



WHITEHAVEN COAL

3 November 2015

Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Mr Mike Young

Dear Mike

RE: NARRABRI MINE MODIFICATION 5 – RESPONSES TO SUBMISSIONS

The Narrabri Mine is an underground coal mining operation located approximately 28 kilometres (km) south-east of Narrabri and approximately 65 km north-west of Gunnedah in the Gunnedah Basin, New South Wales (NSW).

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (NCOPL) on behalf of the Narrabri Joint Venture, which consists of Whitehaven Coal Limited (70%), Upper Horn Investments (Australia) Pty Ltd (7.5%), J-Power Australia Pty Ltd (7.5%), EDF Trading (7.5%), and Daewoo International Corporation and Korea Resources Corporation (7.5%).

NCOPL prepared the *Narrabri Mine Modification 5 Environmental Assessment* (the EA) to support a modification application under Section 75W of the *NSW Environmental Planning and Assessment Act 1979* to allow for a change to the approved underground mine geometry and to increase the ROM coal production rate (Modification 5 [the Modification]).

Responses to Submissions

The EA was placed on public exhibition by the NSW Department of Planning and Environment (DP&E) from 29 September 2015 to 16 October 2015. During this period, government agencies, members of the public and other relevant stakeholders were invited to provide submissions on the EA to the DP&E.

A total of 11 submissions were received for the Modification, including:

- NSW Environment Protection Authority;
- NSW Department of Primary Industries – Water;
- NSW Office of Environment and Heritage;
- NSW Division of Resources and Energy within the NSW Department of Industry, Skill and Regional Development;
- NSW Roads & Maritime Services;
- Transport for NSW;
- North West Local Land Services;
- Forestry Corporation NSW;
- Narrabri Shire Council;
- Gunnedah Shire Council; and

- Australian Rail Track Corporation.

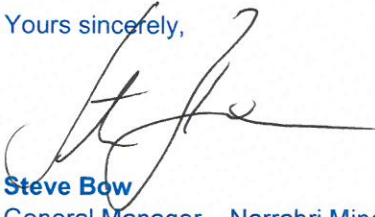
No submissions were received from members of the public.

No objections to the Modification were received.

NCOPL's responses to the submissions received to date are presented in Attachment 1, with supporting information with respect to noise issued provided as Attachment 2 and a response to groundwater issues prepared by HydroSimulations provided as Attachment 3.

Please do not hesitate to contact Steve Farrar on (02) 6794 4167 if you have any queries.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Steve Bow', with a long horizontal flourish extending to the right.

Steve Bow
General Manager – Narrabri Mine

ATTACHMENT 1
RESPONSES TO SUBMISSIONS

Table A1-1
Responses to Submissions

Number	Individual/ Organisation	Submission	NCOPL Response
EPA-1	Environment Protection Authority (EPA)	<i>The noise assessment by Wilkinson Murray Pty Limited (2015) provides insufficient information about the project. The EPA recommends that additional information be provided to allow the EPA to undertake a complete assessment of the proposal.</i>	Please refer to Attachment 2, which provides a description of the proposed real time noise monitoring and management measures proposed, and the responses below.
EPA-2	EPA	<i>Further explanation as to why was the meteorological station "W1" not used at the times of the mid July 2015 noise monitoring and what measures has the proponent taken to ensure that it will be operating in the future so that compliance with noise limits can be ascertained?</i>	NCOPL measures sigma theta at the weather station site W1. However, during periods of attended monitoring, temperature gauges are usually deployed at two locations of different elevations, to provide a measure of temperature inversion strength. However, unfortunately data from these temperature gauges were not available during the noise exceedances measured on 15 July 2015. Please refer to Attachment 2 for a description of proposed improvements to temperature inversion measurements at the NM.
EPA-3	EPA	<i>This suggests that the noise levels for the Mod 5 proposal are under-predicted.</i>	Please refer to Attachment 2.
EPA-4	EPA	<i>The proponent needs to provide updated noise predictions that align with monitored levels, or a satisfactory explanation as to why noise levels have not been under-predicted.</i>	Please refer to Attachment 2. As described in Appendix D of the EA, exceedances were recorded at the "Oakleigh" dwelling (located approximately 2.9 km to south of the coal stockpiles) in June and July 2015. These exceedances were recorded in the context of a sustained record of compliance over the previous years of monitoring (i.e. March 2012 to June 2015). Also, four subsequent operator attended noise monitoring campaigns have been conducted since July 2015 which all recorded noise levels below criteria. Following NCOPL review of the exceedances, it was noted that: • Dozer tracks were noted as a prominent component of noise recorded. • All four dozers were in operation on the ROM and product coal stockpiles. • Stockpiles were at near maximum size. • An inversion of strength of 2.6°/100 m was present during the June survey. The lessons from this review will be considered during the implementation of the real time management system (Attachment 2).

**Table A1-1
Responses to Submissions (Continued)**

Number	Individual/ Organisation	Submission	NCOPL Response
EPA-5	EPA	<i>The proponent needs to revise the NIA for all four dozers operating on the ROM and product coal stockpile more frequently, with coincident noise levels of 40dBA at "Oakleigh", or provide a satisfactory explanation as to why this will not occur.</i>	Please refer to Attachment 2.
EPA-6	EPA	<i>The proponent needs to address the discrepancies between the predicted impacts of the 2013 Noise Model Validation Report and the NIA.</i>	The 2013 Noise Model Validation Report was undertaken for the purposes of noise management (i.e. this report was not part of a broader approval document), hence contained some conservative assumptions which were not adopted in the more recent 2015 Stockpile Extension Modification (e.g. 6°C/100 m inversion strength was conservatively adopted in the 2013 Noise Model Validation Report; whereas the 2015 report used 4°C/100 m in accordance with the Industrial Noise Policy). In addition, there were some slight changes to the sound power level inputs for the CHPP and the bypass crusher following detailed site sound power level measurements (the CHPP increased by 1 dBA, whereas the bypass crusher decreased by 1 dBA).
DPI-1	Department of Primary Industries (DPI) – Water	Groundwater Assessment DPI Water recommends that Narrabri Coal be required to source adequate groundwater entitlement from the Gunnedah - Oxley Basin Murray Darling Basin Groundwater Source to cover the predicted groundwater impact of 1,009 ML, prior to the commencement of the modified activity. Narrabri Coal currently have an entitlement of 818 ML, which gives them a shortfall of 191 ML. A condition or commitment from the proponent to obtain this is recommended.	As discussed in the DPI Water's submission, Comparison of NCOPL's licence entitlements against the predicted annual licensing requirements shows that adequate licences are available to account for the potential take of water associated with the approved NM and the Modification, with the exception of the NSW Murray Darling Basin Porous Rock Groundwater. Appendix B of the EA provides a comparison between the modelled inflows and actual observations, and notes that the model appears to be conservatively overestimating inflows. NCOPL considers that the actual peak inflows may be lower than the model predictions. As shown in Figure 8 of the Modification EA, the peak groundwater inflows are not predicted until approximately Year 11 of the NM, thereby providing several years to procure any necessary additional licenses. As described in Section 5.3.2 of the EA, NCOPL would monitor underground mine inflows against model predictions and obtain additional licence(s) volumes of this water source to account for actual inflows, as necessary.

Table A1-1
Responses to Submissions

Number	Individual/ Organisation	Submission	NCOPL Response
DPI-1	DPI-Water	The groundwater assessment indicated the water table impacts at two bores are predicted to exceed the Level 2 impact assessment consideration of the NSW Aquifer Interference Policy. Make good provisions are therefore required and should be described and committed to by the proponent prior to the commencement of the modified activity.	As discussed in Section 4.5.2 of the EA, make-good commitments are described in the Water Management Plan, which provides: an appropriate preventative and/or remedial strategy would be recommended, which may comprise: - Additional monitoring; - Modification to mine plans; - Provision of alternative water supply or other agreed compensation; - Introduction of engineering structures to break hydraulic coupling caused by mining; or (If appropriate) no change to operations. The above response program would be carried out in consultation with OEH, NOW and other relevant government agencies. From experience at other Whitehaven operations, practical measures may include modification of the existing pump, deepening of the bore or provision of alternative bore(s). Please refer to Attachment 3, which provides a review of the DPI-Water submission by HydroSimulations (Dr Noel Merrick).
DPI-2	DPI-Water	Clarify the location of the two fracture zones and the constrained zone to aid in understanding the subsidence and fracturing processes. It is suggested a graphic figure be provided showing the extent of the fracture zones and its implications for vertical permeability. An explanation is requested as to why cracking will not go to the surface and why affected surface flows will not percolate down to the mined area.	
DPI-3	DPI-Water	Clarify the discrepancy in the groundwater model of the 15 metres between the modelled and observed initial heads. The modelled initial head needs to reflect as close as possible to the observed initial head.	Please refer to Attachment 3.
DPI-4	DPI-Water	Clarify where the water is going that prevents the groundwater levels recovering to the initial levels. Noting that this may be an issue with boundary conditions used in the model for the Pilliga Sandstone layer. The current predictions of groundwater levels recovering to 3m below initial levels after 120 years are a concern and needs to be discussed and justified.	Please refer to Attachment 3.

Table A1-1
Responses to Submissions

Number	Individual/ Organisation	Submission	NCOPL Response
DPI-5	DPI-Water	The Main Report is recommended to reflect what is published in the Appendices. There are inconsistencies between Table 8 in the main report and Table 18 in Appendix B which need to be clarified.	Table 8 in the EA refers to the groundwater licensing summary in the context of the NSW Aquifer Interference Policy, whereas as discussed in Section 5.6 of Appendix B, Table 18 in Appendix B accounts for baseflow losses from the Lower Namoi Regulated River Groundwater Source (i.e. surface water), thus there are no inconsistencies between the two tables.
DPI-6	DPI-Water	It is recommended a new groundwater model is built using MODFLOW USG for future reviews (The calibration statistics have not improved in the last two versions of the model V3 and V4, and discrepancies exist in the initial heads and the calibrated heads. The Modflow USG platform may assist in improving the calibration statistics and the discrepancies).	Please refer to Attachment 3.
DPI-7	DPI-Water	Surface Water Assessment ... - The surface water assessment outlines a number of predicted subsidence impacts that could occur beneath Pine Creek, Pine Creek Trib. 1, Pine Creek Trib. 3, Kurralong Creek, Kurralong Creek Trib. 1 and Kurralong Trib. 2. These impacts include substantial in stream and over bank ponding, sedimentation of the channel in ponded areas, and some of the first order channels may drain into the major watercourses at alternate locations and cause localised bank scour. The surface water assessment outlines the impacts are generally consistent with the currently approved impacts however it is acknowledged the predicted impacts for the modification are moderately larger due to the more detailed LIDAR survey data available for this assessment. - The assessment outlines as a result of the modification there are going to be major impacts on the creeks, however the assessment concludes the geomorphic condition of the creeks won't be changed beyond the original assessment. It is unclear how the geomorphic condition of the creek will not be changed as a result of the major impacts predicted.	The Surface Water Assessment (WRM, 2015) does not describe that there would be "major" incremental subsidence impacts on creeks as a result of the Modification. WRM (2015) assessed the potential incremental subsidence impacts on creeks and concluded the following (Section 7.2 of the Surface Water Assessment): - Pine Creek and Pine Creek Tributary 3 – No additional impacts above the approved impacts given in WRM (2009) are expected. - Pine Creek Tributary 1 – These subsidence predictions and impacts are generally consistent with the approved impacts given in WRM (2009). - Kurralong Creek and Kurralong Creek Tributary 1 – The predicted impacts over the southern longwall panels are marginally greater than what has been predicted in WRM (2009) due to the improved ground level data. The differences are not significant and are expected to be minor. No subsidence impacts on Kurralong Creek Tributary 2 are expected as it is located outside of the underground mine footprint. Based on the above, WRM (2015) concluded the following in relation to potential incremental geomorphological impacts (Section 7.2.5 of the Surface Water Assessment): Overall the impacts are generally consistent with the currently approved impacts described in WRM (2009). ... An inspection of the results suggests that major changes in channel

Number	Individual/ Organisation	Submission	NCOPL Response
			<i>morphology are not expected. Significant changes in channel location (avulsions) are unlikely across the mine subsidence zone. However, some of the minor (first order) channels may drain into the major watercourses at alternate locations and cause localised bank scour. Some sedimentation of the channel is expected in the ponded areas, which may change the channel form over time. Again, these impacts are in accordance with the approved impacts given in WRM (2009).</i> The more detailed LIDAR survey data available for the WRM (2015) assessment compared the WRM (2009) assessment has allowed for more detailed assessment of potential geomorphological impacts. In some instances, this has resulted in the predicted modified impacts being greater than described in WRM (2009) despite there being little of no change to the predicted subsidence levels.
DPI-8	DPI-Water	- Clarify requirements for surface water licences to cover surface water take from regulated and unregulated rivers due to impacts on the surface water flows off site or as a result of surface cracking. Adequate entitlement will need to be obtained to cover the predicted impact and the proponent is requested to consider the market depth to obtain the necessary entitlement. ... - The surface water assessment outlines a number of water licences held by the company which authorise extraction from the Namoi River. The report outlines no additional water access licences would be required. However, the surface water assessment outlines some first order channels may drain into the major watercourses at alternate locations. It appears there is the potential for surface water loss from these minor watercourses but no indication of volumes. The proponent is requested to clarify any additional surface water take and will be required to obtain sufficient entitlement in the relevant water sources.	As described in the Surface Water Assessment (WRM, 2015), Pine and Kurrajong Creeks are ephemeral, generally flowing for short periods after significant rainfall events or protracted wet periods. Base flows in these creeks are insignificant. The Subsidence Assessment (DGS, 2015) concluded that direct hydraulic connection to the surface, due to sub-surface fracturing above the modified underground mine layout is considered unlikely to occur where cover depths are greater than 160 m. The cover depth in all future modified mining areas (i.e. areas that have not yet been mined) is greater than 160 m and therefore it is unlikely that direct hydraulic connection to the surface, due to sub-surface fracturing would occur. In addition, WRM (2015) concluded the following in relation to potential incremental geomorphological impacts (Section 7.2.5 of the Surface Water Assessment): <i>Overall the impacts are generally consistent with the currently approved impacts described in WRM (2009). ...</i> <i>An inspection of the results suggests that major changes in channel morphology are not expected. Significant changes in channel location (avulsions) are unlikely across the mine subsidence zone. However, some of the minor (first order) channels may drain into the major watercourses at alternate locations and cause localised bank scour. Some sedimentation of the channel is expected in the ponded areas, which may change the channel form over time. Again, these impacts are in accordance with the approved impacts given in WRM (2009).</i>

Number	Individual/ Organisation	Submission	NCOPL Response
			It is also noted that the Modification would result in approximately 10 ha of undisturbed Kurralong Creek catchment that currently reports to the site water management system reporting back to Kurralong Creek (Section 4.5.2 of the EA). Given the above, and consistent with the EA, no additional Water Access Licences would be required for the Modification.
DPI-9	DPI-Water	The surface water assessment outlines the management actions and contingency measures for potential subsidence impacts on Pine and Kurralong Creeks and their tributaries are outlined in the Extraction Plan Water Management Plan. Whilst the main report for the modification includes a brief description of mitigation and monitoring measures, it is considered this information should be included in detail in the documents for this modification. The modification documents should be stand alone and the reviewer should not have to source previously approved documents to understand the proposed mitigation and management measures.	The Extraction Plan Water Management Plan (URS Australia, 2012) was prepared in consultation with the DPI-Water and was approved by the Secretary of the Department of Planning and Environment. Section 5.4 of the Extraction Plan Water Management Plan outlines specific management actions for the following potential subsidence impacts on surface water resources: • surface cracking; • slope stability and erosion; • surface uplift; and • ponded water. The Extraction Plan Water Management Plan also includes contingency measures for potential subsidence impacts on surface water resources. The Extraction Plan Water Management Plan is available on the Narrabri Mine Website (http://www.whitehavencoal.com.au/environment/docs/ep-appendix-g-extraction-plan-water-management-plan18095309.pdf).
DRE-1	Division of Resources and Energy (DRE) within the Department of Industry, Skills and Regional Development	Therefore DRE recommends that the proponent ensures that the following management plans, required by Project Approval 08_0144, are revised to adequately address the increase in subsidence impacts: • Extraction Plan (including the relevant sub-plans), and • Landscape Management Plan including the Rehabilitation Plan (Mining Operation Plan) and Mine Closure Plan.	Consistent with Condition 3, Schedule 3 of Project Approval 08_0144, NCOPL would review, and if necessary revise, the strategies, plans, and programs required under Project Approval 08_0144 within 3 months of any approval of the Modification.

**Table A1-1 (Continued)
Responses to Submissions**

Number	Individual/ Organisation	Submission	NCOPL Response
DRE-2	DRE	<i>It considers there are no feasibility issues affecting the proposed mine layout arising from health and safety risks due to subsidence and issues can be appropriately managed through the Extraction Plan process.</i>	Noted.
DRE-3	DRE	<i>The Narrabri Coal Mine contributes significantly to the fabric of the regional area through direct and indirect employment and is important to the economic future of region and the State.</i>	Noted.
OEH-1	Office of Environment and Heritage	<i>In conclusion, as a result of our review of the publicly exhibited EA we have no specific recommendations or amendments that we wish to be considered.</i>	Noted
R&MS-1	Roads & Maritime Services	<i>Roads and Maritime Services do not object to the proposed modification and will not be making a submission.</i>	Noted
TforNSW-1	Transport for NSW	<i>Transport for NSW has reviewed the Environmental Assessment and do not have any additional comments to provide on the above project.</i>	Noted
NWLLS-1	North West Local Land Services	<i>North West Local Land Services (NWLLS) has reviewed the modifications proposed and it appears there will be negligible additional impacts on the NWLLS Transitional Regional Natural Resource Management Plan thresholds and targets.</i>	Noted.
FCNSW-1	Forestry Corporation of NSW	FCNSW has reviewed the tendered Modification documents and makes the following comments: 1. An additional 13 hectares of State forest has been included in the project disturbance area; 2. Narrabri Mine (NM) will repair or replace State forest roads and crossings impacted by the predicted subsidence; 3. NM will repair or replace State forest boundary fencing which is impacted by the predicted subsidence; 4. NM will treat new sources of erosion within State forest caused by subsidence. 5. NM will repair surface cracks within State forest posing safety concerns for forest users; 6. FCNSW expects access restrictions to State forest during and immediately following mining due to risks of subsidence; and	Acknowledged. Acknowledged. Acknowledged. Acknowledged. Acknowledged. Noted.

**Table A1-1 (Continued)
Responses to Submissions**

Number	Individual/ Organisation	Submission	NCOPL Response
FCNSW-1 (Cont.)	FCNSW	7. Subsidence beneath State forest may cause reduced site productivity and loss of commercial timber resources.	As described in Section 4.11.1 of the EA, subsidence impacts on native vegetation are expected to be minimal west of LW103 (i.e. subsidence impacts are expected to be minimal in the Pilliga East State Forest). The depth of cover west of LW103 is greater than approximately 210 m increasing to approximately 370 m in LW111 to the west.
FCNSW-2	FCNSW	FCNSW acknowledges that costs associated with safety and/or infrastructure repair are to be addressed by applicable Management Plans noted in the Project Approval.	Acknowledged.
FCNSW-3	FCNSW	Other commercial impacts not addressed by the said Management Plans (i.e. timber losses) may be recoverable from NM under Section 262 of the Mining Act 1992.	Acknowledged.
FCNSW-4	FCNSW	FCNSW has no other comments regarding the Modification as proposed.	Noted.
NSC-1	Narrabri Shire Council	Council has reviewed the proposal and is satisfied that the alterations to the mining process and proposed increase in the mines annual output will impact Council infrastructure.	Noted.
GSC-1	Gunnedah Shire Council	It is advised that Council does not have any comments or recommendations in regard to the proposed modification request.	Noted.
ARTC-1	Australian Rail Track Corporation (ARTC)	The proponent should assess any additional train movements on ARTC's network associated with the proposed continued operations project in accordance with the Rail Infrastructure Noise guideline.	The Noise Assessment (Wilkinson Murray, 2015) (Appendix D of the EA) included an assessment of potential rail noise impacts associated with the Modification. Wilkinson Murray (2015) concluded that the Modification would not result in an exceedance of the relevant Rail Infrastructure Noise Guideline criteria.
ARTC-2	ARTC	The proponent will be required, if it has not already done so, to undertake and submit modelling to ARTC to determine the impacts on the overall operations of the Hunter Valley rail network particularly resulting from the proposed increase in capacity.	As described in Section 1.3 of the EA, NCOPL consulted with the ARTC regarding an increase in rail movements dispatched from the NM as a result of the Modification. The ARTC General Manager Customer Services & Operations provided a letter on 28 August 2015 (Attachment 4) that stated: ARTC is of the opinion that the movement of ~11Mtpa of coal product from the Narrabri Mine would rest within the currently approved peak and average daily movement limits for this section per day. ARTC notes however that dependant on other network consideration and other Access Holders' contractual movements, additional capacity for the entire zone could be required to ensure total zone capacity is available.

Attachment 2 – Proposed Operational Noise Management Improvements

Introduction

The EPA has raised concern regarding the noise exceedances recorded at the “Oakleigh” receiver as described in Appendix D of the Modification EA and in particular that these exceedances are inconsistent with the modelling that was conducted for the Stockpile Extension Modification and described in Appendix D of the Modification EA.

The recent exceedances in June/July should be viewed in the context of three previous years of compliance at “Oakleigh” (as indicated by Table 2-2 in Appendix D of the Modification EA). In addition, there has been four subsequent operator attended surveys at “Oakleigh” since 15 July 2015 which recorded compliance with the criteria.

Consequently, NCOPL considers these exceedances as being isolated incidents and proposes the following operational response as part of the Responses to Submissions.

Operational Response

1. NCOPL would implement real-time noise monitoring at the “Oakleigh” receiver (or on nearby NCOPL-owned land). This would include continuous measurement of noise and recording of audio to allow determination of the source of elevated noise levels.
2. NCOPL would install a temperature inversion tower at the mine site to allow inversion strength to be continuously monitored. Nominally, the tower would record temperature continuously at heights of 10 and 60 m above ground level, however the details would be subject to detailed design.
3. The monitoring data from the real time monitor and temperature inversion data would be available to the CHPP control room operator, which is manned 24 hours a day. The CHPP control room operator would be responsible for reviewing the data and coordinating responses to real-time noise measurements as required.
4. A Trigger Action Response Plan (TARP) would be developed to identify mitigation measures that would be implemented in response to elevated mine noise. The TARP would identify a trigger level that would be set to allow proactive response to elevated noise levels (i.e. the trigger would be set at below the 35 dBA $L_{Aeq}(15 \text{ min})$ criterion). The TARP would include, but would not necessarily be limited to:
 - a. Review of audio files to determine whether elevated noise levels are related to mine noise as assist to determine the source of this mine noise.
 - b. Review of temperature inversion and meteorological station data to confirm whether noise enhancing weather conditions are prevailing.
 - c. Mitigation measures that would be invoked in response to the trigger, for example:
 - i. Modification of CHPP activities.
 - ii. Re-deployment of stockpile dozers e.g. moving dozers to less prominent locations on the ROM and product coal stockpiles to reduce noise levels.
 - iii. Implementation of first gear reverse on stockpile dozers (i.e. ‘lock-out’ higher gears to reduce dozer track noise).

- iv. Finally 'standing-down' of dozers not essential for mine production should other measures not result in lower noise levels.
- d. Review of real-time noise response following implementation of mitigation measures.
- e. Follow-up communications and reporting.

Actions and Timing

Consistent with the above, NCOPL proposes to:

1. Provide the DP&E and EPA with an action plan for the installation and commissioning of the real-time noise monitoring and temperature inversion monitoring system with the objective of having the system fully operational the end of April 2016 (i.e. prior to the cooler weather where temperature inversions are known to prevail).
2. Document the above measures in a revised Noise Management Plan within 3 months of determination of Modification 5.

Attachment 3 – Responses to DPI Water Submission (provided by HydroSimulations)



Date: 30 October 2015

To: Narrabri Coal Operations Pty Ltd
c/- Resource Strategies Pty Ltd
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From: Dr Noel Merrick

noel.merrick@heritagecomputing.com

Re: **Narrabri Mine - Longwall Panel
Width Modification – Groundwater
Modelling Assessment - Response
to DPI Water**

Our Ref.: HC2015/43

This letter responds to comments raised by DPI Water on the Groundwater Assessment for the planned modification of underground mining at the Narrabri Mine.

ISSUE 1: Calibration

DPI Water:

Clarify the discrepancy in the groundwater model of the 15 metres between the modelled and observed initial heads. The modelled initial head needs to reflect as close as possible to the observed initial head.

Response:

This comment relates to bore P6 in particular, rather than a general observation at all bores. Bore P6 is placed in the Pilliga Sandstone. While there are some discrepancies at standpipes, there is exceptionally good calibration of vibrating wire hydrographs where mining effects have been observed. The discrepancy at P6 is not due to "use of interpolated heads as initial heads" or boundary conditions, as suggested. The general head boundary conditions at the north-western corner of the model have been checked and confirmed to be appropriate. The initial heads are derived from an optimal steady-state calibration.

Standard practice in mining models is to apply a uniform permeability to a given lithology. That has been done here. The setting at P6 is the best that could be achieved with this assumption. As P6 is in the outcropping Pilliga Sandstone, its water level reflects the water table. A best estimate of the regional water table, based on pre-mining field measurements, is shown in Figure 1 [a]. The simulated pre-mining water table is shown in Figure 1 [b]. The patterns agree very well. With an assumption of uniform permeability for Pilliga Sandstone, the model generates a steep hydraulic gradient in the vicinity of P6 and a fairly flat gradient over the northern half of the mine footprint. Better representation of the hydraulic gradient would require localised variations in permeability. The variable hydraulic gradient is responsible for the offset simulated at P6.

Absolute offsets in simulated heads are not a serious issue when the objective is the estimation of impacts, in the form of drawdowns or water level differences due to alternative mine plans, as is the case here.

The National Water Commission guidelines (page 81) recognise that water level differences are more accurate than absolute water levels:

Model outputs obtained from calculating differences between two model simulations (e.g. the difference between a stressed and unstressed or 'null scenario' model) can reduce the predictive uncertainty associated with model outcomes.

This relaxes the need for matching of absolute water levels.

The Pilliga Sandstone model layer has been assigned a horizontal hydraulic conductivity of 0.3 m/day. This compares favourably with the 0.265 m/day value adopted by Aquaterra (2009). Two field measurements by Aquaterra (2009) gave values of 0.029 m/day and 0.19 m/day.

ISSUE 2: Recovery

DPI Water:

Clarify where the water is going that prevents the groundwater levels recovering to the initial levels. Noting that this may be an issue with boundary conditions used in the model for the Pilliga Sandstone layer. The current predictions of groundwater levels recovering to 3m below initial levels after 120 years are a concern and needs to be discussed and justified.

Response:

The recovered levels should not be expected to recover to initial levels. In contrast, we expect recovery to lower levels. This is due to the increased permeability and storage generated in the fractured zone above the mined coal seam.

Given Darcy's Law, an increase in permeability must be associated with a decrease in hydraulic gradient. The water levels must go down, relative to pre-mining levels.

This issue is unrelated to boundary conditions, as suggested.

ISSUE 3: Fracture Zones

DPI Water:

Clarify the location of the two fracture zones and the constrained zone to aid in understanding the subsidence and fracturing processes. It is suggested a graphic figure be provided showing the extent of the fracture zones and its implications for vertical permeability. An explanation is requested as to why cracking will not go to the surface and why affected surface flows will not percolate down to the mined area.

Response:

The Groundwater Assessment report already includes extensive coverage of the fractured zone in Section 3.6, in terms of conceptualisation, the theory of Ditton and Merrick (2014), and calculations to show the height of fracturing, uncertainty of estimates, and vertical buffers to show that fracturing is not expected to reach ground surface. The adopted permeabilities in the fractured zone are listed in Table 9 of the report.

Attachment A of the DPI Water letter (last page, paragraph e) raises an argument for fracturing to the surface because land subsidence (of 2.75 m) reaches the surface. This is an erroneous conceptualisation. Land subsidence must always reach land surface, by definition, but fracturing does not necessarily reach land surface. The objective of the Ditton and Merrick

(2014) theory, based on geotechnical principles and calibration at many mining sites, is to calculate the height of vertical connective fracturing. Above that level is a constrained zone with either disconnected fracturing or no fracturing.

DPI Water suggested provision of a graphic to illustrate the fractured zone in the model. This is considered unnecessary given that the Modification does not change the nature of this issue at the Narrabri Mine. Provided below is a statistical summary of the highest layer fractured in 1130 mining cells in the model:

HIGHEST LAYER FRACTURED	LITHOLOGY	PROPORTION OF CELLS
1	Alluvium / regolith	0 %
2	Pilliga Sandstone	0 %
3	Purlawaugh Formation	9 %
4	Garrawilla Volcanics	25 %
5	Napperby Formation	66 %
6	Basalt Sill	0 %

Other Matters

DPI Water:

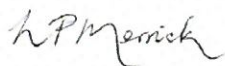
It is recommended a new groundwater model is built using MODFLOW USG for future reviews (The calibration statistics have not improved in the last two versions of the model V3 and V4, and discrepancies exist in the initial heads and the calibrated heads. The Modflow USG platform may assist in improving the calibration statistics and the discrepancies).

Response:

We support migration of the modelling platform to MODFLOW-USG. HydroSimulations has a number of production models already in this platform.

It should not be expected that MODFLOW-USG would give better or more accurate results than MODFLOW or MODFLOW-SURFACT, as used for the Narrabri Modification. However, MODFLOW-USG allows finer spatial resolution where required. Our experience so far is that MODFLOW-USG models have better numerical stability and faster runtime for complex models such as mining models.

Yours sincerely



Dr Noel Merrick

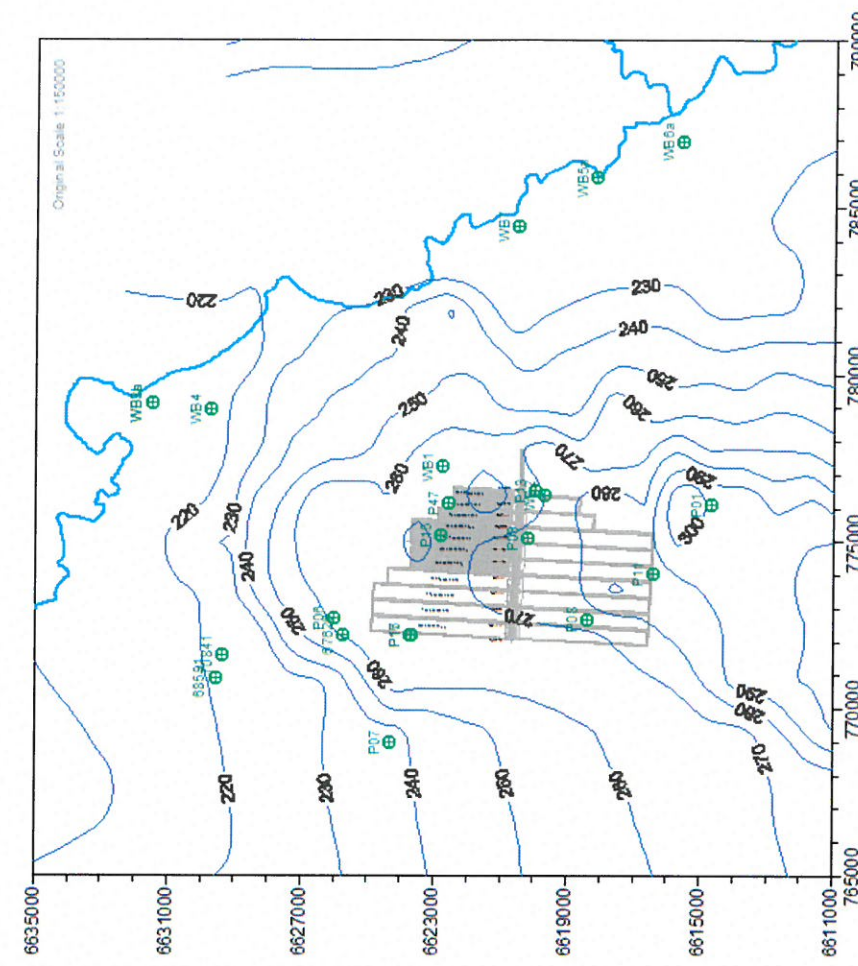
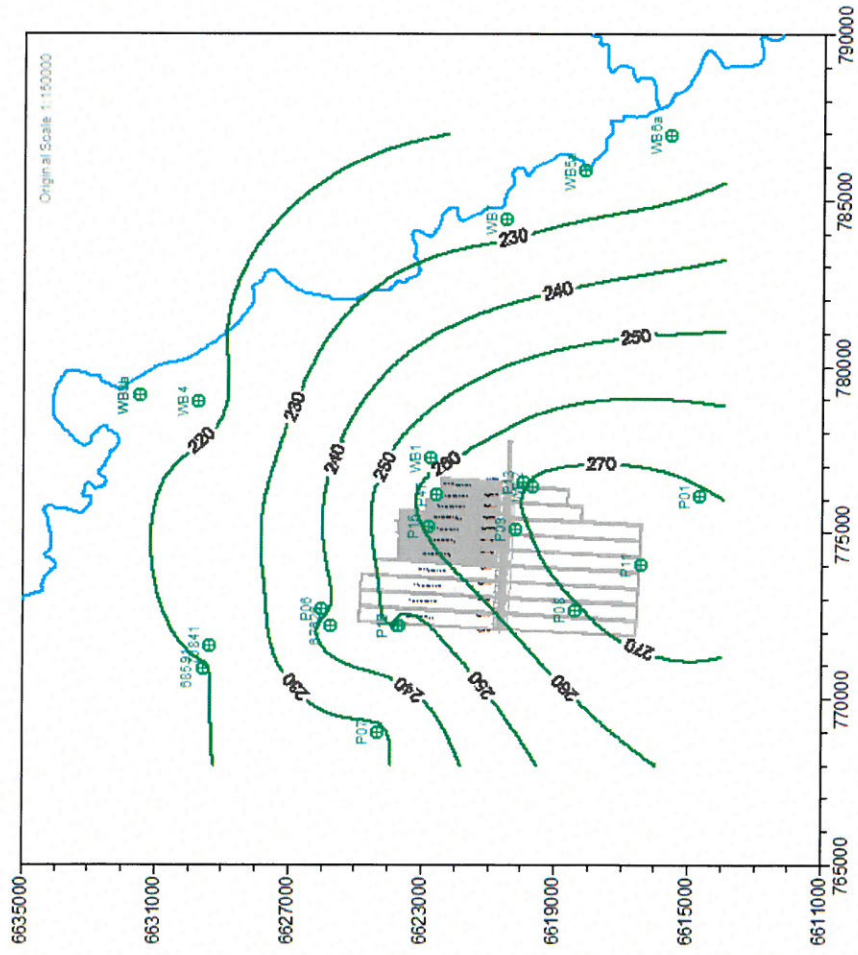


Figure 1. Estimated pre-mining water table contours (mAH): [a] Observed; [b] Simulated

Attachment 4 – Letter from the ARTC Received 28 August 2015

Mr Gerald Linde
Mine Manager – Narrabri Mine
Whitehaven Coal Limited
Locked Bag 1002
Narrabri, NSW, 2390

Email: glinde@whitehavencoal.com.au
CC via email: krochester@whitehavencoal.com.au
JVandervoort@ARTC.com.au

28 August 2015

Dear Gerald,

RE: Narrabri Mine Modification 5 – Product Coal Transport Requirements

The Australian Rail Track Corporation (ARTC) utilises a zoned volume based scenario to work up pathways in the provision of capacity in the Hunter Valley, NSW region. The chosen volume based pathways to capacity realisation are provided annually in the ARTC Hunter Valley, 10 Year Corridor Capacity Strategy which can be found on the ARTC website at:

<http://www.artc.com.au/Content.aspx?p=115>

Narrabri Mine is located within Zone 3 (Gunnedah line) of this three zone network and is situated on a single line railway. The capacity analysis summarised in the Hunter Valley, Corridor Capacity Strategy is correlated to forward contract and prospective volumes, of which ARTC utilises peaking and average paths for the Gunnedah line.

Cumulative rail movement assessment of the Gunnedah line West of Muswellbrook is incorporated in contracted and prospective coal volume based assessments of required capacity. The prospective coal throughput scenario is inclusive of Greenfield projects and Brownfield expansion projects along this corridor, including the projects listed in the 2015-2024 Hunter Valley Corridor Capacity Strategy. Daily rail movement accumulation of Zone 3, inclusive of the average 5.8 round trips per day between Narrabri and Boggabri, is provided below.

Narrabri to Muswellbrook	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Average Daily Paths	9.2	10.5	12.3	13.5	14.3	14.8	15.0	15.5	17.0	17.3
Peak Daily Paths	13.5	15.5	18.1	19.8	21.1	21.8	22.2	22.9	25.1	25.6

ARTC is of the opinion that the movement of ~11Mtpa of coal product from the Narrabri Mine would rest within the currently approved peak and average daily movement limits for this section per day. ARTC notes however that dependant on other network considerations and other Access Holders' contractual movements, additional capacity for the entire zone could be required to ensure total zone capacity is available.

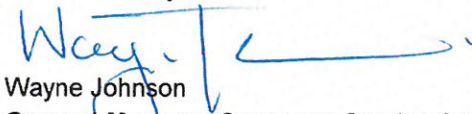
ARTC

ARTC utilises existing mechanisms within the Hunter Valley Access Undertaking (HVAU) to identify, plan and increase network capacity as and when required to meet these ongoing network and contractual requirements. This process has been deemed to be effective in reviews of the HVAU and ARTC can confirm that sufficient capacity would or could be made available for the Narrabri Mine modification.

In forming this opinion, ARTC does not factor in peak movement requirements for each coal mine operation that are to be achieved on any one day. The peak paths analysis is calculated as a function of the adjustment factor allowing for maintenance, cancellations and Target Monthly Tolerance Cap (TMTC) across all Access Holders.

If there are any other queries related to this project and the relationship with the ARTC Zone 3 (Gunnedah line) capacity pathway, please contact me to discuss.

Yours sincerely



Wayne Johnson
General Manager Customer Service & Operations