FINAL

AGL Camden Gas Project – Northern Expansion
AGL Energy Pty Ltd
5 February 2010

AECOM

Northern Expansion of the Camden Gas Project

Environmental Assessment Scoping Report

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Environmental Assessment Scoping Report

Prepared for

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Glossary of Terms

Annual Average Daily Traffic	Traffic in both directions over a 24 hour period, averaged over one year
Camden Gas Project	A major coal seam methane project involving the extraction of gas located within the Southern Coalfields of the Sydney Basin. The Camden Gas Project is a Joint Venture between Sydney Gas (Camden) Operations Pty Limited (Sydney Gas) and AGL Gas Production (Camden) Pty Limited. AGL operates the Camden Gas Project on behalf of the JV.
Coal Seam Methane	A natural gas formed as a by-product during the coalification process whereby organic matter is turned into coal.
Cumulative Effect	Refers to the accumulation of impacts over time.
Distribution Network	Gas distribution network owned by Jemena Gas Networks (NSW) Ltd
Drilling	The perforation of the earth's surface crust by mechanical means, whether the hole caused by the perforation is vertical, inclined or horizontal (Surface to In Seam or SIS) or any future technology, and includes all operations for preventing collapse of the sides of any such hole or for preventing it from being filled with extraneous materials including water.
Ecologically Sustainable Development	Development that aims to meet the needs of the present community without compromising the ecological processes on which life depends for the benefit of future generations.
Emission	The release of constituents into the atmosphere (e.g. gas, steam or noise).
Endangered Species	Those plants and animal species likely to become extinct unless action is taken to remove or control the factors that threaten their survival.
Environment	The physical, biological, cultural, economic and social characteristics of an area, region or site.
Environmental Assessment	The orderly and systematic evaluation of a proposal, including alternatives and objectives, and its effects on the environment, including the mitigation and management of those effects.
Environmental Management	That part of the overall management system which includes organisational structure, planning activities, responsibilities, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policy.
Environmental Management System	The control, training and monitoring measures to be implemented during the design, construction and operation phase of a project in order to avoid, minimise or ameliorate potentially adverse impacts (being socio-economic, cultural, physical, biological) identified during environmental assessments.
Fracture stimulation	A method of fracture stimulation of coal seams to improve the rate and total recovery of gas.
Gas Gathering Line	Pipelines used to collect and transport gas usually at low pressure.
Groundwater	Subsurface water contained within the saturated zone.
Petroleum Exploration Licence	A licence regulated under the Petroleum (Onshore) Act 1991.
Petroleum Production Lease	A lease regulated under the Petroleum (Onshore) Act 1991.
Rehabilitation	The return of previously disturbed land to a stable land surface capable of useful purposes.

Revegetation	The process of re-establishing a vegetative cover.
Risk	Likelihood of a specific undesirable event occurring within specified period or in specified circumstances. Listed as frequency or probability.
Statutory Authority	An authority set up as a requirement of legislation.
Subsurface Drilling	The perforation of subsurface geology by mechanical means. For the purpose of this report, the perforation travels horizontally (SIS) through the target coal seam (along an in-seam path) for distances up to 2500m.
Threatened Species	Animals and plants that are in danger of extinction or may now be considered extinct, but have been seen in the wild in the last 50 years.
Vulnerable Species	Those that may soon become endangered unless action is taken.
Well	A hole made by drilling in connection with exploration for petroleum or operations for the recovery of petroleum.
Well Completion	Is a generic term used to describe the downhole and surface equipment required to enable safe and efficient production from a gas well.
Well Stimulation	Refers to a treatment performed to restore or enhance the productivity of a well.
Well Surface Location	An area that may incorporate up to 6 co-located wells at one site or compound.

Abbreviations

AECOM	AECOM Pty Ltd
AGL	AGL Gas Production (Camden) Pty Limited
AHIMS	Aboriginal Heritage Information Management System
CCC	Community Consultation Committee
CGP	Camden Gas Project
CSM	Coal Seam Methane
GAS PLANT	Gas plant
DECCW	Department of Environment, Climate Change and Water
DEWHA	Department of Environment, Water, Heritage and the Arts
DII	Department of Industry and Investment
DoP	Department of Planning
EA	Environmental Assessment
EASR	Environmental Assessment Scoping Report
EEC	Endangered Ecological Community
EMS	Environmental Management System for the CGP
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPI	Environmental Planning Instrument
EPL	Environment Protection Licence
GIS	Geographic Information System
INP	Industrial Noise Policy
LEP	Local Environmental Plan
LGA	Local Government Area
Northern Expansion	Northern Expansion of the Camden Gas Project
NOW	NSW Office of Water
NSW	New South Wales
PE	Polyethylene
PEA	Preliminary Environmental Assessment
PEL	Petroleum Exploration Licence
PHA	Preliminary Hazard Analysis
POEO Act	Protection of the Environment Operations Act 1997
POP	Production Operations Plan
PPL	Petroleum Production Lease
RPGP	Rosalind Park Gas Plant

SCA	Sydney Catchment Authority
SEPP	State Environmental Planning Policy
SEPP 2005	State Environmental Planning Policy (Major Development) 2005
SIS	Surface to In-Seam
SWGC	South West Growth Centre
TEG	Tri-ethylene Glycol
TSC Act	Threatened Species and Conservation Act

1.0 Introduction

1.1 Background

1.1.1 The Proponent

The Proponent of the project outlined in this Environmental Assessment Scoping Report (EASR) is AGL Gas Production (Camden) Pty Limited (AGL), AGL is a wholly owned subsidiary of AGL Energy Limited.

AGL believes that coal seam methane (CSM) provides a safe and superior alternative energy supply for the New South Wales (NSW) market that is clean, efficient and environmentally friendly when compared to other fossil fuel energy options. As the operator of the Camden Gas Project (CGP), AGL is responsible for the delivery of the proposal in accordance with regulatory requirements, the proponent's Environmental Management System (EMS) and industry best practice.

The proposal is to expand the existing CGP through the establishment of a gas plant and wells at approximately 20 well surface locations, low-pressure gas gathering lines, access roads, and a high pressure supply pipeline. This proposal will be known as the Northern Expansion of the CGP (Northern Expansion).

1.1.2 Petroleum Exploration Licence and Petroleum Production Leases

The CGP is a major CSM project involving the extraction of CSM gas located within the Southern Coalfield of the Sydney Basin. It is bound by Petroleum Exploration License 2 (PEL 2) which extends from Newcastle to Wollongong (see **Figure 1**).

Five Petroleum Production Leases (PPLs) have been granted to allow the production and sale of the gas resource. These leases are known as PPL1, PPL2, PPL4, PPL5 and PPL6 which were issued to the Proponent by the Minister for Mineral Resources pursuant to the *Petroleum (Onshore) Act 1991*.

1.1.3 Existing Camden Gas Project

The CGP is located within the Wollondilly, Camden and Campbelltown local government areas (LGAs). The CGP has been producing gas for the Sydney region since 2001, and currently supplies approximately 6% of the NSW gas market.

The CGP currently consists of 125 wells, low pressure gas gathering lines, access roads, the Rosalind Park Gas Plant and a high pressure gas supply pipeline. The PPLs, planning approvals and development consents for the Project were issued individually from 2002, following initial gas production under Petroleum Assessment Lease 1 (PAL1) issued in November 2000 which became PPL1. PEL 2 surrounds the PPLs, with the ongoing exploration for the future of the project, being conducted within the PPLs and PEL 2.

The EMS for the Project has been developed to satisfy the requirements of the development consents and approvals for environmental management plans (EMPs) and brings these plans together into a project wide management system. There are also environmental management requirements under the PPLs, the Production Operations Plan (POP), PEL 2 and under the Environment Protection Licences (EPLs) which are addressed in the EMS.

The following table summarises the planning approvals for the CGP to date (**Table 1**).

Table 1: Summary of Camden Gas Project

Name / No.	Description	Date of Issue
DA 15-1-2002i Field – RBTP, Apap, Joe Stanley, Johndilo, Loganbrae, Lipscombe, Mahon	Approval granted: - The continued operation of the existing 20 production wells; - Operation of 5 additional wells not yet completed and/or drilled; - Operation of the existing and proposed gas gathering system; - Operation of the existing gas plant (RBTP).	Jul 2002
MOD 53-4-2006	Modification granted for construction, drilling and operation of a directional well (LB11) from LB09.	May 2006
DoP letter of approval 9 Feb 2007	Re-drilling Management Plan for the AP01 and MH01 wells.	Feb 2007
MOD 24-3-2007	Modification granted for the construction, drilling and operation of two Surface to In-Seam (SIS) wells (AP02/AP03) at AP01.	Jul 2007
MOD 3	Modification granted for the Kay Park and Loganbrae Gas Gathering Line twinning modification Project.	Aug 2008
DA 246-8-2002i Field – Kay Park	Approval granted for the connection of three existing wells (KP01, KP02, and KP03) to the Ray Beddoe Treatment Plant, and the continued production and sale of methane gas from the three wells.	Sep 2002
MOD 25-3-2007	Modification granted for the construction, drilling and operation of two SIS wells (KP05 and KP06) at KP01.	Jul 2007
MOD 2	Modification granted for the Kay Park and Loganbrae Gas Gathering Line twinning modification Project.	Aug 2008
DA 282-6-2003-i Fields – RBTP, Rosalind Park, Wandinong, EMAI (EM01-20, 38-40), Glenlee (GL05, 07-10, 14-17)	Approval granted for: - Construction and drilling of 20 wells on the EMAI site; - Operation and production of gas from the existing (drilled) 23 wells and 20 wells to be constructed (a total of 43 wells); - Construction and operation of the gas gathering system; - Construction and operation of the gas treatment plant (RPGP), associated workshop and office facilities; and - Production of up to 14.5 petajoules per annum from the gas treatment plant.	Jun 2004
MOD 72-7-2004	Modification granted for the consent to include land omitted from the development consent, a requirement for an EMP for works in the Campbelltown City Council road reserve, and to allow works to commence prior to the granting of a production lease.	Aug 2004
MOD 5-1-2005	Modification granted for amendment to EMAI Access Road (18-11-2004 Map Ref M240329) and Gathering System (18-11-2004 Map Ref M240328).	Feb 2005
MOD 42-3-2005	Modification Application 42-3-2005 and the letter from Sydney Gas Operations Pty Ltd to the Department dated 14 March 2005, and the accompanying attachments.	Jun 2005
MOD 52-4-2006	Modification granted for the construction, drilling and operation of one directional well (GL16) from GL07 and two directional wells (GL14 and GL15) from GL10.	May 2006
MOD 119-10-2006	Modification granted for the construction, drilling and operation of one directional well (GL16) from GL07 and one directional well (GL15) and one Surface to in-seam well (GL14) from GL10.	Oct 2006

Name / No.	Description	Date of Issue
MOD 124-10-2006	Modification granted for the construction, drilling and operation of one directional well (GL16) from GL07 and two Surface to in-seam wells (GL14 and GL15) from GL10.	Nov 2006
MOD 11-2-2007	Modification granted for the relocation of the Rosalind Park Gas Plant access road.	May 2007
MOD 26-3-2007	Modification granted for the construction, drilling and operation of one SIS well (EM38) at EM20 and upgrading (twinning) of the gas gathering line between MP14-GL10, GL10-GL05, GL05-GL07 and RP03-RP08.	Jul 2007
MOD 9	Modification granted for construction, drilling and operation of two SIS wells (EM39) at EM02 and (GL17) at GL05 and the upgrading (twinning)of the gas gathering line from EM39 to the junction of the gas gathering line and road to the EM03 well, and connection of the new wells to the existing gas gathering system	Apr 2008
DA 183-8-2004-i Fields – Mount Taurus and Menangle Park (MP13-17, MP30)	Approval granted for the following Development: - Connection of 15 existing coal seam methane wells to the Rosalind Park Gas Plant from the Mount Taurus and Menangle Park properties, for the production of methane gas; and - Construction of a Dam at the MT1 gas well site.	Dec 2004
MOD 27-3-2007	Modification granted for the construction, drilling and operation of one SIS well (MP30) at MP13 and upgrading (twinning) of the gas gathering line between MP13 and MP14.	Jul 2007
DA 9-1-2005 Field – Glenlee (incl. EM21/2, GL02, 04, 06, 11-13)	Approval granted for the following Development: - Construction and drilling of well GL11; - Construction of a gas gathering system between four wells at Glenlee and two wells at EMAI; - Connection of six coal seam methane wells to the previously approved Camden Gas Project – Gas Treatment Plant, for the production of methane gas.	May 2005
MOD 51-4-2006	Modification issued for the construction, drilling and operation of a directional well from each of GL02 (GL12) and GL11 (GL13).	May 2006
MOD 28-3-2007	Modification granted for the upgrading (twinning) of the gas gathering line between GL02 and GL05.	Jul 2007
DA 75-4-2005 Field – Sugarloaf	Approval granted for the following Development: - Construction and drilling of seven wells; - Construction of a gas gathering system and access roads; - Connection of the wells to the Camden Gas Project – Gas Treatment Plant; and - Production of methane gas.	Oct 2005
MOD 29-3-2007	Modification granted for the construction, drilling and operation of two SIS wells (SL08 and SL09) at SL03.	Jul 2007
DA 171-7-2005 Field El Bethel NB. Not commenced	Approval granted for: - Construction and drilling of ten wells (EB01 – EB10); - Construction of a gas and water gathering system and access roads; - Connection of the wells to the Rosalind Park Gas Plant; and - Production of methane gas.	Mar 2006

Name / No.	Description	Date of Issue
PA 06_0137 Field Razorback	Approval granted for the construction and drilling of wells RB03-RB12 and gas gathering lines.	Dec 2006
PA 06_0138 Field EMAI (EM23-37)	Approval granted for the construction and drilling of wells EM23-36 and gas gathering lines.	Dec 2006
PA 06_0138 MOD 1	Modification granted for an additional well (EM37).	Jul 2007
PA 06_0291 Spring Farm and Menangle Park	Approval granted for the drilling and operation of four well surface locations in Spring Farm and 12 well surface locations in Menangle Park, with no more than six wells at each well surface location. Approval also granted for associated gas gathering lines, access and for the production and sale of gas.	Sep 2008
Glenlee Modification DA 282-6-2003i	Modification for the re-routing of damaged gas gathering line at Glenlee	Sep 2009

1.2 Proposed Wells and Infrastructure

The Proponent is seeking to develop new gas fields as part of the Northern Expansion of the CGP. The gas plant, wells and infrastructure are being proposed to enable the Proponent to extract and develop gas resources within the vicinity.

The Proponent proposes to construct and operate approximately 20 well surface locations, gas gathering lines and access roads. It is also proposed to construct and operate a gas plant and a high-pressure supply pipeline, along with a southern tie-in to the existing gas fields at Menangle Park. The proposed gas plant, well surface locations and infrastructure are detailed further in **Section 2**.

This EASR provides an overview of the works proposed within the Northern Expansion for which approval is sought. A Project Application supported by an Environmental Assessment (EA) will be prepared and submitted to the Department of Planning (DoP) for consideration.

1.3 Project Context

On 13 June 2003, the Minister declared the CGP as a State Significant development.

On 1 August 2005, planning reforms were introduced to the EP&A Act. Of significance to this project was the introduction of Part 3A of the Act which provides the assessment framework for major projects, previously classified as State Significant development, and other projects declared by the Minister.

The Minister, on 10 October 2005, advised that a Concept Plan must be submitted for the remainder of the development within Stage 2 and for future stages of the CGP, prior to (or concurrently with) seeking Project approval for any part of the development, pursuant to Part 3A of the EP&A Act.

On 17 December 2008, AGL submitted a letter to the DoP requesting the Ministerial Direction for requiring a Concept Plan be removed due to the following:

- A concurrent Concept Application and Project Application was recently prepared (due to the Ministerial Direction) for the areas of Spring Farm and Menangle Park, supported by an Environmental Assessment (EA). After completing the concurrent Concept and Project application process, it is considered that the Concept Approval mechanism did not provide either the community or the government agencies with additional knowledge or information.

- The Spring Farm/ Menangle Park EA included detailed technical assessments on key issues such as Hazard and Risk, Noise and Vibration, Ecology and Indigenous Heritage. These assessments incorporated design measures aimed at minimising impacts as well as complying with and extending the Department of Planning's Locational Guidelines to incorporate the potential co-location of wells at a single surface location (Development in the Vicinity of Operating Coal Seam Methane Wells). The outcomes of the assessments identified that the overall impacts as a result of the CGP were minimal and could largely be addressed in the design process through compliance with the Locational Guidelines as well as additional mitigation requirements from the detailed technical assessments from the EA.
- Following public exhibition of the EA, there were two submissions from the public on the Project Application, one from BHP Billiton and one from a local landowner. There were two submissions from the general public on the Concept Application. Similarly, there were no submissions received from the general public on the EMAI or Razorback Projects (PA 06_0138 and PA 06_0137 respectively), demonstrating that the Project, properly assessed and communicated to the public, isn't considered a complicated or contentious project.
- The nature of CSM gas extraction for the CGP is not comparable to the CSM projects located in Queensland. For example, the Queensland projects, due to their local geology, generate and impact upon large volumes of groundwater, which require detailed technical assessments on impacts to the environment and community. The operation of the CGP has demonstrated that groundwater generation is not a key environmental impact, and has been successfully managed over the last ten years of the Project through EMPs.

For these reasons Concept Approval is not believed to be necessary. In response to the Proponent's request and in consideration of the factors described above, the Minister for Planning exempted the CGP from the need for Concept Plan Approval.

1.4 Location

The proposed Northern Expansion is situated 60km south-west of Sydney in the Camden and Campbelltown LGAs. The Northern Expansion is defined as shown on **Figure 2**.

The Project Area for the Northern Expansion has been separated into two separate areas known as the Subsurface Project Area (within which project works are limited to subsurface drilling activities only) and the Surface Project Area where proposed surface infrastructure would be located.

The Subsurface Project Area is aligned with the boundary of PPL 5 and part of PEL 2 (which would form the subject of an application for a new PPL pending the issue of Project Approval). The Surface Project Area is generally bound by Narellan Road and the Mount Annan Botanical Gardens to the south, Camden Valley Way to the west, the South Western Freeway (M5) to the east, and Denham Court Road to the north (**See Figure 2**, **3a**, **3b** and **3c**). The Surface Project Area will accommodate the proposed gas plant, supply pipeline, well surface locations and associated gas gathering lines.

The Surface Project Area is generally located on non suburban land within the suburbs of Currans Hill, Varroville, Raby and Denham Court. Some lands within the Project Area are earmarked for future urban development as part of the NSW Government's Metropolitan Strategy

The existing gas fields within the CGP are located in the south of the proposed Northern Expansion (**see Figure 4**).

1.5 Project Approval

Project Approval is sought for:

- the construction and operation of approximately 20 well surface locations;
- associated gas gathering and water lines and access roads;
- a high pressure supply pipeline;
- construction and operation of a gas plant;
- Tie-in to the existing gas fields at Menangle Park; and
- Subsurface drilling activities.

The surface infrastructure described above would be located within the identified Surface Project Area as shown on **Figure 1**.

Within the Surface and Subsurface Project Areas, the NSW Government and local councils have identified several future urban development areas (residential, commercial and industrial). Consultation with landowners within the Project Area will enable the identification of final well surface locations and utility corridors that do not physically conflict with current master plans for future urban development. Previous Project Approvals have demonstrated that the Project is able to be constructed and operated in a manner which is compatible with both existing and future land uses.

1.6 Approval Regime

The proposal involves the recovery of CSM which requires drilling and operation of petroleum wells, a gas plant, associated gas gathering lines and ancillary works. The proposal falls under the definition of a 'major development' under Group 2, Clause 6 of Schedule 1 of *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP).

Group 2, Clause 6 of Schedule 1 to Major Development SEPP identifies classes of development which are defined as 'major development' and includes projects related to petroleum (oil, gas and CSM), being:

> *'Development for the purpose of drilling and operation of petroleum wells (including associated pipelines) that:*
>
> *c) Is in the local government areas of Camden, Wollondilly, Campbelltown City, Wollongong City, Wingecarribee, Gosford City, Wyong, Lake Macquarie City, Newcastle City, Maitland City, Cessnock City, Singleton, Hawkesbury, Port Stephens, Upper Hunter or Muswellbrook, but only if the principle resource sought is coal seam methane.*

The recovery of CSM involves the drilling and operation of well surface locations, gas plant, supply pipeline, associated gas gathering lines and ancillary works. The proposal involves well development for CSM extraction within the Northern Expansion of the CGP, which is situated in the Camden, and Campbelltown LGAs. Therefore the proposal falls within the criteria defined under Group 2, Clause 6 of Schedule 1 of the Major Development SEPP.

The Proponent is seeking Project Approval pursuant to Part 3A of the EP&A Act and an EA will be prepared to support the works proposed as part of the Project Application. Details of the proposal are listed below in **Section 2**.

1.7 Purpose of this EASR

This EASR forms the preliminary environmental assessment (PEA) of the proposed works. The purpose of the EASR is to provide the Minister with outline information and background environmental data on the site and the proposed project, sufficient to establish the key environmental issues of significance and the level of environmental assessment required for the application.

1.8 Structure of Report

To inform relevant government agencies and the local councils of the level of environmental assessment required, the EASR has been structured to provide information on broad areas as outlined in **Table 2**.

Table 2: Outline of Report Structure

Section	Issues Addressed
Section 1 Introduction	Provides a background to the project, including information about the Proponent such as location, licenses, existing and proposed well surface locations and infrastructure. The purpose and structure of the EASR will also be outlined.
Section 2 Description of Project	An overview of and description of the subject site and proposed activities linked to the project will be given.
Section 3 Statutory Planning	Relevant legislation to the project will be investigated and presented, and relevant Environmental Planning Instruments (EPIs) addressed.
Section 4 Consultation	Discussion of formal procedures proposed and/or undertaken with other agencies, as well as the community, stakeholders, and relevant authorities for input into the project and the EA.
Section 5 Physical and Pollution Effects	Reports on the environmental implications in terms of physical effects, including baseline studies and anticipated impacts. Environmental aspects of noise and vibration, air quality, water, geology and soils and hazard and risk are considered.
Section 6 Biological Effects	Reports on the environmental implications in terms of physical effects, including baseline studies and anticipated impacts.
Section 7 Resource Implication	An overview of expected impacts and the implications of future gas production on societal and natural resources, such as transportation infrastructure.
Section 8 Community Effects	Outlines the potential community effects, including the social, heritage, cultural and economic implications.
Section 9 Findings	This focuses on the key impacts of the environmental factors addressed earlier in the report.
Section 10 Prioritisation	Prioritises environmental issues for the EA.
Section 11 Recommendations	This section outlines recommendations to be considered as part of an EA, and also outlines recommendations in respect of the level of assessment and approvals process.

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2.0 Description of Project

2.1 Overview of Proposed Activities

The Proponent is seeking project approval for works in the Northern Expansion of the CGP. The Proponent's main objective for this project is to continue gas production from the Illawarra Coal Measures to supply quality, sustainable gas resources for the NSW energy market.

The project includes a Subsurface Project Area (**Figure 2**) for the purposes of subsurface drilling of lateral well paths only, and a Surface Project Area. The Surface Project Area would contain surface infrastructure proposed as part of the Project and would form the limit of any surface disturbance resulting from project construction and operation.

The works proposed involve:

- Approximately 20 well surface locations (containing up to six wellheads each) that would drill down and move laterally in-seam and utilise drilling techniques listed in **Table 5**;
- One new gas plant;
- A high pressure gas supply pipeline;
- Associated gas gathering and water lines, including interconnection with existing gas fields, along with central water storage points where required;
- Access roads and ancillary infrastructure, including storage yard(s), where required;
- Subsurface drilling activities; and
- A tie-in to existing CGP well fields at Menangle Park.

Project approval is being sought for a range of activities which can be divided into the following:

- Construction: The activities required to physically develop the gas plant, supply pipeline, wells, gas gathering lines, access roads and supporting infrastructure. These activities include the drilling of wells and subsurface drilling of lateral in-seam paths.
- Production: Production and delivery of gas from well surface locations to the gas plant via gas gathering lines for distribution, including commissioning and maintenance activities. At the gas plant, the gas is compressed, cleaned, odorised and distributed into the Distribution Network through the supply pipeline;
- Post Development: Operational activities which may be needed to maintain production efficiency. It is anticipated these activities may include the upgrade of gas gathering lines, re-fracture stimulation (if required), re-drilling (if required) and installation of infield compression; and
- Closure and Final Rehabilitation: decommissioning of the Project in accordance with statutory requirements and industry best practice.

A new PPL and a Pipeline Licence would need to be obtained from Department of Industry and Investment (DII) if the Project receives approval. Tasks involved in each of these activities have been outlined below in **Table 3**. A detailed description of the project components and associated activities is provided in **Sections 2.3** to **2.6**.

Table 3: Breakdown of Task by Activity

Construction	Production	Post Development	Closure and Final Rehabilitation
• Preparation of access roads. • Construction of the gas plant, drill pads, and environmental controls. • Construction and drilling (including subsurface lateral paths) of wells. • Construction of water transfer and gas gathering systems. • Construction of Northern Expansion tie-in with existing well fields at Menangle Park. • Fracing (where required). • Installing the well completion, wellhead and surface equipment to enable the production of water and gas. • Connection of the wells to the gas gathering lines. • Construction of high pressure supply pipeline for distribution. • Initial rehabilitation of area used during construction and drilling activities.	• Commissioning of wells, typically including initial work over, dewatering and production testing activities to bring well into production. • Operation of the wells in accordance with relevant PPLs. • Maintenance of wells (work over), access roads and gas gathering lines. • Commissioning of the gas plant and high pressure supply pipeline for distribution typically involving testing of components in line with statutory requirements, Australian Standards and industry best practice. • Commissioning operation and maintenance of gas plant and high pressure supply pipeline connection for distribution. • Compression and dehydration of gas at the gas plant to meet pipeline requirements. • Addition of odorant to gas prior to sale. • Production, metering and sale of gas.	• Upgrade/ installation of access roads, gas gathering and water lines along existing routes. • Re-fracing and re-drilling of wells (where required). • Internal and independent monitoring of environmental, safety controls and performance against statutory requirements.	• Decommissioning wells, plugging and abandoning wells at the conclusion of production. • Removal of wellhead assemblies and rehabilitation of sites. • Decommissioning of the gas plant and high pressure supply pipeline connection in accordance with statutory requirements and industry best practice. • Final rehabilitation of the well surface locations, gas gathering lines, gas plant and access roads.

2.2 Assessment Approach and Development Strategy

As indicated earlier in this report (**Section 1.4**), the Northern Expansion is located approximately 60km south-west of Sydney, within the Camden and Campbelltown LGAs. The components of the Surface Project Area are likely to be located on a number of properties. The approach to the ongoing development of the CGP has grown and changed over time, based on the geology and technical constraints of the area, to create a logical development system for the Project.

2.2.1 Locational Principles / Guidelines

Locational principles have been established over time in partnership with the local councils, landowners and NSW government agencies, based on the flexibility of the gas infrastructure to fit in with the primary land use. These principles show how the initial site selection process works, prior to an environmental assessment being carried out. The Department of Planning's *Locational Guidelines for Development in the Vicinity of Operational Coal Seam Methane Wells* (2004) designed to assist local councils is also used. The location principles for the Project are clearly set out below in **Table 4**.

Table 4 below describes the approach to locating the various elements of surface infrastructure proposed and **Section 2.3.2** describes in more detail the environmental assessment approach outlined above and its basis as part of the Northern Expansion.

Table 4: Locational Principles for the Northern Expansion proposed works

Development Type	Description of Potential Infrastructure Locations within the Surface Project Area
New well surface locations	The location of new well surface locations within the proposed Surface Project Area would be selected generally in line with the following principles (where possible): • Well surface locations would be located in existing disturbed or degraded areas, to minimise new land disturbance; • Well surface locations would be chosen in consideration of the potential environmental issues, including proximity to nearest receivers, items of heritage significance, significant flora and fauna and would take account of local topography, land use and other appropriate issues; • The potential environmental issues would be considered and built into the project at the preliminary planning phase so that potential issues are diminished in the inherent project design.
Supporting Infrastructure, including Gas Gathering lines (and connection to the Menangle Park gas gathering network), Water lines and Access Roads	The location of supporting infrastructure within the proposed Surface Project Area would be selected generally in line with the following: • The routes of the gas gathering and water lines would be selected to utilise previously or currently disturbed land areas where possible; • The routes of the gas gathering and water lines would also follow existing unsealed tracks, fence lines, creeks and drainage lines where possible and appropriate; • Access roads to new well surface locations and the gas plant would be required, and existing roads or tracks will be used and upgraded (if necessary) in the first instance where possible. Where new access roads are required, existing disturbed areas would be utilised wherever possible; • Upgrade of the existing gas gathering and water system to increase capacity would be carried out along established gas gathering routes, if required; • The routes of the gas gathering lines would co-locate with other utility corridors or watercourse or drainage crossings where possible; • Re-fracture stimulation or re-drilling of wells would occur at existing wellhead locations within the Project area, if required. The feasibility of re-fracture stimulation or re-drilling would be subject to environmental considerations at the time.

Development Type	Description of Potential Infrastructure Locations within the Surface Project Area
New Gas Plant and Supply Pipeline	An environmental envelope assessment will be adopted for the proposed gas plant and supply pipeline, which means that an area larger than the proposed footprint of the plant/pipeline would be assessed to give the Proponent flexibility and to ensure any issues identified as part of the assessment can be managed or avoided. The proposed gas plant and supply pipeline location within the Surface Project Area would be selected where possible: • To use existing disturbed or degraded areas; • In consideration potential environmental issues, including proximity to nearest receivers, items of heritage significance, significant flora and fauna and would take account of local topography, land use and other appropriate issues; • So that potential environmental issues would be considered and built into the Project at the preliminary planning phase so that potential issues are diminished in the inherent project design. • Taking into account existing high pressure supply pipelines such as the Eastern Gas Pipeline and the gas distribution network owned by Jemena Gas Networks (NSW) Ltd (Distribution Network).

The Surface Project Area has been identified to accommodate the surface works of the Northern Expansion, including the construction and operation of the gas plant and supply pipeline, well surface locations, gas gathering lines and access roads (**Figure 2**) The remainder of the Northern Expansion area, the Subsurface Project Area, would accommodate subsurface drilling activities (including drilling of lateral well paths) only with no significant surface impacts.

2.2.2 Environmental Assessment Approach

The assessment of this proposed Project will include:

1) an “envelope” approach to impact assessment means that a wider area or “envelope” is assessed to allow the final infrastructure sites to move within the assessed parameters, subject to the recommended environmental management measures and consultation with the landowner; and
2) a worst case approach to the impact assessment which means that the highest impact activities are assessed even when these activities are not the most likely, so that the variety of possible activities at each site are within the assessed parameters and the assessment is conservative.

Given the size of the area and the lead time involved in identifying suitable locations for new wells, gas plant and supporting infrastructure, the assessment approach has been adopted to identify and assess possible locations. The worst case assessment is also intended to establish *maximum* specifications for the various phases for defined activities proposed within the envelope to allow flexibility to incorporate landowner requirements, environmental issues and future urban development.

The assessment approach was established for the approved Spring Farm and Menangle Park Project to enable flexibility with landowners and to accommodate future land uses. In determining well surface locations, gas gathering lines and gas plant siting, the EA will utilise this ‘environmental envelope’ approach.

The ‘environmental envelope’ approach to impact assessment requires a defined assessment area (in this case, a 200m radius for a well surface location and 25 metres either side of gas gathering lines and access roads) within which the highest impact activities are assessed even when these activities are not most likely to occur. This is in order to present a ‘worst case’ scenario within the EA that is environmentally achievable for the project to proceed within the defined envelope.

The existing environment in the proposed Surface Project Area is variable in topography and vegetation as can be seen by **Plate 1** and **Plate 2**. By adopting the locational principles and an environmental envelope approach to assessing the activity, agencies and the community would be provided with an assurance that the future works would occur with minimal impact through issues analysis and landowner consultation, whilst providing the flexibility and time for the determination of precise locations through the EA process. The approach is intended to illustrate the areas in which future infrastructure would be located and explain the nature of the works likely to occur as part of the Northern Expansion.

The environmental envelope approach to assess the proposed Northern Expansion is anticipated to include:

- Identifying the most appropriate location for well construction compounds within each environmental envelope;
- Utilising existing and/or GIS information to identify environmental constraints;
- Developing guiding principles for the location of wells and proposed gas plant;
- Undertaking an environmental assessment based on a description of the activities proposed, and, where relevant, assessment of surface disturbance based on a defined envelope;
- Consultation with the landowner in developing an initial Site Layout Plan; and
- Identifying appropriate management measures to be implemented for each activity based on locational scenarios developed from the field surveys and Locational Principles.

The proposed project has been designed and planned with a degree of flexibility in order to accommodate future development in the surrounding areas, including both residential and other forms of development. Well surface locations, gas gathering lines, access roads, high pressure supply pipeline and the gas plant location have been chosen in consultation with landowners and negotiations with landowners are ongoing. It is proposed that detailed environmental assessment of the envelopes is undertaken to determine the potential impact of locating defined infrastructure at any location within the envelope boundary.

Well design and construction methods also allow for a single change in levels as may be required in relation to future development of roads, possible sand extraction, and re-levelling associated with urban development in the Northern Expansion area.

As a result identified suitable locations for the gas plant, well surface locations and gas gathering lines supporting infrastructure would be refined through the Environmental Assessment process based initially on geology, resource availability, engineering constraints, environmental constraints and land issues. Some key issues include threatened habitat, main roads, residential areas (current and known future) and heritage values.

Plate 1: Topography and transmission line infrastructure within Surface Project Area

Plate 2: Topography within Upper Canal corridors

2.2.3 Site Design Process

The site design process would be based on the locational principles and guidelines outlined in **Table 4** and utilise the outcomes of the environmental envelope approach in order to describe sites of the well surface locations, the gas plant and the routes of gas gathering lines and access roads during the construction and operation phases of the Project. The final locations would typically be the result of implementing the identified measures outlined below and of consultation with landowners.

Therefore, prior to the start of construction at a well surface location, a Site Layout Plan would typically be prepared in consultation with the landowner and the DoP.

The Site Layout Plan is designed to provide more detailed information, typically by establishing the exact footprint of each well surface location, along with the appropriate environmental controls (such as noise mitigation and erosion controls) in accordance with the EMS. It would include the initial rehabilitation of surplus construction footprint following completion of the construction phase.

The locational guidelines and mitigation measures outlined in the EA, Project Approval and in the DoP's Locational Guidelines would generally also be applied to the Site Layout Plan. Consultation with the landowner would typically occur to coordinate the activities with the primary land use and throughout the operations on the land, especially during the construction phase.

Then, generally prior to commissioning, a Landscape and Rehabilitation Management Plan for the life of the well surface location through to decommissioning (anticipated to be approximately 15 years) would usually be prepared and implemented in consultation with the landowner. The Plan would ensure that appropriate rehabilitation and screening measures are implemented. The rehabilitation of the well surface locations and associated infrastructure would be in accordance with the relevant principles of the Australian Natural Heritage Charter, where appropriate.

There is an existing Landscape and Rehabilitation Management Sub Plan for the CGP which establishes the requirements, management measures and monitoring for the whole Project, including the proposed Northern Expansion. The site specific Landscape and Rehabilitation Management Plans would typically build on the measures outlined Sub Plan and would form part of the EMS for the Project. The requirements of Plans would be reported against in the Annual Environmental Performance Report for the Project.

Overall, these two Plans establish a framework to provide greater detail at each well surface location based on landowner consultation and the applicable environmental constraints to ensure that the environmental requirements are met.

The locational principles, assessment approach and site design process provide a strategic overview of future works likely within the Northern Expansion area. This approach is intended to give agencies and the community an understanding of where the future works may occur and when details will be available, whilst providing the flexibility for the Proponent to determine precise locations subject to future production data, geology, and gas reservoir engineering and in consultation with landowners.

Overall, the flexibility built into the proposal should ensure that there is no significant detrimental impact or constraint imposed upon land uses or future development on surrounding land as a result of the proposed Project.

2.3 Well Surface Locations

Well surface locations have been identified using the considerations previously described in **Section 2.3**. Approximately 20 gas well surface locations, each containing up to six wellheads would be drilled into the Illawarra Coal Measures approximately 700 metres below the surface. The development of the well surface locations consists of the following steps, and will be detailed further in this report and subsequent EA:

- Construction: Activities (such as site preparation and subsurface drilling) required to physically develop the gas plant, supply pipeline, wells, gas gathering lines and tie-in connection to existing well fields at Menangle Park, access roads and supporting infrastructure;
- Production: Production and delivery of gas from well surface locations to the gas plant via gas gathering lines for distribution and sale, including commissioning and maintenance activities. At the gas plant, the gas is compressed, cleaned, odourised and sold into the high pressure gas network through the supply pipeline;
- Post Development: Operational activities which may be needed to maintain production efficiency. It is anticipated these activities may include the upgrade of gas gathering lines, re-fracture stimulation (if required), re-drilling (if required) and installation of infield compression; and
- Closure and Final Rehabilitation: decommissioning of the Project in accordance with statutory requirements and industry best practice.
- **Figures 4** and **5** provide an indicative illustration of a typical gas well surface location.

2.3.1 Construction

Civil Earthworks

Construction site preparation would typically involve minor clearing and relevelling if necessary to establish a stable, level pad for the drill rig and associated heavy equipment and would also involve the establishment of appropriate erosion and sedimentation controls.

The construction of well surface locations typically includes the following:

- A construction footprint of approximately 100 metres x 100 metres within a fenced construction compound area;
- A level hardstand ‘pad’;
- A drill pit provided to retain drilling debris and to re-circulate associated water for the drilling process;
- A compacted access road;
- A cut-back, flat operating area where wells are constructed on slopes, generally including an up-slope diversion drain around the site to manage excessive surface water flow. The profile is returned (as near as possible) to the original profile during rehabilitation.
- Environmental controls

Soils would be temporarily stockpiled with appropriate erosion controls during the construction phase then used in the initial rehabilitation of the well surface location.

Drilling Activities

There are a variety of technologies available for the drilling of wells. Geological technical issues must firstly be considered, followed by land use, aboriginal/heritage and other environmental issues.

Water and drilling mud is used in the construction of the well. The volume of water required for the drilling process varies depending on the type of drilling.

Consideration has to be given to the range of impacts anticipated from the proposed drilling techniques, with the assessment of environmental impacts focusing on the surface area disturbed during the construction and operational phases, based on a worst case footprint.

Table 5: Summary of Drilling Technology Options

Drilling Option	Characteristics/Requirements
Surface to In Seam (SIS) or Horizontal Drilling	• The well is drilled vertically from the surface and gradually builds angle to intersect the seam near parallel with the seam dip angle. • Once the coal seam is intersected, the upper portion of the well bore is cased, cemented and a smaller hole is subsequently drilled through the casing and horizontally into the seam for approximately 2,500 m. • This technique allows a significant reduction in the number of surface locations along with the ability to access previously stranded gas reserves more than 2,500 m away from the well surface location. • The technique requires continuous drilling and therefore operations must be conducted 24 hours a day, 7 days a week.
Under-balanced Drilling (the pressure of overlying strata is greater than the pressure of the drilling fluid).	• These were previously the standard wells in the CGP and currently represent approximately 80% of drilled wells within the CGP area. • Equipment required includes a drilling rig equipped with air compressors and booster packages that provide the energy for the percussion air hammer to drive the drill bit and for fluid circulation. • Drilling action employed uses a percussion air hammer, button bit and drill collars to provide the impacts to break up formations. • A drill pit or pits are also required to capture the drill cuttings and produced water and for re-circulation.
Over-balanced Drilling (the pressure of the drilling fluid is greater than the pressure of overlying strata).	• Allows drilling of wells where land access constraints or environmental features limit the use of drill pits. • Equipment includes a drilling rig and equipment required to focus on drill fluid circulation and solid control systems with operating capacity of 1,800 L per minute. • The drilling relies on applied weight on bit and rotation to penetrate formations. • Weight is provided by running drill collars (heavy joints of pipe) behind the bit with rotation and torque provided by the rig's top drive or a downhole motor.
Directional Drilling (drilling at varied angles).	• Major advantage of directional drilling is that bottom hole locations can be located approximately 400 m away from the surface location (depending on the vertical depth of the seam). Therefore, wells can be drilled into areas that are constrained for vertical well construction. • Multiple wells can be drilled from a single location and gas reserves that are potentially sterilised by surface developments can be accessed from outside of the developed areas. • Similar surface equipment is required to that used for overbalanced drilling, however directional equipment and a steerable mud motor are added to the downhole equipment to allow control of drilling angle and direction.

Subsurface Drilling Activities

Subsurface drilling activities relate to all wells whether vertical, directional or SIS. For directional and SIS wells, the continued penetration of the underling geology can be defined as subsurface drilling where the drilling deviates from a central point on the surface and continues along a subsurface path some distance from its origin. These drilling techniques minimise the surface impact of the project and allow access to areas laterally remote from the drilling origin, which would normally not be possible due to surface constraints.

For the purpose of the Northern Expansion, a distance of up to 2,500m of subsurface drilling from the well surface location would be considered in the EA.

Well Stimulation and Completion

There are a number of technologies available for well stimulation which is used to encourage the production of water and gas, generally including fracing and under-reaming, as outlined briefly below:

- SIS wells are drilled within the coal seam thus stimulating the coal seam as it is being drilled.
- Upon completion of drilling, the well can subsequently be hydraulically fractured (known as 'fracing') through the injection of a slurry of sand and water at sufficient pressure to create a conductive pathway into the coal reservoir so the gas and water flow up the well bore to the surface.
- Under-reaming involves enlarging a wellbore past its original drilled size.

Further details will be provided in the EA for the proposed project.

Drill and Frac Water Management

Drilling and fracing water is typically delivered from previous drilling and fracing campaigns or from licensed stand-pipes in the local area. Following fracing, the waters are removed from the coal seam either to future drilling and fracing campaigns or are transported to licensed disposal facilities.

For over-balanced, directional and SIS wells, water and drilling mud is used in the construction of the well. Drilling mud and water is pumped from the well following construction and stored prior to reuse or disposal.

Dewatering pumps and associated equipment are used in some wells to remove the injected fracture stimulation water and the formation water, which reduces reservoir pressure and allows gas desorption of the wells.

To facilitate water collection and to minimise the impact of trucking water around the properties, a water distribution network would be installed and co-located with the gas gathering line. Produced water from wells during the dewatering and early production phases of the wells would be transferred via these water transport lines and collected at storage points. The waters would then be either stored or transported to future drilling/fracing operations or disposed of to licensed facilities.

While drill pits are in operation, the water level in the pit is checked on a daily basis. If the water levels approach the 80% holding capacity, arrangements are made for water to be removed from the pits and disposed of offsite. This ensures that in the event of an unpredicted rain event, direct rainfall will not cause the pit to overflow. The approach to drill and frac water management would be further detailed as part of the EA.

Drill Cuttings Management

Drill cuttings are typically collected and stored in the drill pits. Once the drilling and fracing operations are completed, the drill pits are dewatered and desiccated. Further options are being investigated to manage cuttings, and there are currently several options to deal with the drill cuttings:

- Drill cuttings can be buried and covered with excavated soils and rehabilitated;
- Materials unsuited to onsite disposal are disposed of offsite at an appropriate licensed facility in accordance with DECCW requirements; and
- Capture of coal fines by diverting these solids from the drill pits to a storage point next to the pit where any excess water can drain into the pit and the fines stored and recycled.

2.3.2 Production and Operation

Once the wells have been drilled and completed, the surplus construction area is rehabilitated and the fenced area is reduced to the commissioning area to allow production testing and de-watering to take place to bring the well into production.

Production Testing

Production testing of the CSM resource would be undertaken for all new wells, involving the following program of works:

- Production testing of the well to ascertain the quantities of gas that will flow from the well; and
- Daily checks of gas flow rates are carried out at each well surface location.

Well Surface Location Types

There are two types of wellheads, open and enclosed. The open wellheads are typically used in rural and industrial landscapes while for the enclosed type, the wellhead and instrumentation are generally enclosed in secure purpose built facilities and the production compound surrounded by man-proof fencing.

The production compound is intended to have a small footprint and low visual impact, sound insulation and security from vandalism and is expected to look like a series of electrical substations that are on nature strips throughout many suburbs. Well design and construction methods would allow for a single change in levels if required by future surrounding land use development.

The current design of the two types of wellheads is shown below in **Plates 3** and **4**.

Wellhead Surface Equipment

Each well typically contains the following equipment:

- Well head;
- Isolation, shutdown and pressure safety valve controls;
- Water and gas separator;
- Metering, instrumentation and telemetry;
- Associated piping;
- Onsite tank(s) or water lines.

In addition, the following typical equipment may be installed on wellhead(s) to address well productivity issues:

- Generators;
- Various pumping configurations; and
- Injection facilities.

Maintenance/Work over

During the operational phase, the wells require an occasional 'work over' to maintain the efficiency of gas production. The work over involves a rig, truck or crane to run or remove pipe for clearing the well bore of any fill or obstructions. Work over activities generally take approximately one week per well, based on experience to date in other gas fields in the CGP, and based on normal or typical operations it is estimated that a work over would be required for each well as follows:

- Twice in the first year;
- Once in the third and fifth years; and
- Once every five years thereafter.

A very small number of the existing wells do not fit with the maintenance regime outlined above and this can be the result of production issues, ongoing mechanical problems or blockages.

Plate 3: Typical open design, single producing well: EM22 on the Elizabeth Macarthur Agricultural Institute

Plate 4: Inside view of Well Enclosure

2.3.3 Post Development Operational Activities

The post development operational activities would be undertaken where required only. The activities related to well surface locations during this phase are re-fracing and re-drilling of wells if necessary. These activities would generally be conducted in the same way as outlined in the sections above in accordance with the EMS and relevant management plan to be produced on a case by case basis.

Re-fracing of wells may be required after a period of operation, and would involve the same process as the initial fracing of the wells. It is noted that re-fracing of the wells would only be undertaken where a production or operational issue is identified. There may be instances where existing wells need to be redrilled for a variety of operational, geological, or production reasons.

As a result re-fracing and re-drilling are unlikely to be undertaken at all wells.

2.3.4 Closure and Final Rehabilitation

On completion of operations, all impacted would be cleaned up and rehabilitated to return the land to pre-existing condition or better in accordance with the EMS. This work will typically involve:

- sealing/plugging wells;
- removing plant and equipment from wellheads and removal of fenced compounds;
- filling in any excavation; and
- rehabilitation, contouring, and regrassing/revegetation.

The rehabilitation of the well surface location would be undertaken in consultation with the landowner.

2.4 Gas Gathering System and Associated Infrastructure

2.4.1 Construction

The gas gathering system route would be designed, constructed and operated in accordance with appropriate Australian Standards and industry best practice. The gas gathering system would be buried to a minimum depth of 750 mm (as per Australian Standard AS4645.3-2008) and up to 1,200 mm in some areas, including unsealed and sealed road crossings, and creek and drainage line crossings. Further detailed engineering and design would be required for crossing other infrastructure, including the Upper Canal and existing high pressure interstate gas pipelines. Following consultation with the landowner, the gas gathering system route would seek to utilise existing crossings where possible.

An ancillary water transfer system would be typically co-located in the trenches for the gas gathering system and installed simultaneously.

The route of the gas gathering system for the Surface Project Area would be selected to utilise previously or currently disturbed land areas wherever possible. Further consultation and detailed engineering and design would be required for crossing other infrastructure, including the Upper Canal Water Supply System and existing high pressure interstate gas pipelines. These lines would connect the individual well surface locations to the gas plant and connect with the existing CGP via the Menangle Park well field at MP03, located south of the Project Areas.

This connection would allow for:

- The collection and treatment of gas produced by wells prior to the gas plant becoming operational;
- The flexibility to defer gas to either the proposed new gas plant or RPGP during maintenance or shut-down periods of one plant; and
- Reduction in the need for infield compression during post development activities.

Construction of gas gathering (and water) lines leading from well surface locations to the gas plant would typically involve:

- Survey of pipeline route;
- Clear and grade ‘Right of Way’ pipeline route including stripping of topsoil (where required);
- Stringing of pipe;
- Welding of pipe;
- Trenching and underboring where necessary;

- Lowering-in of pipe strings (including trench preparation and padding);
- Installation of tracer line (for pipe tracing) as pipe is non conductive;
- Install gas marker tape above gas pipe;
- Backfilling and compaction of trench;
- Rehabilitation of ground along pipeline route;
- Installation of gas line signposts to mark and identify pipeline location;
- Pressure testing and commissioning of pipeline; and
- Register the gas gathering line on 'Dial before you dig'.

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

Work would be conducted in accordance with the AGL EMS and the ancillary water transfer system typically co-located in the trenches for the gas gathering system and installed simultaneously.

2.4.2 Production, Post Development and Final Rehabilitation

Production

During the production phase, gas is transported via gas gathering lines to the gas plant for compression and sale. Water traps fitted at low points in the gathering system to allow free water to be removed would be periodically emptied as required.

Maintenance

The gas gathering route is inspected annually by a specialist third party Gas Detection inspection service that performs a leakage survey of the below ground pipelines. Access roads would be maintained as required.

2.4.3 Post Development Operational Activities

The activities related to gas gathering and water lines during this phase are the upgrade or 'twinning' of gas gathering and water lines and upgrade of access roads along existing routes where required to increase the capacity of the system or for operational reasons. These activities would generally be conducted in the same way as the initial construction in accordance with the EMS and relevant management plan to be produced on a case by case basis, where necessary.

2.4.4 Final Rehabilitation

The preferred method of rehabilitation for the gas gathering system would be to purge with air or water in order to remove remaining gas, seal and then leave in position to prevent any further disturbance. This method would be subject to consultation with the land owner. Should removal of the gas gathering system be required, the excavated trench would be backfilled and rehabilitated, including contouring and revegetation.

Roads and water lines would remain in place subject to consultation with the landowner and rehabilitation of these items would typically be approached on a property by property basis.

2.5 Gas Plant and Supply Pipeline

2.5.1 Construction

Construction of the gas plant would typically involve:

- Site preparation including environmental controls clearing and excavation activities in preparation of hardstand areas and equipment;
- Trenching for connection of gas gathering lines and gas supply pipeline; and
- Establishment of access road/s.

Equipment and facilities used for the construction of the gas plant would typically include:

- Inlet 'slug-catcher' separator designed to prevent excess amounts of water from entering the downstream compressor equipment;
- Coalescing filter vessel for removal of coal fines, smaller water particulates not processed in the inlet separator;
- Inlet pressure control valve for controlling compressor(s) suction pressure.
- Gas Compressor units, which generally include engines, cooling and compressors:
- Gas Compressor discharge scrubber for final dewatering of gas;
- Tri-ethylene Glycol Dehydration (TEG) package to dehydrate the gas to the required pipeline specification;
- Metering skid to generally manage gas flow, quality and metering along with backpressure control valve;
- Station shutdown valve for isolation of the plant from the supply pipleline;
- Ethyl Mercaptan Odourant Injection system;
- Oily water separator system;
- Auxiliary gas connections to facilitate gas plant operations;
- Low and high pressure relief system connecting the gas plant to a continuously lit horizontal flare;
- Control Room typically including the following:
    - Supervisory Control And Data Acquisition (SCADA) interface for field, pipeline and gas plant telemetry;
    - Telemetry link to the existing CGP fields and, RPGP SCADA and vice versa;
    - Office, toilet facilities and other amenities as required; and
    - An Evaporation pond / flare pit.

Figure 7 shows the indicative process within the gas plant.

2.5.2 Production

Once operational, the primary purpose of the gas plant is to compress gas to meet pipeline requirements for sale. It is anticipated that there would be several compressor units, run on gas delivered from the Project's gathering system or electricity. The compressors would operate 24 hours a day, seven days a week, except for shutdowns during planned maintenance, or in instances of equipment failure. In the case of planned maintenance, gas flows would be reduced in advance of the planned shutdown by reducing or stopping gas flow at the wellheads and any excess gas is burned in a flare at the gas plant site, to maintain safety and integrity, reduce visual impact and to reduce greenhouse gas impacts.

The gas plant would be a security controlled site restricted from public access. The plant would have stringent safety and operational requirements for staff and visitors in accordance with applicable guidelines, standards and AGL's Occupational Health and Safety Policy.

CSM contains water vapour which must be removed prior to the gas entering the supply line. A dehydration unit is used to do this, which uses a contactor column containing tri-ethylene glycol (TEG). The 'wet' gas enters at the bottom of the column, where it comes into contact with the downward-moving glycol. The glycol absorbs the water from the gas. The gas, water and glycol are then separated, and the glycol is recycled back in a continuous process. Water vapour is discharged through a vent, and the gas is metered and piped for delivery to the customer.

Before the gas would leave the plant, a small amount of odorising agent is added, which gives the gas its characteristic smell and enables any downstream leaks to be immediately detected. Tertiary butyl mercaptan odourant is used for this purpose.

The gas plant would deliver gas directly into a high pressure gas supply pipeline via an existing interstate high-pressure gas pipeline. A Pipeline Licence would be required for the supply pipeline.

During the production phase, gas is transported via gas gathering lines to the gas plant for compression and sale. Operator involvement at the well surface locations is minimised by the installation of various automated and remotely operated functions performed at the control room. The surface production facility instrumentation has telemetry which transmits well information to the control room which controls all wells and production remotely.

In addition to the existing 35 staff employed by the CGP, it is estimated that a further 7 to 10 staff may be employed during production. As mentioned previously the well instrumentation comprises telemetry, which transmits well information to the control room so the production data can be accessed and reviewed. The wells have numerous alarms and automatic shutdown functions, which are based on a 'Cause and Effect' design. Wells and sections of the gathering system can be shut-in or opened remotely from the gas plant and this feature is available to ensure the safety and control of wells and the gathering system.

2.5.3 Supply Pipeline

A supply pipeline would connect the gas plant to an existing interstate high pressure gas pipeline for sale. The supply pipeline would typically include the following:

- Rated to design gas plant discharge pressure;
- Shutdown valve at the interstate gas pipeline tie-in to isolate the supply pipeline;
- Cathodic Protection; and
- Right of way along the pipeline route.

2.5.4 Post Development Operational Activities

The post development operational activities related to the gas plant include the installation of infield compression along the gas gathering line routes or at well surface locations if necessary to increase the capacity of the system or for operational reasons. This would be undertaken where required only.

2.5.5 Closure and Final Rehabilitation

On completion of operations, impacted areas associated with the gas plant and supply pipeline would be cleaned up and rehabilitated to return the land to pre-existing use and condition, or better, as agreed with the landholder. Appropriate rehabilitation of the gas plant site would be undertaken, including, contouring (if required) and regressing /revegetation and subject to the EMS and approval conditions.

2.6 General

2.6.1 Construction Hours

With the exception noted below, work hours during the construction phase of the Project would be 7.00am to 6.00pm, Monday to Friday and 8.00am to 1.00pm Saturday with no work on Sunday or Public Holidays unless inaudible at the nearest receiver or authorised for safety reasons.

Drilling of wells would require 24 hour drilling activities, seven days a week. However, the location of wells has been carefully selected having regard to the distance to adjoining residences and other sensitive receivers to ensure the impact associated with drilling activities is minimised.

2.6.2 Services and Amenities

Temporary portable toilets and amenities would be provided on site for use by construction workers during the drilling of wells, construction of the gas gathering system and construction of the gas plant.

The gas plant is anticipated to also include toilet, shower and accommodation facilities along with other appropriate amenities and services required for the operation of the plant. Storage areas, workshop and laydown yards may also be required for the Project. These will be more fully detailed and assessed in the EA for the proposed Project, based on the final proposed site and the engineering and design of the plant.

Electricity is expected to be either provided by portable generating units or through connection with the existing electricity network, depending on each site (whether at a well surface location or at the gas plant) and its surroundings. Non potable water required for construction and other activities would be provided where available.

2.6.3 Timing of Project

The indicative timing of the proposed Project, current at the time of writing and subject to the planning process, is for the EA to be prepared and submitted to the DoP for adequacy review and public exhibition during early 2010.

Based on this timeframe, it is planned for drilling and associated field construction to start in mid-late 2010 while construction of the gas plant is expected to commence in February 2011 with construction taking approximately 9 months through to completion, subject to approvals.

The indicative timeframe of construction of the gas plant is flexible would be subject to market demand. The work components would be completed generally in the following order:

1) Construction of main spine line and tie-in to the Menangle Park well fields of the existing CGP.
2) Staged drilling of wells
3) Construction of the gas plant

The approximate life of the wells is likely to be 15 years, subject to productivity of each individual well surface location.

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3.0 Statutory Planning

3.1 Commonwealth Matters

The *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* came into effect in July 2000 and requires the approval of the Commonwealth Minister for the Environment and Heritage for actions that may have a significant impact on matters of National Environmental Significance (NES). Approval from the Commonwealth is in addition to any approvals under NSW legislation.

Approval under the EPBC Act is triggered by a proposal which has the potential to have a significant impact on a matter of NES or by a proposal which has the potential to have a significant impact on the environment of Commonwealth land or which involves the Commonwealth. The EPBC Act lists eight matters of NES which must be addressed when assessing the impact of a proposal.

A search of the Department of Environment, Water, Heritage and the Arts (DEWHA) protected matters database was undertaken in December 2008, based on a 10km buffer around the Surface Project area. The following provides a preliminary assessment of the proposal and its potential impacts on matters of NES.

- **World Heritage properties:** There are no world heritage properties proximate to the Northern Expansion, or that would potentially be affected by the Project.
- **National Heritage Places:** There are no Commonwealth Heritage Places identified within the search area, however a total of 80 places listed on the Register of the National Estate (RNE) were identified within the search area which are protected by the provisions of the EPBC Act. Guiding principles for the siting of the well surface locations, gas plant and associated infrastructure will be detailed in the EA and will aim to minimise potential impacts on matters identified by the RNE.
- **Wetlands of National Importance:** The search identified the proposed Project would be located within the same catchment as a Ramsar site, Towra Point Nature Reserve, which is located approximately 16 km south of the Sydney CBD. However, given the nature of the Project, the history of previous works for the CGP and the distance of the site from the Towra Point Nature Reserve, it is not anticipated that there would be a significant impact on the Ramsar Wetland.
- **Commonwealth-listed Threatened species:** 48 Commonwealth listed threatened species (25 fauna and 23 flora) were identified within the search area and therefore, potential exists for the Northern Expansion Project to impact on threatened species listed under Commonwealth legislation. The location of well surface locations and associated infrastructure has been selected having regard to minimising impacts upon threatened species. The construction of the gas plant may require the clearing of some Cumberland Plain Woodland – an Endangered Ecological Community (EEC). A greater level of assessment will be provided within the EA, and environmental safeguards detailed to minimise potential impacts.. Where impacts are unavoidable, an appropriate offset would be provided. This would also be investigated further during the EA process..
- **Commonwealth-listed Migratory Species:** 10 migratory species were identified within the search area. Given the nature of the proposed project, significant impacts on protected migratory species are not expected. Notwithstanding this, a greater level of assessment will be provided in the EA and appropriate mitigation measures identified if deemed necessary.
- **Nuclear Action:** The proposed Project will not involve a nuclear action as defined under the EPBC Act.
- **Commonwealth Marine Area:** There are no Commonwealth Marine Areas proximate to the Northern Expansion, or that would potentially be affected by the Project.
- **Commonwealth Land:** No Commonwealth Land sites were identified within the search area. The proposed Northern Expansion is not on Commonwealth land, nor is Commonwealth land likely to be significantly affected by the Project.

Based on this preliminary assessment the proposal on matters of NES, it is considered that the Project has the potential to impact upon matters of NES, specifically in relation to the potential impacts of the Project on threatened species and ecological communities. The Project would require the clearing of some Cumberland Plain Woodland, an EEC. Therefore, in order to ensure that AGL's obligations under the EPBC Act are met, a referral to the Commonwealth Minister for the Environment, Water, Heritage and the Arts under the EPBC Act will be made and subject to separate, concurrent consideration.

3.2 State Matters

3.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act and the EP&A Regulation provide the framework for environmental planning in NSW and include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment, and provide opportunity for public involvement.

As outlined in **Section 1.3** of this EASR, approval is required for the proposed project under Part 3A of the EP&A Act, and the Minister for Planning has declared the project a 'major development' to which Part 3A applies. The Minister for Planning is therefore the approval authority for the project.

In accordance with the provisions of Part 3A of the EP&A Act, the Proponent intends to seek Project Approval for works required for the Northern Expansion of the CGP, which include installation of a gas plant, well surface locations and associated infrastructure on land located within the Camden and Campbelltown LGAs. Therefore the proposal falls within the definition set out under group 6 of Schedule 1 of the Major Development SEPP.

3.2.2 Petroleum (Onshore) Act 1991

The proposal involves the recovery of CSM through the drilling and operation of petroleum wells, associated gas gathering lines, gas plant and ancillary works. The proposed Project is located within PPL 5 and part of PEL 2 and is for the purpose of extracting, compression and sale of the coal seam gas resources of the Illawarra Coal Measures. PPL 5 and PEL 2 are held by the AGL group pursuant to the *Petroleum (Onshore) Act 1991*.

Clause 41 of the *Petroleum (Onshore) Act* relates to the rights of holders of production leases and states:

> *'The holder of a production lease has the exclusive right to conduct petroleum mining operations in and on the land included in the lease together with the right to construct and maintain on the land such works, buildings, plant, waterways, roads, pipelines, dams, reservoirs, tanks, pumping stations, tramways, railways, telephone lines, electric powerlines and other structures and equipment as are necessary for the full enjoyment of the lease or to fulfil the lessee's obligations under it.''*

Part 6 of the Act provides for consideration to be given to the protection of the environment before a petroleum title is granted. It sets out the scope of PPLs, subject to the terms of the Act. The majority of the proposed development within the Northern Expansion area would be carried out under the existing PPL 5. Activities proposed to take place outside of PPL 5 would require a new PPL. An application would be made for a new PPL in conjunction with the application for Project Approval under Part 3A of the EP&A Act..

3.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) prohibits any person from causing pollution of waters, or air, and provides for penalties for air, water and noise pollution offences. Schedule 1 of the POEO Act identifies "scheduled activities" which are required to be licensed by the DECC.

The gas plant, well surface locations, gathering lines and supply pipeline would need an Environment Protection Licence (EPL).

3.2.4 Pipelines Act 1967

The *Pipelines Act 1967* regulates the construction and operation of pipelines within the State, with certain exemptions such as those operated for the purposes of supply of water or those to be constructed by a public authority.

Section 11 of the Act provides that a pipeline (other than those identified as exempt) cannot be constructed or operated without a licence. The Act also addresses the ongoing maintenance and management of pipelines.

The requirement for a licence in relation to a petroleum pipeline (one which conveys naturally occurring hydrocarbons) generally relates to high pressure trunk lines and does not extend to gathering lines within the well field area.

Construction and operation of the proposed gas gathering lines within the Surface Project Area (as described in **Section 2**) would not require a licence under Part 3 of the Pipelines Act. However, the proposed high pressure supply pipeline to connect the gas plant to an interstate gas pipeline would require a pipeline licence to be issued.

Subject to the issue of the Project Approval, an application for a Pipeline Licence would be made in accordance with section 13 of the Pipelines Act. Under section 75V(1)(g) of the EP&A Act, such an application must be substantially consistent with the terms of the Project Approval..

3.2.5 State Environmental Planning Policies and State Strategic Context

The following State Environmental Planning Policies (SEPPs) are of specific relevance to the proposal.

Major Development SEPP

On 13 June 2003, the Minister declared the CGP as a State Significant Development. The Major Development SEPP was gazetted on 25 May 2005 and amended on 1 August 2005. It replaces previous provisions related to former 'State significant development' in planning instruments, directions and declarations.

The primary aim of the Major Development SEPP is:

> *'to identify development of economic, social or environmental significance to the State or regions of the State so as to provide a consistent and comprehensive assessment and decision making process for that development'.*

The Major Development SEPP identifies classes of development which are defined as 'major development' under Part 3A of the EP&A Act. The class considered applicable to this project is:

Group 2, (6) (Petroleum (oil, gas and coal seam methane)) of Schedule 1 includes:

> *'(1) Development for the purpose of drilling and operation of petroleum wells (including associated pipelines) that:*
>
> > *(c) Is in the local government areas of Camden, Wollondilly, Campbelltown City, Wollongong City, Wingecarribee, Gosford City, Wyong, Lake Macquarie City, Newcastle City, Maitland City, Cessnock City, Singleton, Hawkesbury, Port Stephens, Upper Hunter or Muswellbrook, but only if the principle resource sought is coal seam methane.*
>
> *(2) Development for the purpose of petroleum related works (including processing plants) that:*
>
> > *(a) is ancillary to or an extension of another Part 3A project, or*
> >
> > *(b) has a capital investment value of more than $30 million or employs 100 or more people.*

The proposed Project involves the drilling and operation of petroleum well surface locations, associated gas gathering lines, a gas plant and ancillary works on land within the Camden and Campbelltown LGAs. Therefore the proposal falls within the definition under Group 6 of Schedule 1 of SEPP 2005 and is eligible for assessment under Part 3A.

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

Clause 7(2) of SEPP 2007 identifies development which can be carried out only with consent and includes the following of relevance to the Project:

> *'Petroleum production development for any of the following purposes:*
>
> a) *petroleum production on land which development for the purposes of agriculture or industry may be carried out (with or without development consent),*
> b) *petroleum production on land that is, immediately before the commencement of this clause, the subject of a production lease under the Petroleum (Onshore) Act 1991,*
> c) *facilities for the processing or transportation of petroleum on land which petroleum production may be carried out (with or without development consent), but only if the petroleum being processed or transported was recovered from that or adjoining land.*

The Project is subject to the provisions of the SEPP and the subsequent environmental impact assessment would address the relevant matters for consideration identified in the SEPP.

State Environmental Planning Policy (Infrastructure) 2007

SEPP (Infrastructure) 2007 aims to facilitate the effective delivery of infrastructure across the State.

Clause 104 of the SEPP relates to traffic generating development and requires that certain development with the potential to generate a substantial level of traffic be referred to the RTA for comment. Development to which the clause applies is set out in Schedule 3 of the SEPP and includes development for any purpose not specifically identified in the schedule with the potential to generate traffic of more than 200 vehicles.

The proposed project is unlikely to generate traffic of greater than 200 vehicles during the construction period and is therefore not subject to this clause or Policy. However, the RTA would be consulted with respect to the proposed Project and associated works and traffic impacts would be further considered as part of the EA.

State Environmental Planning Policy (Sydney Region Growth Centres) 2006

State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP) was gazetted on 28 July 2006 and provides land use zones, objectives and land use tables which identify the permissibility of development on land within the identified Growth Centres. More detailed consideration of the provisions of the Growth Centres SEPP will be provided in the EA as appropriate.

State Environmental Planning Policy 33 - Hazardous and Offensive Development

The aims of *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33) include the amendment of definitions of hazardous and offensive industries where used in EPIs and to require development consent for hazardous and offensive development.

The document, *Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines* was prepared by the then Department of Urban Affairs and Planning (now DoP) in 1994 to provide assistance primarily to councils (but also to industry, consultants and other government agencies) in implementing SEPP 33. The Guidelines recommend a 'risk screening' method for determining whether a proposal is hazardous and provides guidance on assessing potentially offensive development proposals. The screening process considers the class and volume of waste materials to be stored on the site and the distance of the storage area to the nearest site boundary.

The guidelines state that the first step to determining whether SEPP 33 applies to a proposal is to consider whether the proposed use falls within the definition of 'industry' adopted by the planning instrument which applies. As discussed in **Section 3.1** of this report, the proposal falls within the definition of a utility installation under the relevant LEPs. Therefore, the provisions of SEPP 33 do not strictly apply, however a Preliminary Hazard Analysis (PHA) will be prepared as part of the EA for the Project.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) applies to a range of LGAs listed in Schedule 1 of the SEPP. SEPP 44 applies to the Surface Project Area as it encompasses a portion of the Campbelltown LGA which is listed in Schedule 1.

The policy applies to land which is the subject of a development application (DA) and which is greater than 1 hectare in area. Whilst the proposed Project is not the subject of a DA, but of a Major Development application, it is assumed that the policy is intended to apply to Part 3A projects and the provisions of the SEPP are therefore considered in relation to the Project.

Part 2 of SEPP 44 requires that prior to granting consent to a development on land subject to the policy, the Council must consider whether the land constitutes 'potential' or 'core' koala habitat. A targeted flora and fauna survey would be undertaken as part of the EA and the provisions of SEPP 44 considered for further assessment.

NSW Sydney Metropolitan Strategy and Sub Regional Strategy

The Sydney Metropolitan Strategy is a framework developed to promote and manage Sydney's growth and outline a vision for the future to 2031. It guides the process of planning for residential locations, as well as employment, transportation and other infrastructure to deliver the best possible services to the community and business across Sydney.

To support this, the Metropolitan Strategy sets out residential and employment planning capacity targets for Sydney's subregions and strategic centres, as well as outlining other land-use and capacity aims. Subregions have been formed to encompass a more specific approach for each grouping of Local Government Areas (LGAs) in smaller vicinity.

The Project Areas lie within the South West Region, and is such subject to encounter land earmarked with uses identified as part of the South West Growth Centre (SWGC), namely future urban (residential, commercial and industrial) development. The locational principles and the assessment will consider these areas.

3.3 Local Matters

The Northern Expansion Subsurface Project Area and Surface Project Area extend over two different LGAs, being:

- Camden; and
- Campbelltown.

There are a variety of Environmental Planning Instruments (EPIs) which apply to the land, the subject of the Northern Expansion works, which are identified in the following table.

Table 6: Relevant Local Environmental Planning Instruments

Local Government Area	Relevant EPIs
Camden	Camden LEP No. 47 (LEP 47)
	Camden LEP No. 48 (LEP 48)
	Camden LEP No. 74 (LEP 74)
	Camden LEP(Camden Lakeside) 2009 (LEP 2009)
	Draft Camden LEP 2009 (Draft LEP 2009)
	Draft Camden LEP 151 - El Caballo Blanco and Gledswood (Draft LEP 151)
Campbelltown	Campbelltown LEP (Urban Areas) 2002 (LEP 2002)
	Campbelltown LEP – District 8 (Central Hills) (LEP D8)

The EPIs which apply to the land within the Subsurface Project Area would be detailed further in the EA and would include an examination of the permissibility of subsurface activities within this area.

3.3.1 Definition of the Development

Camden LEP 47

The proposed project involves the development of well surface locations and the gas plant for the recovery and sale of CSM in the Illawarra coal measures located within the Project Area.

Clause 7 of LEP 47 states that the *Environmental Planning and Assessment (EP&A) Model Provisions 1980* are adopted for the purpose of the plan, except for:

> *(a) the definitions of child care centres, home industry, home occupation, map and residential flat building in clause 4(1) and clauses 8, 15 and 35(c).*

The EP&A Model Provisions 1980 (Model Provisions) were repealed on 30 September 2005. However, given the provisions of LEP 47 were made prior to the date of repeal, the Model Provisions remain applicable in this instance.

Part 2 of the Model Provisions provides definitions. The proposed development comprises a 'public utility undertaking' defined as:

> *'any of the following undertakings carried on or permitted or suffered to be carried on by or by authority of any Government Department or under the authority of or in pursuance of any Commonwealth or State Act:*
>
> *(a) railway, road transport, water transport, air transport, wharf or river undertakings,*
>
> *(b) undertakings for the supply of water, hydraulic power, electricity or gas or the provision of sewerage or drainage services,*
>
> *and a reference to a person carrying on a public utility undertaking shall be construed as including a reference to a council, county council, Government Department, corporation, firm or authority carrying on the undertaking.'*

The Project comprises the construction and operation of gas wells, gas gathering lines, a gas plant, a high pressure gas pipeline and associated infrastructure, all of which is collectively required for the extraction and supply of gas.

AGL is the holder of a Petroleum Production Lease (PPL 5) and a Petroleum Exploration Licence (PEL 2) over the subject land issued under the *Petroleum (Onshore) Act 1991*. These titles give the holders the exclusive right to conduct petroleum mining and exploration operations in and on the land included in the titles together with the right to construct and maintain on the land such works, buildings, plant, waterways, roads, pipelines, dams, reservoirs, tanks, pumping stations, tramways, railways, telephone lines, electric powerlines and other structures and equipment as are necessary for the full enjoyment of the lease or to fulfil the lessee's obligations under it.

An additional PPL would be required for the Northern Expansion and application would be made for this licence following the issue of Project Approval. Once Project Approval is issued, the PPL must be substantially consistent with the terms of Project Approval.

As the project involves works to be carried out for the primary purpose of the supply of gas, authorised under the NSW *Petroleum (Onshore) Act 1991*, it falls within the definition of a 'public utility undertaking' as defined in the Model Provisions.

Under the Model Provisions a 'utility installation' is defined as:

> *'a building or work used by a public utility undertaking, but does not including a building designed wholly or principally as administrative or business premises or as a showroom'.*

As detailed above, the Northern Expansion project is a 'public utility undertaking'. The various Project components (including the gas plant) constitute buildings or works used by a 'public utility undertaking' and are therefore characterised as a 'utility installation'.

Camden LEP 48

Clause 6 of LEP 48 relates to the adoption of the Model Provisions, including the definitions set out under Clause 4(1) and clauses 8, 15, 16, 17 and 35 (c). The proposal fits within the definition of a 'utility installation' as discussed above.

Camden LEP 74

Clause 5 of LEP 74 relates to the adoption of the Model Provisions, except for:

> *(a) the definitions of child care centres, home industry, home occupation, map and residential flat building in clause 4(1) and clauses 8, 15 and 35(c).*

The proposal fits within the definition of a 'utility installation' as discussed above.

Camden LEP (Camden Lakeside) 2009

Camden LEP 2009 was gazetted on the 22 May 2009 and relates to the Camden Lakeside Development Area (see **Figure 7**).

Under LEP 2009, 'public utility undertaking' has the same definition as in the Model Provisions discussed above. The Northern Expansion falls within the definition of public utility undertaking.

Camden Draft LEP 2009

The primary purpose of Draft Camden LEP 2009 is to consolidate Camden Council's eight existing LEPs into one comprehensive planning instrument.

Under the Camden Draft LEP 2009, 'public utility undertaking' has the same definition as in the Model Provisions discussed above. The Northern Expansion falls within the definition of a public utility undertaking.

Camden Draft LEP 151

Draft LEP 151 relates to the El Caballo Blanco Development Area and is to be incorporated into the Draft Camden LEP 2009 upon gazettal.

Under the Camden Draft LEP 151, 'public utility undertaking' has the same definition as in the Model Provisions discussed above. The Northern Expansion falls within the definition of a public utility undertaking.

Campbelltown (Urban Areas) LEP 2002

Schedule 3 of LEP 2002 defines 'public utility undertaking', substantially the same as the definition for a 'public utility undertaking' provided in the Model Provisions (discussed above). The Northern Expansion falls within this definition of public utility undertaking.

As the proposed development is defined as a 'public utility undertaking' and the definition of a utility installation involves 'a building or work used by a public utility undertaking', the proposed development may also be defined as a 'utility installation' under the provisions of LEP 2002.

Campbelltown LEP D8

Clause 6 of LEP D8 relates to the adoption of the Model Provisions, except for the definitions of agriculture, hotel, map and tavern set out under clause 4(1) and clauses 7, 8, 15-28 and 31-33 as described above. The Northern Expansion fits within the definition of a 'public utility undertaking' and/or 'utility installation' as previously discussed.

3.3.2 Permissibility of the Development

The proposed Surface and Subsurface Project Areas for the Northern Expansion are contained within Camden and Campbelltown LGAs. Table 7 below shows the land use zones applicable to the Surface and Subsurface Project Areas for the relevant LEPs and Draft LEPs. For the purposes of the Subsurface Project Area and this EASR, likely LEPs that the subsurface well paths may encounter have been included.

Table 7: Permissibility of Northern Expansion Works – Surface and Subsurface Project Areas

Relevant EPI	Landuse Zone	Permissible	Comment
Surface Project Area			
Camden LEP 47	2(d1) Residential "D1" (Manooka Valley) Zone	✓	Sub-surface infrastructure only. Public utility installations permissible with consent. Permissible pursuant to clause 7(2)(a) of SEPP 2007.
	5(a) Special Uses Zone	✓	Sub-surface infrastructure only. Permissible pursuant to clause 35(a) of the Model Provisions.
	7(d1) Environmental Protection (Scenic) Zone	✓	Sub-surface infrastructure only. Permissible pursuant to clause 35(a) of the Model Provisions.
	7(d2) Environmental Protection (Urban Edge) Zone	✓	Sub-surface infrastructure only. Permissible pursuant to clause 35(a) of the Model Provisions.
	7(d3) Environmental Protection (Bushland Conservation and Restoration) Zone	✓	Sub-surface infrastructure only. Permissible pursuant to clause 35(a) of the Model Provisions.
Camden LEP 48	1(b) Rural B (2ha) Zone	✓	Sub-surface infrastructure only. Public utility undertakings permissible with consent. Permissible pursuant to clause 7(2)(a) of SEPP 2007.
	5(a) Special Uses "A" Zone	✓	Sub-surface infrastructure only. Utility installations permissible with consent
	7(d) Environmental Protection (Scenic) Zone	✓	Surface and sub-surface infrastructure and high pressure supply pipeline. Public utility undertakings and utility installations permissible with consent. Permissible pursuant to clause 7(2) (a) and (d) of SEPP 2007. High pressure supply pipeline permissible without consent pursuant to clause 53(1) of the Infrastructure SEPP**.**
Camden LEP (Camden Lakeside) 2009	R1 General Residential	✓	Sub-surface infrastructure only. Public utility undertakings permissible with consent. Permissible pursuant to clause 7(2) (d) of SEPP 2007.
	RE2 Private Recreation	✓	Sub-surface infrastructure only. Permissible pursuant to clause 7(2) (a) of SEPP 2007.

Relevant EPI	Landuse Zone	Permissible	Comment
Campbelltown (Urban Area) LEP 2002	1(d) Rural Future Urban Zone	✓	Sub-surface infrastructure only. Utility installations permissible with consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
	2(b) Residential B Zone	✓	Sub-surface infrastructure only. Utility installations permissible without consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
	5(e) Special Uses Public Purpose Corridor	✓	Sub-surface infrastructure only. Utility installations permissible without consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
	7(d1) Environmental Protection 100 hectares Minimum Zone	✓	Sub-surface infrastructure only. Utility installations permissible without consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
	7(d5) Environmental Protection 1 hectares Minimum Zone	✓	Sub-surface infrastructure only. Utility installations permissible without consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
	7(d6) Environmental Protection 0.4 hectares Minimum Zone	✓	Sub-surface infrastructure only. Utility installations permissible without consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
Campbelltown LEP District 8 (Central Hills Lands)	5(a) Special Uses (Water Supply) Zone	✓	Sub-surface infrastructure only. Permissible under clause 35(a) of the Model Provisions.
	5(g) Special Uses (Botanic Gardens) Zone	✓	Sub-surface infrastructure only. Permissible under clause 35(a) of the Model Provisions and clause 7(2)(a) of SEPP 2007.
	6(c) Open Space (Regional) Zone	✓	Sub-surface infrastructure only. Permissible under clause 35(a) of the Model Provisions.
	7(d1) Environmental Protection (Scenic) Zone	✓	Surface and sub-surface infrastructure. Public utility undertakings permissible with consent. Permissible pursuant to clause 7(2) (a) of SEPP 2007.
Draft Camden LEP 2009/ Draft Camden LEP 151	R1 General Residential	✓	Sub-surface activities only. Public utility undertakings are permissible with consent.

Relevant EPI	Landuse Zone	Permissible	Comment
(El Caballo Blanco and Gledswood)	RU2 Rural Landscape	✓	Surface and sub-surface infrastructure. Public utility undertakings permissible with consent.
	RE2 Private Recreation	✓	Sub-surface activities only. Permissible under clause 7(2)(a) of SEPP 2007.
	SP2 Special Uses Infrastructure (Water Supply Canal)	✓	Sub-surface infrastructure only. Permissible under clause 7(2)(c) of SEPP 2007.
Subsurface Project Area			
Camden LEP 47	2(d) Residential "D" (Release Areas)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	4(b) Service Industrial	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	5(a) Special Uses (School)	✓	Sub-surface infrastructure only. Permissible under clause 7(2)(c) of SEPP 2007.
	6(d) Regional Open Space	✓	Sub-surface infrastructure only. Permissible under clause 7(2)(c) of SEPP 2007.
	7(d1) Environmental Protection (Scenic)	✓	Sub-surface infrastructure only. Permissible pursuant to clause 35(a) of the Model Provisions.
Camden LEP 48	1(a) Rural "A" (40ha)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	1(b) Rural "B" (2ha)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	1(c) Rural "C" (0.4ha)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	6(a) Open Space (Local)	✓	Sub-surface infrastructure only. Permissible under clause 7(2)(c) of SEPP 2007.
Camden LEP 74	1(f) Rural "F" (0.2 ha)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	2(d) Residential	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	5(a) Cultural Landscape	✓	Sub-surface infrastructure only. Permissible under clause 7(2)(c) of SEPP 2007.
	5(e) Special Uses—Water Management	✓	Sub-surface infrastructure only. Utility installations permissible with consent.

Relevant EPI	Landuse Zone	Permissible	Comment
	6(a) Open Space	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	6(e) Open Space—Waterway Buffer	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	7(a) Environmentally Sensitive Land	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	7(d4) Environmental Protection (Eco-Residential)	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
Campbelltown (Urban Area) LEP 2002	1(a) Rural A	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	2(b) Residential B	✓	Sub-surface infrastructure only. Utility installations permissible with consent.
	3(a) General Business	✓	Sub-surface infrastructure only. Utility installations permissible without consent.
	4(a) General Industry	✓	Sub-surface infrastructure only. Utility installations permissible without consent.
	5(a) Special Uses A	✓	Sub-surface infrastructure only. Utility installations permissible without consent.
	6(a) Local Open Space	✓	Sub-surface infrastructure only. Utility installations permissible without consent.
	6(c) Private Open Space		Sub-surface infrastructure only. Utility installations permissible without consent.
	10 (c) Local Comprehensive Centre	✓	Sub-surface infrastructure only. Utility installations permissible without consent.

Permissibility of development has been considered as part of the locational guidelines and principles in determining siting of the well surface locations, gas plant and associated infrastructure. Permissibility of the project would be discussed in further detail in the EA.

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4.0 Consultation

4.1 New South Wales Formal Procedures

The EA will be prepared in accordance with Part 3A of the EP&A Act and its Regulation. Part 3A of the EP&A Act ensures that the potential environmental effects of the proposal are properly assessed and considered in the decision making process.

In preparing the EA, the requirements of the Director-General will be addressed as required by Clause 75F of the EP&A Act.

4.2 Consultation with Stakeholders and Other Relevant Authorities

The Proponent has already undertaken some initial consultation with

- Sydney Catchment Authority (SCA);
- RTA;
- Local Councils (Camden and Campbelltown); and
- Community Consultative Committee (CCC) for the CGP.

The project is defined as a 'major development' and therefore, written comments from relevant statutory agencies are likely to be requested by DoP, to assist with the preparation of the Director-General's Environmental Assessment Requirements (EARs) and during exhibition of the EA. Key agencies for the Northern Expansion include:

- Department of Industry and Investment (DII);
- Department of Environment, Climate Change and Water (DECCW); and
- NSW Office of Water (NOW)

4.3 Community Consultation

The Proponent has engaged in initial consultation and discussion with property owners potentially affected by the proposed works within the Northern Expansion. These discussions may influence the final siting and design of the proposed well surface locations, gas plant and supporting infrastructure.

The proponent also plans to engage in consultation with local heritage groups during the Indigenous Heritage assessment process in accordance with the relevant Guidelines. Details of indigenous heritage assessment and consultation are further discussed in **Section 8.4**.

At the CGP CCC meeting in November 2008, a plan of the preliminary Project Area was shown to the CCC, and an outline of the Project Approval process was discussed, along with an indicative timetable for future community consultation activities during the EA process. The CCC has an independent chair and includes representatives of local councils, community and environment groups and local residents.

Further consultation will be undertaken throughout the approvals process and as part of the EA.

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5.0 Physical Effects

5.1 Introduction

This section identifies the potential physical effects of the proposed Northern Expansion of the CGP. This section discusses:

- Air Quality;
- Water;
- Noise and Vibration;
- Hazard and Risk; and
- Geology and Soils.

The Surface Project Area would be the area of main disturbance due to the construction and operation of surface infrastructure as part of the proposed works. The environmental assessment would therefore focus largely on potential impacts on the physical environment within the Surface Project Area. Subsurface impacts are expected to be negligible, however would still be assessed as part of the detailed EA.

5.2 Air Quality

Emissions from construction would include dust (including PM_{10}) from earthworks and combustion emissions from construction machinery and vehicles.

The air emissions associated with the operational phase of the gas processing are specific to the fuel type, i.e. CSM. The assessment will quantify the following key criteria pollutants:

- Nitrogen oxides (NO_X);
- Sulfur dioxide (SO_2);
- Total volatile organic compounds (TVOC); and
- Hydrogen sulfide (H_2S).

Potential odour impacts will also be assessed as part of the assessment.

5.2.1 Existing Environment

Air Quality

The Camden air quality monitoring site is located at Camden Airport. The air pollutants measured at Camden were ozone (O_3) and oxides of nitrogen (NO, NO_2 & NO_x). The O_3 instrument at this site is maintained by Pilkington (Australia) Ltd. The DECCW ceased monitoring of NO, NO_2 & NO_x in September 2004.

Maximum NO_2 values monitored at Camden from 1995 to 2003 ranged from 75.8 µg/m^3 to 114.8 µg/m^3, which are well within the DECC's goal of 246 µg/m^3. However, the maximum 1-hour O_3 at Camden from 1995 to 2001 ranged from 173.3 µg/m^3 to 338.1 µg/m^3. Five of the seven years of data provide maximum 1-hour average O_3 concentrations that exceed the DECCW's goal of 214 µg/m^3.

The Campbelltown air quality monitoring site is located off Farrow Street, Campbelltown. The air pollutants measured at Campbelltown were O_3 and NO, NO_2 & NO_x and fine particles (PM_{10}) using a tapered element oscillating microbalance. The O_3, NO, NO_2 and NO_x were maintained at this site by Pilkington (Australia) Ltd. The DECC ceased monitoring of PM_{10} in September 2004.

Maximum NO_2 values monitored at Campbelltown ranged from 125.1µg/m^3 to 207.1 µg/m^3, which are well within the DECCW's goal of 246 µg/m^3. The maximum 1-hour O_3 ranged from 76.9 µg/m^3 to 146.4µg/m^3, which are also well within the DECCW's goal of 214 µg/m^3. The annual average PM_{10} values ranged from 9.9 to 17.4 µg/m^3, which are within the DECCW goal of 30 µg/m^3.

The Campbelltown monitoring site is located closer to sources of combustion such as the South West Freeway (motor vehicles) and industrial sites located along it. The monitoring data appear to reflect this situation with higher levels of NO_2 monitored at Campbelltown.

Meteorology

Air quality assessments based on dispersion modelling require information on wind speed, wind direction and stability class[1]. There are no local meteorological data available at the proposed CGP Northern Expansion area however data from the nearest Bureau of Meteorology station at Camden Airport and data collected by Macquarie University at Campbelltown can be used to characterise local dispersion conditions.

The closest meteorological station to the site is at Campbelltown. On an annual basis the winds are predominantly from the southwest. This persists throughout the year with winds from the northeast and east sectors also present in spring and summer. The lower strength winds (0.5 to 1.5 m/s) were most commonly from the north-northwest and north with an even higher percentage in the winter and autumn months.

Data from the Camden Airport station have been used in conjunction with The Air Pollution Model (TAPM) developed by CSIRO (Hurley 2005a and 2005b; Hurley et al. 2005), as well as data available from the West Camden sewage treatment plant (STP), to derive localised meteorological data. The windroses indicate that light southerly winds dominate during the times of poor dispersion, that is, autumn and winter. The annual average wind speed is 2.56 m/s.

The West Camden STP data have a higher frequency of F class stability (38.8%). Under these stable atmospheric conditions emissions disperse more slowly, particularly from low lying emission sources. A TAPM dataset will be generated for the CGP Northern Expansion area based on nearby meteorological data.

5.2.2 Issues for Consideration

Construction

There is potential for dust to be generated during construction works for drill pads, drill pits, access roads, trenches for gas gathering pipelines and the proposed gas plant. Dust emissions would generally be prevented by water suppression where necessary and by minimising disturbance to groundcover.

The potential for vehicle generated dust would be managed through the use of traffic control techniques such as reduced speed limits, the use of water carts where necessary and minimising disturbance to groundcover. Access to each of the well surface locations would be designed and constructed so as to minimise significant disturbance to existing vegetation and surrounding land uses.

Combustion emissions will be released from diesel used in construction equipment and vehicles. It is expected that AGL and any contractors would minimise combustion emissions by maintaining well serviced equipment.

Previous developments of the CGP have demonstrated that air quality impacts during construction are minor. This is expected to be the case during construction of the proposed Project. Effective mitigation measures during construction works are likely to reduce any potentially adverse effects on air quality to be insignificant.

Mitigation measures would be included incorporated into the existing Air Quality Management Sub Plan for the CGP to ensure potential air quality impacts during construction are minimised.

[1] In dispersion modelling stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford-Turner stability class assignment scheme there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

Operation

The proposed gas plant would consider powering options such as the use of gas or electric driven engines. Gas engines release combustion emissions to atmosphere, however these emissions would be monitored on a regular basis as would be required by the site EPL. The gas engines would include best practice emissions control technology to minimise emissions.

During the operational phase, dust generating activities are related to vehicle movements on unsealed roads Traffic control techniques for the management of vehicle movement would be maintained including speed limits, use of water carts where necessary and minimising disturbance to groundcover.

An odorous mercaptan additive is injected into the gas prior to sale for retail use. The odorant would be contained in a sealed storage building onsite, which is subject to negative air pressure. Air drawn into the building is filtered through charcoal beds prior to venting to atmosphere. Provided that the emissions control system is operating efficiently the odorant storage building is not expected to cause significant odour impacts. Emergency procedures, similar to those in place at the existing CGP gas plants, would apply.

5.2.3 Approach and Methodology

Assessment and Reporting

Air Quality

The assessment will be consistent with requirements of the NSW DECCW *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (*2005) (the Approved Methods). Modelled pollutant concentrations will be compared against the relevant NSW DECCW Air Quality Impact Assessment criteria as outlined in the Approved Methods.

Odour

Odour will be assessed by comparing predicted concentrations of modelled odorous compounds against reported odour thresholds, or detection limits. This analysis involves no odour sampling, so should only be relied on as a screening analysis[2]. It will satisfy the requirements of a Level 1 assessment as per the NSW DECCW's Technical Notes for *Assessment and Management of Odour from Stationary Sources in NSW* (2006). If a Level 1 assessment shows unacceptable odour impacts from the site, odour sampling may be required to better understand odour emissions.

If relevant odour sampling data are available then odour emission rates could be modelled and assessed against relevant odour guidelines.

5.2.4 Summary and Recommendations

An assessment consistent with the requirements of the NSW DECCW Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2005) and the NSW DECCW's Technical Notes for Assessment and Management of Odour from Stationary Sources in NSW (2006) will be prepared within the EA.

The following approach is proposed to assess the potential impact of air emissions from the Project.

- Collate information on emission sources;
- Collate available background information on the site and surrounding area, including existing air quality data, meteorological data and the location of sensitive receptors[3];
- Identify and describe potential emission sources;
- Estimate emissions of identified pollutants;
- Model the emissions using a regulatory dispersion model; and
- Assess air quality impacts against relevant regulatory guidelines

[2] It is possible that the modelling will not include other compounds or combinations of compounds that are 'unknown' to be emitted from the site but may be responsible for objectionable off-site odour. If this situation exists, there is a chance that the approach proposed here would underestimate the odour impacts.

[3] The sensitive receptors that can be potentially affected by the project include residences, businesses, public buildings, schools and sports facilities.

The assessment modelling will focus on NO_2, SO_2, TVOC, H_2S and if available odour emissions from stacks, vents and any relevant fugitive sources.

Management and mitigation measures will be incorporated into AGL's existing Air Quality Management Sub Plan, which is part of the overall CGP EMS.

5.3 Water

5.3.1 Existing Environment

The Surface Project Area is located within the Nepean River and Georges River Sub Catchment. Some areas within the Surface Project Area are located in the vicinity of the Campbelltown Flood Mitigation Scheme. The Nepean River is located to the west and a tributary of the Georges River is to the east.

Groundwater in the vicinity of the Project Area is expected to be present as a shallow aquifer within the alluvial and unconsolidated sediments and as a deeper aquifer within the Hawkesbury sandstone. The presence of low permeability formations between the aquifers within the Hawkesbury sandstone are expected to inhibit groundwater flow between the deeper aquifers. Groundwater quality is described as fresh to brackish within the shallow aquifer and brackish to saline within the deeper aquifers, with salinity generally increasing with depth.

Groundwater usage in the vicinity of the Surface Project Area includes irrigation and stock watering and some domestic use where town water is not available. These groundwater bores generally exploit the shallow aquifer.

5.3.2 Issues for Consideration

Activities which have the potential to impact the water management regime in the vicinity of the Surface Project Area include:

- Release of formation waters into the surface drainage, including the potential for saline waters or sediment laden waters;
- Water, soil and wind erosion transporting sediment particles to surrounding catchment areas during construction;
- Installation and operation of the wells;
- Treatment and disposal of water from compressors at gas plant;
- Fracturing of formations within the coal seams;
- Gas gathering line water discharge during construction;
- Grey water and septic tank water discharge;
- Extraction of methane and associated groundwater; and
- Storage of saline groundwater within surface water storages.
- The existing EMS for the CGP, particularly the Soil and Water Management Sub Plan, outlines management measures and techniques during the activities listed above. These management measures and techniques have been designed and refined throughout the operational life of the CGP to address potential impacts during the construction and production phases of well surface locations. These potential impacts are listed below:
- Dewatering of aquifers other than those being targeted as a result of the propagation of fractures during activities;
- Reduction of groundwater quality of aquifers through connectivity of aquifers and saline groundwater storage on the surface; and
- Reduction in stream (base) flow of nearby rivers and streams if dewatering of the alluvial and shallow aquifers occurs as a result of activities.

The water management component of the EA will consider these impacts as well as the existing management measures for the CGP.

5.3.3 Summary and Recommendations

A water management assessment will be prepared and will describe the local and regional surface water and groundwater regime in the vicinity of the Project Area. An assessment of the potential impacts will be undertaken and appropriate management and mitigation measures identified to minimise or negate the likelihood of potential impacts occurring. These management and mitigation measures will be incorporated into AGL's existing Soil and Water Management Sub Plan, which is part of the overall CGP EMS.

5.4 Noise and Vibration

5.4.1 Existing Environment

Within the Surface Project Area, existing land uses are predominantly rural residential with large amounts of open space, as well as the Upper Canal Water Supply System, electricity transmission line corridor, high pressure interstate gas pipelines and arterial roads, such as Camden Valley Way and the M5. However, some lands are earmarked for future urban (residential, commercial and industrial) development. Therefore, the existing noise environment within the Surface Project Area is predominantly rural in nature with traffic noise dominating the noise environment around the Surface Project Area boundary.

As with the previous EA for the CGP, the noise impact assessment is a primary contributor to the location of the well surface location within the environmental envelope as well as the identified design requirements of the well to achieve the project specific noise criteria at nearby sensitive receivers.

In order to achieve this, an appropriate noise management strategy would be selected for the proposed Northern Expansion based on the following steps:

- Determine the noise reduction required to achieve the project-specific noise levels;
- Identify the specific characteristics of the industry and the site that would indicate a preference for specified measures;
- Examine the mitigation strategy chosen by similar industries on similar sites with similar requirements for noise reduction; and considering that strategy's appropriateness for the subject development;
- Consider the range of noise-control measures available; and
- Consider community preferences for particular strategies. This is especially important when the community has particular sensitivities to noise.

The Proponent will take into account the cost-effectiveness of strategies in determining how much noise reduction is affordable. A proponent's choice of a particular strategy is likely to have unique features due to the economics of the industry and site specific technical considerations.

5.4.2 Issues for Consideration

There is potential for noise and vibration impacts to arise from the following activities:

- Construction associated with the gas wells including drilling and fracing (if required);
- Construction of gas gathering systems and water drainage lines;
- Construction of access roads (if required);
- Construction of the gas plant;
- Operation of gas wells (including work over); and
- Operation of the gas plant.

Noise impacts will be assessed for calm and prevailing weather conditions.

5.4.3 Summary and Recommendations

A computer model will be used to predict noise emissions from the construction and operation of the proposed Northern Expansion of the CGP. A three-dimensional digital terrain map giving all relevant topographic information will be used in the modelling process. The model will use this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers.

The noise assessment will be prepared with reference to Australian Standard AS 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the DECCW NSW Industrial Noise Policy (INP), Assessing Vibration a Technical Guideline and Environmental Criteria for Road Traffic Noise (ECRTN). Where issues relating to noise are not addressed in the INP, such as sleep disturbance, and construction noise goals, reference has been made to the NSW Environmental Noise Control Manual (ENCM).

Responsibility for the control of noise emission in NSW is vested in local government and the DECCW. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the DECCW to regulate premises that are scheduled under the *Protection of the Environment Operations Act 1997*.

The existing ambient noise environment surrounding the Surface Project Area will be monitored at a minimum of five (5) locations to represent the background noise levels of the residential areas of Raby, Eagle Vale, Claymore, Varroville, Blair Athol, Currans Hill and Denham Court.

The monitoring will consist of unattended continuous monitoring for a period of at least seven (7) days supplemented by operator attended measurements to determine the character and content of the ambient noise. Meteorological data will be obtained for a 12 month period from the nearest available weather station.

These management and mitigation measures will be incorporated into AGL's existing Noise Management Sub Plan, which is part of the overall CGP EMS.

5.5 Hazard and Risk

5.5.1 Existing Environment

Previous developments of the CGP have undertaken risk assessments with aims to:

- Identify and analyse hazards associated with all processes involved with the construction and operation of the gas plant and gas well surface locations, specifically aimed at handling and transporting potential hazardous material;
- Identify risk reduction techniques; and
- Make recommendations as appropriate.

The Northern Expansion will investigate hazard and risk from wells below surface, the drilling and casing of wells, bringing the wells into production, gas gathering lines, and the construction and operation of the gas plant.

5.5.2 Issues for Consideration

A preliminary hazard analysis (PHA) will be undertaken as part of the EA, in accordance with the requirements of SEPP 33. The hazard analysis will be carried out with reference to the Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, *Guidelines for Hazard Analysis* and to HIPAP No. 4, *Risk Criteria for Land Use Planning*.

Consideration will be given to the hazards and risks associated with the operation of the gas plant and with the proposed gas well surface locations.

Potential hazards associated with all dangerous and hazardous goods to be processed, used and handled at the gas plant and at the gas wells will be assessed in terms of their possible initiating causes. The main hazards associated with the gas plant and with the gas wells are associated with the flammable nature of the coal seam methane gas and the potential for a loss of containment and subsequent ignition of this gas.

The consequences of identified hazards will be evaluated using current techniques for risk assessment. Well established and recognised correlations between exposure and effect on people will be used to calculate impacts.

Likelihoods and risks will be quantified using the methodologies for Quantified Risk Assessment (or PHAs) which is well established in Australia. Risk will be represented by risk contours or by risk transects.

The risk assessment technique involves the following general steps:

- Identification of the hazards associated with the proposed Northern Expansion, including those which may potentially injure people off-site or damage the off-site environment;
- Identification of the proposed safeguards to mitigate the likelihood and consequences of the hazardous events;
- Estimation of the magnitude of the consequences of these incidents;
- Where the consequences may affect the land uses outside the site boundary, estimation of the probability with which these incidents may occur;
- Estimation of the risk by combining the frequency of the event occurring with the probability of an undesired consequence; and
- Comparison of the risk estimated with the guidelines and criteria relevant to the proposal.

5.5.3 Summary and Recommendations

Risks associated with construction and operation phases of the Northern Expansion are expected to be manageable provided guidelines are followed and appropriate mitigation measures are developed. Further detailed assessment of the issue, including the potential impacts arising from all activities proposed as part of the Project works would be undertaken as part of the EA. Management and mitigation measures are outlined in AGL's existing Dangerous Goods and Hazardous Materials Management Sub Plan, which is part of the overall CGP EMS. Additional mitigation measures proposed as a result of the EA will also be included in the Plan.

5.6 Geology and Soils

5.6.1 Existing Environment

Geology

The Northern Expansion is located within the Permo-Triassic Sydney Basin of NSW, which occupies an onshore area of approximately 49,000m^2. The coal bearing strata of the Sydney Basin are concentrated within two major sequences of terrestrial sediments, 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, and contain significant coal seam methane resources in the Sydney Basin.

Previous studies undertaken for the CGP identified the major coal seams to be targeted for production as the Bulli, Balgownie, Wongawilli and Tongarra seams. The CGP has implemented a program of modelling which has increased confidence in predicting well production rates and led to a better understanding of the sources of gas and the contribution to surrounding formations.

Soil Landscapes

A review of the Soil Conservation Service maps was undertaken to determine the distribution of soil landscapes within the Surface Project Area. 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 study area, the characteristics of which are summarised in **Table 8**.

Table 8: Soil Characteristics

Soil Group	Characteristics
Blacktown	• The landscape is described as gentle undulating with the general fertility of the soils moderate to low. • Vegetation is described as extensively cleared eucalypt low open-forest and eucalypt low woodland with sclerophyllous shrub understorey. • Erosion hazard for non-concentrated flows is generally moderate and may range from slight to extreme.
Luddenham	• Landscape is described as undulating to rolling low hills on Wianamatta Group shales, often associated with Minchinbury sandstone. • The general fertility of the soils is low to moderate. • Vegetation is described as extensively cleared dry sclerophyll open forest. • Limitations associated with this soil type include high soil erosion hazard, localised impermeable highly plastic subsoil and moderately reactive soil materials.
Picton	• Landscape is described as steep to precipitous hills on Wianamatta Group and derived of shale colluvial materials, usually having a southerly aspect. • Vegetation is described as extensively cleared wet sclerophyll open forest. • This soil type has a moderate to low fertility with landscape limitations of the soil including extreme erosion hazard, mass movement and steep slopes.
Berkshire Park	• Landscape is described as gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system. • Very little natural vegetation remains. • Limitations associated with this soil type include moderate to high erosion hazard
South Creek	• Landscape is described as flat to gently sloping alluvial plain with floodplains, valley flats and drainage depressions. • Vegetation is described as mainly cleared with some tall shrubland on elevated streambanks. • Limitations associated with this soil type include flood hazard and very high to extreme erosion hazard.

5.6.2 Potential Impacts

Potential impacts on geology and soils as a result of the activities proposed as part of the Northern Expansion for the CGP include:

- Temporary erosion impacts during the construction and post development/operational phase as a result of earthworks and site preparation;
- Potential for geotechnical impacts to the surface land as a result of drilling and fracing operations (during the construction and post development/operational phases), including:
  - changes to stability along cut and filled areas;
  - soil erosion on unprotected cut and filled areas;
  - vibration from drilling and well development; and.

- Potential for sterilisation to the coal seam as a result of geotechnical changes;
- Potential for contamination of soils arising from accidental spillage of fuels, grease or other chemicals during the construction and post development/operational phases of the project.

Given the use of SIS technology which enable the Proponent to access gas reserves from land constrained by surface development, concerns may also be raised by the community in respect of the potential for such technologies to cause subsidence (with consequent impacts to the environment and surface structures). To date there have been no issues associated with subsidence related to the CGP, and a report was prepared previously which showed that the CGP would have negligible subsidence impact upon the geology of the CGP.

5.6.3 Summary and Recommendations

Management and mitigation measures will be incorporated into AGL's existing Soil and Water Management Sub Plan, which is part of the overall CGP EMS. With the appropriate environmental safeguards implemented it is anticipated that the proposed project would not have a significant adverse impact on soils whilst accessing a valuable geologically formed resource.

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6.0 Biophysical Effects

Biophysical effects are environmental implications in terms of physical and biological effects, including baseline studies and anticipated impacts. Likely/potential impacts are detailed further in this section and outline further biophysical investigations to be undertaken as part of the EA and include impacts on:

- Vegetation; and
- Flora and Fauna (including threatened and endangered species).

6.1 Existing Environment

The investigation area is focused on the Surface Project Area where potential exists for impacts upon vegetation. This area is located in south-western Sydney within the Camden and Campbelltown LGA's and covers an area of some 3,900 ha. The Surface Project Area is largely cleared of natural vegetation, although remnant patches do occur, and is surrounded by residential and industrial development. A number of residential developments are proposed within the Surface Project Area. The Distribution Network and Eastern Gas Pipeline and the Upper Canal Water Supply System run in a northeast-southwest direction through the centre of the Surface Project Area.

6.2 Issues for Consideration

The proposed gas infrastructure includes one gas plant, approximately 20 gas wells, gas gathering lines, a high-pressure supply pipeline, and access roads. The primary impact on the ecology of the Surface Project Area resulting from the proposal would be vegetation clearance and loss of flora and fauna habitat. Depending on the location of the proposed structures, and given that the Project Area is largely cleared, it is unlikely that all structures will require complete vegetation/habitat removal.

The proposed gas plant would require the clearing of some Cumberland Plain Woodland which is listed as an EEC on the EPBC Act (**Section 6.3.1**). A greater level of assessment will be provided within the EA, and environmental safeguards detailed to minimise potential impacts on the EEC. A referral under the EPBC Act will also be lodged with DEWHA for assessment.

Other potential impacts on the ecology of the Project Area include death and/or injury to flora and fauna, fragmentation and isolation of habitat, weed invasion, sedimentation and erosion and water quality impacts.

6.3 Preliminary Assessment

A review of existing records for threatened flora and fauna and communities within a 10 km radius of the Surface Project Area was conducted to determine those that might be present. These records were obtained from the NSW DECCW *Atlas of NSW Wildlife*. A search of the DEWHA on-line EPBC Act *Protected Matters Database* was also conducted (December 2008) to determine the presence of threatened and/or migratory species' potential habitat.

These records are used as a guide to the existence of the species or its potential habitat within a project area (i.e. the species most likely to inhabit an area). They are not, however, exclusive of other threatened species listed under the TSC Act or the EPBC Act which may be present but not previously recorded in a project area.

6.3.1 Endangered Ecological Communities

Vegetation mapping (**Figure 8**; DECC 2002) shows a number of vegetation communities occurring within and surrounding the Surface Project Area. Three are listed as EECs under the TSC and/or EPBC Acts: Shale Sandstone Transition Forest (High Sandstone Influence), Shale Sandstone Transition Forest (Low Sandstone Influence) and Elderslie Banksia Scrub Forest. None of these are mapped as occurring within the Surface Project Area.

Further, a selection of the mapped vegetation communities are considered to be the equivalent of EECs: Shale Hills Woodland and Shale Plains Woodland are equivalent to the EEC Cumberland Plain Woodland and Alluvial Woodland and Riparian Forest are considered to be equivalent to the EEC River Flat Eucalypt Forest on Coastal Floodplains. Cumberland Plain Woodland is listed as Critically Endangered under the EPBC Act. Ground-truthing of mapped vegetation communities within the Surface Project Area would be required to determine their status as EECs.

One additional EEC, the Critically Endangered Ecological Community Turpentine-Ironbark Forest in the Sydney Basin Bioregion also has the potential to occur within the Surface Project area (DEWHA EPBC Act *Protected Matters Database* search result).

6.3.2 Threatened Flora

Through the utilisation of the DECCW Atlas of NSW Wildlife atlas and the DEWHA Protected Matters Database search, several species of threatened flora were identified as having previously been recorded, or have the potential to occur, within 10km of the Surface Project Area. These threatened flora are depicted in **Figure 9** and include:

- 23 species listed under the EPBC Act, comprising of:
  - Six species listed as endangered; and
  - 17 species listed as vulnerable
- 29 species listed under the NSW Threatened Species Conservation TSC Act (TSC Act), comprising of:
  - One endangered population;
  - 14 species listed as endangered; and
  - 14 species listed as vulnerable

A complete species listing of threatened flora listed under these Acts for the areas subject of the Northern Expansion have been tabulated and attached as **Appendix A.**

6.3.3 Threatened and/or Migratory Fauna

Through the utilisation of the DECCW Atlas of NSW Wildlife atlas and the DEWHA Protected Matters Database search, several species of threatened and/or migratory fauna were identified as having previously been recorded, or have the potential to occur, within 10km of the Surface Project Area. These threatened fauna are depicted in **Figure 10** and include:

- 25 species listed under the EPBC Act, comprising of:
  - Five species listed as endangered (one amphibian, two birds, two mammals);
  - Nine species listed as vulnerable (four amphibians, four mammals, one reptile);
  - Ten species listed as migratory (birds); and
  - One species listed as both Vulnerable and Migratory (bird).
- 41 species listed under the NSW Threatened Species Conservation TSC Act (TSC Act), comprising of:
  - 12 species listed as endangered (three amphibian, five birds, one invertebrate, two mammals, one reptile); and
  - 29 species listed as vulnerable (three amphibian, 12 birds, 13 mammals, one reptile)

The DEWHA on-line EPBC Act *Protected Matters Database* search also resulted in two threatened aquatic species: the Macquarie Perch (Endangered) and Australian Grayling (Vulnerable) have the potential to occur within Surface Project Area if suitable habitat exists.

A complete species listing of threatened fauna listed under these Acts for the Surface Project Area have been tabulated and attached as **Appendix A**.

6.3.4 Summary and Recommendations

Potential exists for the siting of the well surface locations, gas plant and associated infrastructure to impact upon the biological values of the areas. The Proponent intends to site the proposed wells, gas plant and infrastructure within disturbed areas, where possible, to minimise potential impact on ecological values. As such, an appropriate level of assessment will be provided in the EA to determine the impact upon threatened or protected species/communities in the event the future works have the potential to impact upon such species.

The methodology employed for the detailed environmental assessment will be consistent with the DEC (now DECCW) Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft; 2004). The proposed methodology will include:

- Data Collation and Literature Review;
- Reconnaissance Survey;
- Mapping;
- Targeted Field Survey; and
- Reporting.
- A comprehensive ecological report would be produced with detailed methodologies would be presented, together with documentation of results and discussion of potential impacts and suitable ameliorative and compensatory measures.

The conservation significance of terrestrial and/or aquatic flora and fauna, populations and ecological communities would be assessed. The report would also include the preparation of any Seven Part Tests (NSW) and/or Significant Impact Criteria Assessments (Commonwealth) to determine the need for a Species Impact Statement and/or Referral as required under the TSC, EP&A and EPBC Acts, where required.

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7.0 Resource Implications

7.1 Introduction

Based on the future development of the Surface Project Area for gas production, an overview of the expected impacts on community, natural and transportation resources is provided in the following sections.

7.2 Community

The proposed works would have some impact on community resources, expected primarily during the construction phase of the Northern Expansion Project.

During construction it is anticipated that there would be a relatively minor influx of construction workers with supporting specialised workers. These workers would be sourced from the local area where available during these activities, and would contribute to demand for community resources including accommodation, goods and services.

In addition, the construction periods of the project are expected to result in minor increased traffic generation, comprising trucks for deliveries of equipment and transport of water, together with employee vehicles. As a result, the construction would result in a minor increase in the use of public roads.

There is not expected to be a significant increase in employment as a result of the production phase related to new gas fields and supporting infrastructure. In this regard, it is anticipated that employment requirements for the proposed works would essentially remain the same as the existing Camden operations.

Potential social and aesthetic impacts would occur primarily during the construction phase of the project, associated with the use of drilling and fracing equipment. Following construction, the primary social and aesthetic impacts would be limited to the sites of the proposed wells and the gas plant. Fencing around the proposed well surface locations would be designed having regard to the visual amenity of the rural and future residential/urban surroundings. Given the transient nature of the proposed works, these impacts are not expected to be significant.

7.3 Natural

The project is seeking to extract a natural resource to produce gas for sale. In this regard, the project would impact on this resource, through its proposed extraction and subsequent consumption.

The construction of well surface locations and subsequent production has the potential to impact on the coal resources, and potential future coal mining. The EA for the proposed Northern Expansion would describe necessary prevention measures to ensure reduced risk of any sterilisation of coal resources in detail.

The construction of the well surface locations and production of gas has the potential to impact on water resources, however these impacts are not expected to be significant providing water management practices are implemented.

The construction of the wells, gas plant and associated infrastructure would require the use of additional water and fuel. Water is required during the construction of the wells, however water is recycled so that it can be re-used during well construction. Water is also used during production at the gas plant. It is not considered that the volumes of water required are large enough to significantly impact upon the supply of natural resources for other users. The EA will describe in further detail water management practices proposed as part of the Project.

7.4 Transportation Infrastructure

The works proposed as part of the Northern Expansion would generate some additional traffic during the construction and post development/operational phases associated with construction of wells, gas plant and supporting infrastructure placing additional demands on existing roads. The upgrade of existing and construction of new private roads to provide access to the surface locations and gas plant would also be required. Whilst anticipated volumes of traffic to be generated during the construction and post development/operational phases of the project are expected to be relatively minor, impacts upon existing and future transportation infrastructure such as the widening of the Camden Valley Way will be considered.

During the production and post development phases, ongoing maintenance activities are relatively minor and there is unlikely to be a significant impact on traffic and transportation infrastructure.

8.0 Social/Cultural Effects

8.1 Introduction

Potential community effects and implications will be considered for the project. These are outlined in this section and include:

- Community Demographic;
- Land use;
- Heritage; and
- Visual amenity.

8.2 Community Demographic

The area for the proposed surface infrastructure and therefore potentially subject to surface impacts from the Northern Expansion is located within the Campbelltown and Camden LGAs. An overview of the characteristics of each LGA is provided below.

8.2.1 Campbelltown LGA

Campbelltown LGA is located in Sydney's outer southwest and is bounded by Liverpool LGA to the north, Sutherland and Wollongong LGAs to the east, the Wollondilly LGA to the south and Camden LGA to the west. Campbelltown LGA stretches over a land area of 311.53km^2 and has a density of some 4.66 persons per hectare.

Campbelltown LGA experienced a slight increase in total population between 1996 to 2001, however, 2001 to 2006 saw a decrease in total population (ABS). While there has been an increase in the number of new dwellings, the average number of persons living in each dwelling has declined.

8.2.2 Camden LGA

Located to the southwest of Sydney and comprises of a mix of agricultural lands, country towns and new residential areas with associated commercial and industrial developments. The area of Camden is renowned for its significance in the origins of Australia's wool industry and is commonly referred to as the "Birthplace of the Wealth of the Nation".

Camden LGA has experienced rapid growth since 1981 with an annual growth rate of approximately 7.8%. It is expected significant growth in Camden will continue in the future as existing release areas are further developed, with a projected average annual population growth of 4.0% between 2005 and 2026. In fact, Camden is projected to be the fastest growing LGA in Western Sydney in terms of percentage population growth.

The Camden LGA has a total land area of some 201km^2 and a population density of around 2.2 persons per hectare.

8.2.3 Population Characteristics

With recent trends showing an overall increase of the Western Sydney population, the project area is no exception. Campbelltown has a significantly larger population than Camden with 150,216 persons recorded in 2005 compared to the 51,361 persons living in Camden. However, Camden is growing at a much faster rate with a projected growth rate of 4% per year compared to Campbelltown with 0.8% per year.

The area is a predominantly young population with averages of younger people higher than the Western Sydney average. The background/birthplace characteristics of the population within the LGAs are generally consistent with the exception of the percentage of population born overseas and Australian born. The population within Campbelltown LGA comprises a higher number of overseas born people which in turn results in a smaller percentage of Australian born population when compared with Camden.

8.2.4 Dwelling Characteristics

As part of the South West Growth Plan, 155,000 new dwellings are proposed to support population growth within the South West subregion over the next 25 years.

In Campbelltown, residential building approvals declined from 2005-2006 by 10.5%. However, growth was recorded in the number of new house approvals in this period by 31.1%.

Camden experienced a similar trend with residential building approvals declining 13.6% from 2005-2006. Whilst there was an 11.2% decline in the number of new houses approved, the total value of approvals increased by 0.4%, suggesting an increase in the value of each approval.

Residential building activity in the region is projected to remain strong, with the provision of an extra 59,000 dwellings within Catherine Fields, Catherine Fields North, Leppington and Oran Park planned in the next 25 to 30 years as part of the NSW Government's Sydney Metropolitan Strategy.

8.2.5 Employment

Both Campbelltown and Camden LGAs have experienced recent declines in employment with a total increase in the number of unemployed persons in the region. This has translated into an overall increase in the unemployment rate, however, it is still below the Western Sydney average.

8.2.6 Issues for Consideration

There are no exceptional socio-economic circumstances applying to the local community within the LGAs, including the Surface Project Area. The socio- economic impacts of the proposed development of gas infrastructure (including wells and gas gathering lines, a gas plant, and the supply pipeline) relate to the direct and indirect employment impacts and benefits. Where possible the Proponent will employ personnel from the local region.

The proposed project will bring state-wide benefits through the increased supply of natural gas. This will help meet the energy demands of a growing State population which is reflected in the forecast population and dwelling growth for the Camden and Campbelltown region.

8.3 Land Use

8.3.1 Future Urban Development

The NSW Metropolitan Strategy identifies several growth centres including the South West Growth Centre (SWGC). The SWGC is located within the boundaries of three local government areas - Liverpool, Camden and Campbelltown. It comprises of 18 Precincts and is approximately 17,000 hectares with an approximate capacity for around 110,000 new homes. The Northern Expansion is located within the Camden and Campbelltown LGAs and therefore encounters land earmarked as part of the SWGC, namely Turner Road and East Leppington Development Estates. El Caballo Blanco, Gledswood and Camden Lakeside Development Areas..

Turner Road is one of the first released Precincts as part of the SWGC. It is 536 ha in area and will comprise of land zoned for future urban development, 96 ha of employment land, and 77ha of open space. This is likely to result in over 4,000 new homes and create around 5,000 jobs.

As the proposed works are generally located within these zoning areas, it will be important for the EA to address the impact on both existing and future land uses, to develop locational guidelines which consider and address potential impacts on residential/urban development, and to identify appropriate mitigation measures.

Integrating both future land use and the CGP is of importance to AGL. Site design of the well surface locations and the gas plant are to enable the project to co-exist with little to no impact on future urban (residential, commercial and industrial) development. The locational guidelines along with the environmental envelope approach involves consultation with landowners, as well as consideration of identified environmental constraints in order to allow the works to be undertaken in environmentally acceptable locations.

A similar approach was utilised and implemented for the Spring Farm and Menangle Park project area, and has shown that the project and future urban development can co-exist with minimal impact.

8.4 Heritage

8.4.1 Existing Environment

The Surface Project Area is located on the margin of the Cumberland Plain, known as the Cumberland Lowlands. The terrain consists of undulating plain, with moderate hills and ridges, dissected by several first and second order creeks. The general area consists of existing residential and commercial properties, open cleared farmland, remnant vegetation along drainage features and road corridors, several golf courses, overhead power line easements, the Distribution Network, Eastern Gas Pipeline, and the Sydney Water Upper Canal Water Supply System.

A number of previous archaeological investigations have been completed within the Surface Project Area in response to various development requirements. This has resulted in the identification of a number of Aboriginal archaeological sites and heritage places, indicating that there is moderate to high potential for additional Aboriginal and historic archaeological sites to occur across those sections of the Project Area that have not yet been subject to archaeological survey and assessment.

8.4.2 Aboriginal Archaeology

A search of the Aboriginal Heritage Information Management System (AHIMS) at DECCW identified a total of 48 known registered Aboriginal archaeological sites within the Surface Project Area (see **Figure 11**). The search focused on this area as subsurface drilling activities in the Subsurface Project Area are unlikely to result in the physical disturbance of artefacts at, or near, the surface.

Of the identified registered sites, the majority comprise open campsites and isolated stone artefact occurrences. Less frequent sites that also occur in the wider region include scarred trees, open areas of potential archaeological deposit and shelters with art. Overall the Project Area has moderate to high potential to yield additional Aboriginal archaeological sites and areas of archaeological potential.

An archaeological predictive model has been formulated based on the results of the location and type of Aboriginal sites previously recorded and regional modelling developed from previous archaeological studies undertaken within or near the Surface Project Area. This information has been broken down into patterns that have been compared to the character of the area to allow for an understanding of Aboriginal archaeological potential or likelihood that such sites will occur and where they will occur.

The general model for the region indicates that the following site types are likely to occur within the Surface Project Area are as follows:

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

8.4.3 Historic Archaeology

The Upper Canal Water Supply System is listed on the State Heritage Register as an item of State Heritage Significance currently managed by the SCA. As such the Canal is also listed on the SCA s.170 Heritage and Conservation Register; the Register of the National Estate; and on the *Campbelltown LEP 2002 – District 8, Schedule 1*. This feature runs northeast-southwest through the western section of the Surface Project Area.

An archaeological prediction model for historical sites in the region has been formulated based on known land use and listed historical sites. Given the nature of historical development within the Surface Project Area, additional sites that are likely to be identified include:

- Structures and features associated with early pastoral use, including domestic remains or farming associated remains, or
- Features associated with the Upper Canal, such as sandstone quarries.

8.4.4 Issues for Consideration

Potential impacts of the project on historical heritage and Aboriginal cultural heritage sites will be considered as part of the detailed EA.

The proposed construction works would involve various levels of ground disturbance. It is highly likely therefore that such works have the potential to impact upon known and unknown archaeological sites within the Surface Project Area, in particular, sub-surface archaeological deposits. Known sensitive landforms that should be avoided by proposed components would include undisturbed ridge crests, major drainage features and creeks, alluvial terraces or rises in close proximity to water courses, and any large remnant trees that may exhibit cultural scarring.

However, due to the nature of the proposed works and the flexibility of moving some components within the envelope of the assessed area, there would be capacity to avoid impact to Aboriginal and historical archaeological sites and features, and areas of archaeological potential.

8.4.5 Consultation with Aboriginal Stakeholders

The Surface Project Area lies within the boundaries of the Tharawal Local Aboriginal Land Council and within an area of potential interest to other local indigenous individuals and organizations. Consultation under Part 3A requirements for Aboriginal assessments are specified in the DECC document *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (Draft July 2005).

This process will involve the following:

- Advertising in print media to notify and identify relevant local Aboriginal stakeholder groups in the wider community;
- Consultation on survey methodology with input from the Aboriginal stakeholder groups identified during the advertising process; and,
- Consultation with Aboriginal stakeholder groups to determine the cultural values of identified Aboriginal archaeological sites and the wider cultural values of the Surface Project Area and region.

Through the above process, the appropriate Aboriginal stakeholder groups and individuals will participate in field survey. All registered stakeholders will be consulted throughout the life of the project.

8.4.6 Summary and Recommendations (Aboriginal and Historical)

The Aboriginal and historical archaeological and cultural heritage assessment process will be comprised of four key components:

- a detailed background review and analysis;
- archaeological field survey;
- detailed reporting and assessment of heritage values; and
- consultation with relevant stakeholders to determine the cultural values of sites and the Surface Project Area.

These key components will involve the a review of past archaeological and heritage studies within and around the Surface Project Area to identify all previously recorded Aboriginal and historical sites and areas of potential sensitivity. This data will be used to provide documentation relating to Aboriginal and non-Aboriginal land use, and to establish a predictive model for site locations, densities, types and chronologies that might be expected to occur within the wider Project Area.

- The desktop review would include accessing and interpreting data from a number of sources including:
    - The DECCW Aboriginal Sites database and historic site register (AHIMS and HHIMS)
    - Heritage Branch NSW DoP State Heritage Register
    - Heritage Branch NSW DoP State Heritage Inventory
    - Heritage Schedules of relevant Local Environmental Plans
    - S.170 registers of State Agencies where applicable
    - The National Trust (NSW) and Register of the National Estate, and
    - Information from any relevant reports from the region that is available.

- A Native Title Search of the Surface Project Area
- Undertake Aboriginal consultation following the *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*. Aboriginal stakeholder groups identified through this process would be consulted and invited to participate in field survey.
- Carry out a suitable field survey to identify any new Aboriginal and historic sites and areas of sensitivity and assess the condition and significance of any existing heritage sites. Previously recorded archaeological sites will be located and areas identified as being of potential archaeological sensitivity will be inspected. All previously unidentified archaeological sites/places will be recorded to the standards required by the Heritage Branch NSW DoP and DECCW.
- Complete heritage significance assessments for all archaeological and heritage sites in accordance with NSW DECCW Guidelines.
- Obtain comments on the cultural values of archaeological sites and the wider area to the identified Aboriginal stakeholders. These comments will be incorporated into the report
- Develop recommendations and safeguards that will ensure compliance with statutory and non statutory obligations and the protection of significant components of the archaeological resource
- Prepare a report that meets the NSW NPWS *Guidelines for Archaeological Survey Reporting, NPWS, 1997* and the *NSW Heritage Manual* and the standards and guidelines of the Heritage Branch NSW DoP.

8.5 Visual Impacts

8.5.1 Existing Environment

The landscape of the Surface and Subsurface Project Area is predominately rural and semi-rural, however, some land has been earmarked for future urban (residential, commercial and industrial) development which may change the landscape character in future. The surrounding suburbs are predominantly residential housing with a few industrial zones. The visual amenity of the Project Area itself is defined by previous and current land uses, consisting of cleared lands with small pockets of mature trees/ vegetation and rural homesteads.

Local infrastructure within and surrounding the Surface Project Area include the railway line to the south west which mirrors the South Western Freeway. Other main roads are Narellan Road, Denham Court Road and the Camden Valley Way. The Upper Canal Water Supply System runs from northeast to southwest and dissects this Area. Several gas and electricity corridors also transect through the Area.

8.5.2 Issues for Consideration

As discussed, the potential visual impacts include current residential and commercial zones and also proposed future development areas. Key areas that have been identified in the preliminary assessment include East Leppington, Camden Lakeside, El Caballo Blanco and Gledswood, Currans Hill, Blair Athol, Claymore, Turner Road, Eagle Vale, Raby, Varroville and Denham Court.

Additionally, key access points with potential visual impact include Camden Valley Way, Turner Road, Badgally Road, Eagle Vale Drive, Frontigan Street, Cahhelas Avenue, Raby Road, St Andrews Road and Denham Court Road.

8.5.3 Summary and Recommendations

A detailed visual assessment will be undertaken which will consider the potential impacts of the Northern Expansion on the sensitive nearby receivers. The report would include analyses of the following:

- Landscape Characterisation and Values - the landscapes within a region differ based on underlying geology, topography, land use and vegetation cover. These factors and the resulting 'landscape units' will be described for the visual assessment and illustrated using various figures, photomontages and viewshed analysis.
- Viewpoint Descriptions – photomontage viewpoint(s) of the well surface locations and gas plant will be analysed with indicative viewpoints shown to represent the range of views from accessible locations within the viewshed. These viewpoints will be selected based on the visual sensitivity at each location and the photomontages will show the existing landscape and the proposed landscape with the proposed facilities.
- Viewpoint Analysis - an assessment will be prepared for each viewpoint which will take into account the distance to the facilities and the landscape sensitivity. Generally, visual impacts are based on the lowest rating of any single factor.
- Mitigation measures will be identified in the EA to address how the potential visual impacts of the proposed Northern Expansion can be managed.

9.0 Prioritisation of Potential Environmental Issues

9.1 Issues Identification

As identified in **Sections 5 to 8** of this report, the list of issues associated with the Northern Expansion Project Application include:

- land use (compatibility with future land use);
- noise and vibration;
- air quality impacts;
- water;
- visual impact;
- ecology (flora and fauna);
- heritage;
- hazard and risk;
- transport and traffic; and
- social and economic.

9.2 Prioritisation of Issues

9.2.1 Approach

The prioritisation of issues for the proposed project is based on the need to recognise that the higher the potential severity of adverse environmental effects and the greater the consequence of those unmanaged effects, the higher the degree of environmental assessment required.

Where a high potential effect was identified, the attribute or issue was allocated a higher priority for assessment.

Table 9: provides the Issues Prioritisation Matrix upon which the ranking of environmental issues has been based. This method assesses priority on the basis of the potential severity of environmental effects and the likely consequences of those potential effects if unmanaged. The potential severity and consequence of the environmental effect are each given a numerical value between 1 and 3. The numbers are added together to provide a result which is then ranked and shaded in the matrix by the level of priority being High, Medium or Low.

Table 9: Issues Prioritisation Matrix

Severity Of Effects	Consequence of Unmanaged Effects		
	3 High	2 Medium	1 Low
1 Low	4 (Medium)	3 (Low)	2 (Low)
2 Medium	5 (High)	4 (Medium)	3 (Low)
3 High	6 (High)	5 (High)	4 (Medium)

9.2.2 Assessment

The prioritisation of environmental issues related to the proposed project is shown in **Table 10**. This assessment aims to allow the prioritisation of issues for assessment and does not consider the application of mitigation measures to manage environmental effects. In all cases, appropriate and proven mitigation measures, chosen based upon the experience of regulators and other similar projects would be used to minimise potential impacts. These measures would be described in detail in the EA prepared for the proposed project.

The allocation of risk is based upon the following considerations:

Severity of Risk

Low: localised implications; imperceptible or short term cumulative impacts.

Medium: regional implications; modest or medium term cumulation of impacts.

High: inter-regional implications: serious or long term cumulation of impacts.

Consequences of Unmanaged Effects

Low: minor environmental change; offsets readily available.

Medium: moderate adverse environmental change; offsets available.

High: important adverse environmental change, offsets not readily available.

Table 10: Prioritisation Analysis

Issue	Severity	Consequence	Priority
Aspect: Air Quality			
Construction related impacts on air quality such as dust generation and vehicle emissions	1	2	**3 (Low)**
Combustion (odour and NO_x) emissions from gas plant during operations and impacts on air shed of surrounding area	2	2	**4 (Medium)**
Impacts on air quality such as dust generation and vehicle emissions during production and post-development activities	1	1	**2 (Low)**
Odour emissions as a result of drilling activities.	1	1	**2 (Low)**
Community concern regarding degradation of air quality.	2	1	**3 (Low)**
Regional and inter-regional impacts upon air quality.	1	1	**2 (Low)**
Aspect: Water			
Degradation of surface water quality in the local area during construction.	1	2	**3 (Low)**

Issue	Severity	Consequence	Priority
Degradation of surface water quality in the local area during operation.	1	1	**2 (Low)**
Release of formation waters into the surface drainage, including the potential for saline waters or sediment laden waters	1	1	**2 (Low)**
Dewatering and disruption to groundwater aquifers due to activities	2	2	**4 (Medium)**
Reduction of groundwater quality through connectivity of aquifers and saline groundwater storage on the surface	2	1	**3 (Low)**
Surface water runoff into the Upper Canal Water Supply during construction and operation of the gas plant	2	3	**5 (High)**
Aspect: Noise and Vibration			
Temporary noise nuisance to local residents during construction of well surface location and gas gathering lines	2	2	**4 (Medium)**
Noise nuisance to local residents during production	1	2	**3 (Low)**
Noise nuisance to local residents during maintenance	1	2	**3 (Low)**
Temporary noise during construction of gas plant	1	2	**3 (Low)**
Noise nuisance during operation of gas plant	2	2	**4 (Medium)**
Aspect: Hazard and Risk			
Exposure of surrounding land uses to risks and hazards during construction.	2	2	**4 (Medium)**
Exposure of surrounding land uses to risks and hazards during operation.	2	2	**4 (Medium)**
Exposure of employees to risks and hazards.	2	2	**4 (Medium)**

Issue	Severity	Consequence	Priority
Aspect: Geology and Soils			
Erosion and sedimentation during construction.	2	1	**3 (Low)**
Potential geotechnical impacts as a result of drilling and fracing operations.	2	2	**4 (Medium)**
Potential sterilisation of coal seams for future mining activities.	1	2	**3 (Low)**
Contamination and sterilisation of land for future uses.	1	2	**3 (Low)**
Aspect: Ecological			
Loss of habitat due to clearing and development.	2	2	**4 (Medium)**
Reduction in biodiversity due to loss of habitat for native species.	1	1	**2 (Low)**
Spread of weeds and feral animals.	1	2	**3 (Low)**
Impact upon threatened species.	2	3	**5 (High)**
Aspect: Socio-Economic			
Demand upon community, natural or transport resources.	1	1	**2 (Low)**
Impacts upon amenity of surrounding properties such as noise, visual, etc	1	2	**3 (Low)**
Job creation during construction	1	1	**2 (Low)**
Job creation during operation	1	1	**2 (Low)**
Aspect: Cultural Heritage			
Impacts on Non-Indigenous heritage (Upper Canal Water Supply System).	2	2	**4 (Medium)**
Impacts on Indigenous heritage.	2	1	**3 (Low)**
Visual Impacts			
Visual impacts during construction.	1	2	**3 (Low)**
Visual impacts during	1	2	**3 (Low)**

Issue	Severity	Consequence	Priority
operation of well surface locations.			
Visual impacts during operation of gas plant	2	2	**4 (Medium)**
Aspect: Land Use			
Inappropriate use of land	1	1	**2 (Low)**
Incompatibility of land use with surrounding environment	1	2	**3 (Low)**
Incompatibility of land use with new land uses proposed for area	2	3	**5 (High)**
Aspect: Traffic and Transportation			
Increase in traffic on local road network during construction.	1	1	**2 (Low)**
Increase in traffic on local road network during operation.	1	1	**2 (Low)**

Table 11 identifies that the prioritisation of environmental issues, and therefore the focus of assessment for the proposed project should be as follows:

Table 11: Prioritisation of Issues

Low	Medium	High
Air Quality Geology and Soils Ecology Socio-Economic Visual Impacts (well surface locations) Traffic and Transportation	Air Quality (Combustion emissions from gas plant) Water (disruption to groundwater) Hazard and Risk Geology and Soils (Geotechnical impacts) Cultural Heritage Ecology Visual (gas plant) Noise and Vibration	Land Use (compatibility with future land use). Ecology (Threatened Species) Surface Water (runoff into water supply)

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10.0 Findings

The EA for the Northern Expansion of the CGP would focus on the key impacts of the environmental factors addressed in **Sections 5** to **8**. This EASR has identified the key environmental issues as being:

- Land Use (compatibility with future land use);
- Ecology (Threatened Species);
- Surface Water;
- Hazard and Risk; and
- Noise and Vibration.

10.1 Land Use

As indicated earlier in this report, the proposed works are generally located within areas which are currently zoned for future urban (residential, commercial and industrial) development. In this regard, it will be important for the EA to address the impact on both existing and future land uses, to develop locational principles in line with the existing guidelines which take into account potential impacts, and to identify appropriate mitigation measures (such as landscaping and/or fencing/enclosures) to manage potential impacts.

Previous developments within the CGP have demonstrated the capacity for coexistence of wells and future urban development zones. Well surface locations have been successfully integrated to have minimal impact on visual amenity of sites. Rehabilitation and design measures would ensure adequate landscaping both during, and post closure of well surface locations.

Consultation with landowners has been significant and emphasised as part of the existing CGP and would continue to play a significant role as part of the Northern Expansion. Ultimately, consultation with landowners would be included in the final selection of well surface locations and associated infrastructure.

10.2 Ecology

The general landscape is primarily semi rural and agricultural lands. Native vegetation has been extensively cleared over a majority of the Surface Project Area with some larger and moderately well connected patches of remnant and regrowth Cumberland Plain Woodland over the hills and lower slopes of the northern section.

The existing ecological environment within each envelope of the well surface locations, gas plant and associated infrastructure would need to be further assessed as part of the EA and appropriate mitigation for the proposed works (where required) identified.

10.3 Surface Water

Surface water impacts are primarily expected during the construction phase of the project. Impacts are expected to be associated with site preparation, construction of the gas plant, truck movements and gas gathering line installation due to the location of the gas plant and gas gathering lines in proximity to the Upper Canal.

A more detailed assessment of the surface water environment within the Northern Expansion would be undertaken as part of the EA. Surface water impacts are expected to be manageable provided appropriate mitigation measures are implemented.

10.4 Hazard and Risk

Previous stages of the CGP have undertaken risk assessments with aims to identify and analyse hazards, identify risk reduction techniques and implement as appropriate. The Northern Expansion will investigate hazard and risk from wells below surface, the drilling and casing of wells, bringing the wells into production, gas gathering lines, and the construction and operation of the gas plant and supply pipeline.

A PHA will be undertaken with reference to the Department of Planning's Hazardous Industry Planning Advisory Paper (HIPAP) No. 6, *Guidelines for Hazard Analysis* and to HIPAP No. 4, *Risk Criteria for Land Use Planning*.

Risks associated with construction and operation phases of the Northern Expansion are expected to be manageable provided guidelines are followed and appropriate mitigation measures are developed.

10.5 Noise and Vibration

The existing environment within which the well surface locations, gas plant and associated infrastructure will be located is predominantly rural in nature with some areas planned for future urban (residential, commercial and industrial) development. In this regard, co-existence of the proposed project and future development will be a key consideration for the project.

Noise impacts from the well surface locations are primarily expected during the construction phase of the project, which is likely to occur prior to occupation of future residential areas. Impacts are expected to be associated with site preparation, construction of access roads, well drilling, truck movements and gas gathering line installation.

Noise impacts from the gas plant are expected during the operational phase of the Project. Siting of the gas plant and identification and implementation of specific noise mitigation will be addressed in a detailed assessment.

A detailed noise report will be undertaken as part of the EA to establish background noise levels, potential impacts and identification of mitigation measures.

10.6 Other Environmental Issues

In addition to the key environmental issues, other environmental issues have been identified as follows:

- Air Quality;
- Groundwater
- Visual;
- Cultural heritage; and
- Transport and traffic.

The impacts associated with these other environmental issues are not expected to be significant and/or are confined primarily to the construction phase of the project. The impacts are likely to be able to be managed through the design of the project and the implementation of standard and proven mitigation. These environmental issues will be addressed further in the EA.

10.7 Social and Economic Issues

In addition to the environmental issues, the proposed Northern Expansion is expected to generate interest from the local and broader community, as well as key agency stakeholders. An appropriate Consultation Strategy has and is continuing to be developed and partially implemented as part of the planning and development process. An appropriate level of consultation will continue to occur during preparation of the EA and a social and economic appraisal of the development would be included as part of the EA of the project.

A key social issue identified throughout this EASR is the co-existence of the proposed works within future residential areas. The Northern Expansion is located within the Camden and Campbelltown LGAs and therefore encounters land earmarked as part of the NSW Metropolitan Strategy SWGC, namely Turner Road and East Leppington Development Estates, as well as Council Development Areas El Caballo Blanco and Gledswood and Camden. The EA will therefore examine a suite of mitigation measures that can be implemented to manage the siting and operation of project elements in an appropriate manner.

11.0 Concluding Statement

11.1 Level of Assessment

This EASR has undertaken an initial appraisal of potential effects associated with the activities proposed as part of the Project and has identified three high priority environmental issues being land use (compatibility with future land uses), ecology (threatened species), and surface water (impact on the Upper Canal). Other key environmental issues for the project include:

- Air Quality;
- Geology and Soils;
- Groundwater;
- Cultural Heritage;
- Visual Impacts (gas plant);
- Hazard and Risk; and
- Noise and Vibration.

These issues would be considered in detail in the EA. Other environmental issues would be addressed as part of the EA, although such issues are not expected to have significant effects and should be able to be managed through the implementation of appropriate mitigation measures and consultation with landowners.

An appropriate level of consultation would continue to be implemented during preparation of the EA as part of the Consultation Strategy for the project. A social and economic approval of the development would be included as part of the EA for the Project.

11.2 Approvals Process

As discussed in **Section 3.3.2,** the proposed project meets the criteria in the Major Project SEPP and therefore is a candidate for assessment under Part 3A of the EP&A Act, subject to the Minister declaring the project as a 'major project' for the purposes of Part 3A of the Act. On the basis of the Minister's decision on this EASR prepared for the project, the Director General's environmental assessment requirements for this project would be requested.

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Figures

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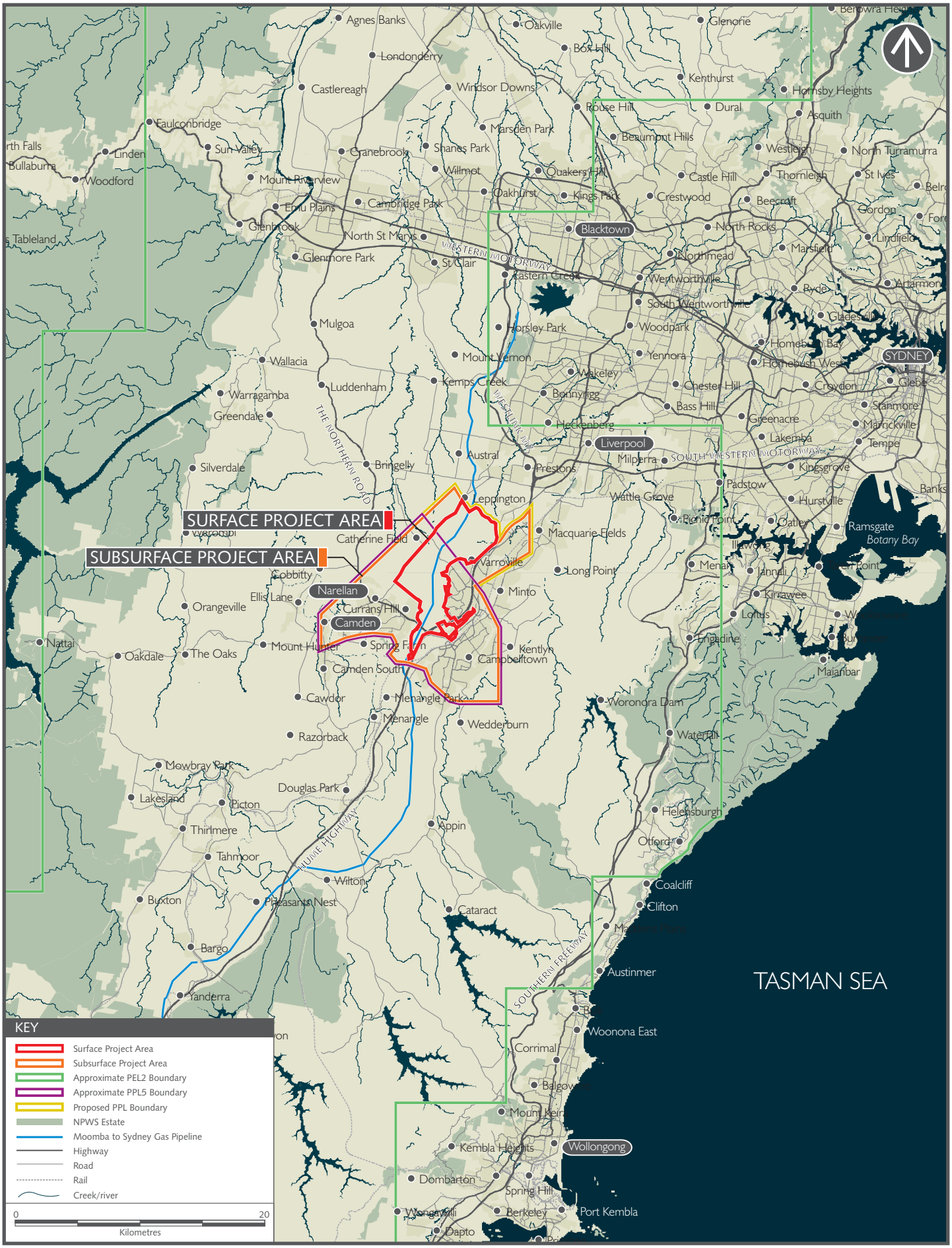

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CAMDEN GAS PROJECT WITHIN PEL 2 BOUNDARY

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 1

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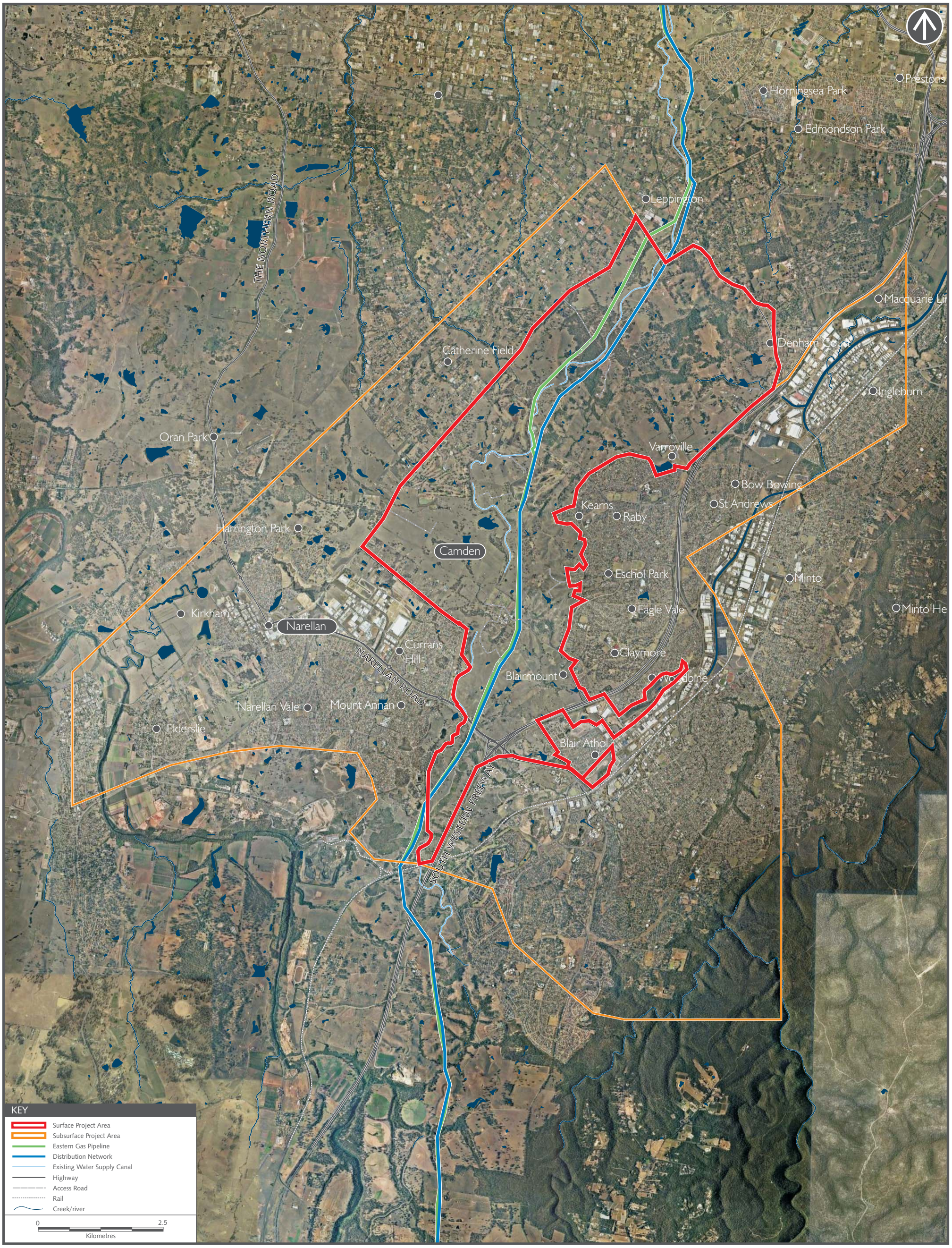

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NORTHERN AREA EXPANSION OVERVIEW

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 2

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UPPER SURFACE PROJECT AREA

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 3a

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CENTRAL SURFACE PROJECT AREA

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 3b

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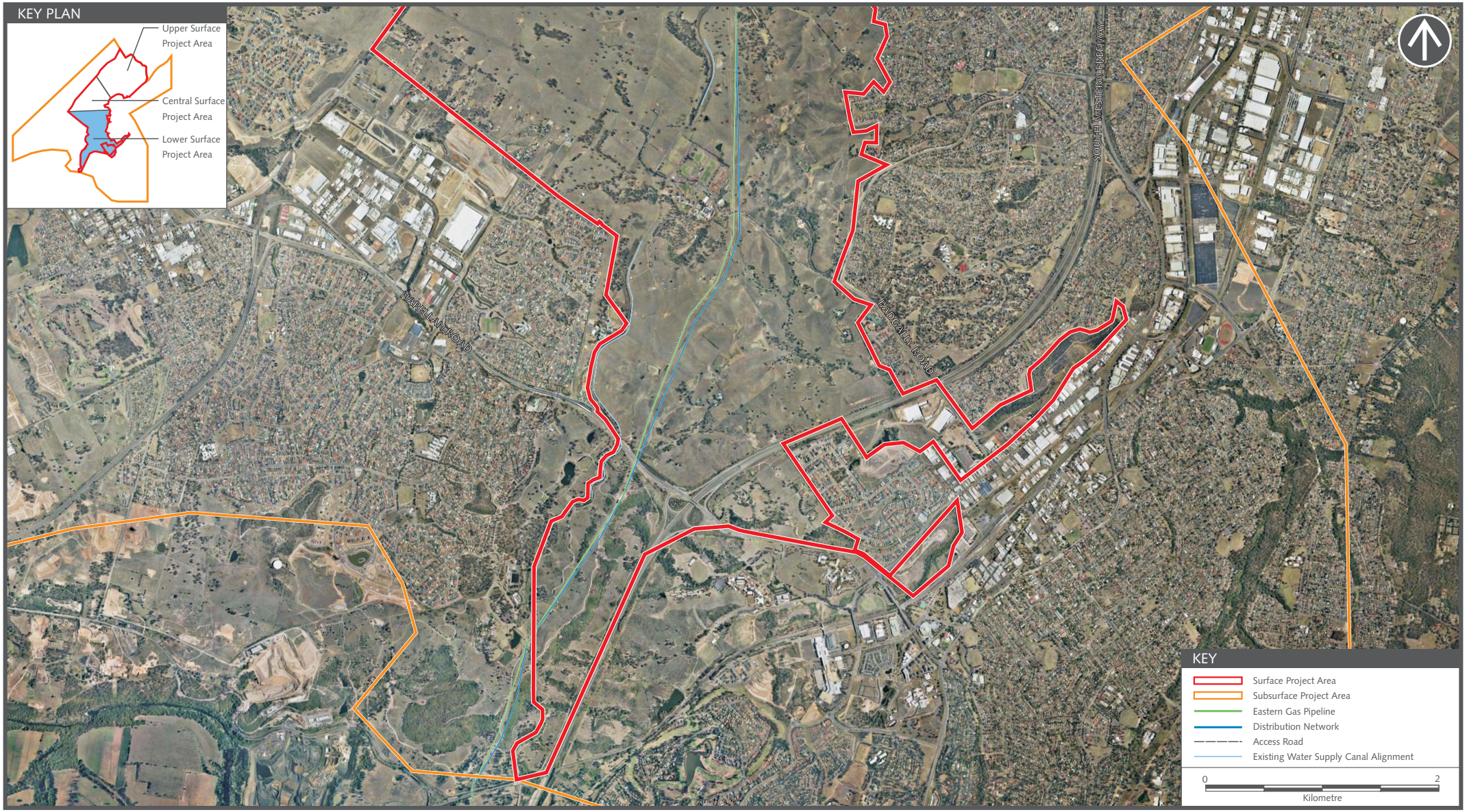

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LOWER SURFACE PROJECT AREA

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 3c

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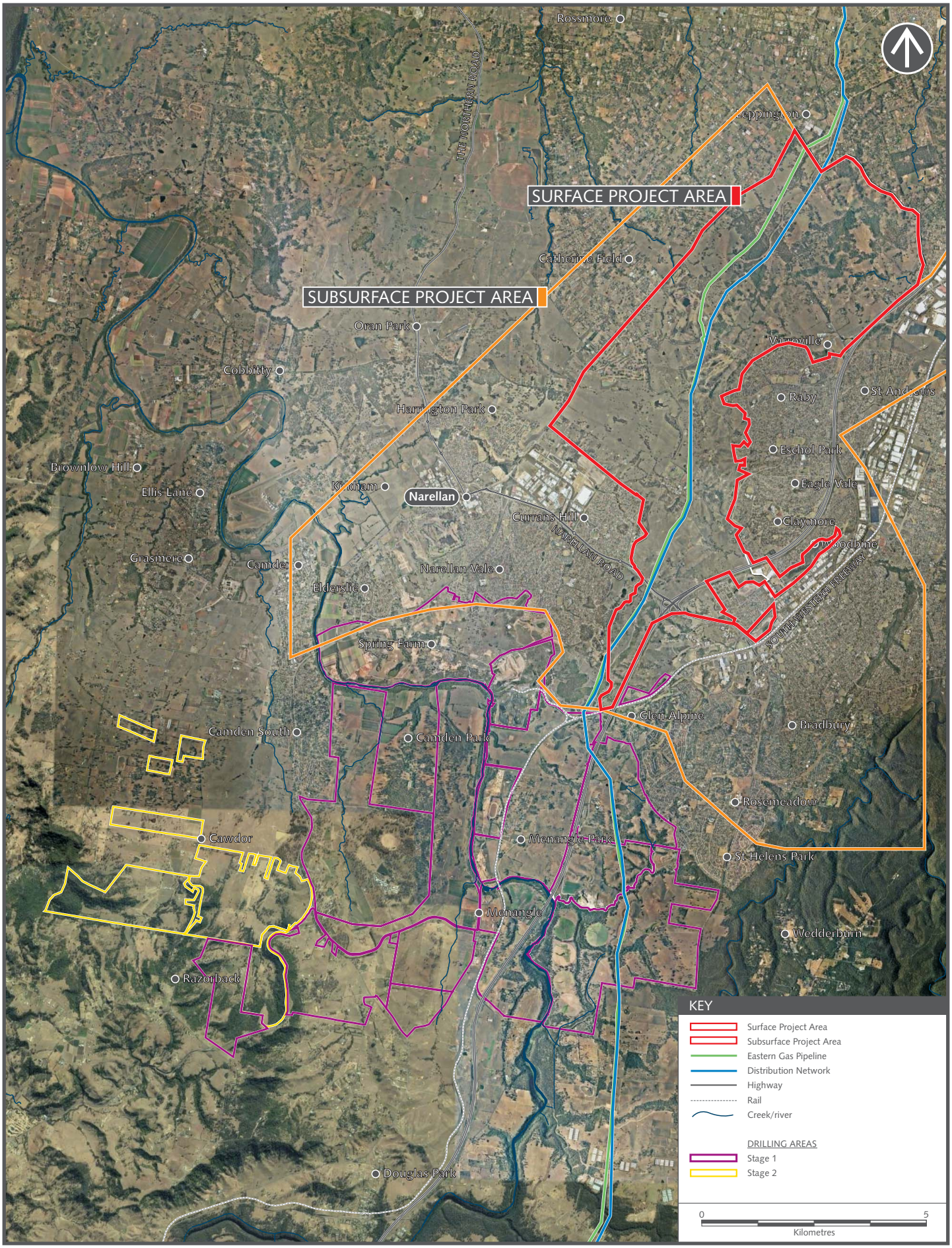

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EXISTING WELLFIELDS - CAMDEN GAS PROJECT

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 4

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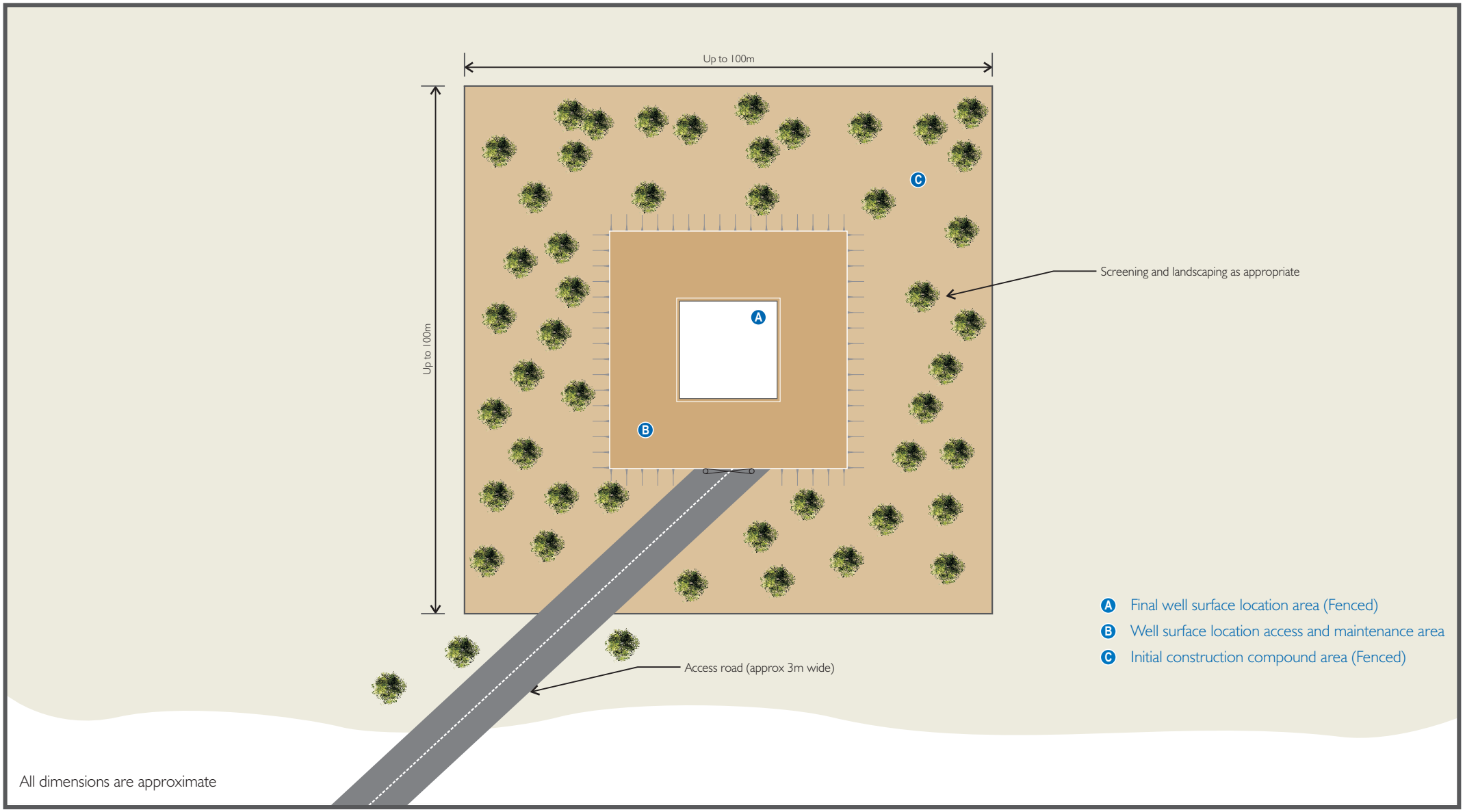

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WELL SURFACE LOCATION INDICATIVE LAYOUT

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 5

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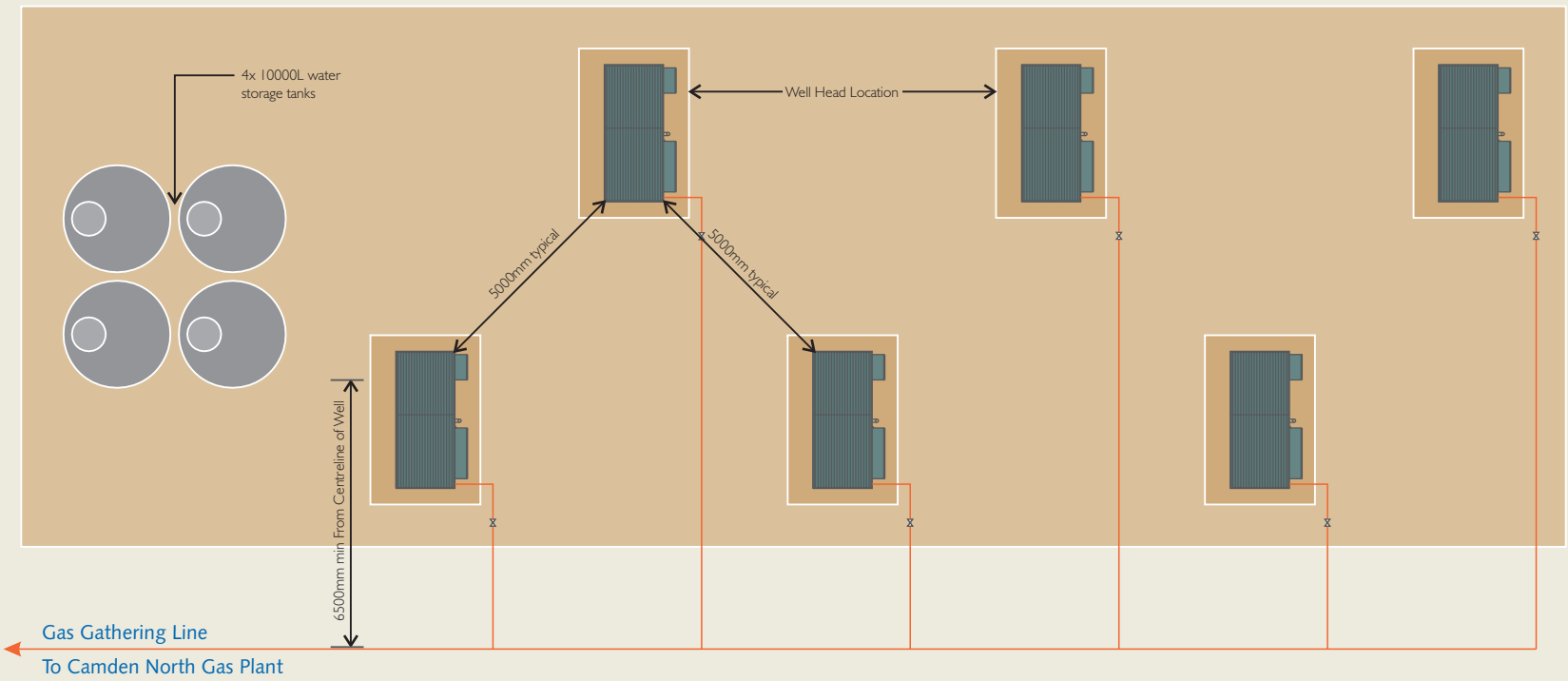

AECOM

INDICATIVE 6 MULTIWELL LAYOUT

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 6

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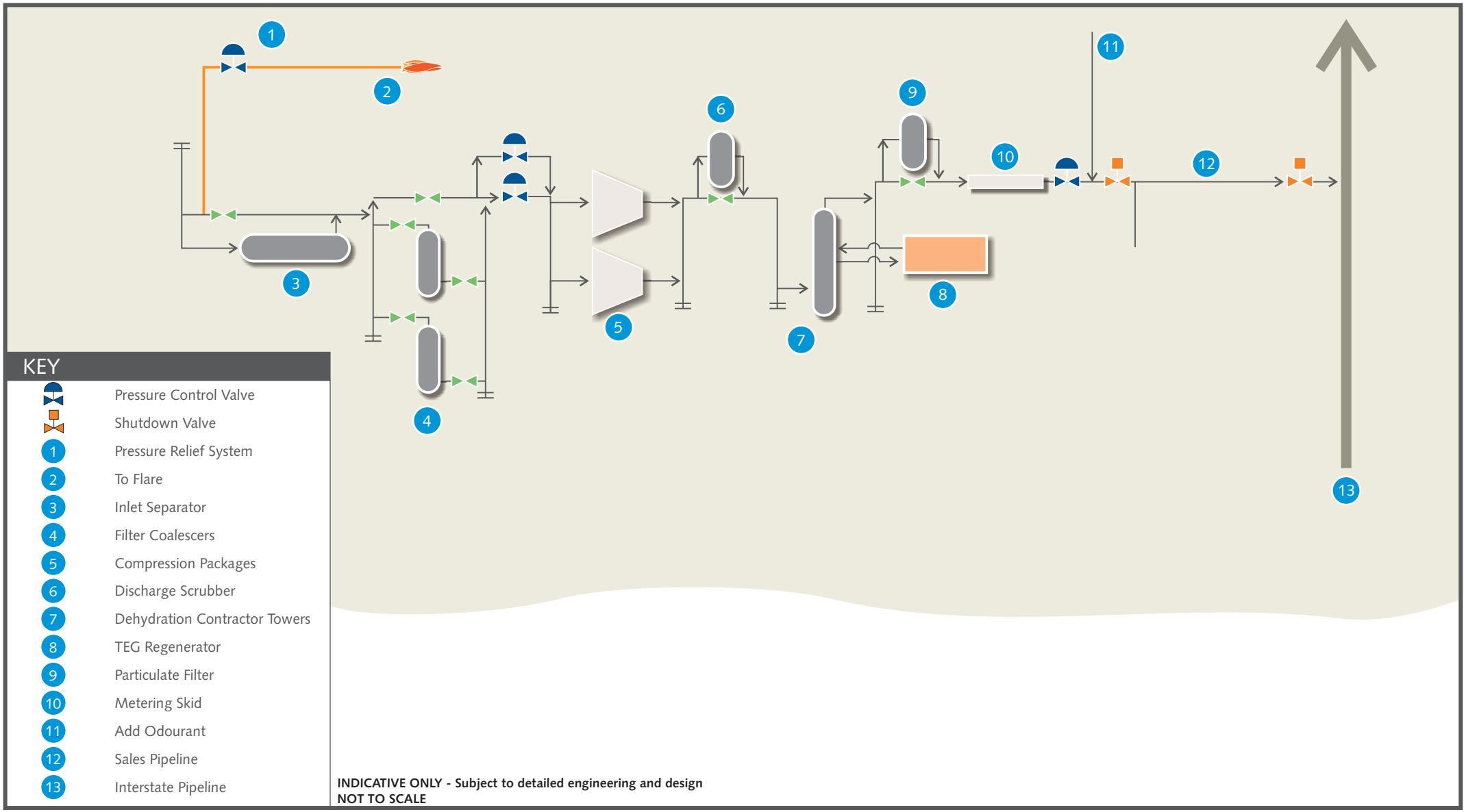

AECOM

GAS TREATMENT PROCESS WITHIN CAMDEN NORTH GAS PLANT

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Figure 7

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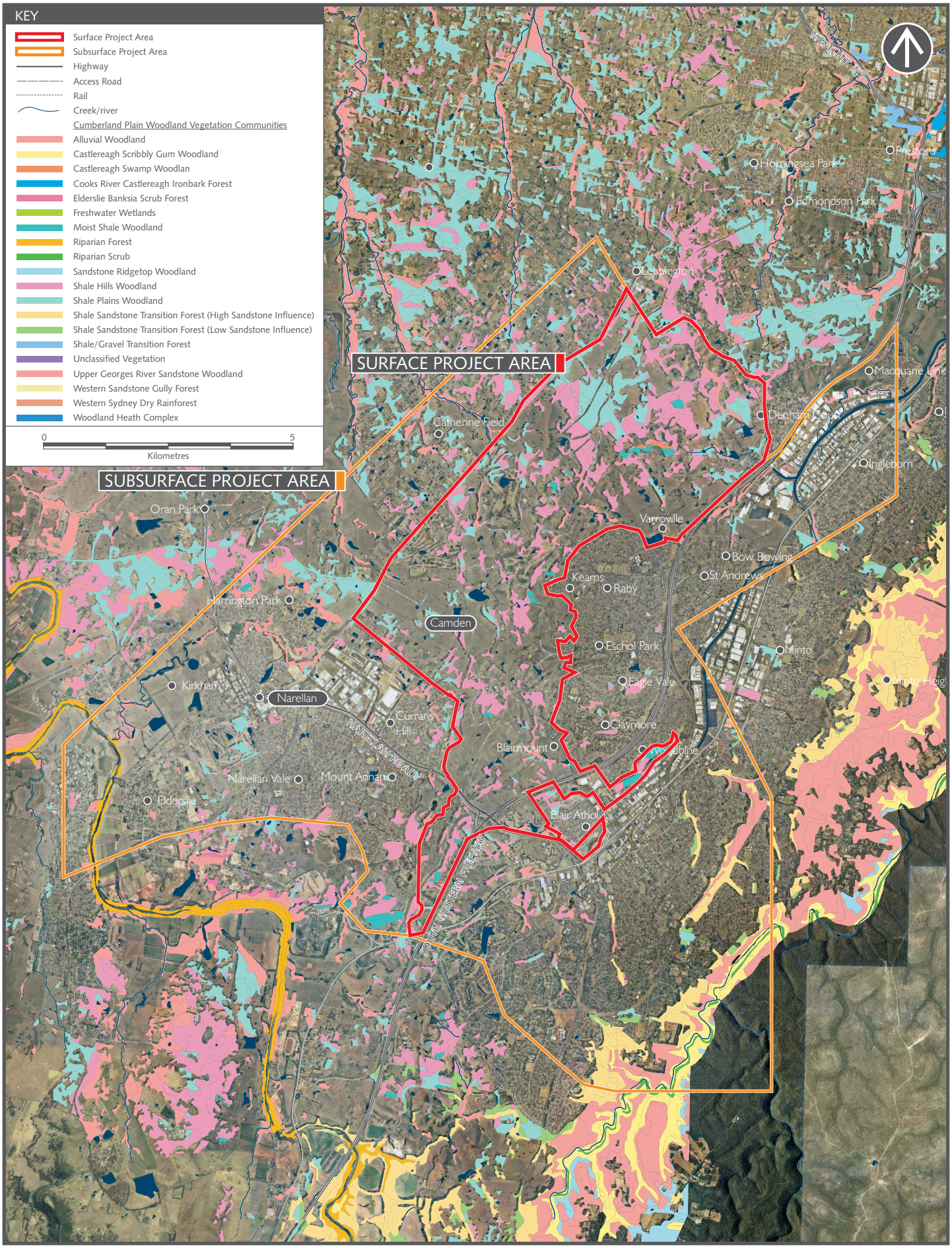

AECOM

CUMBERLAND PLAIN WOODLAND VEGETATION COMMUNITIES

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Figure 8

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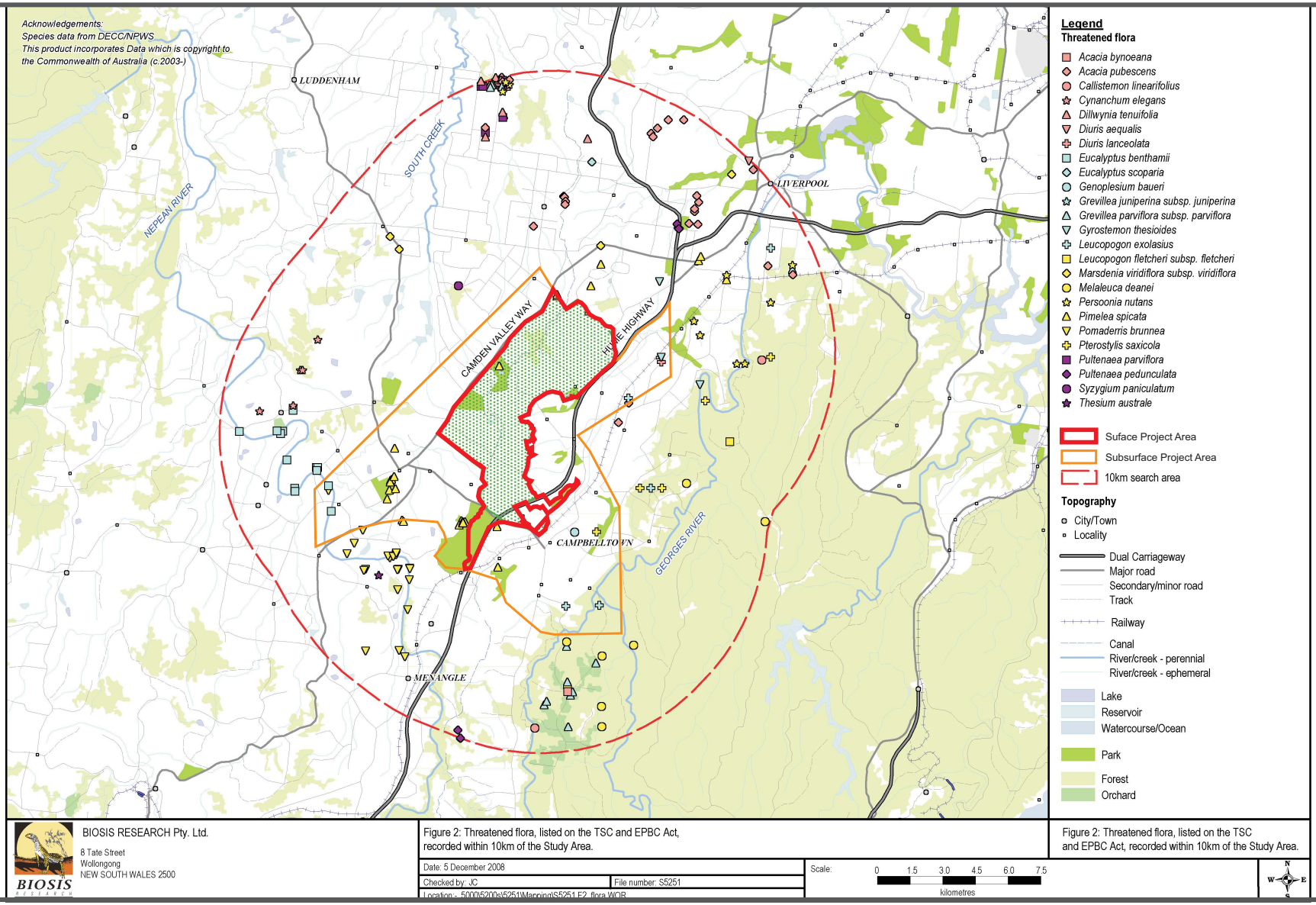

Figure 2: Threatened flora, listed on the TSC and EPBC Act, recorded within 10km of the Study Area.

AECOM

THREATENED FLORA LISTED ON THE TSC AND EPBC ACT

Environmental Assessment Scoping Report

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Figure 9

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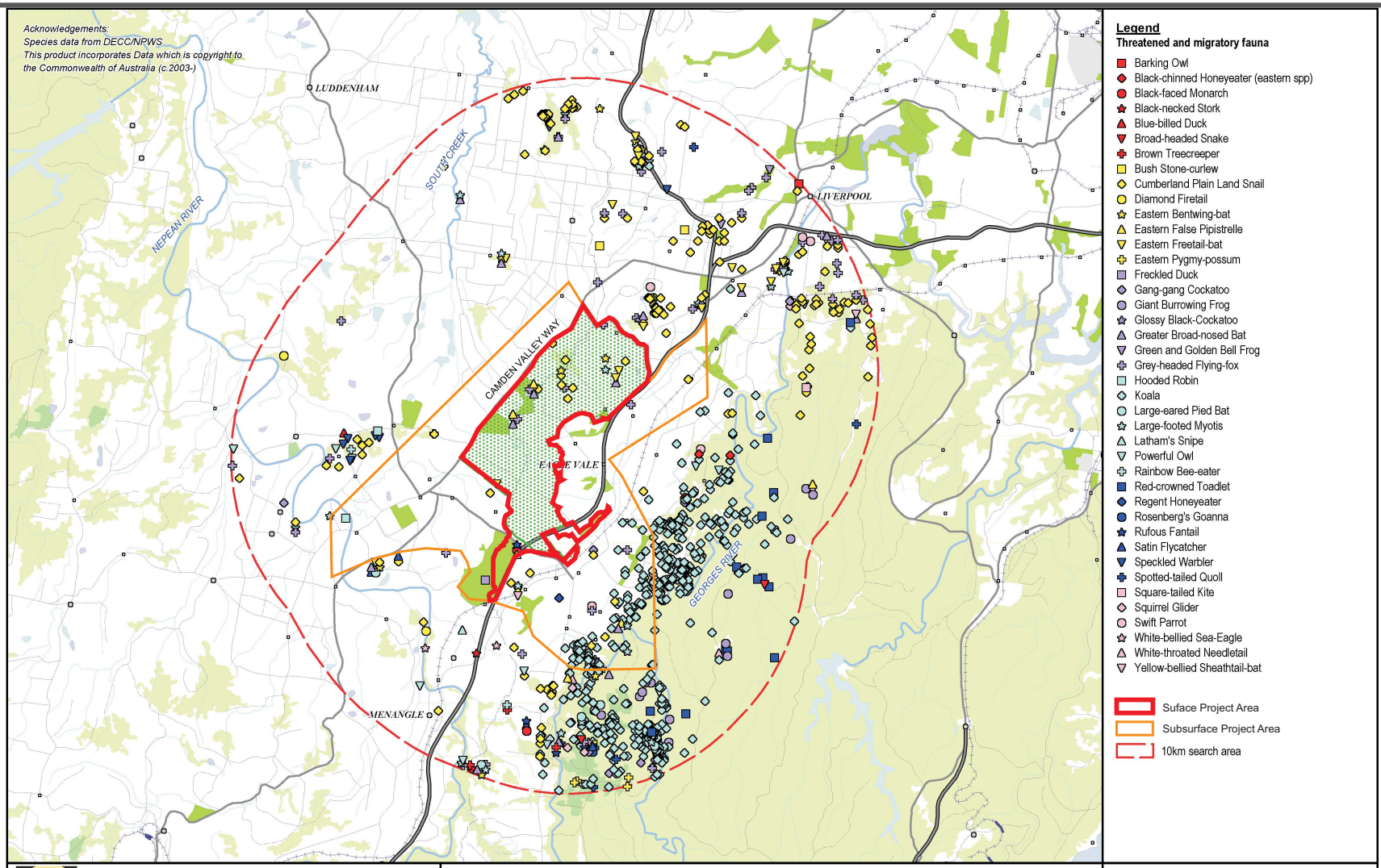

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Wollongong
NEW SOUTH WALES 2500

Figure 3: Threatened and migratory fauna, listed on the TSC and EPBC Act, recorded within 10km of the Study Area.

Date: 5 December 2008
Checked by: JC
File number: S5251
Location: - .5000\5200s\5251\Mapping\S5251 F3_fauna.WOR

Scale: 0 1.5 3.0 4.5 6.0 7.5 kilometres

Figure 3: Threatened and migratory fauna, recorded within 10km of the Study Area.

AECOM

THREATENED FAUNA LISTED ON THE TSC AND EPBC ACT

Environmental Assessment Scoping Report

Camden Gas Project Northern Expansion

Figure 10

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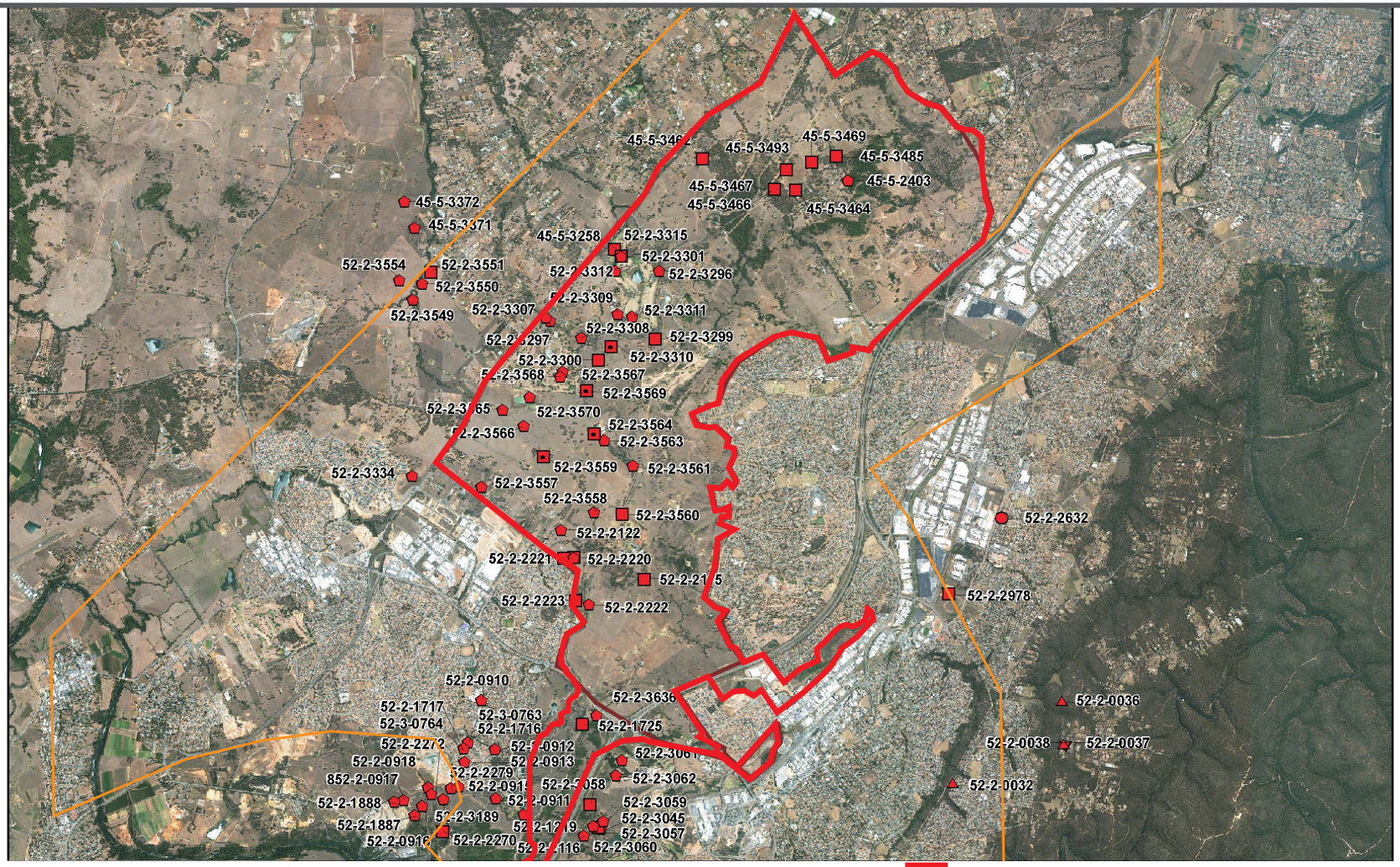

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Author: Courtney Collins

Date: January 2009

Ref: 1862

AECOM

AHIMS REGISTERED SITE LOCATIONS

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Camden Gas Project Northern Expansion

Figure 11

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Appendix A

DECCW Threatened Species Lists

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1.0 DECC Threatened Species Lists

1.1.1 Threatened Flora

Table 1 displays the species of threatened flora that have been previously recorded within 10 km of the study area (DECC *Atlas of NSW Wildlife* record) and/or have the potential to occur (DEWHA EPBC Act *Protected Matters Database* search result). Species previously recorded within the study area are highlighted in bold.

Table 1: Threatened flora recorded or potentially occurring within 10 km of the study area.

Family Name	Scientific Name	Common Name	Status EPBC Act[1]	Status TSC Act[2]	DECC NSW Wildlife Atlas record	DEWHA Protected Matter search result
Asclepiadaceae	*Cynanchum elegans*	White-flowered Wax Plant	E	E1	✓	✓
Asclepiadaceae	*Marsdenia viridiflora* ssp. *viridiflora*	Native Pear	-	EP	✓	-
Brassicaceae	*Lepidium hyssopifolium*	Basalt Peppercress	E	E1	-	✓
Epacridaceae	*Leucopogon exolasius*	Woronora Beard-heath	V	V	✓	✓
Epacridaceae	*Leucopogon fletcheri* ssp. *fletcheri*	-	-	E1	✓	-
Fabaceae (Faboideae)	*Dillwynia tenuifolia*	-	V	V	✓	✓
Fabaceae (Faboideae)	*Pultenaea aristata*	Prickly Bush-pea	V	V	-	✓
Fabaceae (Faboideae)	*Pultenaea parviflora*		V	E1	✓	✓
Fabaceae (Faboideae)	*Pultenaea pedunculata*	Matted Bush-pea	-	E1	✓	-
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	V	E1	✓	✓
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	✓	✓
Gyrostemonaceae	*Gyrostemon thesioides*	Gyrostemon thesioides	-	E1	✓	-
Myrtaceae	*Callistemon linearifolius*	-	-	V	✓	-
Myrtaceae	*Eucalyptus benthamii*	Nepean River Gum	V	V	✓	✓

Family Name	Scientific Name	Common Name	Status EPBC Act[1]	Status TSC Act[2]	DECC NSW Wildlife Atlas record	DEWHA Protected Matter search result
Myrtaceae	*Eucalyptus scoparia*	Wallangarra White Gum	V	E1	✓	-
Myrtaceae	*Melaleuca deanei*	Dean's Melaleuca	V	V	✓	✓
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	V	V	✓	-
Orchidaceae	*Caladenia tessellata*	Tessellated Spider Orchid	V	E1	-	✓
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue Orchid	V	V	-	✓
Orchidaceae	*Diuris aequalis*	Buttercup Doubletail	V	E1	✓	-
Orchidaceae	*Diuris lanceolata*	Snake Orchid	E	-	✓	-
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	-	V	✓	-
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	E	E1	✓	✓
Proteaceae	*Grevillea juniperina* ssp. *juniperina*	-	-	V	✓	-
Proteaceae	*Grevillea parviflora* ssp. *parviflora*	Small-flower Grevillea	V	V	✓	✓
Proteaceae	*Persoonia bargoensis*	Bargo Geebung	V	E1	-	✓
Proteaceae	*Persoonia nutans*	Nodding Geebung	E	E1	✓	✓
Rhamnaceae	*Pomaderris brunnea*	Rufous Pomaderris	V	V	✓	✓
Santalaceae	*Thesium australe*	Austral Toad-flax	V	V	✓	-
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E1	✓	✓

Key: 1) Listed on the EPBC Act as Endangered (E) or Vulnerable (V).

2) Listed on the TSC Act as Endangered (E1), Vulnerable (V) or as an Endangered Population (EP).

1.1.2 Threatened and/or Migratory Fauna

Table 2 displays the terrestrial species of threatened and/or migratory fauna that have been previously recorded within 10 km of the study area (DECC *Atlas of NSW Wildlife* record) and/or have the potential to occur (DEWHA EPBC Act *Protected Matters Database* search result). Species previously recorded within the study area are in bold.

Table 2: Terrestrial threatened and/or migratory fauna recorded or potentially occurring within 10 km of the study area.

Family Name	Scientific Name	Common Name	Status EPBC Act[1]	Status TSC Act[2]	DECC NSW Wildlife Atlas record	DEWHA Protected Matter search result
Amphibians						
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	V	E1	✓	✓
Hylidae	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	-	✓
Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	✓	✓
Myobatrachidae	*Mixophyes balbus*	Stuttering Frog	V	E1	-	✓
Myobatrachidae	*Mixophyes iteratus*	Giant Barred Frog	E	E1	-	✓
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	-	V	✓	-
Birds						
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	M	-	✓	✓
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	-	V	✓	-
Anatidae	*Oxyura australis*	Blue-billed Duck	-	V	✓	-
Anatidae	*Stictonetta naevosa*	Freckled Duck	-	V	✓	-
Apodidae	*Apus pacificus*	Fork-tailed Swift	M	-	-	✓
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	M	-	✓	✓
Ardeidae	*Ardea alba*	Great Egret	M	-	-	✓
Ardeidae	*Ardea ibis*	Cattle Egret	M	-	-	✓
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	-	E1	✓	-
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	-	V	✓	-
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-cockatoo	-	V	✓	-
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	-	E1	✓	-

Family Name	Scientific Name	Common Name	Status EPBC Act[1]	Status TSC Act[2]	DECC NSW Wildlife Atlas record	DEWHA Protected Matter search result
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	-	V	✓	-
Dicruridae	*Monarcha melanopsis*	Black-faced Monarch	M	-	✓	✓
Dicruridae	*Myiagra cyanoleuca*	Satin Flycatcher	M	-	✓	✓
Dicruridae	*Rhipidura rufifrons*	Rufous Fantail	M	-	✓	✓
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	-	V	✓	-
Meliphagidae	*Xanthomyza phrygia*	Regent Honeyeater	E	E1	✓	✓
Meropidae	*Merops ornatus*	Rainbow Bee-eater	M	-	✓	✓
Pardalotidae	*Pyrrholaemus sagittatus*	Speckled Warbler	-	V	✓	-
Passeridae	*Stagonopleura guttata*	Diamond Firetail	-	V	✓	-
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	-	V	✓	-
Psittacidae	*Lathamus discolor*	Swift Parrot	E	E1	✓	✓
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	VM	E1	-	✓
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	M	-	✓	✓
Strigidae	*Ninox connivens*	Barking Owl	-	V	✓	-
Strigidae	*Ninox strenua*	Powerful Owl	-	V	✓	-
Invertebrates						
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	-	E1	✓	-
Mammals						
Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	-	V	✓	-
Dasyuridae	*Dasyurus maculatus maculatus*	Spotted-tailed Quoll (south-eastern mainland)	E	V	✓	✓
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	-	V	✓	-

Family Name	Scientific Name	Common Name	Status EPBC Act[1]	Status TSC Act[2]	DECC NSW Wildlife Atlas record	DEWHA Protected Matter search result
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	V	E1	-	✓
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail Bat	-	V	✓	-
Peramelidae	*Isoodon obesulus*	Southern Brown Bandicoot	E	E1	-	✓
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	-	V	✓	-
Phascolarctidae	*Phascolarctos cinereus*	Koala	-	V	✓	-
Potoroidae	*Potorous tridactylus*	Long-nosed Potoroo (south-eastern mainland)	V	V	-	✓
Pteropodidae	*Pteropus poliocephalus*	**Grey-headed Flying-fox**	V	V	✓	✓
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	✓	✓
Vespertilionidae	*Falsistrellus tasmaniensis*	**Eastern False Pipistrelle**	-	V	✓	-
Vespertilionidae	*Miniopterus schreibersii oceanensis*	**Eastern Bentwing Bat**	-	V	✓	-
Vespertilionidae	*Myotis macropus*	**Large-footed Myotis**	-	V	✓	-
Vespertilionidae	*Scoteanax rueppellii*	**Greater Broad-nosed Bat**	-	V	✓	-
Reptiles						
Elapidae	*Hoplocephalus bungaroides*	Broad-headed Snake	V	E1	✓	✓
Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	-	V	✓	-

Key: 1) Listed on the EPBC Act as Endangered (E), Vulnerable (V) or Migratory (M).
2) Listed on the TSC Act as Endangered (E1) or Vulnerable (V).

The DEWHA on-line EPBC Act *Protected Matters Database* search also resulted in two threatened aquatic species: the Macquarie Perch (Endangered) and Australian Grayling (Vulnerable) have the potential to occur within study area if suitable habitat exists.

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Worldwide Locations

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Azerbaijan	+994 12 4975881
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Brazil	+55-21-3526-8160
China	+86-20-8130-3737
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