This submission predominately relates to the Bylong Coal (the proponent) Groundwater *Impact Assessment* (the Assessment), prepared by Australian Groundwater and Environmental Consultants Pty Ltd (AGE) (June 2015). This submission is not confidential.

Water supply for mine operations

The proponent proposes to construct a bore field comprising 15 shallow wells extracting up to 295 ML/year from the Bylong River alluvial aquifer, however in dry periods this could increased to 31 bores. There is a lack of certainty regarding sustainable water supply and drought security options. There are also no proposed contingency plans for water supply if sufficient water from the proposed bore field is not possible. Contingency plans are a requirement from the NSW Office of Water, as stated in the Appendix A of the Assessment.

The proponent notes that the existing bores targeting the alluvial aquifer cannot take their full entitlement (page 148 of the Assessment). Other mines in the Mid West, including Moolarban, Wilpinjong and Ulan mines, do not rely on the alluvial groundwater as a source of water. In addition the proposed reduction of upwards, vertical flow associated with the proposed mine will further reduce available water from the alluvial source (page 153 of the Assessment).

The confirmation of long term, sustainable groundwater supply has not been tested or verified with any site specific field testing in the form of constant rate pumping tests. The Department of Primary Industries, NSW Office of Water (2014) and Midwest Regional Council recommend aquifer testing be undertaken for this project (Assessment Appendix A), as do the Assessment authors. AGE recommend that the true sustainability of the bore field be tested via long term pumping tests at varying times of the year (page 158 of the Assessment).

Aquifer testing in the form of constant rate pumping tests, are recommended to determine the site specific hydraulic characteristics of an aquifer (notably aquifer storage) and aquifer connectivity. Hydraulic measurements have been predicted using the numerical model, and/or referenced from other locations. Any aquifer testing for the project has focused principally on the Permian Illawarra Coal Measures and has not verified the potential of the proposed water supply from the alluvial aquifer.

Water security for the mine operation

Hunter Unregulated Alluvial Water Sharing Plan is due for extensions/replacement in 2020. The proponent has not investigated the implications for possible reduced available water determinations or the introduction of the 'cease to pump' rules. This was a requirement from the Gateway Panel (Assessment Appendix A).

Being entitled to take from a source that has not been scientifically verified as sustainable is against precautionary principle and would be considered a significant impact, as per the Commonwealth Department of the Environment *Matters of National Environmental Significant* (2013). This guideline states that where there is a lack of scientific certainty about the potential impacts of an action this does not justify that the action is unlikely to have a significant impact on the environment.

Mine water disposal

It is proposed that excess water is stored in the unlined Eastern Open Cut mine pit totalling up to 2,542 ML at the end of mining. Some reinjection of waste water to the underground mine workings has been proposed, the volume is not reported. Reinjection has been included in the numerical model, at a constant rate of 7 ML/day to the Coggan Seam for a one year period. There has been no field investigation to support sustainable reinjection volumes and explore water quality impacts. The reinjection of mine waste water will require approval from the Department of Primary Industries, Water. No such evidence of the approvals is included in the Assessment. In addition it is unclear what will happen to the remainder of the waste water not reinjected. Overall the provisions for mine water management are unclear and not supported by field assessments.

Monitoring network

The NSW Office of Water requests construction details of the proposed abstraction bores be included in the Assessment, while the Gateway Panel requests plans to monitor actual water take (Assessment Appendix A). Construction details and monitoring plans are not included in the EIS. In addition a groundwater monitoring and modelling plan is a standard condition of licence for exploration required under the Mining Act 1992, there is no reference to such plan(s).

Flows to Goulburn River

While drawdown impacts are not predicted to extend to the Goulburn River there is a reduction in baseflow to the Bylong River by 918 ML/year, which will see a subsequent reduction in flow to the Goulburn River. Surface water runoff and rainwater capture to supply site water demands will reduce surface water flows (the maximum reduction in catchment area is 5.8% (of the Lee Creek catchment)). While the reported loss of flow in the Goulburn River catchment would be *immeasurably small (*as per the Surface Water Impact) no exact measurement is provided, and there does not appear to be any consideration of potential reductions from both reduced baseflow and loss of catchment area.

Aquifer disruption

The Independent Expert Scientific Committee (IESC) signalled the potential impacts to the alluvial systems porosity and permeability, and consequential implications for long term flow and storage resulting from the predicted alluvial drawdown (Appendix A, page 6). The proponent has confirmed this has not been addressed. Again this should trigger the application of the precautionary principle.

In addition a requirement of the IESC guidelines (2014) is to provide information on the time for post development drawdown equilibrium to be reached. This has not been provided for the alluvial aquifer, rather it is stated that recovery rates of groundwater levels will depend on rainfall (page 139). Some range of the recovery period should be provided based on numerical modelling and site rainfall patterns. Alternatively it should be clearly stated that groundwater level recovery will not occur.

Geology

The overview of local geology (page 24) lacks sufficient detail, such as grain texture, grain size and cementing. There is no mention of the Marrangaroo Sandstone or the interburden/overburden units, which comprise a large part of the subsurface environment. A detailed and comprehensive description of geology is a requirement of the IESC Guidelines (2014).

In addition the stratagraphic table, Figure 5.14, is not site specific and is not consistent with the units used in Figure 7.21. The cross section in Figure 7.21 is also not consistent with the surface outcrop shown in Figure 5.16, notably the Triassic units are absent.

Figures 5.16 and 5.17 showing folding within the coal measures are unclear, and do not include a reference plan figure showing the location of the cross section lines. Further discussion is required to support these figures. An information request from IESC (2014) and the Gateway Panel (Assessment Appendix A) is a description of the influence of geological structures on groundwater, in particular groundwater flow, discharge and recharge. Such a description is lacking in the Assessment.

Water quality

There are no reported water quality results from the overburden. The six Permian bores assessed for water quality intersect the target coal measures and minor interburden. This does not comply with the NSW Office of Water request to describe groundwater quality for all units (Assessment Appendix A). Without suitable assessment of baseline water quality from all groundwater units the extent of impact on hydrogeological interactions between water resources cannot be explored. This is a requirement of the IESC Guidelines (2014).

Considering the proposed mixing of groundwaters associated with mine dewatering and wastewater storage, and the reported difference in chemical composition between groundwater from coal measures and alluvium, a comprehensive and technically robust assessment of water quality and hydrogeochemistry is expected.

The IESC have requested an assessment of the hydrogeochemistry of spoil and rejects (Appendix A), the Assessment focuses on salinity only with no mention of potential acidity, fouling and metal leachate impacts. These latter impacts can have devastating impacts on environmental health.

It is noted that dissolved iron from alluvium and coal groundwaters exceeds the ANZECC (2000) trigger values for the protection of 95% of species. However this is not disucssed in the main text, rather the reader has to search through the results tables to find this out.

Pit discharge and geochemistry

It is proposed to co-dispose of overburden and coal rejects in the open cut pit. The Assessment reports that the impact on salinity from the rejects material on Bylong River and Lee Creek alluvium depends on the dilution effects within the flow path towards the aquifers, and it is likely the mean alluvium salinity will increase (page 145 of the Assessment). No measures are proposed to further investigate or mitigate salinity impacts, rather the potential influence of rainfall has been used to avoid making a commitment to detailed salinity investigations. This is exactly the type of high level technical assessment that should be undertaken.

The Geochemistry Assessment highlighted the presence of potentially acid forming material and the subsequent generation of acid metalliferous drainage. The acidification of receiving environments can have devastating negative impacts. RGS, authors of the Geochemistry Assessment, have proposed a number of measures to further investigate acid generation potential or mitigate for such impacts. Not all of these mitigation and management recommendations have been adopted by Bylong Coal. Specifically, the completion of scale up of leaching tests for potentially acid forming material and alkaline amendment tests as part of operational planning, and a commitment to encapsulate coal reject material when no storage capacity is available have been ignored.

Best practice observed at Hume Coal Mine

Other mines in NSW are adopting measures to minimise impacts and prioritise environmental protection. The Hume Coal mine, also targeting the Illawarra Coal Measures located in the southern Sydney Basin, is proposing to construct an innovative mine that avoids and reduces environmental impacts wherever possible mining (The Australian Mining Review 2015).

The Hume Coal mine is specifically designed to minimise any impact on the aquifers above the coal seam and the local groundwater systems, while the proposed re-emplacement of reject paste in the underground workings will eliminate subsidence, and other water and atmospheric impacts from reject stockpiling. Subsidence studies for the Bylong Project predict cracking generated by longwall mining could extend 260 meters to the surface over the majority of the mine footprint. The connective fracturing potential reaches land surface at the headwaters of dry creek.

Hume Coal acknowledges that the methods adopted to protect water and subsurface structure are more expensive, however they accept this is now a requirement of modern mining (The Australian Mining Review 2015).

Miscellaneous

- Figure 10.8 showing predicted alluvial groundwater drawdown is unclear, this should be separated into alluvium and regolith to remove the influence of topographic gradient.
- Figure 10.9 showing groundwater levels in the Coggan Seam does not include the contours at the mine footprint.
- Figure 10.10 does not show the location of the proposed bore field. The supporting text on page 117 states that drawdown from the extraction bore field extends 5-9 m, this is not clear on Figure 10.10.
- No justification or reasoning for the groundwater monitoring network is provided.
- No remedial measures or contingency plans are proposed for potential impacts (a requirement from the NSW Office of Water, Appendix A). There is a commitment to ‘further investigation’ however this is not considered a remedial measure or contingency.
- Text confirming that there will be enough overburden to fill the open cut voids or whether mounding will be observed is absent.
- The classification system used to determine the groundwater salinity type on page 67 (ie fresh, brackish) has not been reported.

Conclusion

The water investigations commissioned by Bylong Coal are not considered to be scientifically robust or best practice. This has produced a weak site conceptual model that lacking sufficient details and is often contradictory. There is significant reliance on numerical modelling with minimal focus on a robust, detailed site conceptual model.

There is a lack of water specific management measures, and rather commitments to monitor water resources and adopt management measures only if actual impacts precede the predicted impacts. In some instances the water management approach ignores the fundamental precautionary principle. Other mines in NSW have adopted best practice principles to minimise the environmental impacts of mining, and pride themselves on having as little impact as practically possible.

References

Department of Primary Industries, Office of Water, 2014. Groundwater Monitoring and Modelling Plans, information for prospective mining and petroleum exploration activities.

Department of the Environment 2013. *Matters of National Environmental Significance.*

Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) 2014. *Information guidelines for independent expert scientific committee advice on coal seam gas and large coal mining development proposals*.

Miningoilgas, The Australian Mining Review October 2015. *Australia's first low impact coal mine*.