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Correspondence with NSW EPA on Noise and Air Quality

BYLONG COAL PROJECT
Response to PAC Review Report

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

17 January 2018

Senior Regional Operations Officer – Central West
South & West Branch
NSW Environment Protection Authority
Bathurst NSW 2795

Attention: Ms Sheridan Ledger

Bylong Coal Project EIS
Meeting with EPA to Discuss PAC Review Report

1. INTRODUCTION

Thank you for taking the time to meet with us on Thursday, 26 October 2017 at your Bathurst Offices to discuss the relevant findings of the Bylong Coal Project (the Project) PAC Review Report (Review Report).

As discussed, we were very surprised that the Review Report suggested that the Project team had not satisfactorily resolved all relevant matters with the EPA as it was our understanding that all matters brought to our attention through the Planning and Approvals process had been satisfactorily resolved.

From our meeting, it became clear that our last piece of correspondence in relation to EPA related matters dated 27 October 2016 had not been passed on from DP&E and discussed with your office. This is attached for your reference as **Appendix A**.

2. PAC MATTERS RAISED RELEVANT TO EPA

The PAC raised three matters relating to the EPA in its Review Report. Although previously discussed in our correspondence attached each is further addressed below:

1. *The proposed water management strategy involves a nil discharge mine*

In light of the PAC's uncertainty around the potential for mine water discharges the proponent has commissioned further water balance sensitivity analyses. These sensitivity studies have confirmed that, in light of the high water demands and lower groundwater inflows to the open cut mining area, throughout the life of the open cut, any excess mine water will be securely managed within the mining areas.

Further, the mining of the 100 series longwall panels (i.e. until Project Year 20) can comfortably be undertaken whilst managing excess mine water onsite for all scenarios modelled. It is only following the commencement of mining the 200 series longwall panels in Project Year 19 when groundwater inflows are predicted to substantially increase, and then under the worst case 'very unlikely' groundwater scenario modelled, that inflows would potentially exceed available capacity within the Eastern Void in the absence of additional contingency measures.

In this regard, there is a considerable amount of time to gather data during the operation of the first 18 years of the mine to doubly confirm that this will not happen. This data will assist in refining and validating the model with operational data to provide a better indication of the water balance at the time and to appropriately plan for, develop and implement any contingency measures that may be required.

In the event of the 'very unlikely' groundwater scenario occurring, the following contingency measures could be adopted to ensure the site remains a nil discharged site:

1. Firstly, the sealing of the gate roads between the 100 series and the 200 series longwall panels would create an enormous vessel more than capable of storing this excess water;
2. The precise capacity of the Eastern void will be determined by the final years of open cut mining (i.e. Project Year 7 to Project Year 10). The performance of the water management system throughout the initial open cut operations, also factoring in consideration of the water monitoring data, means the groundwater model and the water balance will be able to be refined and validated to improve the predictions for the excess mine water requiring storage. This updated modelling will assist short term mine planning to determine whether the mining operations plan requires modification to retain a larger void at the completion of open cut mining operations. This would potentially entail the development of surcharged or mounded areas on the Eastern overburden emplacement area to assist in providing additional capacity for the reject materials and excess mine water. Under this scenario, KEPCO would still be committed to developing a final landform with no final void in the landscape, as is currently proposed.
3. Further contingency measures that could be considered prior to commencing mining of the 200 series longwall panels may include adjustments to the proposed mine plan, such as:
    a. Adjustments to longwall mining areas to minimise potential groundwater inflows;
    b. Modifications to the sequencing and timing of mining the 200 series longwall panels;
    c. Reorientation of the 200 series longwall panels; or
    d. Sealing additional longwall panels within the 200 series to retain further underground capacity.

The water balance studies to date have confirmed that in all but the 'very unlikely' groundwater scenario, the mine has more than ample capacity to store all mine water on the site in a combination of dirty water storage dams, open cut mined out areas and mined out underground goafed areas. The attached report from WRM (**Appendix B**) confirms that there is high level of confidence that the mine water management system will be able to be managed over the life of the Project to prevent the discharge of mine water from the site. Further, with the contingency measures available, even under worst case modelled scenarios there is unlikely to be a requirement for a licence to discharge mine water under the *Protection of the Environment Operations Act 1997*.

2. *Mitigation measures could be reasonably deployed to minimise diesel emissions.*

The primary source of diesel emissions at the mine will result from the heavy mobile equipment relied upon during the relatively short eight-year open cut mining operation. Due to the open cut mining operation being of such a short duration, it would be impractical to do anything but rely upon contract mining equipment to undertake these works.

The open cut mining area is remote from highly populated areas with the nearest private receiver being located more than 2 km away. Further, there are no other intensive land use activities generating diesel particulates in proximity that could result in an accumulation of such particulates.

Our investigations have confirmed that there is only 9% of industrial diesel engines in Australia that comply with the Tier 4 US-EPA standards for reduced diesel emissions.

In light of the remoteness of the mine site and the lack of concentration of mining in the area, it would seem unproductive to require this particular project to draw away from other more potentially sensitive locations those few machines that do meet a higher than currently regulated emissions criterion.

KEPCO will require its relatively short-term contract open cut mining fleet to meet all NSW and Federal Government contemporary standards for diesel emission particulates.

It is understood from our discussions with your air quality expert at our meeting that the EPA is comfortable with our approach to ensuring that any equipment either contracted or purchased to work at the mine site will comply with all contemporary NSW and Federal emissions standards at the time.

3. *Suitability of background data used in the air quality model*

The EPA in its last correspondence over the Project dated 17 August 2016 has not questioned the calibre of the air quality modelling over the Project. Nor has the independent peer reviewer raised this as an issue.

We note that extensive consultation has occurred with the EPA dating back to 28 April 2015 over the suitability of background meteorological and air quality monitoring data.

In correspondence from the EPA dated 6 November 2015, your team concluded that the background data relied upon '*was likely to represent usual conditions*'. Of course, additional monitoring data is now at hand which confirms your earlier conclusions.

4. Incomplete analysis of low frequency noise spectrum

An analysis of the low frequency noise spectrum in accordance with the '*UK Department of Environment, Food and Rural Affairs'* method of assessment was conducted over the Project and reported on in our correspondence to DP&E dated 27 October 2016, which is attached in **Appendix A**.

In our discussions you reiterated the requirement to apply a correction factor for low frequency noise in accordance with the EPA's '*Industrial Noise Policy 2000'*. This was done and is reflected in Appendix 5 of the '*DP&E Assessment Report March 2017'*.

However, since our meeting, the EPA has released the long-awaited revision of the Industrial Noise Policy now entitled the '*Noise Policy for Industry October 2017'.* Our acoustic experts have reviewed this updated policy and can confirm that the Project fully complies with the requirements of this policy at all private receivers. As such, any deliberations over the appropriate correction factors for low frequency noise from the Project should now be fully resolved.

5. Noise & air quality impacts approach the limits of acceptability for receivers

The Project's noise and air quality impacts have been determined with certainty and have been confirmed by independent peer review to conservatively comply with all relevant Government guidelines. Further to this, KEPCO is in ongoing discussions with the Project's next closest receiver in relation to KEPCO's potential acquisition of this property, if the Project is approved. Importantly, the Project complies with the '*Voluntary Land Acquisition and Mitigation Policy December 2014'.*

3. OTHER MATTERS DISCUSSED

At the conclusion of our meeting, another matter was raised in relation to the Project which had not been raised by the PAC. This concerned the criterion to be used in the design of sedimentation dams which will be required to capture and treat all rainfall runoff collected from disturbed areas associated with the Project. It has been our intention to design such dams consistent with current design guidelines ('*Managing Urban Stormwater, Soil and Construction, Volume 2E Mines and Quarries*' (DECC, 2008)). As you are aware, the guideline specifies a settling zone volume based on 90th percentile 5 day rainfall for standard receiving environments and 95th percentile for a "sensitive" receiving environment. A "sensitive" receiving environment is defined as one that has a high conservation value, or supports human uses of water that are particularly sensitive to degraded water quality.

During the meeting, it was requested that we take a more conservative approach and design sediment basins to have a settling zone volume based on the 95th percentile 5-day rainfall duration.

In recognition of the fact that now two other mining operations within the Central West Region have been required to apply the more stringent 95th percentile 5-day rainfall duration design criterion, KEPCO has agreed to apply this criterion to the design of their sediment basins as an illustration of wanting to apply all reasonable and feasible best practice design criterion to the Project.

The surface water consultants have confirmed that the performance of the mine water management system will not be heavily influenced by an increase in the rainfall design standard for sediment dams. During the years of active open cut operations, average sediment dam overflow volumes are estimated to be up to 43 ML per year, which represents about 2 to 3% of the system inflows and outflows per year. Increasing the sediment dam design standard will reduce the volume of these overflows, with this water retained within the water management system. This will not a have a significant impact on the performance of the site water management system, which has available water storage capacity very much larger than the volume of water required to be retained on the site.

4. CONCLUSION

We are hopeful that we have now resolved any residual issues that you may have had over the Project and respectfully seek confirmation that it is your view that this is the case.

Should you require anything further in relation to this letter, please contact me on (02) 6575 2000.

Yours faithfully
HANSEN BAILEY

James Bailey
Director

Cc: Mr Stephen O'Donoghue – NSW Department of Planning & Environment

APPENDIX A

Letter dated 27 October 2016 to DP&E

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

27 October 2016

Team Leader
Planning Assessment
22-33 Bridge Street
SYDNEY NSW 2000

Attention: Mr Stephen O'Donoghue

Dear Steve,

Bylong Coal Project EIS
Response to NSW EPA Submission, Dated 17 August 2016

1. INTRODUCTION

The '*Bylong Coal Project Environmental Impact Statement*' (EIS) which supported the State Significant Development Application (SSD) 14_6367 for the Bylong Coal Project (the Project) was placed on public exhibition between 23 September and 6 November 2015.

Hansen Bailey prepared the document '*Bylong Coal Project Response to Submissions*' (RTS) dated 23 March 2016 to address comments received from agencies and other stakeholders during the exhibition of the EIS. The RTS included responses to the NSW Environment Protection Authority (EPA) submission dated 6 November 2015 which was generally associated with air quality, noise, surface water and waste related matters.

A further submission was received from the EPA dated 9 May 2016 making comment on the information presented within the RTS. KEPCO prepared a response to this submission dated 28 June 2016 for the Department of Planning and Environment's (DP&E) consideration. This response was provided as Appendix G of the Supplementary RTS report.

A further submission has been provided by DP&E from the EPA dated 17 August 2016 outlining residual matters within KEPCO's letter dated 28 June 2016. This letter has been prepared in response to the issues raised in EPA's letter for DP&Es consideration.

2. RESPONSE TO NSW EPA SUBMISSION

2.1 AIR QUALITY – DIESEL EMISSIONS

Issue 1 – Impacts of Diesel Emissions on $PM_{2.5}$

The modelling approach is generally adequate, however modelled emissions have not been adequately justified. The assumed emission rate has not been justified on the basis of benchmarking all reasonable and feasible emission controls and management practices for diesel particles and oxides of nitrogen.

Additionally, the assumptions underpinning the assumed emission rate have not been provided, including but not limited to composition of the proposed non-road diesel fleet, mine design and staging, activity rates, fuel consumption, engine capacity, load and emissions performance.

Based on the above, it is not clear that the emission estimates are an accurate representation of proposed operational practice. Further information is needed to establish equipment performance, emissions, and utilisation.

Response

It should be noted that the information which EPA is seeking in relation to diesel particulate emissions was not initially required within the EPA's requirements which were in support of the Secretary's Environmental Assessment Requirements (SEARs) for the Project. Further the information which is now requested within EPA's correspondence dated 17 August 2016 was not specifically identified within the submission following the EIS exhibition or the submission received from the EPA dated 9 May 2016 on the RTS documentation.

Section 2.1 of Appendix G of the Supplementary RTS provides the relevant additional assessment of Particulate Matter (PM) less than 2.5 microns ($PM_{2.5}$) emissions to address EPA's concerns in its correspondence dated 9 May 2016. This additional assessment was completed to address EPAs concerns despite the technical specialists reservations that the US EPA AP-42 emissions factor for coal mine emissions inventories already included PM emissions from both mechanical, processed and diesel extracts. Section 2.1 of Appendix G of the Supplementary RTS refers back to the assumptions and information contained within the EIS and the supporting Air Quality and Greenhouse Gas Impact Assessment (AQGHGIA) (Appendix O of the EIS).

Section 3.4.1 of the EIS outlines the indicative equipment fleet (subject to supply by a mining contractor to be engaged in the future) for open cut and underground mining operations at peak production. As outlined in Section 2.1 of Appendix G of the Supplementary RTS, $PM_{2.5}$ emissions were calculated based on the diesel usage from all mining equipment in Year 3, Year 5 and Year 9 as presented in Table C.1 of the AQGHGIA (Appendix O of the EIS) and utilising the US-EPA Tier 2 $PM_{2.5}$ emission standard of 0.66 kg/L.

Environ (2010) reports that approximately 70% of industrial diesel engines in Australia (as of 2008) were compliant with Tier 2 or higher. Only 9% were compliant with the more stringent US-EPA Tier 4 standards.

Therefore, Tier 2 emission standards were used to derive the estimated emission rates for a future mining operation. This is considered to be a reasonable and conservative approach. That is, should equipment with a higher standard of emission control (i.e. Tier 3 or Tier 4 equipment) be utilised for the Project, this would result in reduced emissions to those modelled for inclusion within the Supplementary RTS.

The diesel usages presented within the AQGHGIA for all mining equipment were derived by experienced mining engineers and supported by evidence based feedback from prospective suppliers during the detailed mining planning analysis undertaken as part of the Feasibility Study for the Project.

The approach to Diesel Emissions PM controls for Project related equipment is discussed in Issue 2 below.

Issue 2 - Approaches to Minimising Diesel PM Emissions

> *Diesel exhaust is classified as a human carcinogen and health evidence indicates no safe level for exposure to fine particulate matter. The EPA is therefore seeking best practice measures for minimising emissions from diesel engines consistent with the objects of Protection of the Environment Operations Act 1997, particularly sections 3 (d) (ii) and 3 (d) (iv).*

Response

As previously noted within the RTS and Supplementary RTS document, the Project is located within an area which is relatively remote from heavily populated residential areas. The additional modelling undertaken for the Supplementary RTS in response to EPAs comments demonstrates that the predicted $PM_{2.5}$ concentrations for Year 3, Year 5 and Year 9 worst case modelling scenarios do not exceed the 24-hour average $PM_{2.5}$ maximum standard (25 µg/m^3) at any neighbouring private receiver, even when the contribution from diesel (utilising the US EPA Tier 2 emissions standard) and existing background concentrations are included. There are also no sensitive receptor locations predicted to experience annual average $PM_{2.5}$ levels above the 8 µg/m^3 standard even when the contribution from diesel and existing background concentrations are included. The EIS also confirmed that the nitrogen dioxide (NO_2) emissions from diesel powered equipment would remain well below the relevant criteria at the nearest private receivers. KEPCO's acquisition of the closest neighbour (i.e. receiver IDs 68 and 69) in June 2016 provides a further buffer from the predicted diesel emissions from the Project for neighbouring receivers.

The Project's open cut activities are proposed to be undertaken over an approximate eight year period before progressing to the longer term underground mining operations. This open cut component represents only a small proportion within the 23 operation years of the Project. The open cut activities are also proposed by be undertaken by contractor whom will be required to utilise equipment which complies with the previously committed noise suppression and attenuation. It has been confirmed that the required noise attenuation will be able to be retrofitted to existing conventional mining equipment currently held by mining contractors.

As explained within the Supplementary RTS response, these factors influence the feasibility of implementing further controls to the equipment fleet beyond the current commitment to utilise US EPA Tier 2 compliant equipment.

KEPCO acknowledges the EPA's efforts towards reducing particulate matter from non-road vehicles diesel exhaust emissions, with a strong focus on the NSW mining industry. This focus is represented within EPA's *NSW Coal Mining Benchmark Study Best Practice Measures for Reducing Non-Road Diesel Exhaust Emissions* (EPA, 2015) (the Benchmarking Study) which was finalised in December 2015. However, this initiative is more relevant to areas within NSW where either there is already an elevated background $PM_{2.5}$ concentrations or where there is a concentration of mining operations adjacent to private residential areas. Neither of which is the case for the Project.

KEPCO is committed to only engaging mining contractors with NSW compliant mining equipment. The primary concern of KEPCO is that if it is singled out and required to nominate the use of Tier 4 equipment at its mine site, suppliers may:

1. Not be able to readily supply it as at present such equipment is not readily available in Australia; and

   (It is understood from our inquiries that the Original Equipment Manufacturers (OEMs) (for example Hitachi and Caterpillar) have been working towards making equipment with improved technologies available. However there is no firm guarantees from the OEMs in relation to the timing that this equipment may be readily available within NSW.)

2. If indeed it is available, it may be cost prohibitive and as such impact on the competitiveness of the Project with other competing coal mines in NSW.

   (The Project team has further investigated the application of additional reasonable and feasible controls to its equipment fleet beyond the US EPA Tier 2 standard, which has been assumed within the Feasibility Study for the Project and was applied to the modelling undertaken within the EIS and Supplementary RTS. This analysis utilised the cost formulas provided within the Benchmarking Study for the Project fleet. It is noted that the Benchmarking Study cost formulas is based on costings from United States case studies and would be on the assumption of a readily available supply and usage of Tier 4 mining equipment for the Australian coal mining industry (i.e. available supply meets required demand). In light of this being the case, KEPCO is hesitant upon relying wholly upon the Benchmarking Study cost formulas.

   The analysis confirmed that under the scenario where new US EPA Tier 4 equipment was acquired for the Project (if new equipment were indeed available and was purchased by the mining contractor), the fleet capital costs would be greater when compared to a scenario of the contractor purchasing new US EPA Tier 2 equipment.

Should the mining contractor propose to utilise existing equipment which is currently owns and operates (which is a likely scenario), the retrofit of diesel particulate control (DPC) accessories, is likely to come at increased capital, operating and maintenance costs.

The OEMs have indicated that in light of the Project likely to be a contractor operated open cut mine, for the contractors to be cost competitive, they will be required to re-deploy existing equipment from other states or escalate pricing to accommodate new equipment purchases. Whilst the aftermarket fit out of existing mining equipment is an option, this option is largely untested technically and due to the potential incompatibilities with other technology (for example noise suppression) this will unlikely be able to provide guarantees and cost assurances for life cycle costings).

In light of KEPCO's concerns, DP&E indicated during the meeting on 13 September 2016 that a condition of consent could be drafted to ensure that reasonable and feasible controls for diesel emissions are implemented during the commissioning of the equipment fleet for the Project. In this regard, KEPCO can only be accepting of a condition of consent as follows:

> "*The Applicant shall ensure the open cut mining fleet (i.e. trucks, water carts and excavators) for the Project has diesel engine emission control technology that meets or surpasses contemporary NSW regulatory requirements.*"

Whilst the implementation of mining equipment which complies with US EPA Tier 4 standards may be possible at some time in the future, KEPCO cannot guarantee that the Project will be in a position to require its utilisation in the early stages of the open cut mine life.

Accordingly, KEPCO is committed to ensuring by way of contractual obligations that any equipment utilised during open cut operations at the mine site meets both NSW and national standards.

2.2 NOISE

Issue 1 - Third-octave band assessment

The revised assessment did not identify any receivers as affected by low frequency noise. However, the assessment has limitations, as it:

- *does not cover the whole frequency range of the criteria (it is limited in range)*
- *is based on octave band levels rather than third-octave bands (it is low resolution).*

This means that there is a risk that low frequency noise impacts at some receivers may exceed criteria, even though the assessment did not identify them as affected by low frequency noise.

It is preferable for low frequency noise to be assessed in every third-octave band threshold level, rather than the two octave band levels provided. This would allow low frequency noise impacts to be identified earlier and dealt with in design of the Project. However, OPE may consider requiring a validation report be prepared by KEPCO post commencement of operations to assess LFN in every third-octave band and to determine whether a LFN correction is required to be applied.

Response

Noted.

Issue 2 - DEFRA –based criteria and corrections to measures noise levels

Any project approval, if issued, should adopt the noise levels predicted by KEPCO as limits, and require that a correction be applied to any measured noise level, before comparison to limits, where the Lceq – Laeq exceeds 15 dB and:

- *where any of the 1/3 octave noise levels in Table A are exceeded by up to 5dB, a 2 dBA positive adjustment to measured A weighted levels applies in the evening and night periods.*
- *where any of the 1/3 octave noise levels in Table A are exceeded by more than 5dB, a 5 dBA positive adjustment to measured A weighted levels applies for the evening and night periods, and a 2 dBA positive adjustment applies for the daytime period.*

Table A: One-third octave low frequency noise thresholds

Centre frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
One-third octave Lzeq (15min) threshold level (dB)	92	89	86	77	69	61	54	50	50	48	48	46	44

Response

Noted.

3. CONCLUSION

KEPCO is supportive of the EPA's intention for the industry to meet or exceed new and improved diesel emission standards. However, KEPCO remains hesitant on making a commitment to commission equipment of a particular standard given the uncertainty surrounding the availability of the supply of this technologically improved equipment.

KEPCO has completed further analysis of additional reasonable and feasible diesel emission particulate control technologies for the Project's open cut equipment fleet beyond the commitment to meet US EPA Tier 2 standards. KEPCO is committed to ensuring by way of contractual obligations that any equipment utilised at the mine site meets both NSW and national standards. A suggested draft condition of consent has therefore been included within this letter.

KEPCO is accepting of the EPAs comments in relation to the treatment of low frequency noise from the Project.

We trust this response addresses the issues raised in the latest NSW EPA correspondence and that DP&E is able to appropriately condition the diesel emission controls required for the open cut equipment fleet for the Project.

Should you have any queries in relation to this letter, please contact us on 6575 2000.

Yours faithfully

HANSEN BAILEY

Nathan Cooper
Principal

James Bailey
Director

APPENDIX B

WRM Report

0887-07-B5

Nathan Cooper
Hansen Bailey
Singleton NSW
Via email: ncooper@hansenbailey.com.au

12 January 2018

Subject: Bylong Coal Project - Response to PAC report

Dear Nathan,

Please find below our response to the various surface water concerns for the Bylong Coal Project (the Project) which have been raised in the Planning Assessment Commission (PAC) Review Report (SSD 6367, 25 July 2017). This response should be read in conjunction with the EIS Surface Water Impact Assessment (WRM 2015a), the surface water sections of the Response to Submissions (RTS) (Hansen Bailey 2016a) and the surface water matters provided within the Supplementary Response to Submissions (Supplementary RTS) (Hansen Bailey 2016b).

1 OVERVIEW

The key surface water matters raised in the PAC Review Report relate to:

- the risk that mine water on the site will exceed the available storage capacities, resulting in the need for controlled or uncontrolled water releases from the mine water system; and
- potential impacts of mine water releases (notwithstanding that releases of mine water are not proposed) on the flow volumes and salinity in the Goulburn River.

These issues are addressed below.

2 ON-SITE WATER CONTAINMENT

The water balance modelling completed for the EIS included an assessment of the storage required within the site water management system to prevent spills (or the need for releases) of mine water as a result of the Project. The water balance assessment was subsequently revised with different assumptions about groundwater inflows for the Supplementary RTS (WRM 2016).

Figure 1 shows an updated plot of the likely range of potential water storage volumes required in the open cut mining area to prevent spills from the mine water system, depending on climatic conditions. The results shown in Figure 1 are based on the revised groundwater inflows shown in Table 1, with inflows varied from year to year, rather than averaged across mine stages as assumed in the assessments from the EIS and the Supplementary RTS.

Level 9, 135 Wickham Terrace, Spring Hill
PO Box 10703, Brisbane Adelaide St Qld 4000

Tel 07 3225 0200
wrmwater.com.au

ABN 96 107 404 544

Figure 1 also shows the total water storage capacity of the open cut pits (mostly provided by East Pit), as well as indicative storage in the underground goaf (attributed to the 100 series longwall panels) which will be available from the latest PY 18. The reduction in water storage capacity over time from Year 11 is due to the placement of coal reject material within the open cut void such that at the end of underground mining it can be capped and rehabilitated. This will enable the entire open cut mining area being rehabilitated to a free draining landform and unlike most open cut mines will not comprise a final void.

Figure 1 shows that over most of the Project life, the available storage capacity within the open cut pits is significantly higher than the 1st percentile prediction (very wet conditions) of the required water storage volume. Even if very wet climatic conditions occur, the available storage volume at the very end of Project life exceeds the required storage volume by more than 3,400 ML. Once the 200 series longwall panels are extracted, the entire underground mine will become available for storage which will further increase the available storage volume.

The first 20 years of operation of the Project will provide a large amount of data to significantly improve the accuracy of estimated groundwater inflows. Hence, many years lead time will be available to make any necessary adjustments to site water storage capacities, or implement other measures, to ensure that the mine water is able to be retained within the site water management system.

In the unlikely event that further contingencies for excess water storage are required, the following measures could be implemented:

1 Sealing of the gateroads between the 100 series and the 200 series would create an enormous storage volume more than capable of containing the potential volume of excess water;

2 The capacity of the Eastern void will be determined by the final years of open cut mining (i.e. Project Year 7 to Project Year 10). The performance of the water management system throughout the initial open cut operations, as well as groundwater inflows, will be closely monitored to validate model assumptions and improve the predictions for the excess mine water requiring storage. This updated modelling will assist short term mine planners to determine whether the mining operations plan requires modification to retain a larger void at the completion of open cut mining operations. This would potentially require the development of mounded areas on the Eastern overburden emplacement area to assist in providing additional capacity for the reject materials and excess mine water. Under this scenario, KEPCO would still be committed to developing a final landform with no final void in the landscape, as is currently proposed.

3 Further contingency measures which could be considered prior to commencing mining of the 200 series longwall panels may include adjustments to the proposed mine plan, such as:

a. Adjustments to longwall mining widths to minimise hydraulic fracturing and hence potential groundwater inflows;
b. Modifications to the sequencing and timing of mining the 200 series longwall panels;
c. Reorientation of the 200 series longwall panels; or
d. Sealing additional longwall panels within the 200 series to retain further underground capacity.

Table 1 - Adopted groundwater inflows for results shown in Figure 1

Project Year	Total groundwater intercepted (ML/a)
PY2	22
PY3	36
PY4	48
PY5	74
PY6	63
PY7	56
PY8	56
PY9	491
PY10	1,173
PY11	1,446
PY12	1,268
PY13	1,049
PY14	804
PY15	704
PY16	508
PY17	526
PY18	1,030
PY19	1,744
PY20	1,943
PY21	2,371
PY22	2,099
PY23	2,869
PY24	2,241
PY25	2,766

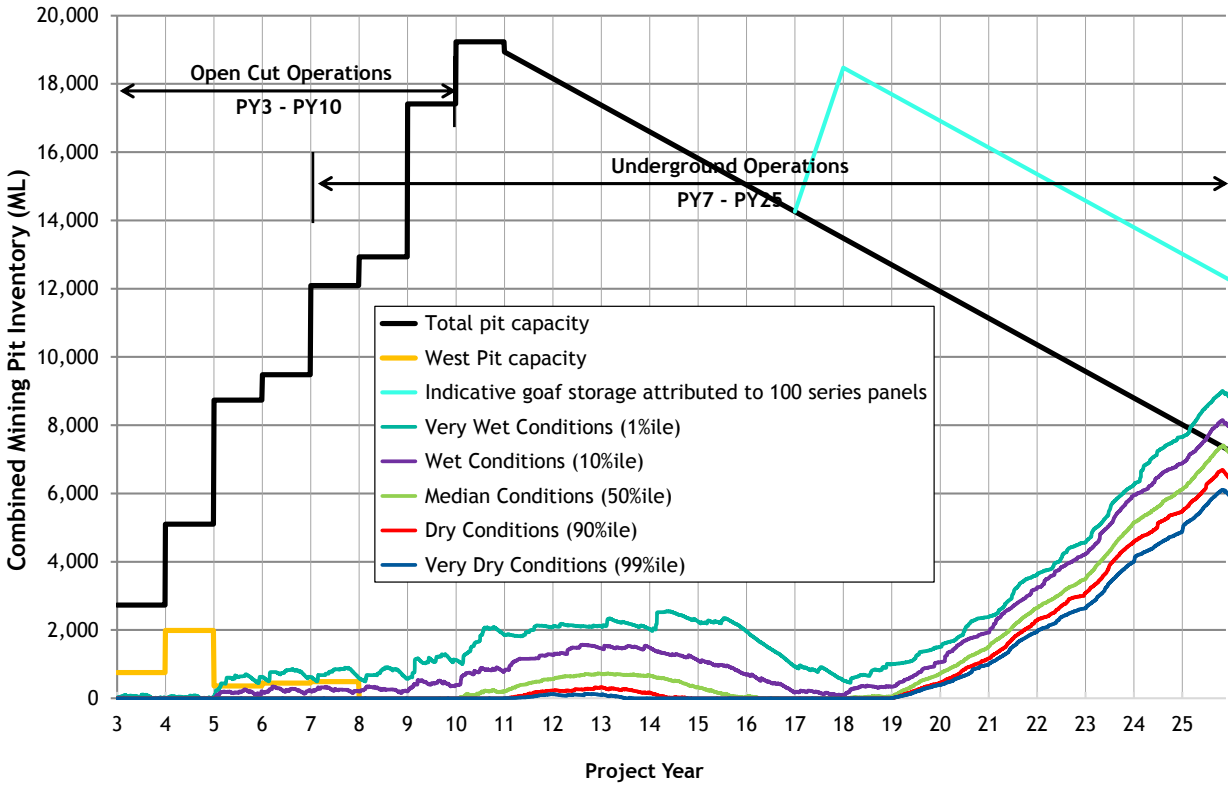


Figure 1 - Combined open cut mining area stored inventory

3 SENSITIVITY ANALYSIS

In response to a peer review of the water balance modelling completed within the EIS by Hydro Engineering & Consulting (HEC), an additional five water balance modelling cases have been assessed with different assumptions for surface runoff and groundwater inflows. The adopted cases are summarised in Table 2. The approach for selecting the sensitivity cases is described as follows:

- Runoff:
  - Calibrated runoff model parameters for the Australian Water Balance Model (AWBM) from the nearby Wilpinjong mine have been adopted (WRM 2015b). These parameters have been verified by comparing site data at the Wilpinjong operation against the model results. Note that these parameters relate to surface runoff only and do not affect groundwater predictions.
  - The sensitivity of the water balance to runoff inflows has been assessed by increasing the depths of conceptual catchment storage (C) in the runoff model by 20% (low runoff case) and decreasing them by 30% (high runoff case).
- Groundwater inflows:
  - Groundwater modelling for the Supplementary RTS by Australasian Groundwater and Environmental Consultants (AGE) includes a likelihood assessment of different groundwater inflow rates. The

uncertainty assessment that was undertaken by AGE has considered inflows that are:

- "Very Likely" 90% probability
- "Most Likely" 33% probability
- "Very Unlikely" 10% probability

- AGE has provided the groundwater inflows which will be available for use within the mine water management system.

Table 2 – Water balance sensitivity cases

Case	Description	Runoff parameters	Groundwater inflows
1	Revised runoff	Wilpinjong	Most likely (33% probability (most likely))
2	Low runoff	1.2 x Wilpinjong C values	Most likely (33% probability (most likely))
3	High runoff	0.7 x Wilpinjong C values	Most likely (33% probability (most likely))
4	High groundwater	Wilpinjong	High (10% probability (very unlikely))
5	Low groundwater	Wilpinjong	Low (90% probability (very likely))

The sensitivity results for the stored water inventories are shown in Figure 2 for the Revised Runoff sensitivity case (Case 1). The revised runoff parameters and groundwater inflows result in generally higher stored water volumes over the life of the Project when compared to the Supplementary RTS case. The available storage capacities (shown in Figure 2) would be sufficient to contain water volumes under this scenario over the Project life. As noted above, many years of mining operations will be available to validate the groundwater model and refine the groundwater inflows and the performance of the water management system and make any necessary changes to the sites water storage capacities to ensure the containment of mine water in the later years of the Project. In addition, inclusion of goaf storage for the 200 series longwall panels will provide additional storage capacity.

Table 3 - Groundwater inflows for sensitivity cases

Project Year	Total groundwater intercepted (ML/a)		
	Low	Most likely	High
PY2	31	40	60
PY3	48	63	92
PY4	65	86	128
PY5	93	121	187
PY6	77	99	153
PY7	72	89	135
PY8	72	91	135
PY9	723	1,157	1,912
PY10	1,233	1,784	2,983
PY11	1,281	1,817	2,978
PY12	1,276	1,810	3,008
PY13	1,058	1,499	2,603
PY14	847	1,194	2,116
PY15	736	1,052	1,979
PY16	539	823	1,571
PY17	493	732	1,378
PY18	1,047	1,557	2,645
PY19	1,561	2,263	3,575
PY20	1,429	2,014	3,240
PY21	1,572	2,146	3,420
PY22	1,402	1,932	2,940
PY23	1,517	2,193	3,721
PY24	1,232	1,808	2,947
PY25	1,245	1,850	3,135

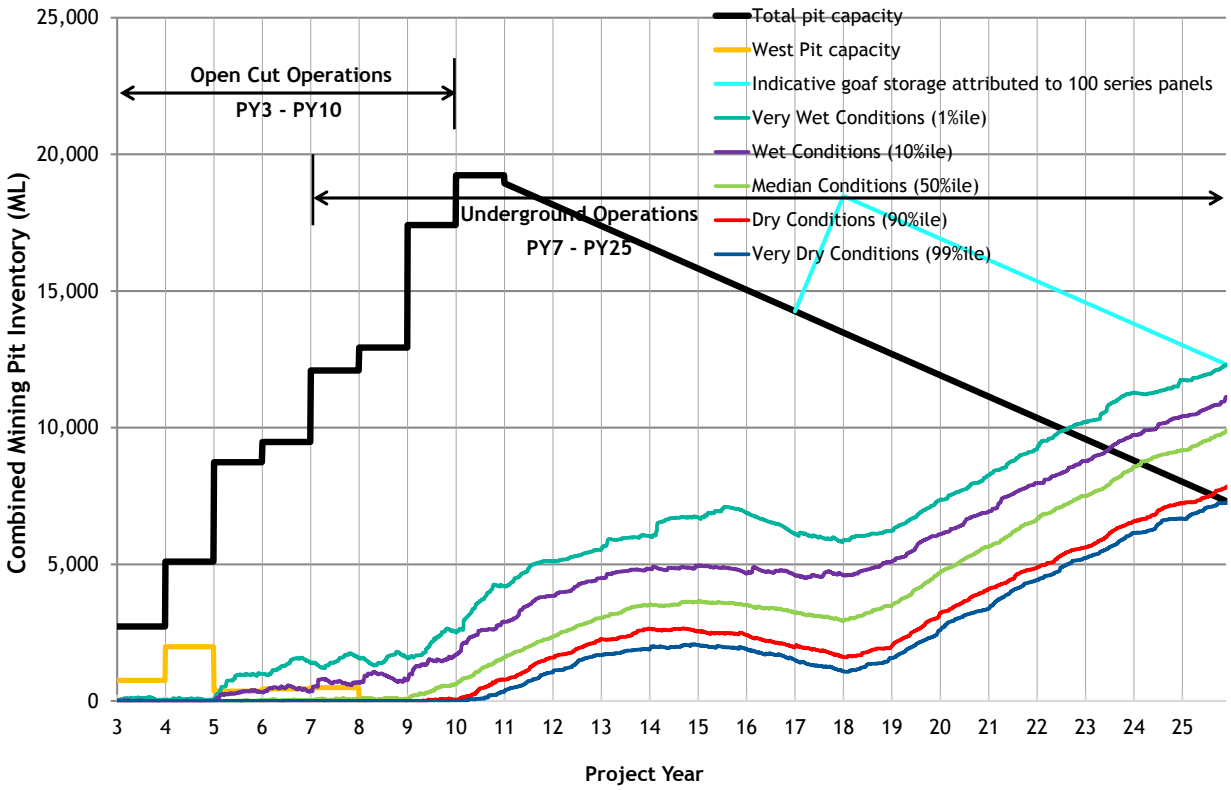


Figure 2 – Sensitivity Case 1 results for stored water inventory (Revised runoff)

The results for stored water inventories (50th percentile) for all sensitivity cases are shown in Figure 3. As anticipated, the Wilpinjong runoff parameters (Sensitivity Case 1) produces higher surface runoff than the Supplementary RTS case.

It is important to note that the water balance model combines results from the groundwater and rainfall runoff models that have differing probabilities of occurring. In this case the probability of these outcomes occurring simultaneously is significantly reduced as the combined probability is represented by the product of the probabilities. For example, Case 4 which is the most extreme of the outcomes tested in the sensitivity analysis, is very unlikely as it is based on the 50th percentile for rainfall runoff and the 10th percentile for groundwater inflow, which results in a combined probability of 5%.

The "Very Unlikely" high groundwater case (Case 4) produces very much higher stored water volumes (refer Figure 3). It should be recognised that this case does not reflect anticipated groundwater inflows. This case represents a very unlikely overestimate of inflows to assess the theoretical impact on the water management system. The model results show that even in this extreme scenario, available mine water storage capacities would be more than sufficient up to Project Year 20. As stated above for the revised runoff scenario, there will be many years of mining operations prior to capacities being exceeded under these unlikely scenarios.

Additional assessment and validation could therefore be undertaken prior to Year 18 (i.e. prior to the commencement of the north-western longwall panels), say

commencing at Year 15, to determine if this extreme eventuality could possibly occur and if so, what would be the appropriate modifications to the mine plan, site water storages or management systems to prevent the need for discharge of mine water from the site. Potential contingency measures for management of excess mine water are discussed in Section 2 above.

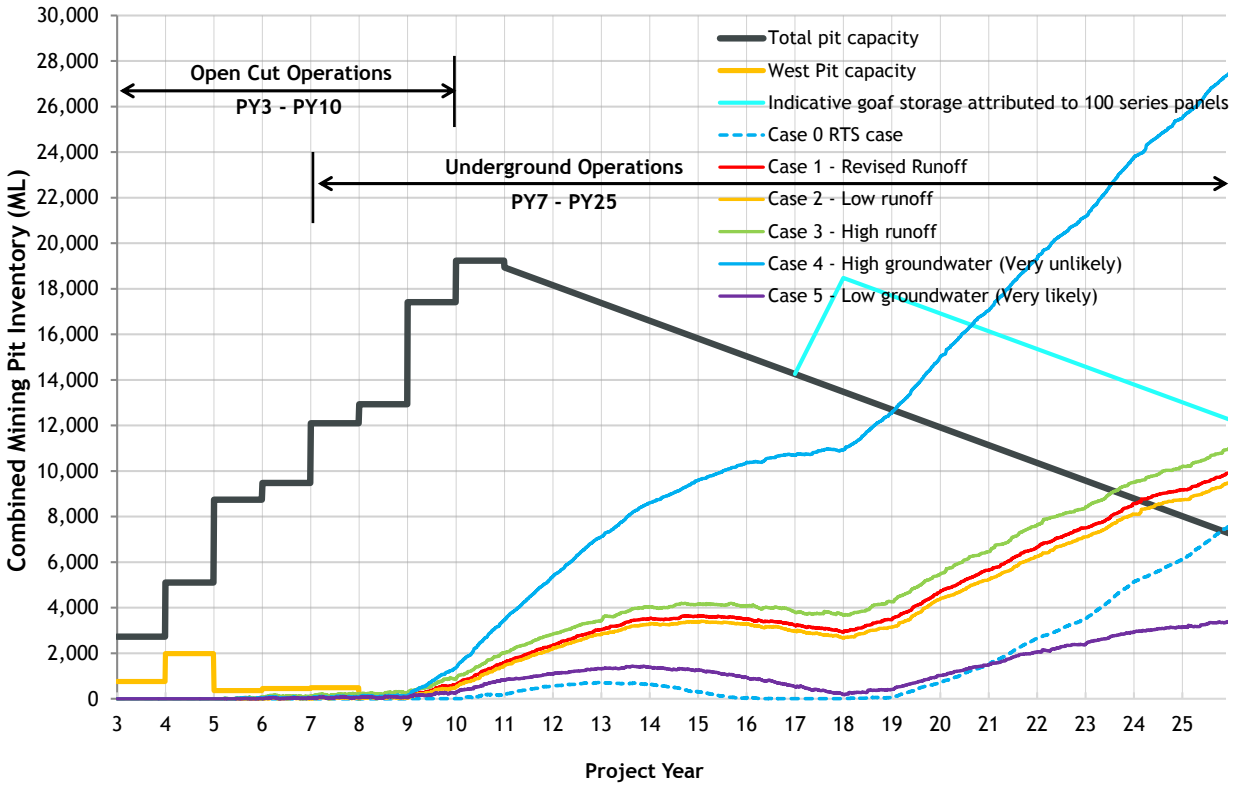


Figure 3 - Sensitivity case results for stored water inventory (50th percentile)

4 IMPACTS ON THE GOULBURN RIVER

The key potential surface water impacts of the Project on the Goulburn River relate to:

- the loss of flow due to capture within the mine water management system; and
- adverse impacts on water quality through discharge of water with elevated salinity.

4.1 Loss of flow

The potential loss of surface flow volume was addressed in the EIS (Section 9.4 of the Surface Water Impact Assessment). The impacts of capturing surface runoff are proportional to catchment area. As discussed in the EIS, clean water diversion drains will be used to minimise capture of clean water runoff and the maximum captured catchment area represents less than 1.3% of the wider Bylong River catchment. This worst-case loss is temporary, as the progressive rehabilitation of the open cut mining areas will quickly reduce the amount of area disturbed at any

one time and facilitate the release of treated storm water runoff. A loss of catchment area this small would have an undetectably small impact on streamflow. The impacts on the Goulburn River would be even smaller.

4.2 Salinity

A presentation to the PAC at its public hearing from the Mudgee District Environment Group claimed that the Goulburn River was subject to increasing salinity from land clearing for agriculture, and more recently from open cut mining.

Details of the three closest stream gauging stations on the Goulburn River downstream of the Bylong River confluence are provided in Table 4. Figures 4, 5 and 6 show time series plots of salinity (Electrical Conductivity (EC)) for the available period of record at each of these three gauges. Inspection of the historical time series EC data does not indicate an obvious increasing trend. Hence, the available historical data does not provide strong evidence that the Goulburn River salinity, downstream of the Bylong River, is increasing in response to mining or other land use impacts.

Water within the proposed Bylong mine water management system that may have elevated salinity levels will be recycled within the site water management system and managed to prevent any discharge. Hence, operation of the Project will have no measureable impact on the salinity in the Bylong River or the Goulburn River.

Table 4 – Goulburn River stream gauges downstream of Bylong River confluence

Gauge no.	Gauge name	Catchment area (km^2)	Period of record for EC
210006	Coggan	3,340	2012-2017
210016	Kerrabee	4,950	2002-2017
210031	Sandy Hollow	6,810	1992-2017

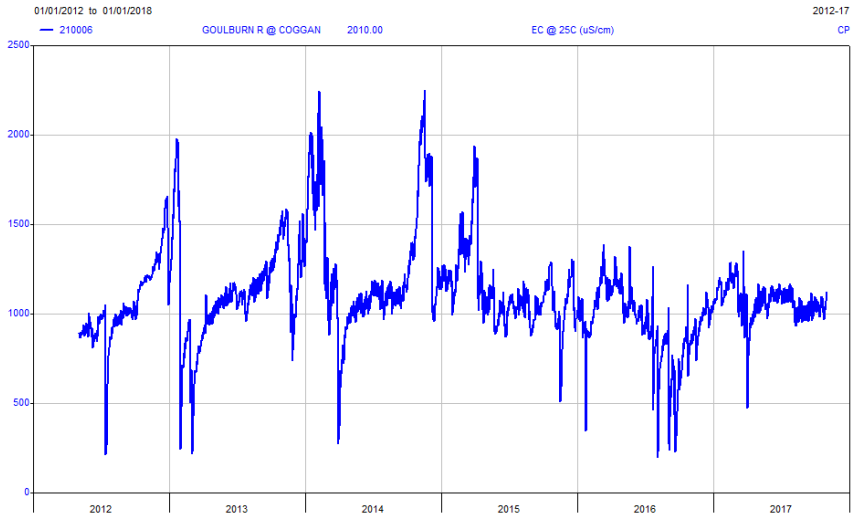


Figure 4 - Goulburn River at Coggan - EC

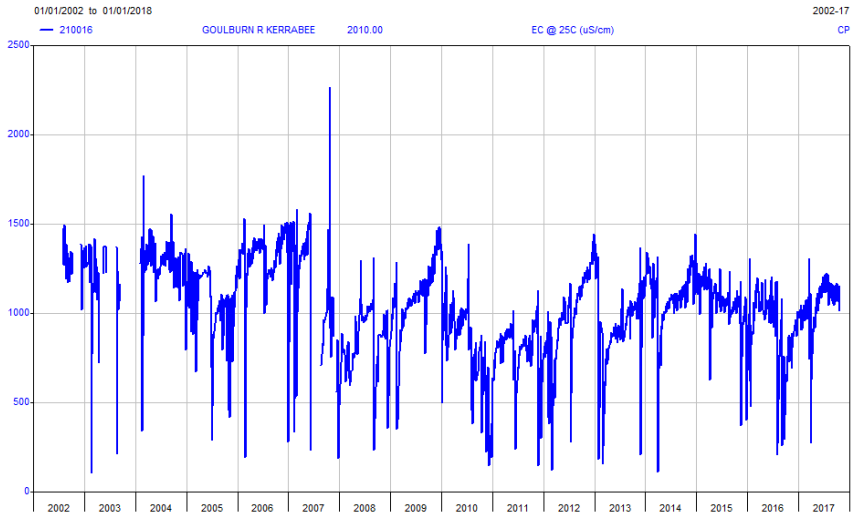


Figure 5 - Goulburn River at Kerrabee - EC

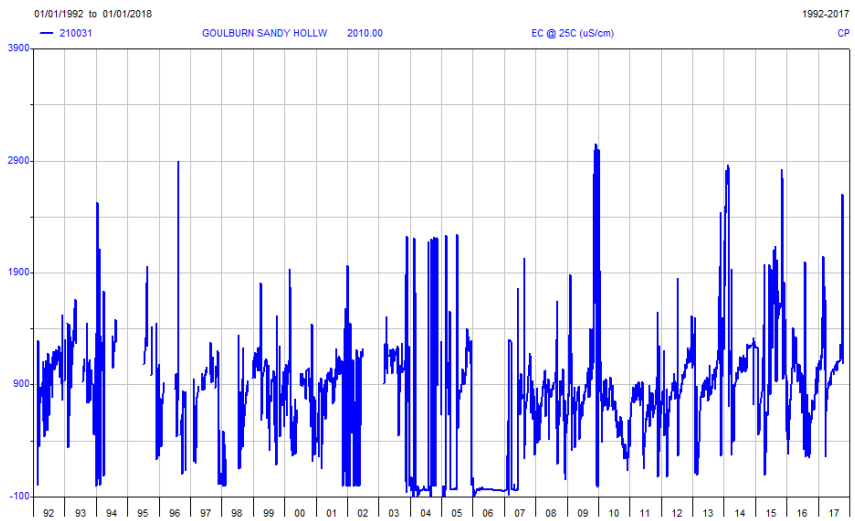


Figure 6 - Goulburn River at Sandy Hollow - EC

5 CONCLUSIONS

The containment of mine-affected water is a key component of the water management strategy for the proposed Bylong Coal Mine.

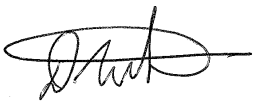
The results of the sensitivity analysis show that even with unrealistically high estimates of potential surface water and groundwater inflows, the available water storage capacities within the mine water management system will be more than sufficient for full containment for at least the first 20 years of the Project. This provides an extended period over which to monitor and validate the performance of the system and many years lead time to adaptively manage the site water storage through modifications to the water management system and/or mine plan. Hence, there is high confidence that the system can be managed over the life of the Project life to prevent discharge of mine-affected water.

The effective containment of mine-affected water on the site will prevent adverse impacts of the Project on water quality in the Bylong River and the downstream Goulburn River system.

Please do not hesitate to contact me if you require further information.

For and on behalf of

WRM Water & Environment Pty Ltd



David Newton, Director

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