

Further Joint Groundwater Experts Report

Land Court of Queensland

Registry: **Brisbane**

Numbers: **MRA428-14, EPA429-14, MRA430-14, EPA431-14, MRA432-14, EPA433-14, EPA446-14**

Applicant: ADANI MINING PTY LTD [Adani]
First Respondent: LAND SERVICES OF COAST AND COUNTRY INC. [LSCCI]
Second Respondent: CONSERVATION ACTION TRUST [CAT]
Third Respondent: JAH'SHUA MCAVOY
Statutory Party: CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION [DEHP]

Report date: 27 March 2015

Meeting: 24 March 2015 via telephone conference and subsequently by email correspondence.

Experts Present: John Webb ('**JW**'), Adrian Werner ('**AW**'), John Bradley ('**JB**'), Noel Merrick ('**NM**').

Our understanding of our responsibilities:

We understand that our responsibilities are as described in Order 4 of the Orders made on 20 March 2015 by President MacDonald:

4. *The Applicant's and First Respondents' nominated experts in the fields of geology/groundwater and groundwater modelling:*
 - (a) *Participate in a further joint experts' meeting to discuss the matters addressed by the supplementary statement of evidence referred to (at order 3 of the Orders); and,*
 - (b) *Prepare and provide to the parties a joint report in accordance with the Land Court Rules by no later than 4:00pm on 27 March 2015*

We also note the following provisions of the Uniform Civil Procedure Rules 1999 (Qld):

429B Court may direct experts to meet

- (1) The court may, at any stage of a proceeding, direct experts to meet and-
 - (a) identify the matters on which they agree; and
 - (b) identify the matters on which they disagree and the reasons why; and
 - (c) attempt to resolve any disagreement.
- (2) The court may, for the meeting-
 - (a) set the agenda; and
 - (b) specify the matters the experts must discuss; and
 - (c) direct whether or not legal representatives may be present; and
 - (d) give directions about the form of any report to be made to the court about the meeting; and

- (e) give any other directions the court considers appropriate.
- (3) Evidence of anything done or said, or an admission made, at the meeting is admissible at a trial of the proceeding only if all parties to the proceeding agree.
- (4) However, subrule (3) does not apply to a report made to the court about the meeting identifying the matters mentioned in subrule (1)(a) or (1)(b).

In addition, we note the following provisions of the Land Court Rules 2010 (Qld):

24A Experts attending meeting must prepare joint report

- (1) The experts attending a meeting of experts must, without further reference to or instruction from the parties, prepare a joint report in relation to the meeting.
- (2) However, the experts attending the meeting may, at any time before the joint report is completed, ask all parties to respond to an inquiry the experts make jointly of all parties.
- (3) Despite subrule (1), any of the experts may participate in a mediation involving the parties.
- (4) The joint report must-
 - (a) confirm that each expert understands the expert's duty to the court and has complied with the duty; and
 - (b) be given to the parties.

24C Duty of expert

- (1) A witness giving evidence in a proceeding as an expert has a duty to assist the court.
- (2) The duty overrides any obligation the witness may have to any party to the proceeding or to any person who is liable for the expert's fee or expenses.

Scope of Discussions:

We understand that the experts are to focus on matters raised in a report titled "Adani Mining Pty Ltd v Land Surfaces of Coast and Country Inc & Ors – Response to Expert Report of Dr John Webb". This document was prepared by John Bradley of JBT Consulting and was dated 17 March 2014. The report has been accepted into evidence by the Court, however the Court has also ordered that the experts meet to prepare a Further Joint Groundwater Expert Report that presents matters of agreement and disagreement in relation to the report.

The report presented a response to a number of assertions in the expert report of Dr Webb that relate to:

- (a) Interpretation of hydrochemistry data;
- (b) Groundwater flow direction;
- (c) The potential for the Rewan Formation to transmit water; and,
- (d) A number of observations relating to Dr Webb's geological interpretation

This joint report is limited to opinions on those matters.

Points of agreement:

In this matter we **agree** on the following:

Groundwater chemistry

1. JB and JW agree that the observed chemistry of the Doongmabulla Springs complex is more consistent with the chloride chemistry of groundwater in both the Clematis Sandstone and the Colinlea Sandstone than with the hydrochemistry of other groundwater units present in the area.

Seep/W groundwater model of JB and groundwater flow direction

2. We agree that the wording of the summary of JB's report of 17 March requires modification to clarify and correct a number of statements in paragraphs 20-24. In paragraph 22 JB states that the *"high groundwater pressures have been generated solely by the weight of water acting on an underlying, continuously porous medium... and that this pressure has been generated in the underlying Bandanna Formation/ Colinlea Sandstone simply by pressure transfer alone (i.e. the transfer of pressure through the Rewan Formation can occur without the transfer of water through that unit)."* In paragraphs 21 and 24 of JB's report it is stated that *"based on output from the model... the Colinlea Sandstone is not recharged in areas where the Rewan Formation overlies the Colinlea Sandstone"*.
3. The experts all agree that groundwater movement must occur through the Rewan Formation to some degree, with the rate of movement dictated by the hydraulic conductivity (predominantly the vertical hydraulic conductivity) of the Rewan Formation and the total head that acts on the system (refer paragraphs 12 to 16 for points of disagreement).
4. In Paragraph 20 (vii) of JB's report (with reference to Figure 3-6 of JB's report) JB makes reference to groundwater flow directions that may be inferred from this figure. The experts agree that this figure shows pressure head only, and that groundwater flow direction can only be inferred from the intersection of the pressure head contours with a single elevation, e.g. -400 m Australian Height Datum (AHD). However, Seep/W software makes this conversion internally in producing the flow vectors shown in Figure 3-3 of JB's report.
5. The statement in paragraph 23 that *"up-dip flow of groundwater can occur in areas where groundwater is moving from a region of high groundwater pressure to a region of low groundwater pressure"* should be *"up-dip flow of groundwater can occur in areas where groundwater is moving from a region of high groundwater **head** to a region of low groundwater **head**"*
6. We agree that there must be localised higher permeability flow paths feeding the high flow springs like Joshua Spring. Refer paragraphs 17 and 18 for areas of disagreement.
7. We agree that the Seep/W model produced by JB does not represent the real-world situation in the study area, but rather is intended to demonstrate general points relating to groundwater movement and pressure distribution.

Points of disagreement

In this matter we **disagree** on the following:

Hydrochemistry

8. JB's opinion, as expressed in his report of 17 March 2014 (Paragraph 11) is that the gathering of additional hydrochemical data would be unlikely to shine further light on the source aquifer to the Doongmabulla Springs complex.
9. JW is of the opinion that the collection of additional hydrochemical data could potentially be useful in providing information as to the source aquifer for the Doongmabulla Springs complex.
10. JW is of the opinion that the similarity in chloride chemistry between the Colinlea Sandstone and the Doongmabulla Spring complex makes the Colinlea Sandstone a viable source aquifer for the Doongmabulla Spring Complex

11. JB is of the opinion that the hydrochemistry data is too inconclusive to support this view.

Seep/W groundwater model of JB and groundwater flow direction

12. With respect to the movement of water through the Rewan Formation (with reference to paragraphs 2 and 3 above), JB and NM are of the opinion that the pressure of overlying water (leading to a transfer of pressure to underlying units) is the dominant mechanism leading to areas of higher hydraulic head in the Colinlea Sandstone (to the west of the mine area). This follows the results of the Seep/W model of JB's 17 March report. JB and NM are of the opinion that the volume of water transferred through the Rewan Formation from overlying aquifers to the groundwater units underlying the Rewan Formation will be minor due to the low permeability and overall thickness of the unit.
13. In contradiction to this, AW and JW believe that any groundwater mounding in the Colinlea Sandstone must be accompanied by significant inflows (either from lateral sources if any exist, or from leakage through the Rewan) that is high enough to support the Colinlea Sandstone flow rates and directions. If pressures in the overlying aquifers dominate the heads in the Colinlea Sandstone, then the overlying aquifers most likely also dominate the inflows to the Colinlea Sandstone (through the Rewan Formation). AW and JW believe that it is not possible for lateral inflows to dominate the Colinlea Sandstone flows if overlying aquifers dominate the Colinlea Sandstone hydraulic head distributions (i.e. by vertical transfer of heads through the Rewan).
14. Further, JB and NM are of the opinion that the observed groundwater flow in the underlying Bandanna/Colinlea aquifer could be provided by a lateral source. The Seep/W cross section model of JB is intended to demonstrate that it is possible to induce an increase in pressure in groundwater units that underlie the Rewan Formation for a case where the Rewan Formation has uniform low permeability and does not address the possibility of a groundwater source that is lateral to the model and which drives groundwater flow in the Bandanna/Colinlea aquifer.
15. JW is of the opinion that the rate of groundwater movement through the Rewan Formation must be significant in order to generate the observed groundwater flow in the Colinlea Sandstone. JW and AW are of the opinion that pressure transfer cannot occur through the Rewan Formation without there being sufficient leakage through the Rewan to accommodate groundwater flow in the underlying Bandanna/Colinlea aquifer that is not provided by a lateral source.
16. AW and JW are of the opinion that flow in the Bandanna-Colinlea aquifer is likely due to both lateral sources (e.g. recharge occurring to the south) and leakage through the Rewan Formation. JW notes that the northwards and eastwards hydraulic gradient in the Bandanna-Colinlea aquifer is approximately the same (from the figure in the previous joint experts' report), so if the permeability of this aquifer is approximately the same everywhere, the groundwater flow per unit cross-sectional area in the aquifer is approximately the same northwards and eastwards. Thus the groundwater flow per unit cross-sectional area in the aquifer due to recharge through the Rewan Formation along the groundwater divide is equivalent to that derived from recharge to the south.
17. JW is of the opinion that the higher permeability pathway that feeds the Joshua Spring is most likely a fault that allows transfer of water from the underlying Colinlea Sandstone aquifer, through the Rewan Formation to surface.
18. JB is of the opinion that the source aquifer for the Doongmabulla Spring Complex is located above the Rewan Formation and that the higher permeability pathway that feeds the Joshua Spring may be a localised zone of weakness in the strata, but does not necessarily need to be a fault or fracture.

Provision of additional information

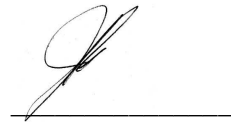
Dr Webb's geological interpretation

19. In order to overcome problems with assessing JW's geological interpretation due to the small size of the figures in his report and difficulty in georeferencing these figures, JW supplied all relevant GIS data layers (tiff and shape files) to JB, NM and AW.

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.

Signed:



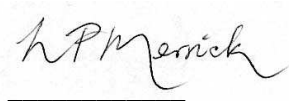
John Webb



John Bradley



Adrian Werner



Noel Merrick

27 March 2015