

LAND COURT OF QUEENSLAND

REGISTRY: Brisbane

NUMBER: EPA495-15

MRA496-15

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Applicant: New Acland Coal Pty Ltd ACN 081 022 380

AND

Respondents: Frank Ashman & Ors

AND

Statutory Party: Chief Executive, Department of Environment and Heritage
Protection

JOINT EXPERT REPORT - GROUNDWATER IMPACTS OF THE PROPOSED STAGE 3 MINE

1. Expert reasons

1.1 Name and qualification

(a) This joint expert report was prepared by Duncan Irvine, Andrew Durick and Brian Barnett on behalf of the applicant, and Matthew Currell and Adrian Werner on behalf of the respondents (as Oakey Coal Action Alliance). The experts are referred to below by their initials – DI, AD, BB, MC and AW, respectively.

(i) Duncan Irvine: BSc (Rhodes University, South Africa).

(ii) Andrew Durick: MAppSc (Maths), Queensland University of Technology, BEng (Environmental Engineering) (Hons), Griffith University.

(iii) Brian Barnett: BEng (Civil) (Hons) (University of Auckland).

(iv) Matthew Currell: PhD (Geoscience, Monash University), BSc (Hons)/BA (University of Melbourne).

(v) Adrian Werner: PhD (University of Queensland), BEng (Civil) (Hons) (Central Queensland University).

(b) The experts met on 11 May 2016 at Brisbane Magistrate's Court, Court Room 43.

2. Issues and Agreement

2.1 A table outlining the issues and detailing the experts' points of agreement and disagreement is annexed as Annexure A.

3. **Expert's statement**

I confirm that I understand I have a duty to assist the court and that duty overrides any obligation I may have to any party to these proceedings or any person who is liable for my fees or expenses and I have complied with that duty.



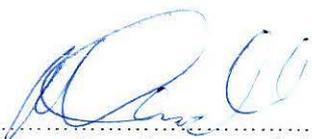
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Duncan Irvine Date: [11th May 2016]



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Andrew Durick Date: [11th May 2016]



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Brian Barnett Date: [11th May 2016]



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Matthew Currell Date: [11th May 2016]



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Adrian Werner Date: [11th May 2016]

Annexure A - Table of Points of Agreement & Disagreement

#	Issue	Points of Agreement	Points of Disagreement
1	<p><u>ISSUE:</u> The groundwater head data presented in Figure 2 of Attachment C to Brian Barnett's statement of evidence, dated 10 May 2016 (the Barnett Memorandum), does not support the justification given in the Barnett Memorandum for the location of faults in the model:</p> <p>a) It is not clear whether head data are from more than one aquifer and at more than one time, such that the groundwater gradients inferred from the data are questionable.</p> <p>b) Even assuming the heads are within a common aquifer and within a reasonable time-period, faults have been inserted where there is no indication of a "steep gradient".</p>	<p>We agree that water levels in Fig. 2 are from different geologies. They are from different times.</p> <p>We agree that some faults have been inserted in areas where there is no indication of a steep gradient.</p>	<p>MC and AW suggest that the groundwater gradients inferred from the data are questionable.</p> <p>BB suggests that the groundwater gradients inferred from the data are not questionable.</p>
2	<p><u>ISSUE:</u> There are reasonable alternative explanations for any variation in groundwater head that do not require the inclusion of faults in the locations in which they have been put in the model, including:</p> <p>a) Geology;</p> <p>b) Topography;</p> <p>c) Enhanced recharge.</p>	<p>We all agree that different modelled faults could have produced the same level of calibration.</p>	<p>BB suggests that there are not alternative explanations for variations in head, aside from different fault locations, and this applies to the 2009 model, which uses a different layering approach to the AEIS model.</p> <p>DI and AD have no comment on the statement above.</p> <p>MC and AW doubt that the modelled faults (2009 model) or alternative faults are the only way to adequately reproduce the field data. The three factors listed are probably likely candidates to replace some of the effects of faults in the 2009 model. BB disagrees with this.</p>

3	<p><u>ISSUE:</u> It is poor modelling practice to model faults where there are none mapped and not to model faults where they are mapped.</p>	<p>We agree that if the fault shows no influence on the hydrogeology, then leaving it out of a model would be appropriate.</p> <p>We agree that it is not appropriate to model a fault where there is no hydrogeological evidence for it.</p>	<p>MC and AW agree that conceptualisation of faults with all available field data should occur prior to including them in a model.</p> <p>BB agrees that hydrogeological evidence is required to add a fault to a model, but suggests that this could take the form of significant head differences as adequate evidence to include a fault in a model.</p>
4	<p><u>ISSUE:</u> The approach said to have been used to model some faults as semi permeable in the Barnett Memorandum (i.e. leaving gaps between the horizontal flow boundary (HFB) applied to cells):</p> <ul style="list-style-type: none"> a) is inconsistent with the MODFLOW manual; b) represents poor modelling practice; c) is inconsistent with the approach described in the SKM Report (2013) included as Attachment 1 to the Barnett Memorandum. 	<p>(a) AD, BB, MC and AW agree that the modelling of some of the faults differs to Figure 5-8B of the MODFLOW manual. DI does not comment on this.</p> <p>(c) We agree.</p>	<p>(a) BB, AD and AW disagree with the intent of the MODFLOW manual as to whether or not it is suggesting to use continuous HFB segments or not. AW understands that the HFB package ought to be applied to faults in a continuous manner.</p> <p>(b) BB and AW disagree (as above).</p>
5	<p><u>ISSUE:</u> There is an alternative orthodox way to increase the permeability across a HFB in MODFLOW by changing the conductivity value of the modelled fault.</p>	<p>We agree.</p>	
6	<p><u>ISSUE:</u> The justification that leaving gaps is done in order to "visually distinguish" increased permeability across a HFB is invalid.</p>		<p>BB and AW disagree on the validity of this approach.</p>
7	<p><u>ISSUE:</u> Inadequate reporting of the 2009 and 2013 modelling referred to in the Barnett Memorandum does not allow a proper appreciation of the steps and assumptions that led to the ultimate approach to modelling faults in the AEIS.</p>	<p>We agree.</p>	

8	<p><u>ISSUE:</u> The reference to "walls" and/or "barriers" in reports that describe the numerical groundwater model for the New Acland Coal Mine Stage 3 Expansion project should not be interpreted as impermeable faults.</p>	We agree.	
9	<p><u>ISSUE:</u> After trialling different modelling strategies it was decided to use the Horizontal Flow Barrier Package of Modflow to model the hydrogeological effect of faults. Faults were incorporated on the basis of mapped structures (data provided by New Hope), and additional faults were added to help achieve model calibration.</p>	We agree that this is consistent with BB's explanation of the process.	
10	<p><u>ISSUE:</u> The low permeability faults which create sharp discontinuities in the hydraulic conductivity distribution were found to be necessary to produce a groundwater model that achieves an appropriate level of calibration and is consistent with the conceptualisation.</p>	We agree that this is consistent with BB's explanation of the process.	MC and AW find that the reporting is inadequate and the hydrogeological evidence is lacking to have necessarily have arrived at this conclusion, notwithstanding that we understand from BB that this was the approach taken.
11	<p><u>ISSUE:</u> There was no intention to design a faulting pattern to restrict the predicted impacts of mining. To the contrary, some faults were intentionally modelled as being semipermeable or leaky to avoid unwarranted restrictions on the predicted drawdown impacts of mining.</p>	We agree that it is difficult to definitely demonstrate the intention of fault modelling that was undertaken at the time of model development, due to a lack of adequate documentation.	BB supports the statement as written based on his involvement in the modelling at that time. Other experts were unable to find adequate reporting, aside from BB's affidavit, to prove or otherwise the statement as written.
12	<p><u>ISSUE:</u> Observed groundwater levels and other relevant data were used to initially calibrate the model in 2009 and again to re-calibrate it in 2013. The re-calibration of the model in 2013 used transient groundwater drawdown data obtained after mining had progressed to elevations below</p>	We agree that this is likely to represent the methodology that was adopted at the time, based on BB's affidavit.	

	the water table. These data supported the modifications that were made to the faults in the 2013 modelling.		
13	<p><u>ISSUE:</u> The faulting pattern that was used in 2013 is relevant to the 2014 groundwater model referred to in the AEIS because, apart from the horizontal flow barrier conditions being removed from the Marburg Sandstone model layer, Brian Barnett's understanding is that the hydrogeological characteristics of the fault in the 2014 AEIS model are the same as those included in the 2013 version of the model. This faulting pattern is illustrated in Figure 6 in the memorandum annexed as Annexure C to Brian Barnett's statement of evidence.</p>	We agree.	