



AGL UPSTREAM INVESTMENTS PTY LTD

GLOUCESTER GAS PROJECT

**October 2014 Water Monitoring Report
Waukivory Pilot Project: Fracture Stimulation and
Flow Test
EPL 20358**

Reporting Period: September - October 2014

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Foreword

| | |
|-------------------------------|--|
| PREMISES | Gloucester Coal Seam Gas Project Bucketts Way Gloucester NSW 2422 |
| LICENCE DETAILS | <u>Environment Protection Licence 20358</u> |
| LICENCEE | AGL Upstream Investments Pty Limited (AGL) |
| LICENCEE'S ADDRESS | Locked Bag 1837, North Sydney, NSW 2060 |
| MONITORING DATE | 30 th September, 1 st and 8 th October, and 4 th November 2014 |
| MONITORING BY | Parsons Brinckerhoff, on behalf of AGL |
| ANALYSIS BY | ALS Laboratory, Smithfield (Work order number: ES1440004; ES1440005; ES1440315) |
| DATE AGL OBTAINED DATA | 20 th and 27 th October, and 7 th November 2014 |
| REPORT DATE | 7 th November 2014 |
| REPORT PREPARED BY | James Duggleby, Senior Hydrogeologist |

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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 water 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 Waukivory Pilot Project, and details baseline monitoring results from sampling events carried out before the Waukivory Pilot Project fracture stimulation commenced. As per the Licence, the monitoring encompasses the monitoring points at the locations as shown in Table 1 and Figure 1. 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 monitoring points that are the subject of this report are part of the GGP groundwater monitoring network, as described in AGL's Surface and Groundwater Monitoring Plan (SGMP) for the Waukivory Pilot Project (AGL, 2014).

Three methods were used to obtain groundwater and surface water samples:

- A submersible pump at groundwater monitoring bores screened within relatively permeable geological materials, monitoring point 90 (12V pump) and monitoring point 91 (240V pump).
- A micro-purge™ low flow sampling pump at groundwater monitoring points 10, 11, and 12. The micro-purge™ system allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need for excessive groundwater purging.
- A telescopic sampler to collect grab samples from the surface water monitoring points 7, 8, and 9.

EC and pH were monitored during purging to ensure that they had stabilised prior to sample collection. 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). The EPA have acknowledged that this method is a suitable technique for detecting dissolved methane in water (EPA, 2014).
- Nitrogen, which was analysed using an updated persulphate digestion method based on the "*Standard Methods for the Examination of Water and Wastewater: 22nd Edition*" (APHA, 2012). The EPA have acknowledged that this method is a suitable technique for analysing total nitrogen in water samples (EPA, 2014).

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

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: Waukivory Pilot Project water monitoring points (as per EPL 20358)

| EPA Identification no. | Monitoring Point | Type of monitoring point | Easting (m) | Northing (m) |
|------------------------|---------------------|--|-------------|--------------|
| 7 | WKSW03 | Stream gauge (surface water) | 402486.36 | 6453090.65 |
| 8 | WKSW02 | Stream gauge (surface water) | 402748.00 | 6452139.00 |
| 9 | WKSW01 | Stream gauge (surface water) | 402069.00 | 6452241.00 |
| 10 | WKMB01 | Groundwater monitoring bore | 402153.63 | 6452566.28 |
| 11 | WKMB02 | Groundwater monitoring bore | 402575.54 | 6452572.49 |
| 12 | WKMB03 | Groundwater monitoring bore | 402589.87 | 6452584.93 |
| 14 | PL03 | Vibrating wire piezometer (groundwater) | 402633.90 | 6449898.67 |
| 85 | WKMB05 ^a | Packer and piezometer completion (groundwater) | 402576.59 | 6452128.62 |
| 86 | WK11 ^a | Gas well | 402419.02 | 6452589.82 |
| 87 | WK12 ^a | Gas well | 402748.92 | 6452883.77 |
| 88 | WK13 ^a | Gas well | 402416.74 | 6452164.46 |
| 89 | WK14 ^a | Gas well | 402906.10 | 6452384.08 |
| 90 | GR-P3 ^b | Private groundwater bore | 402905.50 | 6452518.71 |
| 91 | GW080487 | Private groundwater bore | 401226.00 | 6454020.00 |

^awill only be sampled and reported from the commencement of the Waukivory Pilot Project flow testing program.

^bthe original monitoring point (EPA Identification no. 90) was replaced with groundwater monitoring bore GR-P3. AGL requested to change the original location of monitoring point 90 as access to the original point 90 was denied by the landowner. AGL proposed the use of private monitoring bore GR-P3. The EPA approved the change on 20 October 2014 noting that GR-P3 is better placed to identify changes that may occur in the alluvial groundwater.

Coordinate reference system: Map Grid of Australia 1994

Figure 1: Location of groundwater and surface water quality monitoring points: Waukivory Pilot Program (as per EPL 20358)

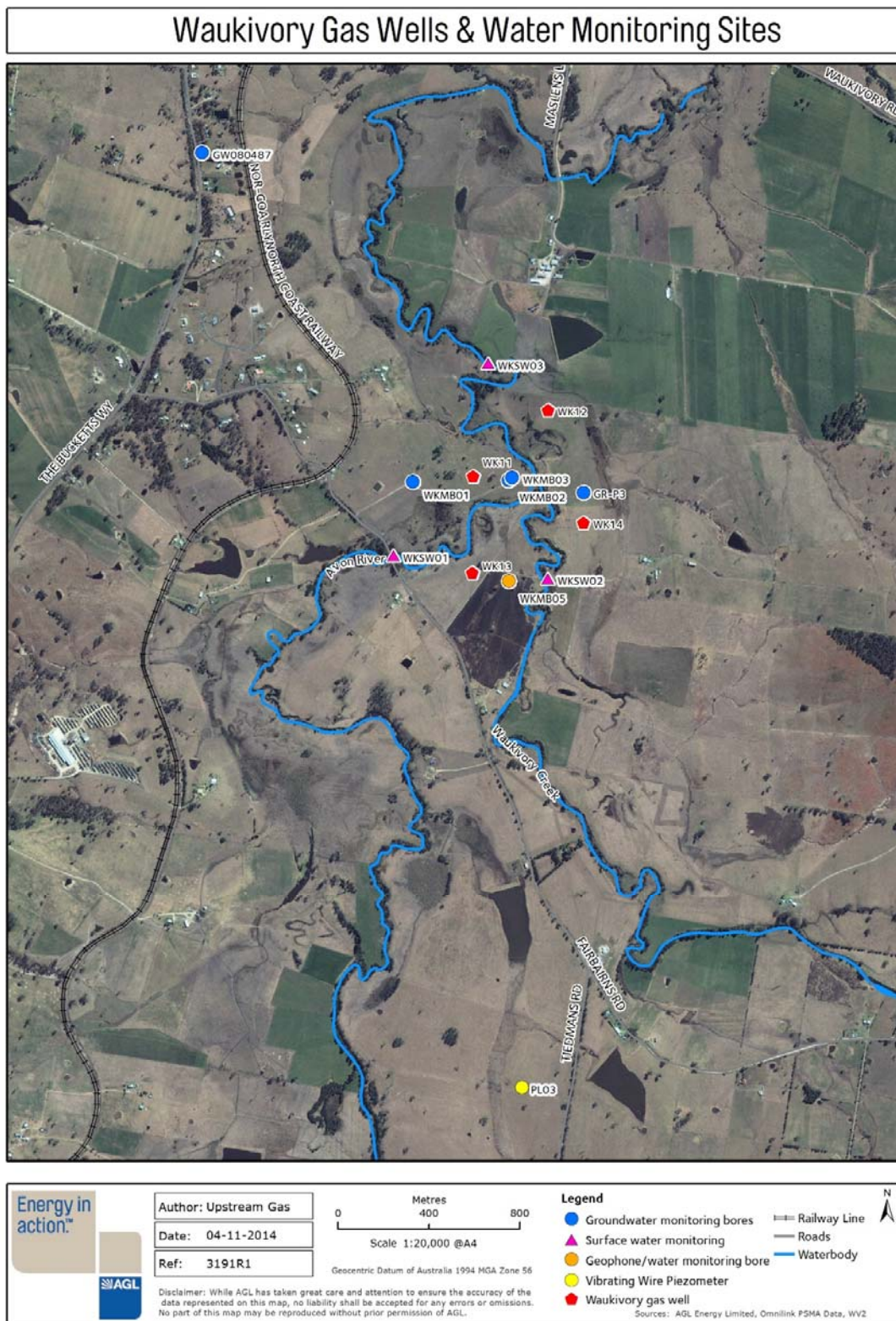




Table 2: Analytes monitored and frequency for points in Table 1 (as per EPL 20358)

| Pollutant | Units of measure | Monitoring points | | | | | | | | | |
|--------------------|----------------------|---------------------|-----------------|---------------------|-----------------|-----------|-----------------|---------------------|-----------------|---------------------|-----------------|
| | | 7,8,9 | | 10,11,12 | | 14,85 | | 86,87,88,89 | | 90, 91 | |
| | | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method |
| Aluminium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Ammonia | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Arsenic | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Barium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Beryllium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Bicarbonate | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Boron | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Cadmium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Calcium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Carbonate | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |



| Pollutant | Units of measure | Monitoring points | | | | | | | | | |
|--------------------------------|-----------------------------|---------------------|---|---------------------|---|-----------|-----------------|---------------------|---|---------------------|---|
| | | 7,8,9 | | 10,11,12 | | 14,85 | | 86,87,88,89 | | 90, 91 | |
| | | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method |
| Chloride | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Choline Chloride | milligrams per litre | Special Frequency 5 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority | | | Special Frequency 4 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority |
| Chromium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Cobalt | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Copper | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Electrical conductivity | microsiemens per centimetre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Fluoride | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Iron | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Lead | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Magnesium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Manganese | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |



| Pollutant | Units of measure | Monitoring points | | | | | | | | | |
|-------------------------|----------------------|---------------------|---|---------------------|---|-----------|-----------------|---------------------|---|---------------------|---|
| | | 7,8,9 | | 10,11,12 | | 14,85 | | 86,87,88,89 | | 90, 91 | |
| | | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method |
| Mercury | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Methane | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Molybdenum | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Monoethanolamine Borate | milligrams per litre | Special Frequency 5 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority | | | Special Frequency 4 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority |
| Nickel | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Nitrate | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Nitrite | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| pH | pH | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Phosphorus (total) | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Potassium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Reactive Phosphorus | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |



| Pollutant | Units of measure | Monitoring points | | | | | | | | | |
|---|----------------------------------|---------------------|---|---------------------|---|---------------------|------------------|---------------------|---|---------------------|---|
| | | 7,8,9 | | 10,11,12 | | 14,85 | | 86,87,88,89 | | 90, 91 | |
| | | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method |
| Selenium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Silica | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Sodium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Sodium Hypochlorite | milligrams per litre | Special Frequency 5 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority | | | Special Frequency 4 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority |
| Standing water level | meters (Australian Height Datum) | | | Special Frequency 8 | Special Method 5 | Special Frequency 8 | Special Method 5 | Special Frequency 9 | Special Method 3 | Special Frequency 6 | Special Method 1 |
| Strontium (dissolved) | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Sulfate | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| THPS (Phosphonium, Tetrakis (Hydroxymethyl-sulfate)) | milligrams per litre | Special Frequency 5 | Method approved in writing by the Authority | Special Frequency 3 | Method approved in writing by the Authority | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Method approved in writing by the Authority |
| Total dissolved solids | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Total organic carbon | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |



| Pollutant | Units of measure | Monitoring points | | | | | | | | | |
|-------------------------------|----------------------|---------------------|-----------------|---------------------|-----------------|-----------|-----------------|---------------------|-----------------|---------------------|-----------------|
| | | 7,8,9 | | 10,11,12 | | 14,85 | | 86,87,88,89 | | 90, 91 | |
| | | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method | Frequency | Sampling method |
| Total suspended solids | milligrams per litre | | | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Uranium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Vanadium | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |
| Zinc | milligrams per litre | Special Frequency 5 | Grab sample | Special Frequency 3 | Grab sample | | | Special Frequency 4 | Grab sample | Special Frequency 3 | Grab sample |

Notes:

Special Frequency 3 – One sampling event before the Waukivory Pilot Project fracture stimulation commences, one sampling event within 24 hours of the completion of the fracture stimulation of each well, and one sample at week 2 and week 4 after the completion of the Waukivory Pilot Project fracture stimulation.

Special Frequency 4 – Every fortnight for 8 weeks from the commencement of the Waukivory pilot flow testing, then every 2 months thereafter until the cessation of the Waukivory pilot flow testing.

Special Frequency 5 – One sampling event within 24 hours of the completion of the fracture stimulation of each well, and one sampling event one week after the completion of the fracture stimulation of each well, and one sampling event every 6 months thereafter until the cessation of the Waukivory pilot flow testing.

Special Frequency 6 – One monitoring event to determine water level prior to the Waukivory Pilot

Special Frequency 8 – Every 6 hours

Special Frequency 9 – Every 6 hours when using an automated datalogger, or, once every fortnight using a Sonolog in the event of failure of an automated datalogger.

Shaded grey = not required to be analysed



Monitoring Results

Table 3: September 2014 Water quality monitoring results for points 7, 8, 9, 10, 11, 12, 90, and 91

| | | Monitoring points | 7 | | 8 | | 9 | 10 | 11 | 12 | 90 | 91 |
|-------------------------------|------------------|------------------------|------------|------------------------|------------|------------------------|------------|------------|------------|------------|------------|------------|
| | | Location | WKS03 | | WKS02 | | WKS01 | WKMB01 | WKMB02 | WKMB03 | GR-P3 | GW080487 |
| | | Sampled date | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 1/10/2014 |
| | | Date AGL obtained data | 20/10/2014 | 27/10/2014 | 20/10/2014 | 27/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 |
| Analyte | Units of measure | Limit of reporting | | | | | | | | | | |
| Aluminium | mg/L | 0.01 | na | <0.01 | 0.02 | na | 0.05 | 0.02 | 0.24 | 0.28 | <0.01 | <0.01 |
| Ammonia | mg/L | 0.01 | | | | | | 0.69 | 0.39 | 31.8 | 0.02 | 0.5 |
| Arsenic | mg/L | 0.001 | na | <0.001 | 0.002 | na | 0.001 | 0.001 | 0.002 | 0.004 | <0.001 | <0.001 |
| Barium | mg/L | 0.001 | na | 0.056 | 0.051 | na | 0.045 | 0.248 | 0.082 | 0.977 | 0.495 | 0.222 |
| Beryllium | mg/L | 0.001 | na | <0.001 | <0.001 | na | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Bicarbonate | mg/L | 1 | na | 62 | na | 72 | 36 | 800 | 189 | <1 | 337 | 1190 |
| Boron | mg/L | 0.05 | na | <0.05 | <0.05 | na | <0.05 | 0.09 | <0.05 | 0.09 | <0.05 | 0.05 |
| Cadmium | mg/L | 0.0001 | na | <0.0001 | <0.0001 | na | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Calcium | mg/L | 1 | na | 20 | 20 | 24 | 10 | 7 | <1 | 2 | 117 | 52 |
| Carbonate | mg/L | 1 | na | <1 | na | <1 | <1 | <1 | 109 | 975 | <1 | <1 |
| Chloride | mg/L | 1 | na | 98 | na | 102 | 96 | 1060 | 72 | 360 | 936 | 687 |
| Choline Chloride ^b | mg/L | na | na | na | na | na | na | na | na | na | na | na |
| Chromium | mg/L | 0.001 | na | <0.001 | <0.001 | na | <0.001 | 0.001 | <0.001 | 0.001 | <0.001 | <0.001 |
| Cobalt | mg/L | 0.001 | na | <0.001 | 0.002 | na | 0.002 | <0.001 | <0.001 | <0.001 | 0.001 | <0.001 |
| Copper | mg/L | 0.001 | na | <0.001 | <0.001 | na | 0.002 | <0.001 | <0.001 | <0.001 | 0.002 | <0.001 |
| Electrical conductivity | µS/cm | 1 | na | 506 | na | 525 | 450 | 5590 | 906 | 4190 | 4090 | 3900 |



| Analyte | Units of measure | Limit of reporting | Monitoring points | | 7 | | 8 | | 9 | 10 | 11 | 12 | 90 | 91 | | |
|--|------------------|--------------------|------------------------|---------|------------|------------------------|------------|------------------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | | Location | | WKSW03 | | WKSW02 | | WKSW01 | WKMB01 | WKMB02 | WKMB03 | GR-P3 | GW080487 | | |
| | | | Sampled date | | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 1/10/2014 |
| | | | Date AGL obtained data | | 20/10/2014 | 27/10/2014 | 20/10/2014 | 27/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 |
| Fluoride | mg/L | 0.1 | na | 0.1 | na | 0.1 | <0.1 | 1.1 | 0.4 | 2.7 | 0.2 | 0.2 | | | | |
| Iron | mg/L | 0.05 | na | 0.12 | 0.7 | na | 0.77 | <0.05 | <0.05 | 0.08 | 0.24 | 0.4 | | | | |
| Lead | mg/L | 0.001 | na | <0.001 | <0.001 | na | <0.001 | <0.001 | <0.001 | 0.012 | <0.001 | <0.001 | | | | |
| Magnesium | mg/L | 1 | na | 13 | 12 | 14 | 10 | 2 | <1 | <1 | 71 | 39 | | | | |
| Manganese | mg/L | 0.001 | na | 0.001 | 0.176 | na | 0.292 | 0.016 | 0.007 | 0.002 | 0.616 | 0.049 | | | | |
| Mercury | mg/L | 0.0001 | na | <0.0001 | <0.0001 | na | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | | | | |
| Methane | mg/L | 0.01 | | | | | | 14.5 | 8 | 16.6 | <0.01 | 0.164 | | | | |
| Molybdenum | mg/L | 0.001 | na | <0.001 | <0.001 | na | <0.001 | <0.001 | 0.002 | 0.004 | <0.001 | <0.001 | | | | |
| Monoethanolamine Borate (reported as (mono) ethanolamine)) | µg/L | 1 | 2 | na | <1 | na | <1 | <1 | <1 | 2 | <1 | <1 | | | | |
| Nickel | mg/L | 0.001 | na | <0.001 | <0.001 | na | 0.001 | 0.001 | <0.001 | 0.003 | <0.001 | <0.001 | | | | |
| Nitrate | mg/L | 0.01 | | | | | | <0.01 | <0.01 | <0.01 | <0.01 | 0.22 | | | | |
| Nitrite | mg/L | 0.01 | | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| pH | pH Unit | 0.01 | na | 7.41 | na | 7.21 | 7.25 | 8.16 | 9.32 | 11.6 | 7.15 | 7.55 | | | | |
| Phosphorus (total) | mg/L | 0.01 | | | | | | 0.02 | 0.12 | 0.03 | 0.03 | 0.02 | | | | |
| Potassium | mg/L | 1 | na | 5 | 5 | 5 | 5 | 4 | 3 | 8 | 2 | 9 | | | | |
| Reactive Phosphorus | mg/L | 0.01 | | | | | | 0.03 | 0.14 | 0.05 | 0.02 | 0.01 | | | | |
| Selenium | mg/L | 0.01 | na | <0.01 | <0.01 | na | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |



| | | Monitoring points | 7 | | 8 | | 9 | 10 | 11 | 12 | 90 | 91 |
|--|------------------|------------------------|------------|------------------------|------------|------------------------|------------|------------|------------|------------|------------|---------------------|
| | | Location | WKSW03 | | WKSW02 | | WKSW01 | WKMB01 | WKMB02 | WKMB03 | GR-P3 | GW080487 |
| | | Sampled date | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 1/10/2014 |
| | | Date AGL obtained data | 20/10/2014 | 27/10/2014 | 20/10/2014 | 27/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 |
| Analyte | Units of measure | Limit of reporting | | | | | | | | | | |
| Silica | mg/L | 0.05 | na | 0.87 | na | 3.98 | 7.89 | 17 | 21.9 | 161 | 35.9 | 19.1 |
| Sodium | mg/L | 1 | na | 54 | 51 | 51 | 57 | 1260 | 232 | 934 | 676 | 811 |
| Sodium Hypochlorite (reported as free chlorine) | mg/L | 0.2 | na | <0.2 | na | 0.5 | <0.2 | <0.2 | <0.2 | 0.9 | <0.2 | <0.2 |
| Sodium Hypochlorite (reported as total residual chlorine) | mg/L | 0.2 | na | <0.2 | na | 0.5 | <0.2 | <0.2 | <0.2 | 0.9 | <0.2 | <0.2 |
| Standing water level | mAHD | 0.001 | | | | | | | | | 96.76 | 14.225 ^d |
| Strontium (dissolved) | mg/L | 0.001 | na | 0.293 | 0.305 | na | 0.21 | 2.23 | 0.239 | 1.11 | 1.95 | 4.55 |
| Sulfate | mg/L | 1 | na | 28 | na | 24 | 36 | 189 | 29 | <1 | 78 | 104 |
| THPS (Phosphonium, Tetra kis (Hydroxymethylna sulfate)) ^c | mg/L | na | na | na | na | na | na | na | na | na | na | na |
| Total dissolved solids | mg/L | 10 | na | 255 | na | 235 | 250 | 3070 | 472 | 2420 | 2050 | 1980 |
| Total organic carbon | mg/L | 1 | 12 | na | 9 | na | 19 | 29 | 6 | 104 | 1 | <1 |
| Total suspended solids | mg/L | 5 | | | | | | <5 | <5 | 38 | 43 | <5 |



| | | Monitoring points | | 7 | | 8 | | 9 | 10 | 11 | 12 | 90 | 91 |
|----------|------------------|------------------------|--|------------|------------------------|------------|------------------------|------------|------------|------------|------------|------------|------------|
| | | Location | | WKSW03 | | WKSW02 | | WKSW01 | WKMB01 | WKMB02 | WKMB03 | GR-P3 | GW080487 |
| | | Sampled date | | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 8/10/2014 ^a | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 30/09/2014 | 1/10/2014 |
| | | Date AGL obtained data | | 20/10/2014 | 27/10/2014 | 20/10/2014 | 27/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 | 20/10/2014 |
| Analyte | Units of measure | Limit of reporting | | | | | | | | | | | |
| Uranium | mg/L | 0.001 | | na | <0.001 | <0.001 | na | <0.001 | <0.001 | 0.001 | <0.001 | 0.003 | <0.001 |
| Vanadium | mg/L | 0.01 | | na | <0.01 | <0.01 | na | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Zinc | mg/L | 0.005 | | na | <0.005 | 0.006 | na | 0.01 | 0.01 | <0.005 | 9.1 | 0.013 | 0.009 |

Notes:

- Shaded grey = not required to be reported
- na = not analysed
- ^a = WKSW02 and WKSW03 were resampled at a later date due to laboratory sample loss of the initial sample.
- ^b = Choline chloride was not analysed as it will not be included in the fracture stimulation chemicals for the Waukivory Pilot Program, therefore analysis of choline chloride in the groundwater, surface water and flow back water is not required.
- ^c = THPS (Phosphonium, Tetrakis (Hydroxymethyl-sulfate)) was not able to be analysed by the date of this report pending development and validation of an approved method of analysis. Samples have been collected and stored in anticipation of the approved method.
- ^d = groundwater level in metres below ground level (mbgl) since survey level data is not currently available for this location. Level survey scheduled for November 2014.

Table 4: Continuous water level monitoring results for monitoring points 10, 11, 12, and 14 for the period 6 August – 30 September 2014

| Monitoring point | 10 | 11 | 12 | 14 | |
|--|---|------------------|---------------|---------------|---------------|
| Location | WKMB01 | WKMB02 | WKMB03 | PL03 Sensor 2 | PL03 Sensor 3 |
| Data type | Standing Water Level | | | | |
| Units | mAHD (metres (Australian Height Datum)) | | | | |
| Date data downloaded | 30/09/14 | 30/09/14 | 30/09/14 | 04/11/14 | 04/11/14 |
| Date data supplied to AGL | 07/11/14 | 07/11/14 | 07/11/14 | 07/11/04 | 07/11/14 |
| Monitoring frequency required by licence | Every 6 hours | Every 6 hours | Every 6 hours | Every 6 hours | Every 6 hours |
| No. of times measured during monitoring period | 57 ^a | 190 ^b | 224 | 224 | 224 |
| Min. value | 91.2 | 94.6 | 90.9 | 89.9 | 55.7 |
| Mean value | 95.2 | 96.0 | 98.5 | 91.0 | 60.3 |
| Median value | 95.3 | 96.1 | 98.5 | 91.0 | 60.2 |
| Max. value | 95.3 | 96.1 | 98.6 | 92.2 | 66.4 |

Notes:

- ^a = Datalogger operational from 16/09/2014
- ^b = Datalogger operational from 14/08/2014

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