



AGL UPSTREAM INVESTMENTS PTY LTD

CAMDEN GAS PROJECT

**Six-Monthly Produced Water Quality Monitoring  
Report**

Reporting Period: September 2019

AGL Upstream Investments Pty Ltd

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## Foreword

<b>PREMISES</b>	Rosalind Park Gas Plant Lot 35 Medhurst Road GILEAD NSW 2560
<b>LICENCE DETAILS</b>	<a href="#"><u>Environment Protection Licence 12003</u></a>
<b>LICENCEE</b>	AGL Upstream Investments Pty Limited (AGL)
<b>LICENCEE'S ADDRESS</b>	Locked Bag 3013, Australia Square, NSW 1215
<b>MONITORING DATE</b>	27 August 2019
<b>MONITORING BY</b>	AGL
<b>ANALYSIS BY</b>	ALS Laboratory, Smithfield (Work order number: ES1927264)
<b>DATE DATA OBTAINED</b>	03 September 2019
<b>REPORT DATE</b>	05 September 2019
<b>REPORT PREPARED BY</b>	D. Mudd, NSW Environment Business Partner

## Introduction

The Camden Gas Project (CGP) is owned and operated by AGL and is located in the Macarthur region 65 km southwest of Sydney, in the Wollondilly, Camden and Campbelltown Local Government Areas (Figure 1). The CGP has been producing gas for the Sydney region since 2001 and consists of 144 gas wells, low-pressure underground gas gathering pipes and a gas plant facility. Not all production wells are currently operational and some have been plugged and abandoned. The production wells are licensed with Water Access Licences, Works Approvals and Use Approvals under the *Water Management Act 2000* (NSW), including an allocation of 30 megalitres (ML) per year for the existing CGP and associated dewatering activities from the coal seams. In the 2018-19 financial year, approximately 1.391 ML of water was produced from the coal seams for the entire CGP operating wellfield.

This Monitoring Report relates to the groundwater monitoring activities specified in Part 5, Monitoring and Recording Conditions, of the Environment Protection Licence 12003. The Licence conditions stipulate groundwater monitoring is required to be carried out at the locations as shown in Table 1 and Figure 1. The specific analytes and frequency tested are shown in Table 2.

The monitoring points that are the subject of this report are part of the CGP groundwater monitoring network, as described in AGL's CGP Groundwater Management Plan (2018). Water samples are taken from each gas well at the separator. The deep groundwater (when brought to the surface) is known as produced water. The water quality samples are analysed by an external NATA certified laboratory (ALS Environmental, Smithfield), in accordance with the EPA Approved Methods Publication "*Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales*" (EPA, 2004), with the exception of dissolved methane, phenols and PAHs, which were analysed with an alternate method following written approval from the EPA (EPA, 2014) (refer to Table 2 for analytical methodology).

Many of the operating wells within the CGP produce very low volumes of water; frequently, there is not enough water present to allow for sampling at these monitoring points. For the monitoring event in this reporting period samples from only four monitoring points were able to be taken as there was not enough water present to sample at the remaining monitoring points. Samples were tested for all six monthly and yearly analytes shown in Table 2.

This report (including amendments) is prepared in accordance with the *Requirements for Publishing Pollution Monitoring Data* (EPA, 2013) (Publication Requirements).

Table 3 displays the results of this monitoring round.

Produced water from the coal seams at the CGP ranges in quality as a result of localised natural variations within the coal. Electrical conductivity (which is a measure of salinity) typically varies between about 7,000 and 15,000  $\mu\text{S}/\text{cm}$ . However, it is not unusual to see values outside of this range. Low volume water producing wells frequently show very low electrical conductivity values as a result of evaporation and condensation processes occurring in the well bore (PB, 2013). These very low values are not representative of formation water samples. It is noted that the results obtained from this monitoring event (FY20: September 2019) at monitoring points 12 and 15 (MP22, MP09) are typical values of electrical conductivity for produced water within the CGP however monitoring point 10 (RB10) has a low electrical conductivity value.

More information on the hydrogeology and groundwater of the CGP is available in the Hydrogeological Summary (AGL, 2013) which can be viewed at the CGP website: [agl.com.au/Camden](http://agl.com.au/Camden)

**Table 1- Groundwater quality monitoring points (as per EPL 12003)**

EPA monitoring point	Location	Easting (m)	Northing (m)
8	SF07	291438.99	6228305.89
9	SF08	291443.09	6228310.08
10	RB10	287810.84	6219786.79
11	SL02	294099.72	6224788.05
12	MP22	293687.20	6224899.40
13	MP07	293375.45	6226186.09
14	MP02	294535.49	6226548.66
15	MP09	294530.71	6226543.64

Coordinate reference system: Map Grid of Australia 1994 Zone 56

**Table 2 – Analytes monitored, frequency (as per EPL 12003) and methodology**

Analyte	Units of measure	Frequency	Sampling Method	Analytical method
<b>Aluminium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Ammonia</b>	milligrams per litre	Yearly	Grab sample	APHA (1998) section 4500-NH3
<b>Arsenic</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Barium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Benzene</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996b) method 8260B
<b>Beryllium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Bicarbonate</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) 2320
<b>Boron</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Bromide</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 4110
<b>Cadmium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Calcium</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 3030B then APHA (1998) section 3120
<b>Carbonate</b>	milligrams per litre	Every 6 months	Grab sample	APHA (2012) 2320B
<b>Chloride</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 4110
<b>Chromium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Cobalt</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Copper</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Electrical conductivity</b>	microsiemens per centimetre	Every 6 months	Grab sample	APHA (1998) section 2510 B
<b>Ethyl benzene</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996b) method 8260B
<b>Fluoride</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 4500-F- C
<b>Iron</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Lead</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Magnesium</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 3030B then APHA (1998) section 3120
<b>Manganese</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Mercury</b>	milligrams per litre	Every 6 months	Grab sample	Preliminary treatment APHA (1998) section 3030B; Then APHA (1998) section 3112
<b>Methane</b>	milligrams per litre	Yearly	Grab sample	In house static headspace GC/FID technique
<b>Molybdenum</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Nickel</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Nitrate</b>	milligrams per litre	Yearly	Grab sample	APHA (1998) section 4500-NO3-F
<b>Nitrite</b>	milligrams per litre	Yearly	Grab sample	APHA (1998) section 4500-NO3-F (with cadmium column removed)
<b>Phenols</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996a) method 8270 D
<b>Polycyclic aromatic hydrocarbons</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996a) method 8270 D
<b>Potassium</b>	milligrams per litre	Every 6 months	Grab sample	Preliminary treatment APHA (1998) section 3030B then APHA (1998) section 3120
<b>Reactive Phosphorus</b>	milligrams per litre	Yearly	Grab sample	APHA (1998) section 4500-P B; followed by APHA (1998) section 4500-P E
<b>Selenium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Silica</b>	milligrams per litre	Every 6 months	Grab sample	APHA 21st ed., 3120
<b>Sodium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Strontium (dissolved)</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3030(E-K) then USEPA (1994f) method 6020

Analyte	Units of measure	Frequency	Sampling Method	Analytical method
<b>Sulfate</b>	milligrams per litre	Every 6 months	Grab sample	APHA(1998) section 4500 SO42--E
<b>Toluene</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996b) method 8260B
<b>Total dissolved solids</b>	milligrams per litre	Every 6 months	Grab sample	APHA (1998) section 2540C
<b>Total petroleum hydrocarbons</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996h) method 8015B
<b>Uranium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Vanadium</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020
<b>Xylene</b>	milligrams per litre	Yearly	Grab sample	USEPA (1996b) method 8260B
<b>Zinc</b>	milligrams per litre	Every 6 months	Grab sample	USEPA (1992a) method 3005A then USEPA (1994f) method 6020

# Groundwater Monitoring Results

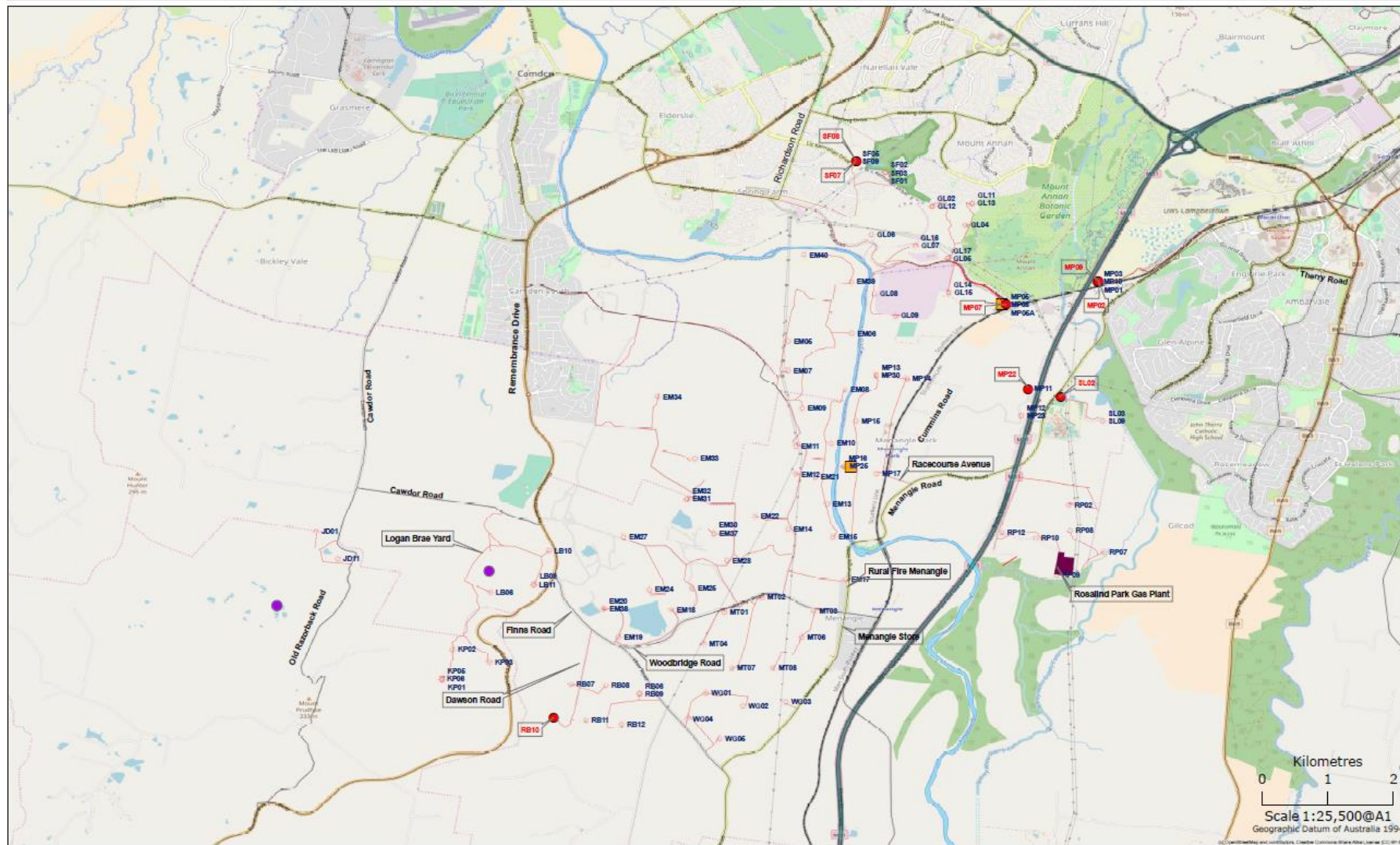
**Table 3 - Produced water monitoring results: September 2019**

		Monitoring point	8	9	10	11	12	13	14	15
		Location	SF07	SF08	RB10	SL02	MP22	MP07	MP02	MP09
		Sampled Date	Not enough water to sample (27/08/2019)	Not enough water to sample (27/08/2019)	27/08/2019	Not enough water to sample (27/08/2019)	27/08/2019	Not enough water to sample (27/08/2019)	Not enough water to sample (27/08/2019)	27/08/2019
		Data obtained	N/A	N/A	03/09/2019	N/A	03/09/2019	N/A	N/A	03/09/2019
Analyte	Units	Limit of reporting								
Aluminium	mg/L	0.01	-	-	<0.01	-	<0.01	-	-	<0.1
Ammonia	mg/L	0.01	-	-	4.23	-	5.4	-	-	5.05
Arsenic	mg/L	0.001	-	-	0.004	-	0.076	-	-	0.011
Barium	mg/L	0.001	-	-	4.07	-	14.1	-	-	14.2
Benzene	mg/L	0.001	-	-	<0.001	-	<0.001	-	-	<0.005
Beryllium	mg/L	0.001	-	-	0.003	-	<0.010	-	-	<0.010
Bicarbonate	mg/L	1	-	-	2020	-	6320	-	-	5470
Boron	mg/L	0.05	-	-	0.08	-	<0.05	-	-	<0.50
Bromide	mg/L	0.01	-	-	<0.500	-	<0.500	-	-	0.896
Cadmium	mg/L	0.0001	-	-	0.0005	-	<0.0010	-	-	<0.0010
Calcium	mg/L	1	-	-	21	-	29	-	-	24
Carbonate	mg/L	1	-	-	<1	-	2260	-	-	1750
Chloride	mg/L	0.1	-	-	37.8	-	358	-	-	780
Chromium	mg/L	0.001	-	-	0.001	-	<0.010	-	-	<0.010
Cobalt	mg/L	0.001	-	-	0.001	-	0.031	-	-	<0.010
Copper	mg/L	0.001	-	-	0.002	-	<0.010	-	-	<0.010
Electrical conductivity	µS/cm	1	-	-	4030	-	14400	-	-	14200
Ethyl benzene	mg/L	0.002	-	-	<0.002	-	<0.002	-	-	<0.005
Fluoride	mg/L	0.1	-	-	0.7	-	1	-	-	2.3
Iron	mg/L	0.05	-	-	0.05	-	0.23	-	-	<0.50
Lead	mg/L	0.001	-	-	<0.001	-	<0.010	-	-	<0.010
Magnesium	mg/L	1	-	-	3	-	16	-	-	<10
Manganese	mg/L	0.001	-	-	0.013	-	0.077	-	-	0.024

		Monitoring point	8	9	10	11	12	13	14	15
		Location	SF07	SF08	RB10	SL02	MP22	MP07	MP02	MP09
		Sampled Date	Not enough water to sample (27/08/2019)	Not enough water to sample (27/08/2019)	27/08/2019	Not enough water to sample (27/08/2019)	27/08/2019	Not enough water to sample (27/08/2019)	Not enough water to sample (27/08/2019)	27/08/2019
		Data obtained	N/A	N/A	03/09/2019	N/A	03/09/2019	N/A	N/A	03/09/2019
Analyte	Units	Limit of reporting								
Mercury	mg/L	0.0001	-	-	<0.0001	-	<0.0001	-	-	<0.0001
Methane	mg/L	0.01	-	-	4.33	-	3.38	-	-	8.65
Molybdenum	mg/L	0.001	-	-	0.004	-	0.025	-	-	0.019
Nickel	mg/L	0.001	-	-	0.005	-	0.23	-	-	0.022
Nitrate	mg/L	0.01	-	-	<0.01	-	0.03	-	-	0.18
Nitrite	mg/L	0.01	-	-	<0.01	-	<0.01	-	-	<0.01
Phenols	mg/L	0.001	-	-	<0.001	-	<0.001	-	-	<0.001
Polycyclic aromatic hydrocarbons	mg/L	0.0005	-	-	<0.0005	-	<0.0005	-	-	0.0099
Potassium	mg/L	1	-	-	9	-	21	-	-	19
Reactive Phosphorus	mg/L	0.01	-	-	0.02	-	0.15	-	-	0.1
Selenium	mg/L	0.01	-	-	<0.01	-	<0.01	-	-	<0.10
Silica	mg/L	0.1	-	-	14.3	-	17.1	-	-	19.3
Sodium	mg/L	1	-	-	1210	-	4490	-	-	5270
Strontium (dissolved)	mg/L	0.001	-	-	1.31	-	6.58	-	-	5.94
Sulfate	mg/L	1	-	-	<1	-	<1	-	-	<1
Toluene	mg/L	0.002	-	-	<0.002	-	<0.002	-	-	<0.005
Total dissolved solids	mg/L	10	-	-	2550	-	10400	-	-	9710
Total petroleum hydrocarbons	mg/L	0.05	-	-	<0.02	-	<0.02	-	-	<0.1
Uranium	mg/L	0.001	-	-	<0.001	-	<0.01	-	-	<0.01
Vanadium	mg/L	0.01	-	-	<0.01	-	<0.10	-	-	<0.10
Xylene	mg/L	0.002	-	-	<0.002	-	<0.002	-	-	<0.005
Zinc	mg/L	0.005	-	-	0.015	-	<0.050	-	-	<0.050

Key: - not analysed    N/A = not applicable    \* LOR for particular analytes raised due to matrix interference within the sample.  
 ^ sample deemed contaminated and resampled

Figure 1- CGP and produced water monitoring locations as listed in EPL 12003 (CSG wells)



Author: Gas Operations  
 Date: 23/07/2018  
 Ref: 3091R7

### Camden Gas Project Ground Water Monitoring Network

Disclaimer: While AGL has taken great care and attention to ensure the accuracy of the data represented on this map, no liability shall be accepted for any errors or omissions. No part of this map may be reproduced without prior permission of AGL.

#### Legend

- Monitored water supply bore
- Nested Groundwater Monitoring Bores
- Water Quality monitoring site (Gas well)
- ◇ Wells
- Public Roads
- Hume Highway
- Emergency Road Not for Public Use
- Private Roads
- Nepean River
- Railway
- RGP

Kilometres  
 0 1 2  
 Scale 1:25,500@A1  
 Geographic Datum of Australia 1994



Figure 1



## References

AGL, 2018. Groundwater Management Plan. AGL document. Dated 16 July 2018. Available online: [https://www.agl.com.au/-/media/aglmedia/documents/about-agl/how-we-source-energy/camden/camden-document-repository/environmental-management-system/180726\\_dcs\\_cm\\_mp\\_hse\\_023\\_camden\\_groundwater-management-plan-rev-5.pdf?la=en&hash=3D8143EB32A686C27FBC982E42CA1B984D610508](https://www.agl.com.au/-/media/aglmedia/documents/about-agl/how-we-source-energy/camden/camden-document-repository/environmental-management-system/180726_dcs_cm_mp_hse_023_camden_groundwater-management-plan-rev-5.pdf?la=en&hash=3D8143EB32A686C27FBC982E42CA1B984D610508)

AGL, 2013. Hydrogeological Summary of the Camden Gas Project area. Dated 31 January 2013. Available online:

<http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/January/Hydrogeological%20Summary%20of%20the%20Camden%20Gas%20Project%20Area.pdf>

Environment Protection Authority (EPA), 2014. Letter correspondence to AGL Upstream Investments Pty Ltd., titled: *Environment Protection Licence 12003*, EPA reference: EF13/2522:DOC14/95163-07:CK, dated 28 August 2014, signed: Greg Newman (Acting Manager Illawarra).

Environment Protection Authority (EPA), 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales, The Department of Environment and Conservation, Sydney, Australia. Available online: <http://www.environment.nsw.gov.au/resources/water/approvedmethods-water.pdf>

The State of NSW and Environment Protection Authority (EPA), 2013. Requirements for publishing pollution monitoring data. Environment Protection Authority, Sydney, Australia. Available online: <http://www.epa.nsw.gov.au/resources/licensing/130742reqpubpmdata.pdf>

Parsons Brinckerhoff (PB), 2013. Water Quality Investigation Camden Gas Project. Report for AGL Upstream Investments Pty Ltd, Document number: 2114759C PT\_7196, dated 2 July 2013. Available online: [http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/September/2114759C%20%20PT\\_7196\\_RevD\\_web.pdf](http://www.agl.com.au/~media/AGL/About%20AGL/Documents/How%20We%20Source%20Energy/CSG%20and%20the%20Environment/Camden/Assessments%20and%20Reports/2013/September/2114759C%20%20PT_7196_RevD_web.pdf)