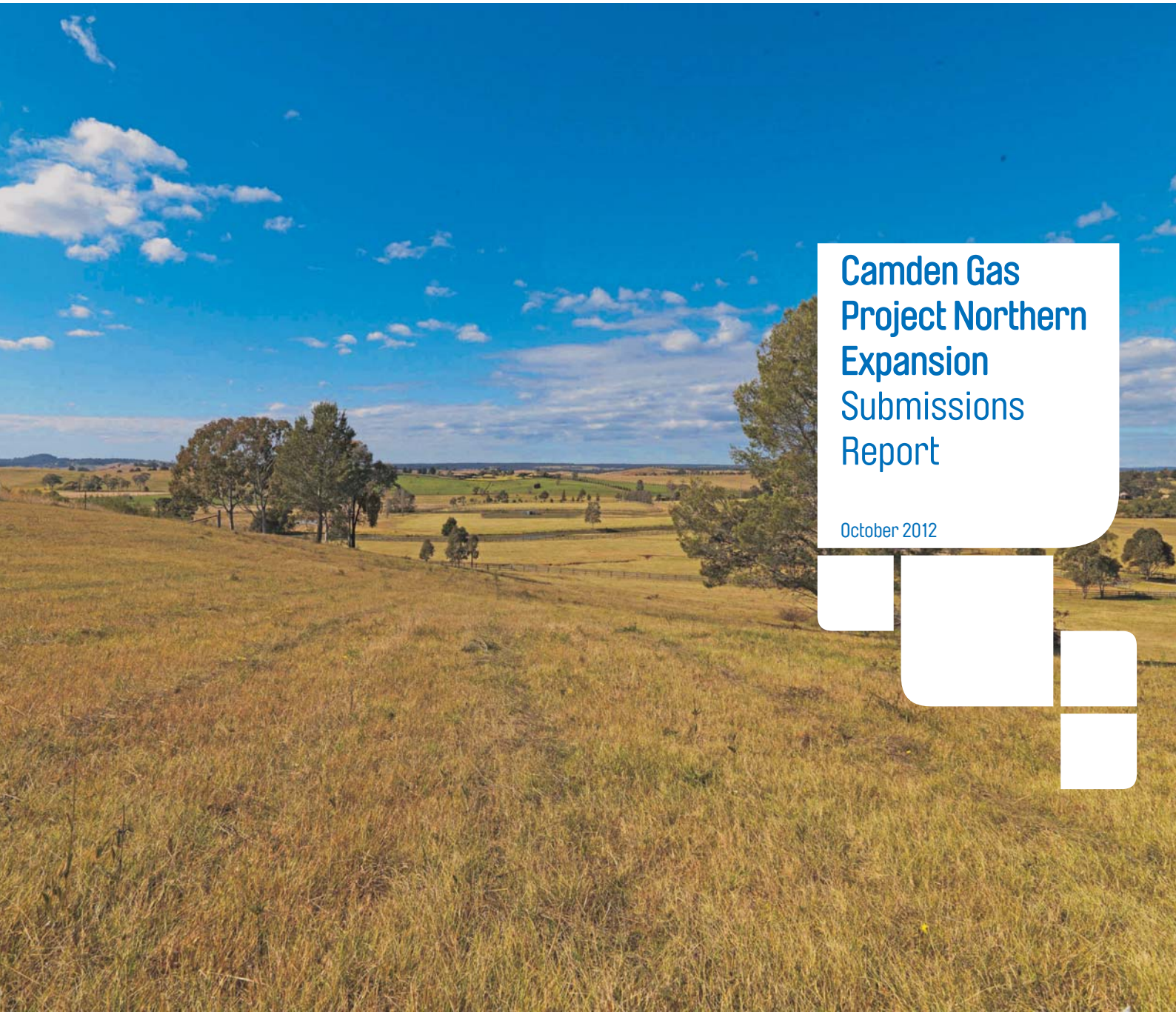

Camden Gas Project Northern Expansion Submissions Report

October 2012

MAIN REPORT

Prepared for AGL Energy Limited
101 Miller Street | Sydney | New South Wales | 2060
www.agl.com.au

Prepared by AECOM
Level 21, 420 George Street | Sydney | New South Wales | 2000 | T +61 2 8934 0000 | F +61 2 8934 0001
www.aecom.com

Submissions Report

Northern Expansion of the Camden Gas Project

Prepared for

AGL Upstream Gas Investments Pty Limited

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

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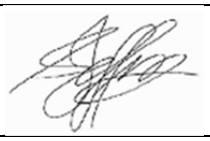
F	28-Oct-2012	Issue of Final Report	Scott Jeffries Associate Director - Environment	

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Executive Summary

AGL Upstream Gas Investments Pty Limited (AGL), a wholly owned subsidiary of AGL Energy Limited, currently operates the Camden Gas Project (CGP) for the extraction of coal seam gas (CSG) from the Illawarra Coal Measures, within the Southern Coalfields of the Sydney Basin. The CGP includes 143 existing CSG wells (of which 86 are currently in operation), access roads, a high pressure supply pipeline, underground gas gathering lines (GGLs) and the Rosalind Park Gas Plant (RPGP). AGL currently proposes to expand its operations to the north of existing CGP infrastructure.

On 23 September 2010, AGL lodged an application under the then Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), seeking approval at the time for an additional 12 well surface locations (each with six wells, for a total of 72 wells), GGLs, access roads and associated infrastructure. An Environmental Assessment for the project (then referred to as the Northern Expansion Project) was prepared and publicly exhibited from 26 October 2010 until 7 December 2010.

The Department of Planning and Infrastructure received a total of 28 submissions on the Northern Expansion Project, both during and after the public exhibition period. These submissions included eight from State and local government agencies, and 20 submissions from private parties. Key issues raised in these submissions included matters such as statutory planning (permissibility of the development), land use impacts (particularly potential conflicts with future developments), impacts on ecology (particularly in relation to the clearing of vegetation), surface and ground water impacts (including issues associated with surface connectivity and hydraulic fracture stimulation) and amenity issues (such as dust generation, noise and vibration and traffic impacts). This Submissions Report responds to each of the issues raised in submissions.

In response to issues raised in submissions, and as part of AGL's ongoing consultation with stakeholders, it has made amendments to the Northern Expansion Project (referred to as the Amended Project). The Amended Project now includes only 11 well surface locations, being:

- Original well surface locations RA09, CU02, CU26, CU10 and CU14.
- Relocation of two well surface locations, CU06 and CU22;
- Two new well locations, VV03 and CU31.

Well surface locations VV07 and VV11 have been removed from the Amended Project. The location of associated access tracks and GGLs have also been amended to accommodate new and amended well surface locations.

This Submissions Report includes an updated assessment of the potential environmental impacts of the Amended Project. As part of this assessment, further field investigations were undertaken with respect to ecological and heritage issues. Significantly, as a consequence of the Amended Project and further investigation of avoidance measures, the need for vegetation clearing has been reduced and listed threatened species and communities will be entirely avoided. This Submissions Report also includes further assessment of surface water and groundwater issues, including a Phase 1 Groundwater Assessment, initial monitoring data gathered to inform a Phase 2 Groundwater Assessment and a Groundwater Management Plan. This additional assessment supports the conclusions drawn in the original Environmental Assessment that the project is unlikely to have a significant impact on surface or groundwater systems.

Updated consideration of other environmental issues presented in this Submissions Report, with respect to noise and vibration, air quality, traffic, waste, visual amenity, hazards and risk, and rehabilitation confirm that the impacts of the Amended Project will either be equivalent to or less than the impacts predicted in the original Environmental Assessment. The Amended Project has been demonstrated as being able to be constructed, operated and decommissioned within acceptable environmental limits.

Since public exhibition of the Environmental Assessment for the Northern Expansion Project in 2010, Part 3A of the EP&A Act has been repealed. However, Part 3A continued to apply to the Northern Expansion Project due to the transitional provisions under the EP&A Act. On 19 October 2012, the project was declared to be State significant development by the Minister for Planning and Infrastructure by an order published in the NSW Gazette on 26 October 2012. Assessment and determination of the Amended Project will therefore now proceed under Division 4.1, Part 4 of the EP&A Act, rather than under (the now repealed) Part 3A.

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1.0 Introduction

1.1 Background

1.1.1 Project Overview

The Camden Gas Project (CGP) involves the extraction of coal seam gas (CSG) from the Illawarra Coal Measures, within the Southern Coalfields of the Sydney Basin, New South Wales (NSW). The Proponent for the Project is AGL Upstream Gas Investments Pty Limited (AGL), a wholly owned subsidiary of AGL Energy Limited.

The current CGP operations consist of 143 existing CSG wells (of which 86 are currently operating), access roads, a high pressure supply pipeline, underground gas gathering lines (GGL) and the Rosalind Park Gas Plant (RPGP), forming Stages 1 and 2 of the CGP. AGL proposes to expand the CGP northward of current operations (the Northern Expansion Project), including development of additional gas wells and associated field infrastructure (refer to **Figure 1**). The Northern Expansion Project would tie in to the existing CGP network.

The primary objective of the Northern Expansion Project is to continue gas production from the Illawarra Coal Measures to supply the NSW energy market.

1.2 Purpose of this Report

The purpose of this Submissions Report is to:

- Detail, and provide responses to submissions by private individuals, community groups and Government agencies regarding the Northern Expansion Project, which were received during the public exhibition of the Environmental Assessment (EA) for the project (refer to **Section 2.0**, **Section 3.0** and **Appendix A**).
- Detail changes made to the Northern Expansion Project as a result of issues raised in submissions, further landholder consultation and as a consequence of on-going design development (the Amended Project). This Submissions Report presents a supplementary environmental impact assessment with respect to these amendments (refer to **Section 4.0** and **Section 5.0**).

This Submissions Report forms the basis for which project approval is now sought from the Minister for Planning and Infrastructure.

A summary of the components of the CGP approved to date, and the status of the Northern Expansion Project and current Amended Project, is provided in **Table 1**.

Table 1 Summary of the CGP, Northern Expansion Project and Amended Project

Year	Relevant CGP Area	Outline of Approval
2002	Stage 1	22 wells, Ray Beddoe Treatment Plant (RBTP), and in-field gas gathering system in the Cawdor area
2004	Stage 2	43 wells, Rosalind Park Gas Plant (RPGP) and gas gathering system in Menangle and Menangle Park
2004	Stage 2	15 wells at Mount Taurus and the Harness Racing Club at Menangle Park
2004	Stage 2	6 wells at Glenlee and Elizabeth Macarthur Agricultural Institute (EMAI) Stage 1
2005	Stage 2	7 wells at Sugarloaf
2005	Stage 2	10 wells on the El Bethel property
2005	Stage 1	1 well
2005	Stage 2	5 wells
2006	Stage 2	14 wells on the EMAI property
2006	Stage 2	10 wells in the Razorback area
2007	Stage 1 and 2	9 wells across the existing field

Year	Relevant CGP Area	Outline of Approval
2012	Stage 2	1 well at Mount Taurus and the Harness Racing Club
Proposed Expansion		
2010 (application lodged)	*Northern Expansion Project (Stage 3)*	*Up to 12 well surface locations (up to 72 wells)*
2012 (application amended)	*Amended Project (Stage 3)*	*Up to 11 well surface locations (up to 66 wells)*

AGL is seeking consent under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for the following:

- construction and operation of 11 well surface locations 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 (as shown on **Figure 1**).

To avoid any doubt, consent is not being sought for survey, fencing, investigative drilling/ excavation, building/ road dilapidation surveys and minor clearing or translocation (except where threatened species, populations or endangered ecological communities would be affected).

For purposes of this Submissions Report, the project described above and in more detail in **Section 2.4** and **Section 4.0** is referred to as the Amended Project.

The project area for the Amended Project (Project Area) has been separated into two distinct components 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) (refer to **Figure 1**).

1.2.1 Location

The Amended Project is situated some 60km south-west of Sydney in the Camden and Campbelltown Local Government Areas (LGAs).

The Subsurface and Surface Project Areas incorporate residential and rural land as well as land designated for future urban (residential, commercial, industrial) development as identified in the *Sydney Metropolitan Strategy* (Metropolitan Strategy) and *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*.

1.3 Repeal of Part 3A

The EA for the Northern Expansion Project was originally lodged under Part 3A of the EP&A Act in October 2010. It was then placed on public exhibition between 26 October 2010 and 7 December 2010. However, submissions continued to be accepted after the closing date for the public exhibition period. Since lodgement and public exhibition of the EA, Part 3A of the EP&A Act has been repealed.

Savings and transitional provisions enacted upon the repeal of Part 3A defined various categories of applications, including a project for which an environmental assessment was duly submitted before the repeal of Part 3A, to be 'transitional Part 3A projects' (clause 2, Schedule 6A of the EP&A Act). Part 3A continues to apply to transitional Part 3A projects, despite its repeal (clause 3, Schedule 6A of the EP&A Act).

The EA for the Northern Expansion Project was submitted on 26 October 2010, which was before the repeal date of Part 3A. Accordingly, the Northern Expansion Project is a 'transitional Part 3A project'.

The savings and transitional provisions also empower the Minister for Planning and Infrastructure to declare a 'transitional Part 3A project' to be State Significant Development, and subject to assessment under Division 4.1, Part 4 of the EP&A Act (clause 6, Schedule 6A of the EP&A Act). On 19 October 2012, the project was declared to be State Significant Development by the Minister under clause 6(1) of Schedule 6A of the EP&A Act by order published in the NSW Gazette on 26 October 2012. As a result, the Northern Expansion Project is now State Significant Development which requires consent under section 80 of the EP&A Act. By virtue of the operation of

the transitional provisions (clause 6(3)(b), Schedule 6A of the EP&A Act), previous steps taken under Part 3A (including issue of Director-General's requirements and public exhibition of the Environmental Assessment) are now taken to have been completed under Division 4.1, Part 4 of the EP&A Act.

This report is now a response to submissions for State Significant Development under clause 85A of the *Environmental Planning and Assessment Regulation 2000* (NSW). This report also addresses the amendments made to the project which have reduced the environmental impact of the development as a result of the issues raised during submissions (refer to **Section 4.0** and **Section 5.0**). In accordance with the requirements of Part 4 of the EP&A Act, this report also addresses the matters as are of relevance to the Amended Project for consideration by the consent authority under section 79C of the EP&A Act (refer to **Section 6.0**).

1.3.1 Determination of the Application

On 14 September 2011, the Minister for Planning and Infrastructure delegated his consent authority role for all State Significant Development applications, except those for which the proponent is a public authority, to the Planning Assessment Commission (PAC). On the same day, the Minister made a further delegation which allows senior officers of the Department of Planning and Infrastructure (DP&I) to determine certain State Significant Development applications where:

- Fewer than 25 public submissions in the nature of objection are received in response to the public exhibition of the Environmental Assessment for the project; and
- Where the local council has not made a submission objecting to the project; and
- Where the proponent has not made a political donations disclosure.

As AGL has made a political donations disclosure, the application is bound to be determined by the PAC rather than senior officers of the DP&I.

Section 6.0 of this Submissions Report provides an assessment of the Amended Project against the heads of consideration under section 79C of the EP&A Act, as required to be considered when determining a development application under Part 4.

1.4 Consistency with the Principles of ESD

Section 6(2) of the *Protection of the Environment Administration Act 1991* defines Ecologically Sustainable Development (ESD) through the implementation of the following four principles:

The precautionary principle *– namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

a) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and

b) an assessment of the risk-weighted consequences of various options.

Inter-generational equity *– namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

Conservation of biological diversity and ecological integrity *– namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

Improved valuation, pricing and incentive mechanisms *– namely, that environmental factors should be included in the valuation of assets and services, such as:*

a) polluter pays –that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement;

b) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste; and

c) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The following sections describe how the Amended Project is in accord with and would contribute to the principles of ESD, including how ESD principles are embedded into the Amended Project operations, objectives and outcomes, and how these principles would be advanced over the Amended Project's lifetime.

1.4.1 Precautionary Principle

The application of the precautionary principle was considered by Justice Preston in *Telstra Corporation Ltd v Hornsby Shire Council* [2006] NSWLEC 133. The precautionary principle was summarised by Justice Preston in that case as follows:

- The application of the precautionary principle and the concomitant need to take appropriate precautionary measures is triggered by the satisfaction of two conditions precedent:
  - a threat of serious or irreversible environmental damage; and
  - a lack of scientific certainty as to that damage.

  Once both of these conditions or thresholds are satisfied, precautionary measures should be taken to avert the anticipated threat of environmental damage, but they should be proportionate.

  It is not necessary that serious or irreversible environmental damage has actually occurred, it is the threat of such damage that is required. Moreover, the environmental damage threatened must attain the threshold of being serious or irreversible. If there is no threat of serious or irreversible environmental damage, or if there is no (or no considerable) scientific uncertainty, the precautionary principle will not apply.
- If the two conditions precedents are satisfied, the precautionary principle will be activated. At this point there is a shifting of the evidentiary burden of proof and a decision maker must assume that the threat of serious or irreversible environmental damage is no longer uncertain but is a reality. The burden of showing that this threat does not in fact exist or is negligible effectively reverts to the proponent of the development.
- The precautionary principle permits the taking of preventative measures without having to wait until the reality and seriousness of the threats become fully known.
- The precautionary principle should not be used to try to avoid all risks. A zero risk precautionary standard is inappropriate. Similarly the precautionary principle cannot be based on a purely hypothetical approach to the risk, founded on mere conjecture which has not been scientifically verified.
- The type and level of precautionary measures that will be appropriate will depend on the combined effect of the degree of seriousness and irreversibility of the threat and the degree of uncertainty. The more significant and more uncertain the threat, the greater degree of precaution required. Some margin for error should be retained until all of the consequences of the decision to proceed with a development are known. One means of retaining a margin for error is to implement a step-wise or adaptive management approach, whereby uncertainties are acknowledged and the area affected by the development is expanded as the extent of the uncertainty is reduced.
- The precautionary principle embraces a concept of proportionality. That is to say, measures should not go beyond what is appropriate and necessary in order to achieve the objectives in question. Where there is a choice between several appropriate measures, recourse should be had to the least onerous measure. A reasonable balance must be struck between the stringency of the precautionary measures, which may have associated financial, livelihood and opportunity costs, and the seriousness and irreversibility of the potential threat.
- The precautionary principle, where triggered, does not necessarily prohibit the carrying out of development until full scientific certainty is attained.
- The precautionary principle is but one of the set of principles of ESD. It should not be viewed in isolation but rather as part of the package of ESD principles.

The precautionary principle has been applied through the environmental assessment process, which has involved numerous studies to evaluate and assess the environmental impacts associated with the Northern Expansion Project, and subsequently the Amended Project, so that where practicable, serious or irreversible damage to the environment can be avoided. A risk assessment was undertaken to determine the risks to specific environmental receivers, prior to mitigation measures being implemented. The outcomes of the risk assessment guided the prioritisation of environmental issues requiring assessment and the mitigation measures proposed to avoid, wherever practicable, the resulting impacts to the environment. The EA for the Northern Expansion Project, this Submissions Report and supporting specialist investigations incorporate conservative assumptions to account for risks and scientific uncertainties. Mitigation measures have been established and would be implemented to minimise and avoid where practicable, identified impacts on the environment to minimise or manage the residual risks to environmental receivers. The Statement of Commitments (refer to **Section 7.0**) provides an overview of all mitigation measures that would be implemented by AGL to avoid where possible, or minimise potential environmental impacts as a result of the Amended Project. Environmental monitoring programs would be

undertaken during construction, operation, decommissioning and rehabilitation of the Amended Project, to assess the adequacy of the measures applied to minimise environmental impacts and to ensure environmental performance is maintained and improved over the life of the Amended Project.

Further, the Department of Planning and Infrastructure has recently prepared new standard conditions for gas production. The new standard conditions adopt an adaptive management approach, consistent with the precautionary principle, to the key environmental issues typically raised by gas production projects including surface and ground water impacts.

1.4.2 Intergenerational Equity

The overall objective of the environmental assessment is to identify and mitigate potential future impacts associated with the Amended Project. Management plans would be established for implementation during construction, operation and decommissioning, to monitor potential impacts and the performance of mitigation measures, over the life of the Amended Project. The management plans provide an avenue for ongoing improvement in environmental performance and would be updated on a regular basis to ensure that developments in science and technology can be incorporated into the Amended Project to ensure that environmental safeguards are in line with industry best practice progress and development.

AGL is currently providing, and would continue to provide, benefits to the region, including:

- investing in the local economy;
- sourcing materials from local suppliers as where possible;
- supporting local community and sporting groups; and
- investigating the procurement of local services where possible.

In addition to these benefits, the Amended Project would:

- provide increased employment opportunities and facilitate up-skilling of the local workforce;
- promote diversification of the local economy through ancillary businesses;
- provide a source of transitional fuel for power generation, reducing the reliance on coal; and
- provide a potentially new energy source for NSW, the development of which would contribute to the State's economy through royalties paid, jobs created and infrastructure investment.

These benefits would extend not only to existing generations but to future generations should the Amended Project be approved.

1.4.3 Conservation of Biological Diversity and Ecological Integrity

AGL has reviewed the scope and configuration of the project in light of issues raised in public submissions, consultation with local landowners and in response to ongoing design development. As a result, changes have been made to the Northern Expansion Project, and the Amended Project now avoids impacts on areas of significant vegetation. As detailed in **Sections 3.3** and **5.2**, and the amended flora and fauna assessment provided in **Appendix** E, the potential biodiversity impacts of the Amended Project have been minimised, with listed threatened species and communities entirely avoided. AGL would continue to consider opportunities to further minimise or avoid the need for biodiversity impacts (particularly vegetation clearing) through detailed design progression facilitated through the flexibility provided by the environmental envelope assessment approach applied to date.

1.4.4 Improved Valuation, Pricing and Incentive Mechanisms

The EA for the Northern Expansion Project, and this Submissions Report, have been prepared on the basis of minimising or avoiding impacts on the natural, built and social environments in recognition of the inherent cost of those impacts. In doing so, the cost of impacts associated with the Amended Project have been minimised as far as reasonable and feasible.

1.5 Structure of this Report

This Submissions Report has been structured in a manner that sets out the key issues raised in the submissions in the main body of the report, identifies the components comprising the Amended Project and assesses the potential environmental impacts of the Amended Project.

Section 1.0 – provides an overview of the proposal, the impact assessment process and Submissions Report purpose and structure.

Section 2.0 – summarises the submissions received and identifies the key issues raised.

Section 3.0 – provides a detailed response to the key issues raised.

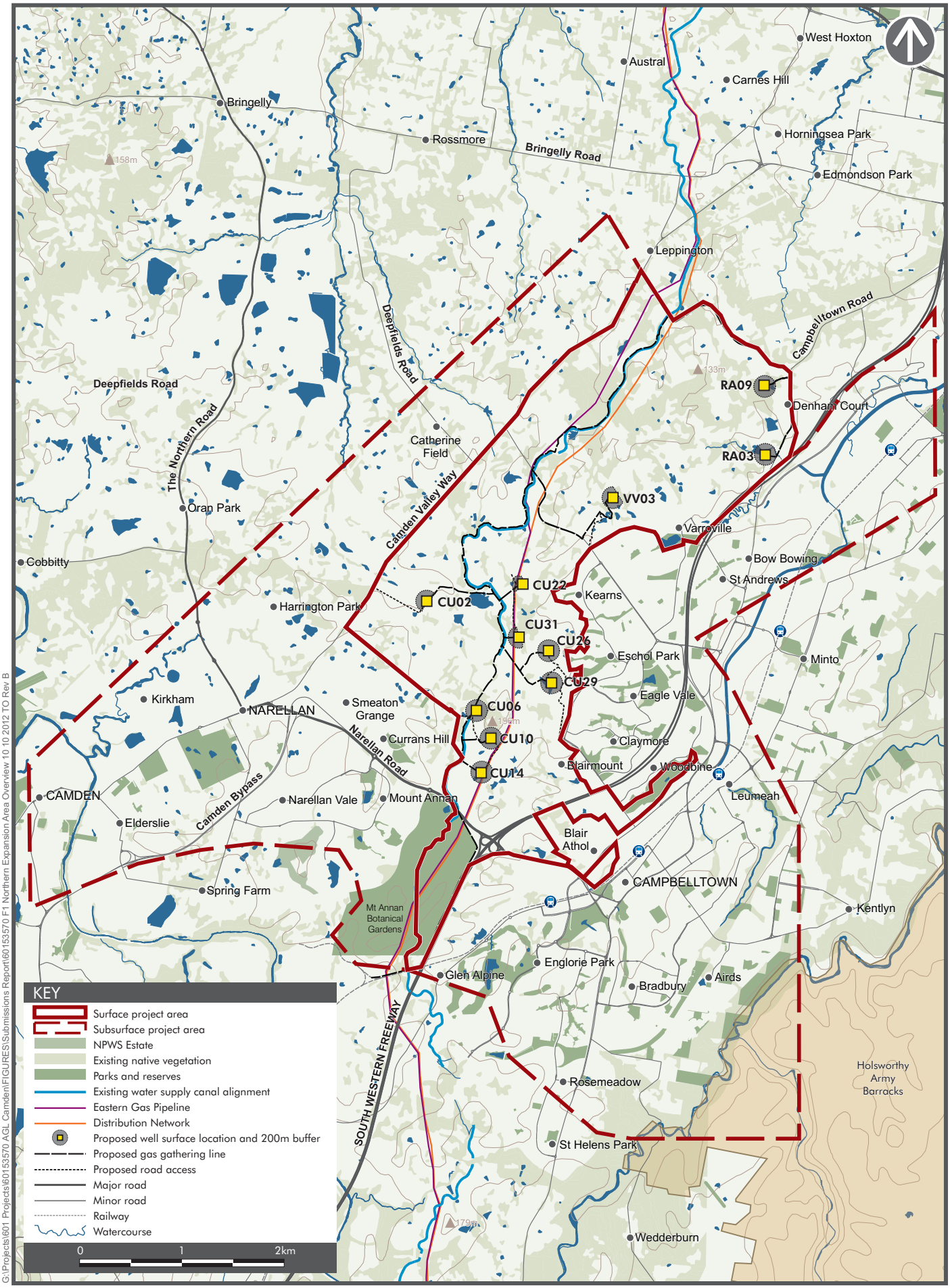
Section 4.0 – defines the Amended Project subject of which project approval is sought.

Section 5.0 – provides an assessment of potential impacts associated with the Amended Project.

Section 6.0 – provides an against the heads of consideration under section 79C of the EP&A Act

Section 7.0 – provides a revised set of consolidated statement of commitments.

Section 8.0 – concludes and summarises the outcomes of the submissions raised and the Amended Project.



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NORTHERN EXPANSION OVERVIEW

Submissions Report
Camden Gas Project Northern Expansion

FIGURE 1

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2.0 Summary of Submissions

2.1 Submissions Process

During the exhibition period, submissions regarding the Northern Expansion Project were accepted by DP&I from online, email, fax and post sources. Submissions were numbered as received and provided to AGL in accordance with the requirements of the EP&A Act.

All submissions were reviewed and issues raised have been included and addressed in **Section 3.0** and **Appendix A** of this Submissions Report.

2.2 Submissions Received

In total, the DP&I received 28 submissions and copies were provided to AGL. Of these:

- Eight were from local and State Government authorities;
- Nineteen were from the public, including private individuals, community and specialist interest groups, and developers.

2.2.1 Agency Submissions

A total of eight submissions were received from State and Local Government agencies including:

- Department of Planning and Infrastructure – Heritage Branch;
- NSW Office of Water (NOW);
- Office of Environment and Heritage;
- NSW Roads and Traffic Authority (RTA);
- Department of Industry and Investment (DII);
- Sydney Catchment Authority (SCA);
- Camden Council; and
- Campbelltown City Council.

Responses to issues raised in each of these submissions are provided in **Appendix A**.

2.2.2 Individual and Community Submissions

A total of 20 submissions were received from individuals, community groups and businesses. Responses to issues raised in each of these submissions are provided in **Appendix A**.

2.3 Key Issues Raised

Submissions were individually reviewed, and issues raised in each submission tabulated and a response provided (refer to **Appendix A**). **Figure 2** indicates the frequency that each category of issue was raised in submissions.

Figure 2 identifies that the key issues of land use, groundwater, the EA process, surface water and air quality were most prominently raised by the submissions. All other issues were raised less frequently.

The key issues for which additional discussion is provided include:

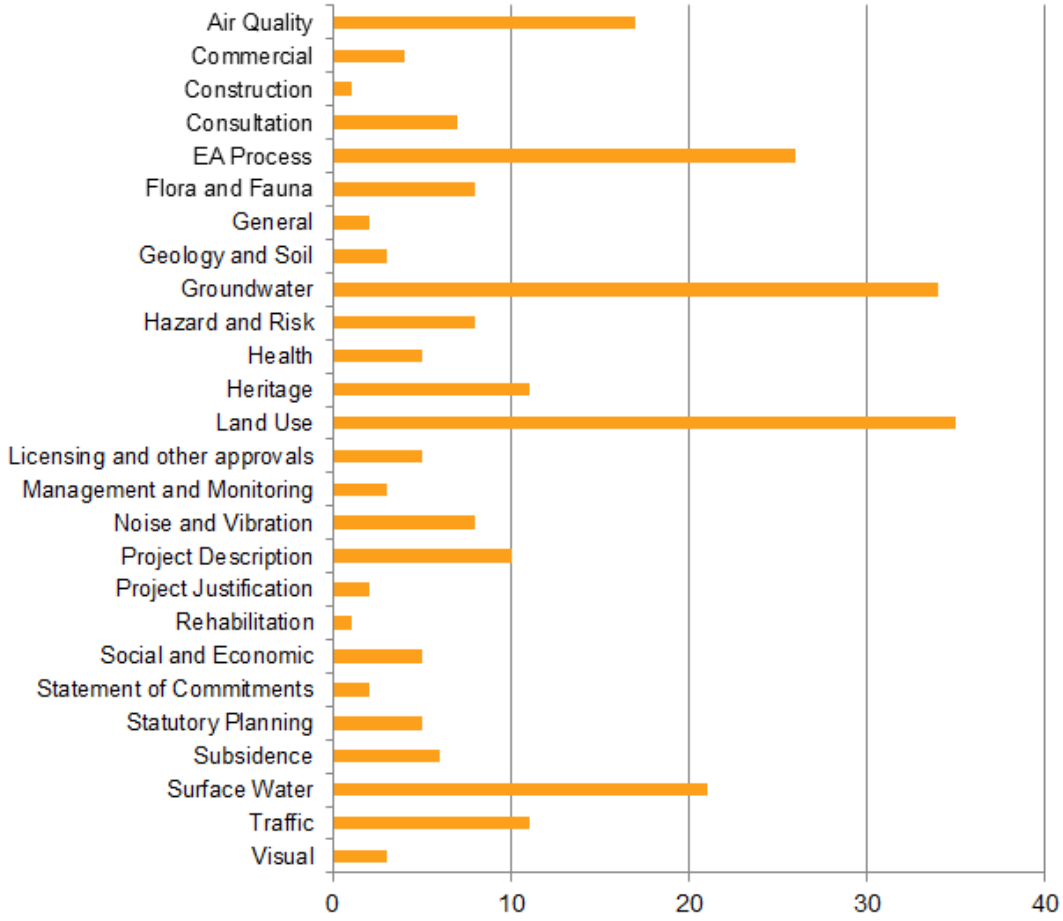
- Environmental assessment process, including the application of the environmental envelope assessment approach.
- Licensing and other approvals associated with the project, including the capacity of the RPGP and current and future water entitlements.
- Ecological impacts of the project, namely:
    - Impacts associated with clearing of Cumberland Plain Woodland (CPW), including the quantification of vegetation to be removed; and
    - Provision of an offset strategy for impacts to CPW.

- Groundwater management and concerns regarding the impact of the project on aquifers and other water sources, including:
    - Lack of detailed information on the hydrogeological environment of the Northern Expansion Area, and aquifer connectivity between the target aquifers in the Illawarra Coal Measures and overlying aquifers (including shallow alluvial aquifers, and the Hawkesbury Sandstone and Narrabeen Group aquifer systems), and potential impacts to groundwater quality in these respective aquifer systems;
    - Potential impacts to groundwater quality associated with fraccing fluids used during the process of hydraulic fracture stimulation; and
    - Management of extracted groundwater, including storage and disposal of extracted groundwater and potential impacts to surface water and shallow alluvial aquifers.
- Surface water, water quality and potential impacts associated with management of water produced by the project, such as:
    - Potential for spills causing contamination of the Upper Canal and local dams; and
    - Lack of information on watercourse crossings presented in the EA.
- Land use considerations, primarily in relation to the industrialisation of the Scenic Hills area, and to a lesser extent, sterilisation of land for agricultural and urban land uses.
- Heritage considerations, primarily in relation to the impact of the project on items of historic heritage such as Varroville House and the Upper Canal.

Section 3.0 provides a discussion on each of the key issues raised.

Appendix A provides tabulated responses to issues raised in submissions received from statutory agencies, community interest groups, businesses and individuals. Where relevant, responses to individual submissions refer to relevant discussions of key issues in **Section 3.0** of this Submissions Report.

Figure 2 Distribution of Issues Raised in Submissions



2.4 Amended Project

Following the receipt of submissions and the comments raised, AGL has developed an Amended Project to address the issues raised in submissions and to further minimise the environmental impacts of the project.

The Amended Project comprises amendments to the layout of project infrastructure informed by feedback from stakeholders and the local community, and with particular consideration of avoidance of land use conflicts and the threatened ecological community CPW.

The Amended Project consists of 11 well surface locations, being:

- Original well surface locations RA09, RA03, CU02, CU26, CU29, CU10 and CU14.
- Relocations of two well surface locations CU06 and CU22.
- Two new well surface locations VV03 and CU31.

Wells VV07 and VV11 have been removed from the scope of the project.

The location of associated access tracks and GGL have also been amended to accommodate the amended well surface locations.

The Amended Project is shown in **Figure 3** and further detailed in **Section 4.0**.

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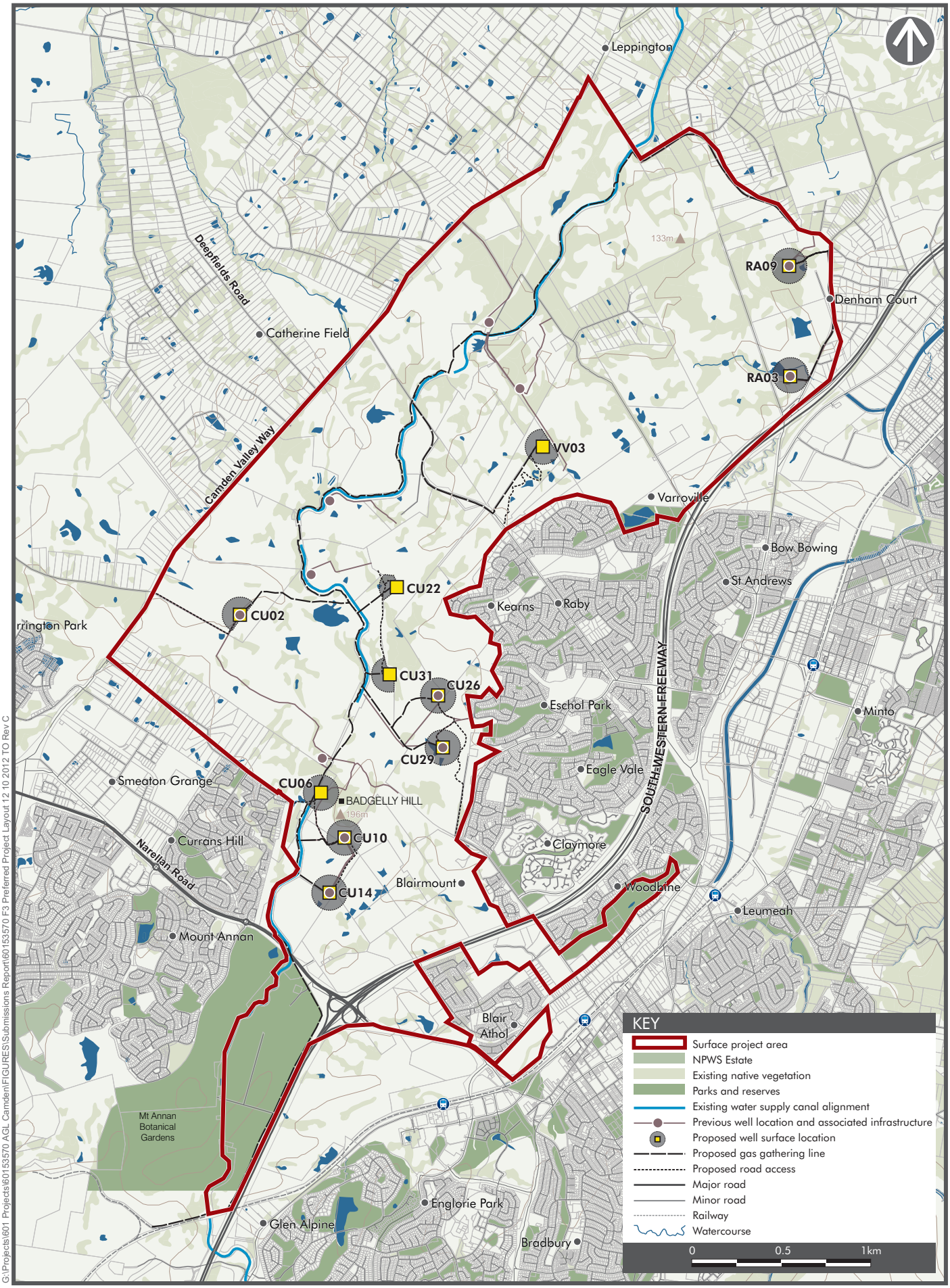

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AMENDED PROJECT LAYOUT

Submissions Report
Camden Gas Project Northern Expansion

FIGURE 3

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3.0 Response to Key Issues Raised in Submissions

3.1 Environmental Assessment Process

Several issues were raised in regard to the environmental assessment process. Comments received were primarily concerned about:

- The validity and suitability of the environmental envelope approach.
- The review process of the EA by AGL, engaged third parties, and Government agencies.

3.1.1 Envelope Assessment Approach

The assessment approach undertaken by AGL for the Northern Expansion Project was described in Section 1.5.1 and Chapter 4 of the EA. The approach identified:

1) An 'envelope' approach to impact assessment, where a wider area or "envelope" was assessed to allow the final infrastructure to move within the assessed parameters, subject to the recommended environmental management measures and consultation with the landowner; and
2) A worst case approach, where the highest impact activities were assessed even when these activities were not the most likely to occur. This enabled a more conservative assessment to be conducted to ensure that the variety of possible activities at each site would be within the assessed parameters.

The assessment approach was established for the approved Spring Farm and Menangle Park Project to enable flexibility in the location of surface infrastructure in consultation with affected landowners, and to accommodate potential future land uses. The assessment approach was also employed in similar CSG projects such as the Gloucester Gas Project.

The 'environmental envelope' approach to impact assessment required a defined assessment area (in this case, a 200-metre radius for a well surface location and 25 metres either side of GGLs and access roads) within which the highest potential impact activities were assessed. Detailed environmental assessment of the envelopes was undertaken to determine the potential impact of locating defined infrastructure at any location within the envelope boundary. This allowed the assessment to present a 'worst case' scenario within the EA and to demonstrate that it was environmentally achievable for the project to proceed within the defined envelope.

The identification of environmental constraints within the envelope allowed AGL to site the final locations of project components in areas to avoid identified environmental constraints. In order to identify constraints, *all possible locations within the envelope were assessed*.

The environmental envelope approach ensured that wells and other infrastructure were able to be sited to accommodate the primary land use and to avoid or minimise disruption to existing and potential future land uses. For example, this approach means that impacts to areas with biodiversity values can be suitably avoided, mitigated and minimise, either by exclusion from the project, detailed design and ground survey, underboring or by construction method. By this method of assessment (i.e. setting the outer limits of the potential impacts from the proposed wells and other infrastructure), AGL has a degree of flexibility to locate, and relocate infrastructure within the assessed envelope to accommodate both landowners and commercial considerations, without affecting the surrounding environment or requiring further approvals.

Comments relating to specific well surface locations have been provided within some submissions, which recommend relocation of particular well sites in more precise or specific areas within the environmental envelope. AGL's response to these relocation recommendations is detailed in **Section 3.6.1** and **Appendix A** of this Submissions Report.

3.2 Licensing and Approvals

Submissions regarding licensing and approvals raised the following primary concerns:

- The existing approved capacity of the RPGP and whether a modification would be required to treat gas received from the Northern Expansion.
- Whether the current groundwater entitlement of 30ML is sufficient to accommodate water produced from the drilling of wells in the Northern Expansion Project in addition to existing well fields.

3.2.1 Rosalind Park Gas Plant

The existing RPGP is subject to development consent (DA 282-6-2003-i), which caps maximum production capacity of the plant at 14.5PJ per annum (refer to condition 6 of that consent).

AGL has no intention to alter the approved capacity of the RPGP at this time, and proposes to manage gas inputs to ensure compliance with the 14.5PJ capacity limit. The performance of AGL's gas compression engines at the RPGP are operated and maintained so as not to produce emissions that are any higher than that designed by the engine manufacturer and set out in AGL's Environment Protection Licence conditions. Should it be necessary to vary this capacity limit in future, it would be subject to separate assessment and approval in accordance with the requirements of the EP&A Act.

It should be noted that the RPGP was previously subject to a detailed environmental assessment. The assessment also utilised a 'worst case' scenario where all compressors were at full capacity. The environmental impacts of the RPGP have therefore been previously assessed and approved, and do not form part of this application.

3.2.2 Groundwater Licensing and Entitlements

The NSW Office of Water (NOW) requires an assessment of the proposal in terms of current water sharing arrangements in the Camden/Macarthur area, potential interaction with higher groundwater sources, and volumetric limits and trade mechanisms. Potential interaction with high groundwater sources is discussed in Section 3.4 of this Submissions Report, and the Phase 1 Groundwater Assessment undertaken by Parsons Brinckerhoff (PB) (2011, refer to **Appendix B** of this Submissions Report), while volumetric limits, water sharing arrangements and trade mechanisms are discussed in this section.

Following the recommendations of the Phase 1 Assessment and advice from NOW, AGL has commenced a Phase 2 Groundwater Assessment (with the installation of 3 dedicated nested monitoring bores) which will assess the baseline groundwater situation prior to construction of wells in the area. Data from October 2011 comprising baseline groundwater monitoring as part of the Phase 2 Groundwater Assessment (PB, 2012) is provided in **Appendix C** of this Submissions Report). This forms part of AGL's Groundwater Management Plan which is discussed in **Section 3.4**

Volumetric Limits

AGL currently holds water licences across its existing CGP operations with a combined entitlement of 30 ML per year. AGL lodged separate applications with NOW in June 2011 for a further allocation of 30 ML per year to accommodate the needs of the Northern Expansion Project. As some of the well locations in the Amended Project have changed, AGL will consult further with NOW in relation to those applications.

The water production profile for the CGP including the Amended Project has recently been reassessed by AGL based on water production data from existing CGP operations, for the purpose of informing the applications for new water licences. Expected dewatering/extraction volumes are now slightly higher than originally predicted in the EA.

Based on the latest pumping information from existing wells in other stages of the CGP, produced water volumes of up to 37 ML per year may be extracted in the early expansion years (cumulative volume for the entire existing CGP, including the Amended Project). The annual rate of extraction would vary depending on the number of wells commissioned. Expected maximum produced water projections are shown in **Table 2**.

Table 2 Expected Maximum Produced Water Volumes per Year for the Existing CGP including the Amended Project

Year	Volume (ML per year)
1	35.0
2	27
3	27
4	27
5	24
6	20
7	8
8	4
9	4
10	4
thereafter	4

Based on the predicted volumes in **Table 2**, the current water allocation for 30 ML per annum would not be sufficient to accommodate the Amended Project Area in its early years of operation, in addition to the existing CGP. The current applications for a further 30 ML per year will provide sufficient buffer to address the predicted small shortfall in groundwater entitlements.

Water Sharing Arrangements and Trade Mechanisms

A review of relevant legislation, plans, policies and current water sharing arrangements that relate to the Northern Expansion Area has been undertaken as part of the Phase 1 Groundwater Assessment (PB, 2011) (refer to **Appendix** B).

The *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* commenced on 1 July 2011, and as a consequence, groundwater dewatering associated with the Amended Project will now be regulated under the *Water Management Act 2000*.

3.2.3 Definition of the Project and Permissibility

The EA characterised the project as a *utility installation* or a *public utility undertaking* and concluded that the project was permissible under each of the applicable environmental planning instruments on the basis of this characterisation (refer to Chapter 5 of the EA).

The permissibility of the Amended Project is established through *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining, Petroleum Production and Extractive Industries SEPP) and the local environmental plans applicable to the Camden and Campbelltown LGAs.

Submissions from the community raised concerns regarding the definition of the project as a 'public utility undertaking', and stated that extractive industries and mining are specifically prohibited under certain land use zonings. The characterisation of development and the interpretation of environmental planning instruments is a matter on which reasonable minds may differ. Further, section 89E of the EP&A Act provides that development consent for State Significant Development may be granted if the development is partly prohibited by the environmental planning instrument so long as it is not wholly prohibited.

Further consideration of environmental planning instruments is provided in the context of section 79C of the EP&A Act in **Section 6.0**, including in Table 3, which summarises the permissibility of the Amended Project on both its characterisation as a *utility installation* or a *public utility undertaking* and on the narrower characterisation as petroleum production. This consideration shows that, even on the assumption that the Amended Project is characterised as petroleum production and not as a *utility installation* or a *public utility undertaking*, the Amended Project:

- is not wholly prohibited; and
- may therefore be approved under section 89E of the EP&A Act.

Table 3 Summary of Permissibility of the Amended Project

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
Camden Local Environmental Plan No. 45			
3(e) Town Centre	Subsurface infrastructure only	Permissible	Permissible
3(f) Town Centre Support	Subsurface infrastructure only	Permissible	Permissible
6 (a2) Open Space Existing	Subsurface infrastructure only	Permissible	Prohibited
Camden Local Environmental Plan No. 46			
1(a) Rural (40 hectares)	Subsurface infrastructure only	Permissible	Permissible
2(a) Residential	Subsurface infrastructure only	Permissible	Permissible
2(b) Residential Medium Density	Subsurface infrastructure only	Permissible	Permissible
2(c) Residential Craft	Subsurface infrastructure only	Permissible	Prohibited
3 (a) General Business	Subsurface infrastructure only	Permissible	Prohibited
3 (b1) Business Support	Subsurface infrastructure only	Permissible	Prohibited
4 (b) Service Industrial	Subsurface infrastructure only	Permissible	Permissible
5(a) Special Uses	Subsurface infrastructure only	Permissible	Prohibited
5(b) Special Uses – Arterial Road 5(b)1 Special Uses – Arterial Road Widening	Subsurface infrastructure only	Permissible	Prohibited
5(d) Special Uses – Proposed Local Roads Reservation	Subsurface infrastructure only	Permissible	Prohibited
6(a1) Open Space Existing	Subsurface infrastructure only	Permissible	Permissible
6(b) Open Space Proposed	Subsurface infrastructure only	Permissible	Permissible
6(c) Open Space Private	Subsurface infrastructure only	Permissible	Prohibited
Camden Local Environmental Plan No. 47			
2(d) Residential “D” (Release Area)	Subsurface infrastructure only	Permissible	Permissible
2(d1) Residential “D1”(Manooka Valley)	Subsurface infrastructure only	Permissible	Permissible
3(b1) Business Support	Subsurface infrastructure only	Permissible	Prohibited
3(g) District Business	Subsurface infrastructure only	Permissible	Prohibited
4(a) General Industrial	Subsurface infrastructure only		Permissible
4(b) Service Industrial	Subsurface infrastructure only	Permissible	Permissible

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
5(a) Special Uses	Subsurface infrastructure only	Permissible	Prohibited
5(b) Special Uses – Arterial Road	Subsurface infrastructure only	Permissible	Prohibited
6(d) Regional Open Space	Subsurface infrastructure only	Permissible	Prohibited
7(d1) Environmental Protection (Scenic)	Subsurface infrastructure only	Permissible	Prohibited
7(d2) Environmental Protection (Urban Edge)	- Part of CU06 envelope - Main Spine Line - Subsurface infrastructure	Permissible	Prohibited
7(d3) Environmental Protection (Bushland Conservation and Restoration)	- CU06 well surface location and associated GGL - Main Spine Line - Access roads associated with CU06 and from CU06 to CU10 - Subsurface infrastructure	Permissible	Prohibited
Camden Local Environmental Plan No. 48			
1(a) Rural "A" (40 ha)	Subsurface infrastructure only	Permissible	Permissible
1(b) Rural "B" (2 ha)	Subsurface infrastructure only	Permissible	Permissible
1(c) Rural "C" (0.4 ha)	Subsurface infrastructure only	Permissible	Permissible
5(a) Special Uses "A" Zone (Water Supply)	- Main Spine Line - Subsurface infrastructure	Permissible	Prohibited
5(b) Special Uses (Arterial Road Reservation)	Subsurface infrastructure only	Permissible	Prohibited
5(c) Special Uses (Botanic Gardens)	Subsurface infrastructure only	Permissible	Permissible
7(d) Environmental Protection (Scenic)	- CU10 well surface location and associated GGL - CU14 well surface location and associated GGL - CU31 well surface location and associated GGL - CU22 well surface location and associated GGL - Access roads associated with CU10, CU14, CU31 and CU22 - Subsurface infrastructure	Permissible	Permissible
Camden Local Environmental Plan No. 74 – Harrington Park			
1(e) Rural "E" (0.6 ha)	Subsurface infrastructure only	Permissible	Permissible
1(f) Rural "F" (0.2 ha)	Subsurface infrastructure only	Permissible	Permissible
2 (d) Residential	Subsurface infrastructure only	Permissible	Permissible
5(a) Cultural Landscape	Subsurface infrastructure only	Permissible	Prohibited
5(e) Special Uses – Water Management	Subsurface infrastructure only	Permissible	Prohibited
6(a) Open Space	Subsurface infrastructure only	Permissible	Prohibited

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
6(e) Open Space – Waterway Buffer	Subsurface infrastructure only	Permissible	Prohibited
7(a) Environmentally Sensitive Land	Subsurface infrastructure only	Permissible	Prohibited
7(d4) Environmental Protection (Eco-Residential)	Subsurface infrastructure only	Permissible	Permissible
Camden Local Environmental Plan No. 117 – Elderslie Release Area			
2(d) Residential	Subsurface infrastructure only	Permissible	Permissible
6(b) Open Space Proposed	Subsurface infrastructure only	Permissible	Permissible
Camden Local Environmental Plan No. 121 – Spring Farm			
2(d) Residential	Subsurface infrastructure only	Permissible	Permissible
5(b) Special Uses (Local Future and Future Arterial Road)	Subsurface infrastructure only	Permissible	Permissible
7(a) Environmentally Sensitive Land	Subsurface infrastructure only	Permissible	Permissible
Camden Local Environmental Plan (Camden Lakeside) 2009			
R1 General Residential	Subsurface infrastructure only	Permissible	Prohibited
RE2 Private Recreation	Subsurface infrastructure only	Permissible	Permissible
E2 Environmental Conservation	Subsurface infrastructure only	Permissible	Prohibited
State Environmental Planning Policy (Sydney Region Growth Centres) 2006 – Turner Road Precinct			
R1 Residential	Subsurface infrastructure only	Permissible	Prohibited
B1 Neighbourhood Centre	Subsurface infrastructure only	Permissible	Prohibited
B4 Mixed Use	Subsurface infrastructure only	Permissible	Prohibited
B5 Business Development	- CU02 well surface location and associated GGL - Access road associated with CU02 - Subsurface infrastructure	Permissible	Permissible
IN1 General Industrial	Subsurface infrastructure only	Permissible	Permissible
RE1 Public Recreation	Subsurface infrastructure only	Permissible	Prohibited
RE2 Private Recreation	- Part of CU02 envelope - Subsurface infrastructure	Permissible	Prohibited
E4 Environmental Living	Subsurface infrastructure only	Permissible	Prohibited
Campbelltown Interim Development Order No. 13			
6(a) Open Space Existing Recreation	Subsurface infrastructure only	Permissible	Prohibited
6(b) Regional Open	Subsurface infrastructure only	Permissible	Prohibited

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
Space			
Campbelltown Interim Development Order No. 15			
5(a) Special Uses (Military Reserve and Water Supply)	Subsurface infrastructure only	Permissible	Prohibited
Campbelltown Interim Development Order No. 28			
6(c) Open Space (Regional)	Subsurface infrastructure only	Permissible	Prohibited
7(c) Scenic Protection Area	Subsurface infrastructure only	Permissible	Prohibited
Campbelltown Local Environmental Plan No. 112 – Macquarie Field House			
Macquarie Field House	Subsurface infrastructure only	Permissible	Permissible
Campbelltown Local Environmental Plan - District 8 (Central Hills Land)			
5(a) Special Uses "A" (Water Supply)	- Main Spine Line - Subsurface infrastructure	Permissible	Prohibited
5(c) Special Uses (Proposed Local Roads and Widening)	- GGL associated with CU20 and VV03 - Subsurface infrastructure	Permissible	Prohibited
5(g) Special Uses (Botanic Gardens)	Subsurface infrastructure only	Permissible	Permissible
6(c) Open Space (Regional)	Subsurface infrastructure only	Permissible	Prohibited
7(d1) Environmental Protection (Scenic)	- VV03 well surface location and associated GGL - CU26 well surface location and associated GGL - CU29 well surface location and associated GGL - RA03 well surface location and associated GGL - RA09 well surface location and associated GGL - Access road associated with CU26 and CU29 - Access road associated with VV03 - Part of CU10 envelope - Part of CU14 envelope - Subsurface infrastructure	Permissible	Permissible
Campbelltown (Urban Area) Local Environmental Plan 2002			
1(a) Rural	Subsurface infrastructure only	Permissible	Permissible
1(d) Rural future urban	Subsurface infrastructure only	Permissible	Permissible
2(b) Residential B	Subsurface infrastructure only	Permissible	Permissible
3(c) Neighbourhood Business	Subsurface infrastructure only	Permissible	Permissible

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
4(a) General Industry	Subsurface infrastructure only	Permissible	Permissible
4(b) Industry B	Subsurface infrastructure only	Permissible	Permissible
4(c) Industry C	Subsurface infrastructure only	Permissible	Permissible
5(a) Special Uses A	Subsurface infrastructure only	Permissible	Permissible
5(b) Special Uses (Arterial Roads)	Subsurface infrastructure only	Permissible	Permissible
5(c) Special Uses (Sub-arterial Roads)	Subsurface infrastructure only	Permissible	Permissible
5(d) Special Uses (Local Roads)	Subsurface infrastructure only	Permissible	Permissible
5(e) Special Uses (Public Purpose Corridor)	Subsurface infrastructure only	Permissible	Permissible
6(a) Local Open Space	Subsurface infrastructure only	Permissible	Permissible
6(c) Private Open Space	Subsurface infrastructure only	Permissible	Permissible
7(d1) Environmental Protection (100 ha)	Subsurface infrastructure only	Permissible	Permissible
7(d4) Environmental Protection (2 ha)	Subsurface infrastructure only	Permissible	Permissible
7(d6) Environmental Protection (0.4 ha)	Subsurface infrastructure only	Permissible	Permissible
9 Community Uses	Subsurface infrastructure only	Permissible	Permissible
10(a) Regional Comprehensive Centre	Subsurface infrastructure only	Permissible	Permissible
10(b) District Comprehensive Centre	Subsurface infrastructure only	Permissible	Permissible
Camden Local Environmental Plan 2010 (Draft at the time of Project Application)			
B1 Neighbourhood Centre	Subsurface infrastructure only	Permissible	Prohibited
B2 Local Centre	CU02 and associated access road, subsurface infrastructure	Permissible	Prohibited
B4 Mixed Use	Subsurface infrastructure only	Permissible	Prohibited
B5 Business Development	Subsurface infrastructure only	Permissible	Prohibited
E1 National Parks and Nature Reserves	Subsurface infrastructure only	Prohibited	Prohibited
E2 Environmental Conservation	CU06 and associated access road, spineline, subsurface infrastructure	Prohibited	Prohibited
E4 Environmental Living	Gas gathering line from CU02, subsurface infrastructure	Prohibited	Prohibited
IN1 General Industrial	Subsurface infrastructure only	Permissible	Permissible

Land Use Zone	Aspect of Amended Project Within Zone	Permissibility – Utility Undertaking	Permissibility – Petroleum Production
IN2 Light Industrial	Subsurface infrastructure only	Permissible	Permissible
R1 General Residential	Envelope of CU02, gas gathering line from CU02	Permissible	Prohibited
R2 Low Density Residential	Subsurface infrastructure only	Permissible	Prohibited
R3 Medium Density Residential	Subsurface infrastructure only	Permissible	Prohibited
R5 Large Lot Residential	Subsurface infrastructure only	Permissible	Permissible
RE1 Public Recreation	Subsurface infrastructure only	Prohibited	Prohibited
RE2 Private Recreation	Access road to CU02, subsurface infrastructure	Prohibited	Prohibited
RU1 Primary Production	Subsurface infrastructure only	Permissible	Permissible
RU2 Rural Landscape	CU22, CU31, CU10, Cu14, access roads, gas gathering lines, spineline, subsurface infrastructure	Permissible	Permissible
RU4 Primary Production Small Lots	Subsurface infrastructure only	Prohibited	Permissible
SP1 Special Activities	Subsurface infrastructure only	Prohibited	Permissible
SP2 Infrastructure	Spineline, gas gathering lines, access roads, subsurface infrastructure	Prohibited	Prohibited

3.3 Flora and Fauna

Submissions regarding flora and fauna raised the following concerns:

- Clearing of native vegetation and the quantity of vegetation impacted, including CPW.
- Provision of biodiversity offsets.

3.3.1 Clearing of Native Vegetation

The Office of Environment and Heritage (OEH) (formerly the Department of Environment, Climate Change and Water) and Campbelltown City Council requested clarification as to the area of CPW that would be cleared and noted that there was a discrepancy between the EA, which stated that no removal of CPW would be required, and Appendix E of the EA (Flora and Fauna Assessment) which stated that approximately 0.1 hectares of CPW would be directly impacted at a section of VV07 GGL, as well as temporary impacts to a further 3.74 hectares of CPW during construction of the GGLs.

Appendix E of the EA correctly stated that a total of 0.1 ha of CPW would be cleared for a section of the VV07 GGL as part of the original Northern Expansion Project. However, since the EA was publicly exhibited AGL has made a series of amendments to the project which has reduced environmental impacts, including impacts on flora and fauna. An updated flora and fauna assessment (Biosis, 2012) has been completed for the Amended Project (refer to **Appendix** E) which indicates that:

- no CPW would be removed;
- no Cumberland Plain Shale Woodland (CPSW) would be removed;
- no River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) would be removed; and
- 4.88 hectares of native shrubland would be removed.

Impacts to significant vegetation, particularly listed Endangered Ecological Communities (EECs) would be avoided through a series of measures, including avoidance by exclusion, minimisation by detailed ground survey and construction methods, minimisation through underboring and minimisation through careful selection of construction methods.

3.3.2 Biodiversity Offsets

Given that no significant native vegetation would be affected by the Amended Project, biodiversity offsets are not considered necessary.

3.4 Groundwater

Submissions were received from regulatory authorities and the community regarding potential impacts on groundwater. The following key issues were raised:

- Lack of detailed information on:
  - The hydrogeological environment of the Northern Expansion Area.
  - Aquifer connectivity between the target aquifers in the Illawarra Coal Measures and overlying aquifers (including shallow alluvial aquifers, and the Hawkesbury Sandstone and Narrabeen Group aquifer systems), and potential impacts to groundwater quality in these respective aquifer systems.
- Potential impacts to groundwater quality associated with fraccing fluids used during the process of hydraulic fracture stimulation.
- Management of extracted groundwater, including storage and disposal of extracted groundwater and potential impacts to surface water and shallow alluvial aquifers.

In addition, since the EA was prepared, the Department of Primary Industries has adopted an Aquifer Interference Policy which applies across NSW and contains the NSW Government policy for the licensing and assessment of aquifer interference activities. The requirements of the Aquifer Interference Policy have been considered in preparing the further groundwater information set out below as part of this report.

3.4.1 Regional Hydrogeological Setting and Aquifer Connectivity

A number of submissions, including submissions from NOW, OEH and Campbelltown City Council, raised concerns regarding the level of groundwater assessment undertaken in the EA.

CGP has been in operation since 2002. There are numerous water bores throughout the south west Sydney area. AGL has a detailed knowledge of the local geology from collecting reliable data of the field over 10 years of operations. Consequently, the hydrogeology of the Camden Gas Project area is very well understood.

However, to address the issues raised in some of the submissions, further assessments and plans have been prepared, including:

- a Phase 1 Groundwater Assessment (refer to **Appendix B**);
- initial groundwater monitoring data (since October 2011) gathered as part of a Phase 2 Groundwater Assessment (refer to **Appendix C**); and
- a Groundwater Management Plan for the CGP (refer to **Appendix D**).

Phase 1 Groundwater Assessment

The Phase 1 Groundwater Assessment and Conceptual Hydrogeological Model (PB, 2011) presents a conceptual hydrogeological model for new CSG development in the Northern Expansion Area. The model was based on a detailed understanding of local and regional geology, and previous groundwater investigations to the south and west which have provided a good appreciation of hydraulic properties that could be expected.

The Phase 1 Groundwater Assessment included the following:

- Literature review and data collation on the geology and hydrogeology, respectively, of the Sydney Basin region and the Northern Expansion Area on a local scale.
- Hydrogeological conceptual model for the Northern Expansion Area.
- Identification of only 12 water bores within the Northern Expansion Area.
- Discussion of groundwater management requirements, including water policy and legislation.

Submissions raised concerns over possible impacts of proposed operations, both on the target water bearing zones and the shallower aquifers, in particular those utilised by other licence holders, and those which may support other environmental features, including surface water.

The groundwater resource in the area is characterised in the Phase 1 Groundwater Assessment as providing low yields from the Hawkesbury Sandstone, Bulgo Sandstone, Wianamatta Shale and alluvium. Groundwater is also generally of variable water quality. Negligible yields and poor water quality characterise the coal measures. The Phase 1 Groundwater Assessment predicts that any future groundwater exploitation would be from the shallower sandstone aquifers on a relatively minor scale and that urban development would be serviced by reticulated water supply.

The Phase 1 Groundwater Assessment considered the potential for connectivity between target water bearing zones in the Illawarra Coal Measures, and the shallow alluvial aquifers, Hawkesbury Sandstone and Narrabeen Group aquifer systems. Based on a review of previous studies undertaken in the Sydney Basin, the assessment concluded that the presence of extensive and thick claystone formations in the stratigraphic sequence that overlies the Illawarra Coal Measures is likely to impede the vertical flow of groundwater such that overlying aquifer zones will be hydraulically isolated, experiencing little, if any drawdown impact related to depressurisation of the coal measures. However, the assessment also identified that the possibility cannot be ruled out that major fault zones could provide a hydraulic pathway through claystone horizons and that some shallow groundwater impacts may be observed in close proximity to those structures.

As such, following the recommendations of the Phase 1 Groundwater Assessment and advice from NOW, AGL has commenced a Phase 2 Groundwater Assessment which is further assessing the groundwater baseline in the area. This is being achieved through the implementation of a groundwater monitoring network to monitor water levels and water quality in the major underlying aquifer zones.

Further, NOW (2011) has identified 24 priority groundwater dependent ecosystems (GDEs). The four closest of these (refer to **Table 4**) are all more than 10 km from the Amended Project and have no association with any of the groundwater systems in and around the Amended Project. There are no GDEs identified by NOW in the Subsurface or Surface Project Areas.

Table 4 Summary of the Southern Sydney Region GDEs (NOW, 2011)

GDE Name	Latitude (GDA 94)	Longitude (GDA 94)	Location	Area (ha)	Distance from Amended Project (km)
Salt Pan Creek	319132	6241847	Estuarine Wetland. Salt Pan Creek, is located in the suburbs of Riverwood and Peakhurst, and flows to the Georges River.	1.077	16
O'Hares Creek	305027	6211055	Floodplain Wetland. Comprises catchment of O'Hares, Stokes and Four Mile Creeks, downstream to the junction of O'Hares Creek and Stokes Creeks, located between Appin and Bulli on the Woronora Plateau. Elevation: 100-450 m ASL. As much of the upper catchment of this creek is covered by wetlands, absorption, retention and release of water by these wetlands is a major determinant on the hydrology of the catchment.	9000	13
Thirlmere Lakes	272861	6211256	Freshwater Lakes. The Thirlmere Lakes are located on the edge of the Southern tablelands approximately 10km south west of Picton. The Lakes include: Gandangarra, Werri-Berri, Couridjah, Baraba and Nerrigorang Lakes.	627	22
Towra Point Estuarine Wetlands	329245	6236488	Located approximately 16 km south of Sydney centre. Towra Point adjoins Kurnell Peninsula forming the southern and eastern boundaries of Botany Bay.	638	25

Initial Phase 2 Groundwater Monitoring Data

Since October 2011, groundwater monitoring has been conducted in the Northern Expansion Area, with the aim of better characterising the hydrogeological environment, including the value of groundwater resources and the possible connectivity between the Triassic aquifers and Permian coal seams targeted for CSG extraction. A summary of data collected to date is provided in **Appendix C**. Although groundwater monitoring is on-going, data collected to date, in conjunction with the Phase 1 Groundwater Assessment, the performance of the existing CGP and other groundwater assessments conducted for areas to the south and west provide confidence that the hydrogeology of the area is well understood and well characterised.

The Phase 2 Groundwater Assessment has included the installation of a dedicated groundwater monitoring network and property surveys of known water bores. Important baseline data for the Wianamatta Group and Hawkesbury Sandstone aquifer has been, and will continue to be, collected from three nested monitoring bores located at Denham Court since October 2011, including water quality, continuous water level data and isotopic analysis. Installation of two additional nested sites, with three monitoring bores also located in the Wianamatta Group and Hawkesbury Sandstone, are planned to be installed within the coming months to provide further baseline information.

Results of the Phase 2 Groundwater Assessment to August 2012 provide evidence to confirm the understanding of aquifer characteristics and the conceptual hydrogeological model presented in the Phase 1 Groundwater Assessment. These baseline results (PB, 2012) are included in **Appendix C** of this Submissions Report. In summary, the quality of this water sampled from the Hawkesbury Sandstone aquifer (considered the only beneficial aquifer within the wider region) is regarded as poor and salty, with electrical conductivity of >5700 µS/cm. Water of this salinity is generally too saline to be used for irrigation and only some stock could potentially tolerate it as a water source. Isotopic and surface water results also indicate that the aquifers in the region contain old water (>30,000 years) and the sampled surface water sites are not linked to deeper groundwater systems. The results are consistent with the findings in the Phase 1 Assessment and indicate that there are no GDEs in the area and that the aquifer systems are hydrogeologically isolated from each other. This is further backed up by evidence from the existing CGP well field, where successful dewatering of many gas wells indicates discrete isolation of the coal seam water bearing zones from the shallower aquifer systems.

Groundwater Management Plan

A Groundwater Management Plan (AGL, 2012) has recently been completed, and endorsed by the NSW Office of Water and the Environment Protection Authority, for the whole CGP (including areas to the north of existing operations to be affected by the Amended Project). The Plan includes a groundwater monitoring program, response triggers and management responses should there be unexpected water level and water quality trends. These responses would be implemented in the event that impacts are detected in the major aquifer zones. This Groundwater Management Plan is included as **Appendix D** of this Submissions Report.

3.4.2 Hydraulic Fracture Stimulation

A number of submissions have raised concerns regarding the impact of chemical additives used during the process of hydraulic fracture stimulation, also known as hydraulic fracturing or 'fraccing', on groundwater aquifers, and potential connectivity with shallow ground water accessed for beneficial uses. The process of fraccing is discussed in Section 4.2.3 and 12.2.3 of the EA. The method of hydraulic fracturing is explained in context with regard to the CSG production process below.

Any hydraulic fracture stimulation will be undertaken in accordance with the *Code of Practice for Coal Seam Gas - Fracture Stimulation Activities (DTIRIS, 2012).* In particular, the Code of Practice requires:

- the preparation and implementation of an approved fracture stimulation management plan (FSMP);
- that the FSMP:
    - contain a full description of the fraccing process;
    - contain a an inventory and characterisation of chemicals used within the fraccing process;
    - address proposed management measures for fraccing fluid; and
    - demonstrate that all risks to the environment, existing land uses, the community and work force, as a result of the fracture stimulation activity, are managed though an effective risk management process that includes identification of hazards, assessment of risks, implementation of control measures and monitoring of the integrity and effectiveness of the control measures.

CSG Extraction Process

CSG is classified as an "unconventional reservoir". This classification is due to the low-pressured, normally water-saturated and naturally fractured (or cleated) coal seam reservoir. While a portion of the gas in coal seams may be stored as free gas in the natural fracture cleat system, the majority of the gas is stored in the surface of the coal by 'adsorption'. In simple terms, 'adsorption' in this context means that the gas is bonded to the coal. Adsorption typically accounts for more than 99% of the gas-in-place in CSG reservoirs.

Production from a CSG reservoir is therefore almost exclusively from the *desorption* of gas from the coal by depressurising the coals (Holditch, 1993). Desorption is the opposite process of adsorption, and releases the adsorbed substance (in this case, natural gas) from the surface of the coal. However, because most CSG reservoirs are 90 to 100% water saturated, this water must first be produced, or released from the reservoir, to enable gas production. Dewatering reduces the pressure of the coal seam reservoir, which allows gas to desorb from the coal and to be produced. In the early life of a CSG well it is not uncommon to produce only water, which contains minor amounts of gas.

In the past, AGL has carried out hydraulic fracturing to stimulate the CSG reservoir to enhance gas production. This process has been in use for more than 50 years. The fracturing process involves the injection of a slurry mix comprising approximately 99.5% sand and water, which creates a conductive pathway into the reservoir. This enhances the productivity of the reservoir over the life of the well. The fracturing process also reduces the need for a dense well network; fewer wells are required to be drilled to produce the recoverable gas reserves.

The hydraulic fracturing process involves the injection of fraccing fluids (specific fluids used are identified below), along with sand and water slurry, into the formation or zone of interest. Specific fraccing fluids are used to aid the fluid's viscosity to help the sand move more easily into the space between the existing fractures in the coal. The fluid flowing into the formation generates a pressure differential, which is the difference in pressure between two points. This in turn creates a stress in the formation. As this pressure differential increases, a point will be reached where the stress becomes greater than the maximum stress that can be sustained by the coal seam and the coal physically splits or fractures (Martin, Economides 2007).

When the hydraulic fracture pumps are shut down after this fracture is created, the fracture will close again. To ensure the fracture does not close, a propping agent (proppant sand) is added to the fluid at varying concentrations, which is then deposited into the fracture. When pumping stops, the fracture is kept open by the sand maintaining the pathway in the reservoir. It is this conductive pathway into the reservoir that enables the reservoir to produce gas at higher rates. In the case of CSG wells and the low permeability coal strata, the enhancement of fracture permeability is essential so the gas can then be produced and the coal seam can be effectively dewatered.

Fraccing Fluids

The technology and the chemistry of fraccing fluids have evolved over the years, and fluids can be selected that are non-toxic and environmentally safe. CSG reservoirs (i.e. coal seams) do not require complex chemistry or complex formulations due to the nature of the reservoir being predominantly a saline water reservoir with methane gas as the primary hydrocarbon and low reservoir temperature.

Hydraulic fracture fluids are designed to suit the reservoir characteristics and properties, such as coal formation thickness, stress or rock mechanic properties, the permeability of the coal (i.e. how well cleated or fractured the coal is naturally), number of coal intervals or fracture length. The fluid mixture commonly referred to as 'frac fluid' is tailored to suit the reservoir conditions and the design of the fracture treatment.

The fracture fluid used as part of AGL's exploration operations at Gloucester in the NSW Hunter Valley consists of approximately 99.5% water and sand, for example. The remaining 0.5% is made up of compounds which aid in the viscosity of the fluids. Human health and ecological risk assessment has been undertaken at the CGP on all fracturing additives proposed by the 3 main Australian based fracture service providers. According to the occupation exposure standards published by the Commonwealth organisation Safework Australia, the risk of fraccing fluids to public health or the environment is considered to be low. Full disclosure of all fracturing additives and their constituents is now a requirement in NSW, as well as confirmation that all additives are BTEX free. In addition, AGL holds material safety data sheets (MSDS) for each chemical used during well construction.

The following additives are typical of those used in other AGL operations in NSW:

- Guar gel, to thicken the water and suspend the sand. It is derived from the guar gum bean and is commonly found in ice cream as a food additive.

- Bactericide or sodium hypochlorite, to treat water prior to the fracturing process to kill bacteria. It is commonly used as flame retardant in clothing, or sodium hypochlorite is bleach.
- Boric oxide (borax), to convert the linear gel to a thicker fluid by crosslinking the linear gel. It is commonly used in the production of glass.
- Potassium carbonate, which raises the pH to 9 to maintain effectiveness of other compounds such as crosslinkers. It is found in detergents, soaps and shampoos.
- Enzyme used to break down guar gel viscosity back to water after a predetermined time in the coal seam and return to surface into tanks for collection for disposal.
- Hydrochloric acid, dilute acid to reduce the pH or to assist with the cleaning of the perforation tunnels to access the coal seam more affectively. It is used in swimming pools to maintain pH levels.

Many of these additives are found in regular household items such as detergents and shampoos. It is also important to note that these additives are significantly diluted prior to injection into the coal seam when used, and are not in concentrated form.

The fracture fluid is recovered from the well through the process of 'flowback' and the dewatering process, as discussed in Section 4.2.3 of the EA. At the completion of a fracture treatment, the breaker additive reacts with the gel, breaking the viscosity back to water. The fluid is then flowed back, either to lined pits or to tanks and disposed of at an appropriately licensed facility in accordance with DRE and EPA requirements.

AGL does not use BTEX chemicals (benzene, toluene, ethyl benzene and xylene) as part of the fracture stimulation process. These components serve no purpose in fracturing CSG wells. AGL requires contractors who provide fracturing services to provide a list of all fracture fluid additives used. This information is confirmed by an independent lab to ensure BTEX chemicals are not present.

The impact of fraccing fluids on groundwater has been assessed in Section 12 of the EA as well as management of these fluids at the surface. Spill containment and contingency measures are outlined in the existing AGL environmental management system (EMS) and include the provision of spill kits in all vehicles and awareness of notification protocols such as reporting incidents such as spills to OEH.

Surface Connectivity

The Illawarra Coal Measures (the Bulli and Bulgownie coal seams) range from 600m to 1000m in depth, and are physically separated from surface groundwater by impermeable layers of thick claystone (refer **Section3.4.1**).

The fracture pathway of hydraulic fracture stimulation is modelled and designed to target the coal seam selected. The potential for creating groundwater flow pathways between the target coal seams and shallow beneficial aquifers is negligible due to many factors including such controls as; understanding of the rock mechanics and stress regime of the coal seam bounding formations, the overall fracture treatment size, diagnostic plots as the fracture occurs, location of beneficial aquifers in reference to the coal seam and post fracture diagnostics.

The stress profile in the CGP and the contrast between the Bulli or Bulgownie coal seam and surrounding formations is significant. The harder and higher strength rock in the formations surrounding the coal seams does not allow the fracture to extend or grow vertically above the Bulli seam. This is confirmed through post fracture pressure diagnostics reports. This is further confirmed and demonstrated by the successful complete dewatering of many fracture stimulated wells in the existing CGP well field. Complete dewatering of a well (when the well has been dewatered completely and remains to produce negligible amounts of water) can only occur if the target coal seam is discretely hydraulically isolated.

AGL cannot determine the number of wells that require hydraulic fracture stimulation prior to well construction. However, it is noted that the construction of Surface-to-Inseam (SIS) wells, which are proposed as part of the Amended Project, will not require stimulation by fraccing compared to traditional vertical wells. It is estimated that as few as 10-20% of the wells proposed in the Northern Expansion may require fraccing, however this would not be known until the wells are constructed and, accordingly, it is also possible that greater than 20% of wells would require fraccing. The EA contained a conservative assessment of the impacts of fraccing wells.

It is estimated that 100% of the fracturing fluid would be recovered plus coal seam formation water. In order to ensure this, AGL would log, test and dispose of 150% of the volume of fracturing fluid as flowback water, ensuring that all fracturing fluid is recovered. After this volume is recovered AGL usual produced water management regime will apply after which time it would revert to produced water.

3.4.3 Management of Produced Water and Drilling Fluid

A number of submissions were received in relation to drilling fluids, and potential risks associated with contamination of beneficial aquifers and water sources.

The management of drilling fluid was considered in Section 9 and 12 of the EA. A range of mitigation measures for drill fluid management would be implemented at each drill site, and would include the following:

- All fluids are contained within a closed system (i.e. contained in sealed tanks).
- Each drill pad is constructed with a bundwall that fully encloses the pad and a small lined sump is constructed to one corner of the pad to capture runoff from the pad.
- The bundwall provides a second barrier of containment in the unlikely event of drill fluid spills on the pad;
- Sediment fencing is also installed around the drill pad as a third line of defence.
- Each drill pad site would be inspected by AGL to ensure compliance with both construction and environmental aspects. A "Daily Shutdown Checklist" has also been developed to ensure maintenance and compliance of the drill site. The checklist, completed each day by the drilling supervisor on site, includes:
    - Checks on the drilling mud management, including the closed tank system;
    - Confirmation that erosion and sedimentation controls are in good condition, including if the sump requires pumping out;
    - Inspection of the general housekeeping of the site to ensure all is secure and well maintained; and
    - The completed checklist would then be submitted to AGL daily. An internal site audit/checklist is also randomly conducted by AGL staff to ensure compliance with environmental controls.

It is worth noting that the drill fluids are all biodegradable and consist primarily of water and bentonite. In addition, standard procedures following drilling of the borehole to the required depth include flushing the borehole with fresh water to remove additives and to minimise the viscosity of the gels lining the borehole wall, further minimising any potential for groundwater impact. Adverse impacts to groundwater quality as a result of drilling and fraccing fluids are not anticipated.

Submissions from the community also raised concerns regarding environmental degradation associated with practices utilised elsewhere in Australia and overseas for the management of produced water. The water volumes likely to be generated by the CGP (including the proposed Amended Project) are significantly less than volumes produced from Bowen Basin and Great Artesian Basin aquifers in Queensland.

Produced water from the existing CGP is essentially old, salty groundwater with some coal fines. Currently, produced water from the existing CGP wells is stored temporarily on site in enclosed, above ground plastic agricultural tanks at each well pad. The water is then collected periodic ally, and transported to the Rosalind Park Gas Plant. Coal fines and other particulate matter are removed at the Rosalind Park Gas Plant, before the filtered, produced water is transported to a licensed off-site, waste-water facility. At this facility, the produced water is blended with other waste waters from urban Sydney, and recycled for beneficial reuses – namely brick making and other industrial processes.

Produced water from the proposed Amended Project wells will be managed in the same way. Produced water would be stored temporarily in enclosed plastic tanks at each well pad.

Produced water would then be either reused in fraccing campaigns, or disposed of to a licensed off-site facility. In summary, it is proposed that all produced water from the Amended Project will be treated and recycled for beneficial reuse, or reused on site. No evaporation ponds or direct discharges to land or water are required.

The management of drilling fluids will be undertaken in accordance with the *Code of Practice for Coal Seam Gas – Well Integrity* (DTIRIS, 2012).

3.5 Surface Water

Submissions regarding surface water raised the following concerns:

- Potential for contamination of drinking water (Upper Canal) and local dams, including the potential for interruption of water supply.
- Lack of information on watercourse crossings provided in the EA.
- Detailed mitigation measures to contain surface water impacts, including the updated Soil and Water Management Sub Plan (SWMSP), should be provided prior to approval.

3.5.1 Water Quality and Supply

The Sydney Catchment Authority (SCA) raised concerns regarding the potential contamination of shallow groundwater and the potential for migration of this shallow groundwater to impact on the Upper Canal. Due to the location of the development adjacent to the SCA Upper Canal Controlled Area, the Amended Project has been re-assessed in accordance with the SCA document *Development Adjoining Sydney Catchment Authority Controlled Areas: Information for Consent and Determining Authorities and Proponents* (SCA, 2009).

The Upper Canal is part of the Upper Nepean Scheme and transports water from two small weirs located across the Nepean and Cataract Rivers to Prospect Reservoir, Sydney's main drinking water storage. Stringent environmental controls would be implemented to ensure the safe capture of all produced and extracted water from the project and to ensure the security of the Upper Canal water supply. These measures were detailed in Section 9.2.2 of the EA. Mitigation measures have been discussed with the SCA and consultation is ongoing.

As outlined in **Section 3.4.1**, the presence of extensive and thick claystone formations in the stratigraphic sequence would hydraulically isolate shallow aquifers and the Upper Canal from the underlying Illawarra Coal Measures. This claystone formation would prevent potential contamination of the Upper Canal, surface water and shallow aquifers from CSG extraction activities occurring at depth (including the use of fraccing compounds). Notwithstanding, even if the claystone formation does not form a complete barrier between shallow aquifers and deeper coal measures, the pumping of groundwater as part of the CSG extraction process and associated depressurisation of the coal measure would produce a pressure gradient that would facilitate migration of potential contamination towards the gas wells, rather than towards the surface. This effect would provide an additional barrier against potential impacts on shallow aquifers and water quality in the Upper Canal.

As identified in the AGL EMS for the CGP, namely the Soil and Water Management Sub Plan, mitigation measures include bunding, diversion drains, silt fences, and immediate initial rehabilitation including contouring and revegetation. The existing EMS has previously been approved by the then NSW Department of Industry and Investment (DII) (now part of the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS)). Additional measures suggested by the SCA include no works or stockpiling within 3m of the Upper Canal, and utilising an SCA approved bulkhead design for all gas gathering line crossings of the Upper Canal in order to maintain the structural integrity of the Upper Canal. These measures will be incorporated in the overarching EMS for the CGP which will also be applied to the Amended Project.

Shallow groundwater is not common in the clayey soils affected by the Amended Project. Perched water may develop at some low lying sites after extensive rain events, however given the very low permeability soils, there is rarely any migration of these ephemeral zones.

Further, the risk of hydraulic connectivity between the Upper Canal and shallow perched groundwater is considered very low (as described by PB in the Phase 1 Groundwater Assessment). The shallowest aquifers occur in the Wianamatta Shales, which are unlikely to be connected and unlikely to have significant effects on the canal water supply given that this groundwater occurs at depth within the shale strata. Farm dams in the area are primarily recharged via rainfall and surface water runoff. The drilling of wells would not impact the runoff to farm dams. Water produced during drilling and fraccing of wells would be managed as described in Chapter 4 of the EA, therefore the potential for contamination due to loss of containment of produced water is not considered to be significant.

The CGP has been in operation for over 10 years, during which time it has successfully co-existed with other land uses in the area (e.g. agriculture at the Elizabeth Macarthur Agricultural Institute).

3.5.2 Watercourse Crossings

Surface water features and watercourses within and in the vicinity of the Surface Project Area are largely ephemeral streams and drainage lines associated with those watercourses identified on **Figure 15**, including:

- Biriwi Creek
- Kenny Creek
- Bunbury Curran Creek
- South Creek
- Rileys Creek
- Cottage Creek
- Bow Bowing Creek.

Not all watercourses or minor streams within the Surface Project Area would be crossed by surface infrastructure as a result of the Amended Project. As part of the overall environmental approach, access roads and gas gathering lines would be co-located within existing infrastructure easements wherever possible in order to minimise environmental impacts. This co-location would also alleviate the need to construct new watercourse crossings through much of the Surface Project Area.

In some instances, watercourses within the Surface Project Area do not exhibit the features of a defined channel with bed and banks. However, site assessments prior to construction would further evaluate each potential watercourse as described below.

Although exempt from the need to obtain a controlled activity approval under the *Water Management Act 2000*, watercourse crossings would be determined and designed in a way which takes into account NOW's *Guidelines for watercourse crossings* and *Guidelines for laying pipes and cables in watercourses*. In accordance with these guidelines, the following process would be undertaken:

1) Identify whether or not the watercourse to be crossed is a defined watercourse and determine its order in accordance with the Strahler System, including whether or not a riparian corridor is identifiable as described in the *Guidelines for riparian corridors*. A site assessment prior to construction would identify the flow regime and sensitivity of the watercourse, and inform the design and construction requirements for a crossing.
2) Where a watercourse crossing is required, the design and construction options would depend on the sensitivity of the watercourse and seek to:
    a) maintain existing or natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse
    b) minimise the design and construction footprint
    c) avoid detrimental impact to natural water functions.
3) For permanent or high flow watercourse crossings, or where required, site plans would be prepared in consultation with NOW and implemented prior to construction.
4) For temporary waterway crossings, crossings would be constructed in accordance with the existing SWMSP and the *Managing Urban Stormwater - Soils and Construction* (Blue Book).

It is expected the majority of watercourse crossings for the Amended Project would be temporary given the ephemeral nature of much of the Surface Project Area.

In addition to utilising existing crossings, various methods for crossing watercourses are available depending on the sensitivity of the watercourse to be crossed. The following design and construction options have been considered for watercourse crossings within the Surface Project Area:

- Open trenching.
- Underbore techniques.

The least sensitive watercourses may be crossed using open trenching techniques, while watercourses with larger water flows may be crossed using open trenching with stream flow diversions, and sensitive watercourses may be crossed using underbore techniques. Watercourses within the Surface Project Area are largely ephemeral in nature, flowing only after periods of rainfall. Open trenching would therefore be the preferred method for watercourse crossings within the Surface Project Area. However, as described above, this would be re-evaluated prior to construction should significant watercourse crossings be identified.

Open trenching involves standard trenching techniques using an excavator or backhoe, ensuring the watercourse bed and bank material and trench spoil would be stockpiled separately, clear of the watercourse channels. A 5m buffer would be maintained between the watercourse and any stockpiles as specified by the SWMSP to be updated for the existing EMS. A prefabricated pipe would subsequently be placed across the watercourse, lowered and the trench immediately backfilled. The prefabricated pipe would involve welding and application of appropriate coating protection prior to placement in the trench.

It should be noted that a flora and fauna field survey was undertaken for the entire route of the main spine line and gas gathering lines. Minimal riparian vegetation currently exists for ephemeral watercourses within the Surface Project Area, with any riparian areas within the project envelopes being in a disturbed condition due to previous clearing activities (refer to **Appendix E**).

The SWMSP addresses watercourse crossings and existing management requirements and would be updated to include the specific measures identified for the Amended Project. Watercourses would be rehabilitated in accordance with the updated Landscape and Rehabilitation Management Sub Plan (LRMSP) and SWMSP, which would include specific erosion and sediment control measures to ameliorate impacts to watercourse banks and flow regime. Works would also consider weather events, for example works in the vicinity of watercourses would cease should high rainfall or flooding events occur.

These measures would be dependent on site characteristics such as soil stability, existing vegetation and water flow. Site specific management would be dependent on further investigation of site characteristics as part of the LRMSP. The construction of watercourse crossings would be done as rapidly as possible, with the open trench across the watercourse crossing left exposed for the minimum amount of time practicable to minimise the potential for erosion and sedimentation downstream.

Rehabilitation would generally involve reconstruction of stream bed and banks and drainage lines to near original condition and profile, and would be provided with scour protection. Soil and mulched vegetation would be stockpiled for reuse during initial rehabilitation and re-establishment of native species or pasture would be undertaken, where required. Rehabilitation would be undertaken as soon as practical after construction and regular maintenance and monitoring would be carried out during the post construction maintenance period once rehabilitation works are completed.

Watercourse crossings would be consistent with the principles and design considerations identified in the *Guidelines for water crossings* and *Guidelines for laying pipes and cables in watercourses* (NOW, 2012), which include but are not limited to:

- Maintain existing or natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse.
- Protect against scour.
- Stabilise and rehabilitate all disturbed areas including topsoiling, revegetation, mulching, weed control and maintenance in order to adequately restore the integrity of the riparian corridor.

3.5.3 Soil and Water Management Sub Plan

The overarching EMS of the CGP contains several sub plans which address the environmental objectives for managing the potential impacts of the CGP. The SWMSP is designed to:

- Prevent soil erosion, exposure and contamination.
- Minimise negative impacts on surface water resources.
- Maintain current surface drainage patterns and surface water quality.
- Ensure there is no long-term erosion as a result of the works.
- Monitor and manage soil erosion and water flows until the area has stabilised.

The SWMSP covers all existing approvals and requirements for the CGP to date. AGL is required to implement all practicable measures to minimise soil erosion and the discharge of sediments and water pollutants. This is applicable to both construction and operation phases. The SWMSP outlines the following methods that are currently implemented, and would continue to be implemented, for the CGP:

- Drainage controls such as diversion drains – drainage controls would be constructed as necessary to divert surface water away from stockpiles, drill pits and other disturbed areas to minimise impacts to surface water quality. Diversion controls would be designed in accordance with the Blue Book, *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004).

- Sediment filters such as silt fences and hay bale filters – sediment filters are used to minimise sediment movement and are used in accordance with the Blue Book, *Managing Urban Stormwater – Soils and Construction* (Landcom, 2004) and as identified in Section 3.2.2 of the SWMSP.
- Watercourse crossings – management of watercourse crossings would include installation of filter fences, and a 5m buffer between watercourses and stockpiles. The SWMSP employs a number of measures identified in NOW's *Guidelines for water crossings* such as:
    - Scour protection in the creek bed downstream of crossings for a distance of either twice the channel width or 20m, whichever is the lesser.
    - Movement of sediment and woody debris will not be inhibited.
    - Natural watercourse functions and site hydrological conditions will be accommodated.

    Additional details on watercourse crossing methods, management and rehabilitation have been addressed in **Section 3.5.2** of this Submissions Report.
- Soil stockpiles – criteria for stockpiles would include maximum heights and slopes to minimise potential for sediment movement. Additional containment measures would also be implemented on a site specific basis as provided in the Site Layout Plan for each well surface location.
- Batters – suitable slopes would be immediately stabilised and disturbed areas revegetated.
- Rehabilitation – detailed rehabilitation measures are contained within the LRMSP and the site specific Landscape and Rehabilitation Management Plan (LRMP) for each well surface location (which was detailed in Chapter 21 of the EA). However, general measures would include the plugging and abandoning wells in accordance with DTIRIS guidelines and complete final rehabilitation of the site to its previous condition. Rehabilitation would be subject to the terms agreed with the landowner and the relevant conditions of approval.

Works within or adjoining the Upper Canal Controlled Area will require specific mitigation measures that would be agreed in consultation with the SCA. These measures include:

- Bunding, diversion drains, silt fences, and immediate initial rehabilitation including contouring and revegetation.
- No works or stockpiling would be undertaken within 3m of the Upper Canal.
- Crossing methods for the Upper Canal are to be agreed with the SCA and should avoid underboring to maintain structural integrity.

In addition to the general management measures outlined above, documented layout of the erosion and sediment controls would be prepared for each well surface location and provided to DP&I prior to construction. The existing EMS has been previously approved by DTIRIS. It is considered that the process of the existing EMS is sufficient to achieve the environmental objectives of the CGP with regard to soil and water management and where appropriate, additional mitigation measures (such as those within the Upper Canal Controlled Area and where specified for watercourse crossings) would be included in an update to the SWMSP and submitted to SCA, NOW and/ or DP&I for approval.

3.6 Land Use

Submissions regarding land use raised the following concerns:

- Interactions with the timing of development of the South West Growth Centre and future development areas resulting in conflicting land uses.
- Potential sterilisation of land for future uses, including industrialisation of the Scenic Hills.

3.6.1 Interaction with Future Development

As described in the EA, there are several areas around the existing CGP and Amended Project that have been earmarked for future urban development. A number of submissions from local landowners and developers have identified potential conflicts between the location of extraction wells and future residential development plans, particularly:

- The original location of well CU02 on the western boundary of the Turner Road release area.
- The original location of well CU06 within a proposed residential lot in the south-east corner of the Turner Road release area, as part of the 'Gregory Hills Masterplan' area.

- The original location of wells CU20 and CU22 within the Scenic Hills/ Gledswood Estate development area.
- The original location of well VV11 and the Main Gas Spine Line within the Sydney Catchment Authority Upper Canal corridor.

The nature of the environmental envelope approach allows the final well site to move within the envelope to areas that would avoid identified constraints such as potential land use conflicts. AGL has consulted with local development interests and has resolved to locate relevant wells outside residential areas to those identified in **Table 5** below and as proposed as part of the Amended Project. In addition to the relocation of well sites outside residential zones, AGL would stage the commissioning of wells to compliment the stages of development of the release areas through ongoing consultation. Individual submissions regarding potential land use conflicts in development areas are responded to in **Appendix A**.

Table 5 Well Surface Locations within Land Release Areas or Future Development Zones

Well Surface Location	Future Development Zones	Proposed Location Within Future Zoning/Area
CU02	Turner Road release area	The well is to be located within a part of the release area earmarked for a riparian zone. The assessment envelope around the well would be reduced in consultation with the landowner to ensure that it would not encroach onto parts of the site proposed for residential development.
CU06	CU06 is no longer located within Turner Road release area – Gregory Hills Masterplan. The well surface location has been moved approximately 380m south of its original location.	
CU20	CU20 is no longer proposed and has been removed from the Amended Project.	
CU22	CU22 is no longer located within Scenic Hills/ Gledswood Estate. CU22 has been moved to a location approximately 900m east from its formerly proposed location.	
VV07, VV11 and Main Spine Line	VV07 and VV11 are no longer proposed and have been removed from the Amended Project. AGL has also relocated the Main Gas Spine Line to the western side of the Upper Canal corridor in accordance with recommendations made by the SCA.	

3.6.2 Sterilisation of Land

The potential for land use conflict has been primarily minimised through the implementation of the environmental envelope assessment approach (refer to **Section 3.1.1**). While much of the surrounding environment is likely to experience a change in character due to the future development of the South West Growth Centre, the presence of field infrastructure is considered unlikely to sterilise the land for future uses or negatively impact on the use of surrounding land, or lead to the industrialisation of the area. Given the transient and temporary nature of impacts associated with the Amended Project, land can be returned to its original condition once the wells are decommissioned and rehabilitated.

Extraction of coal seam gas from the coal measures does not result in the sterilisation of land at the surface. The process of coal seam gas extraction is described in Chapter 4 of the EA. Management measures would be implemented to contain extracted water and is not expected to contaminate soil or surface water.

The Strategic Regional Land Use Policy (Department of Planning and Infrastructure, September 2012) has recently been introduced and aims to protect areas of strategic agricultural land, protect valuable water resources, and provide greater certainty for companies wanting to invest in mining and coal seam gas projects in regional NSW. While this policy does not strictly apply to the Amended Project, the key elements have been considered in the assessment including consideration of:

- Aquifer Interference Policy
- Agricultural impacts
- Two new Codes of Practice for the CSG industry.

Consideration of these elements is contained in **Section 5.0** and throughout the response to submissions contained in **Appendix A**.

The EA (section 8.3.2) assessed potential impacts on agricultural land uses in the area, and concluded that any potential impacts would be low, taking into account the following:

- The majority of rural land within the Northern Expansion Area that is not residential is used for agricultural purposes, predominantly grazing.
- In relation to well head infrastructure and the gas gathering system, the potential for the loss of existing land uses and/or sterilisation of land for future development is considered to be low, given the small area of land used for production. The existing CGP has demonstrated that petroleum production and grazing activities can co-exist.
- Much of the agricultural land within the Project Area has already been rezoned or is proposed to be rezoned as urban release areas, thus resulting in the loss of existing rural and agricultural land in any event.

The EA also included detailed information on the soils, slope, land characteristics, water characteristics (availability, quality) and relevant information on agricultural enterprises within the Surface Project Area.

Overall, it is considered that the Amended Project will not have a detrimental effect on agricultural resources.

3.7 Other Issues

A range of other issues were raised through submissions. These have been addressed in the Response to Submissions table located in **Appendix A**.

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4.0 The Amended Project

4.1 Overview of Amended Project

Amendments to the Northern Expansion Project have been proposed to address key issues raised by agency and community submissions resulting from the public exhibition period of the EA. As a result of further consultation undertaken since the public exhibition period, AGL has been able to address the issues raised by those landholders, government agencies, and community, in their relevant submissions (refer to **Section 3.0** and **Appendix A**). AGL therefore proposes changes to the Northern Expansion Project as detailed in this section.

The Amended Project is shown in **Figure 3** and includes the following changes:

- Construction and operation of proposed new well surface locations VV03 and CU31.
- Removal of CU20, VV07 and VV11 well surface locations.
- Relocation of CU06 and CU22 well surface locations.
- Realignment of the main spine line to the western side of the Upper Canal.
- Realignment of gas gathering lines and access roads to accommodate revised well surface locations.

The Amended Project therefore consists of:

- Construction and operation of eleven well surface locations 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.
- Subsurface drilling of lateral in-seam well paths within the bounds of the Subsurface Project Area (shown on **Figure 1**).

4.2 Well Surface Locations

4.2.1 Preferred Siting and Development

Where possible, AGL has revised the proposed location of well surface locations to avoid any conflict with future land uses. As a result the following well surface locations have been omitted from the Amended Project to provide an overall beneficial outcome:

- VV07 - Potential impacts to CPW have been avoided. Land use conflicts have been avoided.
- VV11 - Potential impacts to CPW have been avoided. Land use conflicts have been avoided.
- CU20 - Land use conflicts have been avoided.

The proposed amendments to the project with respect to well surface locations now forming the Amended Project are summarised in **Table 6** and are shown in **Figure 4**, **Figure 5** and **Figure 6**. **Figure 4**, **Figure 5** and **Figure 6** show the envelope of each of the proposed well locations and the indicative locations of the key ancillary infrastructure. In accordance with the envelope' approach outlined at **Section 3.1.1** above, the final location of the each of the wells and the associated infrastructure within these envelopes remains subject to detailed design in accordance with the locational principles set out in the EA.

The preferred well surface locations have been chosen in consultation with landowners and with consideration of the potential environmental issues, including proximity to nearest receivers, items of heritage significance, significant flora and fauna, land use and other appropriate issues.

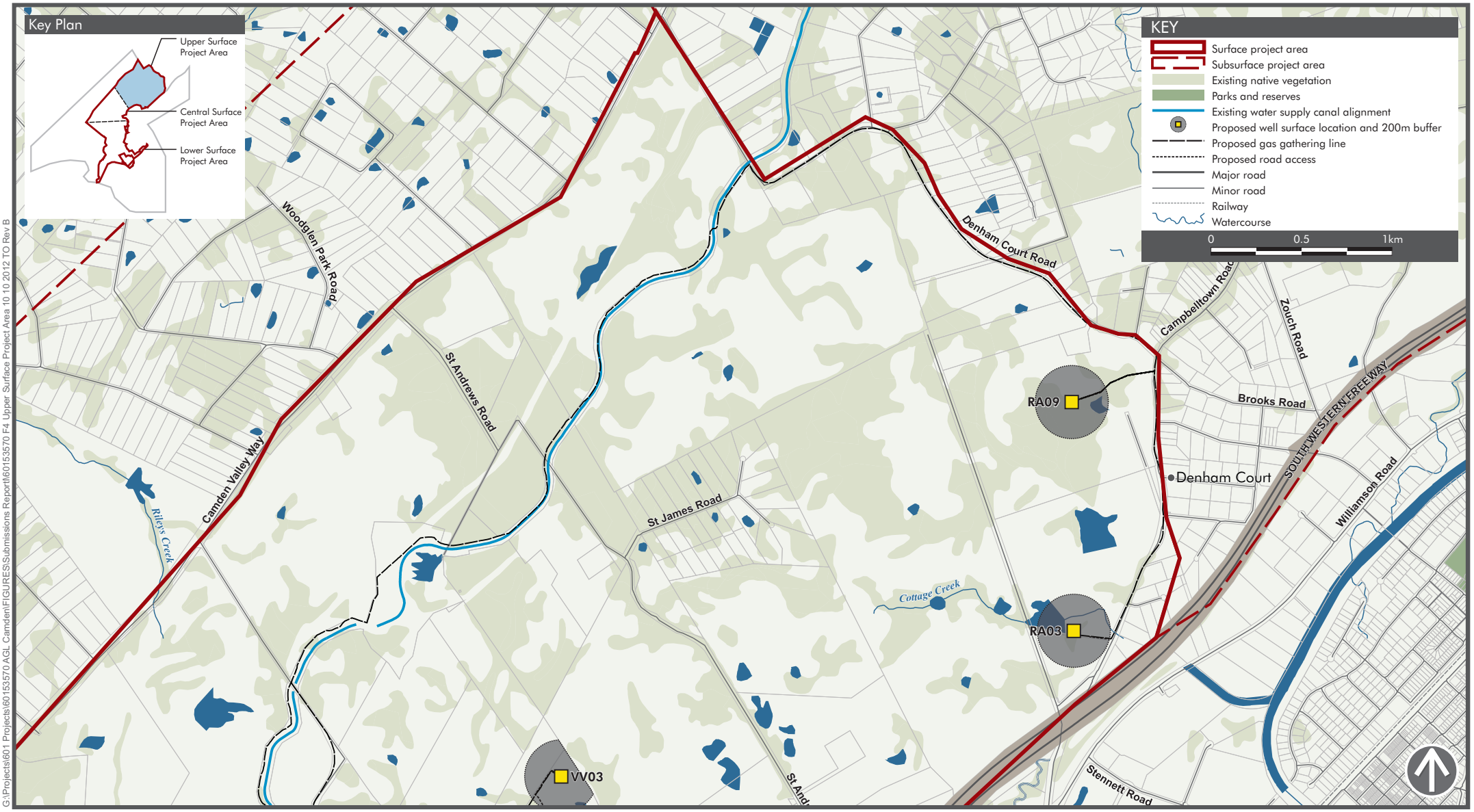
Table 6 Summary of Preferred Well Surface Locations

Well Surface Location	Formerly Proposed Location	Preferred Location	Beneficial Outcome
RA03	No changes to the location of RA03 are proposed.		
RA09	No changes to the location of RA09 are proposed.		
VV03	Was not previously proposed as part of the EA.	The preferred location of VV03 is shown on **Figure 4**. VV03 is located on grazing land away from CPW communities.	VV03 is able to access gas reserves in place of both VV07 and VV11 locations, while avoiding impact to CPW and conflict with existing and future land uses.
CU02	No changes to the location of CU02 are proposed.		
CU06	Within the south east corner of the Turner Road Development Area, adjacent to St Gregory's College.	CU06 has been relocated approximately 380m south from its original location. The preferred location of CU06 is now proposed as shown on **Figure 6**.	A submission was raised suggesting CU06 should be relocated to avoid proposed residential zoned land identified in the Gregory Hills master plan. The preferred location has been moved from the Turner Road Development Area to avoid such constraints.
CU10	No changes to the location of CU10 are proposed.		
CU14	No changes to the location of CU14 are proposed.		
CU22	Adjacent to the eastern side of the Canal in the El Caballo Blanco/ Gledswood Development Area. The location and 200m assessment envelope was previously located entirely within the Development Area.	CU22 has been relocated approximately 900m east from its formerly proposed location and is no longer located within the Scenic Hills/ Gledswood Estate development area. The preferred location of CU22 is now proposed as shown on **Figure 5**.	A submission was raised suggesting CU22 should be relocated to avoid proposed residential zoned land in the El Caballo Blanco/ Gledswood Development Area. The preferred location has been moved away from the El Caballo Blanco/ Gledswood Development Area to avoid such constraints.
CU26	No changes to the location of CU26 are proposed.		
CU29	No changes to the location of CU29 are proposed.		
CU31	Was not previously proposed as part of the EA.	The preferred location of CU31 is shown on **Figure 6**. CU31 is located 250m east of the Upper Canal and approximately 625m north-west of CU26.	CU31 would be located on land that is not within a future estate development area. It is a preferred location to avoid constraints associated with wells located within residential development areas.

The 11 preferred well surface locations, each containing up to six well heads would be drilled into the Illawarra Coal Measures. The development of the preferred well surface locations consists of the following steps:

- Construction: The activities required to physically develop wells, including access roads and supporting infrastructure.
- Production: Production and delivery of gas from well surface locations to the existing CGP network via gas gathering lines, including commissioning and maintenance activities.
- Post Development: Operational activities which may be needed to maintain production efficiency. It is anticipated these activities may include re-fracture stimulation and re-drilling (if required).
- Closure and Final Rehabilitation: decommissioning of the well surface locations in accordance with statutory requirements and industry best practice.

Supplementary information regarding the potential impacts and management of the above phases with regard to preferred well surface locations is provided in **Section 5.0**.



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PROPOSED WELL LOCATIONS - UPPER SURFACE PROJECT AREA

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FIGURE 4

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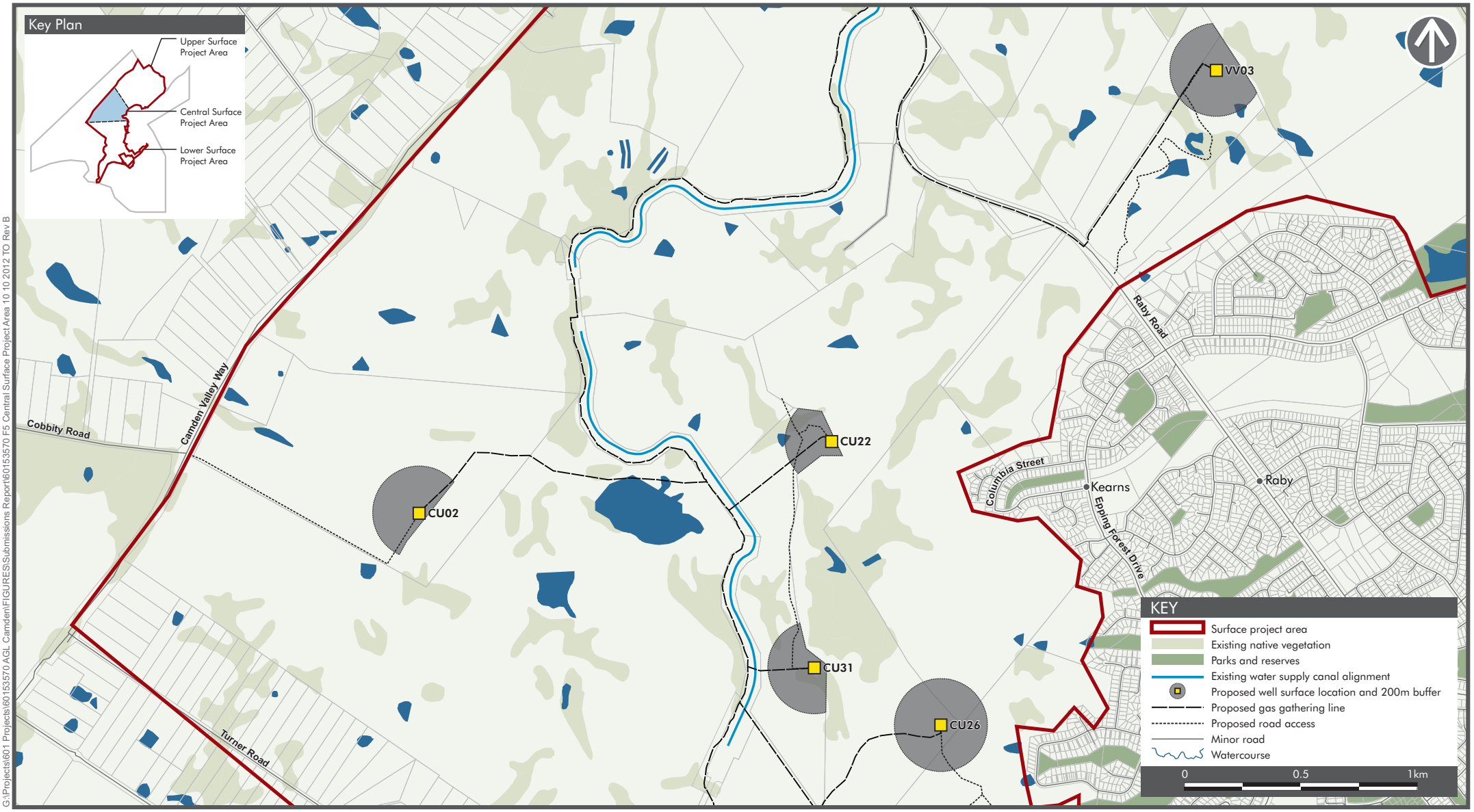

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PROPOSED WELL LOCATIONS - CENTRAL SURFACE PROJECT AREA

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FIGURE 5

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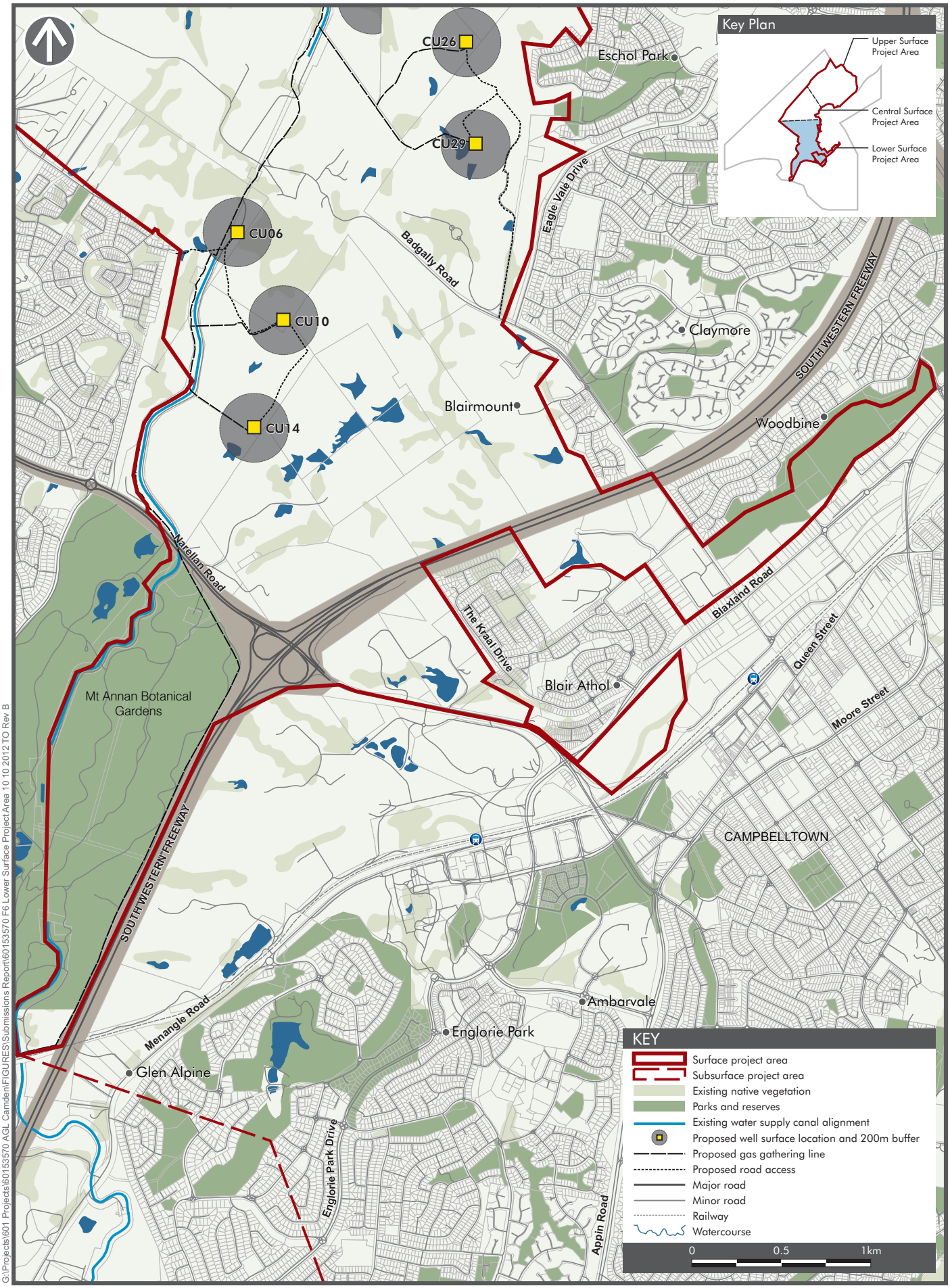

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LOWER SURFACE PROJECT AREA

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FIGURE 6

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4.2.2 Access Roads

Access to the well surface locations would be provided along existing public roads and private tracks within the relevant property boundary. Earthworks would be required to construct or upgrade access roads to new well surface locations to enable the drilling rig and support equipment to access the sites. Where practicable, existing road and track access are proposed to be utilised to minimise construction activity and environmental disturbance. Construction of access roads would be in accordance with the existing AGL EMS for the CGP, which includes a Soil and Water Management Sub Plan.

The proposed amendments to the project with respect to well surface locations now forming the Amended Project are summarised in **Table 7** and are shown in **Figure 4**, **Figure 5** and **Figure 6**. Private roads and tracks used during operations would be returned to their original state, or to a condition agreed by the landholder.

Table 7 Summary of Access Tracks for Amended Well Surface Locations

Well Surface Location	Formerly Proposed Access	Preferred Access	Beneficial Outcome
RA03	Proposed access track to Campbelltown Road.	No changes to the access of RA03 are proposed.	
RA09	Proposed access track to Campbelltown Road.	No changes to the access of RA09 are proposed.	
VV07	Via a proposed access track to be constructed north to join St Andrews road.	VV07 has been removed from the Amended Project. The construction of a new access track to this location is therefore no longer required. No traffic would be generated along St Andrews road as a result of the Amended Project.	A submission raised an objection in relation to the potential sterilisation of land and land use conflicts that may be associated with wells VV07 and VV11. Potential land use conflicts and land sterilisation concerns have been avoided.
VV11	Via a proposed access track to be constructed north along an existing transmission easement then west to join Camden Valley Way.	VV11 has been removed from the Amended Project The construction of a new access track to this location is therefore no longer required.	
VV03	Was not previously proposed as part of the EA.	VV03 is located east of the former VV07 site. Proposed access includes an access track from Raby Road south of VV03.	Access to VV03 will utilise Raby Road and negate the need for access from St Andrews Road, therefore mitigating traffic impacts.
CU02	Via a proposed access road from Camden Valley Way into Gregory Hills.	Via the newly constructed Gregory Hills Drive, off Camden Valley Way into Gregory Hills.	
CU06	Via existing access tracks through Gregory Hills College.	Via a proposed access track from Saddle Close, Currans Hill.	Access to CU06 will minimise traffic impacts to the Gregory Hills College road network.
CU10	Via existing access tracks and through Gregory Hills College to Badgally Road.	CU10 and CU14 will now be accessed from Saddle Close, Currans Hill. Access track to run through CU06, then continue onto CU10 & CU14.	Access through Gregory Hills College is no longer required.
CU14	Proposed access track to CU14 and via the proposed access for CU10.	CU10 and CU14 will now be accessed from Saddle Close, Currans Hill. Access track to run through CU06, then continue onto CU10 & CU14.	Access through Gregory Hills College is no longer required.
CU20	Via Raby Road (>1km) and private access through the existing Upper Canal access	CU20 has been removed from the Amended Project. The construction of a new access track to this location is therefore no longer required.	

Well Surface Location	Formerly Proposed Access	Preferred Access	Beneficial Outcome
	tracks.		
CU22	Via proposed access through private property south from Raby Road (~2km).	CU22 has been relocated approximately 900m east from its formerly proposed location and preferred access is via private access from Raby Road.	Impacts associated with access track construction will be minimised as a result of the change in location and access, reducing the access track by approximately 900m.
CU26	Via proposed access track from Frontignan Street, Eagle Vale.	Access is now from Badgally Rd to CU29, then onto CU26.	Removal of traffic through the suburb of Eschol Park.
CU29	Via proposed access track from Frontignan Street, Eagle Vale.	Access is now from Badgally Rd to CU29, then onto CU26.	Removal of traffic through the suburb of Eschol Park.
CU31	Not previously proposed.	Via access track continuing south from CU22.	

4.3 Gas Gathering System and Associated Infrastructure

4.3.1 Preferred Siting and Development

Main Spine Line

Since the preparation of the EA, AGL has undertaken additional consultation and negotiations with the SCA with regards to the preferred siting and development of the main spine line.

The main spine line as proposed in the EA described an alignment that followed the eastern side of the Upper Canal. The Amended Project has revised this alignment and proposes to utilise the western corridor of the Upper Canal as shown in **Figure 3**. This is primarily to resolve issues indicated by the SCA, as owners and managers of the Upper Canal, relating to the proposed future upgrade of the Upper Canal system (to be located on the eastern side) and the potential for conflict in future land use. Where possible, the proposed western alignment avoids large stands of vegetation and potential CPW species. Where an alignment cannot be navigated through the vegetation, the vegetation would be underbored to avoid any clearing requirements. For any underboring occurring within 3 metres of sclerophyllous trees, underboring will be undertaken at a depth of greater than 1 m, thus avoiding the main root zone for sclerophyllous trees.

Gas Gathering Lines

Preferred GGL routes have been identified to support the preferred well surface locations. The siting of these GGLs was consistent with the locational guidelines and AGL's preference to locate within existing and disturbed corridors such as existing roads or access tracks and other easements in order to minimise environmental impacts. A summary of the preferred routes for GGLs for the Amended Project is presented in **Table 8**.

Table 8 Summary of Gas Gathering Lines for Amended Well Surface Locations

Well Surface Location	Formerly Proposed GGL Route	Preferred GGL Route	Beneficial Outcome
RA03	Along the proposed access track and along Campbelltown road.	No changes to the GGL route from RA03 to the main spine line are proposed.	
RA09	Along the proposed access track and along Campbelltown road.	No changes to the GGL route from RA09 to the main spine line are proposed.	
VV07	West from the well directly to the main spine, adjacent to a stand of CPW vegetation.	VV07 has been removed from the Amended Project. The construction of gas gathering lines to this location is therefore no longer required.	
VV11	Directly south to the main spine (already in close proximity)	VV11 has been removed from the Amended Project. The construction of gas gathering lines to this location is therefore no longer required.	
VV03	Was not previously proposed as	South along existing cleared	VV07 may have necessitated

Well Surface Location	Formerly Proposed GGL Route	Preferred GGL Route	Beneficial Outcome
	part of the EA.	areas and around stands of CPW vegetation to utilise the Raby Road corridor to link in to the main spine line.	the removal of some CPW for the GGL route to the main spine line. The location of VV03 and the GGL avoids impact to CPW vegetation.
CU02	South to and along the future Badgally Road within the Central/Gregory Hills district.	North east through open grazing paddocks to the main spine line.	Shorter length of gas gathering line minimises construction impacts and impacts within residential area of Central/Gregory Hills district.
CU06	East directly into main spine.	West directly into main spine (from new location of CU06).	Benefits are related to minimising impacts associated with land use conflicts which have been avoided by relocation of CU06.
CU10	Along the proposed access track then directly west into the main spine line.	No changes to the GGL route from CU10 to the main spine line are proposed.	
CU14	Along the proposed access track to link in with CU10.	No changes to the GGL route from CU14 to the main spine line are proposed.	
CU22	Directly to the main spine (already in close proximity)	Southwest for approximately 500m from the new preferred location of CU22 to the main spine line.	There is no specific beneficial outcome related to the realignment of the GGL. Benefits are related to the relocation of CU22 (refer to **Table 6**).
CU26	No changes to the GGL route from CU26 to the main spine line are proposed.		
CU29	No changes to the GGL route from CU29 to the main spine line are proposed.		
CU31	Was not previously proposed as part of the EA.	Directly to the main spine (already in close proximity).	Location of CU31 in close proximity to the spine line avoids potential constraints associated with construction and operation of wells further from spine line.

4.4 Changes to Land Affected by the Amended Project

As a consequence of amendments to the project, the land the subject of the application for Amended Project has changed from the original application for the Northern Expansion Project. The updated summary of land directly affected by the Amended Project in the Surface Project Area is provided in **Table 9**. Land within the Subsurface Project Area is shown in **Figure 1**.

Table 9 Land Directly Affected by the Amended Project Infrastructure

Lot and DP	Amended Project Components on the Land	Current Land Tenure
93/1137298	CU14 well surface location, CU10 well surface location, access roads and GGLs for interconnection to CU10 and the Main Spine Line	Marist Brothers
3251/835245	CU29 well surface location, access roads and GGLs for interconnection to CU26 and the Main Spine Line	Ingleburn Mushroom Farms Pty Ltd
3900/1170905	CU26 well surface location, access roads and GGLs for interconnection to CU29 and the Main Spine Line	Faldison Pty Limited, TOSCUZ Investments Pty Limited

Lot and DP	Amended Project Components on the Land	Current Land Tenure
4/260703	CU22 well surface location, CU31 well surface location, access roads, GGLs and connection to the Main Spine Line	Steven Chambers
12/1041381	CU06 well surface location, access roads, GGLs and connection to the Main Spine Line	Wollin Investments Pty Limited and LANDCO (NSW) Pty Limited as tenants in common equal shares of the part formerly 564/1007061 Wollin Investments Pty Limited for the part formerly 436/1008940
3/201351	VV03 well surface location, access roads, GGLs and connection to the Main Spine Line	Anten Bautovich and Mladen Bautovich
701/1154772	CU02 well surface location, access roads and GGLs	Gregory Hills Corporate Park Pty Ltd
4/240775	RA03 well surface location, access roads and GGLs	Capitani, Domenico and Josephine
23/585290	RA09 well surface location, access roads and GGLs	Khengs Pty Ltd
Part 1001/734445 1002/734436	Access roads, GGLs and tie in connection to the existing CGP	Royal Botanic Gardens and Domain trust
455/1097044	Access road to VVO3, GGLs and connection to the Main Spine Line	Anten Bautovich and Mladen Bautovich
2179/1166232	Access roads and GGLs	Trustee of the Marist Brothers
2/1159818	Access roads and GGLs	Capitani, Domenico and Josephine
2/10886624	Access roads and Main Spine Line	Sydney Catchment Authority
1/616147	Access roads and Main Spine Line	Sydney Catchment Authority
2/616147	Access roads and Main Spine Line	Sydney Catchment Authority
12/1041381	Access roads and Main Spine Line	Sydney Catchment Authority
1/619850	Access roads and Main Spine Line	Sydney Catchment Authority
2/619850	Access roads and Main Spine Line	Sydney Catchment Authority
1/623825	Access roads and Main Spine Line	Sydney Catchment Authority
2/623825	Access roads and Main Spine Line	Sydney Catchment Authority
1/610145	Access roads and Main Spine Line	Sydney Catchment Authority
1/610146	Access roads and Main Spine Line	Sydney Catchment Authority
Campbelltown Road, Denham Court	Access roads, GGLs from RA03 to Denhamn Court Road through toRA09	Roads and Maritime Services
Denham Court Road, Denham Court	Access roads, GGL from the Main Spine Line through to RA09	Roads and Maritime Services
Narellan Road, Campbelltown	Access roads, GGLs along Narellan Road, GGL underbored beneath Narellan Road/ South Western Freeway	Roads and Maritime Services
Raby Road, Varroville	Access roads, GGL from VV03 along Raby Road to the Main Spine Line	Roads and Maritime Services

4.5 Director-General's Environmental Assessment Requirements

A full copy of the Director-General's EARs for the Project was provided in Appendix A of the EA. The key matters raised by the Director-General for consideration in the EA were outlined in Table 6-1 and Table 6-2 of the EA. These matters are still applicable to the Amended Project which demonstrates compliance with the assessment of the key issues as shown in **Table 10**.

Table 10 Director-Generals Key Issue Environmental Assessment Requirements

Key Issues	Addressed
- Land Use Conflicts • Identify and address any potential land use conflicts between the project and any future urban release areas proposed in south-west Sydney in consultation with the relevant landowners	This key issue was assessed in the EA and further assessment has been included in Sections 3.6 and 5.1 of this Submissions Report.
- Soil and Water • Proposed water management system during construction and operation; and • An assessment of the potential impacts of the project on the quantity and quality (including salinity) of surface and groundwater resources.	This key issue was assessed in the EA and further assessment has been included in Sections 3.4, 3.5, and 3.7 of this Submissions Report.
- Noise and Vibration	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.3 of this Submissions Report.
- Air Quality • Including potential dust and odour impacts.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.8.4 of this Submissions Report.
- Greenhouse Gas • Include a quantitative assessment of the potential greenhouse gas emissions of the project; and • Include a detailed description of the proposed measures that would be implemented to minimise greenhouse gas emissions, and ensure the project is energy efficient.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.8.4 of this Submissions Report.
- Hazards	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.8.2 of this Submissions Report.
- Biodiversity • Include accurate estimates of any vegetation clearing; and • Include a detailed assessment of the potential impacts on any terrestrial and aquatic threatened species, populations, ecological communities or their habitats.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Appendix E and Section 5.2 of this Submissions Report.
- Heritage • Including Aboriginal and non-Aboriginal.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Appendix G and H and Section 5.3 and 5.4 of this Submissions Report.
- Transport • Include an assessment of potential impacts of the project on the safety and performance of the road network; and • Include a clear demonstration of how the project will not compromise the future upgrade of Camden Valley Way or any other road corridor.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.8.5 of this Submissions Report.

Key Issues	Addressed
- Visual	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.6 of this Submissions Report.
- Rehabilitation • Include a detailed description of how each site would be progressively rehabilitated and integrated into the surrounding landscape; and • Include a detailed description of the measures that would be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation measures, and for the ongoing management of the site following the cessation of gas production.	This key issue was assessed in the EA and further assessment of the Amended Project has been included in Section 5.8.7 of this Submissions Report.
- Consultation • During the preparation of the Environmental Assessment, consultation should be undertaken with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners.	Consultation activities were documented in the EA. Further consultation has been undertaken for the Amended Project, specifically with landowners and the SCA, and local RAPS in relation to the revised cultural heritage assessment. Where additional consultation has been undertaken it has been specified throughout this Submissions Report and the relevant appendices.

5.0 Discussion of Potential Impacts

5.1 Land Use

5.1.1 Existing Environment

The Surface Project Area broadly comprises parts of the suburbs of Currans Hill, Varroville, Raby and Denham Court. These key areas are predominantly made up of semi-rural and rural residential developments, and agricultural lands predominantly used for grazing, with isolated areas of remnant vegetation scattered throughout the Surface Project Area. There are also significant areas of both public and private recreation spaces. The general land use types in the area include a mix of agricultural lands, country towns and proposed future residential areas with associated commercial and industrial developments.

The LGAs of Camden and Campbelltown comprise part of the area identified as the South West Growth Centre (SWGC), for which extensive residential development is planned consisting of 18 precincts over 17,000ha in area, with capacity for approximately 110,000 new homes within future residential land.

The Amended Project spans portions of the land earmarked for future development as part of the SWGC, namely the Turner Road and East Leppington Development Areas within the Surface Project Area. Other development areas within the Subsurface Project Areas (and not subject to surface impacts) include Leppington, Catherine Fields and Catherine Fields North. Areas planned for future development by local Councils include the Camden Lakeside area, El Caballo, Gladeswood and East Side Development Areas.

All future development areas and their relationship to the location of the Amended Project infrastructure are identified in **Figure 7**. As identified in **Figure 7**, CU02 and the associated GGL and access track are located within the Industrial/commercial area of the Turner Road Development Area. Land within this area has been designated for a variety of purposes including residential development, open spaces, recreational areas, Industrial and commercial facilities.

5.1.2 Potential Impacts

Avoidance of land use conflicts between the project infrastructure and future residential estates was a key driver in defining the Amended Project. As such, it is considered the Amended Project is unlikely to result in negative land use outcomes across the Surface Project Area, during construction, production, post-production and rehabilitation.

The presence of field infrastructure is considered unlikely to sterilise the land for future uses or negatively impact on the use of surrounding land, or lead to the industrialisation of the area. Final wellhead infrastructure would require a minimal area of land along with an appropriate buffer to certain land uses in accordance with the DP&I's *Locational Guidelines for Development in the Vicinity of Operating Coal Seam Methane Wells* (2004). The location of this infrastructure has been selected with consideration of both existing and future land use and it has been demonstrated through previous stages of the CGP that this infrastructure can co-exist within an urban environment with no significant residual impact.

It is expected that impacts to land use would be temporary and would result in sites being rehabilitated to pre-existing land use condition or better, or to a condition agreed in consultation with the landowner. Original use of the land would be restored through the rehabilitation process.

Existing Land Use

Potential impacts to land use are primarily related to amenity including noise, visual, air quality and traffic. In addition, the construction phase of the Amended Project would also impact upon existing land use surrounding the well surface locations in the following ways:

- Potential disruption to existing farming and agricultural operations due to requirements for access to land for construction purposes.
- Temporary occupation of land required for the establishment of the construction area.
- Potential for indirect impacts upon agricultural land uses resulting from impacts upon water quality and potential spread of weeds.

However, given the temporary and short-term nature of the construction process for the access roads, wells and associated gas gathering system, as well as proposed initial rehabilitation techniques, it is expected the impacts on land use are manageable.

Potential impacts of the operation phase of the Amended Project on existing land uses include:

- Potential loss of existing land uses such as agriculture
- Potential sterilisation of land for future development
- Potential constraints posed by the operating infrastructure upon surrounding land uses
- Amenity and perceived impacts such as visual and hazard and risk.

The potential for the loss of existing land uses and/or sterilisation of land for future development is considered to be low given that final wellhead infrastructure would require a minimal area of land along with an appropriate buffer to certain land uses. Further, the location of infrastructure has been selected in consideration of both existing and future land use in accordance with the *Locational Guidelines: Development in the Vicinity of Operating Coal Seam Methane Wells* (DoP, 2004).

Constraints to the use of land during the production phase of the Amended Project would be limited to the presence of infrastructure at the well heads, which would limit the use of a relatively small area of land surrounding the infrastructure for some forms of land use. However, it has been demonstrated through previous stages of the CGP in Spring Farm and Menangle Park that this infrastructure can co-exist within both an urban and agricultural environment with no significant residual impact.

Future Land Use

Potential impacts to future land use include:

- Interaction of CU02 with the Turner Road Development Area.
- Interaction with potential future upgrade works of the Upper Canal.

Interaction of CU02 with the Turner Road Development Area

The potential impacts of construction activities on the use of the land on which CU02 and associated infrastructure are proposed mainly relate to amenity impacts such as:

- Noise impacts.
- Short term visual impacts, particularly associated with site disturbance.
- Air quality impacts.
- Construction traffic.

Further, the construction activities undertaken by the developer for Turner Road Development Area may also conversely impact on the proposed development of CU02. Consultation with the landowner and developer would be ongoing to ensure both projects can proceed without delay or interference.

Interaction with Potential Future Upgrade Works of the Upper Canal

Due to the location of the main gas gathering spine adjacent to the Upper Canal, maintenance vehicles for the gas infrastructure would use the SCA access corridor and Upper Canal crossings to access the gas gathering spine. Potential impacts could occur as a result of the interaction between Canal and gas gathering spine upgrades and maintenance. An overloaded access track could result in further impacts such as the development of unstable banks and soil and erosion impacts. AGL will continue work with the SCA to ensure that AGL has regard to the SCA's upgrade program to avoid an excess of vehicles using the access track on the eastern side of the Canal.

5.1.3 Mitigation Measures

Specific mitigation measures relating to minimising land use impacts that were outlined in the EA are still relevant. The Statement of Commitments is included as **Section 7.0** of this Submissions Report.

Moreover, land use impacts would be temporary in nature due to the finite timeframe of the Amended Project. On completion of operations, impacted areas would be cleaned up and rehabilitated to return the land to preexisting use and condition or better in accordance with the EMS. This work would involve:

- Sealing/ plugging and abandonment of wells in accordance with relevant guidelines.
- Removing plant and equipment from wellheads and removal of fenced compounds.
- Filling in excavation.
- Rehabilitation, contouring, and regressing/ revegetation.

These activities would be undertaken in consultation with the relevant landowners.

Given that many of the land use impacts relate to amenity issues the measures proposed to manage air quality, water quality, hazard and risk, noise, visual and traffic impacts would also assist in managing potential land use impacts. These mitigation measures are outlined in the relevant amenity-related sections.

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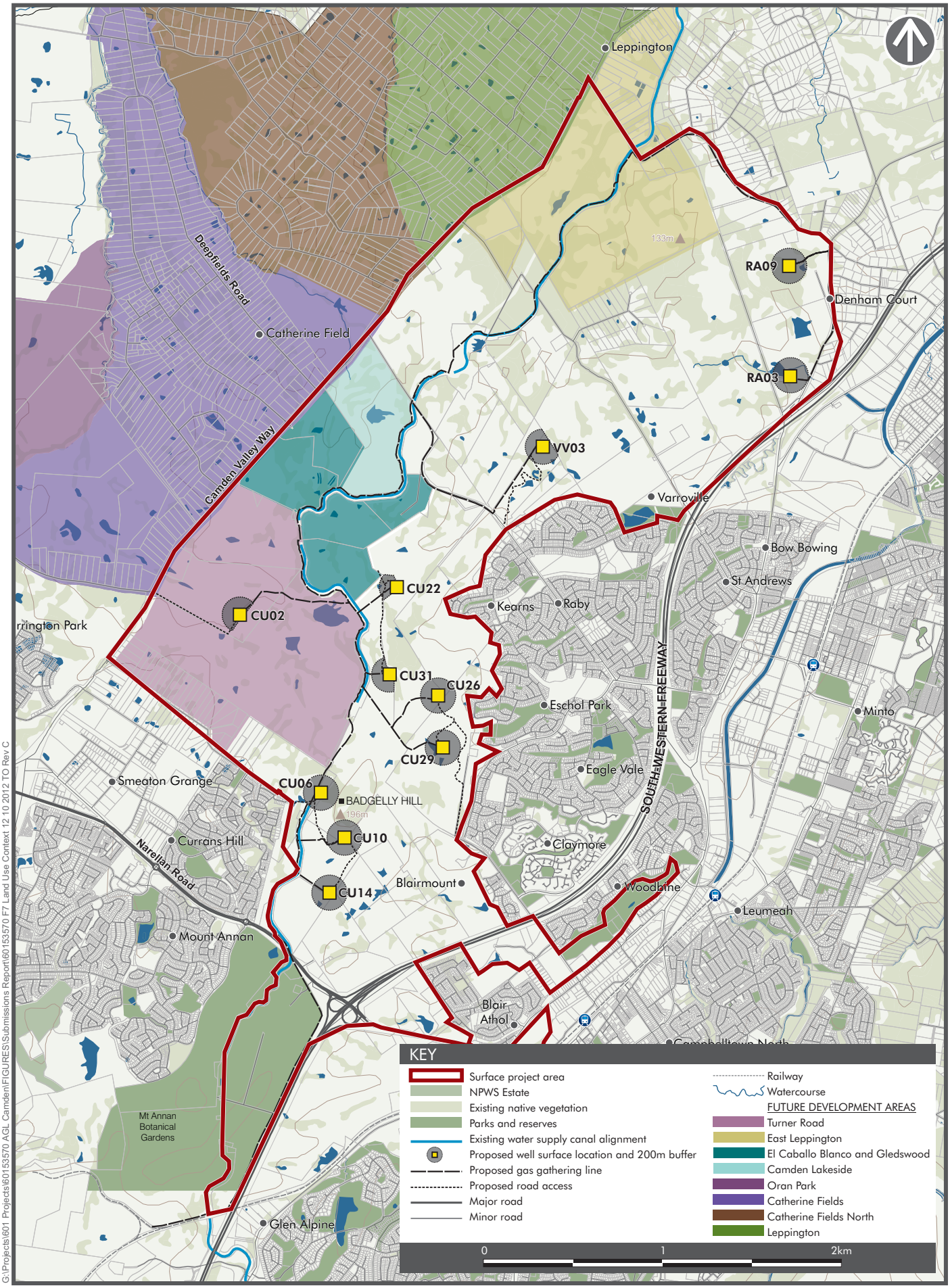

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LAND USE CONTEXT

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Camden Gas Project Northern Expansion

FIGURE 7

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5.2 Ecology

To inform this Submissions Report, a revised Flora and Fauna Assessment was undertaken and is included as **Appendix** E. The review included additional field investigations carried out in June and July 2011 and June 2012. The investigations focused on the location of new wells, gathering lines and access roads, that were not included as part of the original layout for the Northern Expansion Project.

5.2.1 Existing Environment

The general landscape is primarily semi-rural and agricultural lands with native vegetation extensively cleared over the southern two thirds of the Surface Project Area. Some larger and moderately well connected patches of remnant and regrowth woodland occur over the hills and lower slopes of the northern section.

The geology of the region consists of sandstones and shales from the mid-Triassic. The Amended Project is located on the eastern margin of the Cumberland Plain formed on the sediments of the Wianamatta Group shales, in particular the Bringelly Shales. They comprise shale, with occasional calcareous claystone, laminate and coal. This southern area of Cumberland Plain generally comprises gently undulating plains and low rolling hills.

The climate at Campbelltown consists of mild summers with an average maximum of 28.2 degrees Celsius and minimum of 17.5 degrees Celsius in February, and cold, wet winters with an average minimum of 4.9 degrees Celsius and a maximum of 17.3 degrees Celsius in July (Bureau of Meteorology, 2009). The mean annual rainfall is 715 millimetres (Bureau of Meteorology, 2009).

5.2.2 Methodology

The revised Flora and Fauna Assessment for the Amended Project included:

- Taxonomy – classification of flora and fauna species present in the Surface Project Area.
- Legislative review – research and consideration of relevant State and federal legislation and recent changes to legislation since last assessment.
- Literature and data review, including updated database searches for threatened species such as the TSC Act final determination listing for RFEFCF (NSW Scientific Committee, 2004), Protected Matters Searches under the EPBC Act and OEH NSW Atlas of Wildlife.
- Field fauna and flora surveys including targeted flora searches, and assessment of vegetation condition, and fauna habitat assessment.
- Review and assessment of groundwater dependent ecosystems (GDEs).

5.2.3 Results

A summary of the results of the revised flora and fauna assessment for the Amended Project is provided below. These results are presented only for data relating to well surface locations, GGLs, main gas spine and access tracks that are included as part of the Amended Project. All results relating to the components of the Northern Expansion Project which have been removed are not outlined in the following sections.

Flora

Plant Communities

The Surface Project Area encompasses six native plant communities including:

- CPW (in total, as separately defined under the TSC and EPBC Acts), (868.41 ha mapped in the Surface Project Area; 40.35 ha within the assessment envelope);
- Alluvial Woodland (RFEFCF) (42.24 ha mapped the Surface Project Area; 3.46 ha within the assessment envelope);
- Moist Shale Woodland (33.04 ha mapped in the Surface Project Area, 0 ha within the assessment envelope);
- Western Sydney Dry Rainforest (4.52 ha mapped in the Surface Project Area; 0 ha within the assessment envelope);
- Shrubland (19.77 ha mapped in the Surface Project Area; 12.07 ha within the assessment envelope); and
- Closed Grassland.

The main vegetation community occurring in the Surface Project Area and proposed works is Closed Grassland which is not listed as an EEC under the TSC Act.

Well Surface Locations

Table 11 provides a summary of the vegetation encountered at the new well surface locations that form part of the Amended Project layout (including the entire area within the 200m assessment envelope).

Gas Gathering Lines, Main Gas Gathering Spine and Access Tracks

Details of the flora profiles along the GGLs, Main Gas Gathering Spine and access tracks that are now part of the Amended Project are provided in **Table 12**.

Table 11 Flora/Vegetation Summary of Well Surface Locations within the Amended Project

Project Site	Existing Environment		Vegetation condition	Potential Habitat for Listed Species*
	Type	Present Vegetation		
Well Surface Locations				
CU22	Grazed paddock primarily cleared of native woody vegetation	The closed grassland is a mixture of exotic and native grasses and herbs. Within the 200m envelope to the site centroid there are two small stands of trees consisting of *Eucalyptus tereticornis* and *Eucalyptus moluccana.* Two patches of shrubland dominated by *Bursaria spinosa* are present. An additional two patches of shrubland dominated by *Oea europea sppcuspidata* are in the eastern sector of envelope. No threatened flora species were recorded within envelope.	Disturbed - Poor	Low
CU31	Grazed paddock	A closed grassland dominated by exotic pasture grasses occurs over the western areas of the well surface locations. Native groundcovers increase in per cent cover where the closed grassland extends to the east. Vegetation in the northeast sector and extending further to the north is dominated by *Eucalyptus tereticornis* with *Bursaria spinosa* in the understorey and a mixed groundcover of native and exotic grasses and herbs. This stand of native vegetation is in a moderate to good condition and considered to be CPSW. An open stand of CPW characterised by *Eucalyptus tereticornis* with patches of *Bursaria spinosa* and mixed groundcover of native and exotic grasses and herbs is present in the southern portion of the well surface location. The CPW is in a moderate condition. No threatened flora species were recorded in the 200m assessment envelope.	Moderate - Good	Low (the highest potential exists in stands of CPSW and CPW)

CU06	Grazed paddock	The CPW mapped in the eastern section of the 200m assessment envelope is contiguous with a larger stand of the community. Canopy is dominated by *Eucalyptus tereticornis* and *Eucalyptus moluccana* with regrowth canopy species in the midstorey and *Melaleuca styphelioides* present in the gully. The groundcover is in variable condition ranging from good on the upper slopes to poor in the gully. The CPW is in a moderate to good condition. There is a patch of shrubland dominated by *Bursaria spinosa* with mixed native and exotic groundcovers in the western area in a poor condition.	Disturbed	Low
VV03	Grazing paddock.	Vegetation in central area of site is closed grassland. Species composition is mixture of exotic grasses and herbs with occasional occurrences of native species such as *Austrodanthonia tenuior*. No threatened species or EECs are recorded in the disturbed central section of the 200m assessment envelope. Remnant CPSW in a good condition is present within the north-eastern sector of the 200m assessment envelope. A small stand of *Eucalyptus tereticornis* in the south west is considered to be CPW is in a poor condition. A stand of RFEFCF dominated by *Melaleuca styphelioides* and *Eucalyptus moluccana* with a disturbed groundcover stratum is present on the drainage line to the south west.	Disturbed	Low

Table 12 Flora/Vegetation Summary of Gas Gathering Lines, Main Gas Spine Line and Access Tracks for the Amended Project

Project Site	Existing Environment		Vegetation condition	Potential Habitat for Listed Species*
	Type	Present Vegetation		
Gas Gathering Lines				
CU06, CU14 to CU10 to main spine line	SHW	The access track to CU06, CU10 and CU14 has been located to avoid SHW in this area. The canopy is dominated by characteristic tree species with understory primarily cleared and the groundcover is a mix of native and exotic species.	Good	Moderate
	Cleared and disturbed	The main impact areas for GGLs and access tracks to well heads are grazed paddocks or along existing access tracks through paddocks. Closed grasslands dominated by mixture of exotic and native grasses and herbs are present in these locations.	Disturbed	No
CU02 to main spine line, access track	RFEFCF	Two small patches of RFEFCF occur in the assessment envelopes at the eastern end of the GGL. The canopy includes *Angophora subvelutina*, *Eucalyptus tereticornis* and *Eucalyptus moluccana*. The understorey is absent in the western patch and *Lycium ferocissimum* is present in the eastern patch. These areas have been subject to grazing and pasture improvement with the groundcover stratum highly disturbed.	Poor - Moderate	Low
	Shrubland	A small patch of shrubland occurs on the western end of the GGL adjacent to South Creek. Vegetation is characterised by a sparse cover of *Bursaria spinosa* with the groundcover including swards of native grasses such as *Themeda australis* and *Aristida ramosa* with some exotic herbs and grasses mixed through. This area has been subject to vegetation clearing and grazing.	Poor	Low

Project Site	Existing Environment		Vegetation condition	Potential Habitat for Listed Species*
	Type	Present Vegetation		
	Cleared and disturbed – grazed paddock	The majority of the impact areas are grazed paddock and existing access tracks. The dominant plant community is a closed grassland that varies in composition from small patches of mixed native and exotic groundcovers to areas entirely dominated by exotic herbs and grasses. Scattered individuals of *Eucalyptus tereticornis* and *Eucalyptus moluccana* are present adjacent to this alignment.	Disturbed	Low
CU22 and CU31 to main gas spine and access tracks	CPW	A large patch of CPSW is located to the east of the CU22 to CU31 access track consisting of remnant and regrowth canopy and understorey of mixed native and exotic shrubs. The canopy includes *Eucalyptus tereticornis* and *Eucalyptus moluccana* with *Bursaria spinosa* and *Olea europea* ssp *cuspidata* in the understorey. A stand of CPW is located to the west of the access track closer to the CU31 well surface location and the GGL with an open canopy of *Eucalyptus tereticornis* and an absent understorey.	Disturbed	Moderate
	Shrubland	A small patch of shrubland occurs to the south of the CU22 well surface location GGL. This vegetation is characterised by a sparse cover of *Bursaria spinosa* with the groundcover including swards of native grasses such as *Themeda australis* and *Aristida ramosa* with some exotic herbs and grasses such as *Paspalum dilatatum, Setaria gracilis* and *Senecio madagascariensis* mixed throughout. The area has been subject to vegetation clearing and grazing.	Poor	Low

Project Site	Existing Environment		Vegetation condition	Potential Habitat for Listed Species*
	Type	Present Vegetation		
	Cleared and disturbed	Access tracks to CU22 and on to CU31 will be confined to the existing service tracks for the Eastern pipeline with adjacent vegetation assessed as closed grassland. The majority of CU22 and CU31 GGLs will also be through highly disturbed closed grassland characterised by a dominance of exotic grasses and herbs and patchy occurrences of native groundcovers.	Disturbed	Low
CU29 and access track	Shrubland	The GGL passes through shrubland into the well surface location. The site is dominated by patches of *Bursaria spinosa* and *Olea europea* ssp. *cuspidata* with groundcover including a mix of native and exotic herbs and grasses.	Poor	Low
CU26 to main spine line	CPW	CPW is present along the GGL alignment. The canopy includes scattered *Eucalyptus moluccana* and *Eucalyptus crebra* with the understorey dominated by *Bursaria spinosa* and *Olea europea* ssp. *cuspidata*. The groundcover is dominated by exotic grasses and herbs.	Poor - Moderate	Low
VV03, GGLs and access track	CPW	The small patch of CPW within the GGL and access track assessment area is represented as a stand of trees to the side of the existing access track.	Poor	Low

Project Site	Existing Environment		Vegetation condition	Potential Habitat for Listed Species*
	Type	Present Vegetation		
	RFEFCF	The access track passes through a stand of RFEFCF along the existing access track alignment, while the GGL would be underbored beneath this vegetation. The stand of RFEFCF is dominated by *Melaleuca styphelioides* with *Eucalyptus moluccana* on the slopes extending above the drainage line. The groundcover stratum is highly modified and dominated by exotic pasture grasses.	Disturbed	Low
	Cleared and disturbed	The majority of the GGL between the well surface location and Raby Road passes through closed grassland characterised by exotic pasture grasses and herbaceous weeds, with small patches of native grasses. The roadside vegetation along the GGL is dominated by closed grasslands of exotic groundcover, patches of plantings of native and exotic shrubs and trees and shrublands.	Disturbed	Low

Fauna

Observations of fauna species utilising the Surface Project Area are listed in **Appendix** E and include three amphibian species, 52 bird species, four introduced mammal species and two reptile species. Of the 52 bird species recorded in the field surveys, three are introduced.

All native fauna recorded in the field surveys are considered common and abundant within their range and distribution in NSW, the locality and the broader Sydney Basin Bioregion.

Fauna Habitat

Habitat features and species associations within the Surface Project Area include woodlands, shrublands, cleared areas and waterbodies such as farm dams, drainage lines and the Sydney Water Upper Canal).

Well Surface Locations

Table 13 provides a summary of the fauna habitat encountered at the new well surface locations proposed as part of the Amended Project layout (including the 200m assessment envelope).

Table 13 Summary of Fauna Habitat Potential at Well Surface Locations

Project Site	Fauna Habitat	Habitat Condition	Potential for Threatened Species
Well Surface Locations			
CU22	Fauna habitats are highly modified in the direct impact zone of the well surface location. Within the 200m survey footprint the main fauna habitats are the canopy of the principal CPW patch, dense cover of native shrubs in the southern shrubland area and the constructed dam. The survey footprint also includes a larger eastern stand of trees and SPW to the west of Upper Canal.	Poor CPW – Moderate.	Low
CU31	Within 200m envelope the main fauna habitats include stands of CPSW and CPW. The CPSW extends further to the north beyond CU31 as a larger patch of native vegetation which includes two dams.	Moderate	Good
CU06	This area is highly disturbed and there no large trees in the impact zone. On the neighbouring property to the proposed well location, within 200 m of the site, there are a number of large Eucalyptus that were heavily flowering at the time of the survey, providing foraging resources for a range of vertebrate fauna.	Poor	Low
VV03	Fauna habitats are highly modified in direct impact zone of VV03. Within the 200m survey envelope the main fauna habitat is the large stand of CPSW providing a Good level of habitat and the RFEFCF providing a Moderate level of habitat. The CPSW area within the 200m survey envelope and extending into adjoining areas may provide sheltering, roosting, nesting and foraging and habitat for threatened birds, microchiropteran bats and the Cumberland Plain Land Snail.	Poor	Low

Main Gas Gathering Spine, Gas Gathering Lines and Access Tracks

Details of the fauna profiles along the Main Gas Gathering Spine, GGLs and access tracks that are now part of the Amended Project are provided in **Table 14**.

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Table 14 Summary of Fauna Habitat Potential of Main Gas Gathering Spine, Gas Gathering Lines and Access Tracks

Project Site	Fauna Habitat	Habitat Condition	Potential for Threatened Species
Gas Gathering Lines			
CU06, CU14 to CU10 to Spine Line	*SHW* This stand of SPW may provide sheltering, roosting and foraging habitat for a suite of fauna such as arboreal mammals, birds, and bats. Some highly mobile threatened fauna such as birds and microchiropteran bats may forage in and over this stand of SHW and adjacent areas.	Moderate	Low-Moderate
	Cleared and disturbed Fauna habitats are highly simplified in the impact zone. Although some highly mobile threatened fauna such as birds and microchiropteran bats may forage over the survey and adjacent areas there is very little potential habitat for any threatened fauna species within the GGL construction footprint.	Poor	Low
CU02 to Spine Line	*REFEFCF* These small stands of native vegetation may provide sheltering, roosting and foraging habitat for non-threatened native birds, bats and amphibians. Some highly mobile threatened fauna such as birds and microchiropteran bats may also forage in and over these stands of RFEFCF.	Disturbed - Poor	Moderate
	Shrubland This small stand of derived native vegetation may provide sheltering and foraging habitat for non-threatened native birds, reptiles and amphibians. Some highly mobile threatened fauna such as birds and microchiropteran bats may extend foraging in and over the Shrubland from stands of RFEFCF or other areas of canopy adjacent to the South Creek drainage line.	Poor	Moderate
	Cleared and disturbed Although the constructed dam at the eastern end of the GGL will be dewatered for the nearby urban development it current provides sheltering and foraging habitat for waterbirds, amphibians and reptiles. Additionally microchiropteran bats may forage over the water body.	Poor	Low

Project Site	Fauna Habitat	Habitat Condition	Potential for Threatened Species
CU22 and CU31 to Main Gas Gathering Line	*CPW* The stands of CPSW and CPW adjacent to the access track in the exiting easement and CU31 GGL may provide sheltering, roosting and foraging habitat for a suite of fauna such as arboreal mammals, birds, and bats. Some highly mobile threatened fauna such as birds and microchiropteran bats may forage in and over these and adjacent areas.	Moderate	Moderate
	Shrubland This small stand of derived native vegetation may provide sheltering and foraging habitat for non-threatened native birds, reptiles and amphibians. Some highly mobile threatened fauna such as birds and microchiropteran bats may extend foraging in and over the shrubland from nearby stands of CPSW and CPW. Fauna habitats are highly modified.	Poor	Low
	Cleared and disturbed Fauna habitats are highly simplified. Although the constructed dam at the eastern end of the GGL will be dewatered for the nearby urban development it current provides sheltering and foraging habitat for waterbirds, amphibians and reptiles. Additionally microchiropteran bats may forage over the water body.	Poor	Moderate
VV03 and access track	*CPW* Fauna habitats in this patch of Woodland is primarily providing habitat for avifauna and microchiropteran bats. Although some highly mobile threatened fauna such as birds and microchiropteran bats may forage over the survey and adjacent areas there is very little potential habitat for any threatened fauna species in this patch.	Moderate	Low

Groundwater Dependent Ecosystems

GDEs are defined as *'Ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater'* (NOW 2012). GDEs are dependent upon groundwater to varying degrees. The depth to the groundwater table is a key determinant of groundwater dependency, with groundwater dependency decreasing to minimal levels in areas where the groundwater table is greater than 10m (NOW 2012).

A search of GDEs in the vicinity of the Amended Project was undertaken as described in **Section 3.4**. No priority GDEs were identified within the Subsurface or Surface Project Area.

CPW is listed as a high probability GDE by NOW (2012) and is mapped as a GDE on the Atlas of Groundwater Dependant Ecosystems (BoM 2012). However, no justification for the listing of CPW as a GDE is given.

The flora and fauna assessment (**Appendix E**) confirmed that it is likely that the CPW present within the Subsurface and Surface Project Area occasionally relies on shallow perched groundwater within the weathered shale profile. However, there is no known hydraulic connectivity between shallow perched groundwater and groundwater found in the deep coal seam water bearing zones (PB, 2011) so it is most unlikely that CPW, as well as other vegetation communities present within the Subsurface Project Area, have any reliance on deeper, regional groundwater systems.

5.2.4 Potential Impacts

Potential direct impacts of the Amended Project on ecology include:

- Vegetation clearance.
- The removal of potential habitat for threatened flora and fauna.
- The fragmentation of potential habitat for threatened flora and fauna.

Based on the updated flora and fauna assessment included in **Appendix** E, the Amended Project will now affect only Closed Grassland and a small area of Shrubland (4.88 ha) with measures in place to avoid significant vegetation including CPW, CSPW and RFEFCF.

Potential indirect impacts that may result from the Amended Project include:

- Erosion.
- Edge effects.
- Weed invasion.
- Elevated noise and light levels associated with increased human activity within or adjacent to sensitive habitat areas.

Figure 8, **Figure 9** and **Figure 10** depict the ecological constraints across the Surface Project Area.

As the flora and fauna assessment concluded that CPW and other communities within the Subsurface or Surface Project Area are unlikely to rely on deeper, regional groundwater systems (refer **Section 5.2.3** above), additional assessment of potential impacts to GDEs was not required and has not been considered further.

The potential impacts related to each of the Amended Project components is summarised in **Table 15**.

Table 15 Potential Ecological Impacts of Amended Project

Project Component	Vegetation Communities and Associated Habitat within Assessment Envelopes
Main Gas Gathering Spine Line	There will be a minimal amount of clearing of native vegetation for the construction of the Main Gas Gathering Spine. Impacts to habitat for fauna, including birds, bats and the Cumberland Plain Land Snail (CPLS), are expected to be negligible. Construction of the Main Gas Gathering Spine through cleared areas is unlikely to have a significant impact on native flora and fauna or their habitats.
RA03	No clearing of native vegetation communities would occur at RA03. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact upon the native flora and fauna or their habitats.
GGL RA03 to RA09 and	Trees along proposed GGL and access tracks have been avoided by altering alignments of this infrastructure. No impacts to habitat for fauna, including birds, bats and the CPLS, are

Project Component	Vegetation Communities and Associated Habitat within Assessment Envelopes
Access Tracks	expected to occur. No clearing of native vegetation would be required for the GGL and access track.
RA09	No clearing of native vegetation communities would occur for the construction of the well surface location. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure in disturbed or cleared areas within the assessment footprint at RA09 is likely to have little or no impact on the native flora and fauna or their habitats.
GGL RA09 and Access Track	The small patch of CPW identified along access track to RA09 would be avoided. No clearing of native vegetation would be required for the GGL and access track. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
VV03	No clearing of native vegetation communities would occur for the construction of the well surface location in the Amended Project. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure in the disturbed vegetation at VV03 is likely to have little or no impact on the native flora and fauna or their habitats of the site.
GGL VV03 and Access Tracks	Trees along the proposed section of access track and GGLs would be avoided. No clearing of native vegetation would be required for the GGL or access track over disturbed landscapes on private property, or along Raby Road to the Main Spine. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
CU31	No clearing of native vegetation communities would occur for the construction of the well surface location at this location. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats of the site.
GGL CU31 and Access Track	No clearing of native vegetation would occur for the GGL or access track. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
CU22	No clearing of native vegetation communities would occur at CU22. . No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats of the site.
GGL CU22 and Access Tracks	No clearing of native vegetation would occur for the GGL or access track. . No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
CU26	No clearing of native vegetation communities would occur at CU26. . No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats of the site.
GGL CU26 and Access Track	There would be minor disturbance to CPW on the GGL. Impacts to habitat for fauna, including birds, bats and the CPLS, are expected to be negligible.
GGL CU29 and Access Track	No clearing of native vegetation would be required for the GGL.
CU29	No clearing of native vegetation communities would occur for the construction of the well surface location at this location. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats.
CU02	No clearing of native vegetation communities would occur at CU02. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats.

Project Component	Vegetation Communities and Associated Habitat within Assessment Envelopes
GGL CU02 and Access Tracks	No clearing of native vegetation would be required for these GGL and access tracks. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
CU06	No clearing of native vegetation communities would occur at CU06. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats.
GGL CU06 and Access Tracks	No clearing of native vegetation would be required for these GGL and access tracks. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur.
CU10	No clearing of native vegetation communities would occur at CU10. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats.
CU14	No clearing of native vegetation communities would occur for the construction of the well surface location at this location. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Construction of the well surface location and associated infrastructure is likely to have little or no impact on the native flora and fauna or their habitats.
GGLs CU10 and CU14, and Access Tracks	No clearing of native vegetation would be required for the GGL and access track. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. Existing tracks would be used to reduce impacts to identified vegetation.
Mount Annan GGL and Main Spine Line	No clearing of native vegetation would be required for the GGL and access track as the existing Endeavour Energy easement and access would be utilised. No impacts to habitat for fauna, including birds, bats and the CPLS, are expected to occur. There would be no impact on the native flora and fauna or their habitats along the already cleared easement.

Well Surface Locations

Earthworks are the primary source of disturbance at most well surface locations with the associated potential impact being vegetation clearance. The reduced number of total wells to 11 decreases the impacted area of Closed Grassland across the Surface Project Area to 3,960m^2 (approximately 0.4ha). Accordingly the loss of 0.4ha of Closed Grassland will be approximately 0.01% of the vegetation of the Surface Project Area not mapped as a native plant community by NPWS (2002). In addition, loss of 4.41 ha of Shrubland would be unavoidable during construction of the 11 wells. This Shrubland vegetation is considered to be in a degraded condition and represents approximately 22.3% of this community mapped across the Surface Project Area.

The construction and operation of the proposed well surface locations is unlikely to have a significant impact on the native flora and fauna of the Surface Project Area including TSC and EPBC Act listed species provided the recommendations in the flora and fauna assessment included in **Appendix** E are implemented.

Main Gas Gathering Spine, Gas Gathering Lines and Access Tracks

As a result of the new layout for the Amended Project, any impacts to areas in which the main gas gathering spine line, GGLs and access tracks will be constructed have been altered.

The area of vegetation within the assessment envelopes of the Main Gas Gathering Spine, GGL network and access tracks is approximately 283 ha, with an estimated 227 ha of Closed Grassland dominating the landscape. The area of disturbance for the Main Gas Gathering Spine and GGLs will vary throughout the Surface Project Area within a corridor of a maximum of 10m width including trenches, soil stockpile areas, vehicle and plant operational areas. Approximately 0.87 ha of native vegetation would be underbored.

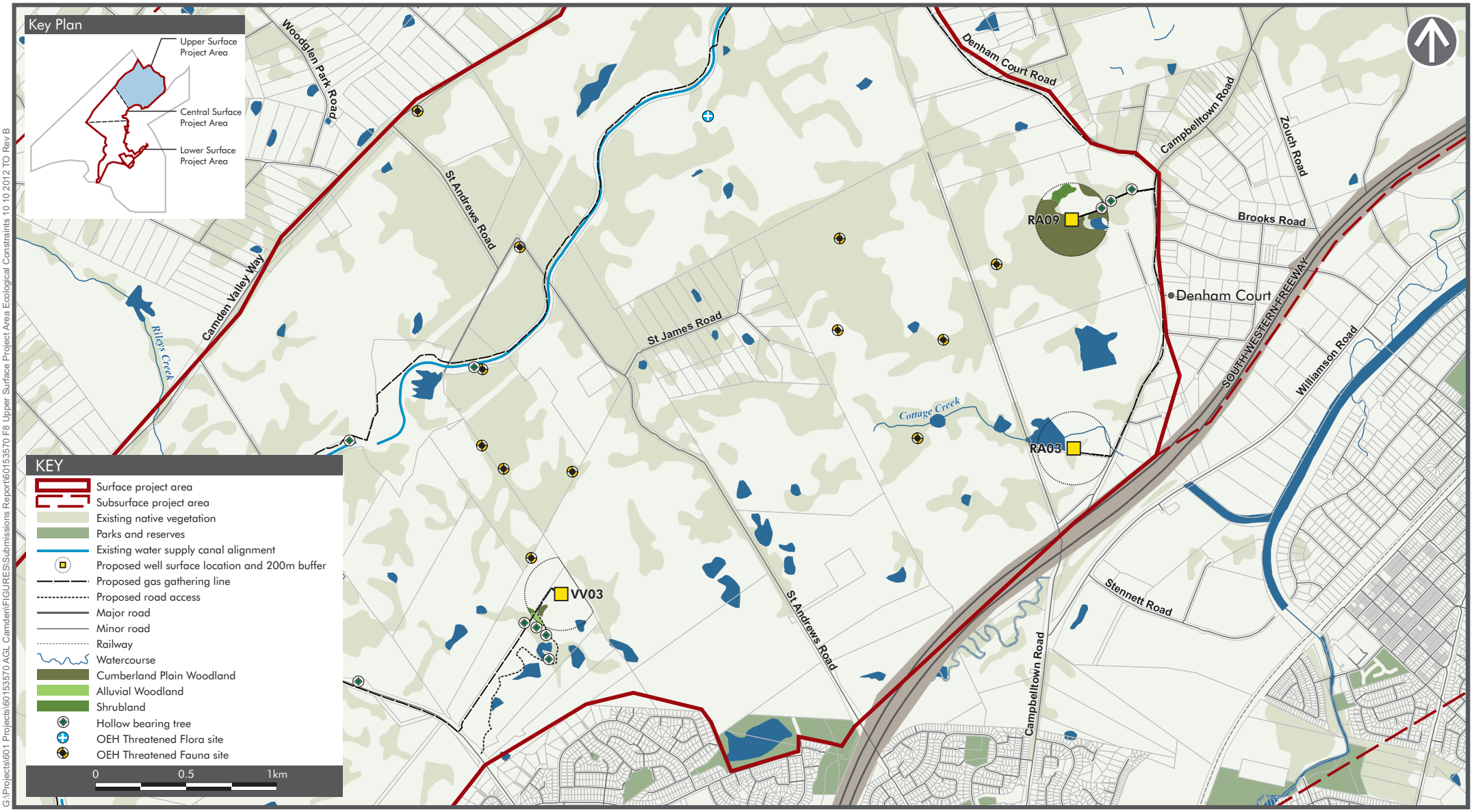
As such over the approximate 15,000m of GGL, 13.75 ha of vegetation (including 0.48 ha of Shrubland and 31.27 ha of Closed Grassland) will be temporarily affected by the Amended Project (none of which is characterised as significant native vegetation or EECs).

Residual Impacts

A suite of additional avoidance and impact minimisation measures will be implemented during construction that will result in a negligible level of impact to general and threatened biodiversity and habitats. There is unlikely to be any long term net loss of native or derived plant communities as a result of the construction and operation of these components of the Amended Project.

The only residual impact of the Amended Project, after the implementation of impact avoidance, minimisation and mitigation measures is the removal of 4.88 has of Shrubland for the entire project (including 4.41 ha for well surface locations). There will be no removal of CPSW, CPW or RFEFCF.

The residual impacts to the biodiversity values of the Amended Project are therefore considered negligible, with no impact to TECs or significant habitat for threatened species likely to occur. This includes avoidance of impacts to 13.9 ha of CPSW (TSC & EPBC Act), 40.35 ha of CPW (TSC Act) and 3.46 ha of RFEFCF. It also includes avoidance of impacts to 7.19 ha of Shrubland.



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UPPER SURFACE PROJECT AREA - ECOLOGICAL CONSTRAINTS

Submissions Report
Camden Gas Project Northern Expansion

FIGURE 8

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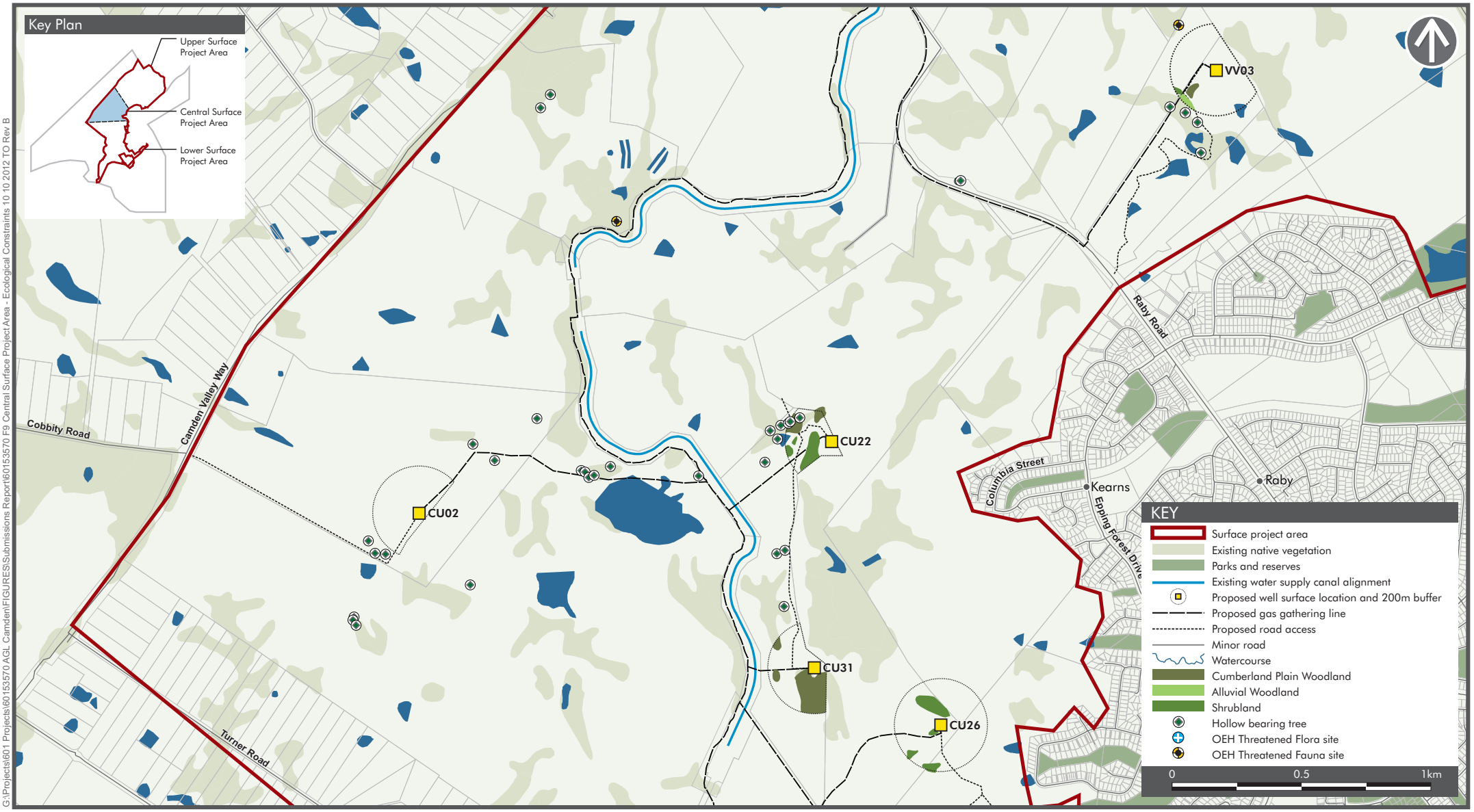

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CENTRAL SURFACE PROJECT AREA - ECOLOGICAL CONSTRAINTS

Submissions Report
Camden Gas Project Northern Expansion

FIGURE 9

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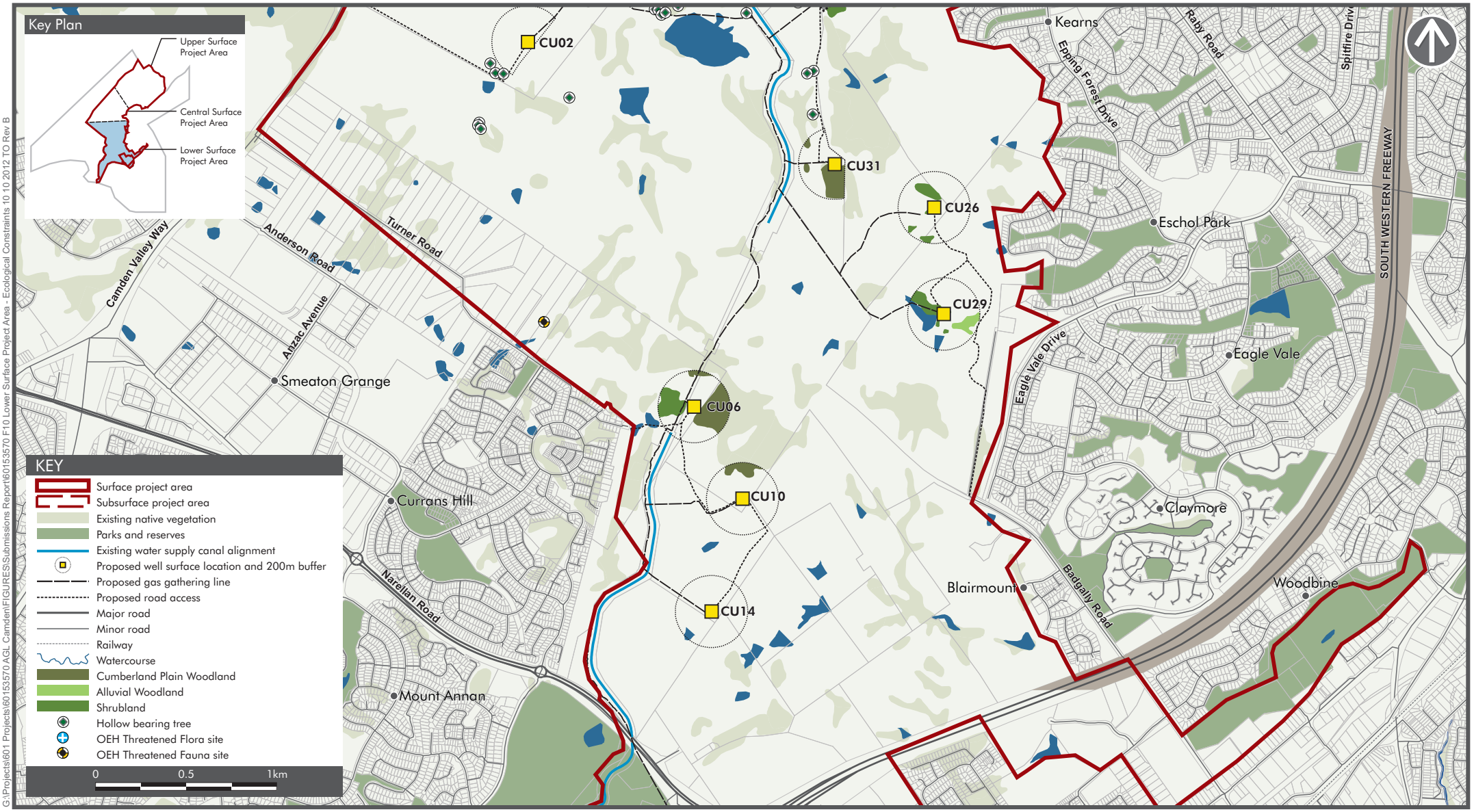

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LOWER SURFACE PROJECT AREA - ECOLOGICAL CONSTRAINTS

Submissions Report
Camden Gas Project Northern Expansion

FIGURE 10

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5.2.5 Mitigation Measures

In order to avoid and minimise as far as possible impacts to biodiversity, the following approach was undertaken for the Amended Project:

- Avoid by design – redesign of assets to avoid impacts.
- Avoid by exclusion – excluding areas from construction works to avoid impacts.
- Minimise by detailed ground survey and construction method – detailed survey to avoid and minimise impacts.
- Minimise by under bore - Where impacts could not be avoided, underboring will be undertaken at depth of greater than 1 m, thus avoiding the main root zone for sclerophyllous trees.
- Minimise by construction methods – adjusting methods to minimise impacts.

Mitigation measures are aimed at avoiding or minimising potential impacts on flora and fauna at key locations in the Amended Project.

A full list of updated recommended mitigation and management measures for the Amended Project is provided in the flora and fauna assessment in **Appendix** E. The following key mitigation and management measures would be implemented as part of the Amended Project:

- Where practicable, existing farm vehicle tracks would typically be used as access roads for the construction and maintenance of GGLs and well surface locations.
- No work would be undertaken in areas identified as 'Avoid by Exclusion'. Should works be required in these areas, further flora and fauna impact assessment would be required. .
- Areas identified as 'Avoid by Exclusion' would be fenced prior to commencement of works, and "Significant Biodiversity – No Access" signage posted.
- In other locations where native plant communities would or may be disturbed, temporary exclusion fencing would be installed around vegetation that is to be retained with no access to occur in the fenced areas. Signs would be placed on the fencing to identify these areas as "no access zones".
- Further adjustments to the location of GGLs and access tracks within the assessment envelopes would be conducted to avoid native trees and other habitat features such as waterbodies, where possible.
- Trees with hollows would be retained and protected where possible. Earthworks in the vicinity of retained trees would conform to the Australian Standard Protection of trees on development sites, AS 4970 – 2009 (Standards Australia, 2009).
- Trimming of branches along existing access tracks to accommodate heavy plant or large vehicles would be carried out by a qualified arborist. Should large branches with hollows be required to be removed, a suitably qualified ecologist would be on site during clearing to ensure that no resident fauna are harmed. Cleared branches would be placed in adjoining vegetation, to provide potential fauna habitat.
- Pre-clearing fauna surveys would be carried out targeting the Cumberland Plain Land Snail in areas supporting woodlands in moderate to good condition, if these areas are proposed to be directly impacted. Cumberland Plain Land Snails would be relocated into nearby areas that will not be disturbed. A qualified ecologist would be on site during clearing to collect and relocate any fauna disturbed during the clearing phase including inspection of excavated trees stumps for the presence of Cumberland Plain Land Snails following clearing.
- A local wildlife rescue organisation would be contacted should any vertebrate fauna be injured during construction.
- Excess subsoil remaining as a result of displacement from the Main Gas Gathering Spine and GGLs would be dealt with in conjunction with the landowner, and if preferred removed from the site. If possible, this soil would be used elsewhere on the project as fill to achieve finished levels around well surface locations, pending appropriate clearances. Alternatively this excess soil would be removed following backfilling of trenches and disposed of at a licensed waste facility.
- Sediment and erosion control measures would be installed and maintained during construction particularly in areas where there are sensitive receiving environments such as native vegetation and waterways. Sediment and erosion controls would stay in place until construction footprints and associated disturbed areas are stabilised.

- To prevent the dispersal of weed seed or soil-borne pathogens into regrowth or remnant native vegetation, hygiene protocols would be implemented for vehicles, heavy plant and machinery used for earthworks. This equipment would be washed down prior to entering a site.
- Vehicles and heavy plant movements and parking would be restricted to designated access and storage/parking areas during and post construction at the well surface locations.
- Site supervisors would be provided with the Biodiversity Exclusion and Impact Minimisation maps.
- The project manager and site supervisors would consult with a suitably qualified ecologist should flora and fauna issues arise during the construction phase.
- A list of recommended native plant species for any revegetation works carried out in rehabilitation works is provided in the flora and fauna assessment in **Appendix E** .
- The CPW and CPSW mapped in well surface locations would be avoided and all native trees should be retained in cleared and disturbed areas.
- Areas mapped as supporting CPW would be avoided.
- Stands of shrubland dominated by *Bursaria spinosa* in well surface locations or GGL areas would be avoided.
- The alignment of GGLs would avoid habitat trees either dead or alive.

5.3 Noise and Vibration

A Noise and Vibration Assessment was undertaken as part of the EA. To assess potential noise and vibration issues associated with the Amended Project, a desktop investigation and a further assessment has been undertaken to assess those elements of the Amended Project which differ from the original layout. The conclusions of the further assessment of the potential noise and vibration issues associated with the Amended Project are set out in the Addendum to Noise and Vibration Assessment Report (SLR, October 2012) which has been included as **Appendix F**.

The noise assessment included in the EA (which was based on a worst-case scenario) demonstrated that the Northern Expansion Project would comply with project specific noise goals at all existing residential dwellings. The noise assessment in the EA also assessed the potential proposed wells, particularly CU02, CU20 and CU22, in relation to potential impacts on future receivers in the Turner Road Development Area. For the purposes of the further noise assessment for the Amended Project, all noise modelling assumptions previously provided in the noise assessment report for the EA have been applied.

In the Amended Project, well surface locations have been removed, or primarily re-located greater distances from residential and other noise sensitive receivers than assessed as part of the EA. The Addendum Report stated that:

- Removal of wells VV07, VV11 and CU20 will only serve to reduce potential noise impacts at the nearest noise sensitive receivers to these sites.
- Due to the remoteness of the location of VV03 from surrounding receivers a further noise assessment at this location was deemed not be warranted at this stage.
- Mitigation measures would be required to manage noise impacts at CU06, CU22 and CU31 locations.

The Amended Project involves the overall reduction in well numbers. Like the Northern Expansion Project, the Amended Project will comply with project specific noise goals at all existing residential dwellings.

5.3.1 Existing Environment

Local Meteorological Conditions

The effects of meteorological conditions can enhance or reduce noise propagation and noise experienced at distant receivers. In the near field, wind has minor influence on measured downwind sound levels. Wind effects become more important as distances increase. Seasonal wind records of Camden Airport weather station indicate that winds from 0.5 m/s to 3 m/s do not exceed the 30% threshold and are therefore not a feature of the area.

Meteorological data was not available from the Camden Airport weather station to allow the determination of the percentage occurrence of temperature inversions during winter nights. A worst case analysis was therefore undertaken and the occurrence of temperature inversion during the night-time period was considered as part of the original noise assessment. This worst-case scenario has also been considered for the assessment of noise and vibration impacts associated with the Amended Project.

Sensitive Receivers

With regard to the Amended Project, analysis of aerial mapping indicates the following sensitive receivers around new or relocated well surface locations:

- VV03 (new): Nearest potential sensitive receiver is located approximately 650m to the south-west on McDonnell Street.
- CU06 (relocated 380m to the south of its original location): Nearest sensitive receiver is St. Gregory's College, approximately 320m to the north-east. The nearest residential receiver is located in Curran's Hill approximately 400m in a south-west direction.
- CU22 (relocated 900m to the east of its original location): Nearest noise-sensitive receiver is approximately 340m to the north-west.
- CU31 (new): Noise-sensitive receivers located around CU31 are the same as those considered in noise assessments for CU22 and CU26. However, there are several newly constructed residences to the west of this location.

5.3.2 Potential Impacts

Potential environmental impacts include:

- Construction noise impacts from access to and drilling of the gas wells.
- Construction noise and vibration impacts of installation of the gas gathering systems.
- Noise impacts of the operation of the gas wells.

Potential noise and vibration impacts remain the same for the construction and operation of wells RA03, RA09, CU02, CU10, CU14, CU26 and CU29, as those identified in the original Noise and Vibration Impact Assessment and have therefore not been considered further.

A summary of the results of the noise and vibration impact assessment for the Amended Project are included in the following sections. These results are presented only for data relating to well surface locations identified as requiring additional assessment due to the proximity to sensitive receiver as described in the Addendum Report provided in **Appendix F**.

It should be noted that due to improvements in technology and drilling methods it is possible that equipment chosen for the Amended Project will have a lower sound power level than that originally assessed. This may reduce overall noise impacts related associated with the construction and operation of the project.

Construction Noise and Vibration

Table 16 outlines the potential impacts related to construction noise and vibration in relation to potential sensitive receivers for the new components of the Amended Project.

Table 16 Potential Noise and Vibration Impacts during Construction

Well Surface Location	Potential Sensitive Receivers	Potential Impact
Noise		
VV03	Nearest sensitive receiver approximately 650m to the south-west of VV03.	Given its location within the same noise catchment, new well VV03 could be considered as a relocation of original well VV07 for the purposes of a noise assessment (noting that VV07 has now been removed from the Amended Project). The noise impact assessment included in the EA indicates that the most stringent night time construction noise goal of 38 dB(A) would be achieved at a distance of up to 550m from well location VV07 (refer to Figure 21, Appendix F of the EA) under worst-case night time temperature inversion conditions. As VV03 is significantly further away from residential receivers than former VV07, and beyond the predicted affectation distance of 550m, it can be concluded that construction of VV03 would comply with the 38 dB(A) construction noise goal and no updated noise assessment was undertaken for this location for this reason.
CU06	Nearest sensitive receiver is St. Gregory's College, approximately 320m north-east and residential receivers in Currans Hill approximately 400m to the south-west.	The noise impact assessment included in the EA demonstrates that construction of well CU06 at its original location would exceed the construction noise goal at the residential component of the St Gregory's College under worst-case, night time temperature inversion conditions (refer to Figure 13, Appendix F of the EA). The Addendum Report concluded that there are no residential dwellings or school classrooms in St Gregory's College that are predicted to be affected by noise from drilling at this location provided noise barriers are in place to shield receptors. The mitigation response for well CU06 would remain the same as presented in the EA, and will include noise barriers. Other noise mitigation measures which may be implemented include: - permanent (fencing, earth mounds) noise barriers located adjacent to the drill rig. AGL has consulted with noise attenuation experts, and developed specific noise barriers that can be utilised to mitigate noise during the construction period. Additionally, the barriers have been painted to mitigate visual impact. Such noise barriers could be expected to reduce noise by up to 10dB(A) at the receiver; and - taking advantage of the directionality of noise sources and facing the noisy side of equipment away from receivers. This approach may reduce noise impacts by up to 3 dB(A) depending on the specific rig and associated equipment.
CU22	Nearest noise-sensitive receiver is approximately 340m to the	The noise impact assessment included in the EA indicates that the most stringent night time construction noise goal of

Well Surface Location	Potential Sensitive Receivers	Potential Impact
	north-west.	38 dB(A) would be achieved at a distance of up to 780m from the original location of well CU22 (refer to Figure 16, Appendix F of the EA) under worst-case night time temperature inversion conditions. A conservative sound power level of 112dB(A) was also applied to the construction noise modeling. Revised construction noise modeling undertaken for CU22 concluded that there are no residential dwellings that are predicted to be affected by noise from drilling at this location provided noise barriers are in place to shield residences to the north-west. The mitigation response for well CU22 would remain the same as presented in the EA, and will include the use of temporary noise barriers. It may also include other noise mitigation measures such as those identified for CU06 above.
CU31	Noise-sensitive receivers located around CU31 are the same as those considered in noise assessments for CU22 and CU26.	The noise impact assessment included in the EA indicates that the most stringent night time construction noise goal of 38 dB(A) would be achieved at a distance of up to 580m from well location CU26 (refer to Figure 17, Appendix F of the EA) under worst-case night time temperature inversion conditions. The Addendum Report concluded that there are no residential dwellings that are predicted to be affected by noise from drilling at this location. The Addendum Report also concluded that since CU31 is remote enough from residential properties, no noise barriers are predicted to be required.
Vibration		
Due to the distance between the receivers and the proposed construction activities, the vibration levels at receivers are predicted to be negligible and below levels for human perception.		

Operational Noise and Vibration

Table 17 outlines the potential impacts related to operational noise and vibration in relation to potential sensitive receptors for the new components of the Amended Project.

Table 17 Potential Noise and Vibration Impacts during Operation

Well Surface Location	Potential Sensitive Receivers	Potential Impact
Noise		
VV03	Nearest sensitive receiver approximately 650m to the south-west of VV03.	Given its location within the same noise catchment, new well VV03 could be considered as a relocation of original well VV07 for the purposes of a noise assessment (noting that VV07 has now been removed from the Amended Project). The noise impact assessment included in the EA presents the operational noise affectation area for well location VV07 (refer to Figure 10, Appendix G of the EA) under worst-case, night time temperature inversion conditions. Based on this information, the operational noise affectation distance for VV07 can be determined as approximately 170m from the centre of the well surface location to achieve the noise

Well Surface Location	Potential Sensitive Receivers	Potential Impact
		criterion of 40 dB(A) at this location. As VV03 is significantly further away from residential receivers than former VV07, and beyond the predicted affectation distance of 170 metres, it can be concluded that operation of VV03 would comfortably meet the 40 dB(A) noise criterion in this area and no updated noise assessment was undertaken for this location.
CU06	Nearest sensitive receiver is St. Gregory's College, approximately 320m to the north-east and residential receivers in Currans Hill approximately 400m to the south-west.	The noise impact assessment included in the EA demonstrates that operation of well CU06 at its original location would not exceed the noise criterion of 38 dB(A) for the residential component of St Gregory's College under worst-case, night time temperature inversion conditions (refer to Figure 5, Appendix G of the EA). The Addendum Report concluded that there are no residential dwellings predicted to be affected by noise from drilling from this well surface location. Further, the relevant criteria are also predicted to be achieved at St Gregory's College. Accordingly, no mitigation measures are required for CU06. Relevantly, additional mitigation options would be available to AGL if required.
CU22	Nearest noise-sensitive receiver is approximately 340m north-west	The noise impact assessment included in the EA presents operational noise affectation areas for well location CU22 (refer to Figure 6, Appendix G of the EA) under worst-case, night time temperature inversion conditions. Based on this information, noise affectation distances for CU22 can be determined as follows: - the applicable noise criterion in this location (38 dB(A)) would be achieved at a radius of approximately 375m from the centre of the well surface location, if six pump-assisted wells are installed; and - the applicable noise criterion in this location (38 dB(A)) would be achieved at a radius of approximately 125m from the centre of the well surface location if six high production free-flowing wells are installed. The Addendum Report concluded that there is one residential dwelling predicted to be affected by noise from this well surface location, exceeding the criteria by 1 dBA. Due to this predicted exceedance, the Addendum Report recommended additional mitigation measures be implemented such as: - Noise barriers on the boundary of the well compound could reduce noise emission levels by up to 10 dB(A). The actual noise reduction achieved would depend on the orientation and height of the barrier and the relative distance and difference in elevation between the noise source and receivers. - Full enclosure around the well equipment, including well heads and pumps/ generators. This would reduce predicted noise emission levels by at least 10 dB(A). The actual noise reduction achieved would depend on the specific design of the enclosure.

Well Surface Location	Potential Sensitive Receivers	Potential Impact
		It was noted at the time of the re-modelling that ambient noise levels in the area are likely to increase as a result of significant residential development west of the subject site. It may be appropriate to re)evaluate ambient background levels, and thus relevant noise criteria, at that time.
CU31	Noise-sensitive receivers located around CU31 are the same as those considered in noise assessments for CU22 and CU26.	The noise impact assessment included in the EA demonstrates that the noise impacts associated with the operation of wells CU26 and CU29 would not exceed the noise criterion of 42 dB(A) for this location at surrounding receiver locations under worst-case, night time temperature inversion conditions (refer to Figure 7, Appendix G of the EA). The Addendum Report concluded that there are no residential dwellings predicted to be affected by noise from this well surface location. Accordingly, no mitigation measures are required for CU31. Relevantly, additional mitigation options would be available to AGL if required.
Vibration		
Vibration caused by the operating wells and pipelines is predicted to be minimal. Potential vibration impacts on the Upper Canal remain as per the original assessment and are considered to be minimal.		

5.3.3 Mitigation Measures

AGL has taken into account the effectiveness of noise strategies in determining how much noise reduction is achievable for the Amended Project. Specific noise and vibration control measures are outlined in the revised Statement of Commitments in **Section 7.0** and include:

- The use of temporary or permanent barriers (where required) to attenuate noise and acoustically shield residences from drilling during construction of the gas wells. AGL has consulted with noise attenuation experts, and developed specific noise barriers that can be utilised to mitigate noise where required. Additionally, the barriers have been painted to mitigate visual impact as shown in **Photo 1**. Such noise barriers could be expected to reduce noise by up to 10dB(A) at the receiver. These barriers could include measures such as shipping containers, fencing, or earth mounds.
- Use of equipment to achieve a noise reduction of approximately 3 dB(A). This would include taking advantage of the orientation of noise sources and directing noise away from nearby residences. The actual method by which this reduction would be achieved would depend on the specific drill rig and associated equipment.
- For under-boring operations within the vicinity of the Upper Canal (if required), a set of in-situ vibration validation tests would be undertaken involving the actual equipment to be used in order to generate a set of Project Specific Vibration versus Distance Curves for the area.
- Management controls such as setting safe working distances for equipment with the potential to cause vibration impacts. This would include:
    - With respect to gas gathering lines, no construction operations are to occur within 3 m of the Upper Canal.
    - The following recommended vibration thresholds would be adopted for the purposes of the Amended Project in areas within the Upper Canal:
        - Operator warning level – 2.4 mm/s
        - Operator halt level – 3 mm/s
    - Should the operator warning level be exceeded, construction works would proceed with caution at a reduced force or load.

- Should the operator halt level be exceeded, construction activities would cease and alternative construction techniques would be implemented.
- Restricting the use of certain equipment during times of greatest noise sensitivity.

For the majority of well surface locations within the Surface Project Area, no mitigation measures are required. However, where attenuation is required, the measures outlined above would be implemented. Where a proposed mitigation strategy is unlikely to achieve the desired noise reduction and has the potential to leave a residual noise impact, other management measures may be implemented including:

- Communication with potentially affected residents regarding the nature and duration of the works, as well as relevant contact details.
- Regular inspection and maintenance of equipment to ensure it is in good working order, including the condition of mufflers and enclosures.
- Consideration of scheduling noisy work during periods when people are least likely to be affected, having particular regard to schools and residential locations.
- Implementation of an effective complaints handling system.

Photo 1: *Noise wall used during construction activities at a well surface location previously approved as part of the existing CGP.*

5.4 Indigenous Cultural Heritage

The Aboriginal Cultural Heritage Assessment Report (ACHAR) prepared by Biosis in July 2012 (refer to **Appendix G**) assesses the potential impacts of the Amended Project on items of Indigenous cultural heritage and archaeological heritage. The potential impacts of the Amended Project on items of indigenous cultural heritage would be limited to the Surface Project Area.

5.4.1 Existing Environment

The Surface Project Area is largely rural, consisting of pasture grasses and open cropped paddocks which are used for agricultural purposes with some scattered rural residential properties. These areas are surrounded by open floodplains on a number of minor and major creek lines, including the Upper Canal, which are mostly ephemeral drainage systems and only flow after sufficient rainfall.

Tree cover within the Surface Project Area has been mostly cleared, however there are some localised pockets of CPW vegetation. The topography of the Surface Project Area is comprised predominantly of gently undulating hills and ridges, with a small number of steeper slopes, typical of the Cumberland Plain. Most of the Surface Project Area occurs within erosional or residual soil landscapes, which are generally shallow in depth and therefore subject to erosional processes, resulting in exposure and movement of archaeological material.

Within the Surface Project Area, historical land use has resulted in a greater level of disturbance, which has increased the likelihood of exposure and movement of cultural material across the present landscape. Areas incorporating low lying drainage features and systems would be favourable for the accumulation and preservation of archaeological material in the Surface Project Area. Historical records suggest that the Surface Project Area is located at or close to the boundaries of the Darug, Dharawal and Gandangara Indigenous language groups.

5.4.2 Methodology

Investigations and assessment of Indigenous archaeological heritage within the Surface Project Area included:

- Indigenous community consultation.
- Desktop assessment and review of existing indigenous archaeological studies and historical knowledge.
- Archaeological field survey.

Consultation

Consultation with the Indigenous community was undertaken in accordance with the *Aboriginal Heritage Standards and Guidelines Kit (DECC-EPA)* as required in the DGRs. The assessment and community consultation was also undertaken in accordance with the *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DECC, 2005). In addition, the requirements set out in *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) and the *Interim Community Consultation Requirements for Applicants* (ICCR) (DECCW 2005) have also been considered. Through this process, two indigenous stakeholders registered their interest in the Northern Expansion Project: Tharawal Local Aboriginal Land Council and the Cubbitch Barta Native Title Claimants Aboriginal Corporation. In addition to participating in the archaeological field survey, these two groups had representatives attend two formal consultation meetings, as well as additional consultation regarding proposed environmental safeguards for the Amended Project. AGL is continuing to consult with Registered Aboriginal Parties (RAPs) as detailed design of the Amended Project progresses.

Desktop Assessment and Review

The desktop assessment and review of existing information pertaining to local and regional indigenous heritage included:

- Investigations into the context of the landscape contained within the Surface Project Area, including identifying the:
  - Topography and hydrology.
  - Soil landscapes.
  - Potential indigenous resources within the landscape.
  - Information about the historical land use.
- A review of previous local and regional Indigenous archaeological investigations, including:
  - Surface surveys and subsurface excavations to provide evidence of previous Indigenous occupation within the Surface Project Area.
  - Identification and analysis of AHIMS sites within the Surface Project Area.

Information obtained from these activities was then synthesised to develop an Aboriginal site prediction model for the Surface Project Area and to identify known Aboriginal sites and/or places recorded within the area.

Archaeological Field Survey

Representatives of the Tharawal Local Aboriginal Land Council and the Cubbitch Barta Native Title Claimants Aboriginal Corporation participated or were otherwise involved in all aspects of the field survey undertaken for the Amended Project. The field survey focused on identifying indigenous archaeological sites and areas of previously identified archaeological potential within the Surface Project Area, which were identified through predictive site modelling.

The archaeological survey for the Amended Project was designed to locate archaeological sites within the Surface Project Area with reference to the defined envelopes surrounding each component of the project, including previously recorded sites of indigenous archaeological significance and areas of archaeological sensitivity identified from the site predictive model.

5.4.3 Results and Potential Impacts

An archaeological significance assessment was undertaken for the newly recorded sites with details provided in **Appendix G**.

Potential archaeological impacts remain the same for the construction and operation of wells RA03, RA09, CU02, CU10, CU14, CU26 and CU29, as those identified in the original Indigenous Cultural Heritage Assessment.

A summary of the results of the archaeological impact assessment for the Amended Project is provided in **Table 18**. These results are presented only for data relating to well surface locations, gas gathering lines, main gas spine and access tracks that are included as part of the Amended Project. All results relating to the components of the Northern Expansion Project which have been removed are not outlined in the following sections. Of the 28 sites located inside the assessment envelopes, the construction footprint can be micro-sited to avoid harm to 24 sites. Four sites are unable to be avoided due to their size. These sites and their proposed management are highlighted in **Table 18**:

5.4.4 Mitigation Measures

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 1994: 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.

As part of the overall EMS for the CGP, an Aboriginal Cultural Heritage Management Sub Plan (ACHMSP) has been developed. This ACHMSP would be updated where necessary to incorporate further recommendations relevant to the Amended Project as identified in this Submissions Report.

A number of management recommendations have been formulated for the Surface Project Area in respect of potential archaeological impacts. These generally include a hierarchy and breakdown of management measures as follows:

- Conservation through avoidance.
- Requirements for further archaeological work – direct impacts to known archaeological sites and areas of potential.
- Requirements for further archaeological work – variation to the Surface Project Area layout.
- Aboriginal stakeholder consultation.
- Ongoing management of known heritage sites in proximity to project infrastructure.
- Procedures for dealing with unanticipated Aboriginal sites.
- Procedures for managing human remains.

Further details regarding these mitigation measures are outlined in Section 6.1 of **Appendix G**.

Table 18 Aboriginal Archaeological Sites Located within the Surface Project Area and Proposed Mitigation

Project Component	Site Name and Type	Site Significance	Impact avoidance and management measures
Main Gas Gathering Spine Line	CG-IA-01 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-02 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-06 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-07 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-08 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-09 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-10 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-11 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-12 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.

Project Component	Site Name and Type	Site Significance	Impact avoidance and management measures
	CG-IA-13 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-16 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-01 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Site is unable to be avoided. Artefacts would be collected and relocated within the site boundary. The site outside of the construction footprint would be fenced during construction.
	CG-OCS-04 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-02 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-05 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-06 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-09 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Site is unable to be avoided. Artefacts would be collected and relocated within the site boundary. The site outside of the construction footprint would be fenced during construction.
	CG-OCS-10 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-OCS-11 (open camp site)	Cultural: High Historic: None	Impacts would be avoided through micrositing. The site would be fenced during construction.

Project Component	Site Name and Type	Site Significance	Impact avoidance and management measures
		Aesthetic: None Scientific: Low	
	PAD 2061-6	Cultural: High Historic: None Aesthetic: None Scientific: Low	Site is unable to be avoided. Archaeological excavation is required.
	PAD 2062-6	Cultural: High Historic: None Aesthetic: None Scientific: Low	Site is unable to be avoided. Archaeological excavation is required.
	TR-5 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	Areas of high and moderate Aboriginal archaeological significance	N/A	Impacts would be avoided through micrositing. The site would be fenced during construction. If avoidance is not possible, archaeological excavation would be required.
RA03 and Access Track	CG-IA-03 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
RA09	CG-OCS-03 (open camp site)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-TRE-01 (scarred tree)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-TRE-02 (scarred tree)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	Areas of high and moderate Aboriginal archaeological significance	N/A	Impacts would be avoided through micrositing. The site would be fenced during construction. If avoidance is not possible, archaeological excavation would be required.
VV03, GGL and	No sites of significance	N/A	N/A

Project Component	Site Name and Type	Site Significance	Impact avoidance and management measures
Access Track			
CU31 and GGL	No sites of significance	N/A	N/A
CU22, GGL and Access Track	No sites of significance	N/A	N/A
CU26, GGL and Access Track	CG-TRE-04 (scarred tree)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	Areas of high and moderate Aboriginal archaeological significance	N/A	Impacts would be avoided through micrositing. The site would be fenced during construction. If avoidance is not possible, archaeological excavation would be required.
CU29	Areas of moderate Aboriginal archaeological significance	N/A	Impacts would be avoided through micrositing. The site would be fenced during construction. If avoidance is not possible, archaeological excavation would be required.
CU02, Access Track and GGL connection with Main Gas Gathering Spine Line	Areas of Aboriginal archaeological sensitivity	Cultural: High Historic: None Aesthetic: None Scientific: Moderate	The site is currently the subject of an AHIP. AHIP holder has complied with AHIP consent conditions and no further action is required.
CU06, CU10, GGL and access Track	CG-IA-05 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
	CG-IA-04 (isolated artefact occurrence)	Cultural: High Historic: None Aesthetic: None Scientific: Low	Impacts would be avoided through micrositing. The site would be fenced during construction.
CU14 and GGL	Areas of moderate Aboriginal archaeological significance	N/A	Impacts would be avoided through micrositing. The site would be fenced during construction. If avoidance is not possible, archaeological excavation would be required.

5.5 European Heritage

The European Historic Heritage Report prepared by Biosis in July 2012 (refer to **Appendix H**) assessed the potential impacts of the Amended Project on items of European historic heritage within the Surface Project Area.

5.5.1 Existing Environment

The Amended Project Area exhibits a cultural landscape that reflects development from the early colonial period to the present. The rural character of the area retains solid visual links to the place's past. The historical context and development of the Surface Project Area is described in detail in **Appendix H**.

The Surface Project Area lies in south western Sydney in an area that was historically populated, in general, with wealthy landowners who built large homesteads on their estates.

5.5.2 Methodology

The European historic heritage assessment included the following activities to identify any items of heritage significance:

- A desktop search of heritage registers and environmental planning instruments to identify heritage items within the Amended Project footprint.
- A review of relevant literature to recognise trends in historical archaeological site distribution and location.
- A pedestrian survey within the curtilage of the Upper Canal.

Field surveys to locate and assess items of European historic heritage were conducted on:

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

5.5.3 Results

Listed Items of Significance

A search of the relevant heritage registers was conducted and existing sites located within the Surface Project Area are shown on **Figure 14** and summarised in **Table 19**. Several other heritage items occur outside the Surface Project Area such as Denham Court Estate, however these have not been assessed as it is considered unlikely that heritage items outside the Surface Project Area would be impacted by the proposed works.

Table 19 Summary of Known Heritage Items within the Surface Project Area

Item	Register of the National Estate	Commonwealth Heritage List	National Heritage List	State Heritage Register	Sydney Water s.170	Camden LEP No.48	Campbelltown LEP District 8	Campbelltown LEP 2002	National Trust
Blairmount, Badgally Road, Blairmount							✓	✓	✓
Campbelltown Reservoir, Narellan Road, Kenny Hill							✓		
Stations of the Cross, Narellan Road, Campbelltown								✓	
Varroville, St Andrews Road, Varroville	✓			✓			✓		✓
Sydney Water Upper Canal				✓		✓	✓		✓
Gledswood Homestead	✓			✓		✓			✓
Kenny Hill Reservoir (WS0390)					✓				
Ingleburn Dam							✓		✓
Milestones, Campbelltown Rd								✓	✓

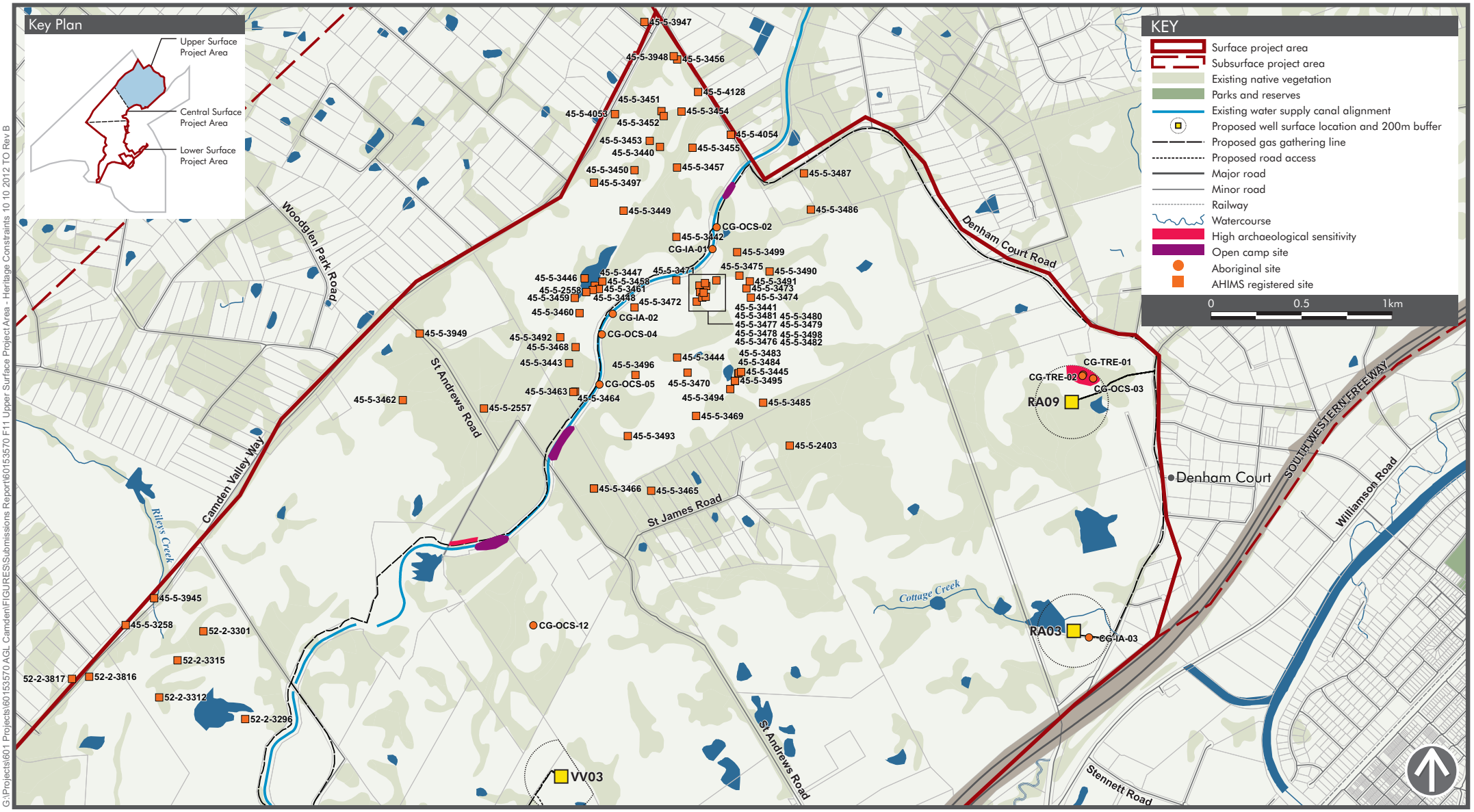
Field Survey Results

The field survey identified the following within the environmental envelope of the proposed works within the Surface Project Area:

- Four house sites were identified within the Upper Canal easement and therefore potentially within the proposed development footprint.
- A horse-jump composed of re-used sandstone blocks, which is not considered to be of heritage significance.
- Two listed heritage items:
    - The Upper Canal, which is comprised of the main water conduit and components such as steps, culverts, bridges etc that are all of heritage value.
    - St Gregory's Agricultural College, which comprises of a number of buildings within a large curtilage. CU14 andCU10 are both located within the curtilage of St Gregory's Agricultural College.

The field survey also located a number of potential heritage items within, or in close proximity to, the envelopes of proposed works. The items identified were:

- Four demolished houses along the length of the canal – and remnant plantings.
- Possible remains of structures associated with construction camps.
- Remains of earlier post and three rail fencing, and gates, etc.
- Structural items, and plants such as an avenue of trees at Kenny Hill.
- Possible locations of construction camps.
- Spoil heaps.



G:\Projects\601 Projects\60153570 AGL Camden\FIGURES\Submissions Report\60153570 F11 Upper Surface Project Area - Heritage Constraints 10 10 2012 TO Rev B

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UPPER SURFACE PROJECT AREA - HERITAGE CONSTRAINTS

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FIGURE 11

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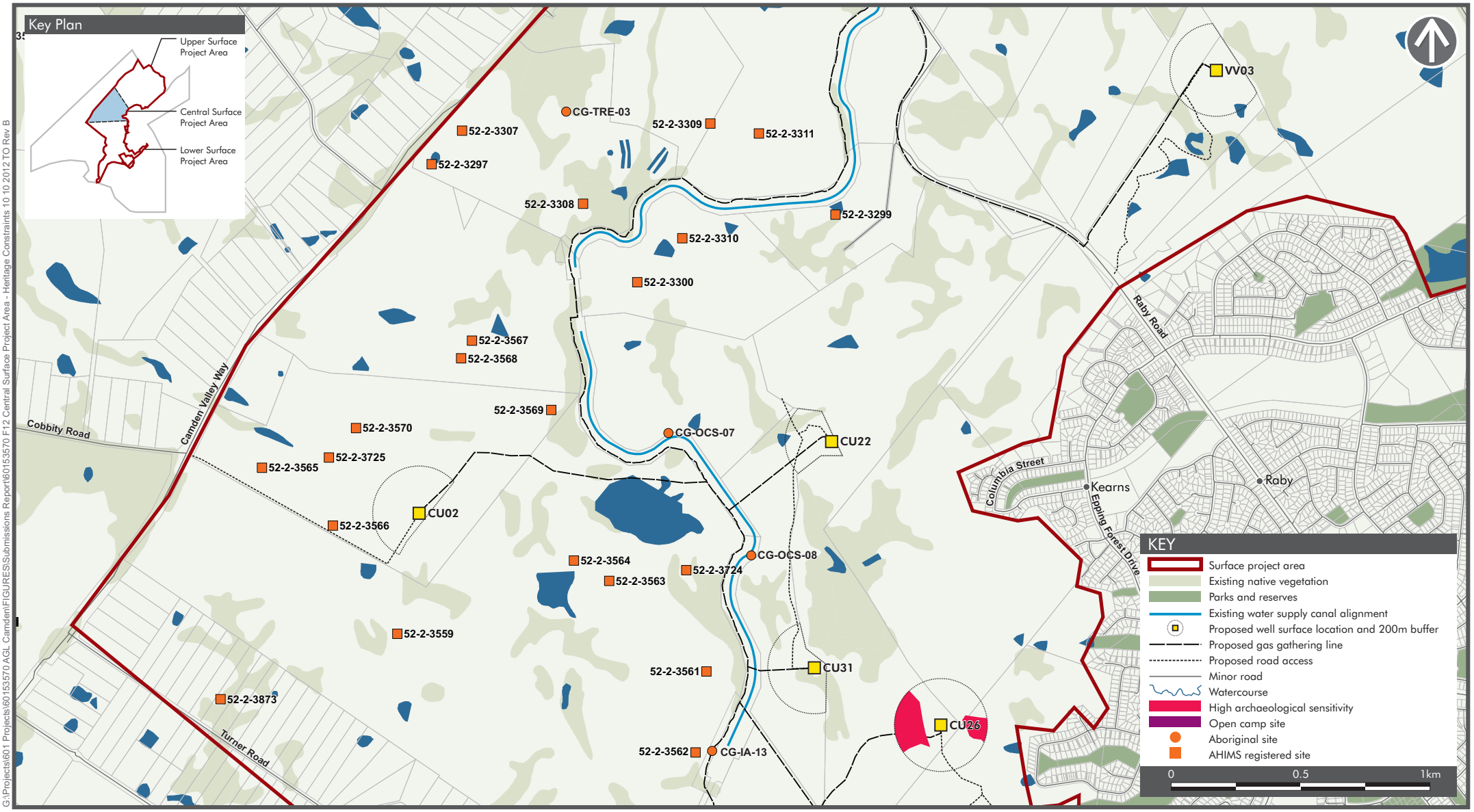

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CENTRAL SURFACE PROJECT AREA - CULTURAL HERITAGE CONSTRAINTS

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FIGURE 12

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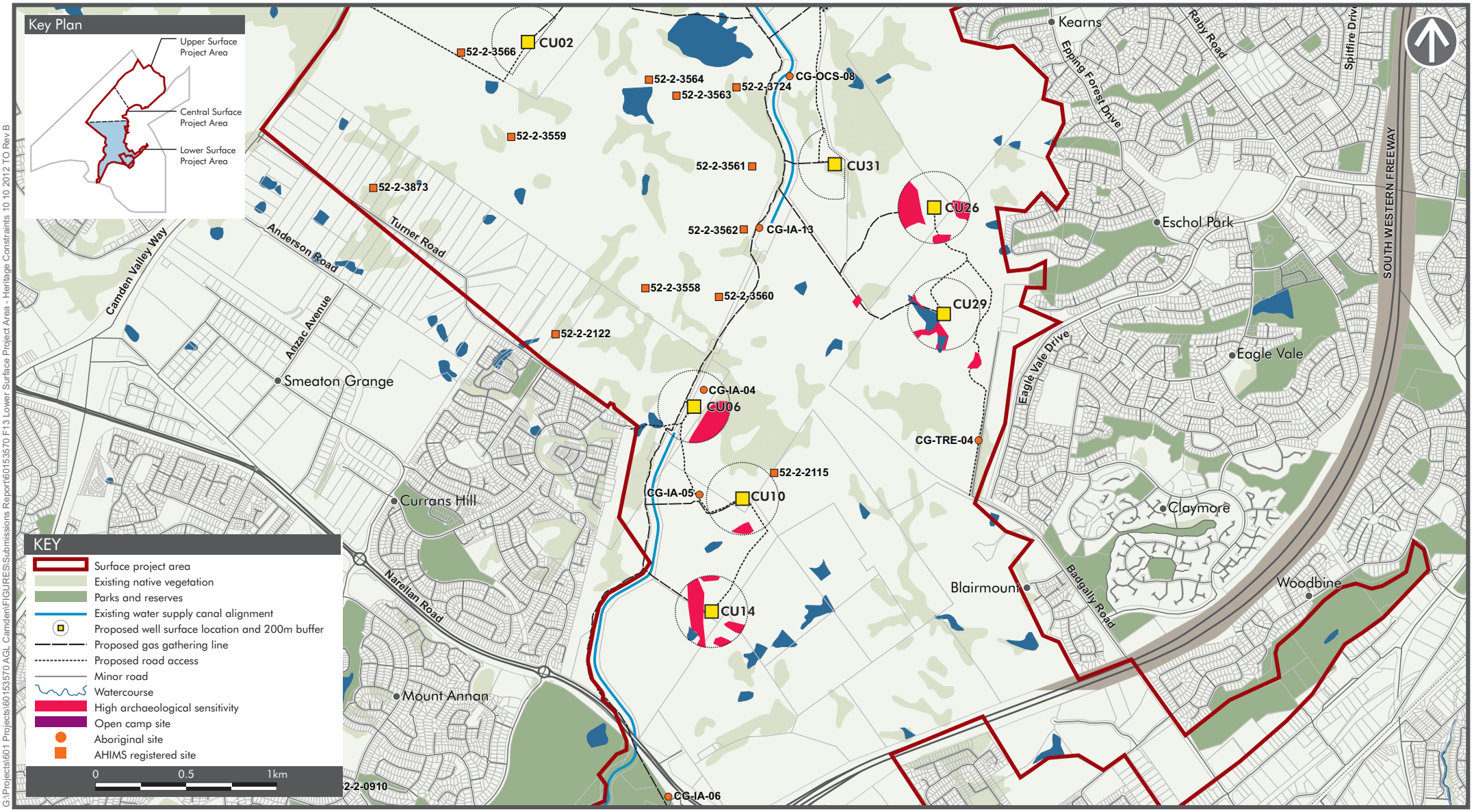

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LOWER SURFACE PROJECT AREA - CULTURAL HERITAGE CONSTRAINTS

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FIGURE 13

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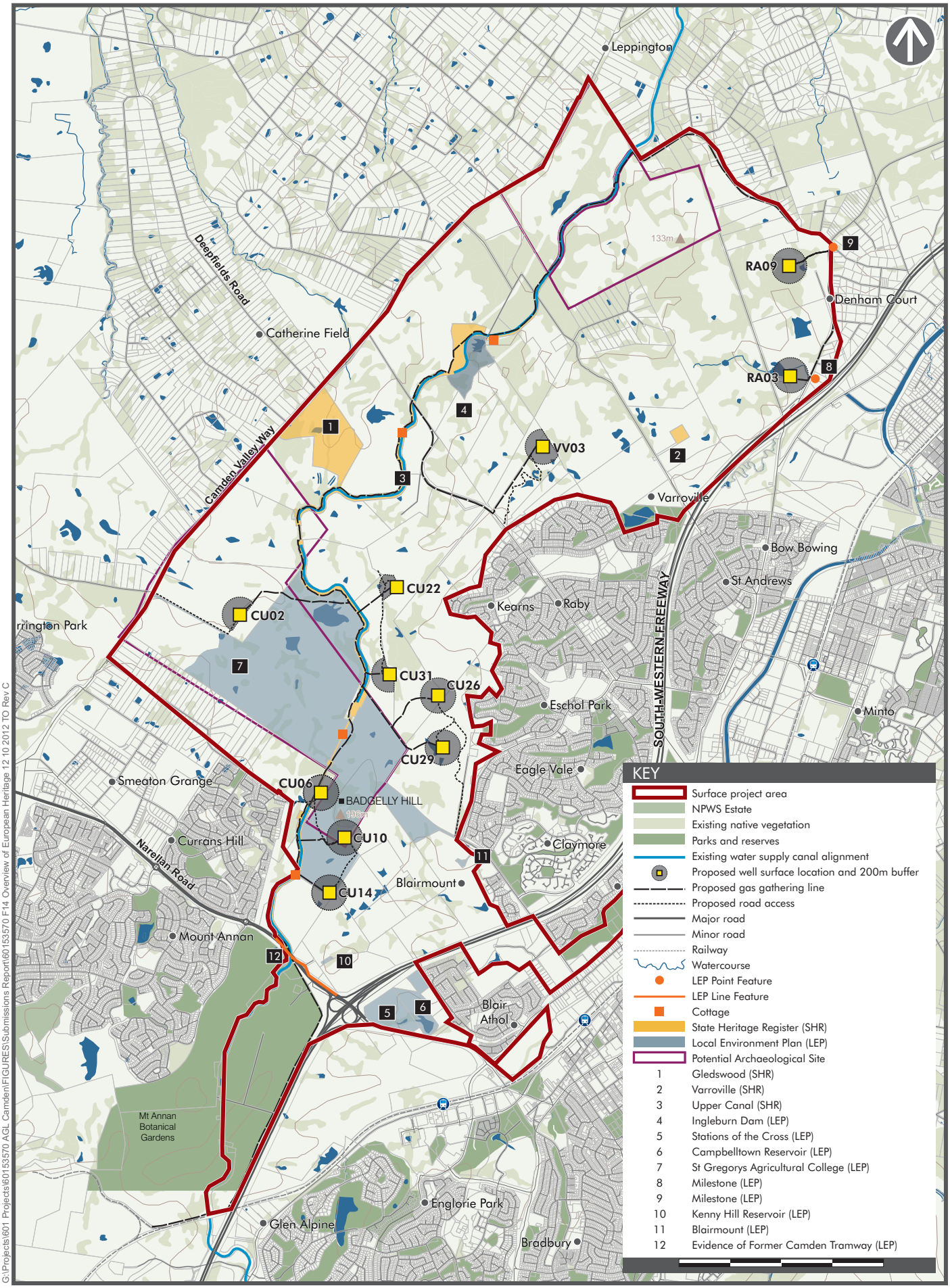

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OVERVIEW OF EUROPEAN HERITAGE WITHIN THE SURFACE PROJECT AREA

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FIGURE 14

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5.5.4 Potential Impacts

The construction of well surface locations, GGLs, access roads and supporting infrastructure would have the potential to disturb soil profiles and as a consequence, to impact on historic archaeological and cultural heritage items and places located within the Surface Project Area. There would be no impacts on historic heritage resulting from subsurface drilling activities in the Subsurface Project Area due to the distance of drilling activities from the surface.

Potential archaeological impacts remain the same for the construction and operation of wells RA03, RA09, CU02, CU10, CU14, CU26 and CU29, as those identified in the original Historic Cultural Heritage Assessment.

A summary of the results of the archaeological for the Amended Project is provided in **Table 20**. These results are presented only for data relating to well surface locations, GGLs, main gas spine and access tracks that are included as part of the Amended Project. All results relating to the removed Amended Project components have been excluded.

5.5.5 Mitigation Measures

The 'envelope' approach of the assessment methodology has provided the opportunity to recommend moving a project component as the first mitigation measure. Where this is not possible and impacts are unavoidable, further mitigation measures have been proposed.

In order to progress the Amended Project and preserve the significant and potentially significant elements within the impact zones, recommendations have been formulated. . These generally include a hierarchy and breakdown of management measures (further detailed in Section 7 of **Appendix H**) as follows:

- Conservation.
- Requirements of Further Archaeological Work - archaeological excavation (where impact on relics (archaeological sites of local or State significance) cannot be avoided).
- Ongoing Management.
- Procedures for dealing with unanticipated historical archaeological sites.
- Procedures for managing human remains.

Specific mitigation details for each site are outline in Section 6.1 of **Appendix H**.

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Table 20 Summary of Potential Impacts

Project Component	Site Name	Impact avoidance and management measures
Main Gas Gathering Spine Line	The Upper Canal and associated infrastructure: - Mollesmain Tunnel; - Badgelly Tunnel; - Steps; - Bridges; - Culverts; - Cottage Site 23; - Cottage Site 44; - Cottage Site 51 and associated gate; and - Junction of Main Spine Line, Upper Canal and Main Southern Railway.	All Upper Canal components would be avoided by ensuring that the Main Gas Gathering Spine Line and associated construction impacts are confined to existing drainage ditches and tracks. Where the Main Gas Gathering Spine Line intersects with the Upper Canal (including a five-metre curtilage from the edge of the canal), AGL would consult further with SCA in relation to an appropriate mitigation strategy to minimise or avoid potential impacts. All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item. Cottage Site 44 and Cottage Site 51 (with associated gate) lie along the current alignment of the Main Gas Gathering Spine Line. The Main Gas Gathering Spine line would be microsited to avoid impacts to these heritage items.
	St Gregory's Agricultural College (Lot 100 DP 1119742)	Works associated with the Amended Project would be undertaken to avoid this site.
	WWII aeroplane crash site (confidential location)	Impacts to this site are unlikely to be avoidable, and AGL proposes to develop mitigation measures in consultation with stakeholders. An option that would be considered for this site would be archaeological excavation.
RA03 and Access Track	No heritage sites or heritage items	N/A
RA09	No heritage sites or heritage items	N/A
GGL from RA09 & RA03 to Main Spine Line GGL	Milestones	Identify and avoid any impacts. Should impacts be unavoidable, consultation with Campbelltown Council will be required. It is unlikely that milestones are located on the western side of Campbelltown Rd.
VV03, GGL and Access Track	No heritage sites or heritage items	N/A
CU02, GGL and Access Track	No heritage sites or heritage items	N/A
CU31, GGL and Access Track	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
CU22, GGL and Access Track	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
CU26, GGL and Access Track	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its

Project Component	Site Name	Impact avoidance and management measures
		components and to avoid future damage to this heritage item.
CU29, GGL and Access Track	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
CU06 and Access Track	The Upper Canal (Badgelly Tunnel)	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
CU10 GGL	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
CU10	No heritage sites or heritage items	N/A
CU14	No heritage sites or heritage items	N/A
Access track to and between CU10 & CU14	No heritage sites or heritage items	N/A
GGL between CU10 WSL and Main Spine Line GGL	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
GGL between CU14 WSL and Main Spine Line GGL	The Upper Canal	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.
Mount Annan GGL Main Spine Line	Upper Canal on the northern side of the junction of the canal with the Main Southern Railway Line	All junctions of Amended Project components with the Upper Canal would include provisions to be developed during detailed design to avoid impacts on the fabric of the Upper Canal and its components and to avoid future damage to this heritage item.

5.6 Visual

5.6.1 Existing Environment

The majority of the Surface Project Area is largely undeveloped and is generally semi-rural in character, with agricultural lands, predominantly used for grazing, scattered between isolated areas of remnant vegetation and land designated for future (residential, commercial and industrial) development. There are also some significant areas of both public and private recreation and scattered timber present across much of the area. The Mount Annan Botanical Gardens comprises 416 ha of hills and lakes, and forms the southernmost aspect of the Surface Project Area. The Surface Project Area is surrounded by residential areas to the north, east and west including Raby, Eaglevale, Claymore and Leppington respectively.

The landform of the Surface Project Area is gently undulating with steeper sections to the south of the site reaching elevations of 196 m AHD at Badgelly Hill. The proposed well surface locations are scattered throughout the Surface Project Area.

Sensitive Receivers

The potential visual receivers relevant to the Northern Expansion Project were identified in the EA, and included:

- Motorists travelling along surrounding major roads and sub-regional roads such as the Camden Valley Way;
- Rural and suburban residents and their visitors;
- Employees and visitors associated with existing golf courses and schools (Marist Brothers);
- Future urban residents and future commercial/ industrial employees and their visitors;
- Employees and visitors associated with the Smeaton Grange Industrial Park.
- Future joggers/ walkers.
- Employees and visitors associated with Mt Annan Botanical Gardens.

For the purposes of assessing the Amended Project, additional receivers that may be visually impacted were identified and include:

- CU31: Sensitive receivers located around CU31 are the same as those considered in noise assessments for CU22 and CU26.
- VV03: The nearest visually-sensitive receiver is located over 650m to the south-west.
- CU06: The nearest visually-sensitive receiver remains St. Gregory's College, approximately 320m to the north-east.
- CU22: The nearest visually-sensitive receiver is located approximately 340m to the north-west.

The distances referred to above have been taken from each of the proposed well surface locations.

5.6.2 Methodology

Remodelling was not considered necessary for the purposes of assessing the visual impact of the Amended Project, due to the similarities in landscape compared with that evaluated in the EA, and the location of wells within the original visual catchment. Minimisation of potential visual impacts was a key factor in determining the location of new and relocated wells as part of the Amended Project, and visual inspection of each proposed well site was conducted to inform the location of wells.

Assessment of the potential visual impacts of the Amended Project has taken into account the following:

- Extent of visibility.
- Viewing distance.
- Number of viewers.

The visual impact assessment of the Amended Project has been based on similar methods to those used in the EA, being:

- Visibility assessment: estimation of the number of well sites that could be seen from a single visual receiver.
- Visual absorption capacity: estimation of the capacity of the landscape to absorb developments without its character being significantly changed.

The following rating system was used to evaluate the visual absorption for receivers nearest the well sites. It considers both visibility and visual absorption capacity, resulting in the following rankings:

- High: The surrounding environment provides a significant level of screening and generally absorbs most objects of similar visual aspect including colour and height.
- Moderate: The surrounding environment provides an adequate level of screening and absorbs some objects of similar visual aspect including colour and height. Some objects may appear to be slightly more prominent.
- Low: The surrounding environment provides a poor level of screening and objects may generally be more visually prominent.

5.6.3 Potential Impacts

Potential visual impacts remain the same for the construction and operation of wells RA03, RA09, CU02, CU10, CU14, CU26 and CU29, as those identified in the original Visual Impact Assessment.

A summary of the results of the visual impact assessment for the Amended Project is provided in **Table 21**. These results are presented only for data relating to well surface locations, GGLs, main gas spine and access tracks that are included as part of the Amended Project. All results relating to components removed from the Amended Project are not included.

Table 21 Visual Impact Assessment for the Amended Project

Well Surface Location	Surrounding Visual Environment	Visibility from Nearest Sensitive Receiver	Absorption Capacity Rating
VV03	Open grassland with undulating hills. Located at an elevation of approximately 90m.	Low due to undulating topography and intermittent vegetation.	Low to moderate due to location in open grassland.
CU31	Open grassland surrounded by undulating hills. Located at an elevation of approximately 124m on the west side of the valley.	Low due to lack of close sensitive receivers.	Low to moderate due to location atop hillside. Trees to the west could provide limited screening.
CU06	Open grassland surrounded by vegetation that could provide some screening.	Low due to a substantial stand of vegetation to the east and north-east providing shielding from sensitive receivers.	High, but surrounding vegetation is likely to provide adequate screening for permanent visual receivers.
CU22	Open grassland with undulating hills. Surrounding vegetation could provide screening.	Low to moderate, with vegetation to north-west potentially providing adequate screening from the nearest sensitive receiver.	Moderate, with surrounding vegetation likely to provide adequate screening for permanent visual receivers.

Given the substantial scale of equipment required during the construction of well sites, visual impacts are anticipated to be greatest during the construction period. This would be exacerbated by the location of the majority of the wells in cleared and open grazing and pasture land. Given the temporary nature of construction works, potential visual impacts would be limited to a finite period, and would not permanently impact on the surrounding landscape.

The visual impact of the well surface locations on the surrounding landscape is also not anticipated to be significant during the production and operation phase. Vegetation bordering most well surface locations is likely to provide adequate screening to minimise the prominence of the infrastructure against the surrounding landscape. Moreover, the design of the infrastructure has taken into consideration the surrounding environment with regard to materials, colour schemes and landscaping, and it is therefore unlikely that wells would be visually intrusive. Given this, and the overall temporary nature of the Amended Project, the scenic value of the area would be maintained in the longer-term.

5.6.4 Mitigation Measures

Mitigation measures to minimise the potential impacts to visual amenity are outlined in the Statement of Commitments in **Section 7.0**. Mitigation measures include the following:

- A Landscape Management Plan would be prepared (or the existing LRMSP updated as part of the overall EMS) for the Amended Project to identify appropriate landscaping to be implemented at well surface locations along with a program of long-term maintenance for landscape works.
- Earthworks, vegetation clearing and soil disturbance would be limited to the construction and operational footprint as appropriate.
- Existing vegetation would be maintained wherever possible.
- Dust control measures would be implemented during construction and operation.
- Screening in the form of appropriate fencing and landscaping would be implemented at well surface locations as necessary and in accordance with the Landscape and Rehabilitation Management Sub Plan for the Amended Project.
- Appropriate colour schemes would be utilised for each well surface location in order to minimise visual impacts with respect to the existing surrounding environment.
- Initial rehabilitation of the well surface locations and gathering lines are to be consistent with the established character of surrounding land.
- Construction activities for the GGLs would be rehabilitated to be consistent with the established character of the land.
- With regard to the future urban (residential, commercial and industrial) land release areas, where well surface locations are expected to be near residential development, material used for fencing or the enclosure would be chosen to integrate with the intended surrounding urban form.
- For well surface locations where residents may be exposed to extended periods of uninterrupted views during construction, mesh or other appropriate fencing would be erected around the construction compound.

5.7 Surface Water

5.7.1 Existing Environment

Surface water has also been discussed in **Section 3.5**. The Amended Project is located within the Hawkesbury-Nepean and Georges River catchments. Watercourses in the area include the Nepean River to the southwest, the South Creek to the west and Kemps Creek to the northwest. A number of small tributaries enter the Surface Project Area from the east, west, south west and northwest (refer **Figure 15**), which drain to the Georges or Nepean Rivers. These watercourses include:

- Biriwi Creek
- Kenny Creek
- Bunbury Curran Creek
- South Creek
- Rileys Creek
- Cottage Creek
- Bow Bowing Creek.

Tributaries and creeks within the Surface Project Area are largely ephemeral, but could be inundated during period of peak rainfall and floods.

The Upper Canal Water Supply System, part of the Upper Nepean Scheme, transects the Subsurface and Surface Project Areas generally in a north-south direction. Flooding from the Nepean River is considered relatively common in the Camden region, although flooding with the potential to affect the Amended Project is likely to be restricted to some of the more low lying regions located in the northeast and southwest portions of the site.

5.7.2 Potential Impacts

Impacts to surface water associated with the existing CGP, including drainage and water quality as a result of the construction and operation of wells and infrastructure has been minimal in the past.

The potential surface water impacts of the Amended Project would be limited to the Surface Project Area as activities proposed within the Subsurface Project Area would not result in measurable impacts at the surface. The

changes to project infrastructure presented as part of the Amended Project are not likely to create potential impacts in addition to those outlined in the EA (refer to Table 9-1 in Chapter 9 of the EA).

Construction, production and rehabilitation-related impacts including those related to potential erosion and sedimentation, surface water contamination and affected water quality from accidental spillages and destabilisation of channel creeks and beds would be minimised by construction and operational design measures and stringent site management. Potential impacts could also arise during the construction of watercourse crossings and construction near private farm dams, particularly with regard to soil and erosion impacts. Watercourse crossings have been discussed in more detail in **Section 0**.

5.7.3 Mitigation Measures

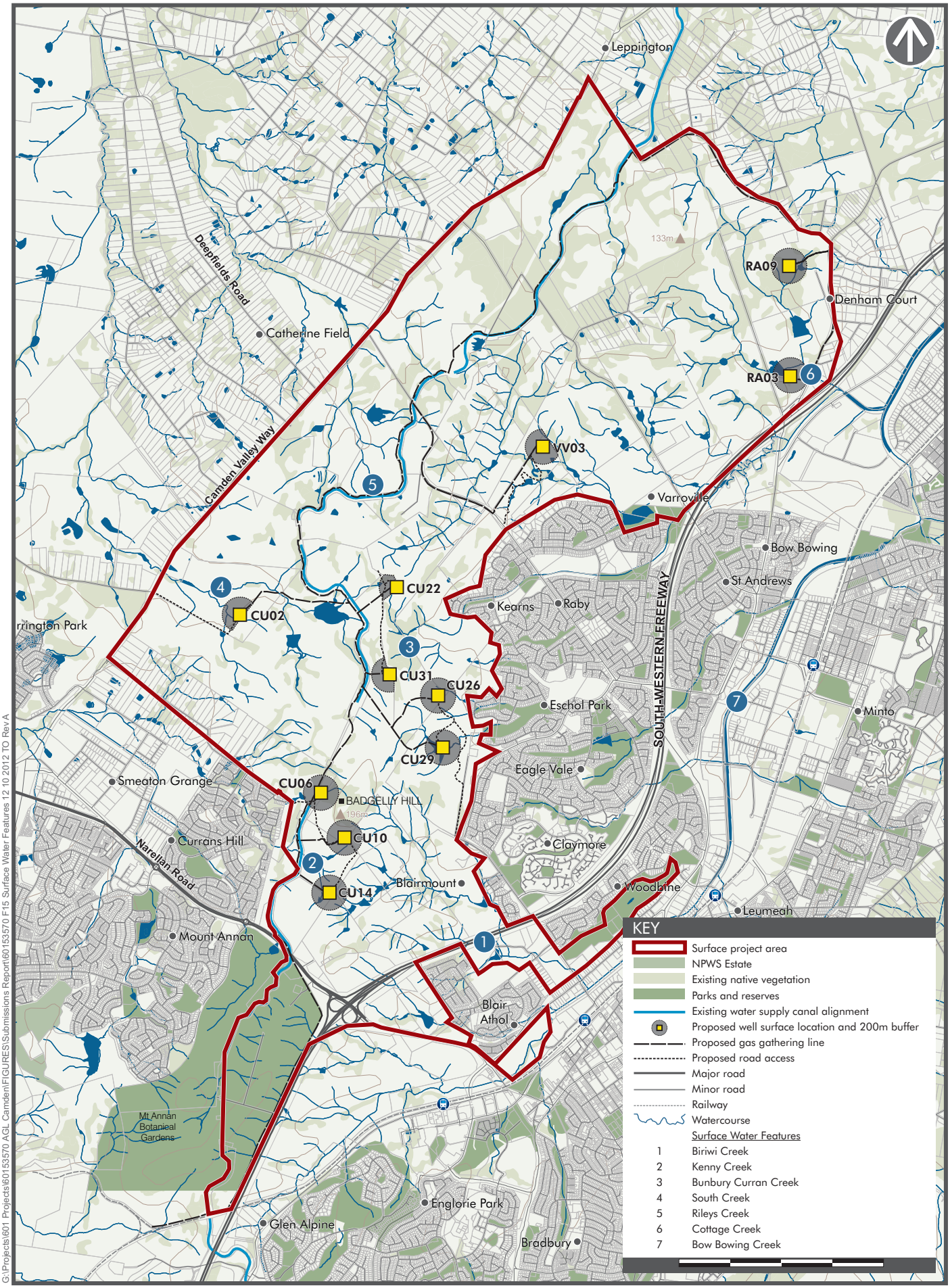
Mitigation measures to minimise the potential impacts to surface water are outlined in **Section 3.5** and the revised Statement of Commitments in **Section 7.0**. The Soil and Water Management Sub Plan of the existing EMS would be updated to include mitigation measures such as bunding, diversion drains, silt fences, and immediate initial rehabilitation including contouring and revegetation of new well sites and GGL land. The sub plan would be submitted to NOW and DP&I for approval prior to implementation. In addition, a documented layout of the erosion and sediment controls would be prepared for each well surface location and provided to DP&I prior to construction.

The environmental safeguards to be implemented during the project have become more stringent, particularly with regard to construction in the vicinity of the Upper Canal Water Supply System, in response to requests made by the SCA. Works within or adjoining the Upper Canal Controlled Area would require specific mitigation measures, to be agreed in consultation with the SCA. These measures would include:

- Bunding, diversion drains, silt fences, and immediate initial rehabilitation including contouring and revegetation.
- No works or stockpiling would be undertaken within 3m of the Upper Canal.
- Crossing methods for the Upper Canal would be agreed with the SCA and would aim to avoid underboring to maintain structural integrity.

Further, watercourse crossings would be consistent with the principles and design considerations identified in the *Guidelines for water crossings* and *Guidelines for laying pipes and cables in watercourses* (NOW, 2012), which include but are not limited to:

- Maintain existing or natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse.
- Protect against scour.
- Stabilise and rehabilitate all disturbed areas including topsoiling, revegetation, mulching, weed control and maintenance in order to adequately restore the integrity of the riparian corridor.



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SURFACE WATER FEATURES

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FIGURE 15

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5.8 Other Impacts

5.8.1 Groundwater

Groundwater was assessed in the EA and further assessment was provided in **Section 3.4** of this Submissions Report to address several submissions raised in relation to groundwater issues including potential impacts and management. Potential impacts identified in the EA and again through the submissions received included:

- Increased permeability and subsequent flow rate within the coal measures aquifer.
- Dewatering and depressurisation of the coal measures aquifers.
- Reduction in groundwater quality.

The requirements of the Aquifer Interference Policy adopted by the NSW DPI were considered in preparing the further groundwater information provided in **Section 3.4** and greater assessment of the Amended Project has been provided through the completion of a Phase 1 Groundwater Assessment and commencement of a Phase 2 groundwater study (refer **Appendi**x **B** and **C**). In addition, a Groundwater Management Plan (**Appendix D**) has recently been completed for the whole CGP (including areas to the north of existing operations to be affected by the Amended Project). With these mitigation measures in place, adverse impacts to the groundwater regime or surrounding beneficial users of the groundwater resources are not considered likely to occur.

The Amended Project is considered to have undertaken a thorough and robust assessment of groundwater and has identified stringent groundwater management measures that have been developed in accordance with the relevant policies and guidelines and endorsed by NOW. Further detail is provided in **Section 3.4**.

5.8.2 Hazards and Risk

As part of the EA, Planager prepared a Preliminary Hazard Analysis (PHA) to assess the hazards and risks associated with the proposed works. The PHA considered the risks of the wells with respect to design and location as well as the operation of the gas gathering system.

The principal hazard associated with the Northern Expansion Project related to the production and handling of CSG, which is a flammable gas held under pressure. A quantitative risk analysis was undertaken to determine the risks associated with production and handling of CSG as part of the Northern Expansion Project, taking into account the consequences of such incidents and the predicted frequency of these events, particularly in relation to the nearest residential receivers. The quantitative analysis showed that:

- The risk of fatality at the nearest residential receiver would be well below the criterion for new installations of one chance in a million per year (1×10^{-6}/ year) for the gas wells.
- The risk of fatality associated with the gas gathering system would be well below the criterion for new installations, and was calculated to be no more than 0.1×10^{-6}/ year at a distance of five metres from GGLs (compared with the fatality criterion for sensitive land uses such as schools and hospitals of 0.5×10^{-6}/ year);
- As the risk of fatality does not extend anywhere close to residential areas and is well within the criteria for business / industrial areas it was concluded that the Northern Expansion Project would not pose a significant societal risk.

The conclusions drawn in relation to the hazards and risks associated with the Northern Expansion Project remain valid and applicable to the Amended Project. As the new and relocated wells, access tracks and GGLs are a greater distance from the existing and proposed residential development areas than the original well surface locations, the findings of the PHA stand and the risks associated with the Amended Project are acceptable provided the proposed environmental safeguards are implemented.

5.8.3 Geology and Soils

The Amended Project is located within the Permo-Triassic Sydney Basin which contains coal bearing strata concentrated in two major sequences of terrestrial sediments. These are informally known as the Upper and Lower Coal Measures and are separated by a thick interval of marine strata (Sydney Gas, 2003). The Upper Coal Measures in the Southern Coalfield are defined as the Illawarra Coal Measures. Areas affected by the Amended Project comprise exposed surface areas of sedimentary strata of the Wiannamatta Group (Hazelton and Tille, 1990). Underlying the Wianamatta Group, the Mittagong Formation forms a thin transitional zone between the Ashfield Shale and the underlying Hawkesbury Sandstone. Beneath the Hawkesbury Sandstone and above the Illawarra Coal Measures lies the Narrabeen Group which comprises fine to coarse grained quartz lithic sandstone with a similar matrix to the Hawkesbury Sandstone.

Based on the Wollongong – Port Hacking Soil Landscape Series Map Sheet 9029-9129 and the Penrith Soil Landscape Series Sheet 9030, five soil groups apply to the Surface Project Area and would be subject to the

proposed surface infrastructure works. These include Blacktown, Luddenham, Picton, Berkeshire Park and South Creek. The elevation of the Surface Project Area is greater than 5 m AHD and it is not located in a coastal area. Therefore the likelihood of ASS occurring is considered to be low. Previous soil assessments within the locality have not identified the presence of ASS. Within the Blacktown Soil Landscape, localised recordings of saline soils have been recorded. Reference to the Salinity Potential in Western Sydney 1:100,000 sheet (DIPNR, 2003), indicates that the soils affected by the Amended Project have a moderate to high salinity potential. Based on existing records, it is not expected that contaminated soil would be encountered during the infrastructure works.

The types and extent of potential impacts to soil and geology in the Subsurface and Surface Project Areas are not likely to change as a result of the locational changes presented in the Amended Project. Potential impacts could still encompass:

- Changes to stability along cut and filled areas.
- Soil erosion on unprotected cut and filled areas.
- Vibration associated with drilling and well development, with potential to impact on nearby structures such as the Upper Canal.
- Potential for sterilisation of coal seams for future coal mining activities.

As the new and relocated wells are not positioned in locations of different geotechnical compositions compared with that considered in the EA, it is considered likely that subsurface impacts would be manageable. Further, drilling techniques and management measures used in the existing stages of the CGP have indicated that it is possible to adequately minimise impacts to geology and soils in the region.

Mitigation measures that would be implemented would be included in the SWMSP as part of the existing EMS. This would comprise the environmental safeguards that are included in Section 18.3 of the EA, and **Section 7.0** of this Submissions Report, such as:

- Erosion and sediment control measures would be implemented where necessary to prevent erosion and water contamination and would be in place prior to the commencement of works with the potential to cause erosion. Control measures may include surface drains and berms and sediment traps such as silt fences and straw bales.
- Erosion control berms and drains would be designed and constructed so as to ensure that runoff water does not result in off-site erosion or sedimentation.
- Areas designated for ground disturbance, including well surface locations and minor vegetation clearing would be clearly marked on site plans and on the ground surface and would be minimised wherever possible.

5.8.4 Air Quality and Greenhouse Gas

The Amended Project is in a largely undeveloped rural area with pockets of rural residential, recreational and future development lands in a predominantly cleared landscape. As such, it is anticipated that air quality would be generally good with few potential pollution sources such as the Smeaton Grange Industrial Park and traffic along major arterial roads and B-double routes such as the Camden Valley Way and Narellan Road.

Pollution sources from the Amended Project are likely to include:

- Combustion emissions from mobile industrial equipment and vehicles;
- Dust generation during use of unsealed roads; and
- Venting of gas during well commissioning;

The Amended Project would result in an overall beneficial outcome in terms of air quality given the reduction of the number of well surface locations proposed. Potential impacts associated with construction are not considered significant given the successful management measures demonstrated by previous stages of the existing CGP. These measures include watering techniques during the event of excess dust generation and ensuring rehabilitation occurs as soon as possible following construction. As the production of wells is expected to immediately tie-in to the existing CGP, the need to vent gases is limited and often removed, therefore potential impacts from venting are also not considered to be significant.

The management measures identified in the existing EMS would be implemented to ensure potential air quality impacts associated with the Amended Project during construction and operation are minimised.

A greenhouse gas assessment was previously undertaken as part of the EA. This assessment identified scope 1, 2 and 3 emissions from the Northern Expansion Project. This assessment is still considered valid for the

Amended Project, however it should be noted that due to the reduction in total number of wells proposed, the total greenhouse gas emissions would also be reduced thus providing an overall beneficial outcome.

5.8.5 Traffic and Transportation

Key roads around the Amended Project include the F5 South Western Freeway, the M5 South Western Motorway, Camden Valley Way, Northern Road, Narellan Road, Denham Court Road, Raby Road, Campbelltown Road, St. Andrews Road and Turner Road. The majority of traffic recording locations in this area have experienced traffic volume increases since 1999. This is likely a result of population and industry growth in the area.

The Amended Project would result in additional vehicles, including vehicles and transport machinery and personnel to and from well surface locations with the most significant impact being through the construction phase of the Amended Project. The production and post-development phases of the Amended Project would result in intermittent vehicle activity associated with maintenance and testing and re-fracture stimulation of wells. Similarly, the closure and final rehabilitation phase of the Amended Project would result in some additional vehicle movements over a relatively short period of time. In this way, potential impacts relative to the construction and final rehabilitation and closure of the Project are temporary and are therefore unlikely to result in any long term impacts on the traffic of the area.

Well surface locations would still be accessed along existing public roads and private tracks within the relevant property boundary. However, several amendments to the access tracks to well surface locations have been identified as previously shown in **Table 7**. The changes to the Amended Project would have an overall beneficial impact on the traffic impacts associated with the development, as there is a net decrease in the number of well surface locations to be developed that would require access. As a result of the removal of VV07 and VV11, no traffic would be generated along St Andrews Road, thus negating potential traffic impacts in this area. Similarly, due to changes to the proposed access to CU26 and CU29, there would be no traffic generated by the Amended Project through Eschol Park.

The contribution to traffic within the existing road network (including Camden Valley Way) would be negligible.

5.8.6 Social and Economic

A high-level social and economic impact assessment was undertaken for the Northern Expansion Project and highlighted the overall regional and local social and economic impacts of the Northern Expansion Project. The changes presented in the Amended Project are at a scale such that the overall social and economic impacts of the Amended Project (both beneficial and non-beneficial) are likely to remain unchanged with the amended layout. That is, the potential economic impacts of the Amended Project are largely related to the broader impacts of provision of an additional natural gas supply into the existing market, and the more localised impacts in terms of employment generation as a result of the construction and operational phases of the Amended Project

The potential for impacts to residential amenity has generally been reduced as a result of the relocation of the wells away from future development areas as well as a beneficial outcome for existing residences, with most well surface locations being relocated further away from sensitive receivers.

Mitigation measures for social impacts relating to amenity have been outlined in relevant sections throughout the Submissions Report. AGL also supports the local community in a number of ways, including through:

- supporting St Vincent de Paul (Nagle Centre Care and Support, Campbelltown);
- supporting the MacArthur Diversity Centre Social Enterprise Group;
- supporting the Materdei School;
- supporting Youth off the Streets (MacArthur).
- sponsorship of the Camden Show
- sponsorship of the Campbelltown Show
- volunteer work with Barragal Landcare Group

Given that the overall economic impacts of the Amended Project are considered to be positive, no specific additional mitigation measures are considered necessary. Management measures would be undertaken to ensure the overall social and economic environment of the communities within and surrounding the Surface Project Area is maintained, including ongoing awareness of the CGP through the CGP Community Consultative Committee and other consultation when required.

5.8.7 Rehabilitation

There would be no changes to the original rehabilitation strategy for the Amended Project, nor would the Amended Project alter any potential impacts that could occur as a result of rehabilitation activities at the new and repositioned well locations, access track and GGL routes.

The overall objective of undertaking rehabilitation at each of the well surface locations and gas gathering lines would be to return the land to original land use condition or better, or to a condition agreed with the landowner. Rehabilitation of well surface locations would also minimise the residual impacts of the Amended Project on land use within the Surface Project Area including the proposed development areas identified as part of the South West Growth Centre. Rehabilitation would be undertaken in the following stages:

- Initial rehabilitation of:
    - Construction footprint at well surface locations.
    - Construction footprint of gas gathering system.
- Decommissioning and final rehabilitation of:
    - Operational footprints of well surface locations.
    - Gas gathering system.

Detailed rehabilitation measures would be contained within the existing Landscape and Rehabilitation Management Sub Plan (LRMSP) for the CGP which would be updated by AGL and approved by the DP&I prior to implementation. In addition to an overarching LRMSP, a site-specific site rehabilitation plan, or Landscape and Rehabilitation Management Plan (LRMP), would be prepared for each well surface location. Consultation would be undertaken with the landowner and the relevant Government agencies to ensure that the landscaping and rehabilitation measures proposed in the LRMP are suitable for that location. The LRMP would be provided to DP&I (and DTIRIS if requested) prior to construction of the well surface location.

5.8.8 Waste

Waste streams generated by the development would not be affected by the changes to the Northern Expansion Project. Waste that could be generated during the Amended Project includes the following:

- Excavated topsoil resources removed from access roads (where minor upgrade is required), drill pits and construction footprint areas.
- Excess construction materials such as materials used in the construction of silt fencing and wire fencing;
- Excavated rock and rubble.
- Cleared vegetation.
- Produced water during drilling, fracturing stimulation and production operations of wells.
- Sanitary waste from contractors and personnel on site.

Overall, waste generated is expected to be minimal. Construction-related waste would be reduced due to the change in Amended Project scope from 12 wells to 11 wells.

Waste management measures proposed for the Amended Project would encourage efficient resource use alternatives, re-use and recycling. Waste that cannot be re-used or recycled would be disposed of in an appropriate manner. Mitigation measures to minimise waste-related impacts are outlined in Section 22.3 of the EA.

5.8.9 Cumulative Impacts

The potential impacts for each of the environmental factors are considered to be minimal provided the prescribed mitigation measures are implemented. It should also be noted that the well surface locations are a temporary and transient land use which will be completely removed after approximately 15 years in the closure and final rehabilitation stage. As a result, no significant cumulative impact is expected.

The Amended Project would not increase cumulative impacts beyond those already considered as part of the EA. As the Amended Project affects only the detail of the sites with a similar net impact to that of the Northern Expansion Project, the relationship between impacts of the Amended Project and those of other projects in the region would not be affected.

The design and assessment approach for the Amended Project allows the extraction of a strategically valuable and important energy resource in an already constrained market, while still allowing future urban (residential, commercial and industrial) development of the land.

6.0 Section 79C Consideration

Under section 79C of the EP&A Act, the Minister for Planning and Infrastructure, or his delegate, is required to consider a number of matters when determining a development application under Part 4. These matters are considered below.

The provisions of any environmental planning instrument

The following environmental planning instruments include provisions relevant to the Amended Project:

- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*;
- *State Environmental Planning Policy No.33 – Hazardous and Offensive Development*;
- *State Environmental Planning Policy No. 44 – Koala Habitat Protection*;
- *State Environmental Planning Policy No. 55 – Remediation of Land*;
- *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*;
- *Camden Local Environmental Plan No. 45*;
- *Camden Local Environmental Plan No. 46*;
- *Camden Local Environmental Plan No. 47*;
- *Camden Local Environmental Plan No. 48*;
- *Camden Local Environmental Plan No. 74 – Harrington Park*;
- *Camden Local Environmental Plan No. 117 – Elderslie Release Area*;
- *Camden Local Environmental Plan No. 121 – Spring Farm*;
- *Camden Local Environmental Plan (Camden Lakeside) 2009*;
- *Campbelltown Interim Development Order No. 13*;
- *Campbelltown Interim Development Order No. 15*;
- *Campbelltown Interim Development Order No. 28*;
- *Campbelltown Local Environmental Plan No. 112 – Macquarie Field House*;
- *Campbelltown Local Environmental Plan - District 8 (Central Hills Land)*; and
- *Campbelltown (Urban Area) Local Environmental Plan 2002*.
- *Camden Local Environmental Plan 2010 (Draft at the time of Project Application)*

The *State Environmental Planning Policy (Major Development) 2005* was discussed in the EA (sections 1.4 and 5.2.9). The *State Environmental Planning Policy (State and Regional Development) 2011* identifies, among other things, development that is State significant development. A discussion of the planning approval pathway for the Northern Expansion Project and the Amended Project has been provided in **Section 1.3** of this Submissions Report.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The Mining, Petroleum Production and Extractive Industries SEPP contributes to establishing the permissibility of parts of the Amended Project, and includes a series of heads of consideration to be taken into account when determining an application for mining, petroleum production or extractive industry development. The permissibility of the Amended Project is outlined in **Section 3.2.3**. Clause 7(2)(a) of the Mining, Petroleum Production and Extractive Industries SEPP makes the Amended Project permissible use in land use zones where agriculture or industry is a permissible use.

Table 3 presented in **Section 3.2.3** sets out the specific zones of relevant LEPs where petroleum production is permissible. Some of these LEPs contain provisions which must be satisfied to carry out petroleum production. Clause 8(1) of the Mining, Petroleum Production and Extractive Industries SEPP provides that if a local environmental provides that development for the purpose of petroleum production may be carried out on land with development consent if provisions of the plan are satisfied, development for that purpose may be carried out on that land with development consent without those provisions having to be satisfied, and those provisions have no effect in determining whether or not development for that purpose may be carried out on that land or on the determination of a development application for consent to carry out development for that purpose on that land.

Clause 8(2) of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* provides that where a local environmental plan provides that petroleum production may be carried out on land with development consent if the consent authority is satisfied as to certain matters specified in the plan, development for that purpose may be carried out on that land with development consent without the consent authority having to be satisfied as to those specified matters. Accordingly, the provisions in the LEP do not need to be satisfied to carry out petroleum production and do not have any effect in determining whether or not petroleum production may be carried out on the land or on the determination of the application.

Part 3 of the Mining, Petroleum Production and Extractive Industries SEPP requires a consent authority to consider the matters outlined in **Table 22** when determining the application for the Amended Project.

Table 22 Heads of Consideration – Part 3 of the Mining, Petroleum Production and Extractive Industries SEPP

Heads of Consideration	Comment
Clause 13 – Compatibility with Other Land Uses	
The consent authority must: a) consider: the existing uses and approved uses of land in the vicinity of the development; and whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development; and any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses; and b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a)(i) and (ii); and c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).	Land use and potential land use conflicts are considered in **Section 5.1** of this Submissions Report. The Amended Project has been designed to locate wells in a manner that minimises impacts on current land uses and receivers, and that minimises the potential for conflict with future permissible uses. Relevantly, amends made as part of the Amended Project, including deletion and relocation of well surface locations, has been largely driven by the outcomes of consultation with landowners and land developers with the aim of reaching an appropriate balance between the needs of the Amended Project and the development aspirations for land in the area. The configuration of the Amended Project balances the benefits of the project and the potential future benefits of development of land in the area for permissible uses. This balance enables an optimised land use outcome in which both the Amended Project and future permissible uses can be accommodated.
Clause 15 – Natural Resource and Environmental Management	
The consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following: a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable, b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable, c) that greenhouse gas emissions are minimised to the greatest extent practicable.	**Sections 0** and **3.4** address potential surface water and groundwater impacts of the Amended Project, and demonstrate that impacts would be avoided or minimised to the greatest extent practicable. **Sections 3.3** and **5.2** demonstrate that the ecological impacts of the Amended Project has been minimised to the greatest extent practicable, and that impacts on listed threatened species and communities have been avoided. Section 14.6 of the EA provides an estimate of the greenhouse gas emissions of the Northern Expansion Project. These emissions have been reduced further with a reduction in the number of wells comprising the Amended Project.
The consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.	Section 14.6 of the EA provides an estimate of the greenhouse gas emissions of the Northern Expansion Project. These emissions have been reduced further with a reduction in the number of wells comprising the Amended Project.
Clause 15 – Resource Recovery	
The consent authority: a) must consider the efficiency or otherwise of the development in terms of resource recovery; and b) must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material; and c) may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of resource recovery and to minimise the creation of waste in association with the extraction, recovery or processing of resources.	As detailed in Section 3.2.3 of the EA, AGL has undertaken detailed consideration of the configuration of the development (and subsequently in relation to the Amended Project) with the aim of maximizing resource extraction within the environmental, planning and social constraints of the locality and region. In doing so, it has struck an appropriate balance between minimising impacts to the natural, built and social environments and the imperative of optimising the extraction of CSG. A key initiative applied in an endeavour to minimise impacts while optimising extraction was AGL's decision to co-locate six wells within each of the 11 well surface locations proposed as part of the Amended Project.

Heads of Consideration	Comment
	This approach enables opportunities to extract CSG to be maximised, while reducing surface disturbance as far as reasonable and feasible to do so. Further, the selective use of hydraulic fracture stimulation techniques (refer to **Section 3.4.2** of this Submissions Report) will facilitate optimum CSG extraction from each of the proposed wells. Given the nature of the Amended Project, there would be minimal potential to waste the CSG resource, or to generate other waste streams as a consequence of the extraction process. Section 22.0 of the EA and **Section 5.8.8** of this Submissions Report detail the waste generation expected during construction and operation of the development, and the measures AGL proposes to implement to ensure that waste generation is minimised, or otherwise carefully managed through reuse and recycling in preference to direct disposal.
Clause 16 - Transport	
The consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following: a) require that some or all of the transport of materials in connection with the development is not to be by public road; b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools; and c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.	Section 19.0 of the EA and **Section 5.8.4** of this Submissions Report considers potential traffic impacts during construction and operation. Given the nature of the CSG extraction process, and the design of the Amended Project to include remote control of wells, traffic generation during the operational phase is expected to be minimal. Occasional access to well surface locations will be required for monitoring and maintenance, but traffic associated with these activities would be negligible in the context of background traffic volumes. In light of this, restrictions on operational traffic movements are not considered necessary. Traffic generation during construction would be managed through an update to the existing Traffic Management Sub Plan (TMSP) for the CGP, which would be revised to reflect the construction of the Amended Project. Given the limited duration and transient nature of construction-related traffic impacts, a management approach is considered appropriate to ensure that impacts are mitigated and managed. The use of public roads to access construction areas would be unavoidable, but measures detailed in the updated TMSP would specifically focus on opportunities to minimise disruptions and impacts to other road users. The TMSP also currently includes provisions relating to the appropriate conduct for drivers associated with the CGP.
If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within seven days after receiving the development application, provide a copy of the application to: a) each roads authority for the road; and b) the Roads and Traffic Authority (if it is not a roads authority for the road). The consent authority: a) must not determine the application until it has	Camden Council, Campbelltown Council and the Roads and Traffic Authority (now Roads and Maritime Services) were all consulted on, and made submissions in relation to, the EA for the Northern Expansion Project. Issues raised by each of these parties have been addressed as part of this Submissions Report.

Heads of Consideration	Comment
taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application; and b) must provide them with a copy of the determination.	
Clause 17 – Rehabilitation	
The consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. In particular, the consent authority must consider whether conditions of the consent should: a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated; or b) require waste generated by the development or the rehabilitation to be dealt with appropriately; or c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the EP&A Act and the *Contaminated Land Management Act 1997*); or d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardise public safety.	Rehabilitation issues are considered in Section 21.0 of the EA for the Northern Expansion Project, and in **Section 5.8.7** of this Submissions Report with respect to the Amended Project. Detailed rehabilitation measures would be contained within the existing Landscape and Rehabilitation Management Sub Plan (LRMSP) for the CGP which would be updated by AGL and approved by the DP&I prior to implementation. In addition to an overarching LRMSP, a site-specific site rehabilitation plan, or Landscape and Rehabilitation Management Plan (LRMP), would be prepared for each well surface location.

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

SEPP 33 requires a consent authority to consider whether a proposed development constitutes 'potentially hazardous industry' and if it does, must also consider a Preliminary Hazard Analysis (PHA) prepared in relation to the development. A PHA was prepared for the Northern Expansion Project and included in the EA. The potential hazard and risk implications of the Amended Project are considered further in **Section 5.8.1** of this Submissions Report. The Amended Project would comply with current land use safety planning criteria.

Clause 13 of SEPP 33 also requires a consent authority to consider certain matters when determining a development application for potentially hazardous industry or potentially offensive industry to consider the matters outlined in **Table 23**.

Table 23 Heads of Consideration – Clause 13 of SEPP 33

Heads of Consideration	Comment
Current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development	The PHA prepared for the Northern Expansion Project and included in the EA was prepared in accordance with relevant guidelines, including the Department of Planning and Infrastructure's *Hazardous Industry Planning Advisory Paper* series of guidelines.
Whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply	This is a matter for determination by DP&I. It is noted that no land use safety requirements from other public authorities have been notified to AGL.
In the case of development for the purpose of a potentially hazardous industry—a preliminary hazard analysis prepared by or on behalf of the applicant	A PHA was included in the EA for the Northern Expansion Project, and considered further in **Section 5.8.1** of this Submissions Report.
Any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including	Alternatives to the Northern Expansion Project were considered in Section 3.2 of the EA.

Heads of Consideration	Comment
any feasible alternatives for the location of the development and the reasons for choosing the location the subject of the application)	
Any likely future use of the land surrounding the development	Potential future land uses in and around the Amended Project have been considered, and in some cases have resulted in changes to the original Northern Expansion Project to avoid potential land use conflicts. The Amended Project has been configured with regard to current and potential future land uses, and designed to avoid potential conflicts with permissible uses on the land (refer to **Section 3.2.3** of this Submissions Report).

State Environmental Planning Policy No. 44 – Koala Habitat Protection

SEPP 44 applies to the Camden and Campbelltown LGAs, in which the Amended Project is proposed to be located. It requires that a consent authority considers:

a) whether or not the land is potential koala habitat;

b) if the land is potential koala habitat, whether it is then core koala habitat; and

c) if the land is core koala habitat, then a plan of management must be prepared.

The updated Flora and Fauna Assessment (Biosis, 2012) (refer to **Appendix** E) prepared for the Amended Project lists two key eucalypt species – the Forest Red Gum (*Eucalyptus tereticornis*) and the Grey Gum (*Eucalyptus punctata*) in the flora results for the Amended Project. Both of these species are listed under SEPP 44 as contributing to potential koala habitat where they constitute at least 15% of the total number of trees in the upper and lower strata of the tree component.

The updated Flora and Fauna Assessment notes that the abovementioned Eucalyptus species are important components of several of the vegetation communities identified across the Surface Project Area, including the Cumberland Plain Woodland (CPW), Cumberland Shale Plains Woodland (CSPW), Alluvial Woodland (River Flat Eucalypt Forest on Coastal Floodplains (RFEFCF) and Moist Shale Woodland. None of these communities would be affected by the Amended Project. Relevantly, the two vegetation communities that would be cleared as part of the Amended Project – Shrubland and Closed Grassland – do not include these two Eucalyptus species. On this basis, the Amended Project is unlikely to impact on potential koala habitat as defined under SEPP 44.

Further, even in the unlikely event that the land affected by the Amended Project is considered to be potential koala habitat, it would not be defined as core koala habitat because survey work undertaken in inform the original and updated Flora and Fauna Assessment did not identify any evidence of a local koala population (a prerequisite for definition of core koala habitat under SEPP 44). The updated Flora and Fauna Assessment considers the likelihood of occurrence of koalas to be low, and that vegetation within the Surface Project Area is not considered core foraging habitat.

State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 requires a consent authority to consider whether land the subject of a development application may be contaminated, and if it is contaminated, whether the land would be suitable for development in its contaminated state (or suitable following remediation). Where remediation is required, the consent authority must also be satisfied that the land would be remediated before the land is used for the development in question.

A search of the EPA contaminated land notice register in August 2012 identified that no contaminated land notices relating to the Camden LGA have been listed on the register, and only one is listed in relation to the Campbelltown LGA (62 Blaxland Road, which lies outside the area the subject of the Amended Project). Notwithstanding, there is some potential for land to be disturbed by the Amended Project to be contaminated as a consequence of historical agricultural practices. Given the nature of the Amended Project, it is unlikely that any historical contamination from agriculture would pose a significant potential incompatibility with the intended land use. Notwithstanding, AGL intends to implement measures during construction, including providing guidance to construction personnel on the identification of potentially contaminated land, to assist in the early identification of contamination risks. Where previously unknown or suspected contaminated soils are uncovered during construction, relevant works would cease until appropriate measures have been developed to manage the contaminated materials.

State Environmental Planning Policy (Sydney Region Growth Centres) 2006

Part of the Amended Project, being well surface location CU02 and the associated GGL and access road lie within the Turner Road Precinct of the Sydney Region Growth Centres SEPP. The application of the Sydney Region Growth Centres SEPP was considered in the permissibility analysis contained in **Section 3.2.3**. Other than this, the Sydney Region Growth Centres SEPP does not include any provisions relevant to the design, construction or operation of the Amended Project. Nonetheless, the objectives of land use zones within the relevant Turner Road Precinct applicable to the Amended Project have been considered in **Table 24**.

The key issue raised in relation to the Sydney Region Growth Centres SEPP is the potential for the Amended Project to conflict with future uses within the Turner Road Precinct. In this regard, well CU02 is to be located within a part of the release area earmarked for industrial/commercial development and a riparian zone. The assessment envelope around the well would be reduced in consultation with the landowner to ensure that it would not encroach onto parts of the site proposed for residential development. Given this, and subject to AGL's ongoing commitment to consult with the affected landowner(s), any potential land use conflict that may arise between the Amended Project and the future development potential of land within the precinct is considered to be minimal and manageable.

Table 24 Local Environmental Planning Instruments - Zone Objectives

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
State Environmental Planning Policy (Sydney Region Growth Centres) 2006 – Turner Road Precinct		
R1 Residential	- To provide for the housing needs of the community. - To provide for a variety of housing types and densities. - To enable other land uses that provide facilities or services to meet the day to day needs of residents. - To support the wellbeing of the community, including educational, recreational, community, religious and other activities and, where appropriate, neighbourhood shops if there will be no adverse effect on the amenity of proposed or existing nearby residential development. - To allow for small scale kiosks, function centres, restaurants and markets that support the primary function and use of recreation areas, public open space and recreation facilities located within residential areas. - To allow for small scale intensity tourist and visitor accommodation that does not interfere with residential amenity. - To provide for a variety of recreational uses within open space areas.	The Amended Project is considered consistent with the objectives of this zone.
B1 Neighbourhood Centre	- To provide a range of small-scale retail, business and community uses which serve the needs of people who live or work in the surrounding neighbourhood and, in relation to the Turner Road Precinct, of a scale and nature that serves the wider community. - To ensure the scale and type of business development is compatible with the amenity of surrounding areas. - To allow for residential development that contributes to the economic and social vitality of the neighbourhood centre. - To ensure that residential development does not preclude the provision of active retail, business and community uses at street level. - To ensure that residential development does not detract from the primary function of the zone which is to provide for retail, business and convenience uses to serve the community. - To promote retail activities in accessible locations that encourage walking. - To promote a sense of place and focal points for the local community. - To ensure retail development does not adversely impact on the viability of retail development in the Local Centre Zone.	The Amended Project is considered consistent with the objectives of this zone.
B4 Mixed Use	- To provide a mixture of compatible land uses. - To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling. - To encourage development that supports or complements the primary office and retail functions of the Neighbourhood Centre Zone and the Local Centre Zone. - To encourage development providing services to the surrounding community. - To permit development that adds to the vitality and diversity of commercial and retail centres while not prejudicing their principal function.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
B5 Business Development	- To enable a mix of business and warehouse uses and specialised retail uses that require a large floor area, in locations that are close to, and that support the viability of, centres. - To provide for a wide range of employment generating development. - To provide for a mix of ancillary uses to support the primary function of providing employment generating development. - To maintain the economic strength of centres by limiting the retailing of food, clothing and convenience shopping. - To provide for a range of uses, including recreational uses and function centres that complement other permissible employment generating land uses within the zone.	The Amended Project is considered consistent with the objectives of this zone.
IN1 General Industrial	- To provide a wide range of industrial and warehouse land uses. - To encourage employment opportunities and to support the viability of centres. - To minimise any adverse effect of industry on other land uses. - To enable development for the purpose of commercial offices only where it is associated with, and ancillary to, another permissible use on the same land. - To enable development for the purpose of retail premises only where it serves convenience needs, or where the goods or materials sold are of a type and nature consistent with construction and maintenance of buildings.	The Amended Project is considered consistent with the objectives of this zone.
RE1 Public Recreation	- To enable land to be used for public open space or recreational purposes. - To provide a range of recreational settings and activities and compatible land uses. - To protect and enhance the natural environment for recreational purposes.	The Amended Project is considered consistent with the objectives of this zone.
RE2 Private Recreation	- To enable land to be used for private open space or recreational purposes. - To provide a range of recreational settings and activities and compatible land uses. - To protect and enhance the natural environment for recreational purposes. - To preserve and maintain the natural values of core riparian areas and to allow development where it can be demonstrated that the development will not destroy, damage or have any other adverse effect on those values. - To ensure that residential development does not have an adverse effect on those values.	The Amended Project is considered consistent with the objectives of this zone.
E4 Environmental Living	- To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values. - To ensure that residential development does not have an adverse effect on those values. - To preserve and maintain the natural values of core riparian areas and to allow development where it can be demonstrated that the development will not destroy, damage or have any other adverse effect on those values. - To ensure that flood prone land is used in a manner appropriate to its environmental characteristics.	The Amended Project is considered consistent with the objectives of this zone.
Camden Local Environmental Plan No. 45		
3(e) Town Centre	a) to encourage office, retail and service development appropriate to the town centre's status and subregional functions, b) to maintain and enhance the historic character of Argyle, Hill and John Streets in the town centre, c) to ensure that development is arranged and carried out in a way that maximises convenience and comfort for	The Amended Project is considered consistent with

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	pedestrians, and d) to accommodate other development which complements or supports the primary office and retail functions of the zone, and e) to permit development which adds to the vitality and diversity of the commercial centre while not prejudicing its principal function.	the objectives of this zone.
3(f) Town Centre Support	a) to encourage development that supports or complements the primary office and retail functions of the Town Centre Zone, b) to encourage development that will expand the range of services provided by the centre, c) to encourage development providing services to the rural community, and d) to encourage development that assists the conservation of historic buildings and streetscape, and e) to permit development which adds to the vitality and diversity of the commercial centre while not prejudicing its principal function.	The Amended Project is considered consistent with the objectives of this zone.
6 (a2) Open Space Existing	To ensure there is provision of adequate open space areas and to enhance the total environmental quality of the Camden Town Centre.	The Amended Project is considered consistent with the objectives of this zone.
Camden Local Environmental Plan No. 46		
1(a) Rural (40 hectares)	a) to promote the conservation of economic units of productive agricultural land, b) to discourage fragmentation of landholdings into areas which are inadequate to support viable commercial agricultural practices, c) to permit the development of appropriate agricultural land-uses and prevent development of inappropriate non-agricultural land-uses, d) to discourage alienation of good farming land while at the same time permitting selected non-agricultural land uses such as rural industries which are in keeping with the principal zone objectives and which will not adversely affect agricultural productivity, e) to permit the development of a number of rural retreats and horse riding and training schools, subject to compliance with suitable performance standards and provided agricultural productivity is not adversely affected and development does not occur on lands subject to environmental hazards, such as bushfire or flood, and f) to ensure that development does not detract from the existing rural character or create unreasonable or uneconomic demands for provision or extension of public amenities and services.	The Amended Project is considered consistent with the objectives of this zone.
2(a) Residential	The objective of this zone is to set aside sufficient land for detached housing within suitable living areas of the Camden local government area.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
2(b) Residential Medium Density	a) to provide land for all forms of residential development to be carried out in a functional, aesthetic and environmentally sensitive manner, and b) to encourage redevelopment of land for medium density housing, including town-houses, villas, cluster housing, semidetached housing, small lots and the like, in locations close to main activity centres within the Camden local government area.	The Amended Project is considered consistent with the objectives of this zone.
2(c) Residential Craft	a) to provide land for detached residential development to permit other forms of accommodation compatible with the amenity of immediate neighbourhood, and b) to enable land within the zone to be developed for certain craft industries together with ancillary shops which may utilise existing buildings, or to be developed for new buildings designed to be compatible with the existing residential development.	The Amended Project is considered consistent with the objectives of this zone.
3 (a) General Business	a) to provide sufficient opportunities for the development of retail and commercial activities designed to satisfy the needs of the community in an environmentally sensitive manner, b) to encourage the development and expansion of business activities which will contribute to the economic growth of, and the creation of employment opportunities within, the Municipality of Camden, and c) to encourage a wide range of retail, commercial and recreational facilities, and d) to encourage a variety of forms of higher density housing in locations that are accessible to public transport, employment, retail, commercial and service facilities.	The Amended Project is considered consistent with the objectives of this zone.
3 (b1) Business Support	a) to set aside land for land uses requiring extensive site areas or a large area for handling, storage and display of goods on a relatively free-standing location with adequate space for on-site vehicular movement, parking and loading and unloading of goods and which is conveniently located with a high level of exposure and accessibility, and b) to ensure that the size and scale of development, in terms of site and floor area, are designed to encourage and provide opportunities for the establishment of bulky goods shops, and c) to ensure that land uses are confined to bulky goods retailing, tourist activities and the provision of services to the travelling public and the like, and d) to provide for appropriate forms of commercial development and light industry which will contribute to the economic and social growth of the area and increase employment opportunities in the area, and e) to provide opportunities for residential development which is either ancillary to a permitted use in this zone or in accordance with a comprehensive masterplanned residential estate integrated with surrounding land uses, and f) to allow shops, other than bulky goods shops, only if they are associated with and ancillary to industry or if they service the day-to-day needs of the immediate neighbourhood, the travelling public or the local workforce, and g) to retain the efficiency of the surrounding road system, maintain safety and reduce vehicular and pedestrian conflicts by rationalising access points.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
4 (b) Service Industrial	a) to set aside sufficient land for: i. the purposes of service industry as defined in this plan, and ii. the display and retailing by shops of generally large scale merchandise requiring extensive site areas or a free standing location for the transfer of goods, but only where such activities cannot be appropriately located in, or would not adversely affect the range of merchandise offered in, Zone Nos 3 (a) and 3 (b), b) to permit the sale in shops of spare parts and finished goods where such goods would, under normal circumstances, require maintenance or repair services by the industry located on the same land, and c) to permit the sale of low volume goods that are completely or almost completely manufactured on the same land.	The Amended Project is considered consistent with the objectives of this zone.
5(a) Special Uses	The objectives of this zone are to make provision for particular specialised uses.	The Amended Project is considered consistent with the objectives of this zone.
5(b) Special Uses – Arterial Road 5(b)1 Special Uses – Arterial Road Widening	The objective of this zone is to identify lands required for existing arterial roads.	The Amended Project is considered consistent with the objectives of this zone.
5(d) Special Uses – Proposed Local Roads Reservation	The objective of this zone is to be set aside land for local roads and local road widening.	The Amended Project is considered consistent with the objectives of this zone.
6(a1) Open Space Existing	a) to ensure there is provision of adequate open space areas to meet the needs of all residents and provide opportunities to enhance the total environmental quality of the Municipality of Camden; b) to identify land which is now owned by the Council for open space or public recreational purposes, and c) to identify certain land which is owned by the Crown and under the care, control and management of the Council as public open space.	The Amended Project is considered consistent with the objectives of this zone.
6(b) Open Space Proposed	The objectives of this zone are to identify land which may be acquired for future open space purposes in accordance with the objectives of Zone No 6 (a1).	The Amended Project is considered consistent with the objectives of this zone.
6(c) Open Space Private	The objectives of this zone are to identify land where private recreation facilities are and may be developed in an environmentally sensitive manner.	The Amended Project is considered consistent with

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
		the objectives of this zone.
Camden Local Environmental Plan No. 47		
2(d) Residential "D" (Release Area)	a) to promote a distinctive character and quality of development in each release area, based on the historic and natural characteristics of the land, and b) to retain a close physical and visual contact with the rural setting, and c) to ensure the provision of accessible and convenient commercial, social, recreational, community and employment facilities and satisfactory public transport to serve the needs of the residential district for educational, recreational, religious, community service and welfare activities, and d) to provide land for use as an appropriate urban drainage system in an environmentally sensitive manner so that it may also be used as recreational land, and e) to provide accessible open space suitable for the active and passive recreation of the population generally and of young children in particular, and f) to allow land for pedestrian and cycle routes between areas of activity.	The Amended Project is considered consistent with the objectives of this zone.
2(d1) Residential "D1"(Manooka Valley)	a) to promote a distinctive character and quality of development in Manooka Valley based on the natural characteristics of the land and its position at the rural-urban interface, and b) to retain a close physical and visual contact with the rural setting, and c) to ensure that provision is made for accessible public transport to serve the needs of the residents, and d) to provide accessible open space for active recreation of the population generally and of young children in particular, e) to allow for pedestrian and cycle routes between areas of activity.	The Amended Project is considered consistent with the objectives of this zone.
3(b1) Business Support	a) to set aside land for land uses requiring extensive site areas or a large area for handling, storage and display of goods on a relatively free-standing location with adequate space for on-site vehicle movement, parking and loading and unloading of goods and which is conveniently located with a high level of exposure and accessibility, and b) to ensure that the size and scale of development, in terms of site and floor area, are designed to encourage and provide opportunities for the establishment of bulky goods shops, and c) to ensure that land uses are confined to bulky goods retailing, tourist activities and the provision of services to the travelling public and the like, and d) to provide for appropriate forms of commercial development and light industry which will contribute to the economic and social growth of the area and increase employment opportunities in the area, and e) to provide opportunities for residential development which is either ancillary to a permitted use in this zone or in accordance with a comprehensive masterplanned residential estate integrated with surrounding land uses, and f) to allow shops, other than bulky goods shops, only if they are associated with and ancillary to industry or if they service the day-to-day needs of the immediate neighbourhood, the travelling public or the local workforce.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
3(g) District Business	a) to provide a district centre with retail, commercial, community and recreational facilities, which are fully serviced, drained and landscaped, to meet the requirements of the Narellan growth area, and b) to provide medium density residential development on any part of the land included in this zone which is not required for development for other purposes permissible in this zone.	The Amended Project is considered consistent with the objectives of this zone.
4(a) General Industrial	a) to set aside land for the purposes of industry (other than offensive or hazardous industry) and bulk warehousing separated from, but with convenient access to, sources of employment in the Municipality of Camden and having convenient access to the Macarthur and adjoining regions, and b) to facilitate the expansion of existing industry and the establishment of new industry in order to expand the local economic base and local employment opportunities, and c) to minimise any adverse effect of industry on the activities in other zones, and d) to allow shops within this zone only if they are associated with and ancillary to industry or if they service the day to day needs of the local industrial workforce, and e) to allow commercial premises only where they are associated with and ancillary to development for industrial, manufacturing, warehousing or similar purposes on the same land.	The Amended Project is considered consistent with the objectives of this zone.
4(b) Service Industrial	a) to set aside land for: i. the purposes of service industries, and ii. the display and retailing of generally large scale merchandise requiring extensive site area or a free standing location for the transfer of goods, but only where such activities cannot be appropriately located in, and would not adversely affect the range and competitiveness of merchandise offered in, the retail and commercial zones elsewhere in the Municipality of Camden, and b) to permit the sale of spare parts and finished goods where: i. the sale of goods and parts will be and will remain ancillary to the principal service industry aspect of the business on the same land, and ii. the finished goods would, under normal circumstances, require maintenance or repair services by the service industry on the same land, and c) to permit the low volume sale of hand made goods that are manufactured on the same land.	The Amended Project is considered consistent with the objectives of this zone.
5(a) Special Uses	The objectives are to identify land that has been acquired or has been precisely identified for acquisition by a public authority, and for the purpose indicated on the map.	The Amended Project is considered consistent with the objectives of this zone.
5(b) Special Uses – Arterial Road	The objective is to identify lands required for existing arterial roads.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
6(d) Regional Open Space	The objective is to identify land acquired for regional open space purposes.	The Amended Project is considered consistent with the objectives of this zone.
7(d1) Environmental Protection (Scenic)	The objectives are to identify and protect the scenic qualities of the environment which enhance visual amenity.	The Amended Project is considered consistent with the objectives of this zone.
7(d2) Environmental Protection (Urban Edge)	a) to contribute to Camden's "sense of place" and unique landscape character, and b) to achieve land that is managed for the purpose of biodiversity protection, where such land has been identified in a plan of management or covenant, to enhance the scenic quality of the area, by protecting ridgetops and upper slopes from development and by revegetating them with indigenous vegetation, as appropriate, and c) to permit limited development of detached dwelling-houses consistent with the other objectives of this zone.	The Amended Project is considered consistent with the objectives of this zone.
7(d3) Environmental Protection (Bushland Conservation and Restoration)	a) to achieve land that is managed for the principal purpose of biodiversity protection, where such land has been identified in a plan of management or covenant, and b) to conserve, restore and enhance the native fauna and flora habitat and the ecological viability of the land identified for biodiversity protection purposes, and c) to restore bushland to viability and to protect it from activities likely to threaten its viability, and d) to conserve the Aboriginal heritage values of the land, and e) to enable development of the land only where it can be demonstrated that the development will not destroy, damage, or compromise the extent, quality or integrity of the ecological or Aboriginal heritage attributes of the land.	The Amended Project is considered consistent with the objectives of this zone.
Camden Local Environmental Plan No. 48		
1(a) Rural "A" (40 ha)	a) to provide suitable land for agricultural use, b) to promote the conservation of economic units of productive agricultural land, particularly those areas designated as having prime crop and pasture potential, by regulating subdivision to prevent the fragmentation of actual or potentially productive rural holdings, c) to enable compatible forms of development, including recreation and tourist orientated uses to be carried out, if they are in keeping with the rural character of the locality, and carried out in an environmentally sensitive manner, d) to permit the development of extractive industries to occur in an environmentally acceptable manner, and e) to ensure that development does not detract from the existing rural character of the area or create unreasonable or uneconomic demands for provision or extension of public amenities and services.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
1(b) Rural "B" (2 ha)	a) to provide for rural residential living opportunities on land having ready access to urban areas and facilities, b) to ensure that development maintains and contributes to the rural character of the locality and minimises disturbances to the landscape and agricultural productivity, c) to ensure that development does not adversely affect rural and residential amenity and does not create unreasonable or uneconomic demands for provision or extension of public amenities and services, and d) to make provision for a reasonable range of suitable activities associated with rural residential occupations of the land, and e) to permit alternative forms of accommodation which do not imperil the rural productivity of the area and which are consistent with the environmental quality of the immediate area.	The Amended Project is considered consistent with the objectives of this zone.
1(c) Rural "C" (0.4 ha)	a) to provide for small holding rural residential living opportunities on land not being of prime crop or pasture potential and having ready access to urban areas and facilities, b) to control by means of a development control plan the density of development for land within the zone considering access, natural hazards, landscape quality and physical environment, c) to provide for such community uses as are necessary to meet community needs generated in this zone, and d) to ensure development is carried out in a manner that minimises risk from natural hazards, particularly bushfires and flooding, and does not detract from the scenic quality of the rural area, and e) to permit alternative forms of accommodation which do not imperil the rural productivity of the area and which are consistent with the environmental quality of the immediate area.	The Amended Project is considered consistent with the objectives of this zone.
5(a) Special Uses "A" Zone (Water Supply)	The objective of this zone is to make provision for particular specialised uses identified on the map and purposes ordinarily incidental or subsidiary to those uses.	The Amended Project is considered consistent with the objectives of this zone.
5(b) Special Uses (Arterial Road Reservation)	The objective of this zone is to identify land required for existing arterial roads.	The Amended Project is considered consistent with the objectives of this zone.
5(c) Special Uses (Botanic Gardens)	a) to provide for the development of a native botanic garden and arboretum in an efficient and effective manner having regard to the environmental characteristics of the subject land, and b) to provide for public access to a unique passive recreation and educational resource.	The Amended Project is considered consistent with the objectives of this zone.
7(d) Environmental Protection (Scenic)	a) to protect and enhance those areas of particular scenic value and ensure that the land remains a rural environment providing visual contrast to urban development, b) to maintain the visual amenity of prominent ridgelines, c) to enable cluster housing and recreation and tourist orientated uses to be carried out if they are in keeping with the	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	environmentally sensitive nature of the zone, and d) to prevent development in geologically hazardous areas and escarpment areas.	
Camden Local Environmental Plan No. 74 – Harrington Park		
1(e) Rural "E" (0.6 ha)	a) to provide for small holding rural residential living opportunities on land not being of prime crop or pasture potential and having ready access to urban areas and facilities, b) to ensure development is carried out in a manner that minimises risk from natural hazards, particularly bushfires and flooding, and does not detract from the scenic quality of the rural area, c) to permit alternative forms of accommodation which do not imperil the rural productivity of the area and which are consistent with the environmental quality of the immediate area.	The Amended Project is considered consistent with the objectives of this zone.
1(f) Rural "F" (0.2 ha)	a) to provide for small holding rural residential living opportunities having ready access to urban areas and facilities on land that does not have prime crop or pasture potential, b) to ensure development is carried out in a manner that minimises risk from natural hazards, particularly bush fires and flooding, c) to permit housing forms which are consistent with the environmental and scenic quality of the area, d) to ensure that the scenic impact of development is minimised, e) to encourage the retention and provision of a range of facilities related to horse agistment and horse riding activities.	The Amended Project is considered consistent with the objectives of this zone.
2 (d) Residential	a) to promote a distinctive character and quality of development, based on the historic and natural characteristics of the land, b) to allow the provision of a range of housing types, c) to promote the provision of accessible and convenient commercial, social, recreational, educational, religious, community and employment facilities close to public transport so as to serve the needs of the residential district for education, recreation, religious, community service and welfare activities, d) to provide an appropriate urban drainage system in an environmentally sensitive manner that provides a dual use facility for control of stormwater and for recreational use, e) to provide a visual and auditory buffer between residential areas and Camden Valley Way and The Northern Road, f) to allow open space for such active and passive recreation as may be required for proper accessibility and distribution in relation to the population generally and to young children in particular, g) to allow land for pedestrian and cycle routes between areas of activity, h) to protect and enhance areas of landscape and vegetation significance, i) to protect the ecological integrity of bush and riparian corridors by facilitating sensitive development on land adjoining land within Zone No 7 (a) and Zone No 7 (d4) and integrating existing bushland into planning for open space and active recreation areas, j) to ensure that development retains the significance of heritage items and archaeological sites and their settings and	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	does not adversely impact on significant views, k) to protect the rural character of Cobbitty Road.	
5(a) Cultural Landscape	The objective is to conserve the heritage significance of the cultural landscape of Harrington Park, Orielton and Wivenhoe, including buildings, associated structures and surrounding vistas.	The Amended Project is considered consistent with the objectives of this zone.
5(e) Special Uses – Water Management	a) to ensure that Narellan Creek maintains its primary function as a water quality system, b) to preserve and enhance vegetation within and adjacent to Narellan Creek, c) to restrict development that would have a detrimental effect on water quality, d) to ensure adequate land is set aside for drainage and water quality management purposes.	The Amended Project is considered consistent with the objectives of this zone.
6(a) Open Space	The objectives are to ensure there is provision of adequate open space to meet the needs of all residents and provide opportunities to enhance the cultural landscape of Harrington Park Homestead.	The Amended Project is considered consistent with the objectives of this zone.
6(e) Open Space – Waterway Buffer	a) to provide a visual and physical riverine buffer between residential development and Narellan Creek so as to protect and enhance the function and amenity of the creek system, b) to ensure that land adjoining Narellan Creek is maintained for open space or public recreational purposes. c) to restrict development that would adversely affect the water quality in Narellan Creek, d) to allow development that fosters the public enjoyment of the foreshores of the creek system without compromising the environmental quality of such system.	The Amended Project is considered consistent with the objectives of this zone.
7(a) Environmentally Sensitive Land	a) to ensure the protection and management of environmentally sensitive land for the principal purpose of biodiversity conservation, b) to conserve, restore and enhance native flora and fauna habitat and the ecological viability of land identified for biodiversity protection purposes, c) to provide for development of a limited scale to support passive recreation and ecological interpretation, d) to foster habitat connectivity by providing links with other natural areas, as part of an open space and bush corridor network, e) to conserve, restore and enhance the functions and habitats of watercourses and their associated riparian areas.	The Amended Project is considered consistent with the objectives of this zone.
7(d4) Environmental Protection (Eco-Residential)	a) to provide for residential development that incorporates design, construction and operational practices that significantly reduce or eliminate negative impacts on the environment through energy efficiency, water conservation, pollution prevention, biodiversity conservation and reducing resource consumption, b) to ensure a distinctive character and urban form that reflects and responds to the natural context of the area and minimises bush fire risk, c) to provide a subdivision pattern which allows for pedestrian and vehicular connectivity and permeability,	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	d) to provide sustainable water quality and quantity controls, e) to ensure that subdivision design retains significant remnant native trees while still achieving an urban setting for housing and associated infrastructure, f) to ensure that development retains the significance of heritage items and archaeological sites and their settings and does not adversely impact on significant views, g) to protect the rural character of Cobbitty Road.	
Camden Local Environmental Plan No. 117 – Elderslie Release Area		
2(d) Residential	a) to permit a range of compatible activities which will support residential development, and b) to provide for a range of housing types, which takes into account accessibility, open space and scenic considerations, and c) to provide for a village centre which is a focal point for transport and community activities and allows an appropriate range of retail, commercial, residential, community and recreational activities, and d) to provide for a subdivision pattern which allows for connectivity with the adjoining existing suburban areas and permeability within the urban village, particularly for pedestrians and cyclists, and e) to conserve the significance of Rheinberger's Hill and its setting as a prominent visual gateway to Camden, and f) to ensure that development retains the heritage significance of heritage items, potential heritage items and archaeological sites and their settings and conserves significant views, and g) to protect residential amenity in relation to noise from the Camden By-pass, and h) to preserve areas of substantial remnant vegetation and integrate them within open space and biodiversity planning, and i) to provide for a variety of recreation forms within the open space areas, and j) to require urban drainage to provide a variety of sustainable water quality and quantity controls, and k) to allow for educational, recreational, community and religious activities which support the wellbeing of the community.	The Amended Project is considered consistent with the objectives of this zone.
6(b) Open Space Proposed	The objective of this zone is to identify land intended to be acquired by the Council for open space and public recreation purposes.	The Amended Project is considered consistent with the objectives of this zone.
Camden Local Environmental Plan No. 121 – Spring Farm		
2(d) Residential	a) to permit a range of compatible activities which will support residential development, and b) to provide for a range of housing types, which take into account accessibility, open space and scenic considerations, and c) to provide for a subdivision pattern which allows for connectivity with the adjoining existing suburban areas and permeability within the urban village, particularly for pedestrians and cyclists, and	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	d) to provide for a village centre which is a focal point for transport and community activities and allows an appropriate range of retail, commercial, residential, community and recreational activities, and e) to protect the ecological integrity of bush corridors by sensitive development at the interface with land in the Zone No 7 (a) and to integrate existing vegetated areas into planning for open space and active recreation areas, and f) to ensure that development retains the heritage significance of heritage items, potential heritage items and archaeological sites and their settings and conserves significant views, and g) to protect residential amenity in relation to noise from the Camden By-pass and the proposed Spring Farm arterial road, and h) to provide for a variety of recreation forms within open space areas, and i) to require urban drainage to provide a variety of sustainable water quality and quantity controls, and j) to allow for educational, recreational, community and religious activities which support the wellbeing of the community.	
5(b) Special Uses (Local Future and Future Arterial Road)	a) to identify land required for local road use, and b) to control vehicular access to and from roads in the zone so as not to inhibit the free flow of traffic.	The Amended Project is considered consistent with the objectives of this zone.
7(a) Environmentally Sensitive Land	a) to ensure protection and management of environmentally sensitive land for the principal purpose of biodiversity conservation where this land has been identified for this purpose on the Riparian Area and Bush Corridor Land Uses Map, and b) to conserve, restore and enhance native flora and fauna habitat and the ecological viability of land identified for biodiversity protection purposes, and c) to provide a buffer around areas identified for biodiversity protection purposes, and d) to provide for development in locations identified on the Riparian Area and Bush Corridor Land Uses Map that will not destroy, damage or compromise: i. the extent, quality or integrity of the ecological attributes of the land or watercourses, or ii. the potential for restoration and enhancement of native fauna and flora habitat on the land identified for biodiversity protection, or e) to provide links with other natural areas, as part of an open space and bush corridor network.	The Amended Project is considered consistent with the objectives of this zone.
Camden Local Environmental Plan (Camden Lakeside) 2009		
R1 General Residential	- To provide for the housing needs of the community. - To provide for a variety of housing types and densities. - To enable other land uses that provide facilities or services to meet the day to day needs of residents. - To provide for a subdivision pattern which allows for connectivity with adjoining existing suburban areas and	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	permeability within Camden Lakeside, particularly for pedestrians and cyclists. - To provide for a variety of recreation forms within open space areas. - To require urban drainage to provide a variety of sustainable water quality and quantity controls. - To allow for educational, recreational, community and religious activities which support the wellbeing of the community. - To retain a close physical and visual contact with the rural setting.	
RE2 Private Recreation	- To enable land to be used for private open space or recreational purposes. - To provide a range of recreational settings and activities and compatible land uses. - To protect and enhance the natural environment for recreational purposes.	The Amended Project is considered consistent with the objectives of this zone.
E2 Environmental Conservation	- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. - To prevent development that could destroy, damage or otherwise have an adverse effect on those values.	The Amended Project is considered consistent with the objectives of this zone.
Campbelltown Interim Development Order No.		
6(a) Open Space Existing Recreation	No objectives identified.	-
6(b) Regional Open Space	No objectives identified.	-
Campbelltown Interim Development Order No. 15		
5(a) Special Uses (Military Reserve and Water Supply)	No objectives identified.	-
Campbelltown Interim Development Order No. 28		
6(c) Open Space (Regional)	No objectives identified.	-
7(c) Scenic Protection Area	No objectives identified.	-

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
Campbelltown Local Environmental Plan No. 112 – Macquarie Field House		
Macquarie Field House	a) to control the uses to which the land to which this plan applies may be put, b) to conserve the environmental heritage of the land to which this plan applies, c) to protect and enhance the role of the land to which this plan applies in providing a clearly perceived break between urban development in the City of Campbelltown and that in the City of Liverpool by preserving the visual character and landscape quality of that land, d) to protect and enhance the role of the land to which this plan applies in providing a rural backdrop to the residential areas of Glenfield, Macquarie Fields and Ingleburn, e) to protect the quality and nature of the view from the South Western Freeway where it passes through the land to which this plan applies, f) to protect that part of the major urban drainage system for the City of Campbelltown situated on the land to which this plan applies, g) to control, by means of a development control plan, the siting, height, bulk, scale and density of any buildings to be erected on the land to which this plan applies to achieve the objectives stated in paragraphs (c), (d), (e) and (f), and h) to guide, by means of a development control plan, the future landscaping of the land to which this plan applies to achieve the objectives stated in paragraphs (c), (d), (e) and (f).	The Amended Project is considered consistent with the objectives of this zone.
Campbelltown Local Environmental Plan - District 8 (Central Hills Land)		
5(a) Special Uses "A" (Water Supply)	The objective of this zone is to set aside certain land for community purposes.	The Amended Project is considered consistent with the objectives of this zone.
5(c) Special Uses (Proposed Local Roads and Widening)	The objective of this zone is to set aside certain land for proposed local roads and local roads widening.	The Amended Project is considered consistent with the objectives of this zone.
5(g) Special Uses (Botanic Gardens)	The objective of this zone is to set aside certain land for use as a Botanic Garden.	The Amended Project is considered consistent with the objectives of this zone.
6(c) Open Space (Regional)	The objective of this zone is to recognise the regional open space that has been identified by the Department of Environment and Planning.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
7(d1) Environmental Protection (Scenic)	a) to set aside certain land as a protected scenic environment, b) to ensure that that land will remain a rural environment providing visual contrast to the urban areas of Campbelltown, Camden and Liverpool, c) to ensure that the inhabitants of Campbelltown will continue to have views of, and access to, a rural environment, d) to maintain a stock of land that is capable of being developed for the purpose of providing recreation establishments of the kind that require large areas of open space, and e) to preserve existing farming and agricultural research activities.	The Amended Project is considered consistent with the objectives of this zone.
Campbelltown (Urban Area) Local Environmental Plan 2002		
1(a) Rural	The objective of this zone is to identify land that constraints make unsuitable for urban use so that it can be put to long-term agricultural use. A further objective of this zone is to encourage a high quality standard of development which is aesthetically pleasing, functional and relates sympathetically to nearby and adjoining development.	The Amended Project is considered consistent with the objectives of this zone.
1(d) Rural future urban	The objective of this zone is to identify and protect land held in reserve for future urban use. A further objective of this zone is to encourage a high quality standard of development which is aesthetically pleasing, functional and relates sympathetically to nearby and adjoining development.	The Amended Project is considered consistent with the objectives of this zone.
2(b) Residential B	a) to make general provision for land to be used for housing and associated purposes, and b) to permit the development of a range of housing types, and c) to encourage a variety of forms of housing that are higher in density than traditional dwelling houses, including accommodation for older people and people with disabilities, in locations which are accessible to public transport, employment, retail, commercial and service facilities, and d) to allow the carrying out of a reasonable range of activities from dwellings, where such activities are not likely to adversely affect the amenity of the locality, and e) to allow development which: i. is compatible with residential use, and ii. is capable of visual integration with the surrounding buildings, and iii. serves the needs of the surrounding population without conflicting with the residential intent of the zone, and iv. does not place demands on services beyond the level reasonably required for residential use.	The Amended Project is considered consistent with the objectives of this zone.
3(c) Neighbourhood Business	a) to provide conveniently located land for a range of shops, commercial premises and professional services that are of a domestic scale, compatible with residential development, and which serve the needs of the local community, and b) to accommodate a restricted range of facilities required in the local community but which are not appropriate on land within Zone 2 (b).	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
4(a) General Industry	a) to encourage activities that will contribute to the economic and employment growth of the City of Campbelltown, and b) to allow a range of industrial, storage and allied activities, together with ancillary uses, the opportunity to locate within the City of Campbelltown, and c) to encourage a high quality standard of development which is aesthetically pleasing, functional and relates sympathetically to nearby and adjoining development, and d) to protect the viability of the commercial centres in the City of Campbelltown by limiting commercial activities to those associated with permitted industrial, storage and allied development, and e) to ensure development will not be carried out unless the consent authority is satisfied that the processes to be carried on, the transportation to be involved, or the plant, machinery or materials to be used, do not interfere unreasonably with the amenity of the area.	The Amended Project is considered consistent with the objectives of this zone.
4(b) Industry B	a) to encourage activity that will contribute to economic and employment growth in the City of Campbelltown, and b) to encourage a high quality standard of development which is aesthetically pleasing, functional and relates sympathetically to nearby and adjoining development, and c) to protect the viability of the commercial centres in the City of Campbelltown by limiting commercial activities to those associated with permitted industrial, storage and allied development or primarily intended to provide a professional facility to serve people employed or occupied in land uses permitted in the industrial zones, and d) to permit the display and sale by retail of bulky goods only if such activities cannot appropriately be located in, or would not adversely affect the viability of development in, the business or comprehensive centre zones, and e) to ensure development will not be carried out if the processes to be carried on, the transportation to be involved or the plant, machinery or materials to be used interfere unreasonably with the amenity of the area.	The Amended Project is considered consistent with the objectives of this zone.
4(c) Industry C	a) to encourage activity that will contribute to economic and employment growth in the City of Campbelltown, and b) to encourage a high quality standard of development which is aesthetically pleasing, functional, and relates sympathetically to nearby and adjoining development, and c) to protect the viability of the commercial centres in the City of Campbelltown by limiting commercial activities to those associated with permitted industrial, storage and allied development, and d) to permit the display and sale by retail of bulky goods only if such activities cannot appropriately be located in, or would not adversely affect the viability of development in, the comprehensive centre zones, and e) to ensure development shall not be carried out if the processes to be carried on, the transportation to be involved or the plant, machinery or materials to be used interfere unreasonably with the amenity of the area, and f) to ensure that development does not unreasonably affect the amenity of existing dwellings on land in the zone.	The Amended Project is considered consistent with the objectives of this zone.
5(a) Special Uses A	a) to provide land for special uses which would otherwise be prohibited by the zoning of the surrounding area, and b) to identify land used or required for railway purposes.	The Amended Project is considered consistent with

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
		the objectives of this zone.
5(b) Special Uses (Arterial Roads)	a) to identify land required for existing or proposed arterial roads (including the widening of existing roads), and b) to control vehicular access to and from roads in the zone so as not to inhibit the free flow of traffic on arterial roads, and c) to allow for the development of such land prior to its acquisition for road purposes.	The Amended Project is considered consistent with the objectives of this zone.
5(c) Special Uses (Sub-arterial Roads)	a) to identify land required for existing or proposed sub-arterial roads (including the widening of existing roads), and b) to control vehicular access to and from roads in the zone so as not to inhibit the free flow of traffic on sub-arterial roads, and c) to allow for the development of such land prior to its acquisition for road purposes.	The Amended Project is considered consistent with the objectives of this zone.
5(d) Special Uses (Local Roads)	a) to identify land required for proposed local roads (including the widening of existing roads), and b) to allow for the development of such land prior to its acquisition or dedication for use for roads.	The Amended Project is considered consistent with the objectives of this zone.
5(e) Special Uses (Public Purpose Corridor)	a) to reserve land through which major linear elements of regional infrastructure may be constructed across the urban area of the City of Campbelltown, and b) to assist in structuring the urban area of the City of Campbelltown, specifically, by physically separating the suburbs of Ingleburn and Minto, and c) to bring a rural landscape into part of the urban area of the City of Campbelltown, and d) to provide recreational and environmental education opportunities for the local community until the land is required for some element of regional infrastructure, and e) subject to paragraph (d), to provide opportunities for land uses which can be removed, at no cost to the public sector, from any land required for any element of regional infrastructure which is to pass through the corridor and which is compatible with other development in or adjoining the corridor.	The Amended Project is considered consistent with the objectives of this zone.
6(a) Local Open Space	a) to ensure there is provision of adequate open space to meet the existing and future needs of residents and to provide opportunities to enhance the environmental quality of the City of Campbelltown, and b) to identify land which is owned, or proposed to be owned, by the Council and to provide for the acquisition or dedication of this land for open space or public recreational purposes, and c) to identify land which is owned by the Crown and is under the care, control and management of the Council as public open space, and d) to protect and preserve areas of urban bushland which are considered valuable because of their natural heritage significance or recreational, educational, aesthetic or scientific values, and e) to provide opportunities for recreation and the provision of community facilities on publicly owned land.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
6(c) Private Open Space	a) to identify areas where private recreation facilities are or may be developed, and b) to allow a limited range of other activities which will not detract significantly from the character of the locality or the amenity of any existing or proposed development in the locality.	The Amended Project is considered consistent with the objectives of this zone.
7(d1) Environmental Protection (100 ha)	a) to set aside certain land as a protected rural environment, and b) to ensure that the land will retain a rural environment providing visual contrast to the urban area of the City of Campbelltown, and c) to ensure that the inhabitants of the City of Campbelltown will continue to have views of, and access to, a rural environment, and d) to maintain a stock of land that is capable of being developed for the purpose of providing recreation establishments and other land uses of the kind that require large areas of open space, and e) to preserve existing farming and agricultural research activities.	The Amended Project is considered consistent with the objectives of this zone.
7(d4) Environmental Protection (2 ha)	a) to identify and protect land and watercourses forming part of the Georges River catchment area, and b) to conserve the rural character of the area by maintaining a minimum area of 2 hectares for lots used for rural living, and c) to protect environmentally important land and watercourses possessing scenic, aesthetic, ecological or conservation value, and d) to allow some diversity of development, but only where it is unlikely to have a detrimental effect on the quality and character of the locality or the amenity of any existing or proposed development in the locality.	The Amended Project is considered consistent with the objectives of this zone.
7(d6) Environmental Protection (0.4 ha)	a) to permit intensive rural-residential living on land which can be provided with sewage reticulation (but, because of scenic quality or for other reasons, has not been zoned residential) by allowing a minimum lot size of 0.4 hectare, and b) to allow some diversity of development, but only where it is unlikely to have a detrimental effect on the quality or character of the locality or the amenity of any existing or proposed development in the locality.	The Amended Project is considered consistent with the objectives of this zone.
9 Community Uses	The objective of this zone is to provide conveniently located land for a range of facilities that are of a domestic scale, compatible with residential development and serve the community. A further objective of this zone is to encourage a high quality standard of development which is aesthetically pleasing, functional and relates sympathetically to nearby and adjoining development.	The Amended Project is considered consistent with the objectives of this zone.
10(a) Regional Comprehensive Centre	a) to provide land for the City of Campbelltown and the Macarthur region's largest centre of commerce, and b) to encourage employment and economic growth, and c) to accommodate tertiary education and hospital facilities for the City of Campbelltown and the Macarthur region, and d) to accommodate a wide range of cultural, entertainment and like facilities, and e) to permit limited industrial uses that are compatible with the proper operation of a major regional centre, and f) to encourage a variety of forms of higher density housing, including accommodation for older people and people with	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	disabilities in locations which are accessible to public transport, employment, retail, commercial and service facilities.	
10(b) District Comprehensive Centre	a) to provide space for a wide range of retail, commercial and like needs to serve the districts within the City of Campbelltown, and b) to encourage employment and business activities in order to promote the economic well-being of the community, and c) to accommodate a range of cultural, entertainment and like facilities for the benefit of the community, and d) to permit limited industrial uses that are compatible with the proper operation of a commercial centre serving a district, and e) to encourage a variety of forms of higher density housing, including accommodation for older people and people with disabilities, in locations which are accessible to public transport, employment, retail, commercial and service facilities.	The Amended Project is considered consistent with the objectives of this zone.
Camden LEP 2010 (Draft at Project Application)		
B1 Neighbourhood Centre	- To provide a range of small-scale retail, business and community uses that serve the needs of people who live or work in the surrounding neighbourhood. - To encourage mixed use developments to present an active frontage to the street by locating business, retail and community uses at ground level. - To minimise conflict between land uses within the zone and land uses within adjoining zones. - To enable other land uses that are complementary to and do not detract from the viability of retail, business and community uses within the zone.	The Amended Project is considered consistent with the objectives of this zone.
B2 Local Centre	- To provide a range of retail, business, entertainment and community uses that serve the needs of people who live in, work in and visit the local area. - To encourage employment opportunities in accessible locations. - To maximise public transport patronage and encourage walking and cycling. - To ensure that mixed use developments present an active frontage to the street by locating business, retail and community uses at ground level. - To minimise conflict between land uses within the zone and land uses within adjoining zones. - To enable other land uses that are complementary to and do not detract from the viability of retail, business, entertainment and community uses within the zone.	The Amended Project is considered consistent with the objectives of this zone.
B4 Mixed Use	- To provide a mixture of compatible land uses. - To integrate suitable business, office, residential, retail and other development in accessible locations so as to maximise public transport patronage and encourage walking and cycling. - To minimise conflict between land uses within the zone and land uses within adjoining zones. - To encourage development that supports or complements the primary office and retail functions of the local centre zone.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
B5 Business Development	- To enable a mix of business and warehouse uses, and bulky goods premises that require a large floor area, in locations that are close to, and that support the viability of, centres. - To encourage development that supports or complements the primary office and retail functions of the local centre zone. - To enable other land uses that are complementary to and do not detract from the viability of retail, business and warehouse uses within the zone.	The Amended Project is considered consistent with the objectives of this zone.
E1 National Parks and Nature Reserves	- To enable the management and appropriate use of land that is reserved under the *National Parks and Wildlife Act 1974* or that is acquired under Part 11 of that Act. - To enable uses authorised under the *National Parks and Wildlife Act 1974*. - To identify land that is to be reserved under the *National Parks and Wildlife Act 1974* and to protect the environmental significance of that land.	The Amended Project is considered consistent with the objectives of this zone.
E2 Environmental Conservation	- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. - To prevent development that could destroy, damage or otherwise have an adverse effect on those values. - To protect and enhance the ecology, hydrology and scenic views of waterways, riparian land, groundwater resources and dependent ecosystems.	The Amended Project is considered consistent with the objectives of this zone.
E4 Environmental Living	- To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values. - To ensure that residential development does not have an adverse effect on those values.	The Amended Project is considered consistent with the objectives of this zone.
IN1 General Industrial	- To provide a wide range of industrial and warehouse land uses. - To encourage employment opportunities. - To minimise any adverse effect of industry on other land uses. - To support and protect industrial land for industrial uses. - To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area. - To enable non-industrial land uses that are compatible with and do not detract from the surrounding industrial and warehouse land uses.	The Amended Project is considered consistent with the objectives of this zone.
IN2 Light Industrial	- To provide a wide range of light industrial, warehouse and related land uses. - To encourage employment opportunities and to support the viability of centres. - To minimise any adverse effect of industry on other land uses. - To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area. - To support and protect industrial land for industrial uses. - To enable non-industrial land uses that are compatible with and do not detract from the surrounding industrial and warehouse land uses.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
R1 General Residential	- To provide for the housing needs of the community. - To provide for a variety of housing types and densities. - To enable other land uses that provide facilities or services to meet the day to day needs of residents. - To allow for educational, recreational, community and religious activities that support the wellbeing of the community. - To minimise conflict between land uses within the zone and land uses within adjoining zones.	The Amended Project is considered consistent with the objectives of this zone.
R2 Low Density Residential	- To provide for the housing needs of the community within a low density residential environment. - To enable other land uses that provide facilities or services to meet the day to day needs of residents. - To allow for educational, recreational, community and religious activities that support the wellbeing of the community. - To minimise conflict between land uses within the zone and land uses within adjoining zones.	The Amended Project is considered consistent with the objectives of this zone.
R3 Medium Density Residential	- To provide for the housing needs of the community within a medium density residential environment. - To provide a variety of housing types within a medium density residential environment. - To enable other land uses that provide facilities or services to meet the day to day needs of residents. - To encourage redevelopment of land for medium density housing in locations close to main activity centres within the Camden local government area. - To minimise conflict between land uses within the zone and land uses within adjoining zones.	The Amended Project is considered consistent with the objectives of this zone.
R5 Large Lot Residential	- To provide residential housing in a rural setting while preserving, and minimising impacts on, environmentally sensitive locations and scenic quality. - To ensure that large residential lots do not hinder the proper and orderly development of urban areas in the future. - To ensure that development in the area does not unreasonably increase the demand for public services or public facilities. - To minimise conflict between land uses within this zone and land uses within adjoining zones.	The Amended Project is considered consistent with the objectives of this zone.
RE1 Public Recreation	- To enable land to be used for public open space or recreational purposes. - To provide a range of recreational settings and activities and compatible land uses. - To protect and enhance the natural environment for recreational purposes.	The Amended Project is considered consistent with the objectives of this zone.
RE2 Private Recreation	- To enable land to be used for private open space or recreational purposes. - To provide a range of recreational settings and activities and compatible land uses. - To protect and enhance the natural environment for recreational purposes.	The Amended Project is considered consistent with the objectives of this zone.
RU1 Primary Production	- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. - To encourage diversity in primary industry enterprises and systems appropriate for the area. - To minimise the fragmentation and alienation of resource lands. - To minimise conflict between land uses within this zone and land uses within adjoining zones. - To permit non-agricultural uses which support the primary production purposes of the zone.	The Amended Project is considered consistent with the objectives of this zone.

Land Use Zone	Objectives of Land Use Zone	Consistency with the Amended Project
	- To maintain the rural landscape character of the land.	
RU2 Rural Landscape	- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. - To maintain the rural landscape character of the land. - To provide for a range of compatible land uses, including extensive agriculture. - To protect and enhance areas of scenic value by minimising development and providing visual contrast to nearby urban development. - To maintain the visual amenity of prominent ridgelines. - To permit non-agricultural uses which support the primary production purposes of the zone.	The Amended Project is considered consistent with the objectives of this zone.
RU4 Primary Production Small Lots	- To enable sustainable primary industry and other compatible land uses. - To encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature. - To minimise conflict between land uses within this zone and land uses within adjoining zones.	The Amended Project is considered consistent with the objectives of this zone.
SP1 Special Activities	- To provide for special land uses that are not provided for in other zones. - To provide for sites with special natural characteristics that are not provided for in other zones. - To facilitate development that is in keeping with the special characteristics of the site or its existing or intended special use, and that minimises any adverse impacts on surrounding land.	The Amended Project is considered consistent with the objectives of this zone.
SP2 Infrastructure	- To provide for infrastructure and related uses. - To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The Amended Project is considered consistent with the objectives of this zone.

Local Environmental Plans and Interim Development Orders

Several local environmental plans and interim development orders apply to the land the subject of the Amended Project, as listed above. The application of these plans was considered in the permissibility analysis contained in **Section 3.2.3** and also in **Table 24**. In addition, some of the local planning instruments include matters for consideration when determining development applications that are relevant to the Amended Project, as outlined in **Table 25**.

Table 25 Relevant Provisions – Local Planning Instruments

Relevant Provision	Comment
Camden Local Environmental Plan No. 45	
No relevant provisions applicable to the Amended Project.	
Camden Local Environmental Plan No. 46	
No relevant provisions applicable to the Amended Project.	
Camden Local Environmental Plan No. 47	
Clause 30 The consent authority may grant consent to the carrying out of development on an archaeological site that has Aboriginal heritage significance (such as a site that is the location of an Aboriginal place or a relic, within the meaning of the *National Parks and Wildlife Act 1974*) or a potential archaeological site that is reasonably likely to have Aboriginal heritage significance only if: a) it has considered an assessment of how the proposed development would affect the conservation of the site and any relic known or reasonably likely to be located at the site prepared in accordance with any guidelines for the time being notified to it by the Director-General of National Parks and Wildlife; and b) except where the proposed development is integrated development, it has notified the local Aboriginal communities of the development application and taken into consideration any comments received in response within 21 days after the notice was sent.	Well surface location CU06 and associated GGL and access road lie on land to which Camden LEP No. 47 applies, and in proximity to heritage item CG-IA-04. The Aboriginal heritage impacts of the Amended Project are addressed in **Section 5.4** and **Appendix G** of this Submissions Report. Heritage item CG-IA-04 would not be directly affected by the Amended Project and would be fenced during construction to protect it. Other heritage items within the area covered by Camden LEP No. 47 are sufficiently distanced from proposed works so as to be unlikely to be directly or indirectly affected by the Amended Project.
Camden Local Environmental Plan No. 48	
Clause 24(3) The consent authority must take into consideration the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item.	The Main Gas Gathering Spine Line and the GGL and access road associated with well surface location CU10 lie on land the subject of Camden LEP No. 48, and in proximity to known Aboriginal heritage items as well as the listed Upper Canal. Other infrastructure on land covered by Camden LEP No. 48 is sufficiently distanced from known heritage items that it is unlikely to directly or indirectly affect those items. The Aboriginal heritage impacts of the Amended Project are addressed in **Section 5.4** and **Appendix G** of this Submissions Report. The historic heritage impacts of the Amended Project are addressed in **Section 5.5** and **Appendix H**. Based on these assessments, Aboriginal heritage items around the Amended Project and on land covered by Camden LEP No. 48 would be avoided, and fenced during construction for protection. Impacts on the Upper Canal and associated structures would be avoided, and
Clause 25(5) The consent authority must not consent to development involving a heritage item unless it has considered a heritage assessment report or a conservation plan.	
Clause 25B The consent authority must consider the likely effect the proposed development will have on the heritage significance of a heritage item, archaeological site or potential archaeological site, when determining an application for consent to carry out development on	

Relevant Provision	Comment
land in its vicinity. Clause 25D The consent authority may grant consent to the carrying out of development on an archaeological site that has Aboriginal heritage significance (such as a site that is the location of an Aboriginal place or a relic, within the meaning of the *National Parks and Wildlife Act 1974*) or a potential archaeological site that is reasonably likely to have Aboriginal heritage significance only if: a) it has considered an assessment of how the proposed development would affect the conservation of the site and any relic known or reasonably likely to be located at the site prepared in accordance with any guidelines for the time being notified to it by the Director-General of National Parks and Wildlife; and b) except where the proposed development is integrated development, it has notified the local Aboriginal communities (in such a way as it thinks appropriate) of the development application and taken into consideration any comments received in response within 21 days after the notice was sent; and c) it is satisfied that any necessary consent or permission under the *National Parks and Wildlife Act 1974* has been granted. The consent authority may grant consent to the carrying out of development on an archaeological site that has non-Aboriginal heritage significance or a potential archaeological site that is reasonably likely to have non-Aboriginal heritage significance only if: a) it has considered an assessment of how the proposed development would affect the conservation of the site and any relic known or reasonably likely to be located at the site prepared in accordance with any guidelines for the time being notified to it by the Heritage Council; and b) it is satisfied that any necessary excavation permit required by the *Heritage Act 1977* has been granted.	AGL has committed to ongoing consultation with SCA in relation to this issue. Submissions have been made by the Office of Environment and Heritage (including that part of the Office formerly comprising the National Parks and Wildlife Service) and the then Department of Planning (Heritage Branch, reflecting the views of the Heritage Council). Issues raised in these submissions have been addressed in this Submissions Report. As State Significant Development under Division 4.1, Part 4 of the EP&A Act, the Amended Project does not require separate Aboriginal heritage impact permits under the *National Parks and Wildlife Act 1974* or approvals or permits under the *Heritage Act 1977*.
Clause 29 The consent authority must take into consideration the extent to which clearing would adversely affect the amenity of the natural and rural landscape	The assessment of flora and fauna impacts in **Sections 3.3** and **5.2** and **Appendix** E of this Submissions Report highlight the limited extent of clearing that would be required for the Amended Project. Given that the vegetation is question has been assessed as being in a disturbed and fragmented, it is unlikely that this minor level of vegetation clearing would adversely affect the amenity of the natural and rural landscape.
Camden Local Environmental Plan No. 74 – Harrington Park	
No relevant provisions applicable to the Amended Project.	

Relevant Provision	Comment
Camden Local Environmental Plan No. 117 – Elderslie Release Area	
No relevant provisions applicable to the Amended Project.	
Camden Local Environmental Plan No. 121 – Spring Farm	
No relevant provisions applicable to the Amended Project.	
Camden Local Environmental Plan (Camden Lakeside) 2009	
No relevant provisions applicable to the Amended Project.	
Campbelltown Interim Development Order No. 13	
No relevant provisions applicable to the Amended Project.	
Campbelltown Interim Development Order No. 15	
No relevant provisions applicable to the Amended Project.	
Campbelltown Interim Development Order No. 28	
No relevant provisions applicable to the Amended Project.	
Campbelltown Local Environmental Plan No. 112 – Macquarie Field House	
No relevant provisions applicable to the Amended Project.	
Campbelltown Local Environmental Plan - District 8 (Central Hills Land)	
Clause 18(2) The consent authority shall not grant consent to development that may affect an item of environmental heritage unless it has made an assessment of: a) the significance of the item as an item of the environmental heritage of the Central Hills Lands; b) the extent to which the carrying out of the development in accordance with the consent would affect the historic, scientific, cultural, social, archaeological, architectural, natural or aesthetic significance of the item and its site; c) whether the setting of the item, and in particular whether any stylistic, horticultural or archaeological features of the setting, should be retained; and d) whether the item constitutes a danger to the users or occupiers of the item or to the public.	Components of the Amended Project are sufficiently distanced from the environmental heritage items listed under Schedule 1 of the Campbelltown LEP – District 8 to avoid potential direct and indirect impacts. Consideration of potential impacts on these items is included in **Section 5.5** and **Appendix** G and **H** of this Submissions Report.
Campbelltown (Urban Area) Local Environmental Plan 2002	
No relevant provisions applicable to the Amended Project.	

The provisions of any proposed instrument that is or has been subject to public consultation

The Camden LEP 2010 was in draft form at the time of Project Application. While the instrument does not strictly apply to the Amended Project, the objectives of this LEP have been considered in **Table 24** and the permissibility has been considered in **Section3.2.3** .The are no other proposed instruments that have been subject to public consultation that would apply to the Amended Project.

The provisions of any development control plan

The following development control plans include guidance relevant to aspects of the Amended Project:

- *Structure of Camden Development Control Plan 2011*;
- *Campbelltown (Sustainable City) Development Control Plan 2009*;
- *Development Control Plan No.83 – Heritage Policy* (Campbelltown); and
- *Section 94A Development Contributions Plan* (Campbelltown).

Structure of Camden Development Control Plan 2011

Part B of the *Structure of Camden Development Control Plan 2011* provides a series of general land use controls applicable to all development proposals in the Camden LGA. These land use controls include provisions relating to environmental management, landscape design, environmental heritage, advertising and signage, and access and parking. The EA for the Northern Expansion Project and this Submissions Report have been reviewed in light of the guidance presented in the Structure of Camden DCP. Based on this review, the Amended Project is considered to be generally consistent with the scope, intent and provisions of the DCP. Relevantly, the provisions of the DCP relating to environmental management would be considered during the preparation and/ or relevant environmental management plans, with relevant and applicable provisions incorporated in the environmental management approach for the Amended Project.

Campbelltown (Sustainable City) Development Control Plan 2009

Part 2 of the *Campbelltown (Sustainable City) Development Control Plan 2009* provides a series of general land use controls applicable to all development proposals in the Campbelltown LGA. Relevant provisions with potential application to the Amended Project include those in relation to flora and fauna, weed management, erosion and sedimentation control, water management, Aboriginal heritage, non-Aboriginal heritage and potentially contaminated land. The assessments presented in the EA for the Northern Expansion Project and in this Submissions Report with respect to the Amended Project are generally consistent with the guidance provided in the DCP, and have either complied with or provided an equivalent outcome to the environmental assessment and development control matters outlined in the DCP. Where the DCP includes guidance on environmental management measures, for example in relation to erosion and sedimentation control, this guidance would be taken into account when preparing and implementing relevant environmental management plans and procedures for the Amended Project.

Development Control Plan No.83 – Heritage Policy

Development Control Plan No.83 – Heritage Policy outlines Campbelltown City Council's policy with respect to protection, management and potential impacts on heritage items within the LGA. The heritage assessments included in the original EA and updated as part of this Submissions Report are generally consistent with the policy guidance presented in the DCP.

Section 94A Development Contributions Plan

Section 94A Development Contributions Plan specifies contributions of 1% of the total capital investment value of developments in the LGA where the capital investment of development exceeds $200,000 (which would be the case for the Amended Project). Given that the Amended Project would not significantly affect or otherwise increase the need for public infrastructure or services, a development contribution of this nature is not considered warranted.

The provisions of any planning agreement that has been entered into

There are no planning agreements that have been entered into, nor are any planning agreements proposed, that relate to the Amended Project.

The provisions of the regulations

Clause 92 of the EP&A Regulation requires consideration of:

- The Government Coastal Policy, for development applications in certain local government areas;
- The provisions of AS2601 for development applications involving the demolition of structures.

Neither of these provisions is relevant to the Amended Project. In particular, the Amended Project is not within one of the LGAs identified in the EP&A Regulation (and is outside the Coastal Zone) and demolition of structures is not proposed.

The provisions of any coastal zone management plan

The Amended Project is not located within the Coastal Zone and there are no coastal zone management plans that apply to the Surface or Subsurface Project Areas.

The likely impacts of the development, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality

The likely impacts of the Amended Project, including environmental impacts on both the natural and built environments, and the social and economic impacts in the locality, are detailed in the EA for the Northern Expansion Project and updated through this Submissions Report in relation to the Amended Project. Together, these documents demonstrate that the environmental impacts of the Amended Project have been avoided or

minimised through careful project design. Key to this approach has been review of the project and further avoidance of impacts in response to issues raised in submissions, with amendments made to the project accordingly. Further, the environmental envelope approach provides AGL with the flexibility to revisit opportunities to avoid or minimise environmental impacts through the detailed design and implementation phases of the project. The Amended Project would make an important contribution to the local social and economic environments, through the generation of employment and investment, and support for the continued operation of the existing CGP.

Suitability of the site for the development

The Amended Project involves the construction, operation and rehabilitation of well surface locations and associated subsurface drilling of lateral in-seam well paths, associated GGLs and access roads. It aims to continue to supply an essential energy resource to NSW with the provision of an alternative and cleaner fuel by comparison to many of the other existing fossil fuels such as coal.

The design of the Amended Project and the assessment of potential impacts presented in the EA and this Submissions Report demonstrates the suitability of the site for development.

The Amended Project is located to the north of the existing CGP and would expand on the existing operations. The Amended Project would tie-in to the existing well fields for the treatment and sale of gas to the NSW energy market. Further, the user market for gas in this region is immediately adjacent to the gas source, thus reducing the consumption of resources in the construction of pipelines to transport the gas to market.

In addition, consultation with land owners has enabled the identification of well surface locations and infrastructure corridors that do not physically conflict with existing or current master plans for future urban (residential, commercial and industrial) development. Environmental compatibility with future land uses has been facilitated through the use of an environmental envelope for well surface locations and an environmental corridor for gas gathering lines and access roads as outlined in **Section 3.1.1**. It is considered that the Amended Project is able to be constructed, operated and decommissioned in a manner which is compatible with both existing and proposed land uses.

Potential impacts have been assessed and are well known due to the existing operations in the area. Based on this experience and knowledge, the Amended Project provides a suitable site for development.

Any submissions made on the development

Issues raised in submissions made in relation to the proposed development have been considered in detail in this Submissions Report. As a result of these issues, and through ongoing consultation with stakeholders, AGL has made several amendments to the development (now the Amended Project) to address and resolve issues of concern, and to further minimise the potential environmental impacts of the development.

The public interest

The Amended Project is in the public interest because:

- it will facilitate the extraction of an important resource;
- it will contribute to the local, regional and State economics through the generation of jobs and investment;
- it will be undertaken in an ecologically sustainable manner, with impacts on the natural, built and social environments mitigated and managed within acceptable limits.

The importance of securing an indigenous, cost-effective energy supply, with lower greenhouse emissions is considered vital to the social and economic growth of both the region and the State.

Gas is being increasingly relied upon as a fuel source for power generation during peak demand periods. Additionally, natural gas is considered to be the cleanest and most environmentally acceptable of the fossil fuels, and with the recent push for more environmentally friendly forms of energy, the demand for natural gas is expected to increase substantially into the future.

There are two main proven conventional gas sources available as gas supplies, the Gippsland Basin in Victoria and the Cooper Basin in South Australia. These sources currently supply the majority of gas to NSW. Gas from the Gippsland Basin (offshore gas fields off the coast of Victoria from Lakes Entrance to Sale) is supplied into the NSW market via the Eastern Gas Pipeline gas distribution network, which has a capacity of 268 TJ/day, at a number of delivery points (e.g. Horsley Park, Wollongong, Nowra etc). Gas from the Cooper Basin in South Australia is supplied into the NSW market via the Moomba-Sydney Pipeline, which has a capacity of 420 TJ/day, at a number of delivery points (e.g. Wilton, Orange, Wagga Wagga etc).

The NSW gas distribution network supplies natural gas to more than 1,040,000 gas consumers via approximately 24,000 kilometres of mains.

- According to the Australian Energy Market Operator (AEMO), winter peak gas demand (1 in 20 probability of exceedence) for NSW/ACT is expected to be 616 terajoules per day (TJ/day) in 2010, 700 TJ/day in 2014 and 766 TJ/day in 2019. 94% of gas supplied into the NSW gas network is imported from interstate.
- The total installed gas pipeline capacity into the NSW/ACT market is 688 TJ/day. Based on AEMO's forecasts, the current gas pipeline capacity will shortfall the winter peak day gas demand by 2014.
- Temporary disruptions to the supply chain can and do cause gas shortages. For example:
    - In 2007, NSW experienced a shortfall of supply resulting from coincident gas demand peaks in NSW, SA, and VIC, requiring the curtailment of large industrial and commercial customers and resulting in an estimated two days lost production for 30-40% of NSW largest commercial and industrial gas customers.
    - In 2008, there was another gas supply shortfall, resulting from an infrastructure failure at the Moomba gas production facility in South Australia which resulted in the curtailment of large industrial and commercial customers for approximately 24 hours.
    - In 2010, there were a number of separate infrastructure failures at the Moomba gas production facility in South Australia. The resulting curtailment of large industrial and commercial customers as a result was only narrowly avoided.

Energy produced from CSG is estimated to generate 55% less greenhouse emissions than conventional coal electricity generation. The CGP is already a source of indigenous gas supply to the NSW energy market. As NSW currently relies heavily on imported gas from Bass Strait in Victoria and Moomba in South Australia, the opportunity exists for the CGP to provide greater security of gas supply in times of interstate disruption.

In regard to alternative energy sources, the Amended Project has been specifically designed to develop and exploit an existing indigenous gas source. CSG is considered to be a superior option for bringing a cleaner and more energy efficient fuel source to the market. CSG produced in NSW represents a small but growing proportion of gas supplied into the NSW gas network. NSW production is currently limited to the CGP which supplies approximately 16 TJ/day or approximately 6% of NSW's gas needs.

The Amended Project would improve gas supply security to NSW and enable it to better meet its growing energy needs by providing an alternative gas source independent of gas field production facilities with ageing infrastructure and existing pipeline capacity constraints.

The ongoing benefits of the Amended Project, with its close proximity to the Sydney market would contribute to the establishment of an indigenous supply of a cleaner energy source. Given the current success of the existing CGP within the south-west region of Sydney, the Amended Project is considered to bring social, economic and environmental benefits to NSW.

Historically, most of NSW gas supply has been provided by the Cooper Basin in South Australia via the Moomba to Sydney pipeline and the distribution network which runs up the New South Wales east coast and through the CGP from the landfall of the Bass Strait fields at Longford (Victoria). The increasing demand for energy, especially the demand for less carbon intensive energy, is continuing to drive the gas market and the subsequent increase in consumption. Further, several National and State policy initiatives designed to encourage the use of lower greenhouse gas intensive fuels have also been implemented. The Amended Project therefore provides a cleaner source of energy that would contribute to alleviate the growing demand for gas resources in the Sydney basin.

The Amended Project represents a significant investment in the region and provides the local community with the impetus to plan for future business and service opportunities in the area.

The Amended Project is therefore considered in the public interest to secure an indigenous gas supply and to provide local and regional economic benefits in an environmentally acceptable manner.

7.0 Revised Statement of Commitments

The Statement of Commitments encompassing mitigation measures for the Amended Project has been revised and is contained in **Table 26**.

Table 26 Statement of Commitments

Issue	Commitment
General	AGL will implement all reasonable and feasible measures to prevent or minimise harm to the environment that may result from the construction, operation or rehabilitation of the Amended Project.
	Surface infrastructure associated with the Amended Project will be located within the Surface Project Area only with activities within the Subsurface Project Area limited to subsurface drilling of lateral well paths.
	The location of supporting infrastructure within the Surface Project Area will be selected generally in line with the following: - If required, increasing the capacity of the existing gas gathering system will be carried out along established gas gathering routes. - If required, re-fracture stimulation of wells would occur at existing well head locations, subject to environmental considerations at the time.
	The location of wells within the Surface Project Area will be selected generally in line with the following: - Well surface infrastructure will be located to avoid areas of native vegetation wherever possible; - Supporting gathering lines will be located in existing disturbed areas wherever possible; and - Access roads will be located in existing disturbed areas wherever possible.
	AGL will provide Camden Council and Campbelltown City Council with the Geographical Positioning System (GPS) co-ordinates and digital survey data for gas well surface locations and gas gathering systems within their respective LGAs, in a format suitable to each council, within three months of the commissioning of the gas wells.
	AGL will provide Camden Council and Campbelltown City Council with the well head configurations of each gas well within three months of the gas wellbeing commissioned.
	AGL will construct the gas gathering system so as not to impede lateral water flows.
	AGL will ensure that no crown or camber remains along the gas gathering systems, following construction.
	The gas gathering system will be designed, constructed and operated in accordance with the Australian Standard for the installation and maintenance of Plastic Pipe Systems for Gas AS 3723-1989 (or its latest version).
	AGL will comply with the following in the construction of the gas gathering system pipeline: - The route of gas gathering and water transport systems and access roads will follow previously or currently disturbed areas wherever possible. - Signs stating the presence of a buried gas pipeline will be erected periodically along the length of the trench once the pipeline has been laid. - Trenches will be restored and reseeded with local grass seeds or a seed blend agreed to by the landowner on completion of the work.
Surface Water	AGL will prepare/ update and implement the Soil and Water Management Sub Plan (SWMSP) for the Amended Project to the satisfaction of the Director-General. The plan will be submitted to the Director-General prior to construction commencing.
	AGL will prepare and implement a Flood Management Plan for wells located within the 1 in 100 year flood level to the satisfaction of the Director-General. The plan will be

Issue	Commitment
	submitted to the Director-General prior to commissioning of those wells, and will include measures to minimise and mitigate flooding impacts associated with the Amended Project.
Groundwater	AGL will continue to monitoring groundwater consistent with the monitoring program conducted to date (refer to **Appendix** C of this Submissions Report)
	AGL will submit the Phase 2 Groundwater Assessment to NOW and continue ongoing consultation activities in relation to groundwater management for the Amended Project. Should the Phase 2 Groundwater Assessment predict groundwater impacts that differ significantly from those considered as part of the assessment of the Amended Project, AGL will identify potential additional mitigation and management measures with the aim of minimising or avoiding adverse groundwater impacts.
	AGL will not use BTEX chemicals (benzene, toluene, ethyl benzene and xylene) as part of the hydraulic fracture stimulation process.
	With respect to drilling fluid management, AGL will apply the following measures: - All fluids will be contained within a closed system (i.e. contained in sealed tanks). - Each drill pad will be constructed with a bund wall that fully encloses the pad and a small lined sump will be constructed to one corner of the pad to capture runoff from the pad. - A bund wall will be provided as a second barrier of containment in the unlikely event of drill fluid spills on the pad. - Sediment fencing will be installed around the drill pad as a third line of defence. - Each drill pad site will be inspected by AGL to ensure compliance with both construction and environmental aspects. A "Daily Shutdown Checklist" will be applied to ensure maintenance and compliance of the drill site. The checklist, to be completed each day by the drilling supervisor on site, will include: • Checks on the drilling mud management, including the closed tank system. • Confirmation that erosion and sedimentation controls are in good condition, including if the sump requires pumping out. • Inspection of the general housekeeping of the site to ensure all is secure and well maintained. • The completed checklist will be submitted to AGL daily. An internal site audit/checklist will be randomly conducted by AGL staff to ensure compliance with environmental controls.
Ecology	AGL will take all reasonable and feasible measures to minimise potential flora and fauna impacts of the Amended Project.
	AGL will take all reasonable and feasible measures to limit the potential spread of noxious weeds.
	AGL will take all reasonable and feasible measures to avoid any potential impacts on the CPW community within the Amended Project Area.
	AGL will revise and implement the existing Landscape and Rehabilitation Management Plan for the CGP detailing landscaping to be undertaken at well surface locations, including a maintenance program for these landscaping works. Landscaping will be undertaken using appropriate native species. Well surface infrastructure will avoid areas of native vegetation wherever possible.
	Where practicable, existing farm vehicle tracks will typically be used as access roads for the construction and maintenance of GGLs and well surface locations.
	No work will be undertaken in areas identified as ‘Avoid by Exclusion’. Should works be required in these areas, further flora and fauna impact assessment will be required. In other locations where native plant communities would or may be disturbed, temporary exclusion fencing will be installed around vegetation that is to be retained with no access to occur in the fenced areas. Signs will be placed on the fencing to identify these areas as “no access zones”.

Issue	Commitment
	Further minor adjustments to the location of GGLs and access tracks will be conducted to avoid native trees and other habitat features such as waterbodies, where possible.
	Trees with hollows will be retained and protected where possible. Earthworks in the vicinity of retained trees will conform to the Australian Standard Protection of trees on development sites, AS 4970 – 2009 (Standards Australia, 2009)
	Trimming of branches along existing access tracks to accommodate heavy plant or large vehicles will be carried out by a qualified arborist. Should large branches with hollows be required to be removed, a suitably qualified ecologist will be on site during clearing to ensure that no resident fauna are harmed. Cleared branches will be placed in adjoining vegetation, to provide potential fauna habitat.
	Pre-clearing fauna surveys will be carried out targeting the Cumberland Plain Land Snail in areas supporting woodlands in moderate to good condition, if these areas are proposed to be directly impacted. Cumberland Plain Land Snails will be relocated into nearby areas that will not be disturbed. A qualified ecologist will be on site during clearing to collect and relocate any fauna disturbed during the clearing phase including inspection of excavated trees stumps for the presence of Cumberland Plain Land Snails following clearing.
	A local wildlife rescue organisation will be contacted should any vertebrate fauna be injured during construction.
	Excess subsoil remaining as a result of displacement from the Main Gas Gathering Spine and GGLs will be removed from the site. Ideally this soil will be used elsewhere on the Project as fill to achieve finished levels around well surface locations. Alternatively this excess soil will be removed following backfilling of trenches and disposed of at a licensed waste facility.
	Sediment and erosion control measures will be installed and maintained during construction particularly in areas where there are sensitive receiving environments such as native vegetation and waterways. Sediment and erosion controls will stay in place until construction footprints and associated disturbed areas are stabilised.
	To prevent the dispersal of weed seed or soil-borne pathogens into regrowth or remnant native vegetation, hygiene protocols will be implemented for vehicles, heavy plant and machinery used for earthworks. This equipment will be washed down prior to entering a site.
	Vehicles and heavy plant movements and parking will be restricted to designated access and storage/parking areas during and post construction at the well surface locations.
	Site supervisors will be provided with the Biodiversity Exclusion and Impact Minimisation maps. The project manager and site supervisors will consult with a suitably qualified ecologist should flora and fauna issues arise during the construction phase.
	Stands of shrubland dominated by *Bursaria spinosa* in well surface locations or GGL areas will be avoided.
	The alignment of GGLs will avoid habitat trees either dead or alive.
	Where areas of native vegetation have been identified as to 'avoid by underbore', a depth of at least 1m will be achieved to avoid sensitive root systems.
Noise and Vibration	With the exception of drilling activities, AGL will conduct construction activities during the following hours: - 7:00am to 6:00pm Mondays to Fridays; - 8:00am to 1:00pm on Saturdays; and - At no time on Sundays or public holidays.

Issue	Commitment
	AGL will implement all reasonable and feasible measures to undertake the Project in a way that minimises the generation of noise.
	AGL will utilise a combination of design measures at well construction sites as required to ensure that noise impacts during the construction period are minimised.
	AGL will update the Construction Noise Management Plan (CNMP) for the CGP to incorporate the Project considering the following issues: - Identification of noise goals. - Identification of residential receivers. - Length of construction. - Hours of construction. - Best practice, construction equipment and noise mitigation. - Noise monitoring. - Community notification. - Complaints handling.
	The use of temporary or permanent barriers (where required) to attenuate noise and acoustically shield residences from drilling during construction of the gas wells will be considered. AGL has consulted with noise attenuation experts, and developed specific noise barriers that can be utilised to mitigate noise during the construction period. Additionally, the barriers have been painted to mitigate visual impact. Such noise barriers could be expected to reduce noise by up to 10dB(A) at the receiver. Other barriers can include shipping containers, fencing, or earth mounds.
	Use of equipment to achieve a noise reduction of approximately 3 dB(A) will be considered. This will include taking advantage of the orientation of noise sources and directing noise away from nearby residences. The actual method by which this reduction may be achieved would depend on the specific drill rig and associated equipment.
	If required for some areas with greater affectation, additional measures such as full-enclosures of well heads or reducing the number of well heads at each location will be considered.
	For under-boring operations within the vicinity of the Upper Canal (if required), a set of in-situ vibration validation tests will be undertaken involving the actual equipment to be used in order to generate a set of Project Specific Vibration versus Distance Curves for the area.
	Management controls such as setting safe working distances for equipment with the potential to cause vibration impacts. This will include: - With respect to gas gathering lines, no construction operations will occur within three metres of the Upper Canal. - The following recommended vibration thresholds will be adopted for the purposes of the Amended Project in areas within the Upper Canal: • Operator warning level – 2.4 mm/s • Operator halt level – 3 mm/s - Should the operator warning level be exceeded, construction works will proceed with caution at a reduced force or load. - Should the operator halt level be exceeded, construction activities will cease and alternative construction techniques would be implemented. - Restricting the use of certain equipment during times of greatest noise sensitivity.
	Where a proposed construction noise mitigation strategy is unlikely to achieve the desired noise reduction and has the potential to leave a residual noise impact, other management measures may be implemented including: - Communication with potentially affected residents regarding the nature and duration of the works, as well as relevant contact details. - Regular inspection and maintenance of equipment to ensure it is in good working order, including the condition of mufflers and enclosures. - Consideration of scheduling noisy work during periods when people are least likely to be affected, having particular regard to schools and residential locations. - Implementation of an effective complaints handling system.

Issue	Commitment
	AGL will undertake a program of noise monitoring once wells are operational in order to validate design of operating well surface locations. A combination of mitigation measures and design options will be applied on a site by site basis, as determined by the results of noise monitoring, to ensure that operational noise is maintained at an acceptable level.
	AGL will monitor vibration of works within the vicinity of the Upper Canal as to ensure its structural integrity is not compromised.
	AGL will comply with acceptable vibration levels as agreed through prior consultation with the SCA.
Air Quality	AGL will implement all reasonable and feasible measures to minimise dust and other emissions generated by the construction and operation of the Amended Project.
Heritage	AGL will revise the existing Cultural Heritage Management Plan for the CGP to reflect the findings of the studies relevant to Project. The revision of the plan will include consultation with OEH and relevant Aboriginal stakeholders, and will be prepared to the satisfaction of the Director-General. The plan will be submitted to the Director General prior to commencing construction, and will include: - A description of the measures that would be implemented for the salvage, relocation or mapping of the archaeological relics as identified in the Aboriginal Heritage Assessment included as **Appendix G** to the Submissions Report. - In accordance with section 146 of the Heritage Act, the AGL will notify the Heritage Council of NSW if any historical archaeological 'relics' (within the meaning of the Heritage Act) are disturbed by the proposed works
Visual	Earthworks, vegetation clearing and soil disturbance will be limited to the construction and operational footprint as appropriate.
	Existing vegetation will be maintained wherever possible.
	Screening in the form of appropriate fencing and landscaping will be implemented at well surface locations as necessary and in accordance with the Landscape and Rehabilitation Management Sub Plan for the Amended Project.
	Appropriate colour schemes will be utilised for each well surface location in order to minimise visual impacts with respect to the existing surrounding environment.
	Initial rehabilitation of the well surface locations and gathering lines will be consistent with the established character of surrounding land.
	Construction activities for the GGLs will be rehabilitated to be consistent with the established character of the land.
	With regard to the future urban (residential, commercial and industrial) land release areas, where well surface locations are expected to be near residential development, material used for fencing or the enclosure will be chosen to integrate with the intended surrounding urban form.
	For well surface locations where residents may be exposed to extended periods of uninterrupted views during construction, mesh or other appropriate fencing will be erected around the construction compound.
Safety and Risk Management	All works will be subject to AGL's Emergency Response Plan and Safety Management System. The plan/ system will be submitted to the Director-General, prior to the commissioning of the Amended Project.
Rehabilitation	On completion of operations, impacted areas will be cleaned up and rehabilitated to return the land to pre-existing use and condition or better in accordance with the EMS. This work will involve: - Sealing/ plugging and abandonment of wells in accordance with relevant guidelines. - Removing plant and equipment from wellheads and removal of fenced compounds. - Filling in excavation. - Rehabilitation, contouring, and regressing/ revegetation.

Issue	Commitment
	These activities would be undertaken in consultation with the relevant landowners.
EMS	AGL will update the existing Environmental Management System (EMS) to provide environmental management practices and procedures to be followed during the operation of the Amended Project. The EMS will include, but not necessarily be limited to: - identification of statutory and other obligations that AGL is required to fulfil in relation to operation of the Amended Project; - a description of the roles and responsibilities for all key personnel involved in environmental management of the Amended Project; - the environmental policies and principles to be applied to the operation of the Amended Project; and - describe in general terms how the environmental performance of the Amended Project would be monitored and managed.
	AGL will commission and pay the full costs of an Independent Environmental Audit of the construction of the gas gathering system, construction of the access roads and drilling and fracture stimulation of gas wells within the CGP. The audit will: - be conducted by a suitably qualified, experienced, and independent person(s) whose appointment has been approved by the Director-General; and - be consistent with ISO 19011:2002 – Guidelines for Quality and/or Environmental Management Systems Auditing, or updated versions of these guidelines/manuals. - assess the environmental performance of the construction of the Project, and its effects on the surrounding environment; - assess whether the development is complying with the relevant standards, performance measures, and statutory requirements; - consider AGL's EMS Sub Plans; and - recommend measures or actions to improve the environmental performance of the construction of the Amended Project, and/or its environmental management and monitoring systems (if required).

8.0 Conclusions

The EA for the Northern Expansion Project and this Submissions Report as it relates to changes made to the Amended Project, have demonstrated that the Amended Project can be undertaken within acceptable environmental limits. Subject to the implementation of mitigation, management and monitoring measures as proposed by AGL, the Amended Project would be designed, constructed, operated and decommissioned with minimal impact on the natural, built and social environments. Application of the principles of Ecologically Sustainable Development at each step of project development has ensured that the Amended Project has avoided or otherwise minimised potential environmental impacts wherever possible.

In responding to issues in submissions, and as part of its ongoing consultation with stakeholders, AGL has made a number of significant improvements to the project (the Amended Project). In doing so, it has further reduced the potential for future land use conflicts, and has managed to totally avoid the need for clearing listed threatened species or communities. Further, and as secondary consequence of amendments made to the project, other environmental impacts (including in relation to noise, traffic, dust and visual amenity) have reduced in some areas. Overall, the Amended Project represents a reduced environmental footprint compared to the Northern Expansion Project presented in the EA, and a superior outcome for both the environment and the local community.

In reducing the environmental impacts of the Amended Project as far as reasonable and feasible to do so, AGL has ensured that the significant benefits for employment and investment will not be overshadowed by the minimal residual environmental issues. The comprehensive suite of mitigation, management and monitoring measures proposed to be implemented by AGL will ensure that predicted low environmental impacts will be achieved.

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9.0 References

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