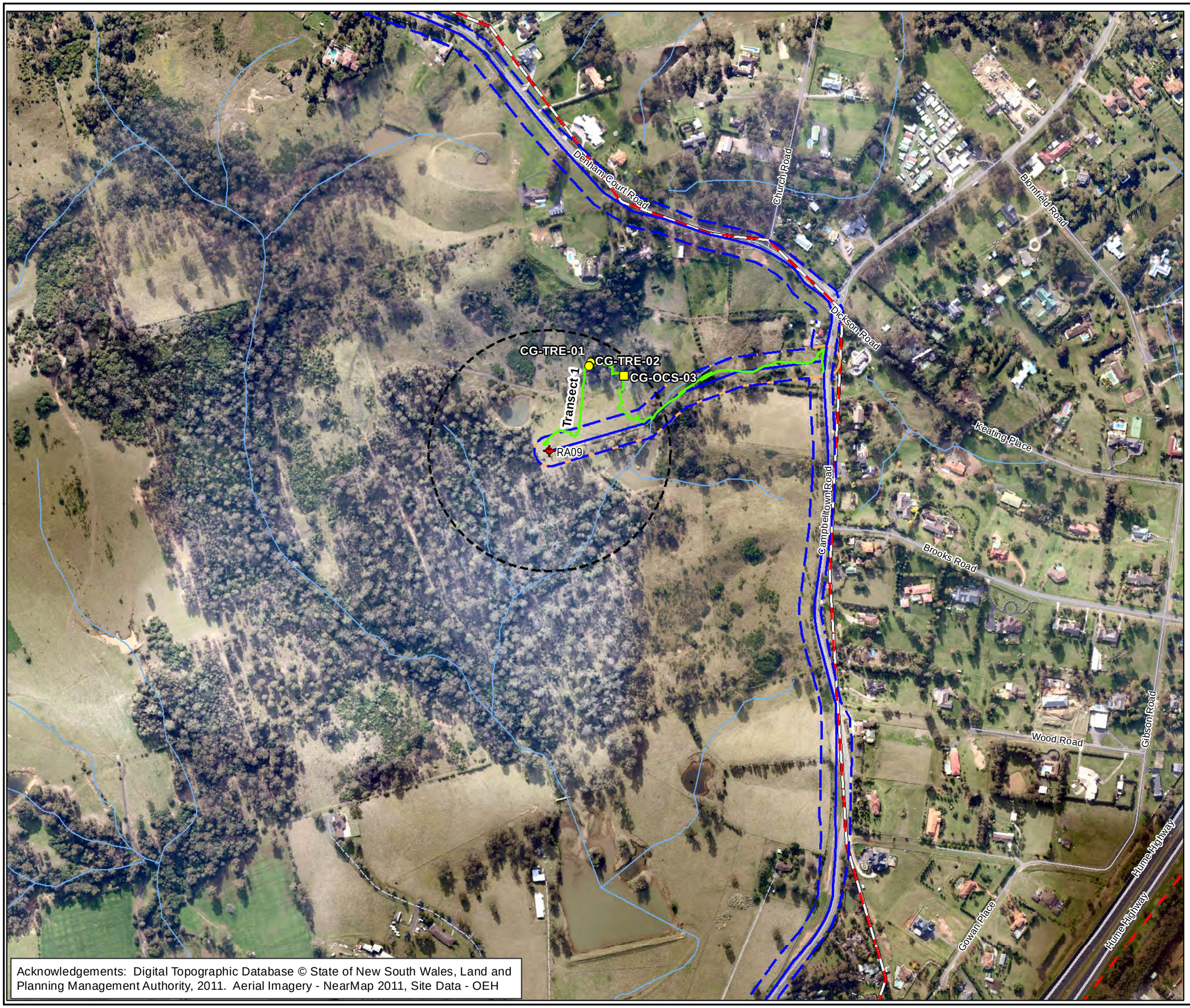
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

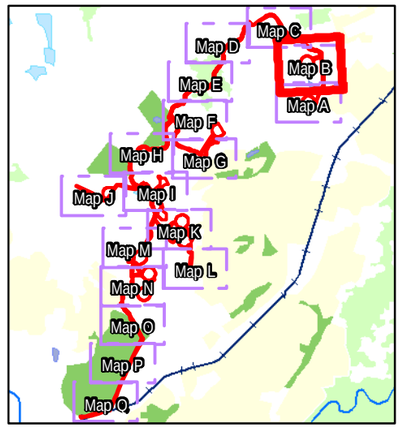
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9B: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

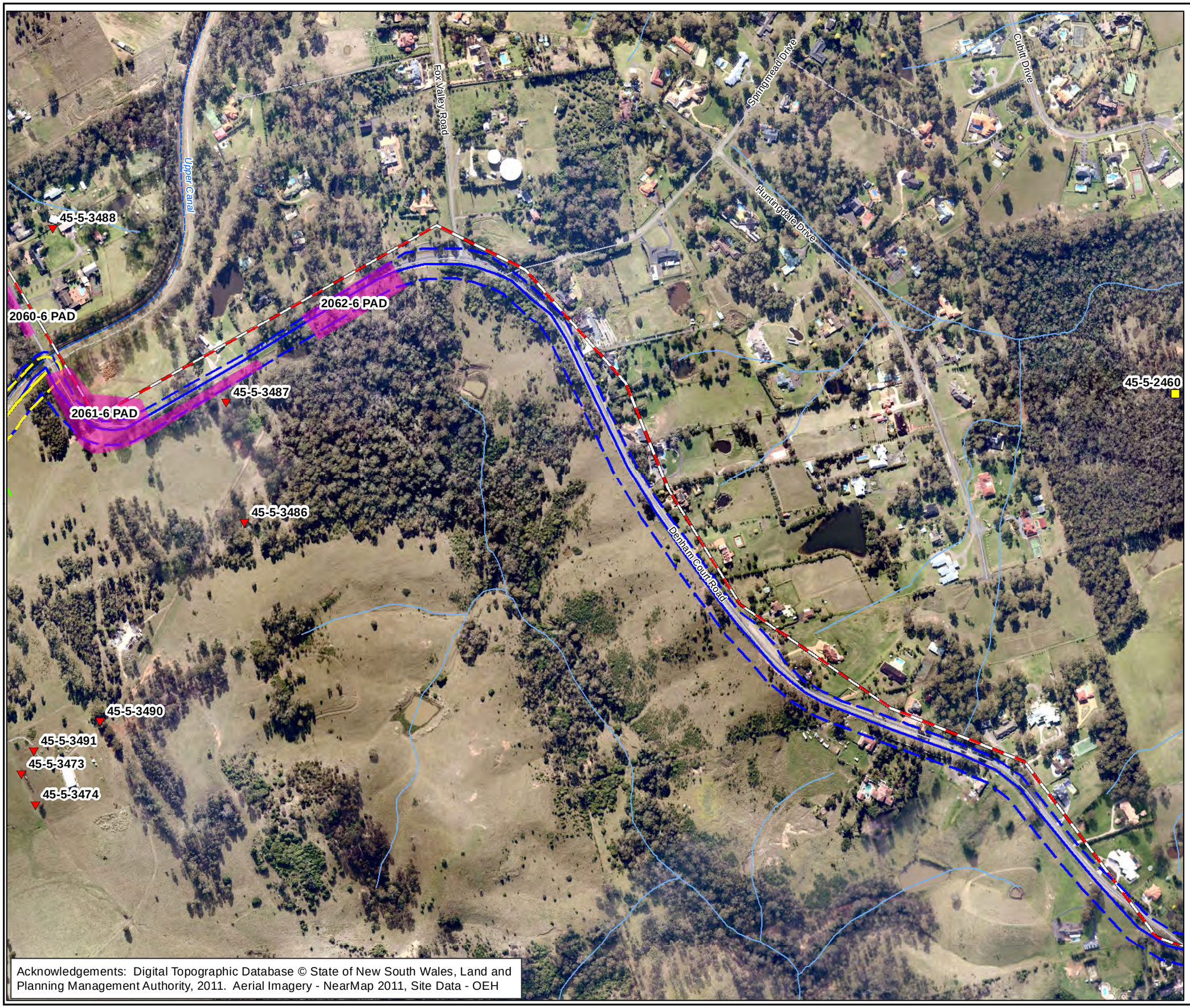
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

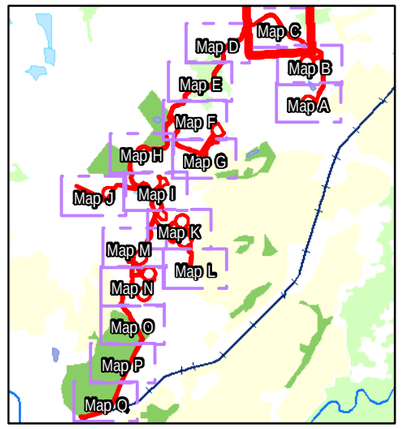
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9C: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

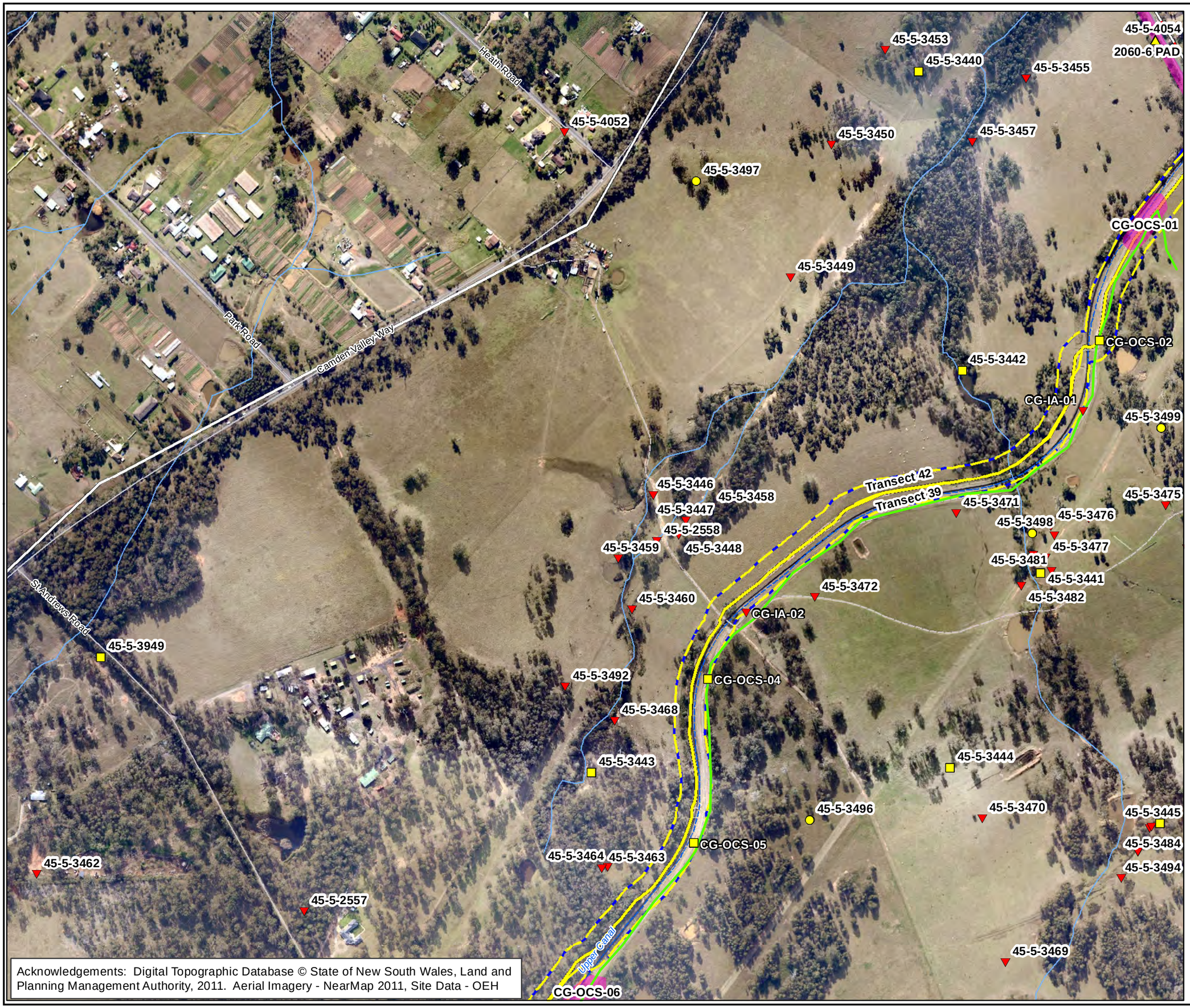
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

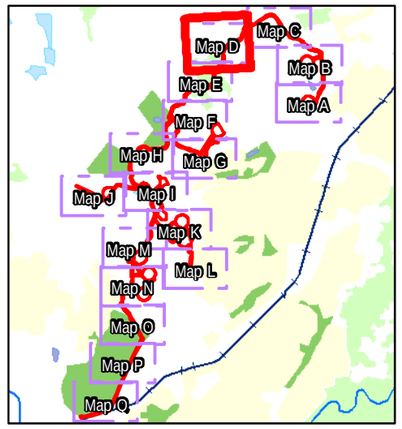
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9D: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

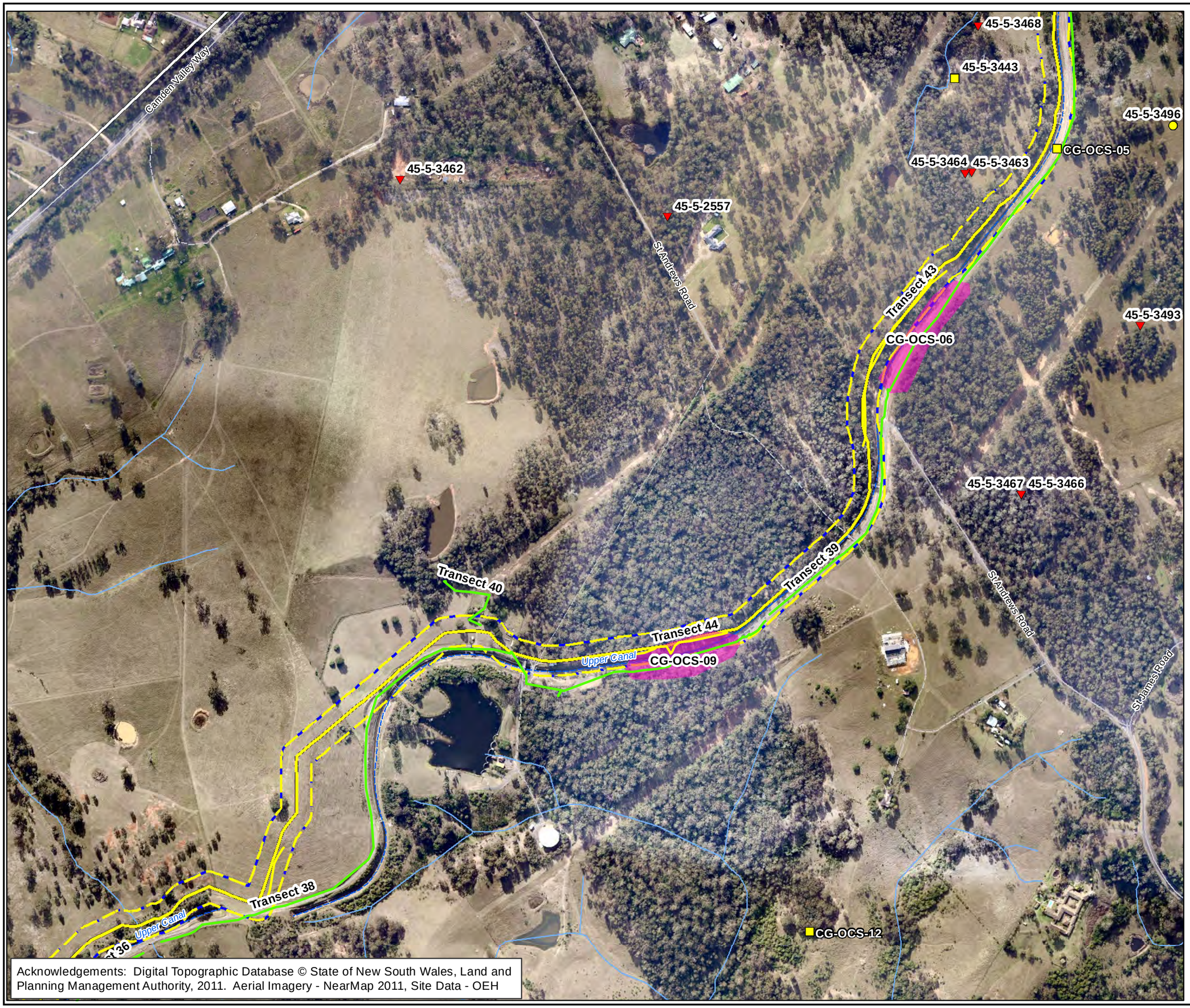
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

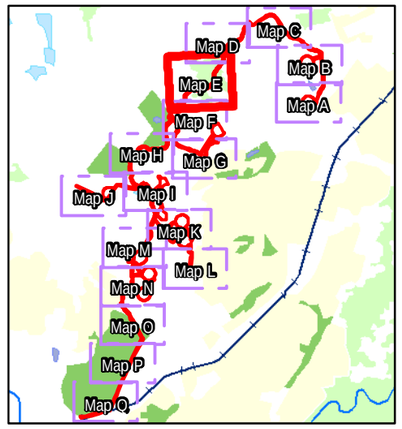
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9E: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

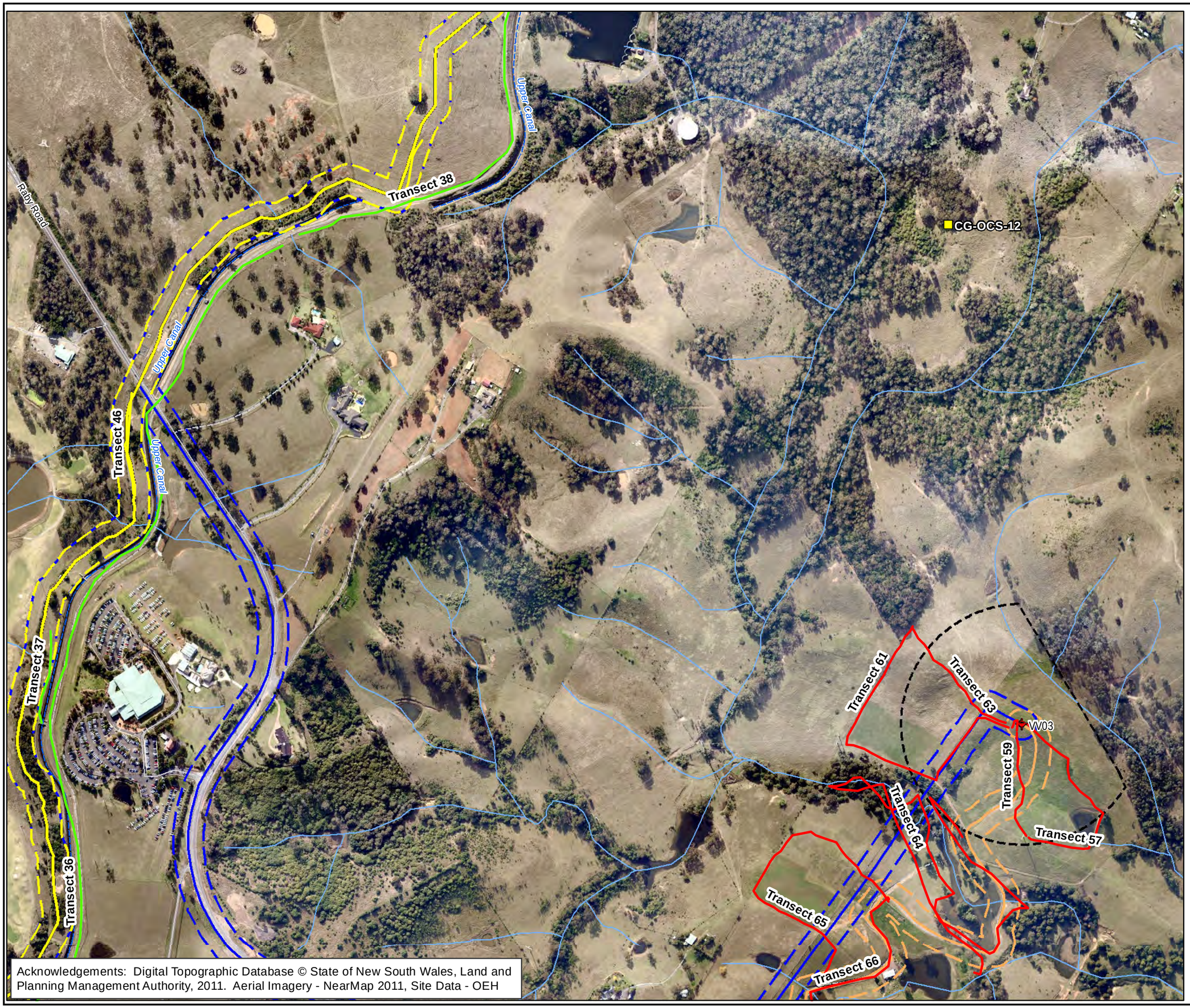
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

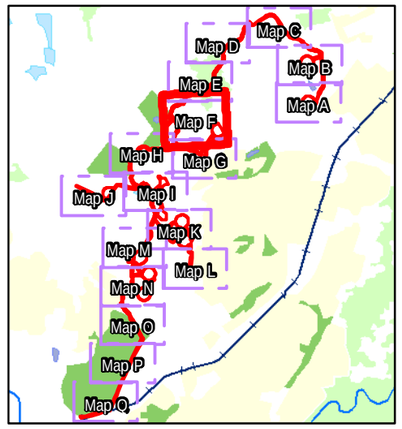
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9F: Survey Coverage

0 50 100 150 200 250

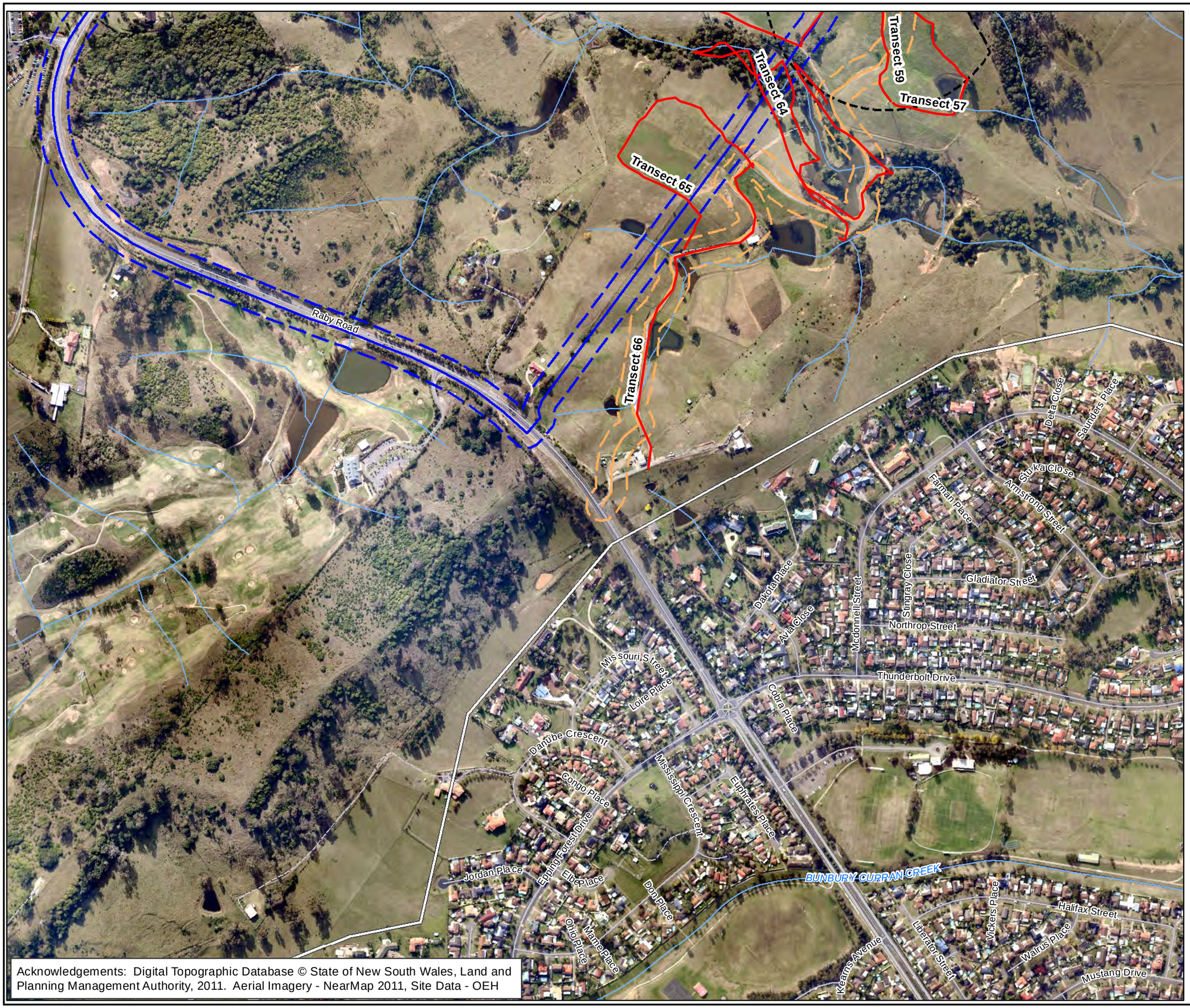
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

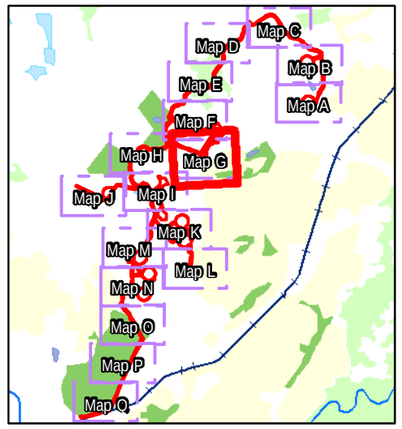
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9G: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

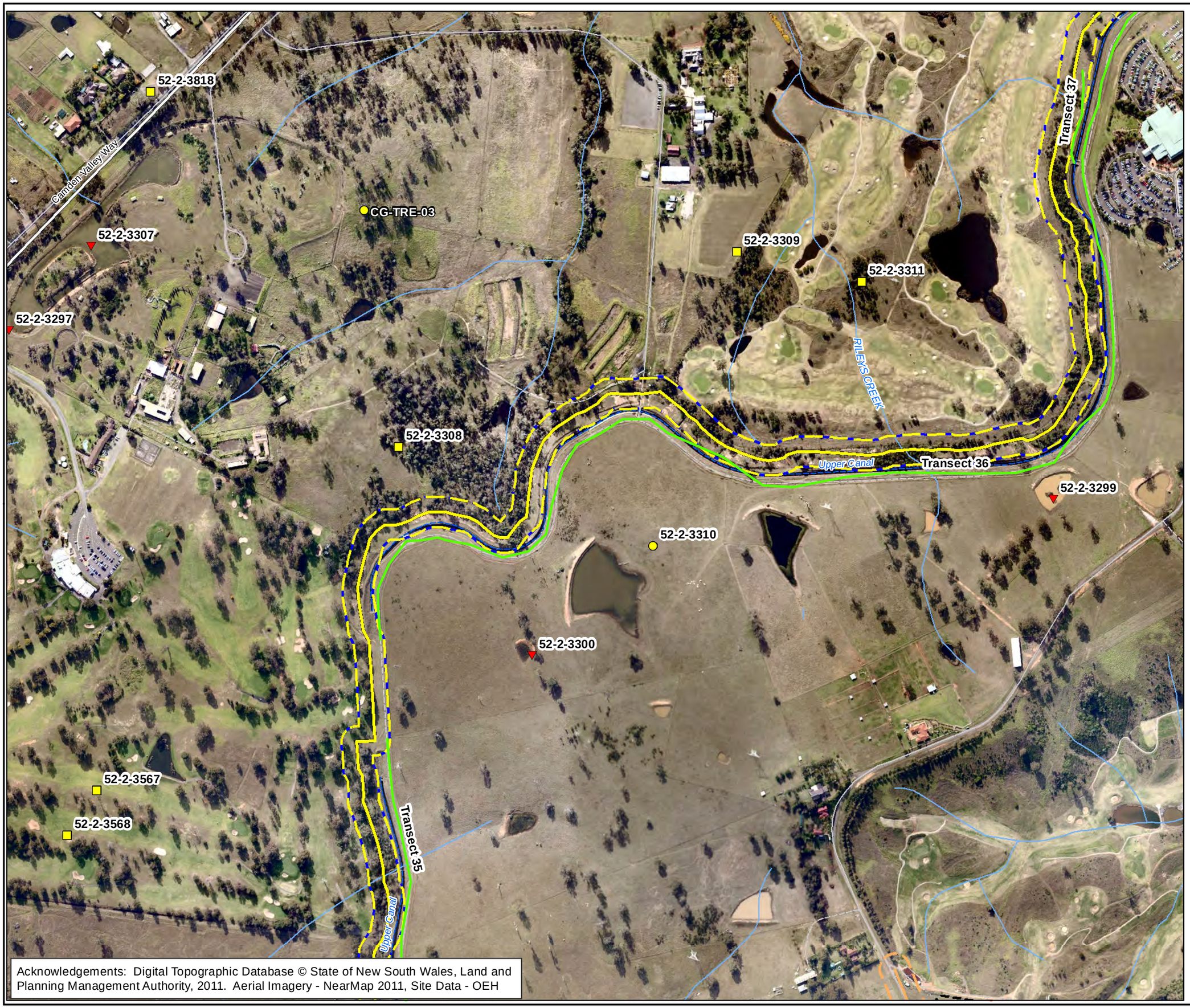
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

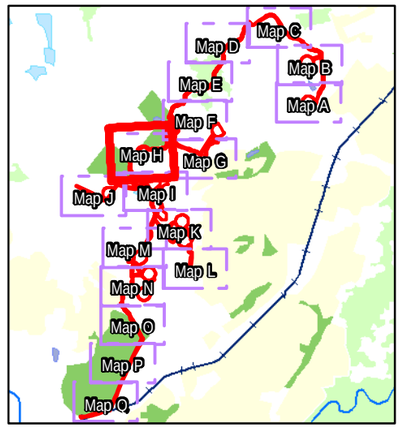
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9H: Survey Coverage

0 50 100 150 200 250

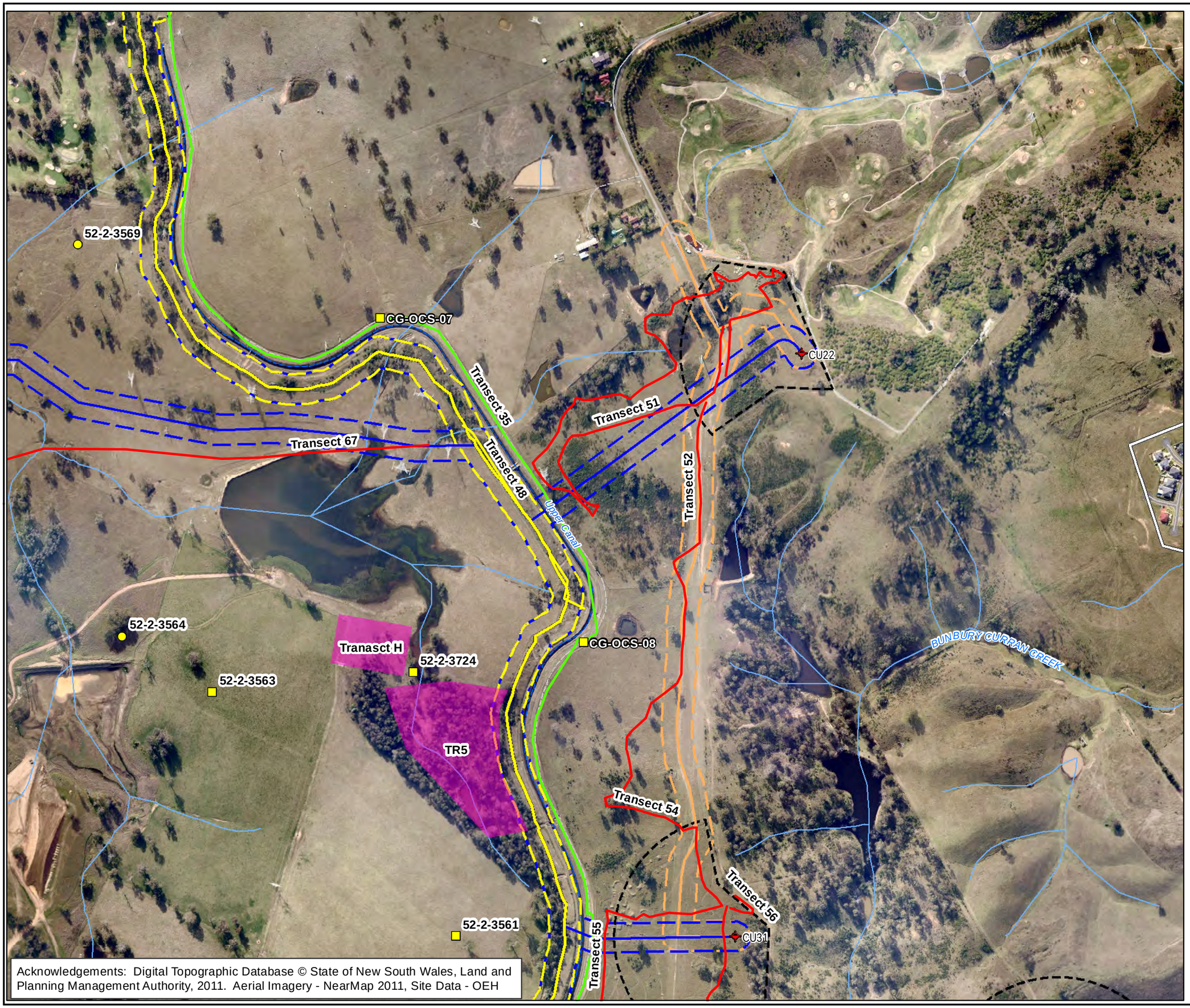
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

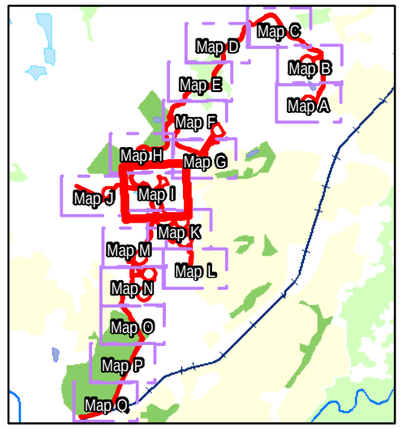
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9I: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

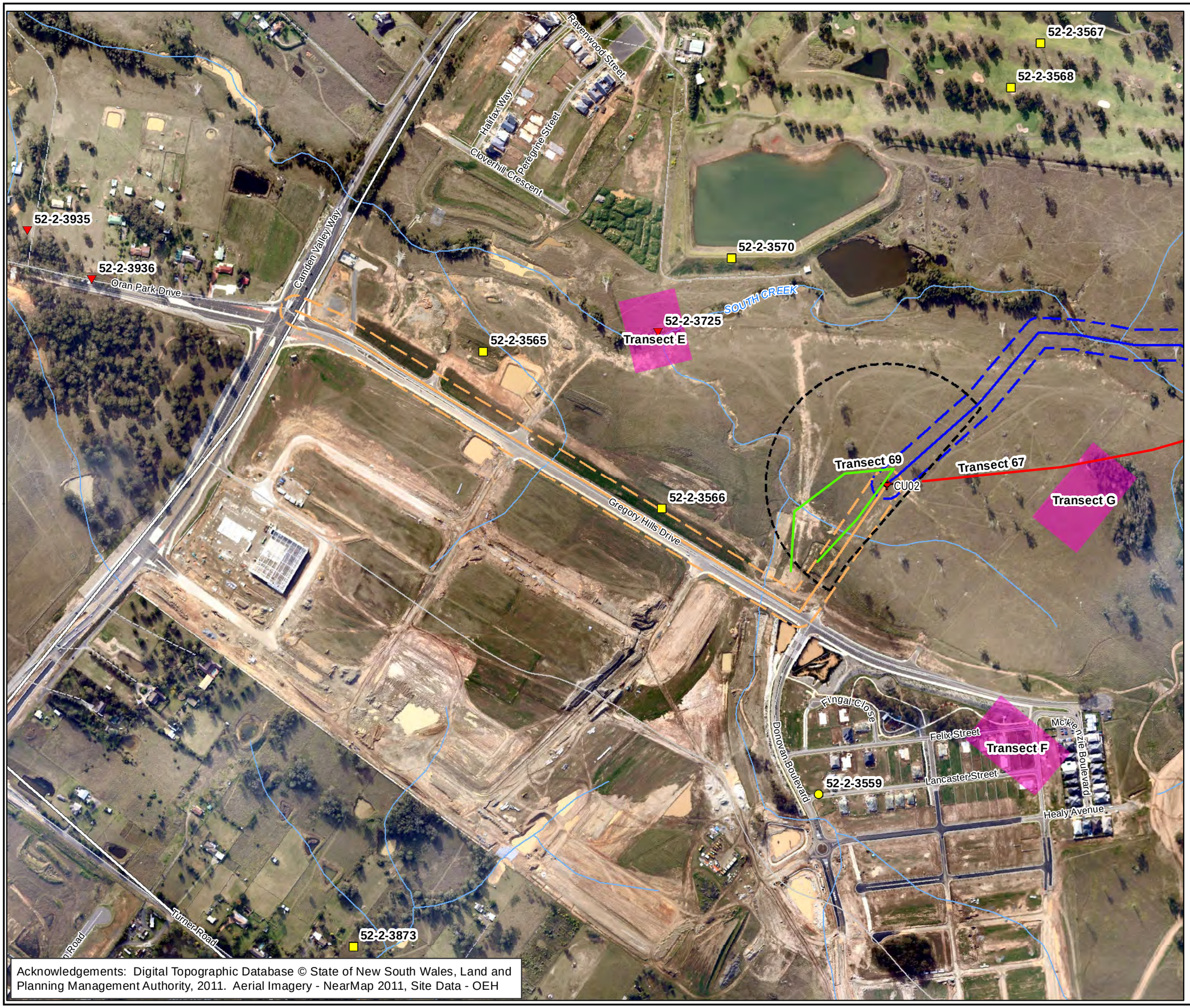
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

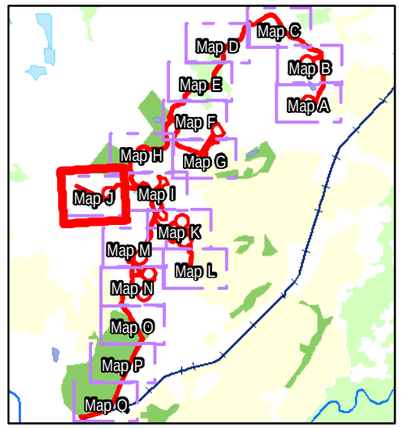
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9J: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

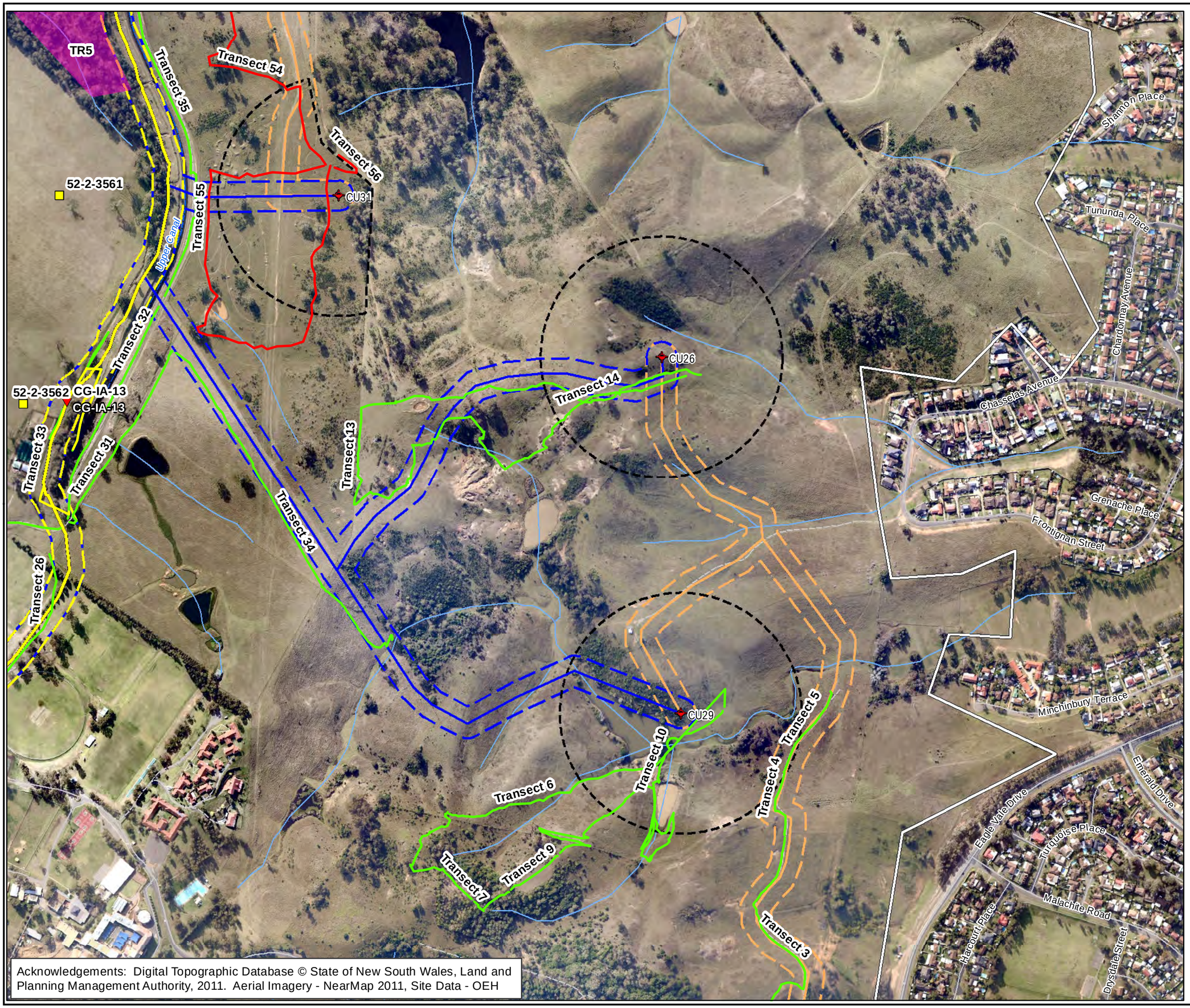
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

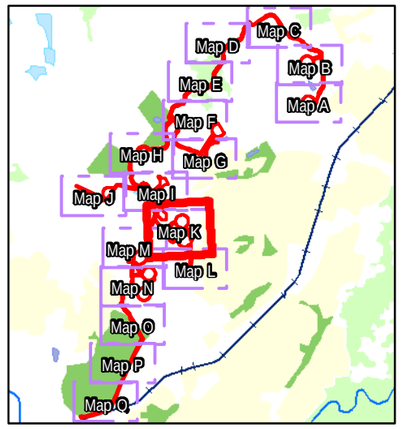
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9K: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

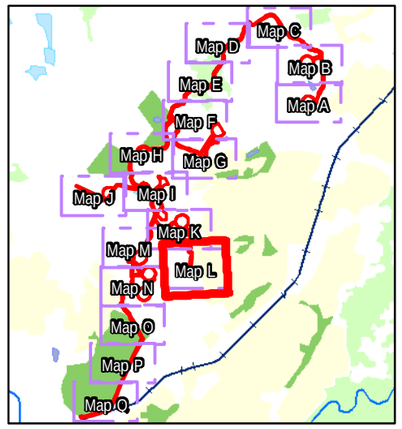
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9L: Survey Coverage

0 50 100 150 200 250

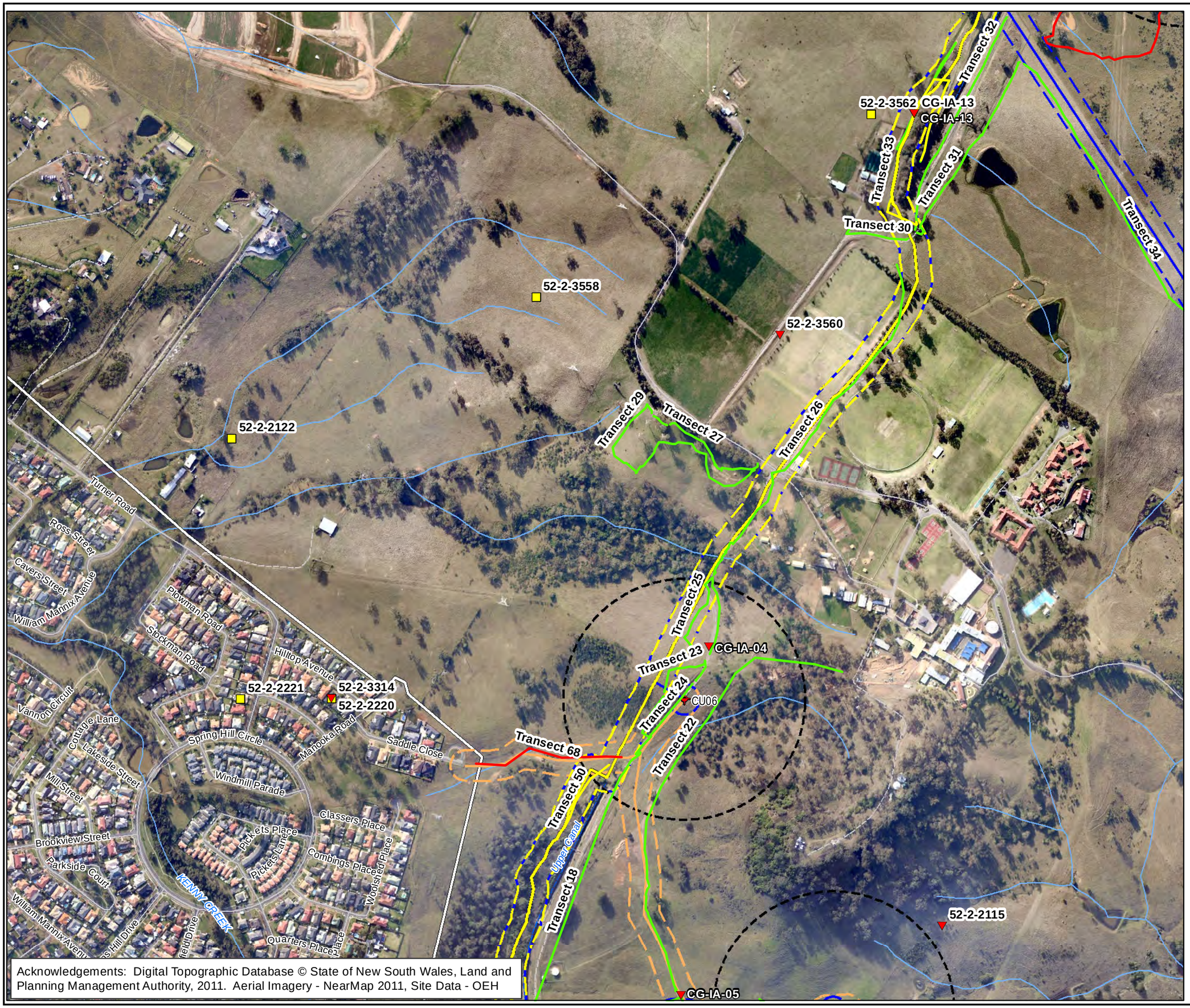
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd



Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9M: Survey Coverage

0 50 100 150 200 250

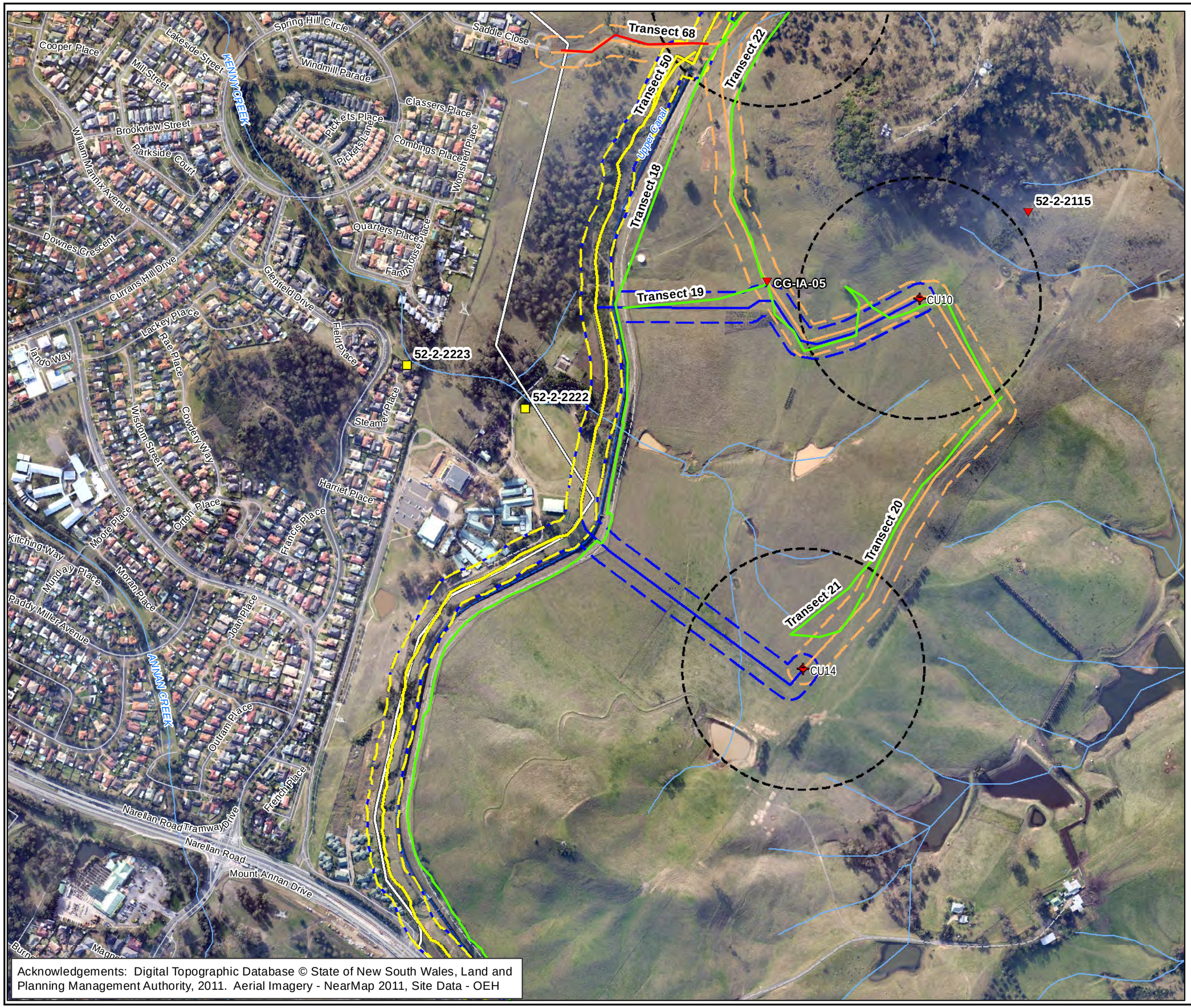
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd



Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9N: Survey Coverage

0 50 100 150 200 250

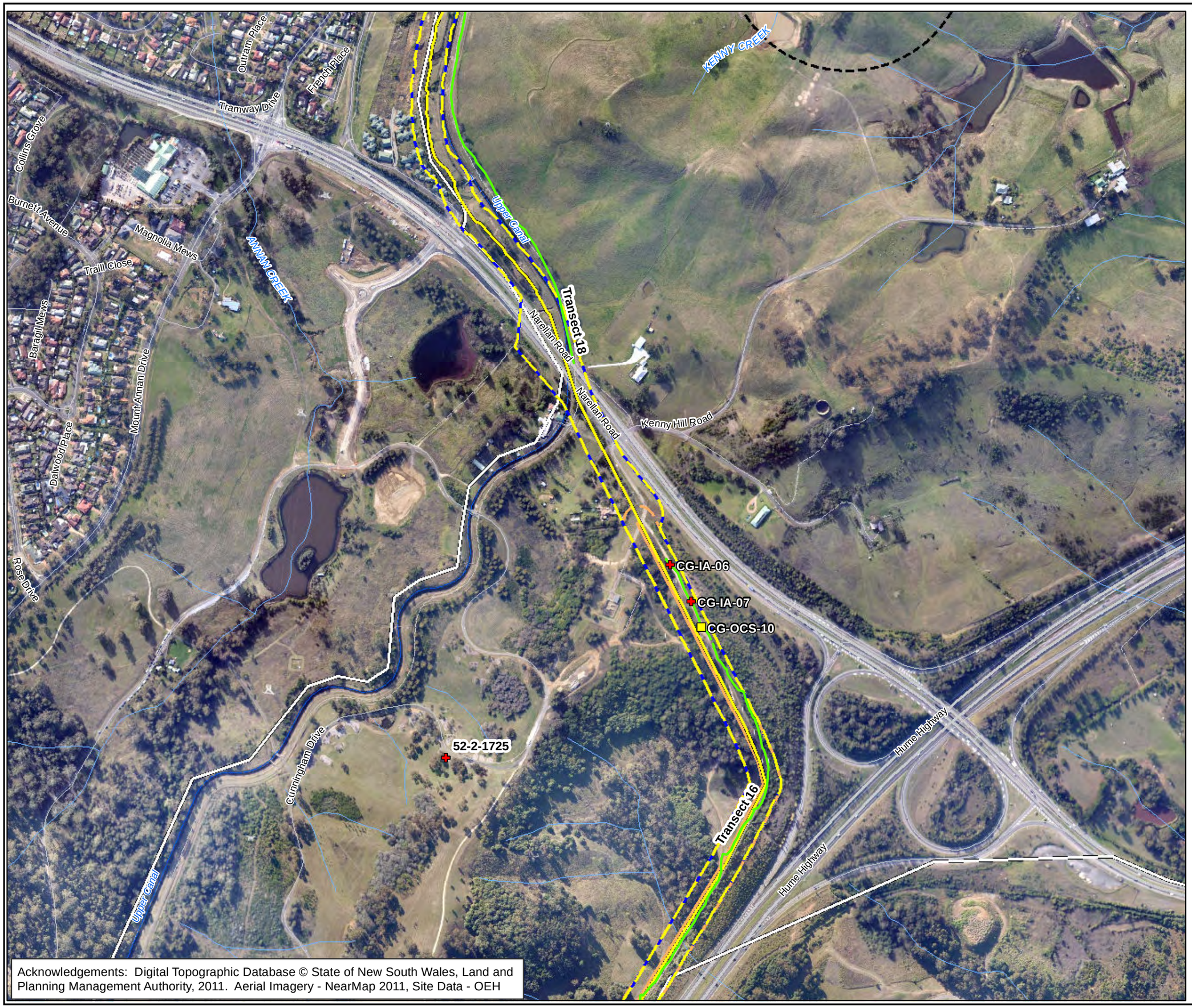
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

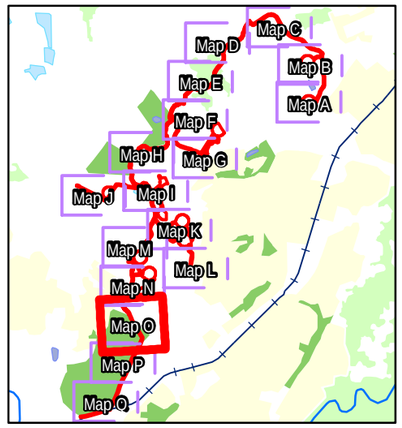
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9O: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

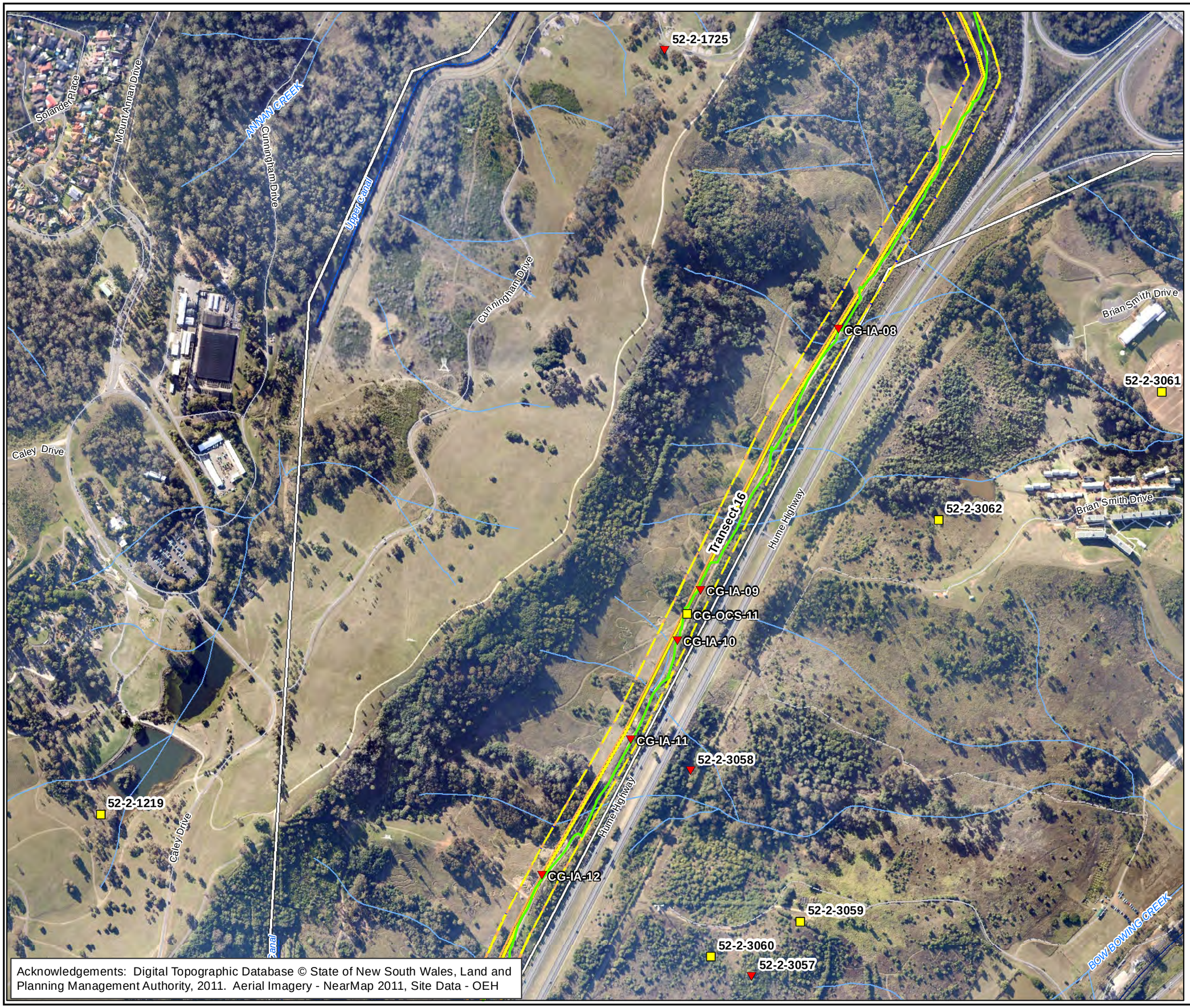
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

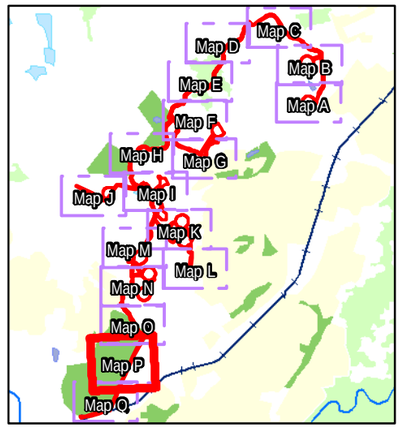
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 26 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\L4975 F9 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9P: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

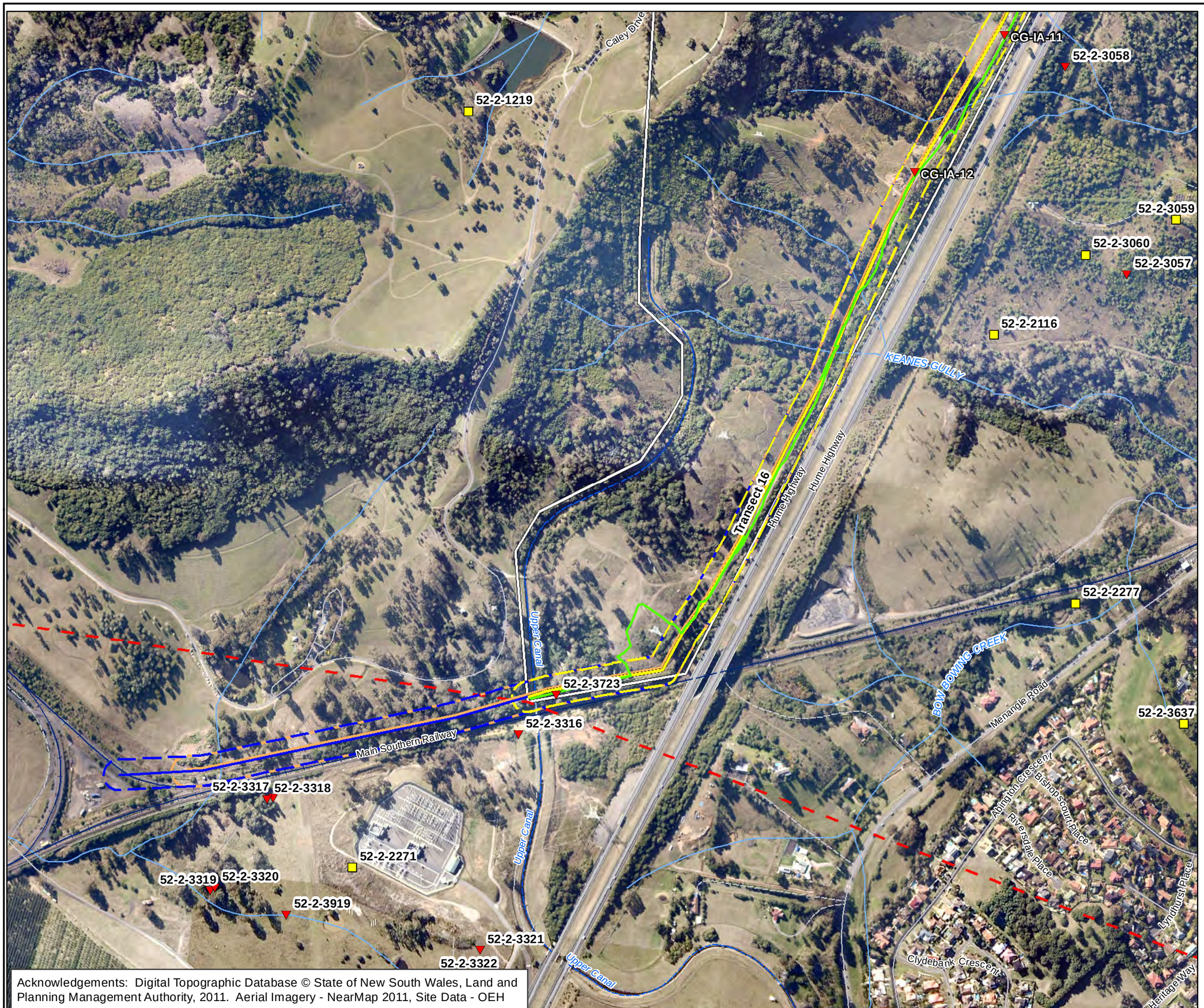
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

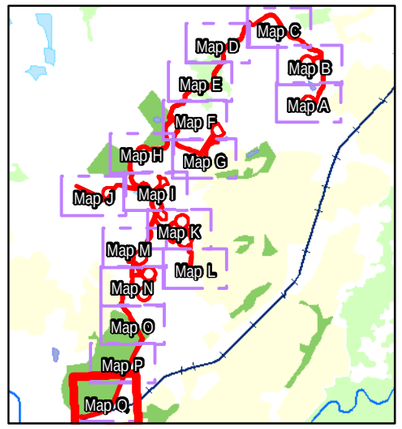
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 9Q: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F9AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

5.0 ANALYSIS AND DISCUSSION

5.1 Archaeological Analysis

Overall, the results of the archaeological survey within the Surface Project Area reflect the predictive modelling for the Cumberland Plain; that the most likely site types to occur are open lithic scatters and isolated artefact occurrences. In addition, a small number of scarred trees were identified. Within the Surface Project Area, the density of artefacts for the majority of open campsite sites was low (no more than three artefacts) with the major exceptions being the newly recorded sites CG-OCS-06, CG-OCS-09 and CG-OCS-10 and the previously recorded TR-5, TR-6, TR-7 and TR-10. In particular the sites with a high density of flaked stone artefacts, the TR series, were located around a natural basin which would likely have been the most reliable source of water in the Surface Project Area. The lack of high density artefact sites in other areas of the Surface Project Area supports White and McDonalds' suggestion that the reliability of water sources influenced past Aboriginal activities in the landscape.

The predominant raw material recorded at new sites was silcrete (69%), although a number of other materials were present, including chert (10%), mudstone (5%), tuff (5%), basalt (3.4%), with minor quantities of quartz, quartzite, petrified wood and chalcedony (1.9%) (Table 7).

Almost all of the sites were considered to be situated within a disturbed context, being that all were located in association with various damaging land use practices within the Surface Project Area. Land use practices, particularly vegetation removal for grazing, were evident throughout the Surface Project Area. Although these surface occurrences have in some way been disturbed, they are an indication of occupation and use of the area.

The disturbances have reduced the likelihood of locating intact archaeological cultural deposits, with no areas of PAD being identified in association with recorded sites. It was deemed that there was adequate ground surface visibility to determine the possibility of further sub-surface cultural material at these sites. Whilst no new PADs were identified, two previously identified PADs were re-assessed. Areas of Aboriginal archaeological sensitivity were identified throughout the Surface Project Area, where there is varying degrees of likelihood for intact sub-surface archaeological deposits.

Table 7: Description of stone artefacts located at each newly recorded Aboriginal archaeological site

Site Name	Material	Artefact Type	Dimensions	Notes
CG-IA-01	Red silcrete	Completed flake	17x12x8.5mm	15% cortex, backed
CG-IA-02	Cream silcrete	Core	23.3 x16x6.5mm	40% cortex – 6 flake scars
CG-IA-03	Quartz	Complete flake	12x6x3mm	Broken in half by stock

Site Name	Material	Artefact Type	Dimensions	Notes
CG-IA-04	Black basalt	Flake piece	33x27x17mm	60% cortex -
CG-IA-05	Tuff	Cortical flake	20x15x9mm	60% cortex – 1 scar
CG-IA-06	Pink silcrete	Distal flake	8x4.6x3.1mm	Broken
CG-IA-07	Red silcrete	Distal flake	16.6x11x2mm	Broken
CG-IA-08	White quartzite	Flake fragment	13x9x2mm	50% cortex
CG-IA-09	Brown chert	Distal flake	17x14x4mm	20% cortex - broken
CG-IA-10	Grey tuff	Core	20x18x4mm	
CG-IA-11	Red silcrete	Distal flake	25x17x4mm	5% cortex
CG-IA-12	Green chalcedony	Complete flake	29x20x20mm	
CG-IA-13	Red silcrete	Complete flake	15x10x5mm	
CG-OCS-01	Grey tuff	Complete flake	22x17x8mm	
	Red silcrete	Scraper	11x10x4mm	20% cortex - backed
CG-OCS-02	Cream silcrete	Core	26x25x18mm	6 scars
	Cream silcrete	Complete flake	19x18x3mm	
	Red silcrete	Scraper - broken	19x14x4mm	
CG-OCS-03	Cream silcrete	Core	22x14x15mm	30% cortex – 6 scars
	Cream silcrete	Distal flake	12x7x9mm	20% cortex – 3 scars
CG-OCS-04	Cream silcrete	Core	26x26x12mm	2 scars
	Red silcrete	Complete flake	16x15x3mm	
	Cream silcrete	Complete flake	23x16x6mm	
CG-OCS-05	Red silcrete	Core		
	Red silcrete	Flake fragment		
CG-OCS-06	Cream mudstone	Complete flake	49x33x14mm	30% cortex
	Red silcrete	Complete flake	39x22x6mm	
	White mudstone	Flake fragment	27x19x8mm	
	Red silcrete	Complete flake	12x12x2mm	
	Red silcrete	Complete flake	24.19x3mm	
	Red silcrete	Complete flake	24x21x5mm	5% cortex
	Red silcrete	Scraper	11x9x3mm	Fine retouch
CG-OCS-07	Yellow mudstone	Broken tool	38x36x10mm	Backed – 5% cortex
	Red silcrete	Core fragment	50x29x16mm	4 scars
CG-OCS-08	Black banded chert	Complete flake	25x18x4mm	

Site Name	Material	Artefact Type	Dimensions	Notes
	Black chert	Flake fragment	22m max	
CG-OCS-09	Red silcrete	Complete flake		
	Red silcrete	Complete flake	16x9x3mm	
	Grey silcrete	Core	25x18x8mm	4 scars
	Red silcrete	Complete flake	26x17x5mm	
	Red silcrete	Backed blade	18x17x4mm	
	Grey silcrete	Complete flake	17x4x4mm	
	Red silcrete	Distal flake		
CG-OCS-10	Grey basalt	Flake fragment	29x19x10mm	50% cortex
	Cream chert	Proximal flake	13x19x13mm	
	Grey chert	Core	24x22x14mm	4 scars
	Caramel chert	Flake fragment	31x19x14mm	
	Pink silcrete	Flake fragment	31x13x8mm	
	Pink silcrete	Core	23x22x13mm	60% cortex – 4 scars
	Red silcrete	Flake fragment	13x13x3mm	50% cortex
	Grey silcrete	Flake fragment	15x13x6mm	10% cortex
CG-OCS-11	Red silcrete	Flake fragment	11x4x1mm	
	Red silcrete	Core	33x30x12mm	5 scars
CG-OCS-12	Red silcrete	Core	23x18x16mm	2 scars
	Red silcrete	Distal flake	22x15x11mm	30% cortex – 2 scars
	Red silcrete	Proximal flake	23x13x9mm	50% cortex – 2 scars
	Red silcrete	Distal flake	11x10x4mm	20% cortex – 5 scars
	Grey petrified wood	Distal flake	8x4x3mm	

Where deposits are deeper and not impacted by shallow surface disturbances, subsurface cultural material will remain in situ. The majority of these areas are located on upper slopes and crests of hills and ridges, and along creeks and drainage features.

While no definitive interpretation of the archaeology of the Surface Project Area can be made, the identification and nature of known Aboriginal archaeological sites will aid in further refining the overall archaeological modelling of the Cumberland Plain.

6.0 SCIENTIFIC VALUES AND SIGNIFICANCE ASSESSMENT

The two main values addressed when assessing the significance of Aboriginal sites are cultural values to the Aboriginal community and archaeological (scientific) values. This report will assess scientific values while the Aboriginal Cultural Heritage Assessment Report will detail the cultural values of Aboriginal sites in the Surface Project Area.

6.1 Introduction to the Assessment Process

Heritage assessment criteria in NSW fall broadly within the significance values outlined in the Australia ICOMOS Burra Charter (Australia ICOMOS 1999). This approach to heritage has been adopted by cultural heritage managers and government agencies as the set of guidelines for best practice heritage management in Australia. These values are provided as background and include:

- **Historical significance** (evolution and association) refers to historic values and encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment.

- **Aesthetic significance** (Scenic/architectural qualities, creative accomplishment) refers to the sensory, scenic, architectural and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.

- **Social significance** (contemporary community esteem) refers to the spiritual, traditional, historical or contemporary associations and attachment that the place or area has for the present-day community. Places of social significance have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be determined through consultative processes with local communities.

- **Scientific significance** (Archaeological, industrial, educational, research potential and scientific significance values) refers to the importance of a landscape, area, place or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place or

object and will consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

The cultural and archaeological significance of Aboriginal and historic sites and places is assessed on the basis of the significance values outlined above. As well as the ICOMOS Burra Charter significance values guidelines, various government agencies have developed formal criteria and guidelines that have application when assessing the significance of heritage places within NSW. Of primary interest are guidelines prepared by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities, the OEH and the Heritage Branch, NSW Department of Planning and Infrastructure. The relevant sections of these guidelines are presented below.

These guidelines state that an area may contain evidence and associations which demonstrate one or any combination of the ICOMOS Burra Charter significance values outlined above in reference to Aboriginal heritage. Reference to each of the values should be made when evaluating archaeological and cultural significance for Aboriginal sites and places.

In addition to the previously outlined heritage values, the *OEH Guidelines* (DECC 2006) also specify the importance of considering cultural landscapes when determining and assessing Aboriginal heritage values. The principle behind a cultural landscape is that 'the significance of individual features is derived from their inter-relatedness within the cultural landscape'. This means that sites or places cannot be 'assessed in isolation' but must be considered as parts of the wider cultural landscape. Hence the site or place will possibly have values derived from its association with other sites and places. By investigating the associations between sites, places, and (for example) natural resources in the cultural landscape the stories behind the features can be told. The context of the cultural landscape can unlock 'better understanding of the cultural meaning and importance' of sites and places.

Although other values may be considered – such as educational or tourism values – the two principal values that are likely to be addressed in a consideration of Aboriginal sites and places are the cultural/social significance to Aboriginal people and their archaeological or scientific significance to archaeologists. The determinations of archaeological and cultural significance for sites and places should then be expressed as statements of significance that preface a concise discussion of the contributing factors to Aboriginal cultural heritage significance.

6.2 Archaeological (Scientific Significance) Values

Archaeological significance (also called scientific significance, as per the ICOMOS Burra Charter) refers to the value of archaeological objects or sites as they relate to research questions that are of importance to the archaeological community, including indigenous communities, heritage managers and academic archaeologists. Generally the value of this type of significance is determined on the basis of the potential for sites and objects to provide information regarding the past life-ways of people (Burke and Smith 2004: 249, NPWS

1997b). For this reason, the NPWS (part of DECCW) summarises the situation as 'while various criteria for archaeological significance assessment have been advanced over the years, most of them fall under the heading of archaeological research potential' (NPWS 1997b: 26). The NPWS criteria for archaeological significance assessment are based largely on the ICOMOS Burra Charter.

Research Potential

Research potential is assessed by examining site content and site condition. Site content refers to all cultural materials and organic remains associated with human activity at a site. Site content also refers to the site structure – the size of the site, the patterning of cultural materials within the site, the presence of any stratified deposits and the rarity of particular artefact types. As the site contents criterion is not applicable to scarred trees, the assessment of scarred trees is outlined separately below. Site condition refers to the degree of disturbance to the contents of a site at the time it was recorded.

The site contents ratings used for archaeological sites are:

> 0 - No cultural material remaining.
>
> 1 - Site contains a small number (e.g. 0–10 artefacts) or limited range of cultural materials with no evident stratification.
>
> 2 - Site contains a larger number, but limited range of cultural materials; and/or some intact stratified deposit remains; and/or are or unusual example(s) of a particular artefact type.
>
> 3 - Site contains a large number and diverse range of cultural materials; and/or largely intact stratified deposit; and/or surface spatial patterning of cultural materials that still reflect the way in which the cultural materials were deposited.

The site condition ratings used for archaeological sites are:

> 0 - Site destroyed.
>
> 1 - Site in a deteriorated condition with a high degree of disturbance; lack of stratified deposits; some cultural materials remaining.
>
> 2 - Site in a fair to good condition, but with some disturbance.
>
> 3 - Site in an excellent condition with little or no disturbance. For surface artefact scatters this may mean that the spatial patterning of cultural materials still reflects the way in which the cultural materials were laid down.

Pearson and Sullivan note that Aboriginal archaeological sites are generally of high research potential because 'they are the major source of information about Aboriginal prehistory' (1995: 149). Indeed, the often great time depth of Aboriginal archaeological sites gives them research value from a global perspective, as they are an important record of humanity's history. Research potential can also refer to specific local circumstances in space and time – a site may have particular characteristics (well preserved samples for absolute dating, or a series

of refitting artefacts, for example) that mean it can provide information about certain aspects of Aboriginal life in the past that other less or alternatively valuable sites may not (Burke and Smith 2004: 247-8). When determining research potential value particular emphasis has been placed on the potential for absolute dating of sites.

The following sections provide statements of significance for the Aboriginal archaeological sites recorded during the sub-surface testing for the assessment. The significance of each site follows the assessment process outlined above. This includes a statement of significance based on the categories defined in the Burra Charter. These categories include social, historic, scientific, aesthetic and cultural (in this case archaeological) landscape values. Nomination of the level of value—high, moderate, low or not applicable—for each relevant category is also proposed. Where suitable the determination of cultural (archaeological) landscape value is applied to both individual sites and places (to explore their associations) and also, to the Surface Project Area as a whole. The nomination levels for the archaeological significance of each site are summarised below.

Representativeness

Representativeness refers to the regional distribution of a particular site type. Representativeness is assessed by whether the site is common, occasional, or rare in a given region. Assessments of representativeness are subjectively biased by current knowledge of the distribution and number of archaeological sites in a region. This varies from place to place depending on the extent of archaeological research. Consequently, a site that is assigned low significance values for contents and condition, but a high significance value for representativeness, can only be regarded as significant in terms of knowledge of the regional archaeology. Any such site should be subject to re-assessment as more archaeological research is undertaken.

Assessment of representativeness also takes into account the contents and condition of a site. For example, in any region there may only be a limited number of sites of any type that have suffered minimal disturbance. Such sites would therefore be given a high significance rating for representativeness, although they may occur commonly within the region.

The representativeness ratings used for archaeological sites are:

1 - common occurrence

2 - occasional occurrence

3 - rare occurrence

Overall scientific significance ratings for sites, based on a cumulative score for site contents, site integrity and representativeness are:

1-3 low scientific significance

4-6 moderate scientific significance

7-9 high scientific significance

Each site is given a score on the basis of these criteria – the overall scientific significance is determined by the cumulative score. This scoring procedure has been applied to the Aboriginal archaeological sites identified during the sub-surface testing. The results are in Table 10.

6.2.1 Statements of Archaeological Significance

The following archaeological significance assessment is based on Requirement 11 of the *Code of practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010). Using the assessment criteria detailed in Scientific Values and Significance Assessment, an assessment of significance was determined and a rating for each site was determined. The results of the archaeological significance assessment are given in Table 8 below.

In general sites rated of low scientific significance in Table 8 have small amount of artefactual material, are in poor or disturbed condition and are common sites in the wider region. CG-OCS-06 is of moderate scientific significance due to large amount and range of artefactual material present and potential for archaeological deposits despite disturbance to these sites, they are still common within the wider region.

Table 8: Scientific significance assessment of archaeological sites recorded within the Surface Project Area.

Site Name	Site Content	Site Condition	Representativeness	Scientific Significance
PAD 2061-6 (45-5-4054)	1	1	1	Low
PAD 2062-6 (45-5-4055)	1	1	1	Low
CG-IA-16 (52-2-3723)	1	1	1	Low
CG-IA-01 (52-2-3736)	1	1	1	Low
CG-IA-02 (52-2-3780)	1	1	1	Low
CG-IA-03 (52-2-3781)	1	1	1	Low
CG-IA-04 (52-2-3737)	1	1	1	Low
CG-IA-05 (52-2-3738)	1	1	1	Low
CG-IA-06 (52-2-3739)	1	1	1	Low
CG-IA-07 (52-2-3740)	1	1	1	Low
CG-IA-08 (52-2-3741)	1	1	1	Low
CG-IA-09 (52-2-3742)	1	1	1	Low
CG-IA-10 (52-2-3743)	1	1	1	Low
CG-IA-11 (52-2-3744)	1	1	1	Low
CG-IA-12 (52-2-3745)	1	1	1	Low

Site Name	Site Content	Site Condition	Representativeness	Scientific Significance
CG-IA-13	1	1	1	Low
CG-OCS-01 (52-2-3782)	1	1	1	Low
CG-OCS-02 (52-2-3783)	1	1	1	Low
CG-OCS-03 (52-2-3784)	1	1	1	Low
CG-OCS-04 (52-2-3785)	1	1	1	Low
CG-OCS-05 (52-2-3786)	1	1	1	Low
CG-OCS-06 (52-2-3792)	2	1	1	Moderate
CG-OCS-09 (52-2-3788)	1	1	1	Low
CG-OCS-10 (52-2-3748)	1	1	1	Low
CG-OCS-11 (52-2-3749)	1	1	1	Low
CG-TRE-01 (52-2-3790)	1	1	1	Low
CG-TRE-02 (52-2-3791)	1	1	1	Low

7.0 IMPACT ASSESSMENT

The following impact assessment will aim to identify any potential harm to identified Aboriginal archaeological sites arising from the Amended Project, assess such potential impacts and determine the appropriate mitigation and management measures for these potential impacts.

7.1 Predicted Physical Impacts

A number of Aboriginal archaeological sites, areas of PAD and areas of high and moderate Aboriginal archaeological sensitivity have been identified within the current Project Envelope (see Figure 10 series). Where possible, areas of greatest environmental constraint will be avoided (i.e. identified archaeological sites and areas of high and moderate sensitivity) and an "Envelope" approach (see Section 1.2) to the assessment has been undertaken in order to allow flexibility for avoidance of environmental constraints during construction.

The main disturbance at most WSLs will be earthworks undertaken for the drilling and establishment of wells and cut and fill for finished levels to construct the wells and associated infrastructure. The area of disturbance for the establishment of a drilling compound is estimated at up to 1 ha within the approximate 12.5 ha of a WSL.

Construction and establishment of GGLs, the main spine and access tracks will involve earthworks within narrow construction footprints. In addition to the trenches there will be some disturbance for machinery and vehicle access. Design of the Main Gas Gathering Spine, GGL network and access tracks has considered alignments through previously disturbed areas wherever possible and under boring of some areas.

Where practicable, existing farm vehicle tracks will typically be used as access roads for the construction and maintenance of GGLs and WSL. Artefacts recorded on existing tracks are considered to be in a disturbed state as a result of the constant vehicle traffic, stock movement and natural erosion. Continued use of these existing tracks, as they are, will not greatly compromise the already disturbed archaeological integrity of those sites located along existing tracks. The use of existing tracks is therefore a preferred scenario to constructing tracks in areas that have not been previously disturbed and potentially impacting on intact archaeological remains. If, however, existing tracks require upgrade or widening into areas that are not previously disturbed, there is the potential to impact on intact archaeological remains. Defined areas of archaeological sensitivity indicate areas of sensitivity that indicate various levels of potential for such intact cultural material.

Due to the localised and temporary nature of the proposed works it is unlikely that a significant impact would occur to Aboriginal archaeological sites or landscape values across this part of the Cumberland Plain compared with other large scale development approvals within the region. Table 9 identifies those Aboriginal archaeological sites and PADs that fall within the Project Envelope.

Table 9: Aboriginal archaeological sites and areas of Aboriginal archaeological sensitivity in the Project Envelope

Project Component	Sites Located Within Project Envelopes'
Main Spine Line GGL	CG-IA-01, CG-IA-02, CG-IA-06, CG-IA-07, CG-IA-08, CG-IA-09, CG-IA-10, CG-IA-11, CG-IA-12, CG-IA-13, CG-IA-16, CG-OCS-01, CG-OCS-02, CG-OCS-04, CG-OGS-05, CG-OCS-06, CG-OCS-09 CG-OCS-10, CG-OCS-11, PAD2061-6 and PAD2062-6. Areas of high and moderate Aboriginal archaeological sensitivity
RA03 WSL & access track	CG-IA-03
RA09 WSL	CG-OCS-03, CG-TRE-01 and CG-TRE-02 Areas of high and moderate Aboriginal archaeological sensitivity
VV03 WSL, GGL and access track	No sites or areas of Aboriginal archaeological sensitivity
CU22 WSL & GGL	No sites or areas of Aboriginal archaeological sensitivity
CU02 WSL, and access track	Areas of moderate Aboriginal archaeological sensitivity subsequently tested by AECOM (2009) and demonstrated to have artefacts.
GGL between Main Spine Line GGL & CU02	Areas of moderate Aboriginal archaeological sensitivity subsequently tested by AECOM (2009) and demonstrated to have artefacts.
Access track between CU22 and CU31	No sites or areas of Aboriginal archaeological sensitivity
CU31 WSL & GGL	No sites or areas of Aboriginal archaeological sensitivity
GGL between CU26, CU29 and Main Spine Line	Areas of moderate Aboriginal archaeological sensitivity
CU26 WSL	Areas of moderate and high Aboriginal archaeological sensitivity
CU29 WSL	Areas of moderate Aboriginal archaeological sensitivity
Access track to CU26 and CU29	CG-TRE-04 Areas of moderate and high Aboriginal archaeological sensitivity
Access track to CU06, CU10 and CU14	CG-IA-05 Areas of moderate Aboriginal archaeological sensitivity
CU06 WSL	CG-IA-04 Areas of moderate Aboriginal archaeological sensitivity
CU10 WSL & GGL	CG-IA-05 Areas of moderate Aboriginal archaeological sensitivity
CU14 WSL & GGL	Areas of moderate Aboriginal archaeological sensitivity

7.2 Avoidance and Mitigation Considerations

Ideally, heritage management involves conservation of sites through the preservation and conservation of fabric and context within a framework of "*doing as much as necessary, as little as possible*" (Marquis-Kyle and Walker 1992: 13). In cases where conservation is not practical, several options for management are available. For sites, management often involves the salvage of features or artefacts, retrieval of information through excavation or collection (especially where impact cannot be avoided) and interpretation.

Of the 28 Aboriginal sites located inside the Project Envelope (see Table 9), the construction footprint can be micro-sited within the Project Envelope to avoid harm to 24 sites (see Table 10). In addition to micro-siting the construction footprint in the Project Envelope, the location of Aboriginal sites and areas of Aboriginal archaeological sensitivity should be clearly marked and identified to construction personnel to ensure that they are avoided. Marking is best undertaken by using above ground temporary fencing which is clearly visible and provides a physical barrier to construction equipment.

Table 10: Impact avoidance and management measures for Aboriginal archaeological sites and areas of Aboriginal archaeological sensitivity in the Project Envelope

Project Component	Sites Located Within Project Envelopes'	Impact avoidance and management measures
Main Spine Line GGL	CG-IA-01	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-02	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-06	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-07	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-08	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-09	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-10	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-11	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-12	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-IA-13	Microsite GGL and access track to avoid site. Fence site during construction.

Project Component	Sites Located Within Project Envelopes'	Impact avoidance and management measures
	CG-1A-16	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OCS-01	Site is unable to be avoided, collection and relocation of artefacts within the site boundary. Fence site outside of construction footprint during construction to minimise harm.
	CG-OCS-04	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OCS-02	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OGS-05	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OCS-06	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OCS-09	Site is unable to be avoided, collection and relocation of artefacts within the site boundary. Fence site outside of construction footprint during construction to minimise harm.
	CG-OCS-10	Microsite GGL and access track to avoid site. Fence site during construction.
	CG-OCS-11	Microsite GGL and access track to avoid site. Fence site during construction.
	PAD 2061-6	Site is unable to be avoided, archaeological excavation required.
	PAD 2062-6	Site is unable to be avoided, archaeological excavation required.
	Areas of high and moderate Aboriginal archaeological sensitivity	Microsite GGL and access track to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
RA03 WSL & access track	CG-IA-03	Microsite WSL to avoid site. Fence site during construction.
RA09 WSL	CG-OCS-03	Microsite WSL to avoid site. Fence site during construction.
	CG-TRE-01	Microsite WSL to avoid site. Fence site during construction.
	CG-TRE-02	Microsite WSL to avoid site. Fence site during construction.
	Areas of high and moderate Aboriginal archaeological sensitivity	Microsite WSL to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
VV03 WSL, GGL and access track	No sites or areas of Aboriginal archaeological sensitivity	Nil
CU22 WSL & GGL	No sites or areas of Aboriginal archaeological sensitivity	Nil
CU02 WSL, and access track	Areas of Aboriginal archaeological sensitivity	AHIP holder has complied with AHIP consent conditions and no further action is required.

Project Component	Sites Located Within Project Envelopes'	Impact avoidance and management measures
GGL between Main Spine Line GGL & CU02	Areas of Aboriginal archaeological sensitivity	AHIP holder has complied with AHIP consent conditions and no further action is required.
Access track between CU22 and CU31	No sites or areas of Aboriginal archaeological sensitivity	Nil
CU31 WSL & GGL	No sites or areas of Aboriginal archaeological sensitivity	Nil
GGL between CU26, CU29 and Main Spine Line	Areas of moderate Aboriginal archaeological sensitivity	Microsite GGL to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
CU26 WSL	Areas of moderate and high Aboriginal archaeological sensitivity	Microsite WSL to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
CU29 WSL	Areas of moderate Aboriginal archaeological sensitivity	Microsite WSL to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
Access track to CU26 and CU29	CG-TRE-04	Microsite access track to avoid site. Fence site during construction.
	Areas of moderate Aboriginal archaeological sensitivity	Microsite access track to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.
Access track to CU06, CU10 and CU14	CG-IA-05	Microsite access track to avoid site. Fence site during construction.
CU06 WSL	CG-IA-04	Microsite WSL to avoid site. Fence site during construction.
CU10 WSL & GGL	CG-IA-05	Microsite WSL and GGL to avoid site. Fence site during construction.
CU14 WSL & GGL	Areas of moderate Aboriginal archaeological sensitivity	Microsite access track to avoid areas. Fence areas during construction. If unable to avoid archaeological excavation required.

Four Aboriginal sites cannot be avoided due to their size, these sites are:

- PAD 2061-6 (Figure 10C);
- PAD 2062-6 (Figure 10C);
- CG-OCS-01 (Figure 10D); and,
- CG-OCS-09 (Figure 10E).

PAD 2061-6 and PAD 2062-6 are PADs recorded by AHMS in 2010 along sections of the Upper Canal. An excavation strategy should be developed for these sites as part of the Aboriginal Cultural Heritage Management Plan (ACHMP) (which forms part of the overall Environmental Management System for the CGP) in consultation with RAPs and take into

account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works.

CG-OCS-01 and CG-OCS-09 are open camp sites consisting of low density flaked stone artefact scatters along road exposures on the Upper Canal. While the site extent will be harmed, the stone artefacts themselves can be moved outside of the construction footprint. Prior to works being undertaken surface collection and relocation should be undertaken in conjunction with RAPs. Artefacts should be relocated within the current site boundaries outside of the construction footprint.

Areas of Aboriginal archaeological sensitivity occur within the Turner Road North and Turner Road South Precincts (Figure 9I and 9J). Aboriginal Heritage Impact Permits (AHIPs) for the Turner Road North Precinct (AHIP No: 1106218) Turner Road South Precinct (AHIP No: 1101808) have been issued. Consultation with AHIP holders has indicated that the CU02 WSL, associated GGL and access track do not prevent compliance with relevant conditions for either AHIP. AHIP 1106218 requires the preservation of an Aboriginal conservation area, TR5, which can be avoided by the proposed works. No further heritage management actions are required for the Turner Road North and Turner Road South areas within the Project Envelope.

A number of areas of moderate and high archaeological sensitivity have been identified in the Project Envelope. These areas have potential for Aboriginal objects and should be avoided in the same manner as identified Aboriginal sites. If these areas cannot be avoided, then detailed archaeological excavation and recording to recover relevant information should be undertaken prior to the commencement of construction. An excavation strategy should be developed as part of the ACHMP in consultation with RAPs and take into account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works.

The Potential for harm to Aboriginal sites within the Project Envelope has been summarised in Table 5.

Table 11: Summary of Potential Harm to Aboriginal Sites in the Project Envelope

AHIMS Site No.	Site Name	Type Of Harm	Degree Of Harm	Consequence Of Harm
45-5-4054	PAD 2061-6	Direct	Partial	Partial Loss of Value
45-5-4055	PAD 2062-6	Direct	Partial	Partial Loss of Value
52-2-3561	TR-5	None	None	No Loss of Value
52-2-3723	CG-IA-16	None	None	No Loss of Value
52-2-3736	CG-IA-01	None	None	No Loss of Value
52-2-3780	CG-IA-02	None	None	No Loss of Value
52-2-3781	CG-IA-03	None	None	No Loss of Value
52-2-3737	CG-IA-04	None	None	No Loss of Value
52-2-3738	CG-IA-05	None	None	No Loss of Value
52-2-3739	CG-IA-06	None	None	No Loss of Value
52-2-3740	CG-IA-07	None	None	No Loss of Value
52-2-3741	CG-IA-08	None	None	No Loss of Value
52-2-3742	CG-IA-09	None	None	No Loss of Value
52-2-3743	CG-IA-10	None	None	No Loss of Value
52-2-3744	CG-IA-11	None	None	No Loss of Value
52-2-3745	CG-IA-12	None	None	No Loss of Value
N/A	CG-IA-13	None	None	No Loss of Value
52-2-3782	CG-OCS-01	Direct	Partial	Partial Loss of Value
52-2-3783	CG-OCS-02	None	None	No Loss of Value
52-2-3784	CG-OCS-03	None	None	No Loss of Value
52-2-3785	CG-OCS-04	None	None	No Loss of Value
52-2-3786	CG-OCS-05	None	None	No Loss of Value
52-2-3792	CG-OCS-06	None	None	No Loss of Value
52-2-3788	CG-OCS-09	Direct	Partial	Partial Loss of Value
52-2-3748	CG-OCS-10	None	None	No Loss of Value
52-2-3749	CG-OCS-11	None	None	No Loss of Value
52-2-3790	CG-TRE-01	None	None	No Loss of Value
52-2-3791	CG-TRE-02	None	None	No Loss of Value

8.0 RECOMMENDATIONS

Strategies have been developed based on the archaeological (significance) of cultural heritage relevant to the Surface Project Area and influenced by:

- Predicted impacts to Aboriginal cultural heritage;
- The planning approvals framework;
- Current best conservation practise, widely considered to include:
    - Ethos of the Australia ICOMOS Burra Charter; and,
    - *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010).

8.1 Recommendations

The management recommendations formulated for the Amended Project are provided below, and a break down of management actions by project component is shown in Table 10 and on the Figure 10 series:

Recommendation 1: *Conservation through Avoidance*

In the first instance, where practicable, AGL should avoid impact to ***all*** registered Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity by adjusting the alignment of GGLs and well heads at the design stage, prior to the commencement of ground disturbance works within the Project Envelope.

Where works are to be undertaken in close proximity to registered Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity the following should occur:

- Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity that will not be subject to direct impacts should be fenced with temporary above ground fencing. If Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity are separated from works by existing property boundary fencing then no further fencing is required; and,

- Clear mapping and identification of Aboriginal archaeological sites, PADs, and areas of high and moderate archaeological sensitivity must be provided to personnel undertaking works so that they can identify and avoid these areas during works.

Recommendation 2: *Requirements of Further Archaeological Work - Direct Impacts to known Archaeological sites and areas of potential*

Where registered Aboriginal archaeological sites, PADs and areas of high and moderate archaeological likelihood cannot be avoided, additional archaeological work will be required. These additional works may include:

- RAPs to be given an opportunity to undertake a surface collection of artefacts at CG-OCS-01 and CG-OCS-09 and to relocate the material outside of the construction area. If possible the artefacts should be relocated within the current site boundaries. Updated AHIMS site cards updating the location of any relocated artefacts should be submitted to the AHIMS register;

- An excavation strategy should be developed for PAD 2061-6 and PAD 2062-6 and incorporated in the ACHMP in consultation with RAPs and should take into account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works; and,

- Detailed archaeological excavation and recording to recover relevant information should be undertaken at areas of moderate and high archaeological sensitivity prior to the commencement of construction. An excavation strategy should be developed and incorporated in the ACHMP in consultation with RAPs. The excavation strategy should take into account the level of sensitivity and previous archaeological work undertaken in the area. The excavation strategy must also include procedures for the handling and long term storage of Aboriginal objects recovered during further works, taking into account any relevant conditions of the Turner Road North Precinct and Turner Road South Precinct AHIPs

Recommendation 3: *Requirements of Further Archaeological Work – Variation to the Surface Project Area Layout*

If there are any variations to the Project Envelope, additional archaeological survey and assessment by a qualified heritage consultant and the RAPs will be required.

Recommendation 4: *Registered Aboriginal Parties Consultation*

All aspects of management and mitigation should be developed and implemented in consultation with the RAPs and a qualified Aboriginal heritage consultant.

Recommendation 5: *Ongoing Management*

To successfully manage and mitigate Aboriginal cultural heritage within the Project Envelope, the existing ACHMP should be updated based on the findings of this study and in consultation with relevant Aboriginal stakeholder groups and OEH. This would consider the management and mitigation of Aboriginal cultural heritage at all stages of the Amended

Project, including construction, production, post development activities, closure and final rehabilitation. The ACHMP should include a Trigger Action Response Plan for management of Aboriginal heritage in the Project Envelope.

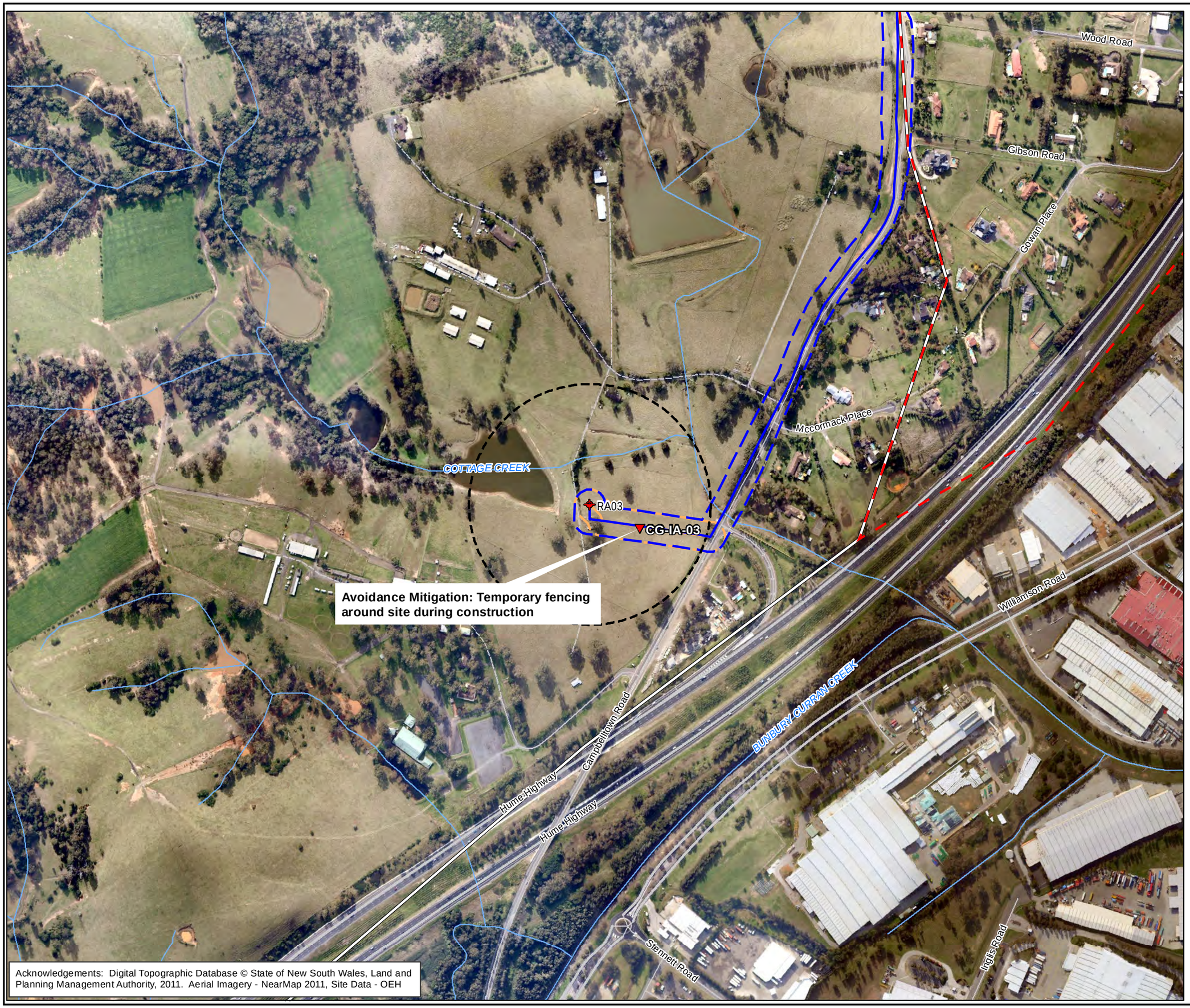
Recommendation 6: *Unanticipated Aboriginal Sites*

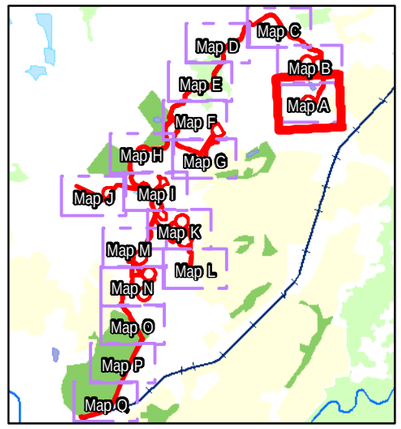
Should unanticipated Aboriginal archaeological material be identified during any works of each component, works should cease in the vicinity of the find and a qualified archaeologist should be contacted to assess the find. OEH and Aboriginal stakeholders will also require notification

Human Remains

In the case of any skeletal remains, suspected of being human, being found during any works of each component, the following process will be required:

- Immediately cease all work at that location and do not further move or disturb the remains;
- Report the find to the NSW Police and State Coroner;
- Notify AGL of the find;
- Notify Aboriginal stakeholders of the find;
- Notify OEH NSW of the find;
- If the skeletal remains are of Aboriginal ancestral origin, develop an appropriate management strategy in consultation with the Aboriginal stakeholders;
- Record the find in accordance with the OEH *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010); and
- Amend the ACHMP to include the newly discovered Aboriginal ancestral remains in the management regime established by the plan.





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10A: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

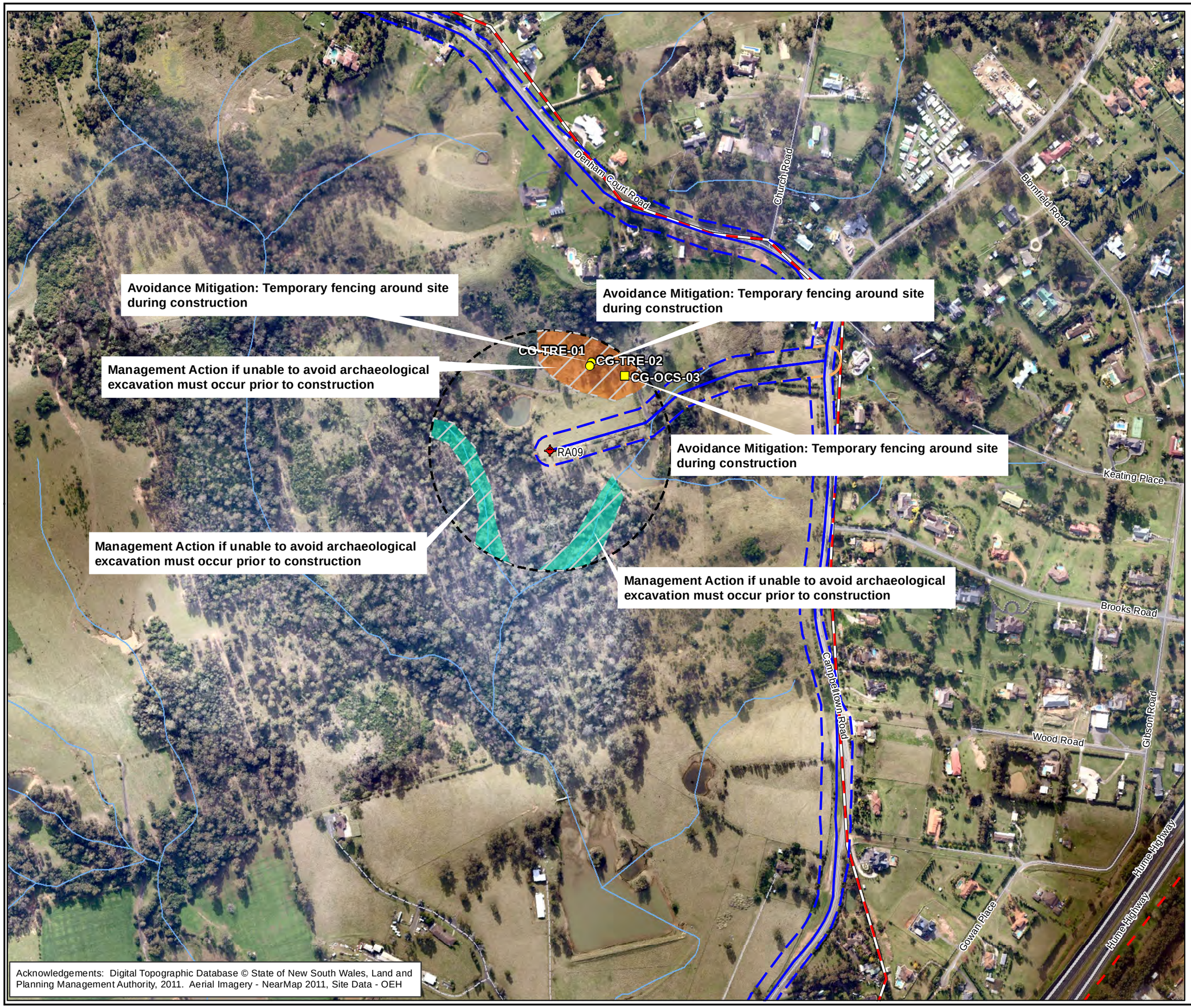
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

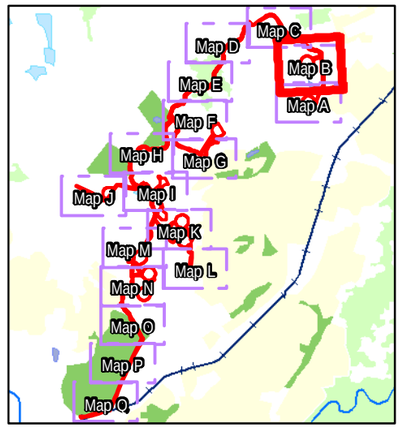
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10B: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

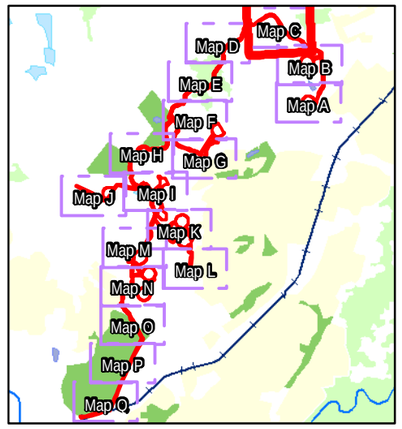
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10C: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Heath Road
Park Road
Camden Valley Way
St Andrews Road
Upper Canal

45-5-4054
2060-6 PAD
45-5-3453
45-5-3440
45-5-3455
45-5-4052
45-5-3450
45-5-3457
45-5-3497
45-5-3449
45-5-3442
45-5-3499
45-5-3446
45-5-3458
45-5-3447
45-5-3471
45-5-3475
45-5-3498
45-5-3476
45-5-3477
45-5-3481
45-5-3441
45-5-3472
45-5-3482
45-5-3949
45-5-3492
45-5-3468
45-5-3443
45-5-3444
45-5-3496
45-5-3470
45-5-3445
45-5-3484
45-5-3494
45-5-3462
45-5-3464
45-5-3463
45-5-2557
45-5-3469

CG-OCS-01
CG-OCS-02
CG-IA-01
CG-IA-02
CG-OCS-04
CG-OCS-05
CG-OCS-06

Management Action: Relocation of surface artefacts outside of construction footprint

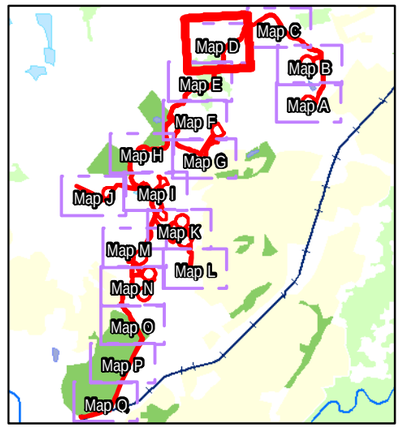
Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction



Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10D: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

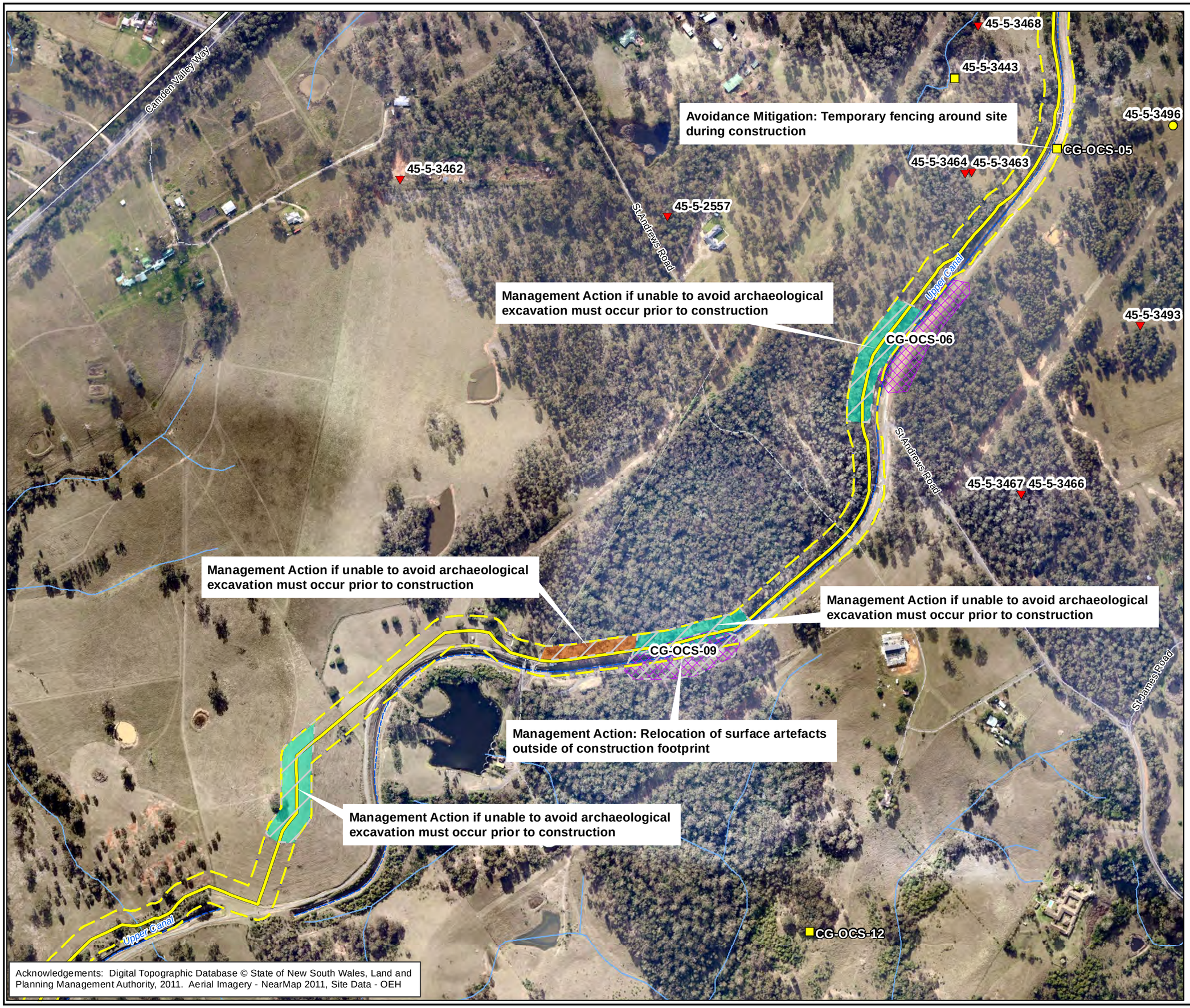
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

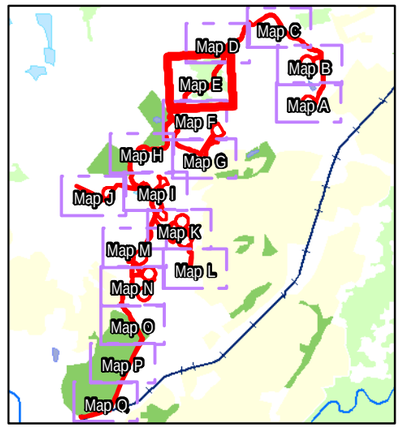
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10E: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Management Action: Relocation of surface artefacts outside of construction footprint

Management Action if unable to avoid archaeological excavation must occur prior to construction

Raby Road

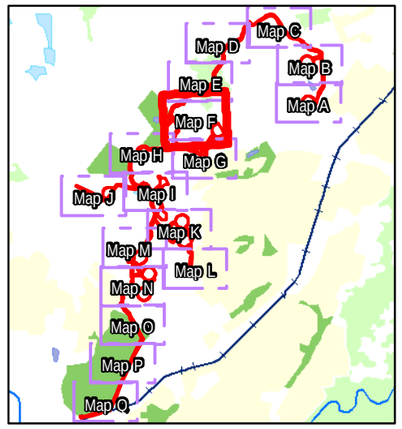
Upper Canal

Upper Canal

Upper Canal

CG-OCS-12

VV03



Legend

- Management Action Required

Archaeological Potential

- High
- Moderate

Registered Sites

- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations

- Well Surface Location
- Well Assessment Area

Gas Gathering Lines

- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks

- Access Track
- Access Track Envelope

Survey Area

- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10F: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

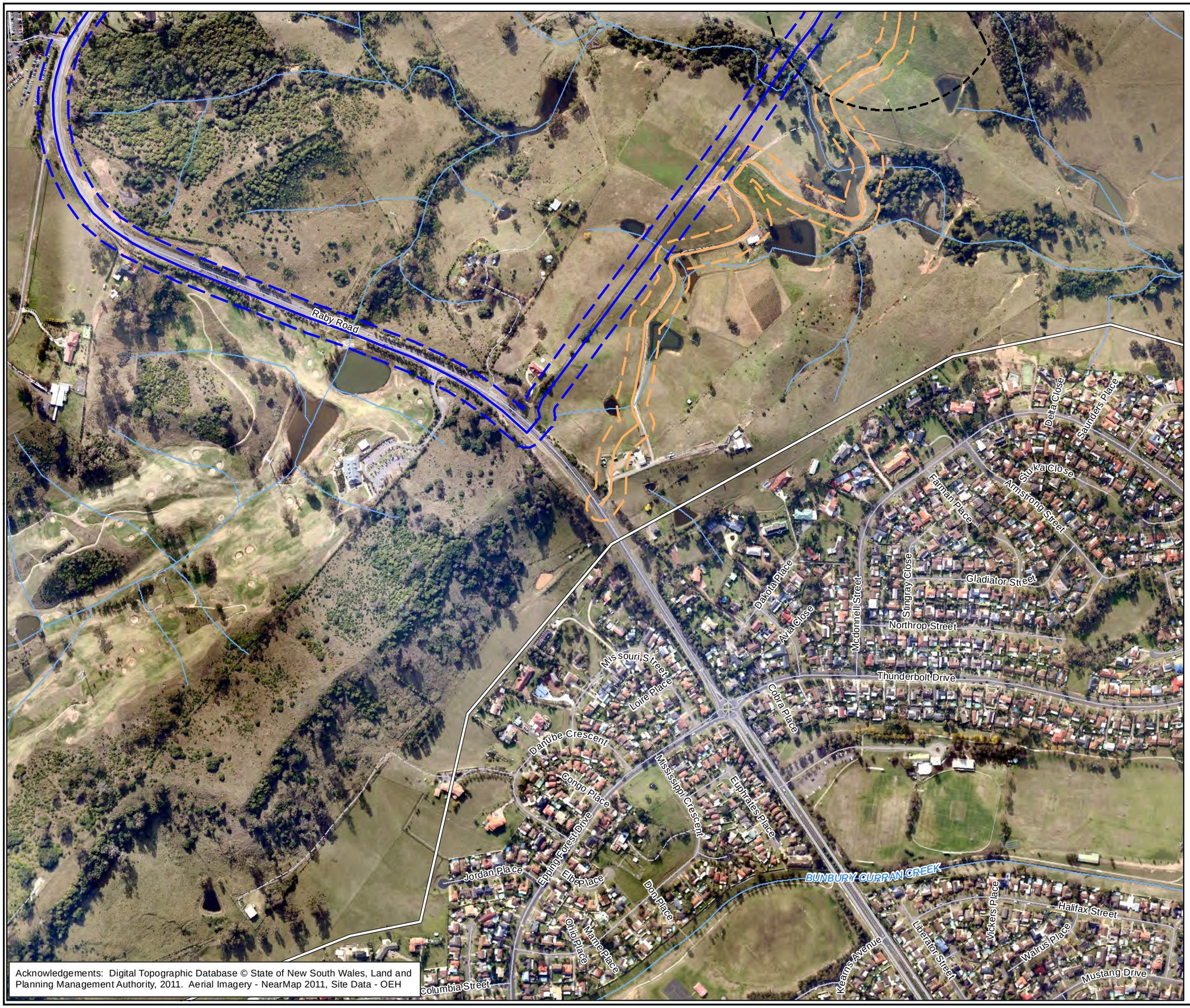
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

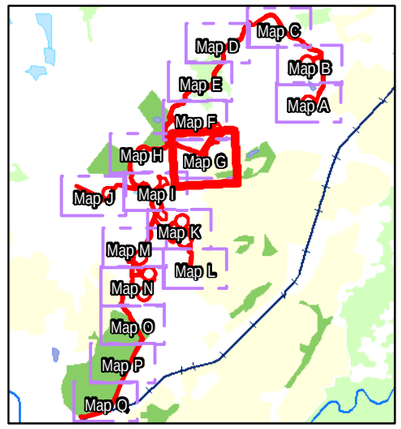
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10G: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

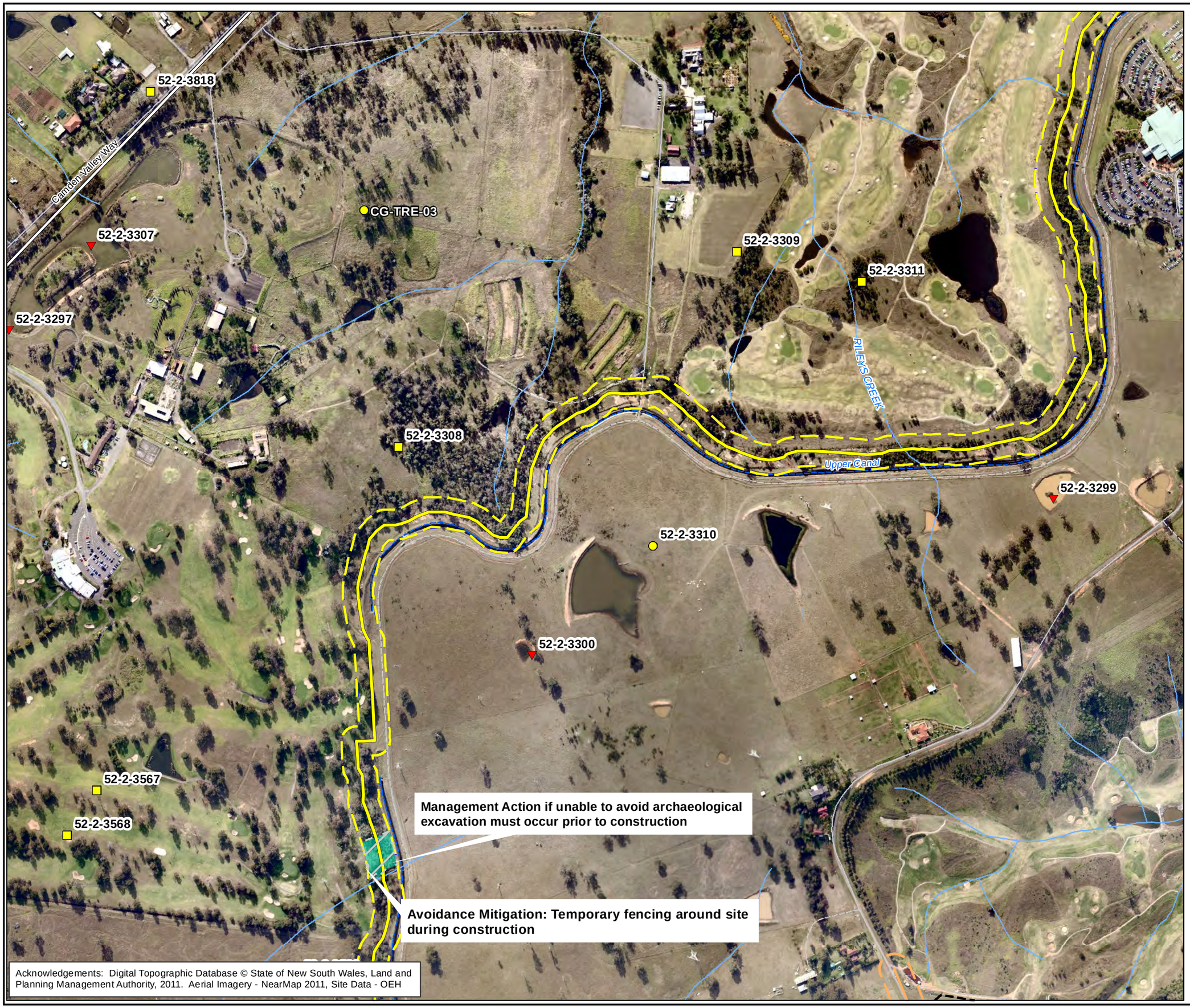
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

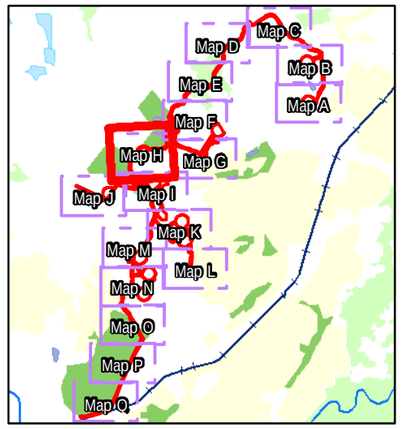
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10H: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

52-2-3569

CG-OCS-07

CU22

Upper Canal

Turner Road Precinct AHIP holders have complied with AHIP conditions and no further actions are required

52-2-3564

Tranasct H

52-2-3724

52-2-3563

CG-OCS-08

BUNBURY CURRAN CREEK

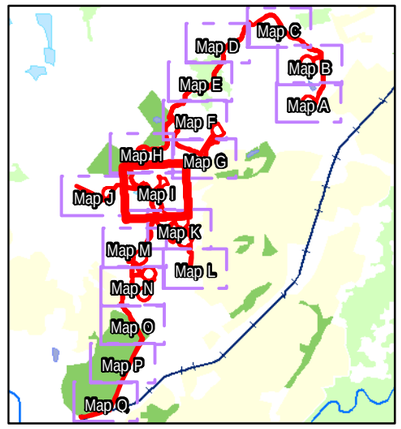
TR5

Avoidance Mitigation: Temporary fencing around site during construction

52-2-3561

CU31

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10I: Management Recommendations

0 50 100 150 200 250

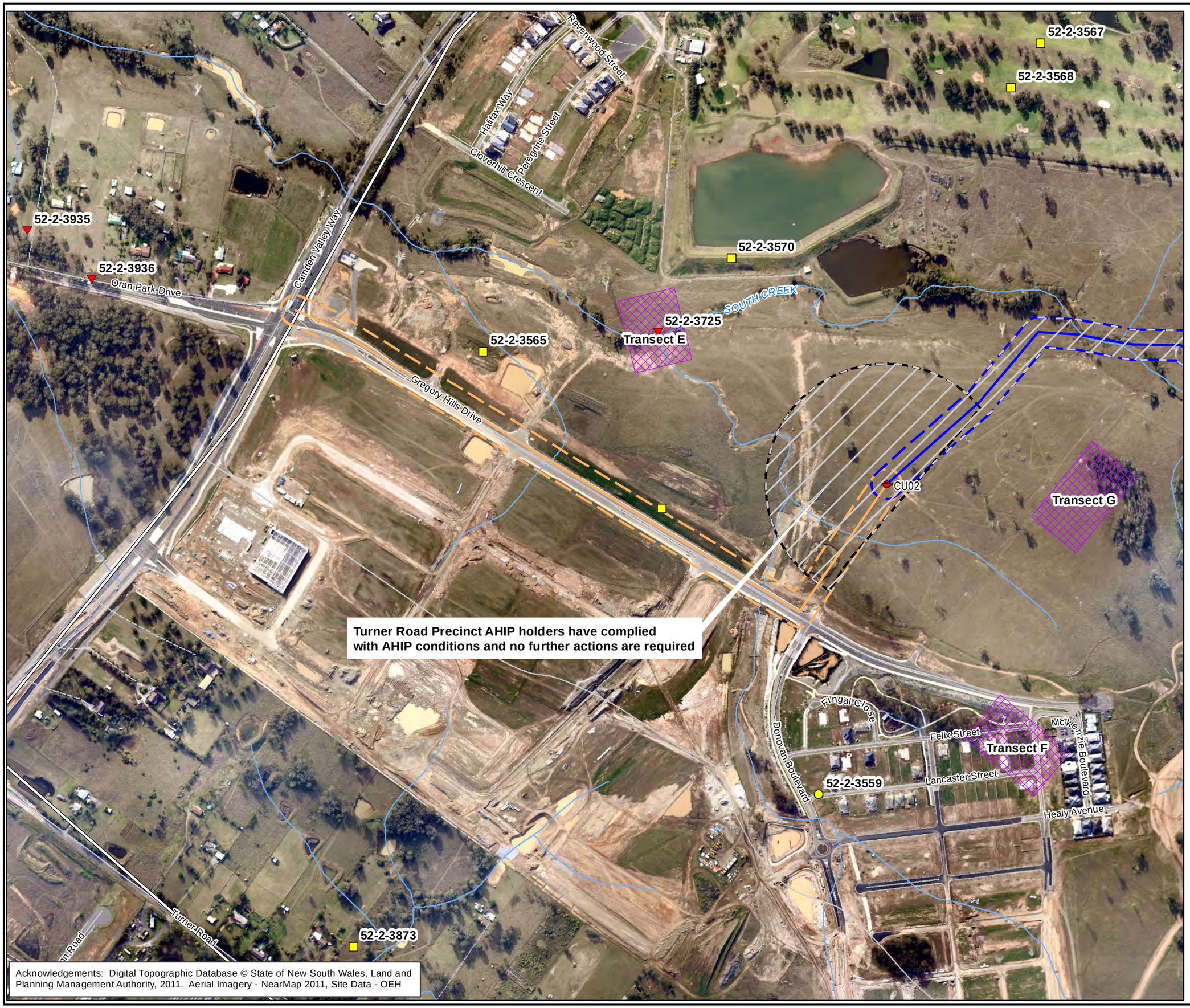
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

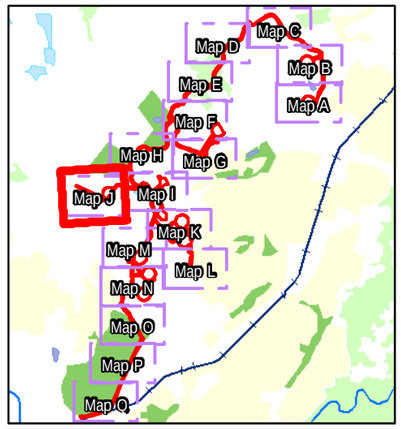
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10J: Management Recommendations

0 50 100 150 200 250

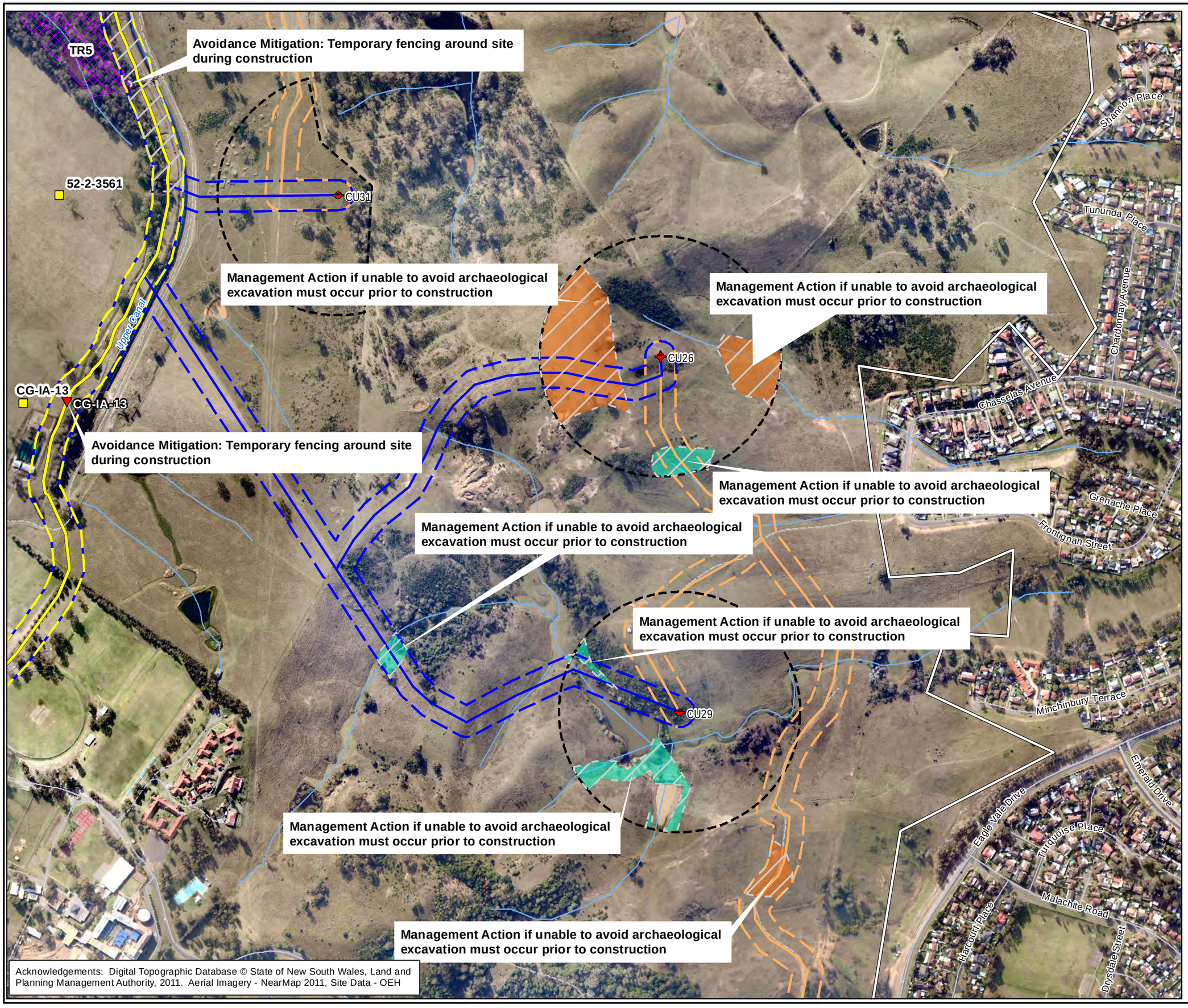
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

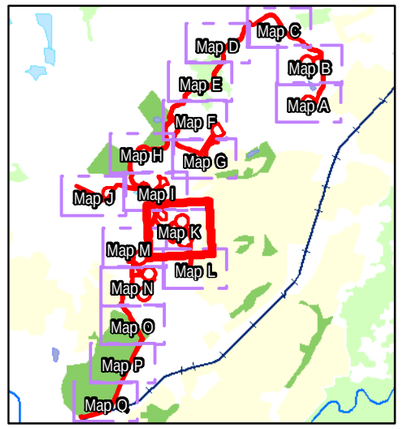
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10K: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

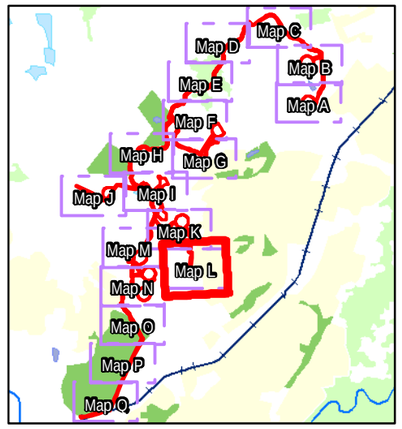
Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

CG-TRE-04

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10L: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

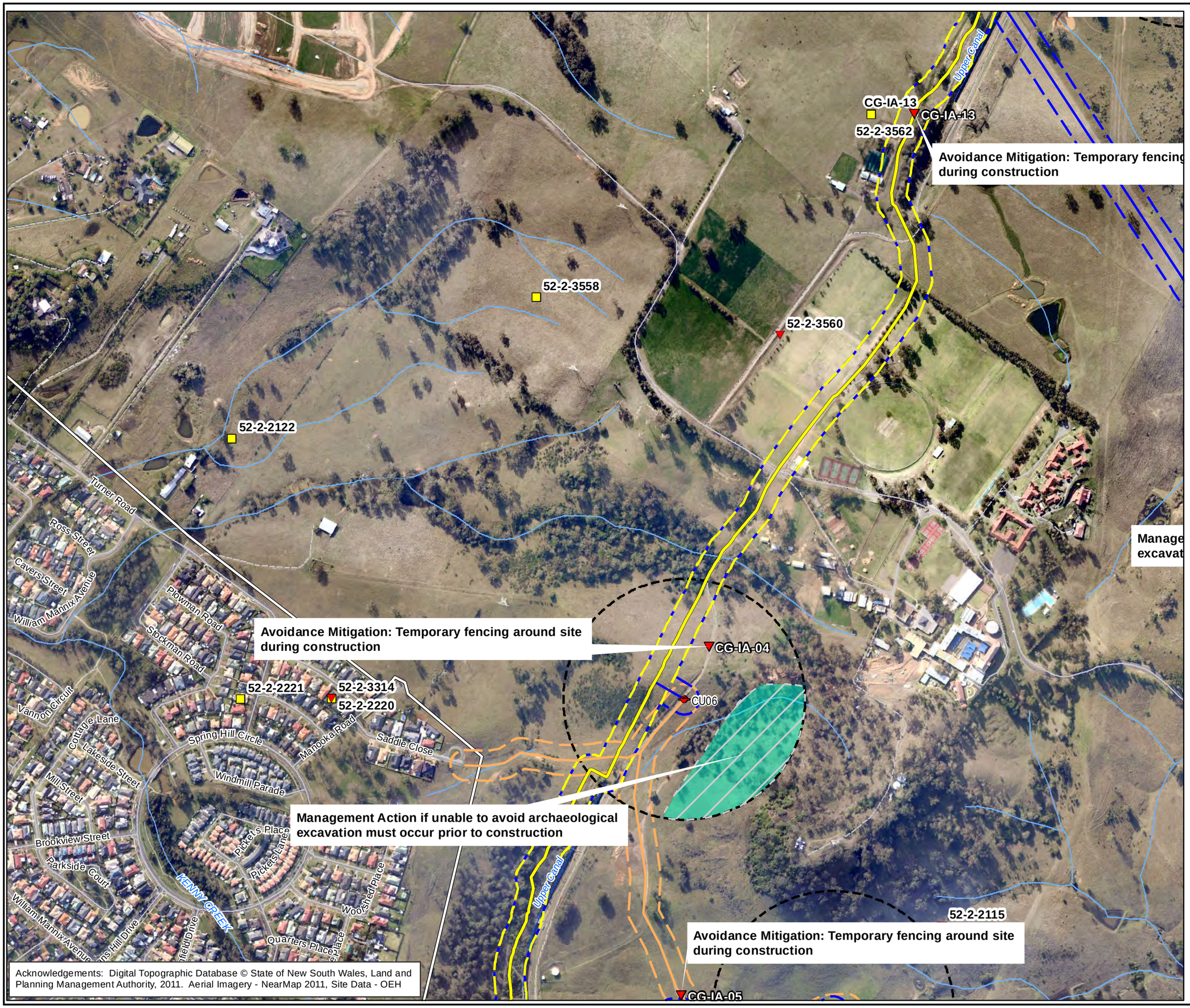
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10M: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

52-2-2115

52-2-2223

52-2-2222

CG-IA-05

CU10

CU14

Cooper Place
Lakeside Street
Spring Hill Circle
Saddle Close
Mill Street
Windmill Parade
KENNY CREEK
Brookview Street
Pickets Place
Pickets Lane
William Mannix Avenue
Parkside Court
Upper Canal
Woolshed Place
Quarters Place
Farmhouse Place
Downes Crescent
Currans Hill Drive
Glenfield Drive
Lackey Place
Rae Place
Field Place
Iando Way
Steamer Place
Wisdom Street
Cowdery Way
Harriet Place
Orton Place
Moore Place
Francis Place
Kitching Way
Munday Place
Moran Place
Joan Place
Paddy Miller Avenue
ANNAN GREEK
Outram Place
French Place
Narellan Road Tramway Drive
Narellan Road
Mount Annan Drive

Map A
Map B
Map C
Map D
Map E
Map F
Map G
Map H
Map I
Map J
Map K
Map L
Map M
Map N
Map O
Map P
Map Q

Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10N: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

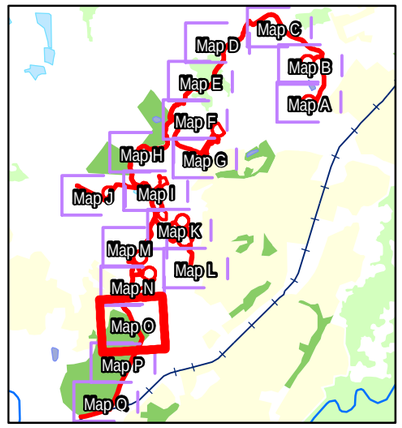
CG-IA-06

CG-IA-07

CG-OCS-10

52-2-1725

Outram Place
French Place
Tramway Drive
Collins Grove
Burnett Avenue
Magnolia Mews
Traill Close
ANNAN CREEK
Upper Canal
Narellan Road
Narellan Road
Kenny Hill Road
Baragil Mews
Mount Annan Drive
Dalwood Place
Rose Drive
Cunningham Drive
Upper Canal
Hume Highway
Hume Highway



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10O: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

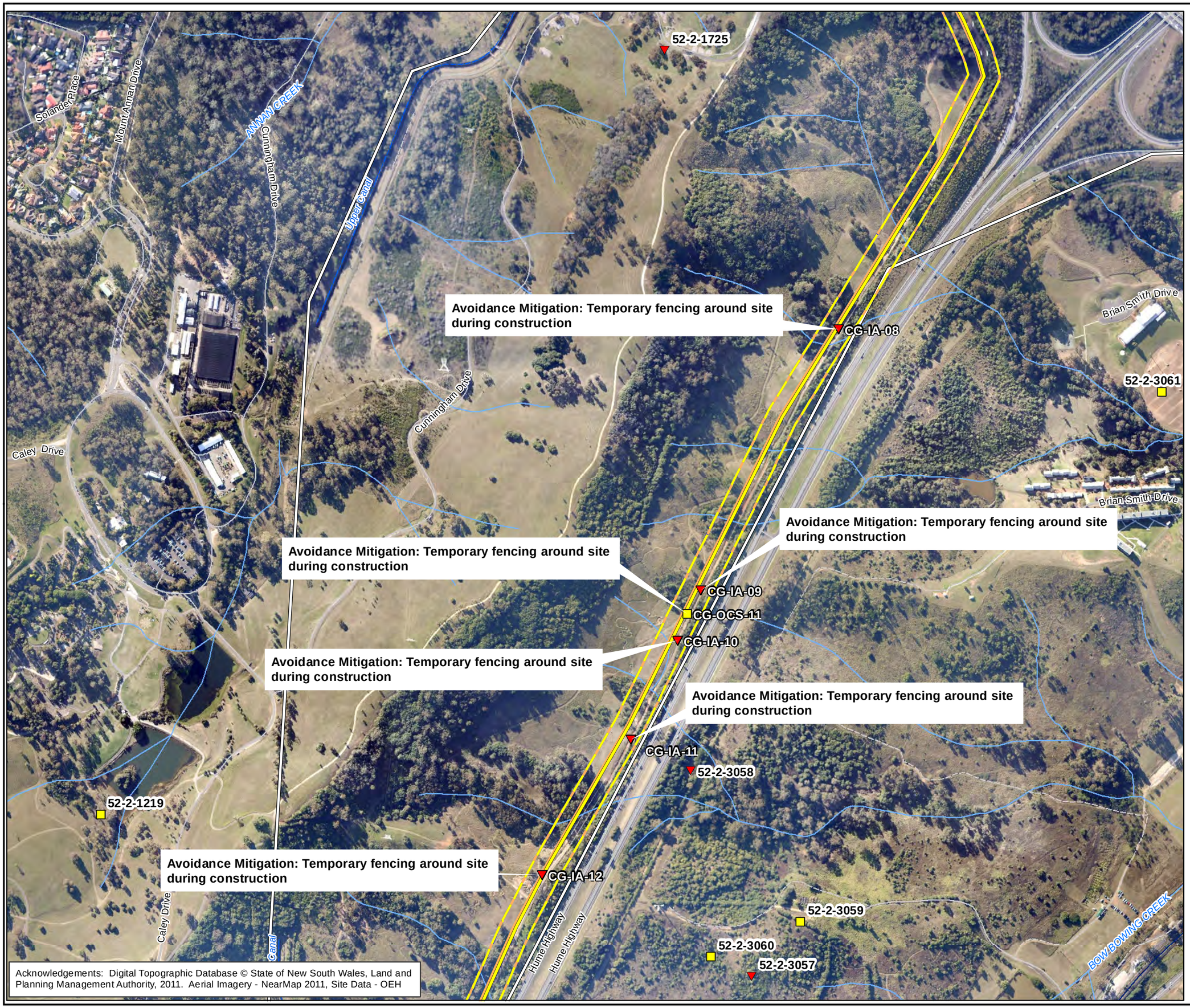
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

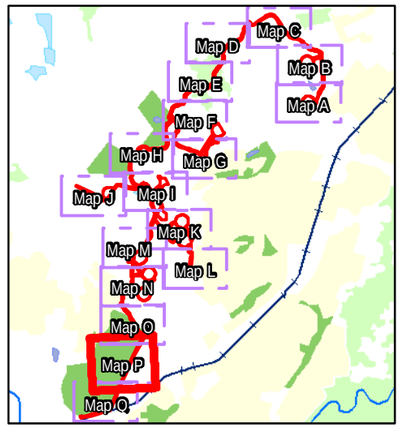
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 26 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10P: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

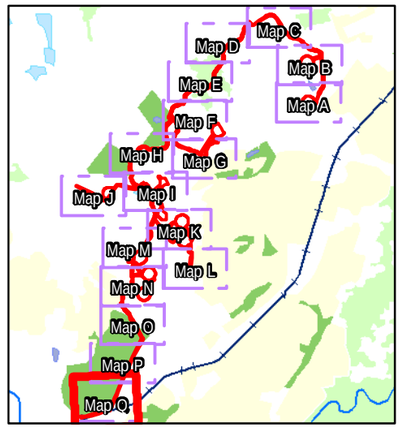
Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing aroundsite during construction

52-2-1219
CG-IA-11
52-2-3058
CG-IA-12
52-2-3059
52-2-3060
52-2-3057
52-2-2116
52-2-2277
52-2-3637
52-2-3723
52-2-3316
52-2-3317
52-2-3318
52-2-2271
52-2-3319
52-2-3320
52-2-3919
52-2-3321
52-2-3322

Caley Drive
Upper Canal
Hume Highway
KEANES GULLY
BOW BOWING CREEK
Menangle Road
Main Southern Railway
Abington Crescent
Bishopscourt Place
Riversdale Place
Lyndhurst Place
Clydebank Crescent
Heritage Way



Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 10Q: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F10 AR Constraints_20121009.mxd

REFERENCES

AECOM 2010, Environmental Assessment, Northern Expansion of the Camden Gas Project. A report prepared for AGL.

AECOM 2012, Submissions Report, Amended Northern Expansion of the Camden Gas Project. A report prepared for AGL, AECOM Australia Pty Ltd, September 2012.

Allen, J. and O'Connell, J.F. 2003, The long and the short of it: Archaeological approaches to determining when humans first colonised Australia and New Guinea. *Australian Archaeology*, Number 57, pp5-19.

AMBS (Australian Museum Business Services) 2006a, *Harrington Park 2 and Mater Dei Rezoning Project Phase 2 Indigenous Heritage Assessment and Conservation Strategy*. Unpublished report to APP Corporation on behalf of Camden Council.

AMBS (Australian Museum Business Services) 2006b, *Central Hills Rezoning Aboriginal Heritage Assessment.* A report to APP Corporation on behalf of Camden Council.

AMBS (Australian Museum Business Services) 1997, *Cumberland Plain: Regional Archaeological Study: Stage 1: Part of the Cumberland Plain Regional Aboriginal Heritage Study.* A study commissioned by the NSW National Parks and Wildlife Service.

Attenbrow, V. 1987, *The Upper Mangrove Creek Catchment: A Study of Quantitative Changes in the Archaeological Record.* Unpublished PhD Thesis, University of Sydney.

Attenbrow, V. 2002, *Sydney's Aboriginal Past: investigating the archaeological and historical records.* UNSW Press, Sydney.

Australia ICOMOS 1999, *Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter), revised edition*, Australia ICOMOS, Canberra.

Bannerman and Hazelton, 1990, *Soil Landscapes of the Penrith 1:100,000 Map Sheet* (Soil Conservation Service NSW, Sydney)

B Cubed Sustainability, June 2003, 'Upper Canal known drainage hot spots: Heritage impact statement', for SMEC Australia and the Sydney Catchment Authority.

Bonhomme, T. 1986, *An Assessment of Archaeological Sites at Narellan, Near Campbelltown, New South Wales*. Unpublished report prepared for The Department of Housing through Landcom.

Brayshaw, H. & McDonald, J. 1990, *Archaeological Survey at Menangle Park*. A report to Travers Morgan Pty Ltd on behalf of Department of Housing and Campbelltown City Council.

Brayshaw. H. & McDonald, J. 1991, *Archaeological Investigation at Sites MP1, MP2 and MP3, Menangle Park, NSW.* A report to Travers Morgan Pty Ltd on behalf of Department of Housing and Campbelltown City Council.

Bureau of Meteorology (2009): http://www.bom.gov.au/climate/averages/tables/ca_nsw_names.shtml (Accessed on 15 July 2009)

Burke, H. and C. Smith. 2004, *The Archaeologists Field Handbook.* Allen and Unwin, Crows Nest, NSW.

Central West Archaeological and Heritage Services Pty. Ltd. 2004, *A preliminary Aboriginal archaeological study for the proposed Harrington Park 2 & Matter Dei residential subdivisions, near Camden, NSW.* A report to Clive Lucas, Stapleton & Partners Pty Ltd Architects & Heritage Consultants.

Crew Archaeological Consultants 1998, *An archaeological survey of a proposed subdivision of Lot 204 Mt. Annan, near Campbelltown, NSW.* A report to D.P. Hayes, Land Consultant for George Wimpey Australia Pty. Ltd.

Dallas, M. 1982. *An Archaeological Survey at Riverstone, Schofields and Quakers Hill, NSW*. Prepared for the Land Commission of NSW.

Dallas, M. & Whitter, D. 1983, *Investigation of an Open Sites at Plumpton.* A report to Lawrence Rose Management Pty Ltd for Landcom.

DEC NSW 2004. National Parks and Wildlife Act 1974: *Part 6 Approvals – Interim Community Consultation Requirements for Applicants.* NSW Department of Environment and Climate Change, Sydney NSW.

DECC NSW 2005. *Draft Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation.* NSW Department of Environment and Climate Change, Sydney NSW.

DECC NSW n.d. *Guidelines for Aboriginal Heritage Impact Assessment* (1997). Prepared by the NSW National Parks and Wildlife Service with additional text by Krystal Buckley, Context Pty Ltd.

Dibden, J. 2002a, *Glenlee Coal Bed Methane Project – Archaeological and Heritage Assessment.* A report to Harvest Scientific Services.

Dibden, J. 2002b, *Glenlee Coal Bed Methane Project – Archaeological and Heritage Assessment - Addendum.* A report to Harvest Scientific Services.

Dibden, J. 2002c, *Glenlee Coal Bed Methane Project Stage 2 – Archaeological and Heritage Assessment - Addendum.* A report to Harvest Scientific Services.

Dibden, J. 2003, *Camden Gas Project Stage 2 – Camden New South Wales: Archaeological and Heritage Assessment*. An unpublished report to Sydney Gas Operations Pty Ltd.

Dixon, R. M. 1980. *The Languages of Australia.* Cambridge University Press, Cambridge.

English, A. 1994, *Archaeological survey of proposed Harrington Park Housing Estate, Narellan, NSW*. An unpublished report to Hassell Planning Consultants.

English, A. & Gay, L. 1994, *Test excavations of PADI, Harrington Park Housing Estate, Narellan, NSW*. An unpublished report to Hassell Planning Consultants.

ENSR / AECOM 2009, *Phase 2 Archaeological Investigations at Oran Park Precinct & Turner Road Precinct, South West Sydney.* A report prepared for Landcom, Dart West Developments and Paynter Dixon Golf.

ERM 2006, *Aboriginal Archaeological Salvage Excavation Report of Aboriginal Site OAD1 at Claremont Meadows, New South Wales.* Unpublished report to Landcom.

Etheridge, R. 1918, The Dendroglyphs, or "carved trees" of New South Wales. Memoirs of the Geological Survey of New South Wales. William Applegate Gullick, Government Printer, Sydney, Australia.

Hanrahan, J.J. 1981, *Report on the archaeological survey of Stage 1 of development of an area in Currans Hill / Menangle Park as part of environmental studies for its proposed release for residential developments, Stage 2.* Unpublished report to Macarthur Developments Board.

Hanrahan, J.J. 1982a, *Report on the archaeological survey of an area in Currans Hill / Menangle Park as part of EIS requirements for its proposed release for residential development.* Unpublished report to Macarthur Development Board.

Hanrahan, J.J. 1982b, *Report on an archaeological survey of Stage 3 of a development in Currans Hill / Menangle Park.* Unpublished report to Macarthur Development Board.

Haglund, L. 1985, *Preliminary Archaeological Assessment of Area Proposed for Mt. Anon Botanic Garden and Native Arboretum.* A report to the Public Works Department of New South Wales.

Haglund, L. 1989, *Department of Housing Project 144 Residential Estate – Narellan. Preliminary Archaeological Investigation of archaeological sites 2 and 5.* A report to Benjamin M. T. Chow & Associates on behalf of the Department of Housing.

Hazelton, P.A. & Tille, P.J. 1990, *Soil Landscapes of the Wollongong-Port Hacking 1:100 000 Sheet*, Soil Conservation Service of NSW, Sydney.

Heritage Concepts 2008, *Aboriginal Archaeological and Cultural Heritage Assessment East Leppington, NSW.* A report prepared for Walker Corporation Pty Limited.

Higginbotham & Associates 2002, *Conservation Management Plan for the Upper Canal, Pheasant's Nest to Prospect Reservoir, NSW*, *Volume 1 History, Survey and Significance (Draft)*. Report Prepared for the Sydney Catchment Authority.

HLA – Envirosciences Pty Limited 2007, *Aboriginal Heritage Assessment: Camden Gas Project Stage 2 Concept Plan. Spring Farm and Menangle Park Project Areas*. A report to AGL Gas Production (Camdne) Pty Ltd.

Jo McDonald Cultural Heritage Management, 1996, *Camden Bush Corridor Management Plan*. An unpublished report for Edaw on behalf of Camden Shire Council.

Jo McDonald Cultural Heritage Management, 2000, *Archaeological survey for Aboriginal sites, proposed re-zoning for "Manooka Valley" Rural/Residential subdivision Currans Hill, NSW.* A report prepared for Landcon (NSW) Pty. Ltd.

Jo McDonald Cultural Heritage Management, 2001, *Archaeological survey for Aboriginal sites, proposed extension area to "Manooka Valley" Rural Residential subdivision Currans Hill, NSW*. A report prepared for Landcon (NSW) Pty. Ltd.

Jo McDonald Cultural Heritage Management 2006, *Archaeological salvage excavation of the Colebee Release Area, Schofields, NSW.* Draft report prepared for Medallist Developments.

Jo McDonald Cultural Heritage Management, 2007a, *Archaeological investigation of the Turner Road and Oran Park Precincts within the South West Growth Corridor, Camden, NSW*. An unpublished report to APP on behalf of the Growth Centres Commissions and Camden City Council.

Jo McDonald Cultural Heritage Management, 2007b, *Archaeological investigation of the Oran Park Precinct within the South West Growth Corridor, Camden, NSW: Stage 2 Report.* An unpublished report to APP on behalf of the Growth Centres Commissions and Camden City Council.

Jo McDonald Cultural Heritage Management, 2007c, *Archaeological investigation of the Oran Park Precinct within the South West Growth Corridor, Camden, NSW: Stage 3 Report.* An unpublished report to APP on behalf of the Growth Centres Commissions and Camden City Council.

Jo McDonald Cultural Heritage Management, 2007d, *Archaeological investigation of the Turner Road Precinct within the South West Growth Corridor, Camden, NSW: Stage 2 Report.* An unpublished report to APP on behalf of the Growth Centres Commissions and Camden City Council.

Jo McDonald Cultural Heritage Management, 2007e, *Archaeological investigation of the Turner Road Precinct within the South West Growth Corridor, Camden, NSW: Stage 3 Report.* An unpublished report to APP on behalf of the Growth Centres Commissions and Camden City Council.

Koettig, M. 1985, *Archaeological investigations of sites HCA 11, 13 and 14 near Berrima*. Unpublished report to the DMR.

Kohen, J. 1986, *Prehistoric settlement in the West Cumberland Plain: resources, environment and technology.* An unpublished PhD Thesis, Macquarie University, Sydney.

Landarc Landscape Architects, June 1993, 'Camden Significant Trees and Vegetated Landscape Study', for Camden Municipal Council.

Liston, C 1988a, *Campbelltown: The Bicentennial History*, Allen and Unwin, Sydney.

Liston, C. 1988b, The Dharawal and Gandangara in Colonial Campbelltown, New South Wales, 1788-1830. *Aboriginal History 12(1):48-62.*

Long, A. 2005, *Aboriginal Scarred Trees in New South Wales: A Field Manual*, A report for the Department of Environment and Conservation (NSW), Hurstville.

Mary Dallas Consulting Archaeologists 2007, *Aboriginal Archaeological Test Excavation Report. Areas of Aboriginal Archaeological Sensitivity at Spring Farm Near Camden, NSW.* A report to Mirvac Homes and The Cornish Group.

Marquis-Kyle, P. & Walker, M. 1992, *The Illustrated Burra Charter: Making Good Decisions about the Care of Important Places*, Australia ICOMOS, Brisbane.

Mary Dallas Consulting Archaeologists 2003, Denbigh cartilage study: Aboriginal cultural heritage. An unpublished report to McIntosh Bros. Pty. Ltd.

Mary Dallas Consulting Archaeologists 2007, Aboriginal Archaeological Test Excavation Report: Areas of Aboriginal Archaeological Sensitivity at Spring Farm near Camden, NSW. A report to Mirvac Homes and the Cornish Group.

Mathews, R.H. 1896, The Bunan Ceremony of New South Wales in American Anthropologist, Vol. 9, No. 10:327-344. Blackwell Publishing, American Anthropologist Association.

Mathews, R. 1901. 'The Thurrawal Language (including Gundungarra and Dharrak languages, with vocabularies' in *Journal & Proceedings of the Royal Society of New South Wales.* 35:127-160

McDonald, J. 1986, *Preliminary Archaeological Reconnaissance of the Proposed Scholfields Regional Depot, Plumpton, NSW.* A report to the ADI Ltd – Lend Lease Joint Venture.

McDonald, J. 1992, *Archaeological Survey of Spring Farm, Camden.* An unpublished report to PPK Consultants, Camden.

McDonald, J. & Mitchell, P. 1994, *An assessment of archaeological context, landuse history and management requirements for Aboriginal archaeology in the Australia Defence Industries Site, St Marys, NSW*. An unpublished report to ADI Ltd, NSW Property Group.

MSEC, 2010. *Camden Gas Project Proposed Expansion of Stage 2. The Potential for Coal Seam Methane Gas Extraction to results in Subsidence at the Surface.* Report Number MSEC305 Revision C. A report to AGL Gas Production (Camden)Pty Ltd

Mylrea P.J. 2002, *Camden district: a history to the 1840s.* Camden Historical Society, Camden NSW.

Navin Officer 2008, *Cultural Heritage Assessment: Proposed 66kV Powerline Construction, Mount Annan Botanic Gardens, NSW.* A report to Integral Energy.

NSW NPWS, 1997, *Aboriginal Cultural Heritage Standards and Guidelines Kit.* Hurstville, NSW.

NSW NPWS 2002, *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney*. Threatened Species Unit, Conservation Programs and Planning Division Central Directorate. NSW National Parks and Wildlife Service.

Pearson, M. & Sullivan, S. 1995, *Looking After Heritage Places*, Melbourne University Press, Melbourne.

Rhodes, J and G. Dunnett 1985 *Aboriginal Resources Planning Study: City of Penrith.* Prepared for the Department of Anthropology University of Sydney for Penrith City Council.

Smith, L. J. 1989. *Archaeological site survey and analysis of sites on the Northern Cumberland Plain.* Report prepared for National Parks and Wildlife Service.

Speight, J. 1990. "Landform" in McDonald, R., Isbell, R., Speight, J,. Walker, J. and Hopkins, M. (eds) *Australian Soil and Land Survey: Field Handbook Second Edition.* Inkata Press, Sydney.

Steele, D. 2005, *Aboriginal Cultural Heritage Survey and Assessment Report For Fifteen New Proposed Gas Production Well Sites, Gathering Systems & Access Routes. Camden Gas Project Stage II – The Elizabeth Macarthur Agricultural Institute Property.* A report to Sydney Gas Limited.

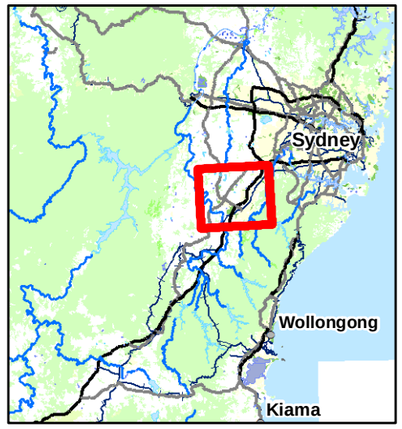
Therin Archaeological Consultants 1998, *Archaeological survey for the proposed Currans Hill Public School site, Currans Hill.* A report prepared for the Department of Public Works and Services.

White, B. and McDonal, J. 2010. "Lithic Artefact Distribution in the Rouse Hill Development Area, Cumberland Plain, New South Wales". In *Australia Archaeology*, no. 70, June 2010, pp 29-38.

Websites

Sydney Catchment Authority: www.sca.nsw. gov.au/dams/history.html

APPENDICES



Legend

Subsurface Project Area

Surface Project Area/Study Area

Figure 1: The location of the Surface Project Area in a regional context.

0 0.65 1.3 1.95 2.6 3.25

Kilometers

Scale: 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 30 August 2012, File number: 15282
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\Report Figures\14975 F1 AR_Locality_20120830.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

Figure 2: Aerial of the Project Area

Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 30 August 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F2 AR_Overview_20120830.mxd

0 0.6 1.2 1.8 2.4 3
Kilometers
Scale 1:60,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Legend

Well Locations
- Well Surface Location

Gas Gathering Lines
- Gas Gathering Line
- Main Gas Gathering Spine

Access Tracks
- Access Track

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Bellfield Avenue
Eighth Avenue
Austral
Prestons
Robinson Road
Bringelly Road
Polo Road
Barry Avenue
Camden Valley Way
CABRAMATTA CREEK
Edmondson Park
Eastwood Road
Heath Road
RILEYS CREEK
Denham Court Road
England Road
George Road
RA09
Oran Park
Deepfields Road
Leppington
Ingleburn
St Andrews Road
RA03
Cobbitty
The Northern Road
Springfield Road
Catherine Field
Varroville
VV03
Ingleburn Road
BUNBURY CURRAN CREEK
Raby Road
COBBITTY CREEK
Oran Park Drive
SOUTH CREEK
CU22
CU02
Kirkham
Kearns
Raby
CU31
CU26
Minto
NARELLAN CREEK
Macquarie Grove Road
Gregory Hills
CU29
THOMPSON CREEK
BOW BOWING CREEK
MYRTLE CREEK
CONDRON CREEK
KENNY CREEK
CU06
MCBARRON CREEK
Dobell Road
CU10
CU14
OXLEY RIVULET
Camden Bypass
THORNLEIGH GULLY
PETER MEADOWS CREEK
SMITHS CREEK
BIRIWIRI CREEK
ANNAN CREEK
River Road
Narellan Road
Old Hume Highway
Richardson Road
Macquarie Avenue
Georges River Road
Ruse
JACKS GULLY
NEPEAN RIVER
KEANES GULLY
BIRUNJI CREEK
Kentlyn
GEORGES RIVER
St Johns Road
Camden Park Road
Racecourse Avenue
Hume Highway
SPRING CREEK
Derwin Road
Airds
MATAHIL CREEK
Camden Park
St Helens Park
Holsworthy
Menangle
MENANGLE CREEK
Wedderburn Road
Woodbridge Road
Finns Road
Gilead
Aberfoyle Road
Wedderburn

Biosis Research Pty. Ltd.
8 Tate Street
Wollonong
NEW SOUTH WALES 2500

BIOSIS

Offices also in:
Sydney, Canberra,
Ballarat, Melbourne, Wangaratta

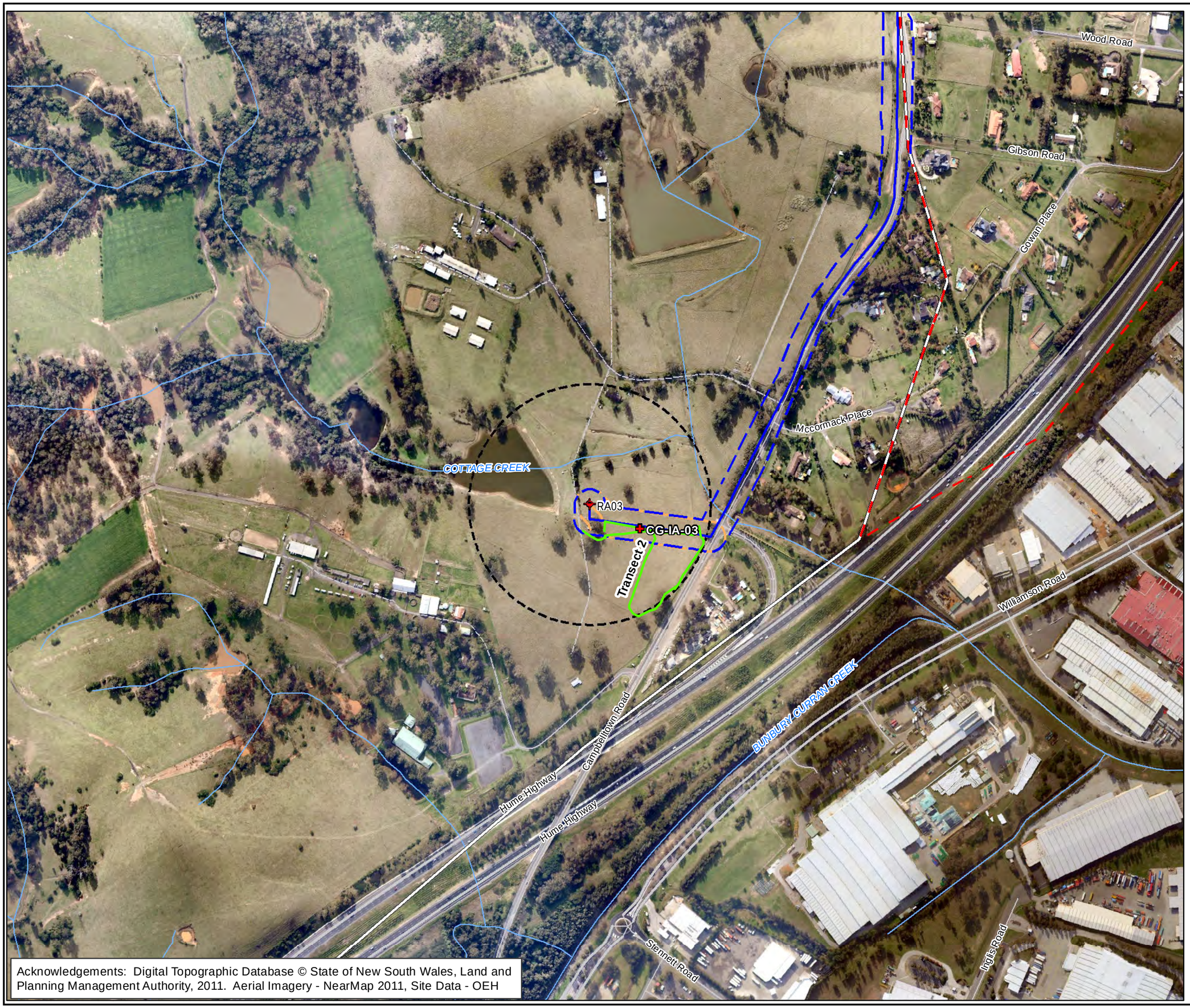
Figure 3: Proposed Amended Project

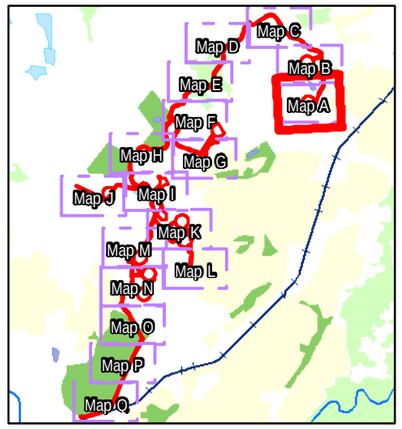
Acknowledgements: Aerial Imagery - NearMap, Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011

Date: 12 September 2012
Checked by: ASF
Drawn by: ANP
File number: 14975
Path: P:\14900s\14975\Mapping\Report Figures\14975 F3 AR_Development_20120830.mxd

0 0.6 1.2 1.8 2.4 3
Kilometers
Scale 1:60,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4A: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

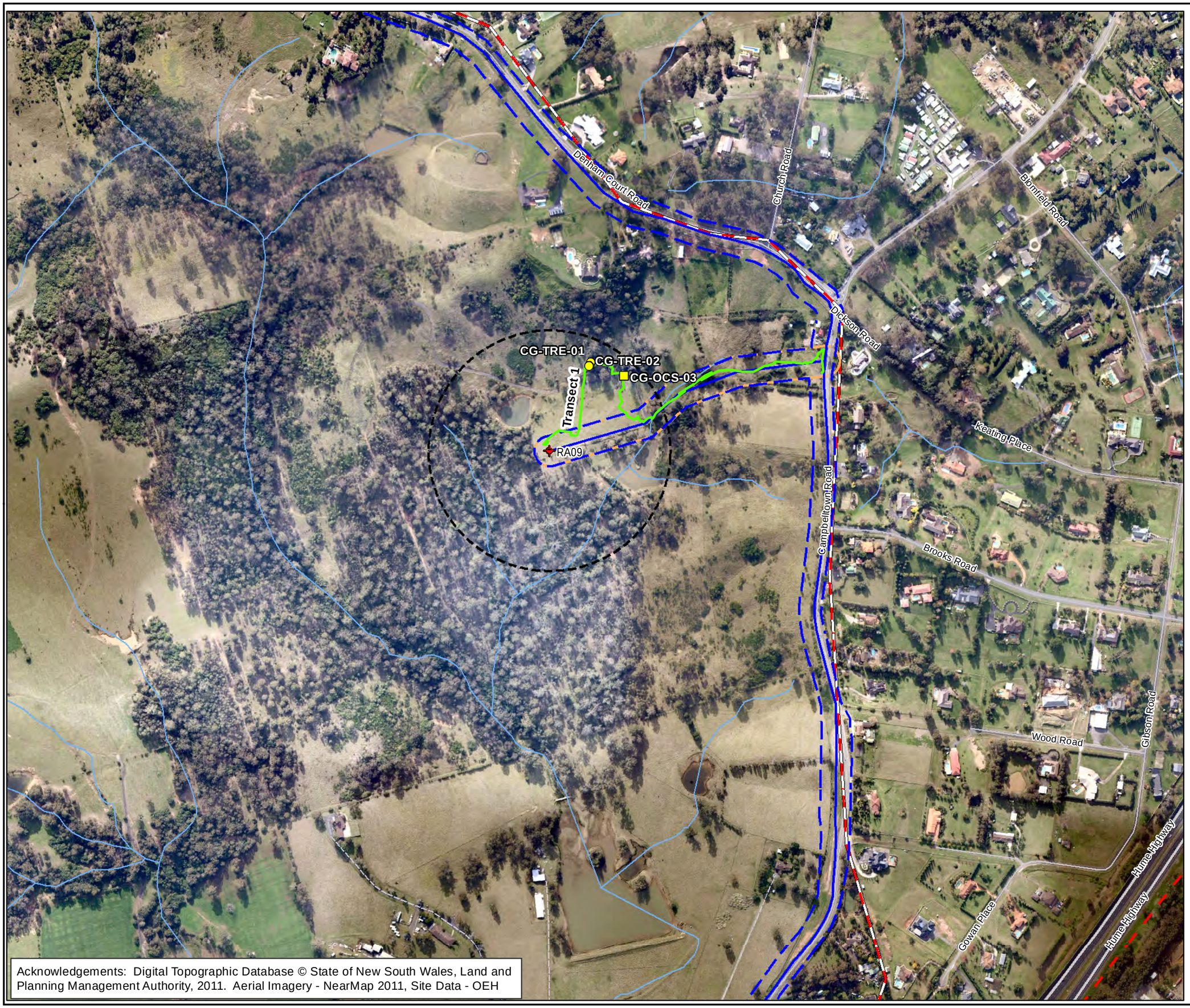
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

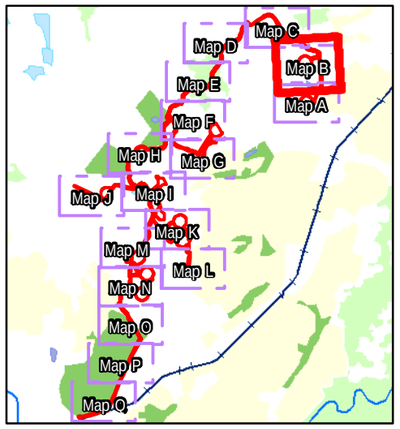
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4B: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

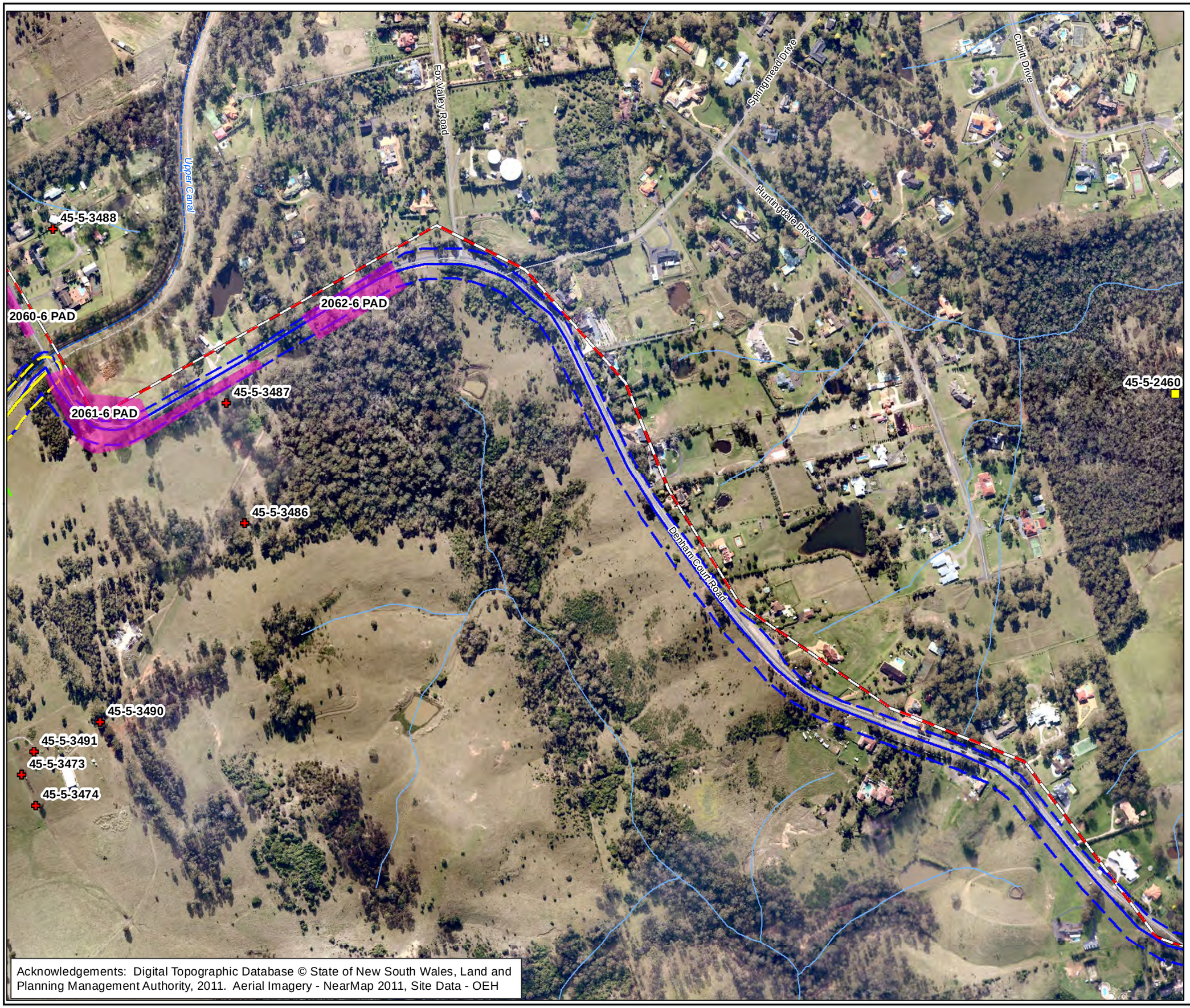
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

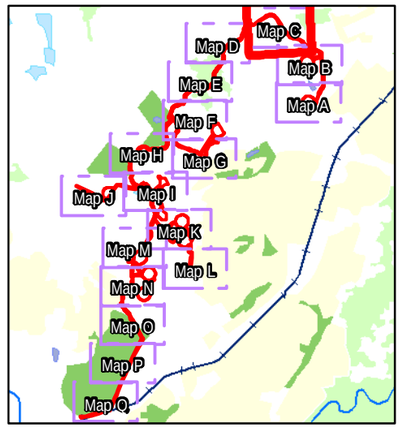
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4C: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

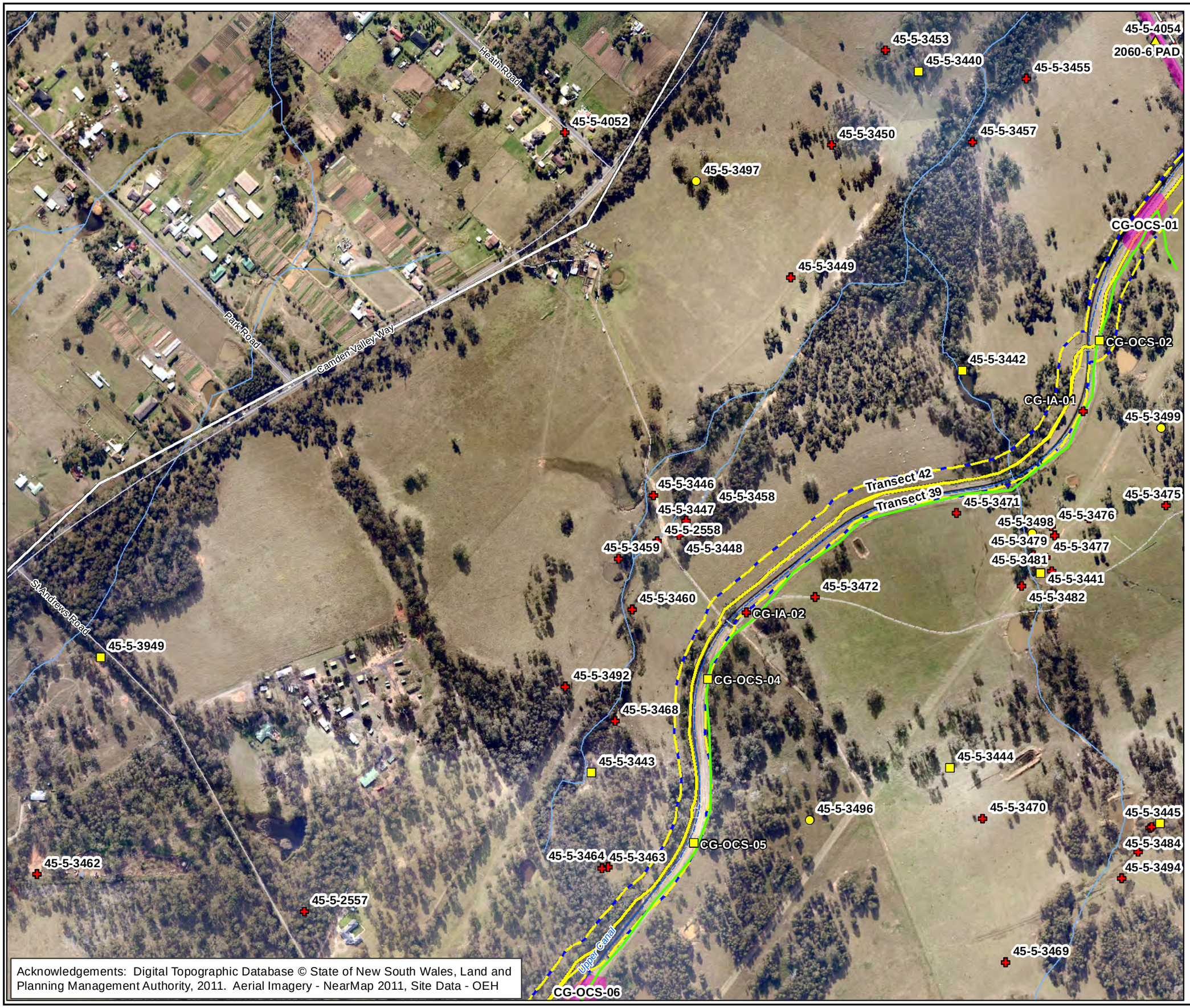
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

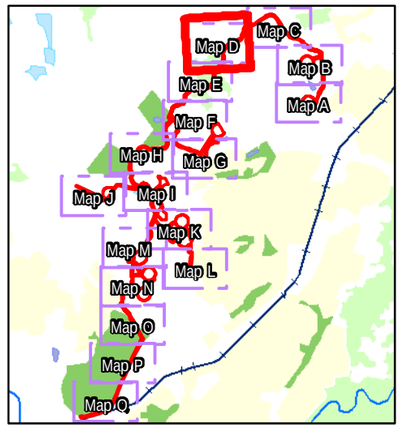
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4D: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

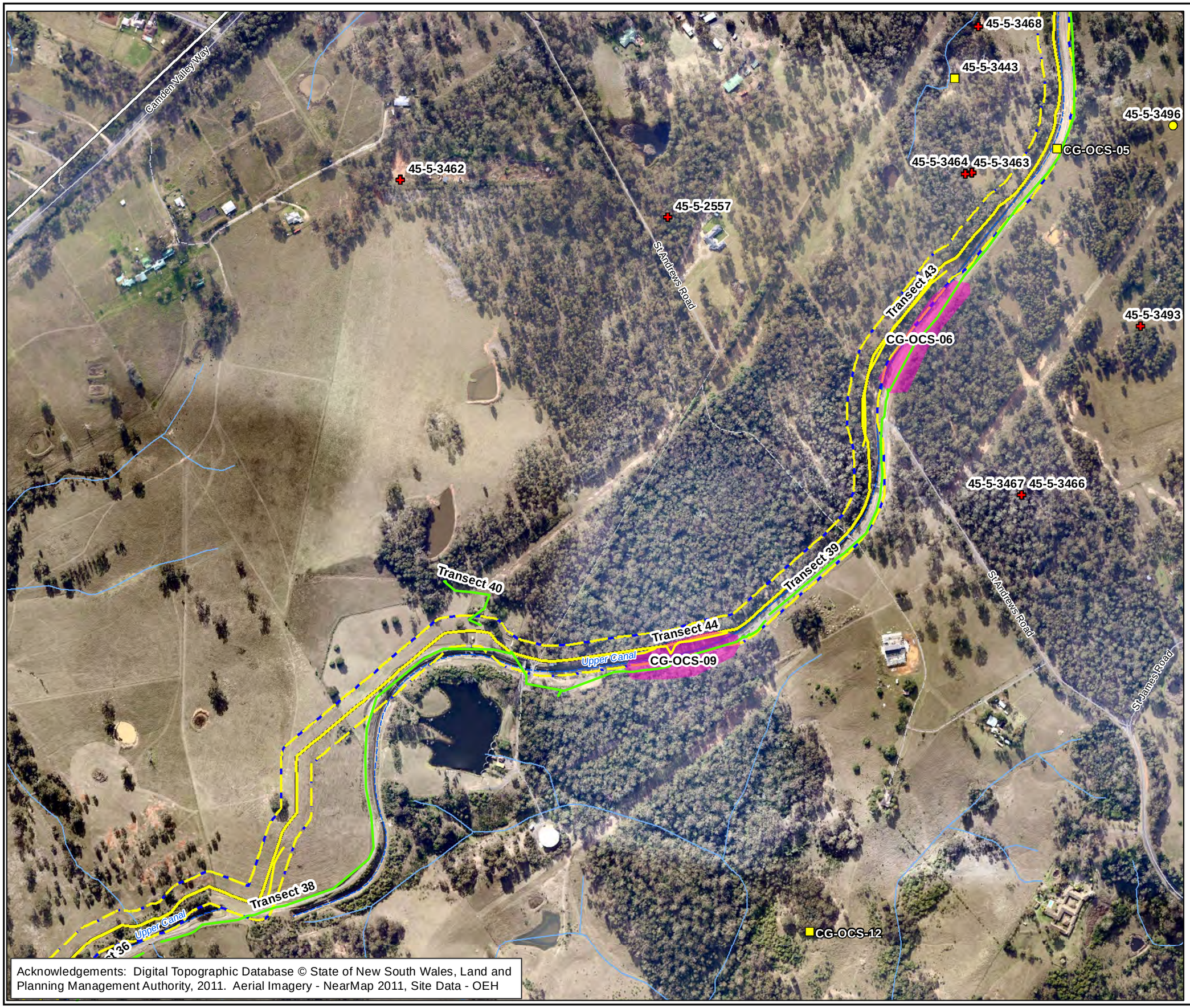
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

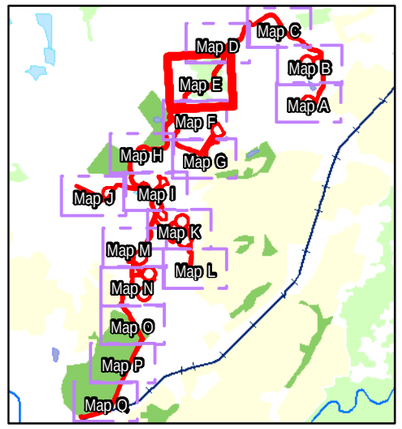
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_ Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4E: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Raby Road

Transect 38

Upper Canal

Upper Canal

Upper Canal

Transect 46

Transect 37

Transect 36

CG-OCS-12

Transect 61

Transect 63

VV03

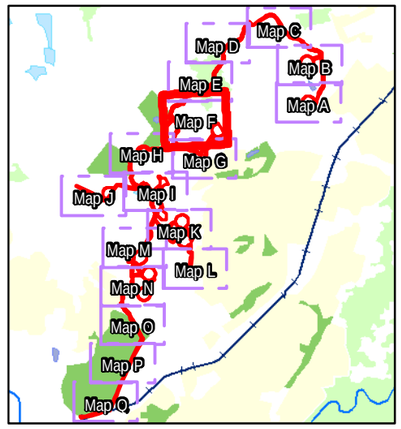
Transect 59

Transect 64

Transect 57

Transect 65

Transect 66



Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4F: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

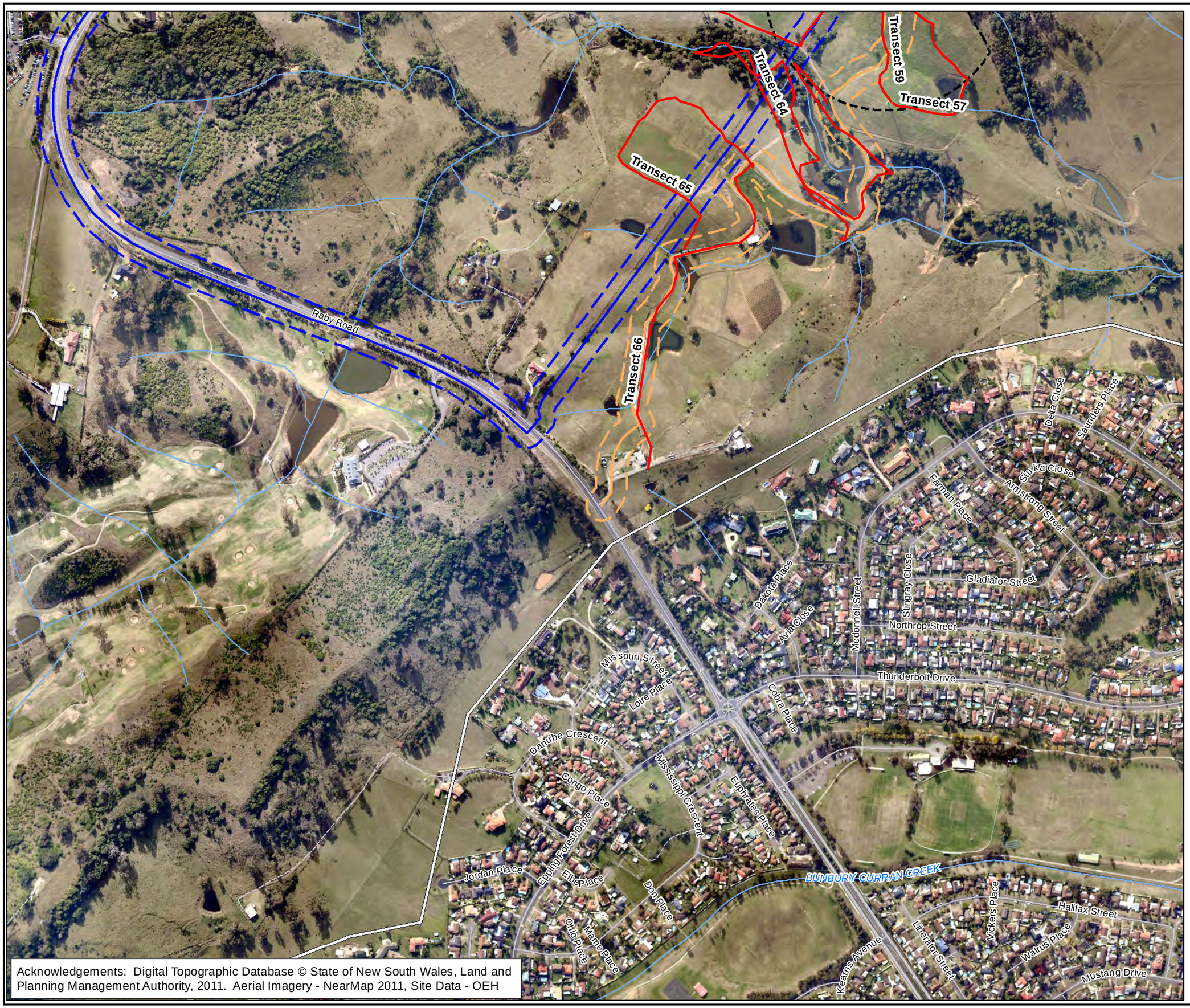
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

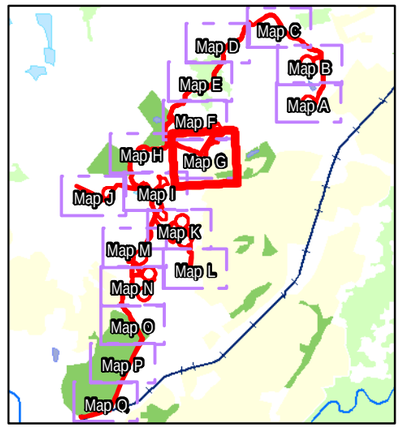
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4G: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

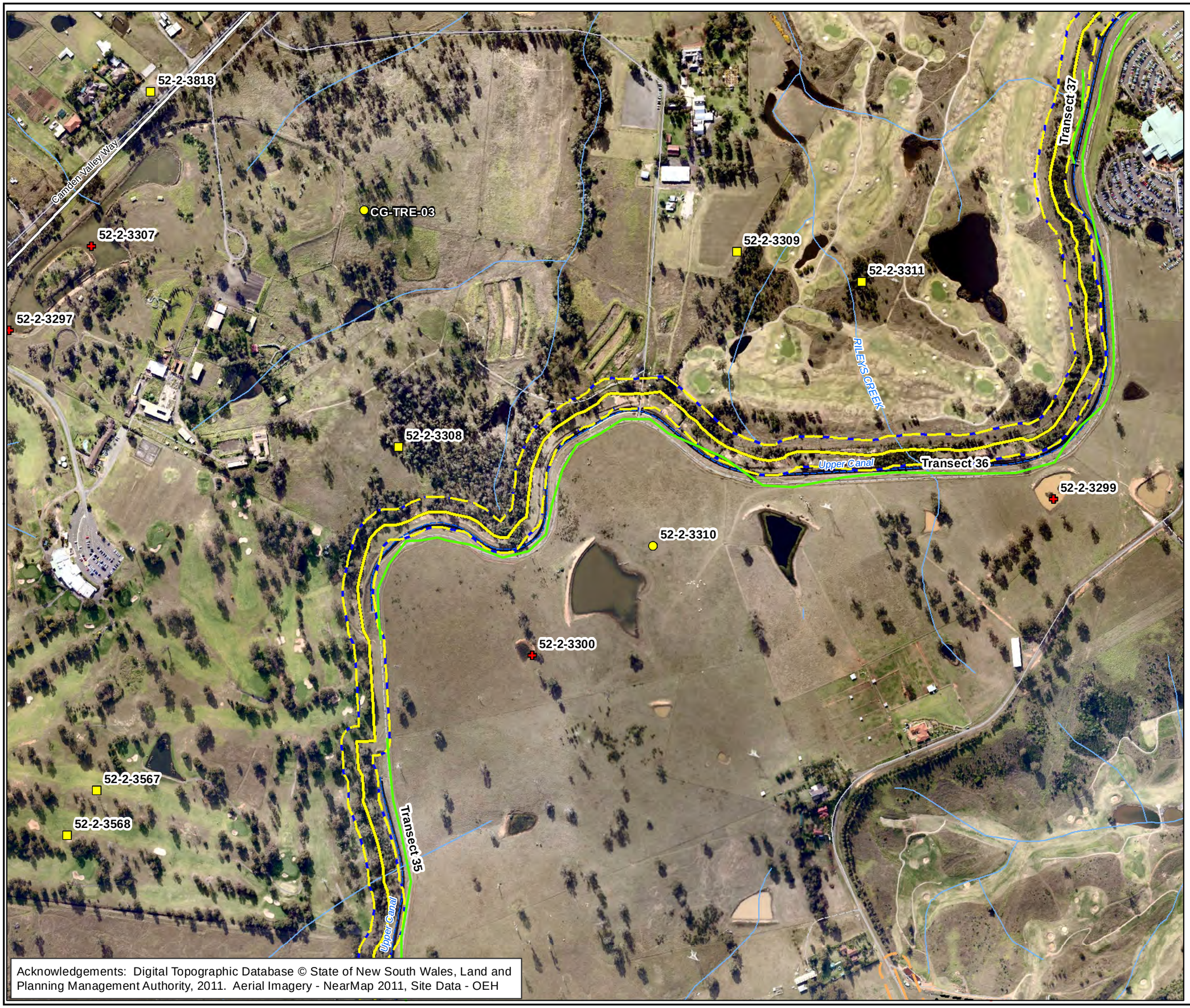
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

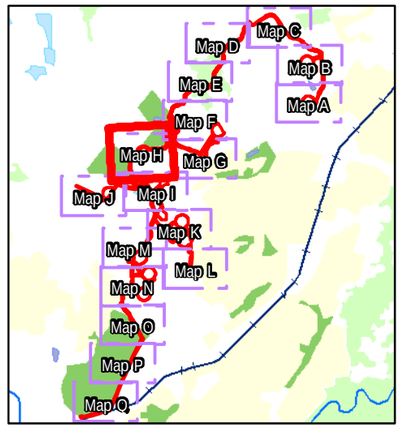
N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd



Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4H: Survey Coverage

0 50 100 150 200 250

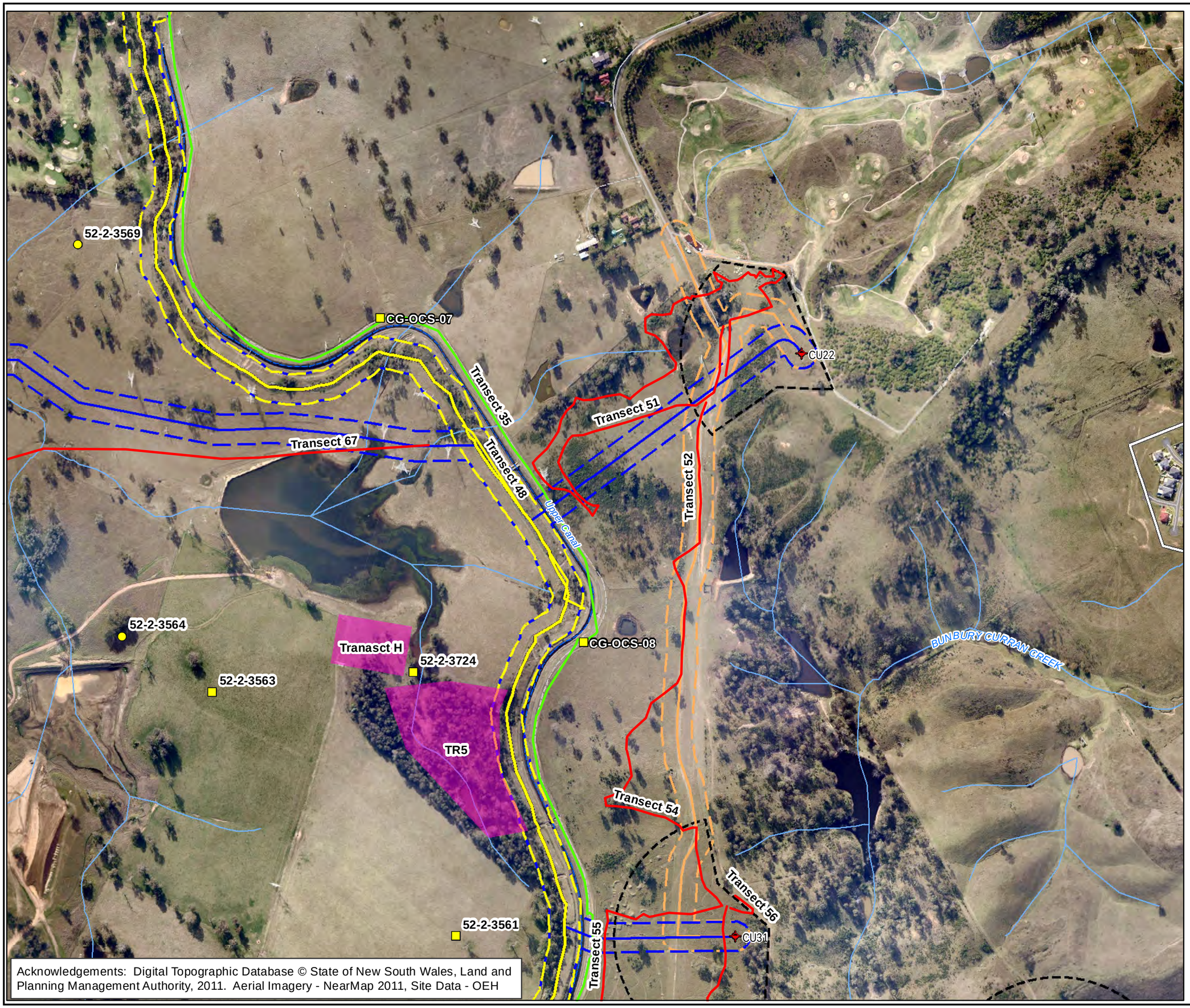
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

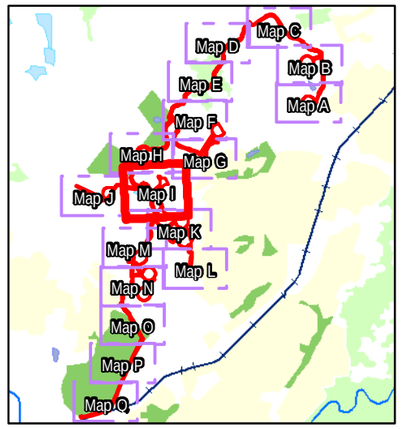
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4I: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

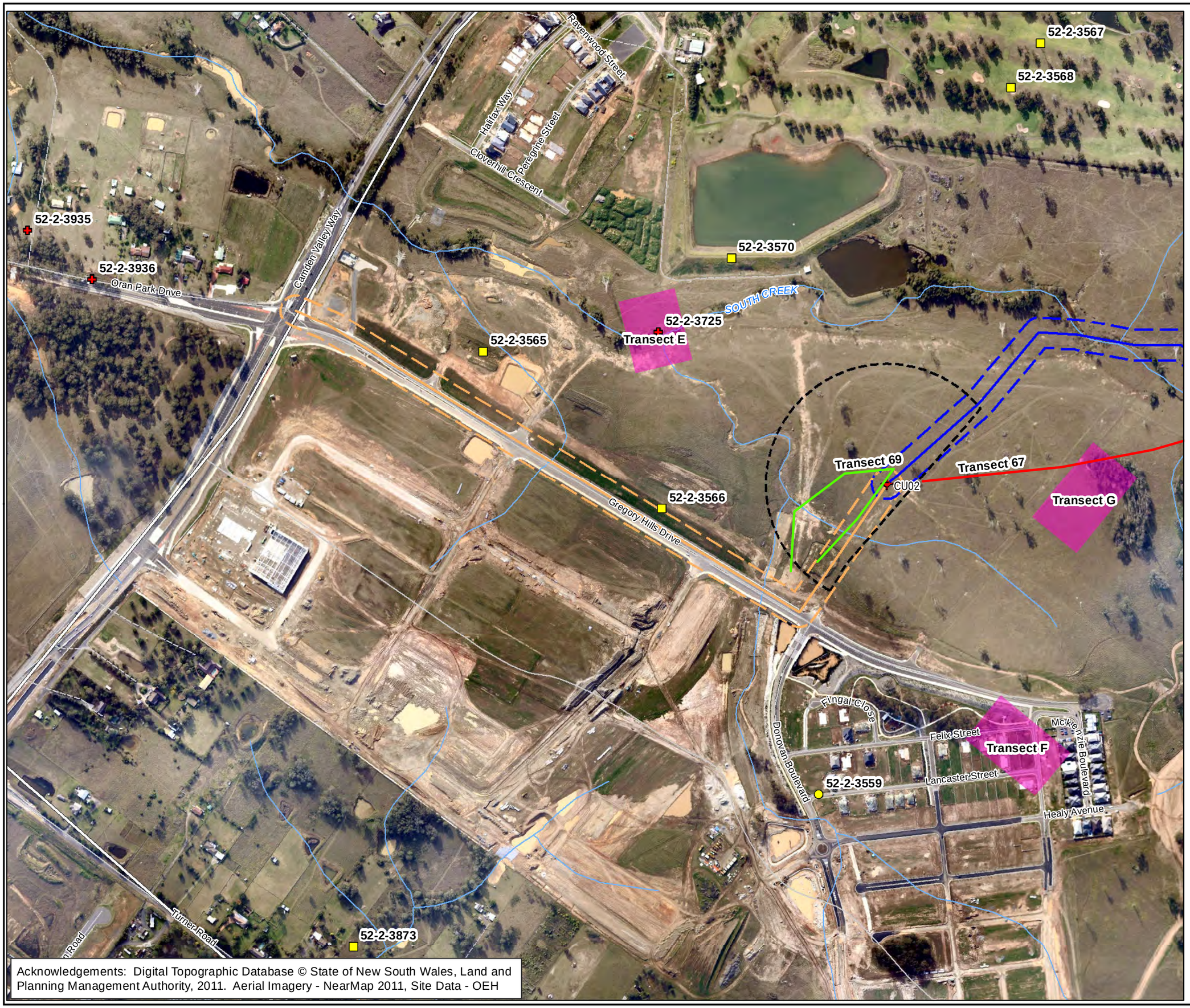
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

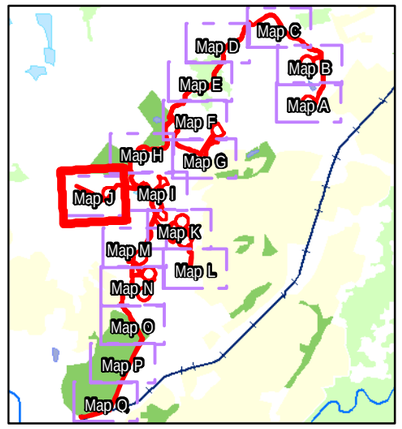
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4J: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

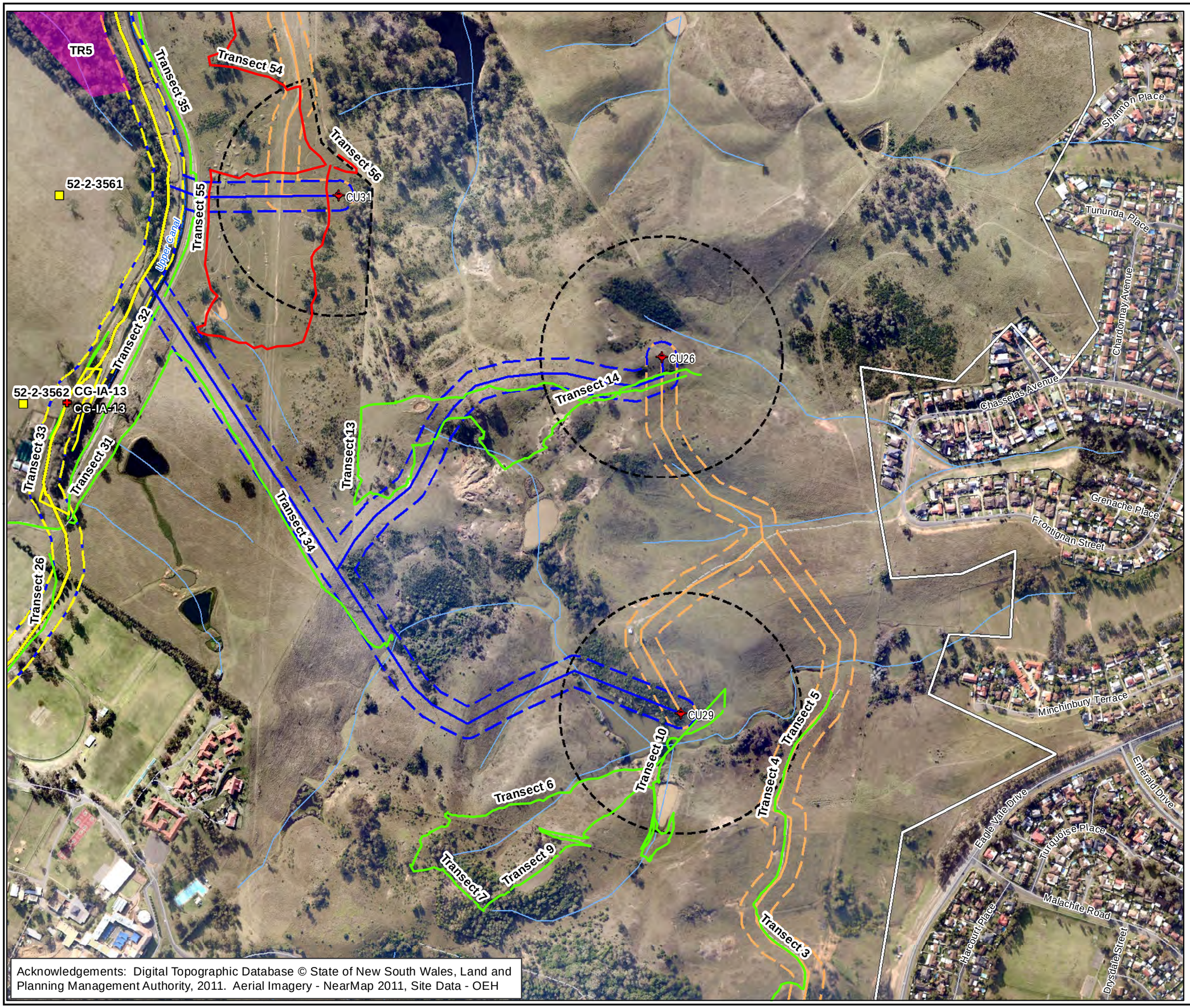
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

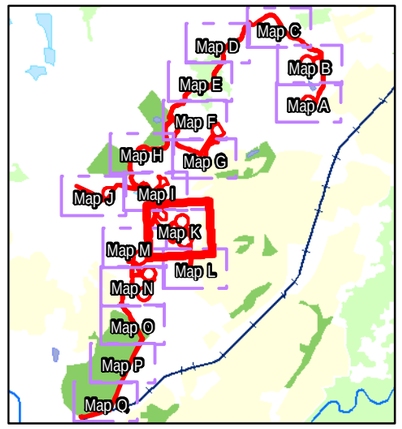
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4K: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4L: Survey Coverage

0 50 100 150 200 250

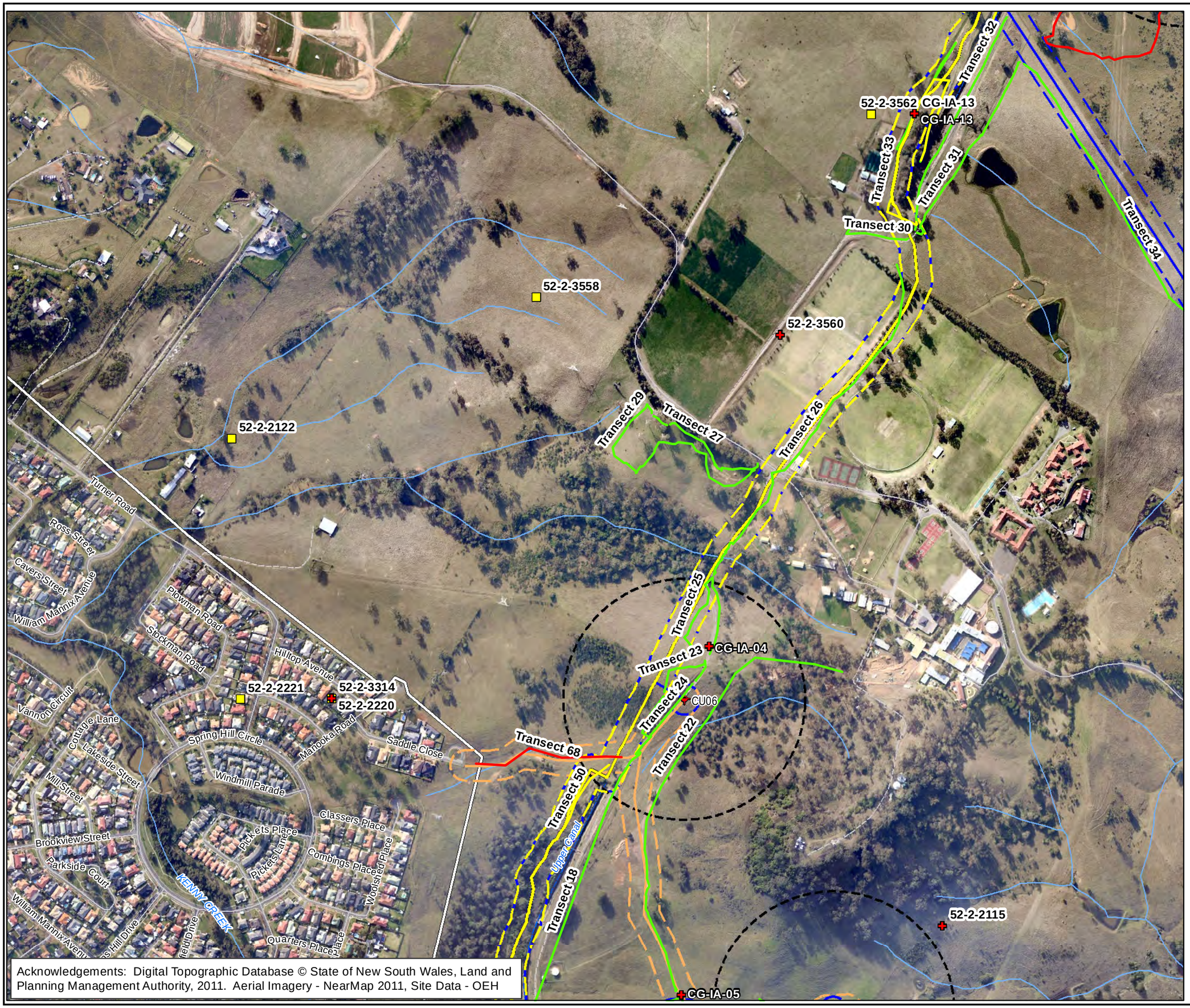
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd



Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4M: Survey Coverage

0 50 100 150 200 250

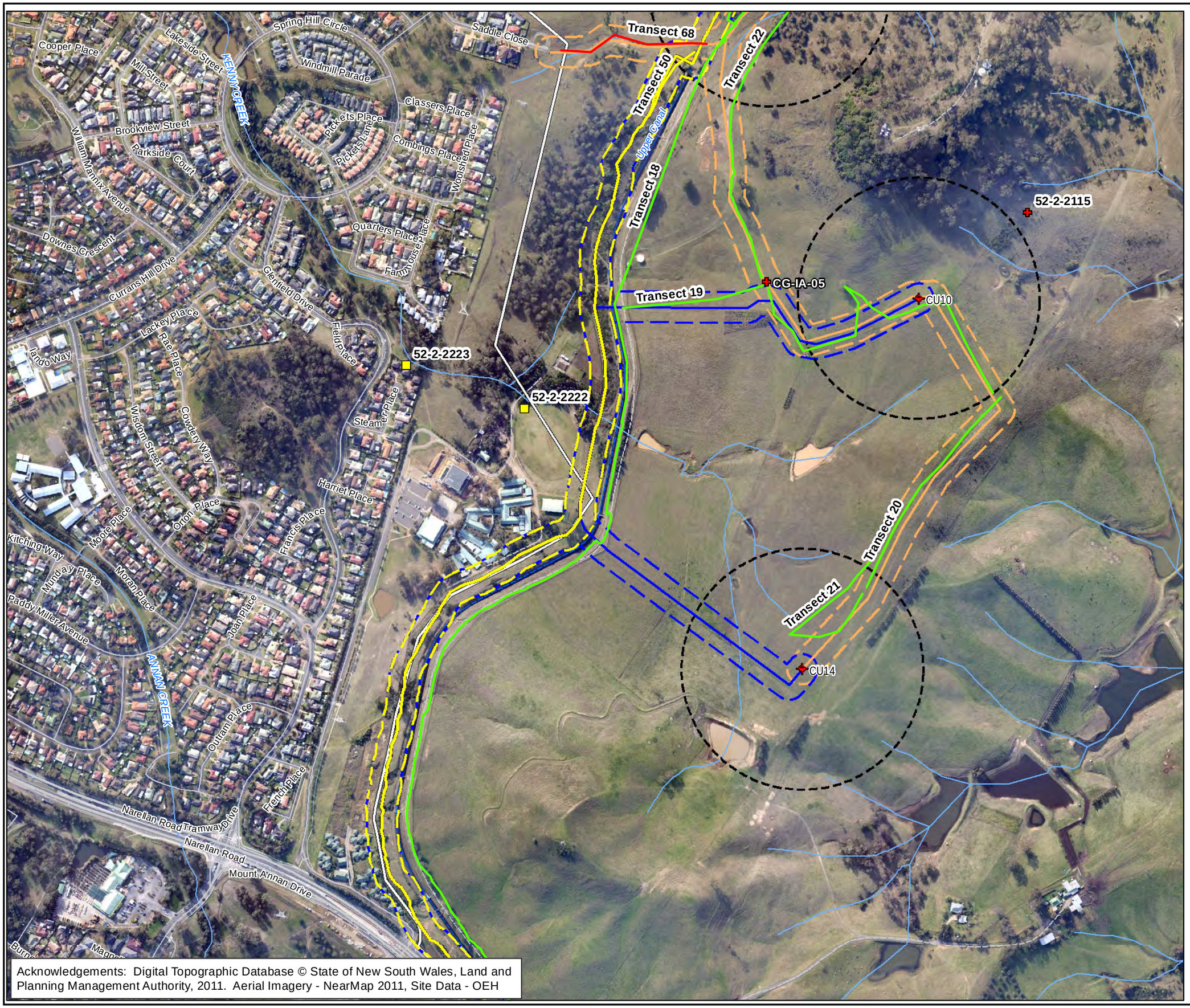
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd



Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4N: Survey Coverage

0 50 100 150 200 250

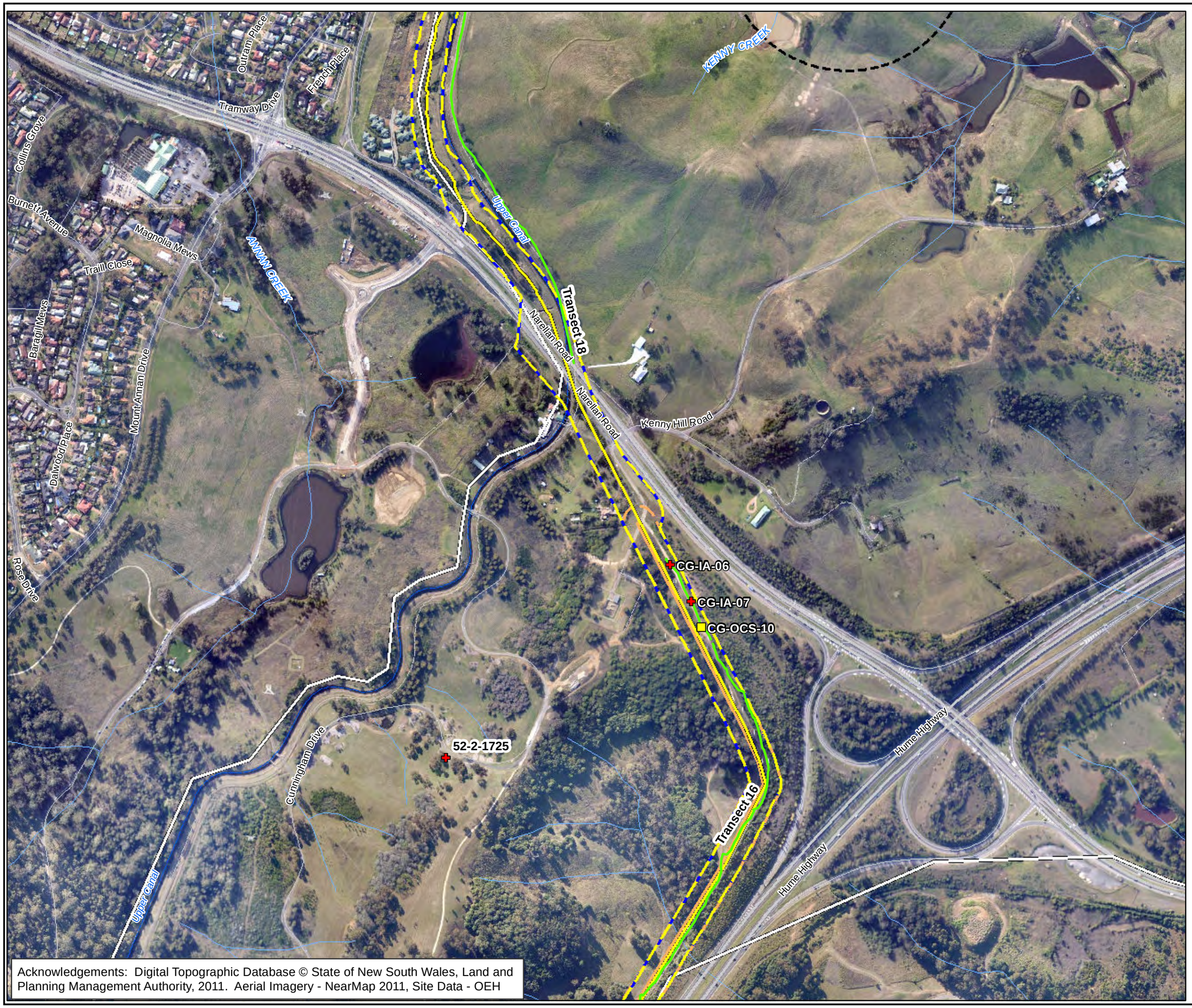
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

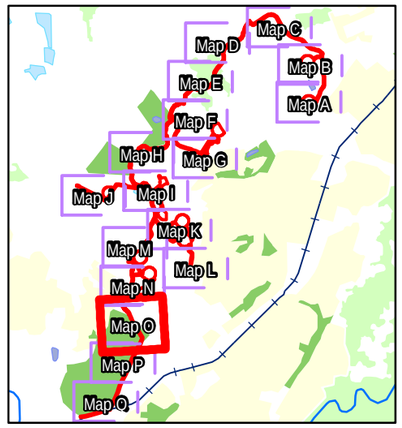
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4O: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

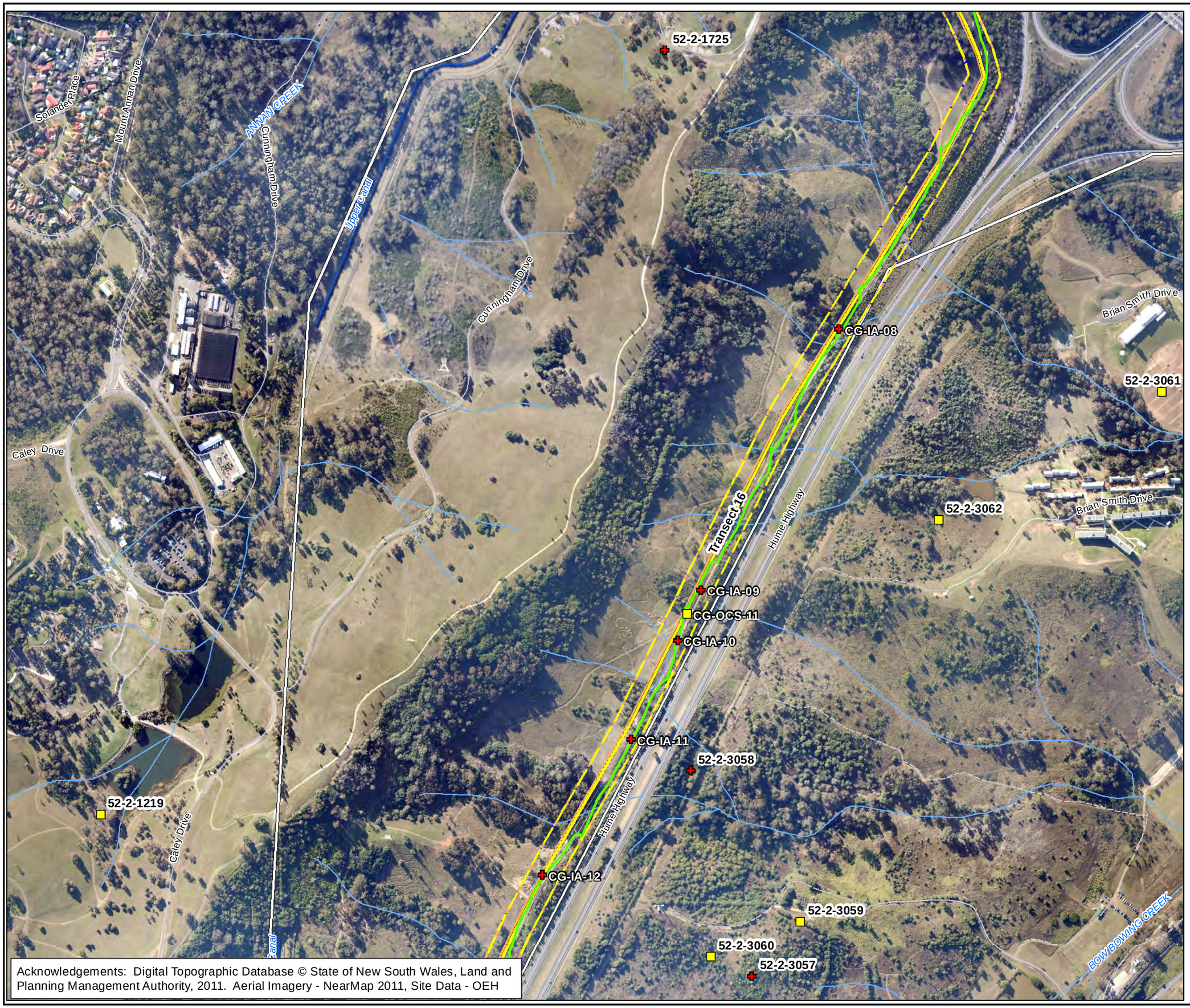
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

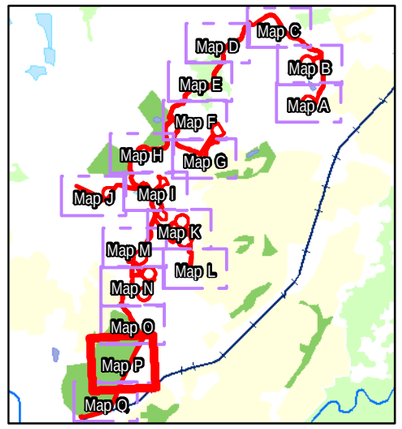
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 26 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4P: Survey Coverage

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

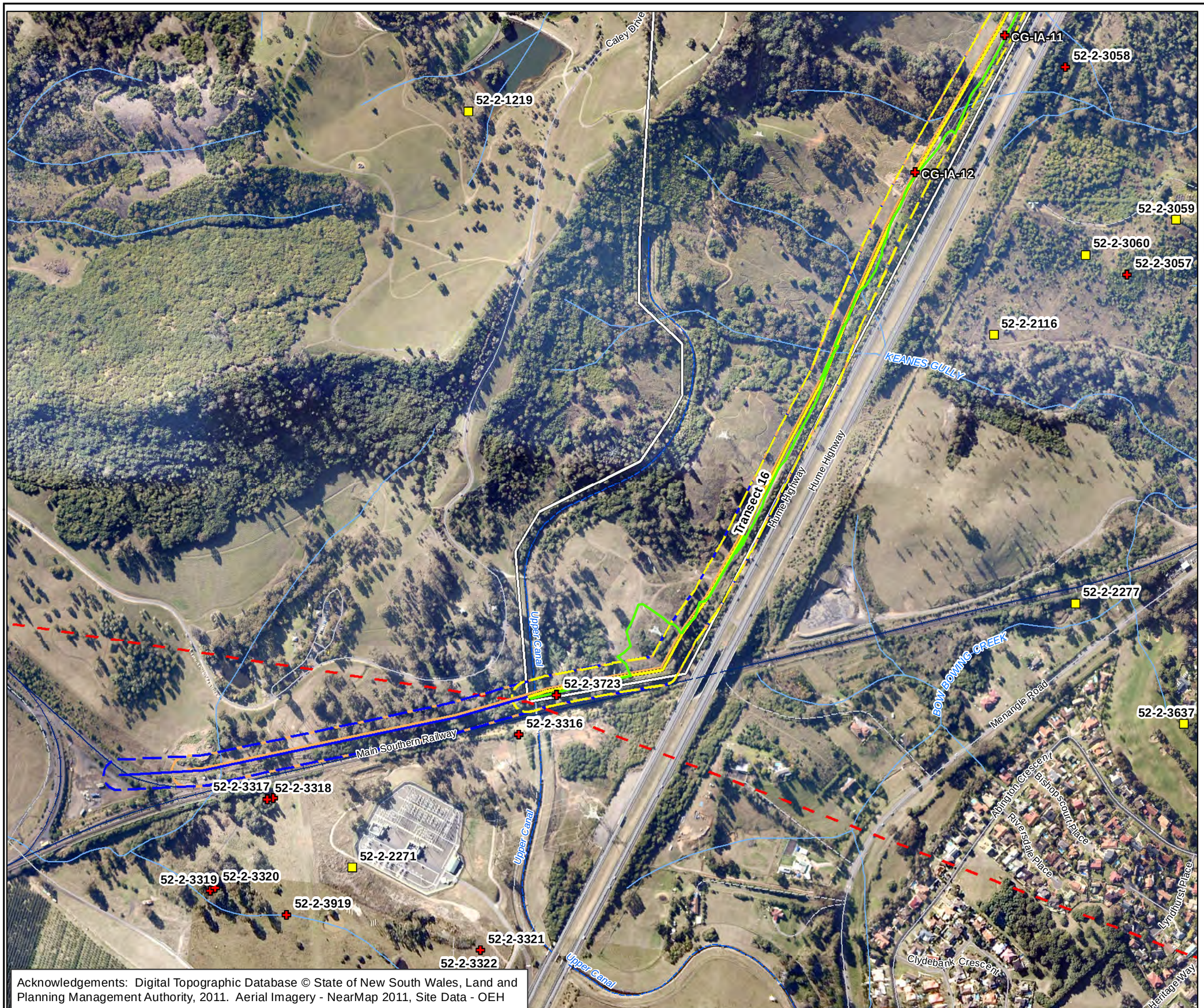
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

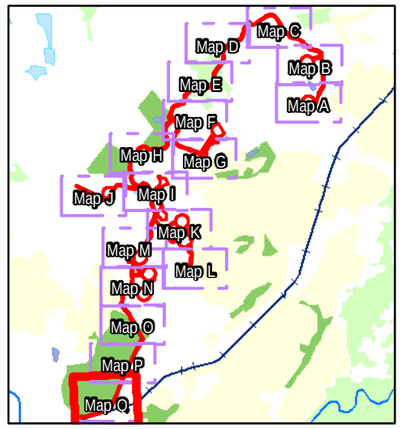
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

Biosis Research Survey Effort
- 2009 Survey
- 2011 Survey
- 2012 Survey

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine
- Main Gas Gathering Spine Envelope

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 4Q: Survey Coverage

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

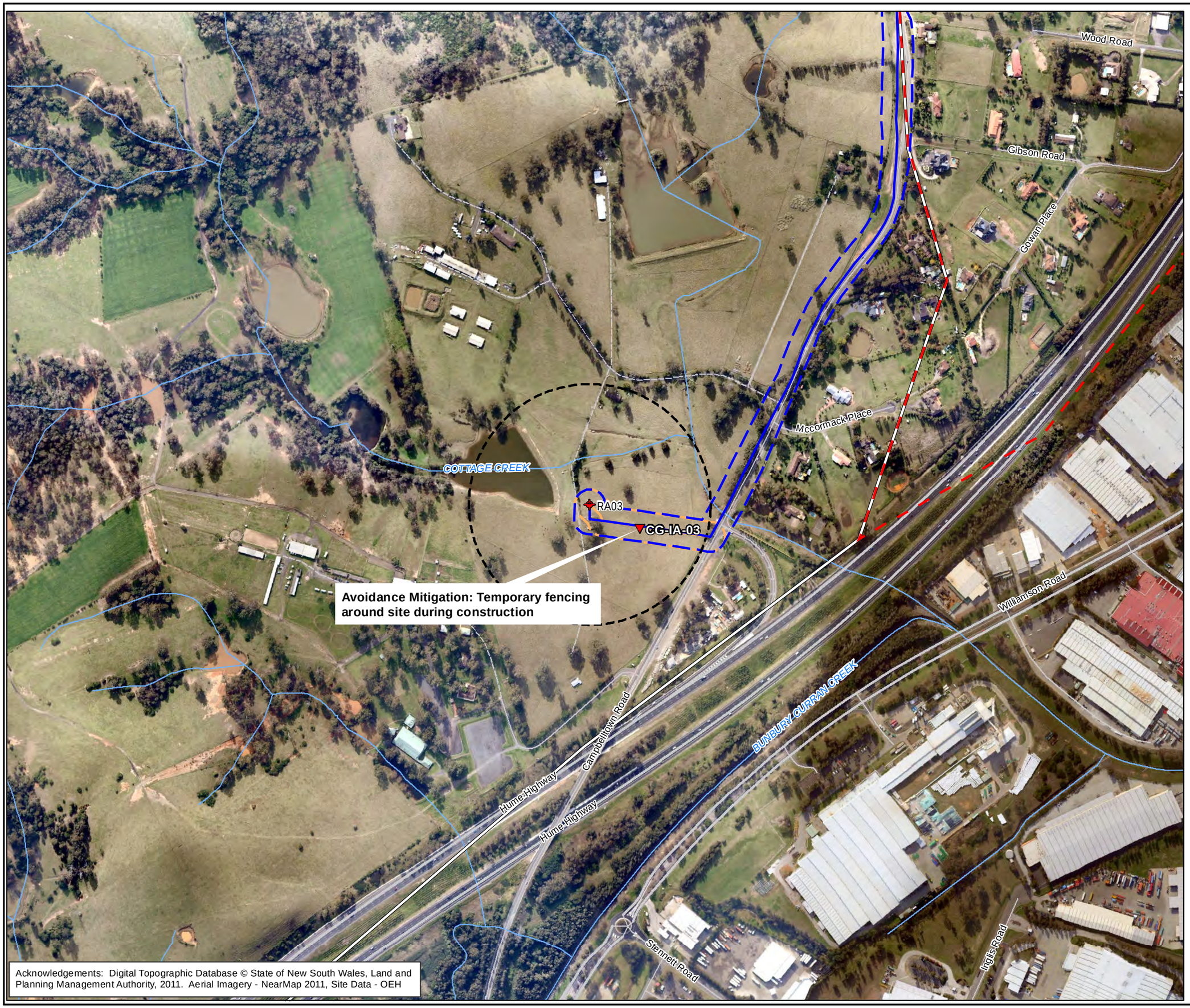
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

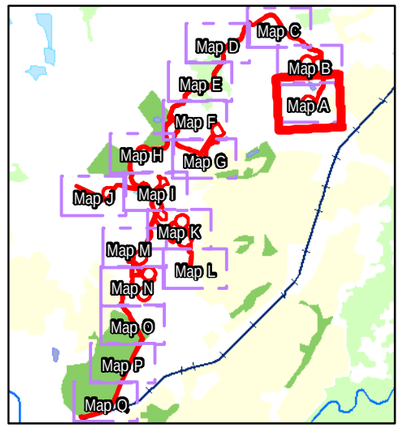
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F4 AR_Survey Effort_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5A: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

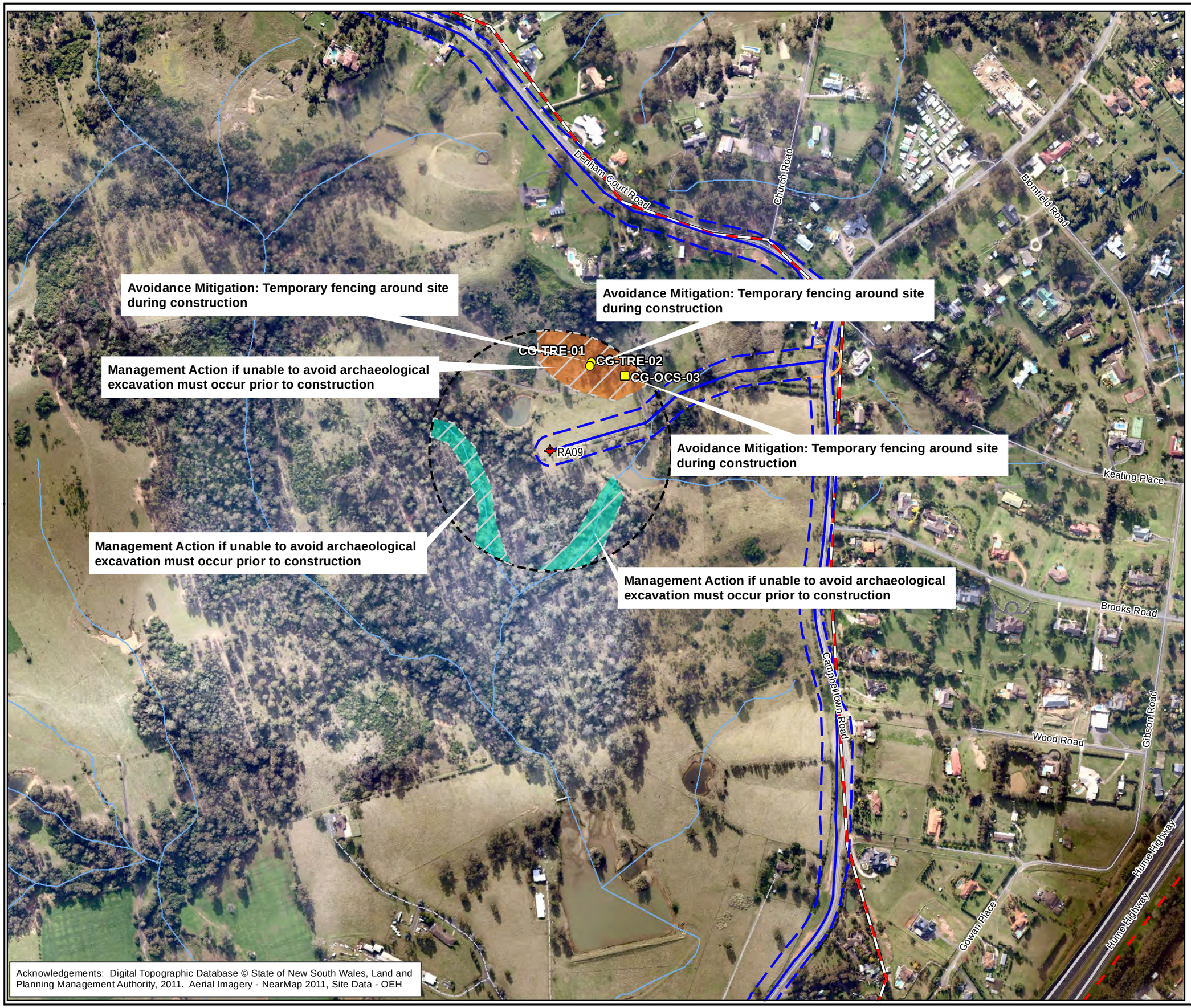
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

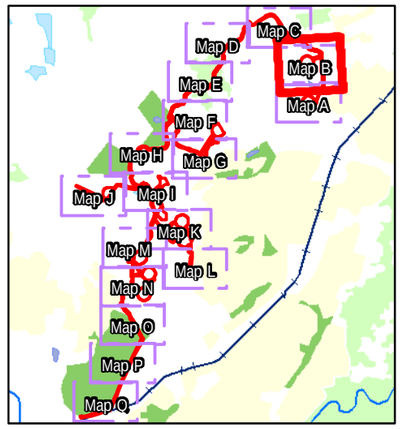
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5B: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

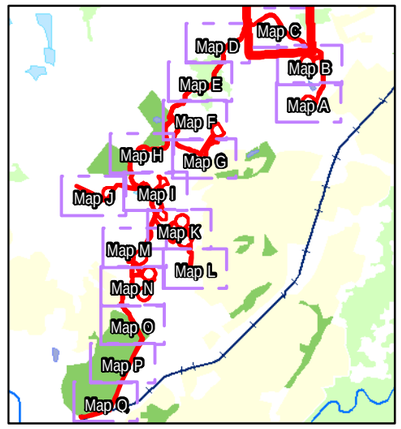
N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Fox Valley Road
Springmead Drive
Cubitt Drive
Huntingdale Drive
Upper Canal
Denham Court Road

45-5-3488
2060-6 PAD
2062-6 PAD
Management Action if unable to avoid archaeological excavation must occur prior to construction
45-5-3487
2061-6 PAD
Management Action if unable to avoid archaeological excavation must occur prior to construction
45-5-2460
45-5-3486
45-5-3490
45-5-3491
45-5-3473
45-5-3474

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5C: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Heath Road
Park Road
Camden Valley Way
St Andrews Road
Upper Canal

45-5-4052
45-5-3453
45-5-3440
45-5-3455
45-5-4054
2060-6 PAD
45-5-3450
45-5-3457
45-5-3497
45-5-3449
45-5-3442
45-5-3446
45-5-3458
45-5-3447
45-5-3471
45-5-3498
45-5-3476
45-5-3475
45-5-3477
45-5-3481
45-5-3441
45-5-3482
45-5-3472
45-5-3949
45-5-3492
45-5-3468
45-5-3443
45-5-3444
45-5-3496
45-5-3470
45-5-3445
45-5-3484
45-5-3494
45-5-3462
45-5-3464
45-5-3463
45-5-2557
45-5-3469
45-5-3499

CG-OCS-01
CG-OCS-02
CG-IA-01
CG-IA-02
CG-OCS-04
CG-OCS-05
CG-OCS-06

Management Action: Relocation of surface artefacts outside of construction footprint

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Map A
Map B
Map C
Map D
Map E
Map F
Map G
Map H
Map I
Map J
Map K
Map L
Map M
Map N
Map O
Map P
Map Q

Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5D: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Camden Valley Way

45-5-3468

45-5-3443

45-5-3496

Avoidance Mitigation: Temporary fencing around site during construction

CG-OCS-05

45-5-3462

45-5-3464 45-5-3463

St Andrews Road

45-5-2557

Upper Canal

Management Action if unable to avoid archaeological excavation must occur prior to construction

45-5-3493

CG-OCS-06

St Andrews Road

45-5-3467 45-5-3466

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

CG-OCS-09

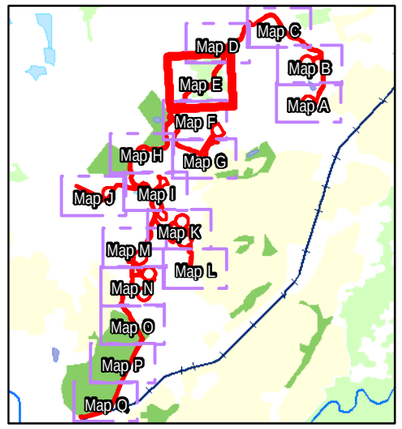
Management Action: Relocation of surface artefacts outside of construction footprint

St James Road

Upper Canal

CG-OCS-12

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5E: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Management Action: Relocation of surface artefacts outside of construction footprint

Management Action if unable to avoid archaeological excavation must occur prior to construction

Raby Road

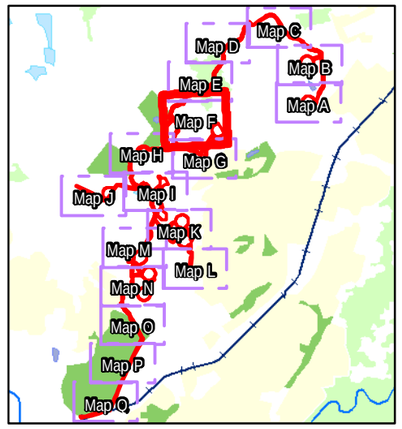
Upper Canal

Upper Canal

Upper Canal

CG-OCS-12

VV03



Legend

- Management Action Required

Archaeological Potential

- High
- Moderate

Registered Sites

- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations

- Well Surface Location
- Well Assessment Area

Gas Gathering Lines

- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks

- Access Track
- Access Track Envelope

Survey Area

- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5F: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

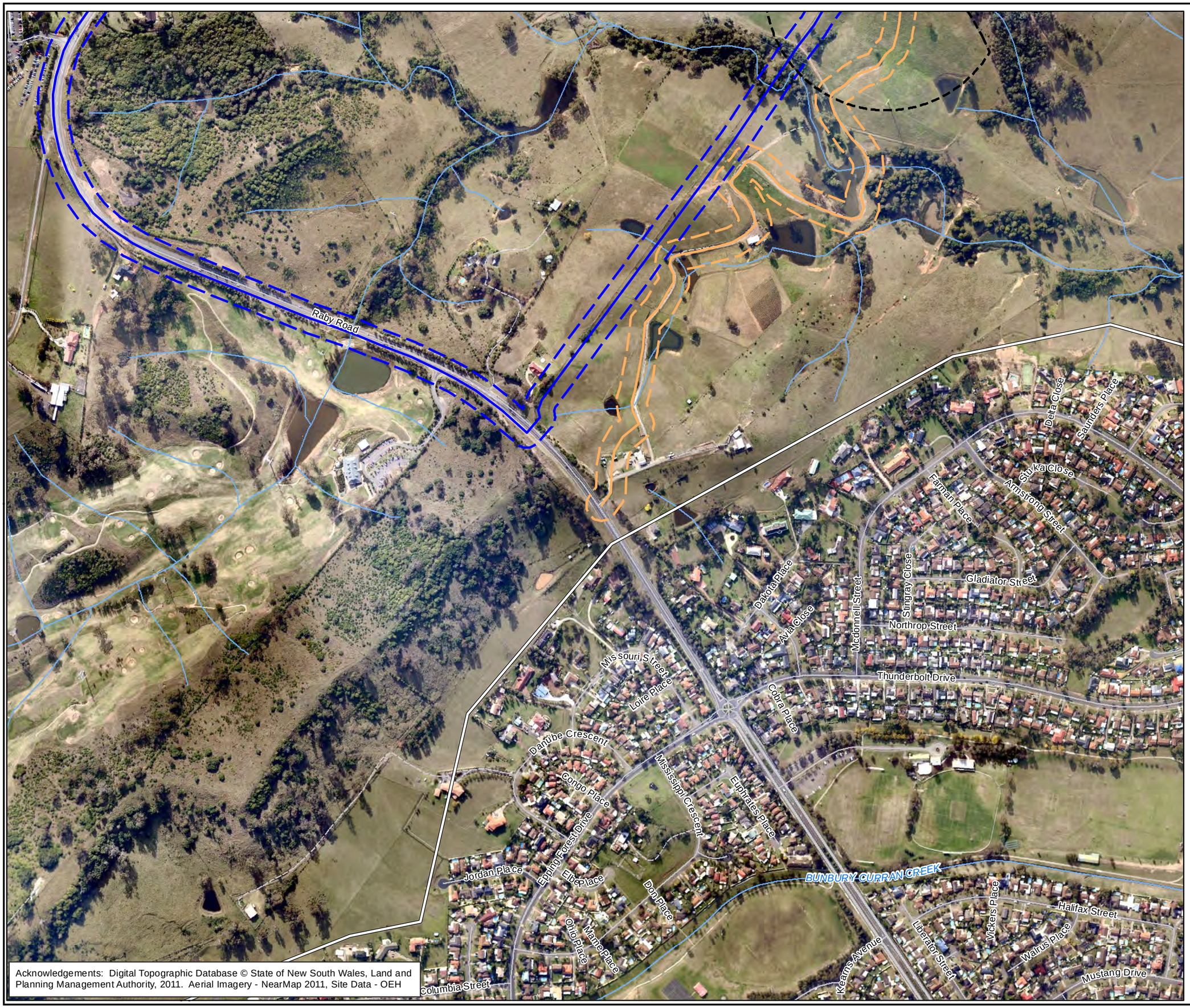
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

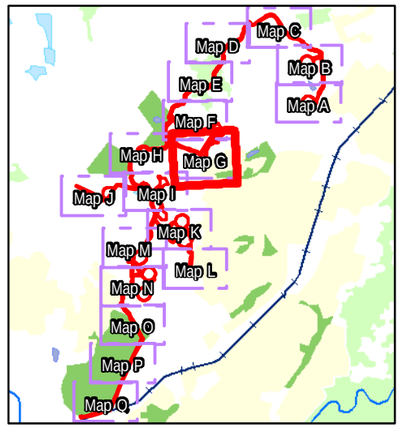
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5G: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

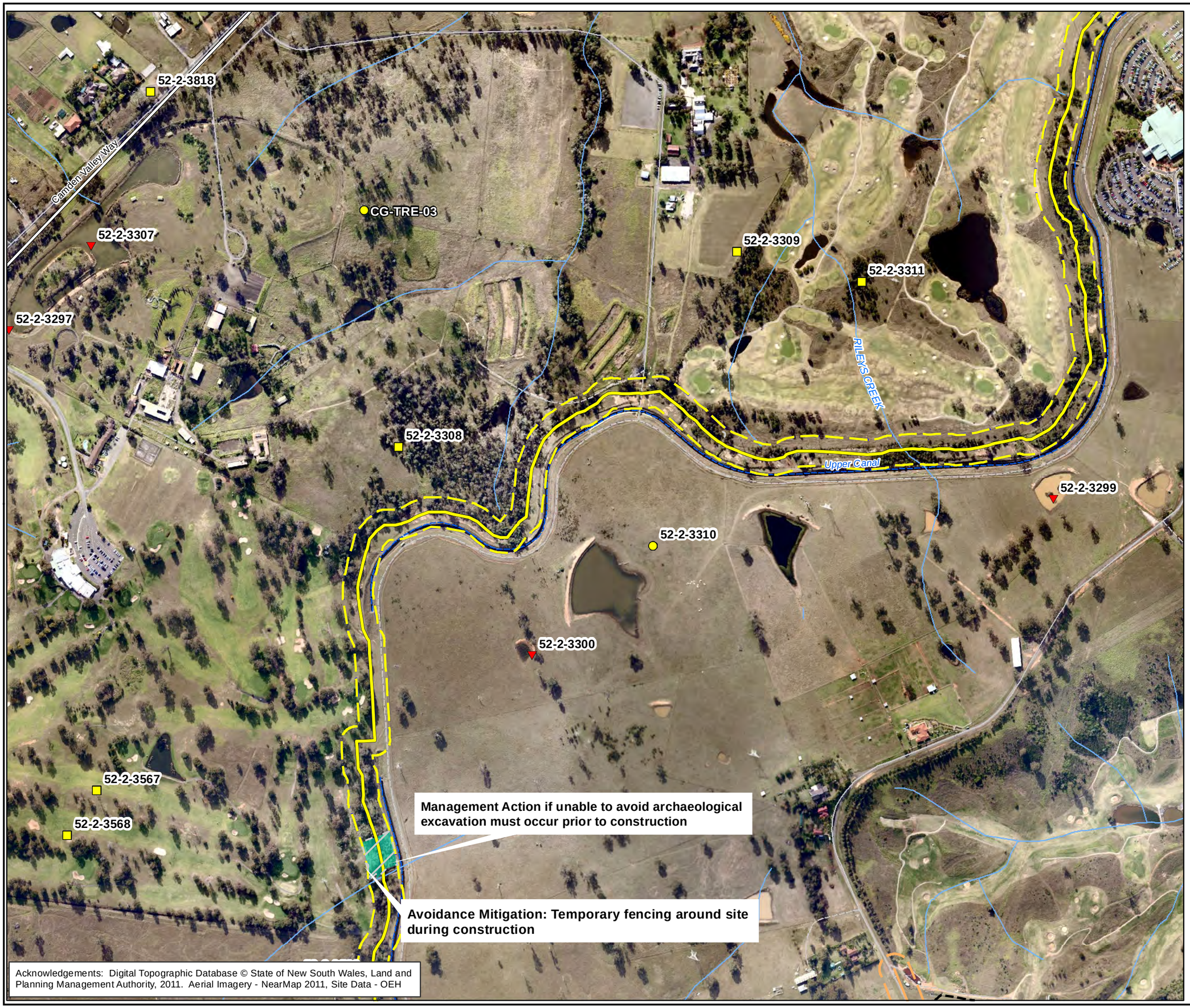
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

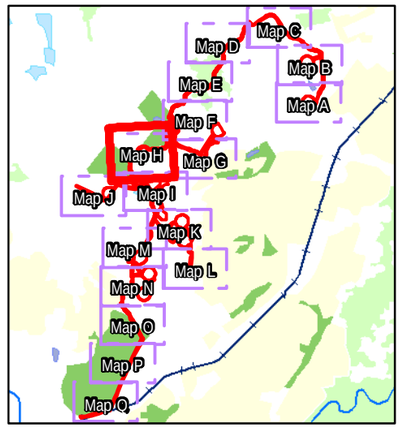
N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd



Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5H: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

52-2-3569

CG-OCS-07

CU22

Upper Canal

Turner Road Precinct AHIP holders have complied with AHIP conditions and no further actions are required

52-2-3564

Tranasct H

52-2-3724

52-2-3563

CG-OCS-08

BUNBURY CURRAN CREEK

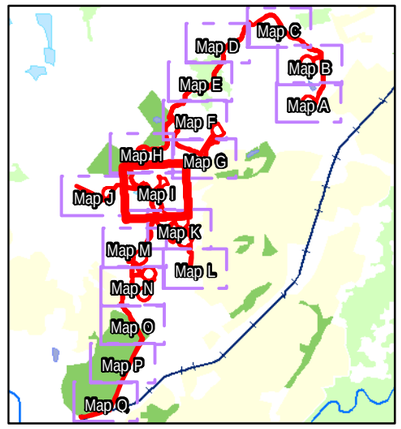
TR5

Avoidance Mitigation: Temporary fencing around site during construction

52-2-3561

CU31

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH



Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5I: Management Recommendations

0 50 100 150 200 250

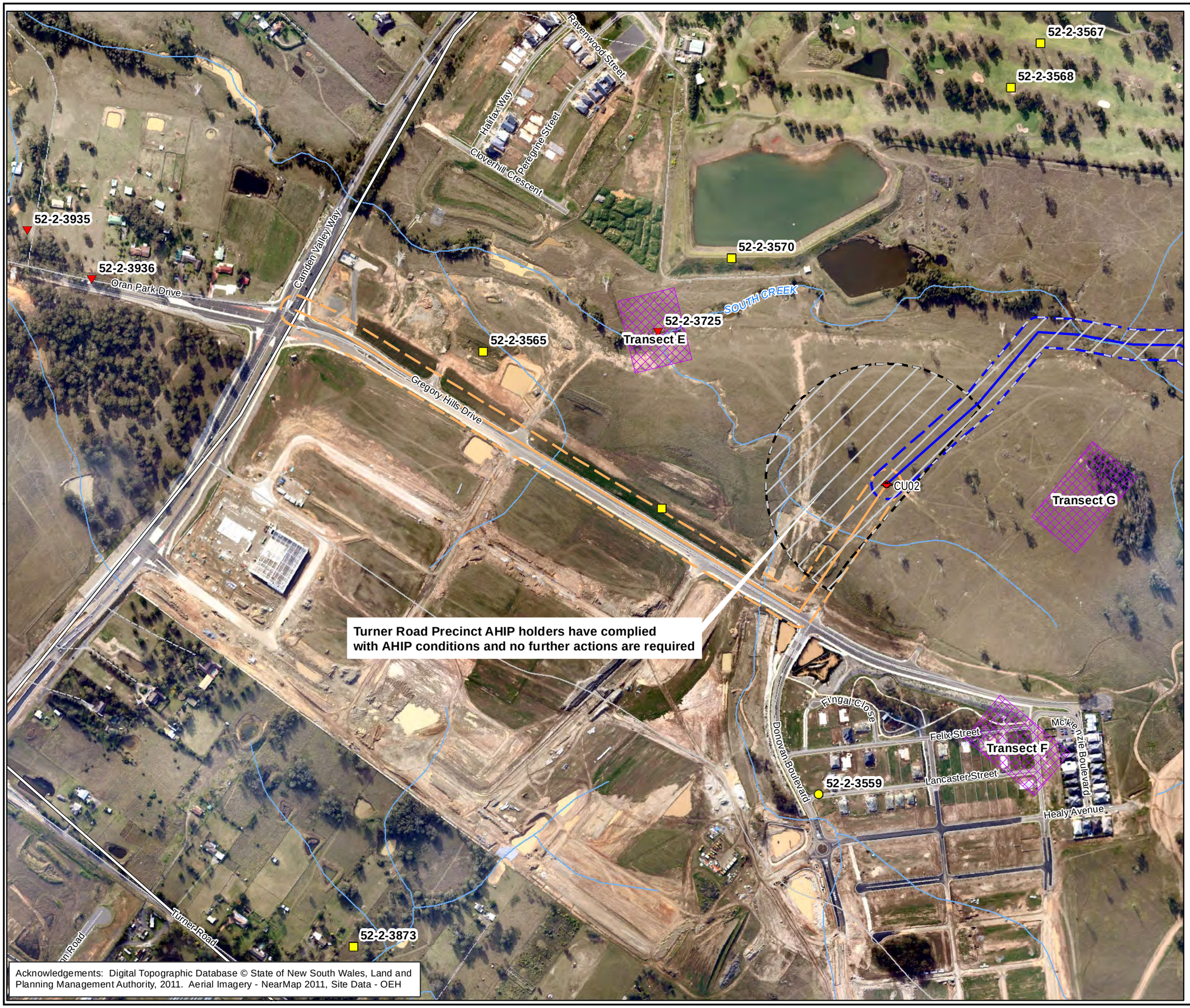
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

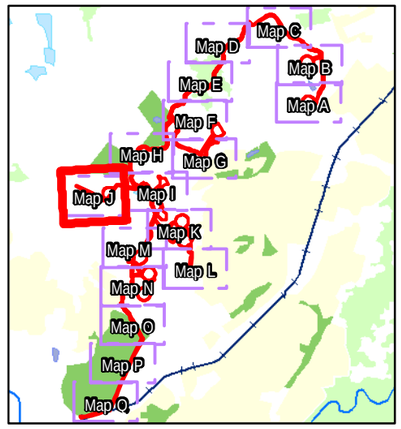
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5J: Management Recommendations

0 50 100 150 200 250

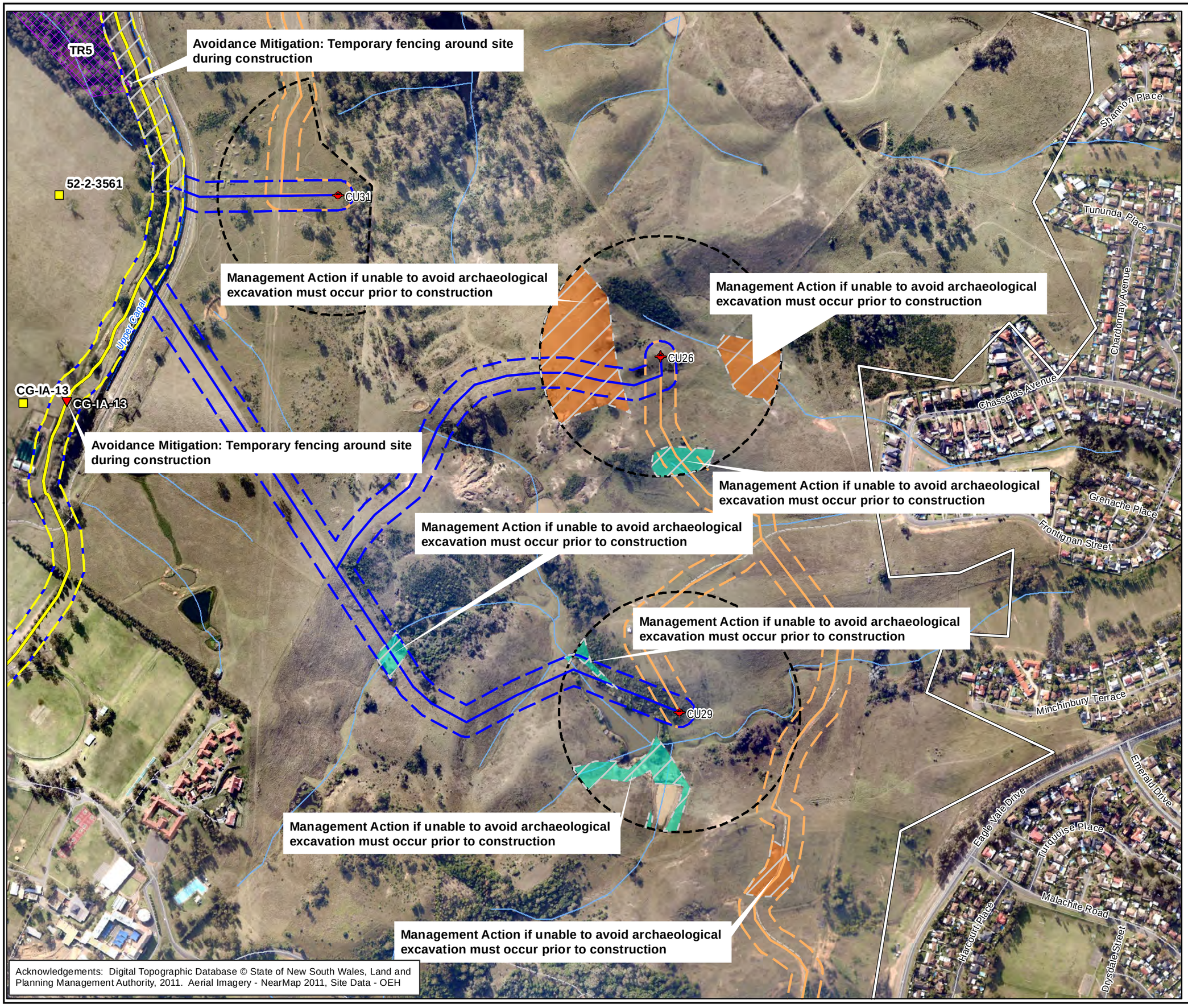
Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

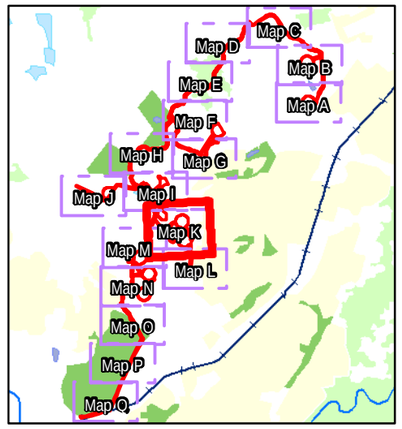
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5K: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

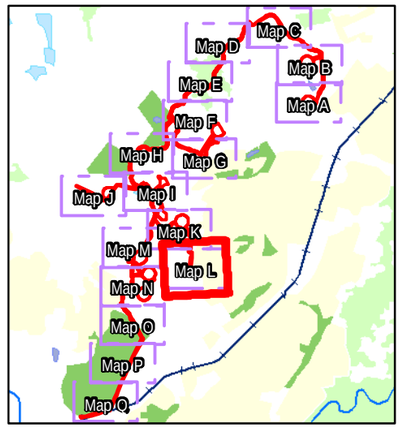
Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

CG-TRE-04

Turquoise Place
Serpentine Place
Cameo Place
Topaz Place
Emerald Drive
Sapphire Place
Mica Place
Harcourt Place
Malachite Road
Silica Crescent
Diamond Place
Boyd Street
Jade Place
Calcite Place
Bauxite Place
Crozier Street
Brierley Place
Ashton Close
Dargie Place
Dysdale Street
Auld Place
Namatjira Close
Carter Place
Eagle Vale Drive
Young Place
Dobell Road
Hall Place
Martens Way
Newbury Place
Griffiths Place
Power Close
Taylor Way
Westhall Way
Murch Place
Earle Way
Garling Way
Badgally Road
Waling Way
Colquhoun Way
Salvana Way
Prout Way
Gidley Crescent
Daplyn Way
Neri Way
Byant Way
Norman Crescent
Conder Way
Claymore Walk
Dyson Way
Ruby Way
Sumba Place
Chevalier Way
Withers Way
Buvelot Way
Clydesdale Drive
Waler Place
Shetland Road
Dobell Road



Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5L: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

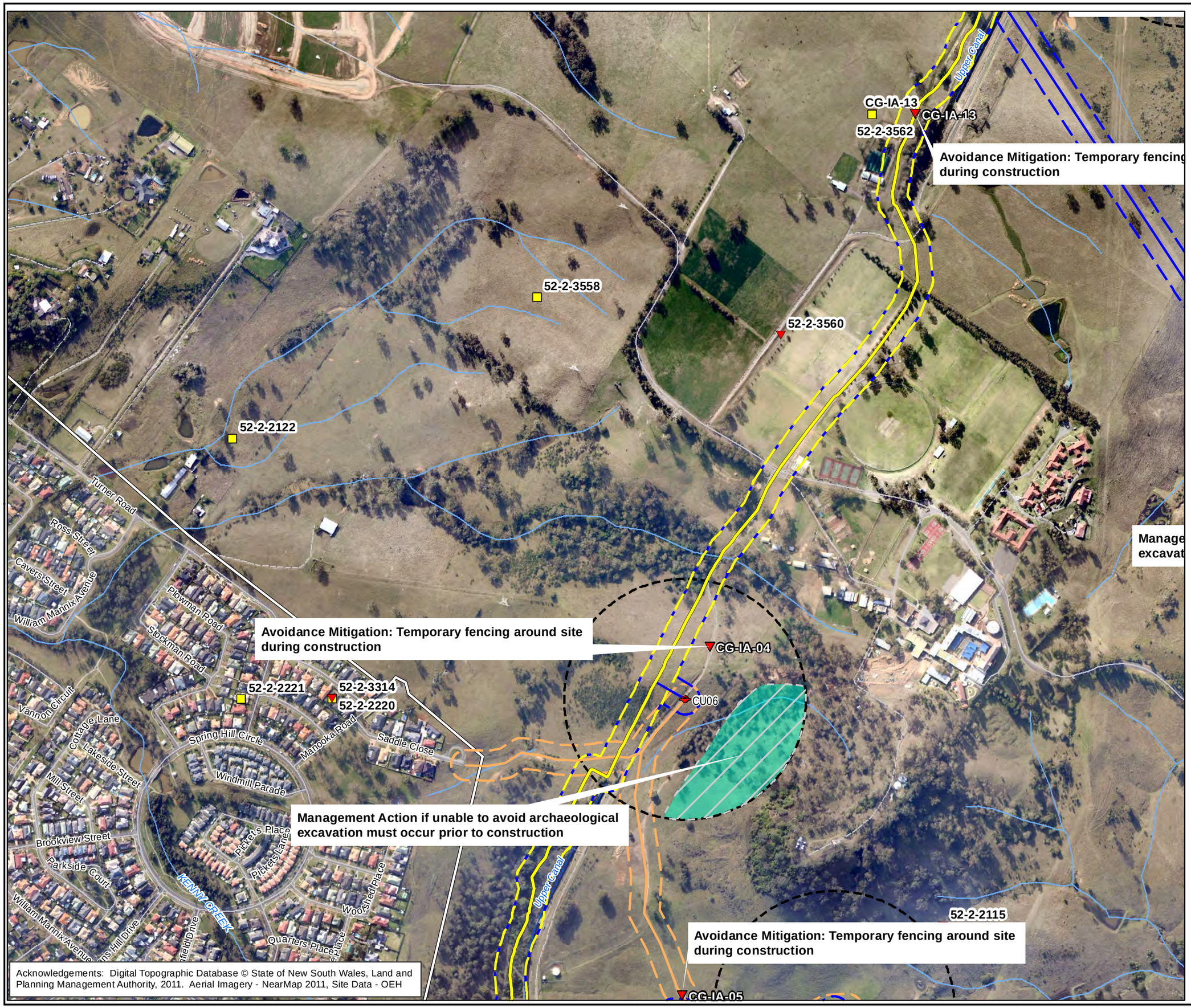
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

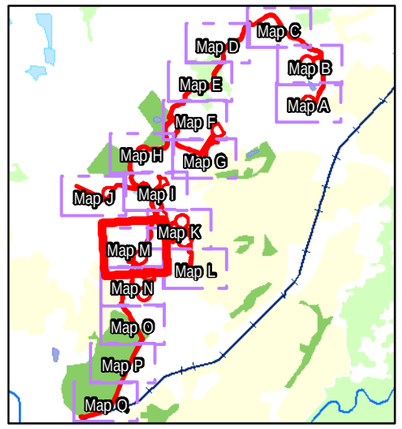
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5M: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

52-2-2115

52-2-2223

52-2-2222

CG-IA-05

CU10

CU14

Cooper Place
Lakeside Street
Spring Hill Circle
Saddle Close
Mill Street
Windmill Parade
KENNY CREEK
Brookview Street
Parkside Court
William Mannix Avenue
Pickets Place
Pickets Lane
Upper Canal
Woolshed Place
Quarters Place
Farmhouse Place
Downes Crescent
Currans Hill Drive
Glenfield Drive
Lackey Place
Rae Place
Field Place
Iando Way
Steamer Place
Wisdom Street
Cowdery Way
Harriet Place
Orton Place
Moore Place
Francis Place
Kitching Way
Munday Place
Moran Place
Joan Place
Paddy Miller Avenue
ANNAN GREEK
Outram Place
French Place
Narellan Road Tramway Drive
Narellan Road
Mount Annan Drive

Map A
Map B
Map C
Map D
Map E
Map F
Map G
Map H
Map I
Map J
Map K
Map L
Map M
Map N
Map O
Map P
Map Q

Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5N: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Management Action if unable to avoid archaeological excavation must occur prior to construction

Management Action if unable to avoid archaeological excavation must occur prior to construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing around site during construction

CG-IA-06

CG-IA-07

CG-OCS-10

52-2-1725

Outram Place
French Place
Tramway Drive
Collins Grove
Burnett Avenue
Magnolia Mews
Traill Close
Baragil Mews
Mount Annan Drive
Dalwood Place
Rose Drive
ANNAN CREEK
Upper Canal
Narellan Road
Kenny Hill Road
Cunningham Drive
Hume Highway

Map A
Map B
Map C
Map D
Map E
Map F
Map G
Map H
Map I
Map J
Map K
Map L
Map M
Map N
Map O
Map P
Map Q

Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5O: Management Recommendations

0 50 100 150 200 250

Metres

Scale: 1:5,800 @ A3

Coordinate System: GDA 1994 MGA Zone 55

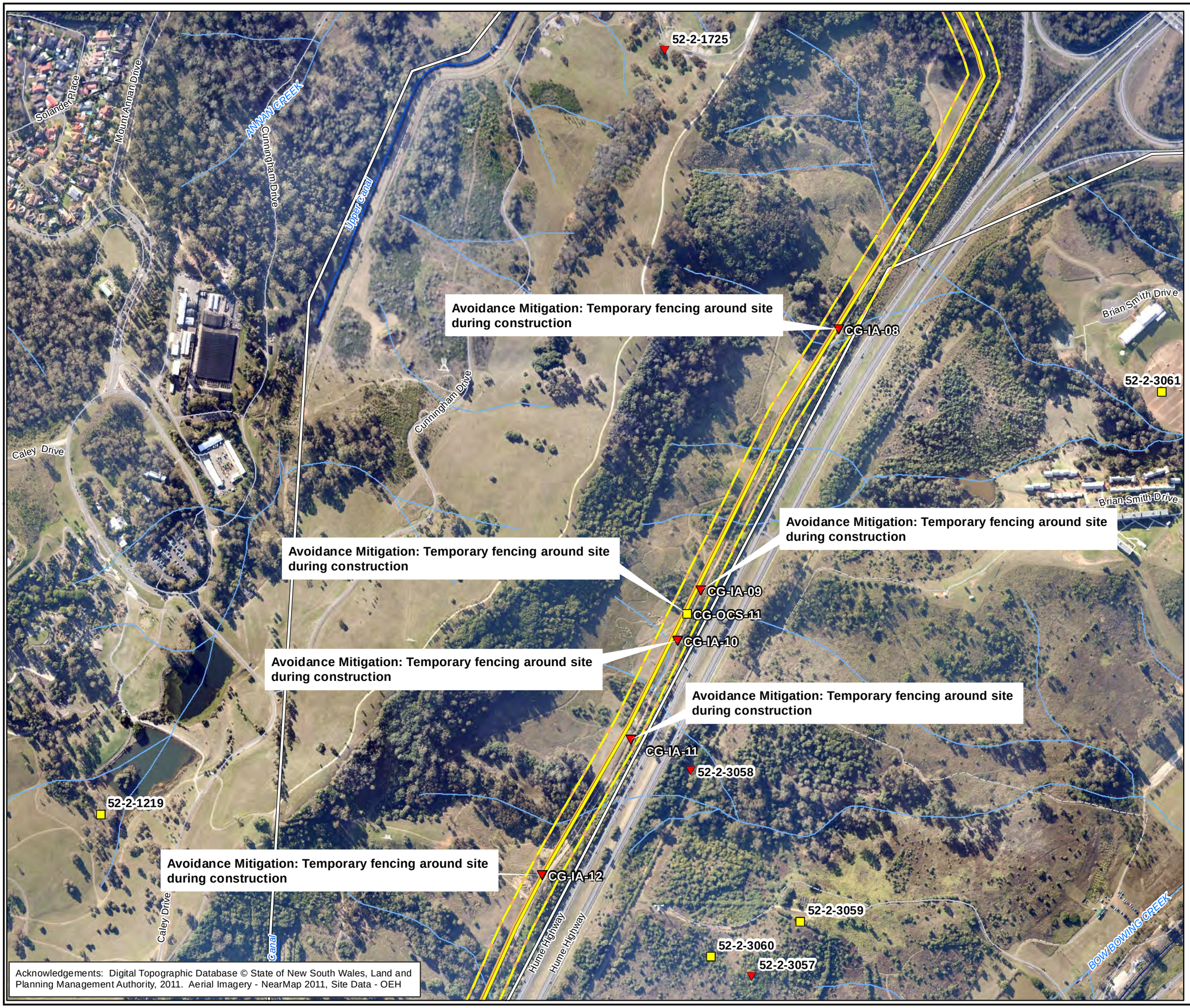
Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

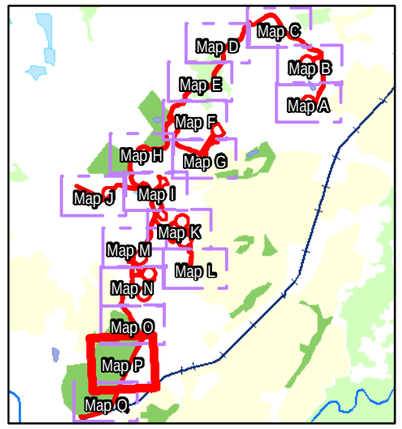
Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 26 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd





Legend

- Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5P: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

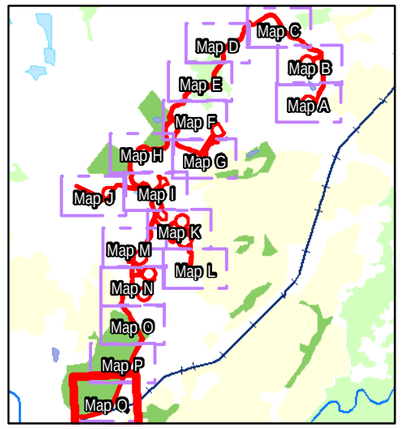
Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd

Avoidance Mitigation: Temporary fencing around site during construction

Avoidance Mitigation: Temporary fencing aroundsite during construction

52-2-1219
CG-IA-11
52-2-3058
CG-IA-12
52-2-3059
52-2-3060
52-2-3057
52-2-2116
52-2-2277
52-2-3637
52-2-3723
52-2-3316
52-2-3317
52-2-3318
52-2-2271
52-2-3319
52-2-3320
52-2-3919
52-2-3321
52-2-3322

Caley Drive
Upper Canal
Hume Highway
KEANES GULLY
BOW BOWING CREEK
Main Southern Railway
Menangle Road
Abington Crescent
Bishopscourt Place
Riversdale Place
Lyndhurst Place
Clydebank Crescent
Heritage Way



Legend

Management Action Required

Archaeological Potential
- High
- Moderate

Registered Sites
- Axe Grinding Groove
- Grinding Groove, Shelter with Deposit
- Earth Mound
- Isolated Artefact
- Scarred Tree
- Open Camp Site
- Potential Archaeological Deposit
- Quarry
- Rock Engraving
- Shelter with Art
- Shelter with Art, Shelter with Deposit
- Stone Arrangement
- Open Camp Site
- PAD

Well Locations
- Well Surface Location
- Well Assessment Area

Gas Gathering Lines
- Gas Gathering Line
- Gas Gathering Line Envelope
- Main Gas Gathering Spine Envelope
- Main Gas Gathering Spine

Access Tracks
- Access Track
- Access Track Envelope

Survey Area
- Surface Project Area/Study Area
- Subsurface Project Area

Figure 5Q: Management Recommendations

0 50 100 150 200 250

Metres
Scale: 1:5,800 @ A3
Coordinate System: GDA 1994 MGA Zone 55

Biosis Research Pty. Ltd.
8 Tate Street
Wollongong
NEW SOUTH WALES
2500

Offices also in: Sydney, Canberra, Ballarat, Melbourne, Wangaratta

N

Acknowledgements: Digital Topographic Database © State of New South Wales, Land and Planning Management Authority, 2011. Aerial Imagery - NearMap 2011, Site Data - OEH

Date: 09 October 2012, File number: 14975
Checked by: ASF, Drawn by: ANP
Location:P:\14900s\14975\Mapping\ACHA Report Figures\14975 F5 AR Constraints_20121009.mxd