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Dear Stephen

Peer Review of Site Water Use Aspects of Boggabri Coal MOD5 Project

Boggabri Coal Operations Pty Ltd (BCOPL) has submitted an Environmental Assessment (EA) in support of an application to modify its existing consent to include additional activities and ancillary infrastructure for ongoing operations at the Boggabri Coal Mine. A key element of the application is to source additional water supply from a borefield containing seven bores located west of the Boggabri Mine, within alluvium on the floodplain of the Namoi River.

The EA indicates that borefield water is required to supplement the available supply from surface water collected on site and groundwater. The demand from the borefield is anticipated to be about 5.7 ML/day (2,080 ML/year) under median rainfall conditions. In the event of extended dry conditions demand from the borefield may possibly be up to 9.4 ML/day (3,430 ML/year).

The mine currently holds a total of 848 unit shares of groundwater entitlements together with 294 unit shares of general security surface water entitlements and 32.1 unit shares of supplementary water access licenses from the Namoi River.

This letter provides my assessment of matters relating to the existing and proposed water use at the Boggabri Mine and the implications for additional supplementary supply from external water sources.

In order to proceed with the proposed borefield, Boggabri Coal will need to acquire additional groundwater unit shares. The licencing and management of groundwater under the relevant Water Sharing Plan are matters for the DPI Water and will dictate the actual volume of water available. Accordingly, matters relating to the availability of water from outside the mine site are outside the scope of this review.

In order to prepare this letter report I have briefly reviewed relevant sections of:

- *Boggabri Coal Mine - Project Approval Modification Environmental Assessment (MOD 5)* (PB, November 2015),
- *Site Water Balance* (Boggabri Coal, June 2015) (Appendix A to the EA).

I have particularly taken note of the matters raised in letters from Boggabri Coal (dated 29 April 2016 and 8 July 2016) in response to a request from the Department of Planning and Environment for supplementary information.

1. Background Information

Tables 3.2 and 3.3 of the EA summarise the elements of the site water balance and the water requirements under wet, normal and dry conditions. In essence, these tables indicate that median water demands for 2017 mine conditions, including evaporation losses, would total 3,377 ML/year of which 2,082 (62%) would be met from 'imported' water. In 90th percentile (dry) conditions the requirement for imported water would rise to 2,647 ML/year (78% of the assessed water demand for mine operations. I note that the stated requirement for 3,430 ML/year from the borefield in extended dry conditions (4 years with less than 10th percentile rainfall) would represent a situation in which there was no supply from on-site sources and would provide about 140 ML in excess of the site demands (assuming no evaporation from on-site dams).

The stated water requirements for site operations (Table 3.2 of the EA) are:

- Dust suppression – haul roads 1,461 ML/year (4 ML/day);
- CHPP 1,461 ML/year (4 ML/day);
- MIA and potable water 365 ML/year (1 ML/day).

The fact that the annual water requirements can be expressed in simple whole numbers per day, suggests that water requirements are 'ball-park' estimates rather than values derived from operational monitoring.

Subsequent responses by Boggabri Coal to requests for supplementary information from the Department of Planning and Environment have sought to justify the dust suppression and CHPP water use numbers. These are the subject of the comments below.

2. Haul Road Dust Suppression

The water requirements for dust suppression on haul roads are a function of:

- the area of haul roads and other areas requiring water application for dust suppression (length and width);
- the particle size of the material on the running surface (fine silt can be expected to generate more dust);
- the moisture content of the running surface which is governed by weather conditions (rainfall, evaporation and wind at any particular time);
- the number of vehicle movements and the speed of the vehicles.

The particle size in the running surface is largely a function of the on-site material. The length of haul road at any one time is a function of mine layout, but is capable of some control by limiting the number of active coal extraction and overburden dumping locations at any one time.

Table 1 below is a copy of the data in Table A in the response by Boggabri Coal dated 29 April, while Table 2 shows the average daily water application calculated from Table 1 and from other sources of information. For purposes of deriving the water application rate for Boggabri, I have assumed an active haul road width of 30 m. This figure has been derived by examination of an image of the site from Google Earth dated 8 February 2016. Although the total width of the haul road is about 36 m in some locations, the width watered by the water-cart in one pass is

only about 12 m. On the basis of these observations I have assumed an effective haul road working width of 30 m. This assumption probably over-estimates the area actually watered and, consequently reduces the calculated water application rate in Table 2.

Table 1: Boggabri Mine Haul Road Dust Suppression Demand

Year	Haul Road Length (km)	Water Used (ML)
2013	12.8	699
2014	13.9	1,016
2015	19.1	1,176
2016 (estimate)	23.1	1,461

Source: *Table A - letter from Boggabri Coal (19/4/2016)*

Table 2: Water Application Rate for Haul Road Dust Suppression

Location	Year/Source	Water Application (mm/day)
Boggabri[1]	2013	5.0
Boggabri	2014	6.7
Boggabri	2015	5.6
Boggabri	2016 (estimate)	5.8
Watermark EA	ACARP – Hunter Valley	4.0
Maules Creek EA	ACARP – Hunter Valley?	3.8
Other	Confidential	4.7

Note: *1. Assumes effective watering width of 30 m (max road width 36 m)*

On the basis of data that I am aware of, I consider an average water application of about 4.5 mm/day would be required to achieve the 80% dust control required by the EPA. Actual application rate would vary with the seasons with an application of 1.5 times the average in the peak of summer and about 0.4 of the average in mid-winter.

Opinions

1. On the basis of the data in Tables 1 and 2, and assuming a watered haul road width of 30 m, I consider the average application derived from the data provided by the mine is about 25% more than used elsewhere. If the actual width of watering is nearer to 25 m (as appears from the Google Earth image), the water usage by the mine appears to be about 50% more than used elsewhere.

2. I note that the letter of 29 July 2016 seems to argue that the use of ultra-class trucks will lead to increased generation of dust and, therefore, will require more water for dust suppression. I do not understand the logic behind this. My understanding is that dust generation is a function of the number of vehicle movements and vehicle speed.

Accordingly, assuming the same vehicle speed, the use of larger trucks would reduce the required number of vehicle movements and the dust generation.

3. Haul Road Length

The information regarding the haul road length presented in various documents appears inconsistent. For example different haul road lengths for coal cartage are quoted as follows:

- 9.8 km (Table 1 of the letter dated 8 July);
- 7.5 km (Table 2 of the letter dated 8 July)
- 23.1 km (Table 4.1 in Appendix A of the letter dated 8 July);

Which is correct?

I also note that the letter dated 8 July 2016 (page 2) makes reference to a total 'in use' road network as at 24 May 2016 totalling 33.7 km. No explanation is provided for the disparity between this value and the value of 23.1 km quoted above.

Realistic estimates of the length of haul road in use at any point in time are fundamental to estimating the operational water requirements.

4. Stockpile Dust Suppression

Table C in Appendix A of the letter of 29 April lists the annual demand for water for dust suppression on the product stockpile as being 125 ML/year. Appendix D of the same letter shows a requirement of 131 ML/year for processing 2 Mtpa. In contrast, Table 4 of the letter of 8 July specifies a usage of 15 m^3/hour for 15% of 'annual hours'. Assuming 'annual hours' to be 8322 hours as quoted in the same table for the operation of the CHPP, the annual volume required for this aspect of dust suppression would be 18.7 ML not 125 or 131 ML.

Which is correct?

5. CHPP Water Requirements

The water requirements for various aspects of the CHPP operations are presented as ML/year in Appendix C to the letter of 29 April and as m^3/hour in Appendix C to that letter. Table 4 of the letter of 8 July quotes the same hourly flow rates as Appendix C, but also includes a specified number of hours. Although presented in different formats, both tables indicate that the CHPP is expected to require the same annual volume for each process except product stockpile dust suppression. The annual total is quoted as 1,461 ML (which, as noted before, converts to a neat round 4 ML/day!). This suggests that the water usage for various operations have been back calculated from a notional 4 ML/day.

These data appear to derive from the Project Definition Statement for the new CHPP by Thiess Sedgman (extracts in Appendix B to the letter of 29 April). In relation to the water requirements for the new CHPP the Thiess Sedgman report notes that:

> *"There are a number of operating and environmental factors that will affect the actual requirements throughout operation. These include:*
>
> - *Climate conditions;*

- *Sizing distribution of feed;*
- *CPP yields."*

Unfortunately the annual tonnage to be processed is not stated. However, the operational forecasts in Table E of Appendix A to the letter of 29 April indicate the expected ROM of the order of 7.7 Mtpa. This throughput for a water use of 1,461 ML/year is equivalent to 190 L/t ROM. This contrasts with 362 L/tonne of processed coal quoted in the last dot point on page 1 of the letter of 29 April. Even allowing product yield of about 85% of ROM (as per Table E of Appendix A to the letter of 29 April), 362 L/t would convert to about 310 L/t ROM. Comparable data quoted by other sources are:

- Maules Creek 200 L/t ROM;
- Watermark 76 L/t ROM.

Opinion

Both the quoted CHPP water usage for Maules Creek (200 L/t ROM) and the calculated 190 L/t Rom for Boggabri are theoretical 'design' values. The actual water usage for the CHPP at Boggabri will only be determined by operational monitoring.

6. Provision for Drought Conditions

For purposes of the groundwater assessment a 'worst case' assessment of the external supply to maintain operations has been assumed to be 9.4 ML/day (3,431 ML/year). This value has been justified on the basis that, during 4 year period with rainfall less than the 10th percentile, there would be no on-site sources of surface or groundwater.

I consider this assessment to be unrealistically high because of other measures to minimise water usage that would be taken in the event of drought conditions, such as the use of chemical dust suppressants to minimise water use. I note that the letter of 29 April (bottom of page 2) states that:

> *"Whilst dust suppressing agents are utilised by Boggabri Coal, no water demand reduction has been incorporated. Numerous trials of application of dust suppressing agents undertaken by Boggabri Coal have not resulted in consistent enough water usage reductions to be considered reliable for inclusion in water efficiency demand calculations. "*

This observation is not consistent with experience at other mines.

7. Conclusions and Recommendations

CHPP water usage of 190 L/t ROM appears to be at the upper end of water required for facilities that use belt press filters. There are likely to be water efficiencies available.

The claimed water demand for dust suppression appears to be highly speculative and to be between 25% and 50% above benchmark rates (depending on the actual width of haul road to be watered).

I recommend that Boggabri Coal be encouraged to improve water management and water use efficiency on site (consistent with maintaining obligations for managing dust).

My suggestions are that the mine be required to:

- Install meters for all major water flows including:
  - Water transfers from sediment dams and mine pits into mine water storages;
  - All water-cart fill points;
  - All elements of the anticipated water demands for various purposes associated with the CHPP (as identified in Table 4 of the letter dated 8 July);
  - All water 'imports' including any bore water obtained on site.
- Install water level meters on all significant water storages as a check on inflows and outflows and a means of assessing evaporation and seepage losses. This data will also provide a basis for improving estimates of the runoff from the different surface types (hardstand, mine pit, 'raw' overburden, etc.).
- Collect moisture content data for all coal flows associated the CHPP to permit full water balance accounting.
- Record all flow meters and water levels at least weekly (preferably by means of continuous recording) and analyse the data on a monthly basis to develop a full accounting of all water sources and losses.
- Compare monitored gains from rainfall and losses by evaporation from water storages to the rainfall and evaporation data from the weather station.
- Update the site water balance annually based on monitored data and provide details in the annual report to the Department.

Yours sincerely,

Stephen Perrens
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