Peer Review of the HB02 Pump Test (October, 2009) and the PB Report "Broke Groundwater Investigation and Monitoring Report - AGL Hunter Gas Project". Preliminary Report for the 10 March 2010 BCCC Meeting.

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6. Recommendations

The analysis of the PB report is incomplete at this stage. Most of the report has been assessed but the final conclusions, and resolution of some subtle interpretation issues to do with the analysis of the pump testing component of the report, are still to be finalised. Specifically recommendations cannot yet be made with respect to sections 6.3 to 6.7. Nothing should be read into this other than that the technical component of the peer review is not yet complete.

Subject to this caveat the peer review is sufficiently finalised to be able to make the following recommendations.

My comments specifically to do with the PB report are:

1. **Executive Summary**: The executive summary is an accurate representation of the results from the water quality monitoring, pump test, and the interpretation of the water quality data and pump test by PB. Moreover, the interpretation of the data by PB, in so far as what is described in the executive summary, is supported by the assessment of the peer reviewer.
2. **Section 9 Conclusions**: The conclusions are an accurate representation of the results of the report. Moreover, the conclusions of the report can supported by the peer reviewer at this stage in the peer review process with the exception of the 2nd paragraph in the section titled "Aquifer Permeability". This exception is simply a result of the peer review of the pump test not being complete at this stage and nothing untoward should be read into this exception.
3. **Section 10 Recommendations**: The peer reviewer supports all of the recommendations of the report.

In addition, I have a number of further recommendations and conclusions as follow:

1. There is no evidence to suggest aquifer leakage during the well pump test. Furthermore the seismic survey data suggests that the geology tested during the pump test is typical of the region likely to be impacted by the flow test. Accordingly there is no evidence to suggest that there will be any impact of the flow test on the near surface and alluvial aquifers. I recommend that approval be given to allow the flow test in HB02 to commence for a period of up 6 months and allowing a drawdown to 360m below ground surface, subject to the following conditions.
2. The peer reviewer should monitor the flow test as outlined below. PB will be monitoring all of the currently established monitoring wells and should be in regular communication with the peer reviewer about the results from these wells during the duration of the flow test. If untoward behaviour exhibits itself then PB, AGL and the peer reviewer should review the data and decide on further action in consultation with BCCC and, if need be, the regulator responsible for the flow test approvals.
3. Monitoring at the observations wells (established by PB to collect baseline data and to monitor the pump test) should be continued. Current baseline data, while it was adequate to characterise the background for the pump test does not provide coverage of a sufficient range of wet and dry periods to reflect the full dynamics of the groundwater response to climate variation and weather extremes. This will be crucial to assessing the long-term impacts of the flow test and any subsequent gas field development. Given the recent wet summer geochemical sampling at all of the monitoring wells should be done before the flow test is commenced. This will better

characterise wet conditions then the less extreme "wet" period in 2009 presented in PB's report.

4. The protocols for monitoring the electrical conductivity of the water being pumped out of the well, as used during the pump test, should also be applied to the flow test.
5. That water level drawdowns in the pumping and nearby monitoring well (if it is established) be available to the peer reviewer during the flow test (rather than only at the end as was the case in the pump test) to allow an assessment to be made as to any well level deviations from expected behaviour (expected behaviour would be assessed using, for example, the groundwater code in Appendix A, or any other model established in the groundwater or gas reservoir community; e.g. MODFLOW). This may require technical modifications to the well head to allow online water level monitoring to occur.
6. Priority should be given to the establishment of a monitoring well in the Blakefield seam at a distance of 50-100m from HB02. The use of a single well (as was done in the pump test) makes it difficult to estimate both the aquifer conductivity and the storativity independently reducing the reliability of the aquifer parameters derived. Work by others (Wheaton and Metesh, 2001) indicates that the value of aquifer storativity is critical to determining the regional impact on groundwater levels and the amount of water generated from coal seam gas extraction schemes. While this report has not studied regional impacts the results from the more limited modelling in this study are consistent with the conclusion that storativity is important and poorly estimated using the single well methodology in the pump test. Using a single well test, as done for the pump test, makes storativity difficult to estimate while two wells will allow storativity to be estimated. This is not essential for the flow test, but will be crucial before any EIS work for any future development is prepared.
7. That gas flow volumes and gas pressure be monitored and provided to the peer reviewer as part of the flow test monitoring process. This will allow an assessment of the effect of within-aquifer gas generation on the aquifer storativity, an issue that has arisen in the peer review of the pump test data.