AGL Upstream Investments Pty Ltd

Camden Gas Project - FY14 Q1 Groundwater Monitoring Update - September 2013

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1. Introduction

AGL Upstream Investments Pty Ltd (AGL) owns and operates the Camden Gas Project (CGP) located in the Macarthur region, 65 km southwest of Sydney, NSW. The CGP has been producing natural gas from coal seams for the Sydney region since 2001 and currently consists of 144 gas wells (of which, 97 were operational at 30 June 2013). The target coal seams are the Bulli and Balgownie coal seams within the Illawarra Coal Measures at depths of approximately 600–700 m below ground level (mbgl). Parsons Brinckerhoff was engaged to investigate the hydrogeological environment to characterise the groundwater systems within the region, to assess the degree of connectivity (if any) between the shallow beneficial aquifers and the Permian coal seams, and to monitor trends within the shallow groundwater systems and with respect to the operating gas project.

This report details activities undertaken up to September 2013 and forms the first quarterly summary of groundwater monitoring for the CGP for FY2014.

1.1 Phase 1

The Phase 1 Groundwater Assessment and Conceptual Hydrogeological Model for the Northern Expansion of the Camden Gas Project (Parsons Brinckerhoff, 2011), was a desktop study summarising information from a number of sources including the NSW Office of Water (NOW) groundwater database and the DIGS geological database, and previous reports and detailed drill logs supplied by AGL. The main conclusions from the Phase 1 investigation are:

- groundwater is rarely used for consumptive uses across the area given the urbanisation and the availability of reticulated water supplies from Sydney Water
- the available hydrogeological data for the region suggest that the groundwater systems of the project area are:
  - alluvial aquifer system
  - Hawkesbury Sandstone aquifer system
  - Narrabeen Group aquifer system
  - Illawarra coal measures.
- the Hawkesbury Sandstone is the main aquifer across the expansion area, with minor aquifers in the Narrabeen Group sandstones. The coal seams are low permeability water bearing zones and are not useful aquifers for supply purposes
- available water quality data suggests distinct differences in water chemistry and isolation of each of these aquifer zones. The groundwater quality in aquifer systems in the study area is highly variable, ranging from fresh (below 300 mg/L TDS) to slightly salty (up to 7,500 mg/L TDS). Groundwater quality is generally brackish to salty in the shallow Wianamatta Group shales, while the most saline groundwater generally occurs in the deeper Permian coal seams
- groundwater resources are characterised by low yields from the Hawkesbury Sandstone and alluvial aquifers. Negligible yields characterise the Ashfield Shale and coal measures
- it is anticipated that the presence of extensive and thick claystone formations in the stratigraphic sequence that overlies the Illawarra coal measures in the project area will impede the vertical flow of groundwater such that overlying aquifer zones will be hydraulically isolated, experiencing little, if any drawdown impact related to depressurisation of the coal measures. However the possibility cannot be ruled out that major fault zones could provide a hydraulic pathway through claystone horizons and that some shallow groundwater impacts may be observed close to those structures.

The Phase 1 assessment also facilitated the development of a conceptual model that provided a characterisation of the groundwater systems in the area north of the existing CGP.

1.2 Phase 2

The Phase 2 Groundwater Investigations comprise the installation of a groundwater monitoring network of eight bores, and subsequent groundwater quality and level monitoring at AGL's Denham Court (four bores) and Menangle Park (four bores) sites (Figure 1.1). The objective of the drilling was to establish dedicated monitoring bores in the surface alluvium, shallowest aquifer (Ashfield Shale) and the main water supply aquifers (Hawkesbury Sandstone) so as to obtain baseline water level and water quality prior to any coal seam gas development.

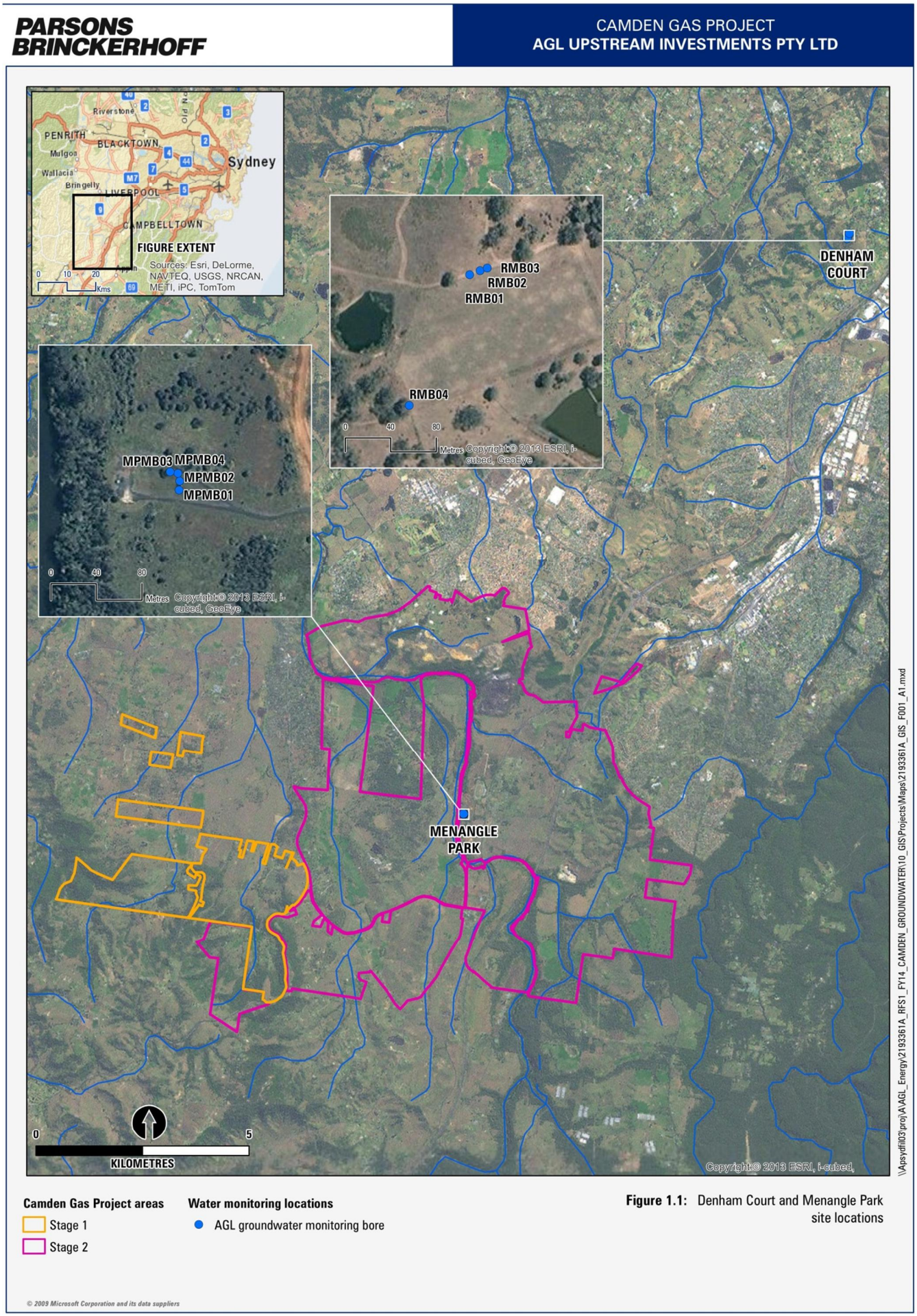

Figure 1.1: Denham Court and Menangle Park site locations

2. Monitoring network

2.1 Bore completions

The groundwater monitoring bore installation program at the Denham Court site was undertaken between 4 October and 19 October 2011. The bore installation program at the Menangle Park site, together with one additional bore at the Denham Court site, was undertaken between 21 May and 14 June 2013. The drilling of the groundwater monitoring bores was undertaken by Highland Drilling using an air rotary drilling rig supervised by Parsons Brinckerhoff hydrogeologists. The drilling and construction of the groundwater monitoring bores was carried out in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (ARMCANZ, 2003).

Table 2.1 Groundwater monitoring bore construction details

Monitoring bore	Location	Total depth (m)	Screened interval (mbgl)	Lithology	Casing material	Target Formation
RMB01	Denham Court	84	69–81 (12 m)	Siltstone	50 mm, class 18 u PVC, screwed casing	Wianamatta Group, Ashfield Shale
RMB02	Denham Court	150	135–147 (12 m)	Sandstone	50 mm, class 18 u PVC, screwed casing	Upper Hawkesbury Sandstone
RMB03	Denham Court	300	290–299 (9 m)	Sandstone	50 mm, galvanised/stainless steel, screwed casing	Lower Hawkesbury Sandstone
RMB04	Denham Court	8.5	4.5–7.5 (3 m)	Clay/ siltstone	50 mm, class 18 u PVC, screwed casing	Wianamatta Group, Ashfield Shale
MPMB01	Menangle Park	18.5	10–16 (6 m)	Clay	50 mm, class 18 u PVC, screwed casing	Alluvium
MPMB02	Menangle Park	42	27–39 (12 m)	Sandstone	50 mm, class 18 u PVC, screwed casing	Upper Hawkesbury Sandstone
MPMB03	Menangle Park	108	97–106 (9 m)	Sandstone	50 mm, class 18 u PVC, screwed casing	Middle Hawkesbury Sandstone
MPMB04	Menangle Park	192	182–191 (9 m)	Sandstone	50 mm, galvanised/ stainless steel, screwed casing	Lower Hawkesbury Sandstone

The groundwater monitoring bores were drilled through the following Triassic formations within the Sydney Basin: Ashfield Shale, Mittagong Formation and Hawkesbury Sandstone. Some shale lenses, up to seven metres thick, were observed in the Hawkesbury Sandstone. It was noted that the Ashfield Shale was minimal or absent at the Menangle Park Site. In addition, Tertiary alluvium was present at the Menangle Park site.

Minor seeps were encountered in the Ashfield Shale at depth. At the Denham Court site groundwater was encountered in the Hawkesbury Sandstone at approximately 108–114 mbgl and minimal flows were recorded throughout (a maximum value of 0.9 litres per second when airlifting). At the Menangle Park site minimal flows we recorded within the alluvium (a maximum of 0.7 litres per second when airlifting). Groundwater was encountered in the Hawkesbury Sandstone at approximately 42–60 mbgl and flows were up to 14.3 litres per second when airlifting.

No fractures were encountered during drilling and therefore groundwater flow is assumed to be via primary permeability. Within the stratigraphy encountered at both monitoring sites there are no major fault zones.

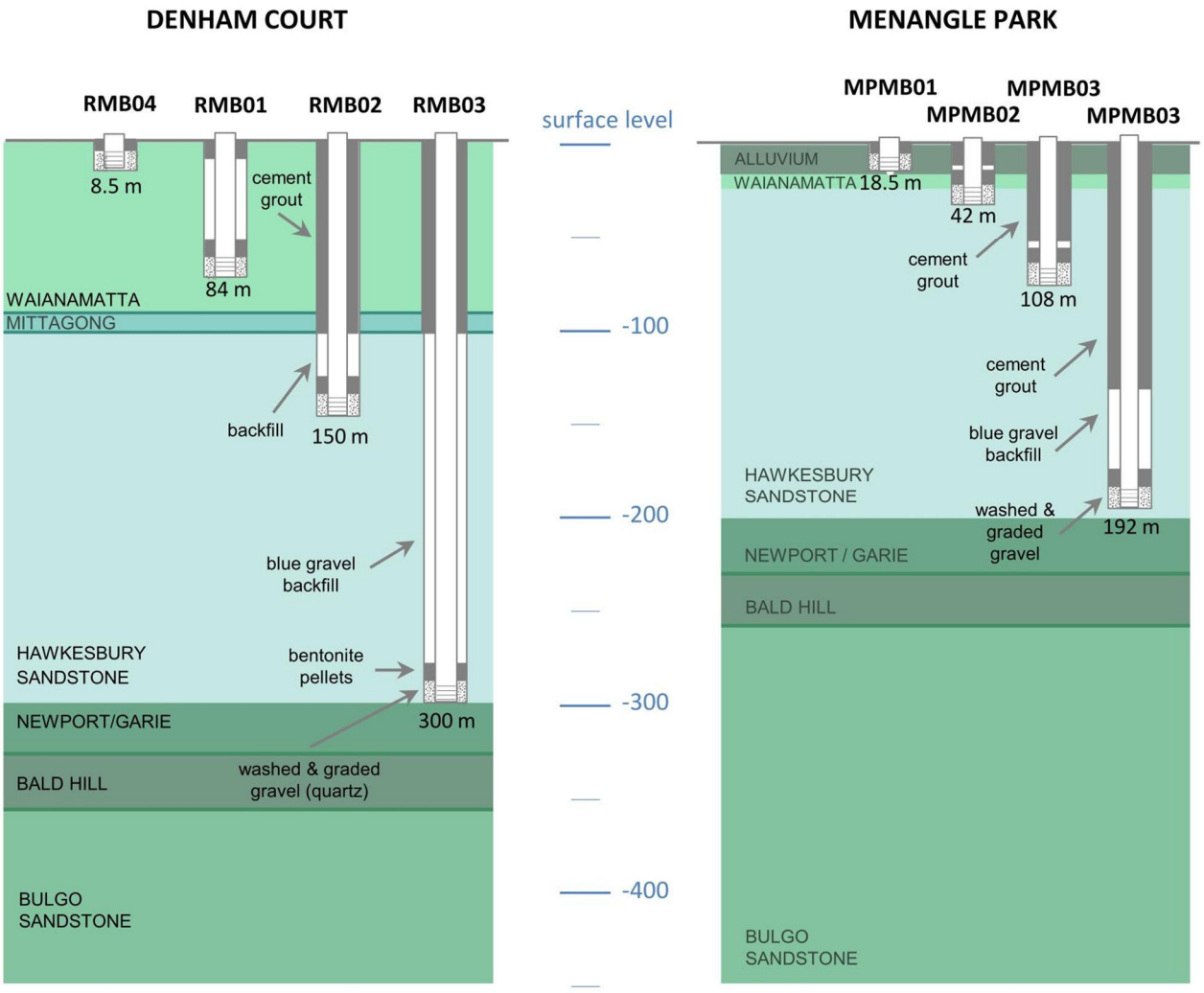

Figure 2.1 Nested groundwater monitoring bores at Denham Court and Menangle Park

2.2 Survey

The groundwater monitoring bore locations were surveyed by registered surveys (SMEC Pty Ltd) to MGA, a grid coordinate system based on the Geocentric Datum of Australia 1994. The bores were also surveyed for surface elevation to Australian Height Datum (AHD). The survey results are detailed in Table 2.2.

Table 2.2 Monitoring bore coordinates and elevations

Monitoring Bore	Survey date	Easting*	Northing*	Ground level (mAHD)	Top of casing (mAHD)
RMB01	09/03/2012	300465.860	6237305.080	72.42	72.94
RMB02	09/03/2012	300474.930	6237308.700	72.80	73.34
RMB03	09/03/2012	300481.290	6237310.920	73.00	73.54
RMB04	12/07/2013	300412.627	6237189.692	61.926	62.463
MPMB01	12/07/2013	291426.371	6223648.178	66.672	67.196
MPMB02	12/07/2013	291426.853	6223656.095	66.626	67.129
MPMB03	12/07/2013	291425.335	6223662.800	66.418	66.971
MPMB04	12/07/2013	291418.472	6223664.149	66.203	66.912

* Grid system:GDS94 – MGA56

3. Groundwater levels

Solinst Levelogger (M30) dataloggers are installed in each monitoring bore, programmed to record water levels at 6-hourly intervals. Groundwater level hydrographs for each groundwater monitoring site are plotted with daily rainfall recorded by the Bureau of Meteorology for the Ingleburn rain gauge located near to the CGP (BoM site: 066190).

A hydrograph showing fluctuations in groundwater level from November 2011 to September 2013 within each bore at the Denham Court site is shown in Figure 3.1, with the exception of RMB04, which was dry throughout the monitoring period (June to September 2013). Individual hydrographs are attached in Figures A.1 to A.3 in Appendix A.

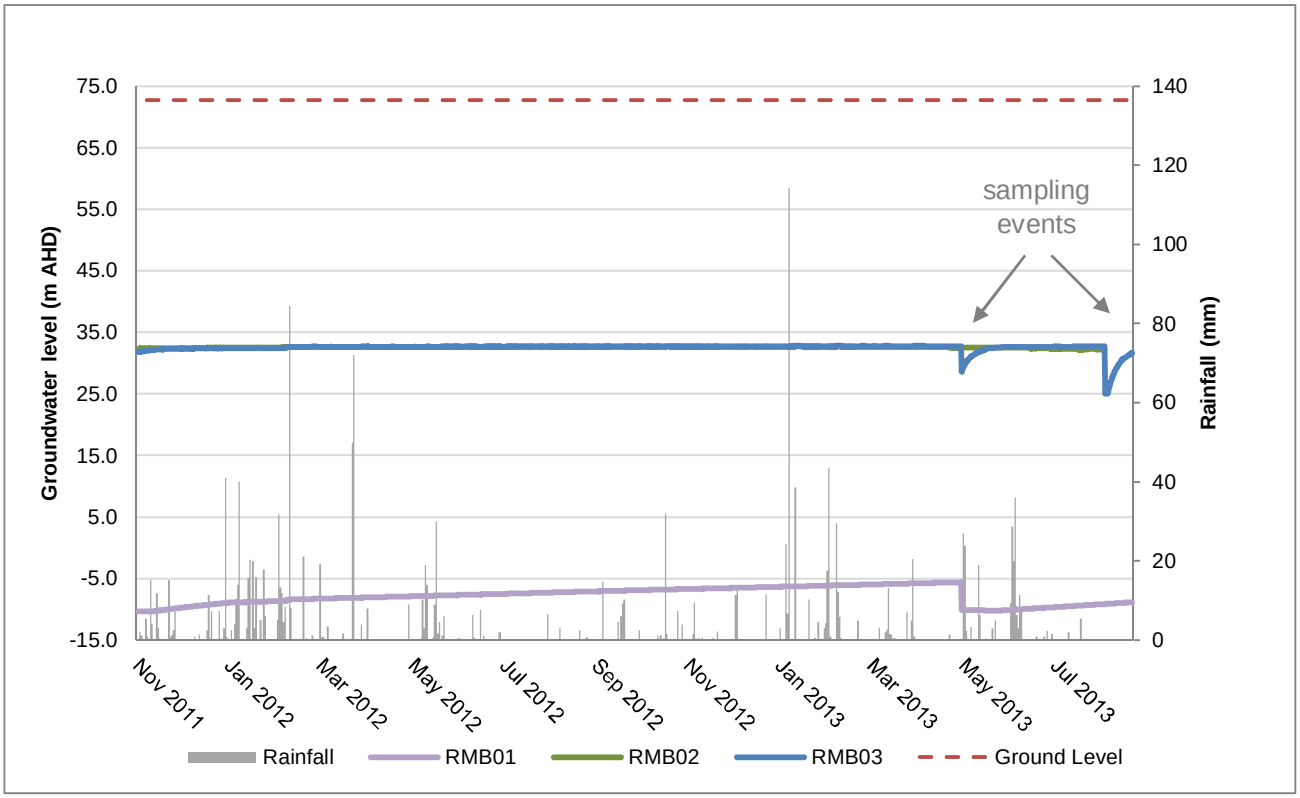

Figure 3.1 Groundwater levels in the Denham Court monitoring bores

A hydrograph showing fluctuations in groundwater level from June to September 2013 within each bore at the Menangle Park site is shown in Figure 3.2. Individual hydrographs are attached in Figures A.4 to A.7 in Appendix A.

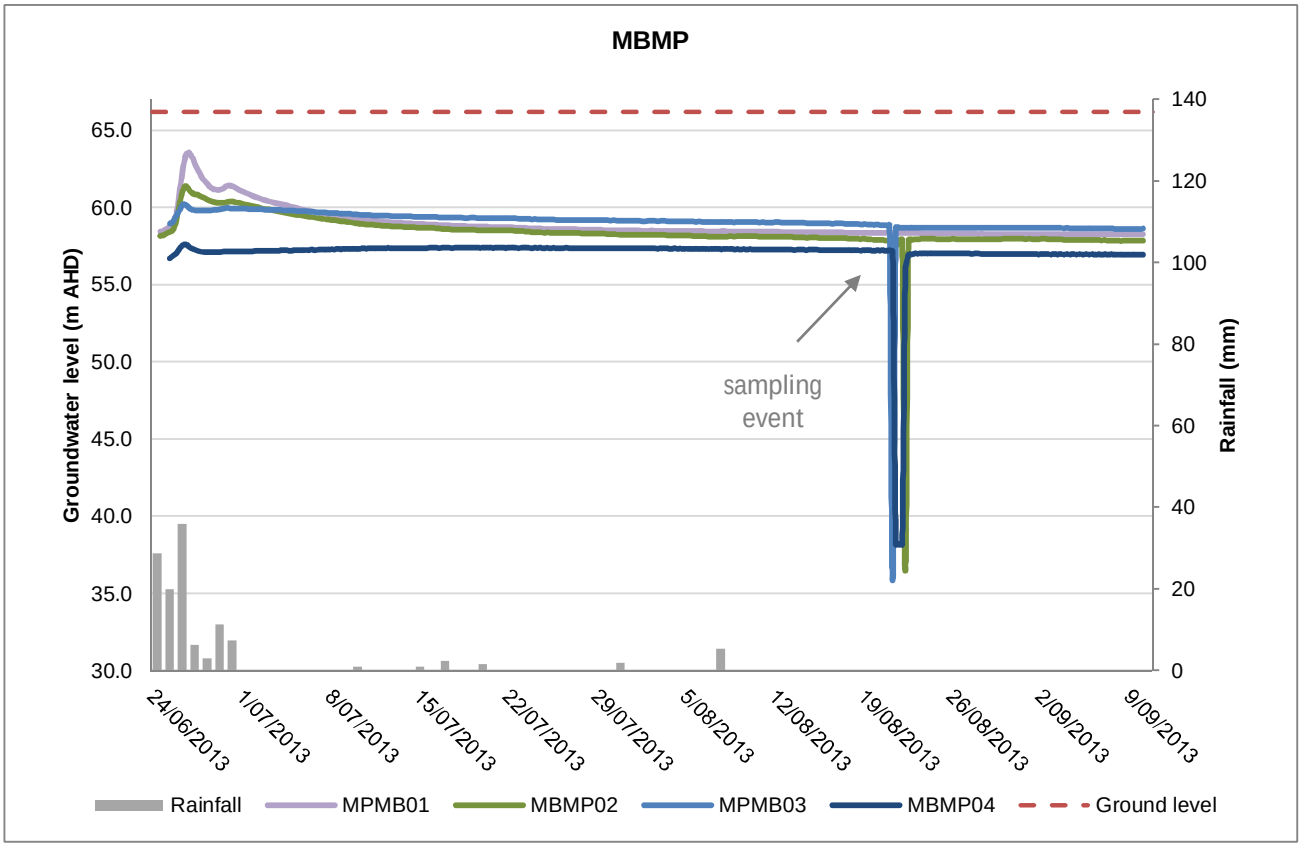

Figure 3.2 Groundwater levels in the Menangle Park monitoring bores

4. Groundwater quality

The monitoring bores were sampled between 21 and 23 August 2013. (Note that RMB01 and RMB04 were not sampled as there was insufficient groundwater in the bores to obtain a representative sample). MPMB04 was not sampled as a blockage was encountered at 147 mbgl obstructing the bore. This blockage will be investigated in FY2014 Quarter 2. A sample was also taken from the Nepean River at the Menangle Park site.

A micro-purge™ low flow sampling system was deployed allowing a representative groundwater sample to be drawn into the pump intake directly from the screened portion of the sandstone aquifer. Water levels and water quality parameters were monitored with a calibrated YSI water quality meter during the micro-purge™ pumping to ensure that a representative groundwater sample was collected. Samples were sent to Australian Laboratory Service (ALS) Environmental Pty Ltd for laboratory testing. ALS is certified by the National Association of Testing Authorities (NATA) for all analytes tested.

RMB02, RMB03, MPMB02 and MPMB03 were analysed for stable isotopes of water (oxygen-18 [$\delta^{18}O$], deuterium [$\delta^{2}H$]), carbon-13 [$\delta^{13}C$] of dissolved inorganic carbon (DIC) and radioisotopes (radiocarbon [^{14}C] and tritium), to further characterise and date groundwater and to enhance the hydrogeological conceptual model. The isotope testing laboratories; Rafter Radiocarbon Laboratory, GNS Science Stable Isotope Laboratory and UC Davis Stable Isotopes Facility are located overseas and are not NATA certified but have been principal isotope laboratories for over three decades. These laboratory results are provided in the *Drilling completion report* (Parsons Brinckerhoff, 2013 (in preparation)).

Table 4.1 details the analytical results from the groundwater quality sampling event. All results have been compared against the ANZECC (2000) guidelines for freshwater ecosystems (southeast Australia – lowland rivers) because the rivers are the ultimate receiving waters for both surface water runoff and groundwater discharge. However, these water guidelines are often naturally exceeded in catchments with rocks deposited in marine environments, hence they are only guidelines and not strict criteria that should be used to evaluate individual water quality results.

Table 4.1 Groundwater quality (August 2013)

Parameters	Units	ANZECC (2000) guidelines[a]	RMB02	RMB03	MPMB01	MPMB02	MPMB03	Nepean River
General parameters								
pH	pH units	6.5 – 8.0[b]	6.67	**9.61**	**4.78**	**5.72**	**6.30**	**6.36**
Conductivity	µS/cm	125-2200[b]	**10106**	**8173**	980	874	1092	201
Temperature	°C	-	18.22	18.48	18.16	18.88	17.03	14.70
Dissolved oxygen	% sat	80-110[b]	**3.2**	**4.1**	**19.8**	**20.0**	**2.3**	**43.6**
Total Dissolved Solids	mg/L	-	6569	5316	637	568	716	188
Suspended Solids	mg/L	-						
Redox	mg/L	-	-122.0	-119.0	81.0	-88.9	-144.3	na
Water type[c]			Na-Cl	Na-Cl	Na-Mg-Cl	Na-Mg-Cl-HCO_3	Na-Ca-HCO_3-Cl	Na-Cl-HCO_3
Laboratory analytes								
Hydroxide Alkalinity as CaCO3	mg/L	-	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	-	<1	268	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	-	886	255	18	182	416	35

Parameters	Units	ANZECC (2000) guidelines[a]	RMB02	RMB03	MPMB01	MPMB02	MPMB03	Nepean River
Total alkalinity as $CaCO_3$	mg/L	-	886	523	18	182	416	35
Sulphate	mg/L	-	2	<1	6	10	<1	5
Calcium	mg/L	-	293	7	15	32	80	3
Magnesium	mg/L	-	84	25	25	31	23	3
Sodium	mg/L	-	1760	1740	129	93	116	28
Potassium	mg/L	-	42	26	2	4	15	2
Chloride	mg/L	-	3080	2490	294	174	109	33
Silica	mg/L	-	10.3	6.01	16.3	13.0	9.9	2.6
Total Cyanide	mg/L	0.007	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	-	0.2	0.3	<0.1	0.2	0.2	<0.1
Dissolved metals								
Aluminium	mg/L	0.055	<0.01	0.02	0.05	0.03	**0.08**	0.05
Antimony	mg/L	-	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.013	0.002	<0.001	<0.001	0.008	**0.022**	<0.001
Beryllium	mg/L	ID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	39.80	7.42	0.75	0.44	4.04	0.05
Cadmium	mg/L	0.37	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	ID	0.044	<0.001	0.044	0.010	0.009	<0.001
Copper	mg/L	0.0014	<0.001	<0.001	<0.001	**0.003**	<0.001	<0.001
Lead	mg/L	0.0034	<0.001	0.002	0.002	0.013	0.002	<0.001
Manganese	mg/L	1.9	0.040	0.004	0.486	0.278	0.329	0.028
Mercury	mg/L	0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	ID	<0.001	0.007	<0.001	0.007	0.004	<0.001
Nickel	mg/L	0.011	0.001	0.002	**0.016**	0.010	**0.013**	0.001
Selenium	mg/L	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	-	9.660	2.510	0.169	0.361	1.150	0.052
Uranium	mg/L	ID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	ID	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	**0.043**	**0.035**	**0.057**	**0.059**	**0.031**	**0.015**
Boron	mg/L	0.37	<0.05	0.16	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	ID	5.59	0.08	0.08	3.36	2.63	0.22
Bromine	mg/L	ID	6.4	4.9	0.6	0.3	0.2	0.1
Nutrients								
Ammonia as N	mg/L	0.02[b]	**3.97**	**3.36**	<0.01	**0.08**	**0.76**	**0.03**
Nitrite as N	mg/L	0.02[b]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.7	<0.01	<0.01	0.09	<0.01	<0.01	0.21
Total Phosphorus	mg/L	0.05[b]	0.04	0.03	0.02	0.02	0.02	**0.36**
Reactive phosphorus	mg/L	0.02[b]	**0.04**	0.02	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon	mg/L	-	-	25	<1	<1	<1	4
Gases								
Methane	µg/L	-	17700	18600	<10	83	14700	<10
Phenolic compounds								
Phenol	µg/L	-	<1.0	1.2	<1.0	<1.0	<1.0	<1.0
Polycyclic aromatic compounds	µg/L		< LORs	< LORs	< LORs	< LORs	< LORs	< LORs

Parameters	Units	ANZECC (2000) guidelines[a]	RMB02	RMB03	MPMB01	MPMB02	MPMB03	Nepean River
BTEX compounds								
Toluene	µg/L	-	23	74	<2	<2	<2	<2
Total petroleum hydrocarbons								
C_6-C_9	µg/L	-	50	140	<20	<20	40	<20
C_{10}-C_{14}	µg/L	-	<50	120	<50	<50	<50	<50
C_{15}-C_{28}	µg/L	-	<100	190	<100	<100	<100	<100
C_{29}-C_{36}	µg/L	-	<50	<50	<50	<50	<50	<50
Isotopes								
Oxygen-18	%	-	-5.91	-6.07	na	-6.11	-6.38	na
Deuterium	%	-	-36.3	-34.8	na	-31.7	-33.3	na
Carbon-13	%	-	5.3	14.1	na	-16.4	-1.7	na
$a^{14}C$	pMC	-	NR	NR	na	0.5104 ± 0.0017	0.0395 ± 0.0008	na
Carbon-14 (uncorrected age)	Yrs BP	-	NR	NR	na	5403 ± 26	25964 ± 155	na
Tritium	TU	-	NR	NR	na	NR	NR	na
Carbon-13 of methane	%	-	NR	NR	na	NR	NR	na
Deuterium of methane	%	-	NR	NR	na	NR	NR	na

a) ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems: 95% protection levels (trigger values).
b) ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems: trigger values for lowland rivers in south-east Australia.
c) Calculated using AQUACHEM
na not analysed
NR not reported at time of writing
Bold indicates exceedance of guideline value.

Full analysis of these data will be presented in the 2013-2014 annual groundwater monitoring status report. However the results can be summarised as follows:

- Groundwater at Denham Court is characterised as saline, with sodium and chloride the dominant ions. Groundwater pH conditions range from slightly acidic to alkaline. Dissolved metals concentrations are generally low and do not exceed ANZECC (2000) criteria with the exception of zinc. Ammonia (as N) concentrations exceed ANZECC (2000) guideline criterion and dissolved methane concentrations are generally elevated in the Hawkesbury Sandstone. Phenol was detected at concentrations just above the laboratory limit of reporting (LOR) in RMB02. Toluene was detected at both bores. No Polycyclic Aromatic Hydrocarbons (PAHs) were detected. Total petroleum hydrocarbon (TPH) C_{15}–C_{29} was detected at both bores.
- Groundwater at Menangle Park is characterised as fresh, with sodium and chloride the overall dominant ions. Groundwater pH conditions are slightly acidic. Dissolved metals concentrations are generally low and do not exceed ANZECC (2000) criteria with the exception of aluminium, arsenic, copper, nickel and zinc. Ammonia (as N) concentrations exceed ANZECC (2000) guideline criterion and dissolved methane concentrations are generally elevated in the Hawkesbury Sandstone. Methane was detected in all bores except at MPMB01, and was relatively low at MPMB02. No phenol compounds, PAHs and BTEX were detected. TPH C_{15}–C_{29} was detected at MPMB03 only.
- The water quality in the Nepean River is low salinity and pH conditions are near neutral. The dominant cation is sodium and the dominant anions are chloride and bicarbonate. Dissolved metals concentrations are low and do not exceed ANZECC (2000) criteria with the exception of zinc.

5. Summary

The preliminary results of the CGP groundwater investigation support the conceptual model presented in the Phase 1 report (Parsons Brinckerhoff, 2011) and the results presented in the *2012-2013 Annual Groundwater Monitoring Status Report* (Parsons Brinckerhoff, 2013). In brief summary:

Denham Court site

- Groundwater levels are deep and there is currently no apparent interaction with the surface environment.
- Groundwater quality in all aquifers and water bearing zones is poor and of limited beneficial use.

Menangle Park site

- Groundwater trends for the Menangle Park site are not considered in this quarterly report due to the very short period (two months) of monitoring data.
- Groundwater quality in all aquifers and water bearing zones is reasonably fresh and suitable for livestock.

The field investigation program is ongoing with quarterly sampling and water level monitoring.

6. Statement of limitations

6.1 Scope of services

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and Parsons Brinckerhoff (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

6.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

6.3 Environmental conclusions

In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

6.4 Report for benefit of client

The report has been prepared for the benefit of the client (and no other party). Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

6.5 Other limitations

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

7. References

- ANZECC, 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volumes 3 and 4.* Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
- Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2003. *Minimum Construction Requirements for Water Bores in Australia*.
- Parsons Brinckerhoff, 2011. *Phase 1 Groundwater Assessment and Conceptual Hydrogeological Model for the Northern Expansion of the Camden Gas Project*. February 2011, PR_5375 RevF.
- Parsons Brinckerhoff, 2013, *Camden Gas Project - 2012-2013 Annual Groundwater Monitoring Status Report*. October 2013, RPT_7568 Rev C.

Appendix A

Groundwater hydrographs

Figure A.1 Groundwater levels and rainfall RMB01

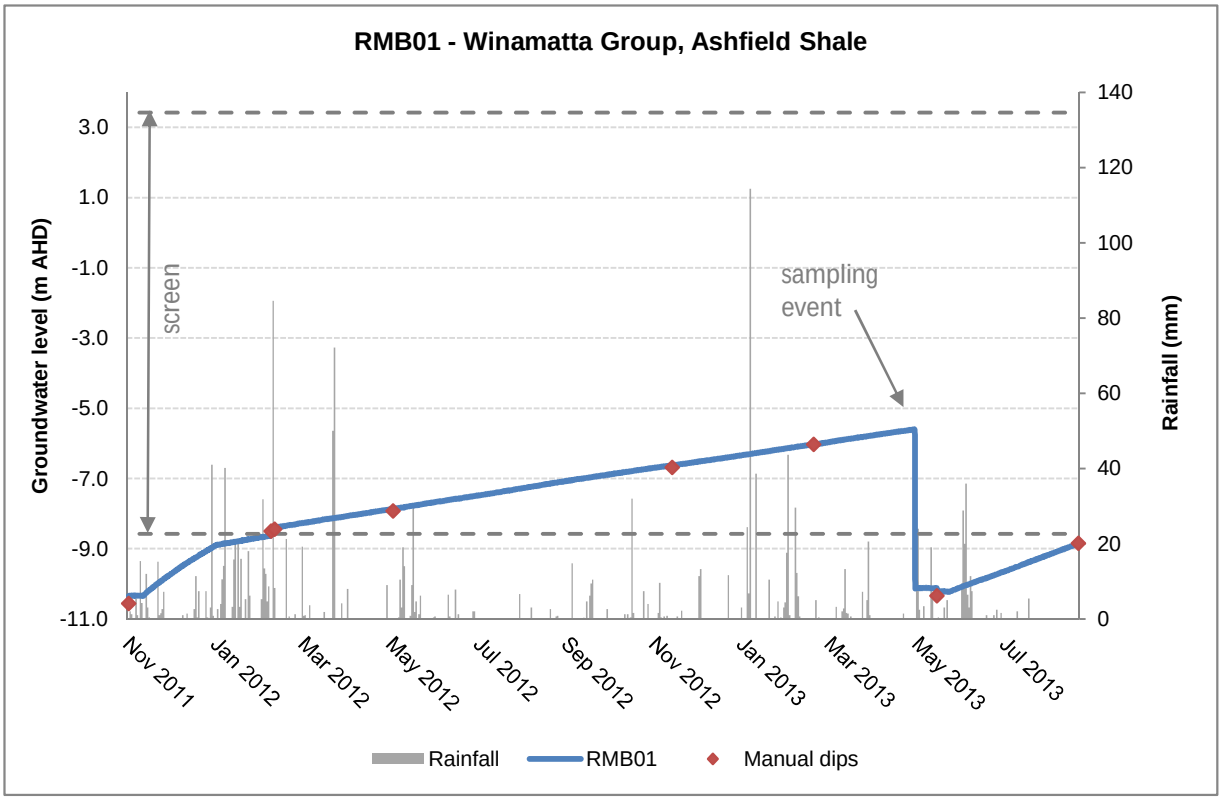

Figure A.2 Groundwater levels and rainfall RMB02

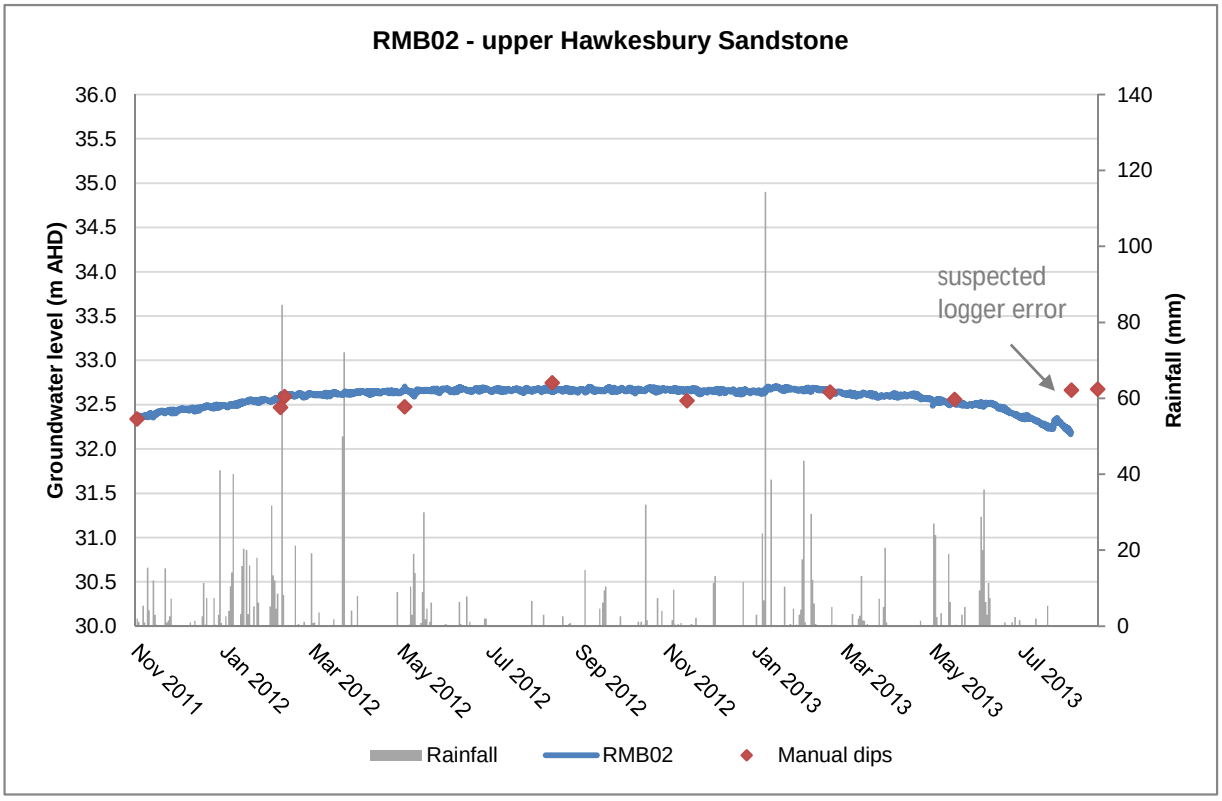

Figure A.3 Groundwater levels and rainfall RMB03

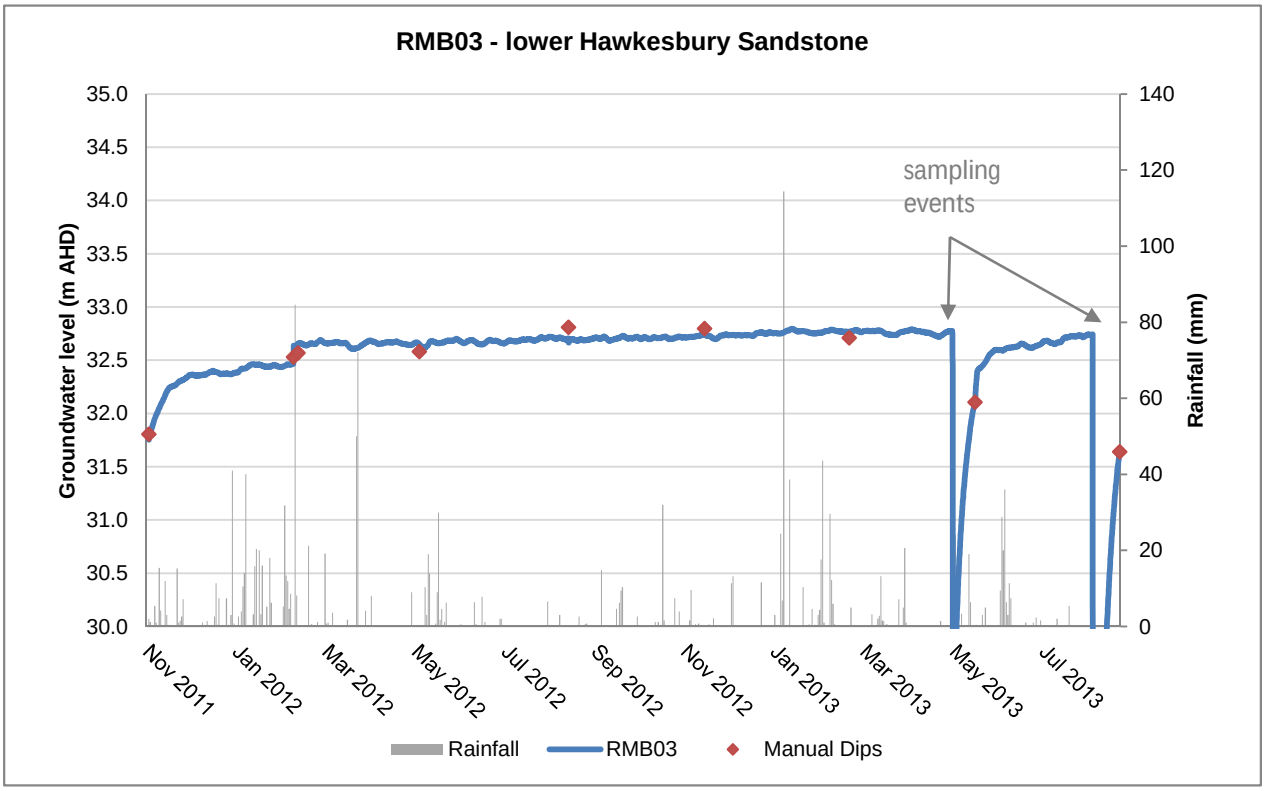

Figure A.4 Groundwater levels and rainfall MPMB01

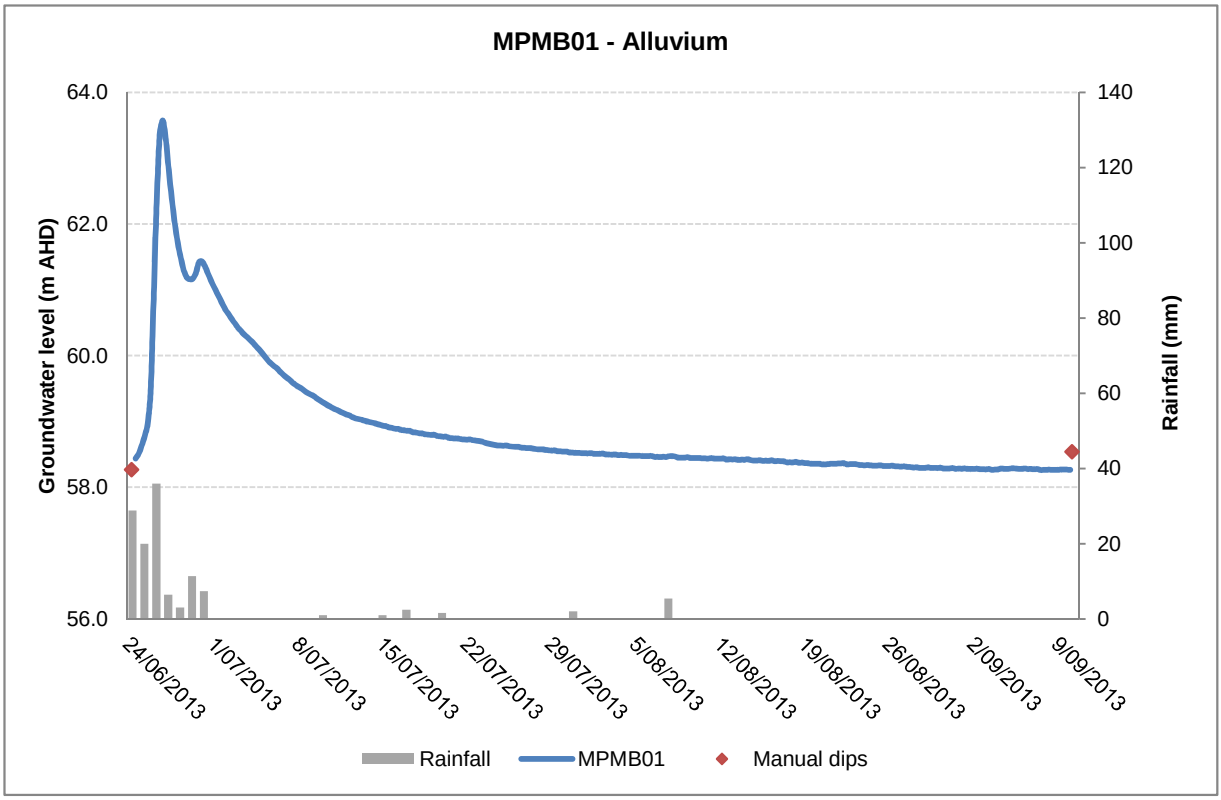

Figure A.5 Groundwater levels and rainfall MPMB02

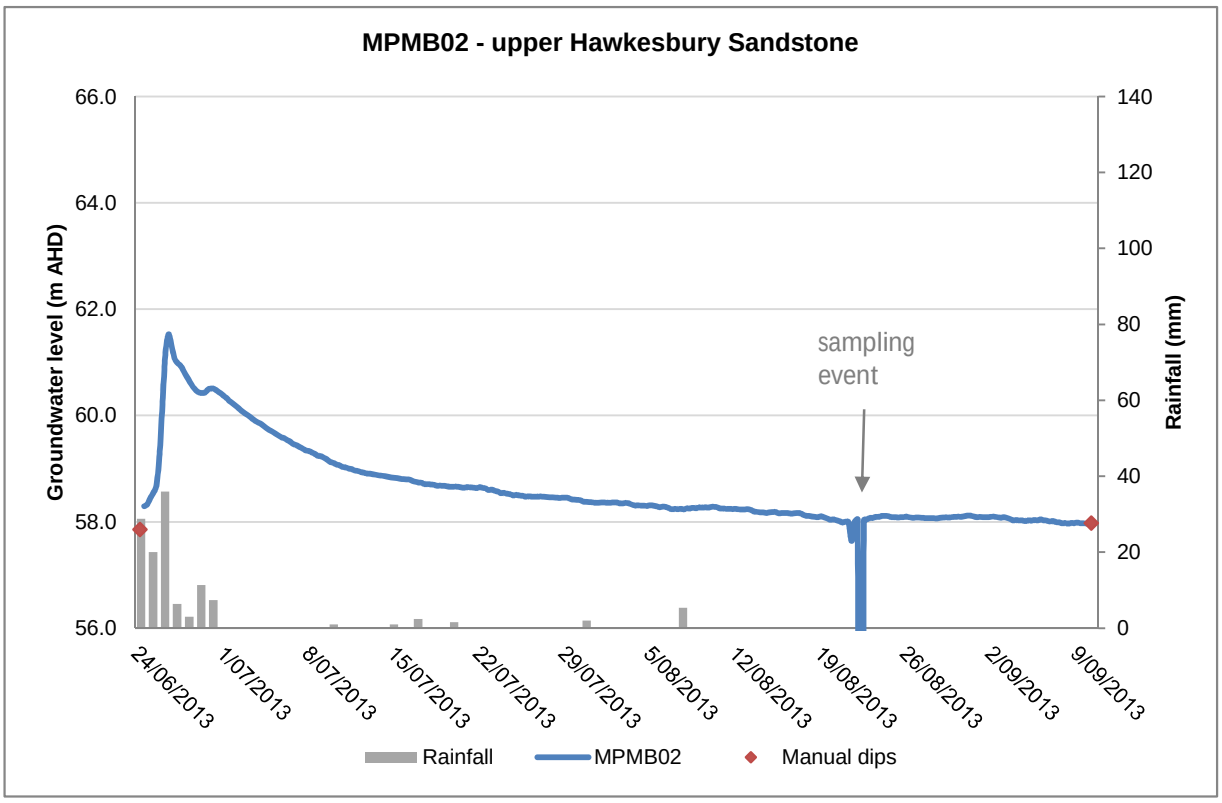

Figure A.6 Groundwater levels and rainfall MPMB03

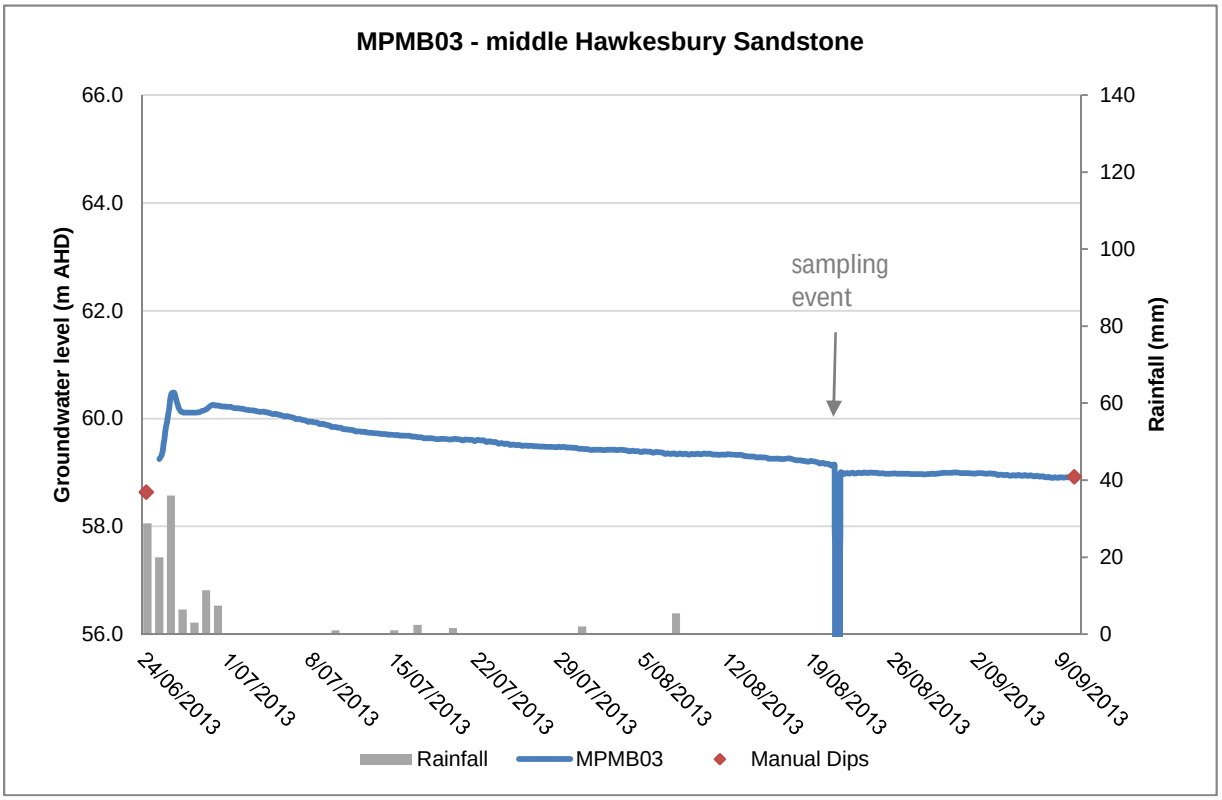

Figure A.7 Groundwater levels and rainfall MPMB04