AGL UPSTREAM INVESTMENTS PTY LTD

GLOUCESTER GAS PROJECT

September 2014 Water Monitoring Report
Craven Flow Test
EPL 20358

Reporting Period: August 2014

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Foreword

PREMISES	Gloucester Coal Seam Gas Project Bucketts Way Gloucester NSW 2422
LICENCE DETAILS	Environment Protection Licence 20358
LICENCEE	AGL Upstream Investments Pty Limited (AGL)
LICENCEE'S ADDRESS	Locked Bag 1837, North Sydney, NSW 2060
MONITORING DATE	21st August 2014
MONITORING BY	Parsons Brinckerhoff, on behalf of AGL
ANALYSIS BY	ALS Laboratory, Smithfield (Work order number: ES1418534)
DATE AGL OBTAINED DATA	10th and 11th September 2014
REPORT DATE	25th September 2014
REPORT PREPARED BY	James Duggleby, Senior Hydrogeologist

Introduction

AGL is proposing to build the Gloucester Gas Project (GGP) which comprises several stages of development facilitating the extraction of coal seam gas (CSG) from the Gloucester Basin. Concept plan and project approval (Part 3A Approval) for the Stage 1 GFDA was granted on 22 February 2011 under Part 3A of the Environmental Planning and Assessment Act (1979) (EP&A Act). In addition the project received approval under the Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act) (EPBC Approval) on 11 February 2013.

The GGP will involve depressurising of deep groundwater and the extraction of gas from multiple coal seams within the Gloucester coal measures. Target coal seam depths will vary from site to site but are expected to range between 200 and 1,000 m below ground level (mbgl). The current GGP includes the construction, operation and decommissioning of not more than 110 coal seam gas wells and associated infrastructure, including gas and water gathering lines within the Stage 1 GFDA. A comprehensive groundwater investigation (Phase 2 Groundwater Investigations) was completed in early 2012 to confirm the hydrogeological conceptual model across the Stage 1 GFDA (PB, 2012). Surface water and groundwater investigations are ongoing pending the commencement of the GGP.

This Monitoring Report relates to the groundwater monitoring activities specified in Part 5, Monitoring and Recording Conditions, of the Environment Protection Licence 20358. This report relates specifically to the monitoring surrounding the Craven 6 (CR06) flow testing program, and as per the Licence, encompasses the monitoring points at the locations as shown in Table 1 and Figure 1 (monitoring points: 15,16,17 in EPL 20358). The specific analytes and frequency tested are shown in Table 2. The monitoring results for this reporting period are shown in Table 3, and Table 4.

The flowing program at CR06 (point 17) ceased with the well shut in on 31st July 2014 (therefore no data are provided in this report). As per Condition M2 in EPL 20358, monitoring bores RMB01 and RMB02 (points 15 and 16) were sampled on 21st August 2014 within four weeks of the cessation of the flow testing.

2013 water monitoring results for the CR06 flow testing program are presented in PB (2014) (for point 17), and the 2013 Gloucester Groundwater and Surface Water Monitoring report (PB, 2013) (for points 15 and 16). Produced water samples are taken from CR06 (point 17) via a tap at the separator, and using a submersible 12V pump at monitoring bores RMB01 and RMB02 (points 15 and 16). 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 methane, which was analysed with a laboratory developed in-house technique which offers higher resolution based on the "*Technical Guidance for Natural Attenuation Indicators: Methane, Ethane and Ethene*" (USEPA, 2002). AGL is currently corresponding with the EPA regarding use of this more recent methodology.

This report is prepared in accordance with the *Requirements for Publishing Pollution Monitoring Data* (EPA, 2012) (Publication Requirements).

The monitoring data for August 2014 relating to the other water and land monitoring points 27-31, 33-81 (Irrigation Trial program) are contained within a separate report also hosted on: http://www.agl.com.au/about-agl/how-we-source-energy/monitoring-data. The remaining water and land monitoring points in EPL 20358 will be reported in subsequent reports when the requirement for monitoring is triggered.

More information on the groundwater monitoring of the GGP is available on the project website: agl.com.au/Gloucester

Table 1: Groundwater quality monitoring points (as per EPL 20358)

EPA Identification no.	Monitoring Point	Type of monitoring point	Easting (m)	Northing (m)
15	RMB01	Groundwater quality monitoring bore	400215.31	6443387.34
16	RMB02	Groundwater quality monitoring bore	400220.05	6443387.11
17	CR06	Groundwater quality monitoring bore: Gas well	400426.83	6444365.65

Coordinate reference system: Map Grid of Australia 1994

Figure 1: Location of groundwater quality monitoring points: Craven Flow Test (as per EPL 20358)

Table 2: Analytes monitored and frequency for points 15 and 16 (as per EPL 20358)

Analyte	Units of measure	Monitoring points			
		15,16		17	
		Frequency	sampling method	Frequency	sampling method
Aluminium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Ammonia	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Arsenic	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Barium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Beryllium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Bicarbonate	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Boron	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Cadmium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Calcium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Carbonate	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Chloride	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Chromium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Cobalt	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Copper	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Dissolved oxygen	milligrams per litre	-	-	Every 2 months	Grab sample
Electrical conductivity	microsiemens per centimetre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Fluoride	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Iron	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Lead	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Magnesium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Manganese	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Mercury	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Methane	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Molybdenum	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Nickel	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Nitrate	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Nitrite	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
pH	pH	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Phosphorus (total)	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Potassium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Reactive Phosphorus	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Redox potential	millivolts	-	-	Every 2 months	Grab sample
Selenium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample

Analyte	Units of measure	Monitoring points			
		15,16		17	
		Frequency	sampling method	Frequency	sampling method
Silica	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Sodium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Standing water level	meters (Australian Height Datum)	Special Frequency 2	Level sensor and continuous logger	-	-
Strontium (dissolved)	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Sulfate	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Total dissolved solids	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Total organic carbon	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Total suspended solids	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Uranium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Vanadium	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample
Zinc	milligrams per litre	Special Frequency 7	Grab sample	Every 2 months	Grab sample

Notes:

Special Frequency 2 – Every 24 hours

Special Frequency 7 – One sampling event within 4 weeks of the cessation of the Craven 6 pilot flow testing.

Monitoring point 17 can only be sampled when CR06 well is operational

Shaded grey = not required to be analysed

Groundwater Monitoring Results

Table 3: Water quality monitoring results for points 15,16,17 for August 2014

		Monitoring points	15	16	17
		Location	RMB01	RMB02	CR06
		Sampled date	21/08/14	21/08/14	Not sampled (not operational)
		Date AGL obtained data	10/09/14	10/09/14	
Analyte	**Units of measure**	**Limit of reporting**			
Aluminium	mg/L	0.01	<0.01	0.01	na
Ammonia	mg/L	0.01	2.99	1.97	na
Arsenic	mg/L	0.001	<0.001	<0.001	na
Barium	mg/L	0.001	14.2	6.12	na
Beryllium	mg/L	0.001	<0.001	<0.001	na
Bicarbonate	mg/L	1	763	861	na
Boron	mg/L	0.05	<0.05	0.06	na
Cadmium	mg/L	0.0001	<0.0001	<0.0001	na
Calcium	mg/L	1	147	74	na
Carbonate	mg/L	1	<1	<1	na
Chloride	mg/L	1	2,890	2,340	na
Chromium	mg/L	0.001	<0.001	<0.001	na
Cobalt	mg/L	0.001	<0.001	<0.001	na
Copper	mg/L	0.001	<0.001	<0.001	na
Dissolved oxygen	mg/L	0.01			na
Electrical conductivity	µS/cm	1	10,100	8,680	na
Fluoride	mg/L	0.1	0.1	0.4	na
Iron	mg/L	0.05	0.91	1.04	na
Lead	mg/L	0.001	<0.001	<0.001	na
Magnesium	mg/L	1	95	56	na
Manganese	mg/L	0.001	0.015	0.112	na
Mercury	mg/L	0.0001	<0.0001	<0.0001	na
Methane	mg/L	0.01	13.1	42.7	na
Molybdenum	mg/L	0.001	<0.001	<0.001	na
Nickel	mg/L	0.001	<0.001	0.002	na
Nitrate	mg/L	0.01	<0.01	<0.01	na
Nitrite	mg/L	0.01	<0.01	<0.01	na
pH	pH	0.01	7.6	7.82	na
Phosphorus (total)	mg/L	0.01	<0.01	<0.01	na
Potassium	mg/L	1	11	10	na
Reactive Phosphorus	mg/L	0.01	<0.01	<0.01	na
Redox potential	millivolts	0.1			na
Selenium	mg/L	0.01	<0.01	<0.01	na
Silica	mg/L	0.1	16.8	21.3	na
Sodium	mg/L	1	1,660	1,650	na
Standing water level	mAHD	0.01	124.00	124.22	na
Strontium (dissolved)	mg/L	0.001	14.3	6.72	na

		Monitoring points	15	16	17
		Location	RMB01	RMB02	CR06
		Sampled date	21/08/14	21/08/14	Not sampled (not operational)
		Date AGL obtained data	10/09/14	10/09/14	
Analyte	Units of measure	Limit of reporting			
Sulfate	mg/L	1	8	<1	na
Total dissolved solids	mg/L	10	5,240	4,630	na
Total organic carbon	mg/L	1	5	6	na
Total suspended solids	mg/L	5	<5	33	na
Uranium	mg/L	0.001	<0.001	<0.001	na
Vanadium	mg/L	0.01	<0.01	<0.01	na
Zinc	mg/L	0.005	0.010	0.008	na

Shaded grey = not required to be analysed

na = not available as well not operational

Table 4: Water level monitoring results for monitoring points 15, 16 for the period 6 August 2014 – 3 September 2014

Monitoring point	15	16
Location	RMB01	RMB02
Date data downloaded	03/09/14	03/09/14
Date data supplied to AGL	11/09/14	11/09/14
Monitoring frequency required by EPL 20358	Every 24 hours	Every 24 hours
Actual monitoring frequency	Every 6 hours[a]	Every 6 hours[a]
No. of times measured during monitoring period	114	114
Min. value (mAHD)	123.84[b]	117.91[b]
Mean value (mAHD)	124.00	124.20
Median value (mAHD)	123.98	124.30
Max. value (mAHD)	124.14	124.38

[a] Dataloggers are programmed to record a water level every 6 hours

[b] Minimum groundwater levels were recorded during purging of the bores for groundwater sampling (21/08/14)

References

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

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