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As an engineer and corporate executive with extensive experience in the oil industry, and to a lesser extent, the Hunter Valley coal industry, I wish to register my objections to the Hume Coal Environment Impact Statement (EIS) and more generally to the concept of the Hume Coal Project. I believe this project would be detrimental to the Southern Highlands environment, to affected landholders and to the community in general.

My wife and I have lived in the Southern Highlands for the past 16 years, for most of that time as small-scale farmers, fattening cattle and breeding Australian Stock Horses.

I have been part of community opposition to coal mining and coal seam gas extraction in the Southern Highlands since 2011. The CSG proposal was misguided and quickly disappeared. The small Berrima Colliery, which damaged aquifers in Joadja and Mandemar, and created difficulties for residents in the village of Medway, was closed in 2013 on predominately economic grounds.

The Hume project remains, but the EIS that has been submitted in support of this project provides a clear indication that the proposal is unfit, technically and economically, and approval should be denied.

<u>Summary.</u>

The EIS for the Hume Coal Project is a flawed document based on a number of selective and unjustified assumptions, incomplete analysis of the impact of the mine plan and misrepresentation of the social impacts of the project. This submission will focus on the assumptions and analytical aspects of the EIS.

- The mining concept is described in the EIS as new and innovative. However, the concept of adapting high wall mining ideas to a full scale underground mine, with the mining taking place close by reject emplacement operations and resultant flooded mine voids, should raise safety concerns and be closely examined by mining authorities.

- The proponent has provided insufficient information to validate the in-situ resources let alone properly evaluate the extensive faulting and volcanic intrusions that are assumed to be present. Knowledge of the geological anomalies will be necessary to allow the mining activities to safely proceed.

  These matters are apparently left for future discovery after the mine is approved, when landholders, who to date have strenuously and successfully resisted the intrusion of Hume Coal onto their properties, will willingly, or perhaps by legal force, allow access to enable the mining to proceed. From my knowledge of the people concerned, the access that Hume requires will be fought at every turn, as it is detrimental to the landholders interests and wellbeing.

- Many of the problems with the EIS, at least as far as technical aspects are concerned, arise from the requirement to minimize the ‘water take’ from the mine which will need to be licensed by DPI-Water. The mine water licence will come from Nepean Area 1, which is currently fully allocated to landholders. Hence the proponent’s need to have a mine plan, and related modelling, that provides a expectation that a low ‘water take’ will be realized, and that Hume will have a reasonable prospect of acquiring sufficient groundwater licensed volume.

- The conceptual geology for the mine area on which the groundwater analysis is based is not justified by the data presented in the EIS, and in fact runs contrary to the experience of other professionals. If Hume has supporting information it should be produced, not hidden behind barriers of confidentiality.

- The groundwater model based on the assumed geology imagines a series of semi-impermeable strata, just above the coal seam, which constrains water flow into the mined void. The sensitivity cases that are part of the groundwater analysis are totally inadequate and do not reflect the range of possibilities. The aim appears to be to ensure the headline groundwater make is limited to modest levels.

  The groundwater make from the Hume mine is likely to be far greater than the singular estimate provided by Coffey in their analysis.

- The result that has been calculated is inconsistent with local experience. The mine area is known to have numerous faults and has a number of water bores with yields in excess of 50 litres/sec and the capacity to drive major irrigation equipment.

- The plan to emplace rejects in mined voids which would then be sealed to minimize groundwater ingress is incompletely described in the EIS, and yet the groundwater minimization strategy is dependent on it. This procedure entails significant risks that have caused at least one mine (Airley near Lithgow) to reject it on safety and cost grounds (3).

  The EIS provides contradictory views on the timing of the emplacement process. The most often expressed view is that it will be almost immediately after completion of mining. Yet, the EIS lists as one of the measures available to control acidification in the voids as being to halve the period between mining and emplacement from 12 to 6 months. Confusion reigns on this subject and many others in the EIS.

- There is just one other coal mine in NSW, Metropolitan Colliery in Helensburgh, that emplaces at least some of their rejects into mined voids as a slurry (2). This operation takes place at much greater depths than in the Hume situation, and the slurry has no direct contact with any productive aquifers.

  The Helensburgh mine also had the benefit of years of trial and error testing the feasibility of the process, and knowledge of the actual composition of the rejects involved. In the Hume case, this is just one grand experiment, with the community, and the affected landholders in particular, exposed to long-term contamination of a valuable groundwater resource.

The uncertainty surrounding the closure of the mined panels increases the chance of acidification of the voids. Limestone will be added as a control, but if a problem occurs it will be impossible to rectify.

- The geochemical analysis of the slurry in the EIS takes no account of the chemicals that will be part of the process, or the coal particles that will be included in the reject. There is no justification for this material being re-injected into the mined void to become part of the aquifer in perpetuity.

- The acknowledged depletion of groundwater bores undermines the credibility of the Hume EIS. Even using the low estimate for water intrusion into the mine, 99 bores will be affected and around 26 bores will run dry. The EIS attempts to gloss over this damage with the statement that the proponent will 'make good' any water loss has no substance. In the case of moderate to high volume bores, the speculative solutions offered by Hume will not provide relief, and the any solution that does is impractical.

  The EIS does not spell out how the 'make good' arrangements with landholders will work, other than to say they will be negotiated. However, as Queensland Land Court Member P A Smith pointed out in his recent judgement in a matter concerning the expansion of the New Acland Coal mine (5), once a landholder loses bore water, all leverage is with the miner, and the landholder shoulders the burden of proving the damage is caused by mining and the costs of possible litigation.

  The EIS gives some clues as to where Hume is heading with the 'make good' provisions; with the groundwater model output assigning the blame for bore impacts between the mine and other landholder users. Clearly this concept will be a source on contention in the future.

  If a more realistic estimate of the groundwater make is used, the damage to landholder bores will be greater and more widely distributed, and recovery will take considerably longer. The inter-generational issues raised by this groundwater damage warrant close consideration.

- The EIS presents a water balance calculated by Parsons Brinckerhoff based on the singular figure for water make from the Coffey model. On this basis PB declares that the Primary Water Dam can accommodate all water discharges from the site, and hence a water treatment plant investment is unnecessary.

  It is understandable that PB would feel constrained to use the single low data point from the Coffey model, as testing the water balance over a wider range would add weight to the argument that the groundwater model results understate the water make. If the assumptions that drive the Coffey model are invalid, as I believe they are, so is the PB water balance analysis.

- Finally, the EIS contains limited information on the economics of the project, as Hume has withheld some of the data that would normally be revealed to support their position as 'commercial in confidence'. However, it is clear from the data that has been included, that the economics of this project are very poor. A taxable profit is unlikely to be achieved during the life of the mine and the project overall will have strongly negative returns.

Key concerns in more detail.

The reasons for my objections are shown briefly below. I will focus on the mine design, groundwater issues, the site water balance, the emplacement of washery rejects in the mined voids, the practicality of sealing each mined panel and the overall economics of the project.

Mine design

The EIS describes the Hume proposal as a 'bespoke' mine design of proven components put together in a novel manner. The 'pine feather' design is certainly novel by Australian standards. This design offers some efficiencies over conventional Bord and Pillar layouts, particularly the continuous conveyor arrangement.

However, the use of high wall mining methods with remote controlled continuous mining equipment, adjacent to sealed and flooded mined out panels, in an environment of unresolved faults and volcanic intrusion, should raise safety concerns with the authorities involved.

The mine plan presented in the EIS is idealistic and takes no account of the geological anomalies that are present. The EIS does not provide any detail of the work the company needs to do to firm up its understanding of the geology of much of the area.

Groundwater. (GW).

As a member of the Hume Coal Water Advisory Group since 2012, I have watched the painful development of the company's groundwater modelling, First by Parsons Brinckerhoff (PB) who developed a draft model only to hand over to Coffey in mid 2015 in unexplained circumstances. Coffey took another 18 months to finish the job. I remain mystified as to why PB would suddenly abandon the modelling work after at least 3 years of involvement.

The need to have licences to fully cover the GW take generates an imperative to minimize the calculated output from the model. The Coffey model appears to employ a number of debatable model inputs to achieve this result.

- A number of thin layers near the coal interface have low permeability to constrain GW inflow to the mine void. The geological justification for this assumption is not provided.
- Coffey's analyst claims that permeability of the dominant Hawkesbury sandstone layer decreases with depth. The Southern Highlands experience is contrary to this, permeability increases with depth.
- Hume chose to conduct just 2 pump tests, one of 7 days duration, the other just one day. While many more slug and packer tests were conducted, the best guide to overall permeability of the aquifer system comes from pump tests, which highlight the degree to which fracturing influences GW flows. Perhaps they are concerned that pump tests would not support their arguments.
- One of the most surprising aspects of the Coffey GW report is the lack of meaningful sensitivity analysis. Even more surprising is the fact that peer

reviewers, one of which has been associated with the project since 2012, would label these minimal efforts as 'adequate'.

- The Coffey report seems to assume that hydrogeology is a perfect science and that the semi-impervious layer that acts as an aquitard for the mine void operates flawlessly over the mine area. The model suggests the net GW make will be a maximum of 1 GL/yr. The likelihood is it will almost certainly be higher.
- The Hume EIS states that the company has acquired sufficient licensed GW volume to cover 60% of their needs, and will obtain the balance by purchase on the open market, or by persuading the NSW Government to increase water availability in the Nepean No.1 area. The company's requirement for GW licences is an unknown at this time, and that the EIS should not be approved while this uncertainty exists

<u>Drawdown of landowner bores and the 'Make Good' provisions</u>

The Coffey GW model has calculated the theoretical drawdown for the 99 bores they assess to be affected by the mine. Of these it appears that 26 will run dry or be destroyed during the course of mining. These calculations have been made based on Coffey's low estimate of GW take and the likelihood is that at higher levels the number of affected bores, the severity of impact will be much greater and the recovery will take much longer.

The EIS states that under the 'make good' provisions of the Aquifer Interference Policy (AIP) the dry bore problem can be managed. The practicality of that concept must seriously be questioned.

One of the more seriously affected bores has a licence to draw 550 ML/yr. to drive a pivot irrigator. The options for 'make good' for a bore of this productivity are unworkable. It would for example take over 18,000 water deliveries in a 30,000-litre tanker to make up this volume. Drilling below the coal seam would not give the volume this landowner requires. Even for lower licence levels, say 30 ML/yr., it is unlikely that 'make good' is workable.

The claim made in the EIS that the company will adhere to and meet the 'make good' provisions of the AIP do not satisfy even cursory analysis. The EIS should be rejected on this basis alone.

<u>Other 'Make Good' Concerns.</u>

The recent judgement in the matter of New Acland Coal (NAC) vs. Ashman & Ors (5) handed down by Member P A Smith in the Queensland Land Court, explores potential inequities in the 'make good' concept. In his conclusion he recommended that NAC be refused approval for Stage 3 expansion of their mine based principally on groundwater concerns.

Mr. Smith points out the imbalance of power between a landholder and the mining company when 'make good' issues arise. When the damage has been done, it falls to the landholder to make his case for reparations. This could be a very expensive process involving expert advice and litigation with the mining company's deep pockets placing the landholder at a considerable disadvantage. The judgement also points out the impracticality of 'make good' in cases where large volumes of groundwater are involved, and the clear issue of intergenerational equity in cases involving damaged aquifers.

The Hume EIS reports that significant aquifer damage can be expected with at least 26 bores to be destroyed or run dry, and this with an extremely low water make generated from their groundwater model – the damage should be expected to be much greater. Some of the landholders affected have water licenses for very large volumes that would simply be irreplaceable under the 'make good' offerings included in the EIS.

However it is clear from the EIS that the Hume approach will be to 'negotiate' a 'make good ' outcome with landholders concerned. They make the case at the outset that if a bore runs dry the miner is not fully responsible – other groundwater users must share the blame.

The blame-sharing exercise is calculated using the Hume groundwater model, and while the current calculations show the miner being responsible for the majority of the damage, there is plenty of scope for contentious debate when, and if, a problem has to be dealt with. The situation of high cost of proof and costly litigation foreseen by Land Court Member Smith in the NAC case is a very real prospect for landholders in the Sutton Forest and Belanglo areas.

<u>The EIS Water Balance</u>

The site water balance was undertaken by Parsons Brinckerhoff and is based on the assessment of an admirable 107 years of climate variation. However the study uses just one data point for the water make from the mine, the number provided by Coffey and discussed above. No sensitivity analysis of this important number was undertaken, allowing PB to reach the conclusion that the Primary Water Dam had the capacity to contain all the site water, discharge to Oldbury Creek would be minimal and investment in a water treatment plant would be unnecessary.

Clearly, the PB analysis is constrained by the very low predictions of GW make in the Coffey model, which is in turn limited by the requirement to come up with a number that is feasible from a water licensing point of view.

Of course there is the important caveat that if they are wrong then a water treatment plant could be built later: after how many years and after how much environmental damage that may be. This seems to be a highly unsatisfactory approach; the proper analysis should be done with appropriate sensitivity analysis, and the same can be said, even more strongly, for the GW model.

<u>The Emplacement of Rejects in the Mined Voids</u>

This is one of the most controversial aspects of the Hume proposal and is poorly and inadequately dealt with in the EIS. As far as I am aware, there is no other example in the coal mining industry where ground up rejects, coal dust and other chemicals are pumped into the aquifer relied upon by landowners.

- Hume claims the material is inert, but this is based on laboratory samples of what they believe the rejects to be, not the real thing. In reality the reject samples may not be truly representative and in any case would not include materials that are part of the coal washing process or those needed to ensure the material going underground is pumpable.
- The EIS also has no mention of the residual coal dust that will be part of the reject material.

- It is clear from the EIS that the method of emplacement is still under development. In a paper presented to a mining conference at UOW in February this year (1), the reject material would be ground and mixed with water to form a paste, 'roughly the consistency of toothpaste'. The Coffey GW study also uses the paste description.

  Yet in the main report of the EIS, presented at the end of March, the rejects stream is described as slurry, having been ground down to a maximum particle size of 10 mm. There clearly has been a last minute change and one wonders just how much thought has gone into this important part of the mining process.

The only coal mine that uses the underground reject emplacement method, at least in part, is the Metropolitan Colliery in Helensburgh (2). This mine is very old, the operators know the exact composition of the rejects they are dealing with, the emplacement takes place at considerable depths and at a location well away from the current coal extraction area. Even so, the colliery had to experiment for a number of years before they found the right combination of slurry characteristics that would allow a reliable and safe operation.

The Hume project approaches the task of reject emplacement without any of the basic advantages that assisted Metropolitan. They can only guess at the reject composition and they have no idea of the pumping characteristics of the slurry. However they are aware it might prove to be a difficult proposition as they are assuming they will need additional redundant piping to allow operations to continue when blockages occur.

The other important difference in the Hume mine is that the task of reject emplacement and sealing of the panels with concrete bulkheads will take place in close proximity to the coal mining operations. Safe Work Australia, in their Code of Practice for Inrush and Inundation Hazard Management (4), identify hydraulic and paste-filling operations as a hazard, and the Airly Colliery near Lithgow rejected reject emplacement in mined voids on the grounds of cost and safety (3).

The practicalities of the reject emplacement process, and the related operations to seal the mined-out panels, receive inadequate attention in the EIS. Yet without the emplacement and sealing operation commencing 'almost immediately' or 'about one week' (according to Coffey Volume 2, 5.3.1) after the completion of mining in a panel, the groundwater make could be significantly higher than calculated in the Coffey model.

However, p189 of the main EMM report lists the 'management measures' available to Hume to counter unexpected GW impacts. If water inflows into the sump are higher than predicted or acidification of the sealed voids occurs, the recommended solution is to fill and seal the voids at a faster rate than planned, on the basis that the GW model allowed for 12 months to seal the mine after completion of mining. As noted above, the Coffey report states nothing of the kind, and leaves no scope for expediting the sealing operation.

In reality, the reject emplacement and sealing operation could prove to be very problematic, and may indeed prove to be unsafe and impractical. There is nothing in the Hume EIS that gives confidence that this process has been properly analysed and contingencies evaluated.

<u>Bulkhead Seals</u>

While concrete bulkheads are routinely used to seal mined areas, the scope of the sealing proposed here is perhaps in a different league. By my calculations, more than 150 seals, each comprising roughly 140 cubic metres of concrete, will be required to control the GW inflow and provide a safe working environment. These bulkheads need to be watertight to achieve their purpose, a challenge as concrete shrinks on curing, and fixed into a solid surround. The concrete will not leak, but the interface with the coal must be considered a point of weakness and, with GW filling the void and building hydraulic pressure, a source of safety concern.

Once again we have a situation where the EIS assumes no risk with this operation, and takes no account of the fact that it may prove impractical or at least very costly. The problems that can occur when you are alternately pumping slurry and cement should be considered. If the concept doesn't work the EIS is invalid.

Project Economics

The economic evaluation of the Hume Project was done by BAEconomics and included in the EI as Appendix Q. This consultant states at P42 that guidelines for this type of analysis requires 'proponents, where practicable, to undertake a sensitivity analysis of how much output prices would need to fall for the project to have zero NPV, and to report whether such a scenario is likely or unlikely'.

The consultant states that 'Hume Coal considers that such analysis is commercial-in-confidence', and as such, they did not undertake this work. Sufficient information is included in the EIS to piece together a reasonable picture of the profitability of this project, and given the poor prognosis revealed, the reluctance of Hume to be more transparent is understandable.

The proposed Hume Coal mine is relatively small at just 2.1 Mt/yr. average saleable products over the mine life. The product mix is just 55% metallurgical (PCI) coal and the balance lower value thermal coal, a much less valuable product mix than we had been led to believe. Hume could have made it easier, but it is possible to reconstruct a spreadsheet from the limited data in the EIS.

The revenue from the project can be calculated from the volumes and prices revealed in the EIS and crosschecked against the revenue calculated from the declared royalties paid to the State over the mine life. While not fully defined, the EIS provides sufficient information to allow labour and non-labour costs to be estimated. With the royalties and given the indications in the EIS of the investment involved, depreciation can be determined, the cash flow of the project can be estimated and economic returns calculated.

It can be said with some confidence that the project is unlikely to ever pay income tax and will have a substantially negative NPV over the project life. The project should be rejected on this basis.

The strongest number in these calculations is the revenue, which has two points of reference, and it is likely that the cost side of the calculations underestimates the likely situation. To improve the economics to a commercial level, the key EIS assumptions need to be substantially adjusted to raise revenues and reduce costs.

Hume has used a future coal price forecast from reputable forecaster Wood Mackenzie, which is probably as good as any at the present time. This means that revenues can only increase with higher product coal production which implies an increased yield of ROM coal from the previously indicated 35% of the available resource, and/or the company gets some relief from State royalties. Either way, the assumptions in the EIS are compromised.

The project economics could be improved by reducing costs, but the operating assumptions included in the EIS appear to be already on the low side. Despite the claimed efficiencies, the reject emplacement process greatly increases expense, and that is before accounting for the risks that might be involved.

If Hume is of the opinion that some of the EIS data has been misinterpreted, they should lift the veil of confidentiality and provide the information and analysis needed to demonstrate the worth of their project.

Conclusion.

This is a low volume, high cost, green-fields mine with no, or at least very limited, prospects for future expansion. Hume relies on a series of dubious assumptions to minimize the environmental impact of the mine, fails to provide a complete analysis of key features of their operations, and hides behind confidentiality to avoid revealing the poor economic returns that will flow from this project.

The EIS should be rejected, and to avoid throwing good money after bad, the project should be abandoned and the exploration licence cancelled at the earliest opportunity.

Alan R Lindsay

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