Hansen Bailey

ENVIRONMENTAL CONSULTANTS

9 December 2014

Manager Mining Projects
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Mike Young

Dear Mike,

BENGALLA CONTINUATION PROJECT (SSD 5170)
ADDITIONAL INFORMATION REQUEST

1 INTRODUCTION

We refer to the Department of Planning & Environment's (DP&E) letter dated 25 November 2014 which requests additional information on two issues in relation to the Bengalla Continuation Project (the Project). That is:

1. *"Sufficient information on the predictions for project-alone 24 hour PM_{10} concentrations for vacant land to allow the Department to determine the properties that may be entitled to acquisition in accordance with the NSW Government's 'Voluntary Land Acquisition and Mitigation Policy'"* undated but available on 18 November 2014 (referred to as the '**Draft Policy**'); and

2. *"Reasonable and feasible options for minimising the size of the final void, including details about the economic, operational and cost and benefits of the options considered*."

DP&E's letter is reproduced in **Appendix A**. A response to each issue is provided below in **Section 2** and **Section 3**.

Suggested amendments to the draft Development Consent conditions (draft conditions) as appended to the 'Secretary's Environmental Assessment Report' (EA Report) dated 12 November 2014 as they relate to this letter are also discussed in **Section 4**.

2 AIR QUALITY – PM10 (24 HR)

2.1 CRITERION

2.1.1 Precedent Criterion

The 'Continuation of Bengalla Mine Environmental Impact Statement' (Bengalla EIS) (Hansen Bailey, 2013) included a comprehensive assessment of air quality impacts including PM_{10} (24 hour) project alone.

The Bengalla EIS applied the following PM_{10} (24 hr) project alone acquisition criterion to the Project, which was consistent with DP&E practices in the Upper Hunter and applies to adjacent Mt Arthur Operations and Mangoola Mine which have each been granted project approval modifications consistent with this existing acquisition 'precedent criterion' during 2014:

- PM_{10} (24 hr) criterion of 50 µg/m^3 applied incrementally (i.e. project alone) at a residence at the 98.6th percentile (i.e. exceeded on greater than 5 occasions in any year).

2.1.2 Draft Policy

Table 1 of the Draft Policy for PM_{10} (24 hr) acquisition criterion includes:

- PM_{10} (24 hr) criterion of 50 µg/m^3 applied incrementally (i.e. project alone) at a residence; and at over 25% of land (where a residence is able to be constructed under a valid planning control).

The Draft Policy was placed on public exhibition for 2 weeks to 2 December 2014. It should be noted that that the Draft Policy could be amended in response to public consultation comments.

However, this Report considers the Draft Policy which was placed on public exhibition.

2.2 EIS RESULTS FOR PROJECT ALONE PM10 (24 HR)

2.2.1 Receivers

Predictions

The dispersion modelling predictions presented in the EIS Appendix G Air Quality and Greenhouse Gas Impact Assessment (AQIA) (Todoroski Air Sciences, 2013) indicated the potential for elevated dust levels to occur at nearby sensitive receptor locations for only a few brief periods during the assessed years.

Predictive / reactive mitigation strategies that would reduce these short term elevated dust levels were proposed in the AQIA and BMC has committed to implementing these strategies. The potential effects of the proposed strategies in reducing the predicted dust levels were not explicitly assessed in the AQIA EIS modelling which is consistent with contemporary practice.

Table 31 of the Bengalla EIS (Hansen Bailey, 2013) lists (amongst other air quality predictions) all properties which are predicted to exceed PM_{10} 24 hour 'project alone' 50 µg/m^3 and also indicates the number of days anticipated to be exceeded under that particular modelled scenario.

Table 1 applies the Draft Policy criterion. It indicates privately-owned receivers (i.e. residences) where the criterion is predicted to be exceeded over 1 day per year (for each of the five scenarios modelled) and includes results from the EIS AQIA (Todoroski Air Sciences, 2013). Blank cells indicate no exceedance is predicted.

An asterisk (*) denotes a property which currently has acquisition rights upon request from another mining company (i.e. other mining operations have predicted exceedances of criterion from that project). Receivers which BMC has previously indicated are predicted to exceed noise and cumulative air quality criteria in the EIS modelling are also indicated in the last 2 columns – ZOA (Zone of Affectation properties).

Table 1

EIS Predicted Exceedances of PM_{10} (24 hr) (50µg/m^3) Project Alone at Receivers

ID	Name	Prediction (days) Year 1	Prediction (days) Year 4	Prediction (days) Year 8	Prediction (days) Year 15	Prediction (days) Year 24	Project cumulative AQ ZOA	Project Noise ZOA
29	Jabetin Pty Ltd		53 (1)	57 (1 d)				
114*	JM Wild					58 (1 d)		Y
118*	E & WJ Rankin				62 (4)	67 (8)	Y	Y
119*	E & WJ Rankin					51 (3)	Y	Y
155*	PG & CM Lane					59 (6)		Y
156S	NJ & RH Ellis					60 (9)		Y
156E	NJ & RY Ellis					52 (2)		Y
161	RB & SA Parkinson					63 (2)		
166*	BA & TE Strachan			52 (1)	52 (1)	92 (44)	Y	
168*	JB Moore		56 (13)	90 (46)	83 (55)	211 (166)	Y	Y
169*	JB Moore				52 (1)	88 (57)	Y	
171*	BL & ML Bates			60 (10)	54 (3)	109 (83)	Y	
222	JD Vandenberg					55 (1)		
230	GC Sparre					80 (3)		
286	IJ & CM Richards					55 (1)		

Discussion

When private properties with rights to acquisition by another mining company (Receivers 114, 118, 119, 155, 166, 168, 169 and 171) or with predictions of exceedance of noise or cumulative air quality acquisition criteria (Receiver 156S, 156E) are excluded, **five** additional privately-owned residences are predicted to exceed the PM_{10} (24 hr) 50 µg/m^3 criterion of the Revised Policy (coloured grey).

As shown in **Table 1**, four of these (Receivers 161, 222, 230 and 286) are predicted to exceed PM_{10} (24 hr) 50 µg/m^3 in one modelled scenario only (Year 24):

- Receivers 222 and 286 are predicted to exceed the criterion by 5 µg/m^3 on 1 day;
- Receiver 161 is predicted to exceed the criterion by 13 µg/m^3 on 2 days; and
- Property 230 is predicted to exceed the criterion by 30 µg/m^3 on 1 day.

The fifth, Receiver 29 is predicted to experience exceedances between Years 4 and 8 on only one day per year and within 3-7 µg/m^3 of the criterion.

2.2.2 Land

No predictions for the assessment of PM_{10} (24 hr) 50 µg/m^3 over 25% of land were presented in the Bengalla EIS (Hansen Bailey, 2013) as it was not consistent with precedent criterion.

Table 2 provides a summary of where the PM_{10} (24 hr) 50 µg/m^3 project alone contour from the conservative Bengalla EIS modelling (i.e. combined all modelling scenarios for 24 years of operations without the proposed predictive and real-time system controls incorporated) is predicted to exceed the criterion on greater than 1 day over 25% of any contiguous land in a single ownership (excluding private properties in another mining company's ZOA or the Project ZOA listed in **Table 1**). This has been extrapolated from Figure 31 of the EIS.

Table 2
EIS Predicted Exceedances of PM_{10} (24 hr) (50 µg/m^3) Project Alone over 25% of a Contiguous land ownership

ID	Name	Comment **
215 & 216*	JH & CM Almond	No residence on either block.
220*	AJ & LL Martin	No residence on block 220.

** Located in West Muswellbrook AL19.*

*** Excludes residences in **Table 1**.*

In its EIS, BMC has committed to enhancing the existing real time environmental monitoring system for air quality and noise and the implementation of a best practice predictive and real-time system. Consistent with the existing operation, this will enable BMC, through the implementation of best practice, to avoid exceedances of PM_{10} 50 µg/m^3 (24 hr) incremental criterion by utilising the system's predictive capabilities to plan forward and/or modify operations under particular meteorological conditions where a potential to impact private receivers above the criterion is predicted.

2.3 REVISED RESULTS FOR PROJECT ALONE PM10 (24 HR)

A revised Air Quality Assessment been undertaken by Todoroski Air Sciences to model the predicted air quality impacts for PM_{10} (24 hr) inclusive of the use of the revised predictive and reactive real time air quality management system (see **Appendix B**). All other dust mitigation measures included in the model remain consistent with that included in the AQIA.

2.3.1 Receivers

An analysis of the AQIA meteorological conditions utilised for the predictions for PM_{10} (24 hr) found that potentially elevated dust levels occurred infrequently for a few hours at a time under poor air dispersion conditions when the wind was blowing from Bengalla towards sensitive receivers in the north west (for further discussion see **Appendix B**).

A comparison of the predicted 24-hour average PM_{10} levels with and without the implementation of a reactive dust mitigation strategy was completed for Year 4, 8 and 24 respectively at residences (see **Table 3**). **Bold** values denote a predicted exceedance of the criterion.

Results demonstrate that with the use of the predictive/ reactive mitigation strategy, air quality impacts would not exceed the 24-hour average PM_{10} criterion of 50 µg/m³ at any receiver (residence) location (except the new receiver 167 which is predicted to exceed the criterion in Year 24 only).

Table 3
Revised Modelling Predicted PM_{10} (24 hr) at Selected Sensitive Receivers (µg/m³)

Receptor ID	Year 4		Year 8		Year 24	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
29	**53**	34	**57**	38	-	-
156S	-	-	-	-	**60**	48
156E	-	-	-	-	**52**	40
161	-	-	-	-	**63**	47
167*	-	-	-	-	**56**	**54**
222	-	-	-	-	**55**	35
230	-	-	-	-	**80**	39
286	-	-	-	-	**55**	27

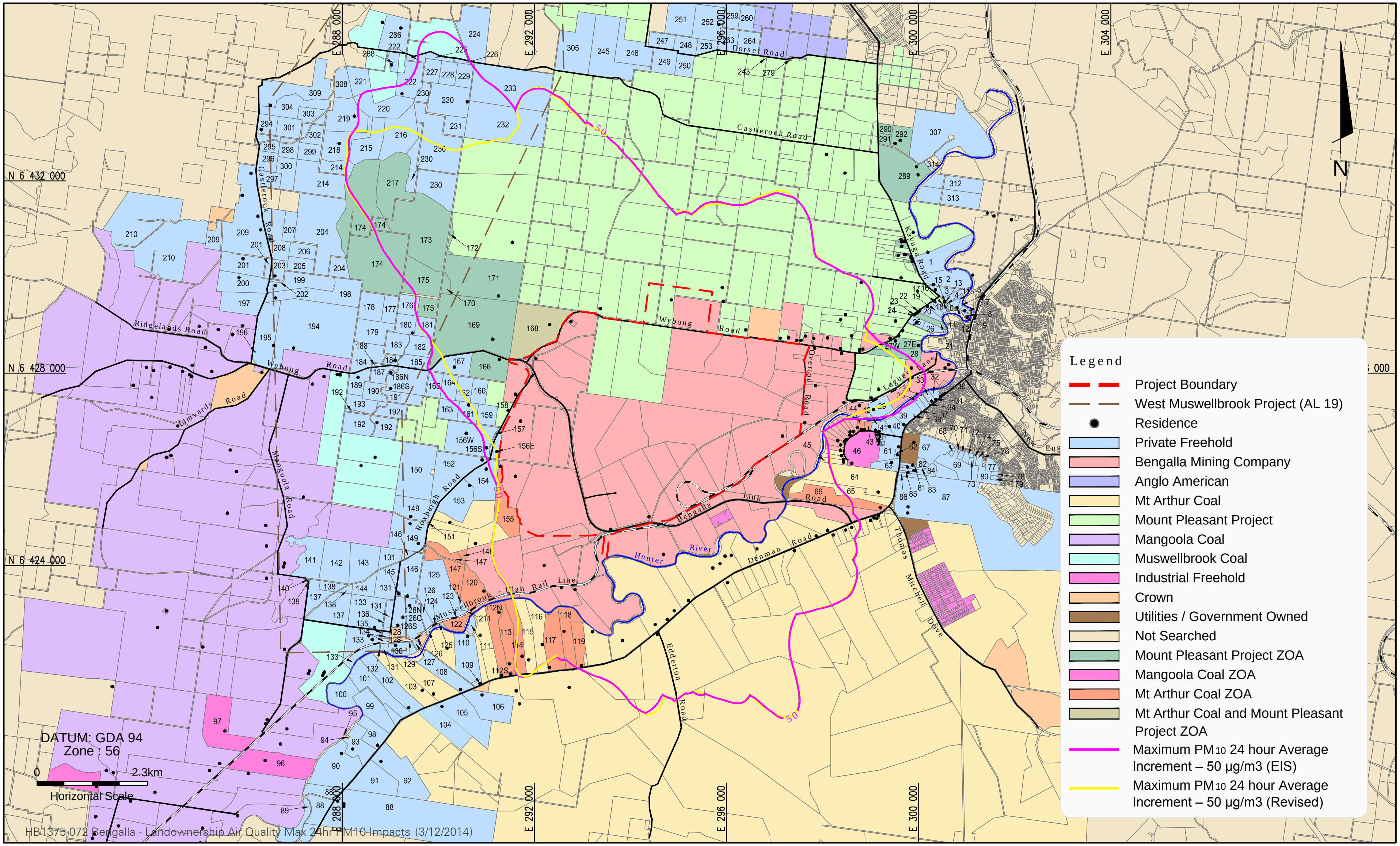
** Receiver 167 has a residence (constructed during the EIS process).*

2.3.2 Land

Table 4 provides a summary of where the revised modelling indicates the PM_{10} (24 hr) 50 µg/m³ project alone contour indicates an exceedance of the criterion on greater than 1 day over 25% of contiguous land in a single land ownership (excluding private properties in another mining company's ZOA or the Project ZOA). The revised contour and EIS Figure 31 PM_{10} (24 hr) 50 µg/m³ contour is shown on **Figure 1**.

Table 4
Revised Modelling Predicted PM_{10} (24 hr) over 25% of Contiguous land in a single landownership

ID	Name	Exceed Criterion (50 µg/m³)	Notes
29	Jabetin Pty Limited	Year 4 & Year 8	Not impacted above criterion at residence.
225-233	GC Sparre	Year 24	Residence on block 230 not impacted.
159-165, 186-187, 190-191	RB & SA Parkinson	Year 24	Residence on block 161 not impacted.
215 & 216	JH & CM Almond	Year 24	No residence on land.



BENGALLA MINE

Maximum 24hr PM_{10} Impacts

BENGALLA

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2.3.3 Conclusion

The Bengalla EIS anticipated that during operation potential short-term dust impacts would be unlikely, however any potential short term effects would be effectively managed through the proposed predictive/reactive dust mitigation system. The proposed predictive/ reactive dust mitigation system will utilise a combination of predictive dust forecasting tools with real-time ambient dust monitoring to identify in advance when elevated short term impacts are likely to occur and thus allow BMC to take actions to reduce dust levels at these times. The actions applied may include the relocation of mobile equipment or temporary cessation of mining activities during periods of potential impact.

Real-time dust monitors with an appropriate trigger alarm feature will be commissioned to inform operations when actions to reduce dust may be needed.

Residences

Table 5 shows the combined Residences predicted to receive impacts above the criterion combined from **Table 1** & **Table 3**.

The revised modelling indicates that BMC will be able to manage mining operations and potential impacts on a daily basis to ensure it meets the Draft Policy's PM_{10} (24 hr) 50 µg/m^3 project alone criterion at all residences (with the exception in Year 24 at Receptor 167).

Table 5
Combined Predicted Exceedances of PM_{10} (24 hr) (50µg/m^3)
Project Alone at Receivers

ID	Name	Prediction (days) Year 1	Prediction (days) Year 4	Prediction (days) Year 8	Prediction (days) Year 15	Prediction (days) Year 24	Project cumulative AQ ZOA	Project Noise ZOA
114*	JM Wild					58 (1 d)		Y
118*	E & WJ Rankin				62 (4)	67 (8)	Y	Y
119*	E & WJ Rankin					51 (3)	Y	Y
155*	PG & CM Lane					59 (6)		Y
156S	NJ & RH Ellis					60 (9)		Y
156E	NJ & RY Ellis					52 (2)		Y
166*	BA & TE Strachan			52 (1)	52 (1)	92 (44)	Y	
168*	JB Moore		56 (13)	90 (46)	83 (55)	211 (166)	Y	Y
169*	JB Moore				52 (1)	88 (57)	Y	
171*	BL & ML Bates			60 (10)	54 (3)	109 (83)	Y	
167	RJ & SA Lane					54 (x)		

** In another mine's existing ZOA.*
X – not calculated.

Contiguous Land with Residence & Vacant Land

Table 6 indicates the combined contiguous land with residences and vacant land predicted to receive impacts above the criterion combined from **Table 2** & **Table 4**.

Table 6
Combined Predicted Exceedances of PM_{10} (24 hr) (50 µg/m^3) Project Alone over 25% of a Contiguous land ownership

ID	Name	Impacted Year	Comment **
29	Jabetin Pty Limited	Year 4 & Year 8	Not impacted above criterion at residence.
117	E Rankin	Not Modelled	Not modelled under 'mitigation'. Already in BMC AQ ZOA for TSP. In Mt Arthur Coal ZOA also.
225-233	GC Sparre	Year 24	Residence on block 230 not impacted.
159-165, 186-187, 190-191	RB & SA Parkinson	Year 24	Residence on block 161 not impacted.
215 & 216	JH & CM Almond	Year 24	No residence on land.

** Located in West Muswellbrook AL19.*
*** Excludes residences in **Table 1**.*

<u>Contiguous Land with Residence</u>

The revised modelling shows that at Properties Sparre (225-233) and Parkinson (159-165, 186-187 & 190-191) although not predicted to exceed at the existing residence, are predicted to exceed greater than 25% of the contiguous land in at least 1 day in Year 24.

Jabetin (29) although not predicted to exceed at the existing residence, are predicted to exceed greater than 25% of the contiguous land in at least 1 day in Year 4 & 8.

<u>Vacant Land</u>

The revised modelling indicates that should the owners of vacant lots 215 & 216 construct a dwelling on the property in the future (in accordance with a valid planning control), dependant on the location, BMC has a potential to exceed 50 µg/m^3 project alone criterion in Year 24.

2.3.4 Air Modelling Commentary

The revised modelling demonstrates that exceedances of incremental 24-hour PM_{10} 50 µg/m^3 are sensitive for a matter of hours in a day (and in most cases not predicted until Year 24). BMC will be able to modify its operations as required, through the implementation of the predictive real time monitoring and alarming system. In addition, the Draft Consent provides for the revision of the Bengalla Mine Air Quality Management Plan which will include the detail of the development and implementation of the predictive system and upgraded air quality monitoring program which adequately supports proactive and reactive approach to air quality management.

The Draft Policy requires modelling of PM_{10} (24 hr) project alone against the criterion of 50 PM_{10} µg/m^3. This revised modelling demonstrates the application of management and mitigation strategies employed by the operation in relation to PM_{10} 24 hr impacts which was not undertaken for the EIS. The nature of this modelling is inherently complex and sensitive and is developing. BMC is continuing to refine the modelling approaches to this criterion and anticipate that with this refinement, predictions for properties in **Table 5** and **Table 6** may be subject to change.

3 FINAL VOID JUSTIFICATION

3.1 OVERVIEW

The Bengalla EIS (Hansen Bailey, 2013) presents the following position with regard to the Project conceptual final landform:

> '*an additional coal resource is known to occur west of the Disturbance Boundary however is not proposed to be extracted as part of the Project. It is anticipated that subject to market factors and resource confirmation, BMC will seek the relevant approval for the extraction of these additional resources in the future. However, should a future approval not be sought or approval not be granted, a single final void has been developed for the Project following the completion of mining in Year 24.'*

The single final void described above was presented and assessed in the Bengalla EIS (Hansen Bailey, 2013) as a component of the Conceptual Final Landform (EIS Figure 68) and reproduced on **Figure 2**.

A detailed justification and discussion as to how the final void was derived was also included in the Bengalla EIS (Hansen Bailey, 2013) and subsequent *Continuation of Bengalla Mine Response to Submissions* (RTS) (Hansen Bailey, 2014). This justification included discussion in relation to alternative options also considered prior to the finalisation of the Project mine plan.

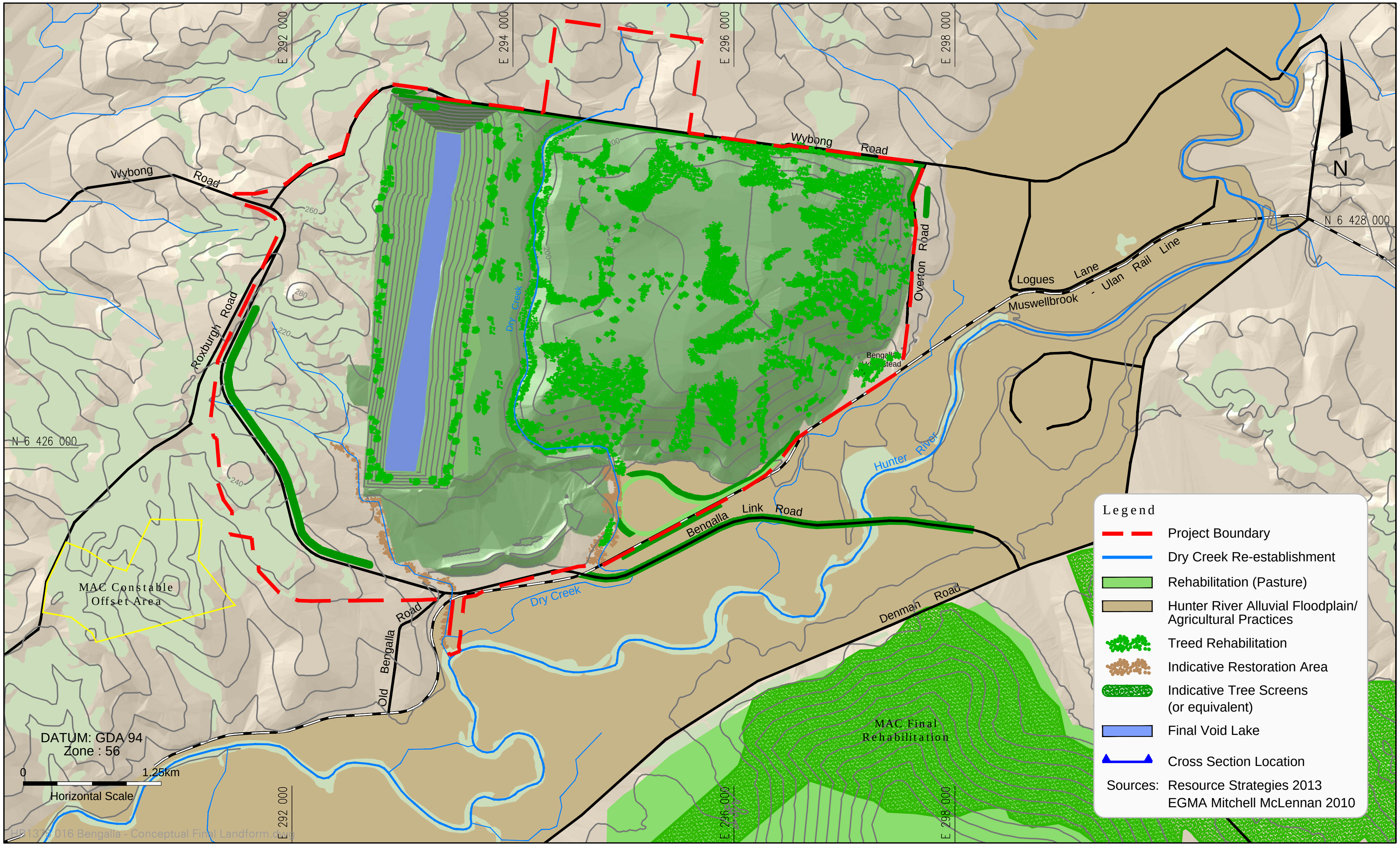
A summary of the potential alternatives considered as part of a detailed Palaris Final Void Rehabilitation Report (Palaris, 2012) is provided. An additional alternative final void option was also considered (which has not previously been presented in the EIS). This is now discussed with further information on other options in order to clearly demonstrate that the proposed final void is the most reasonable and feasible final void option for the Project.

3.2 ALTERNATIVES CONSIDERED

A number of options for final void development and rehabilitation were considered during the development of the Project mine plan. An assessment of each option considered the economic costs and environmental constraints associated with each, including overburden volumes, overburden rehandle requirements and the potential coal resource sterilisation.

The options considered the following alternatives for the development of a final void (this first three of which are presented in the EIS):

1. Option 1 – 'Blast and Doze' to a stable final landform (the Project);
2. Option 2 – Backfill the void to the original surface level;
3. Option 3 – Backfill to re-establish natural drainage; and
4. Option 4 – Raise the pit floor in last six strips.



BENGALLA MINE

Revised Conceptual Final Landform

BENGALLA

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3.2.1 Option 1 – Blast & Doze to Stable Landform (Preferred Option)

Option 1 considered utilising the 'Blast and Doze' method in combination with backfilling to shape the final void. Approximately 4 million loose cubic metres (Mlcm) of waste will be required to backfill the upper surfaces of the final highwall as in some areas the upper bench is above the level required for a consistent slope. A total of 9 Million bank cubic metres (Mbcm) of waste in the highwall and endwalls will be required to be drilled and blasted to achieve a consistent angle. Approximately 14 Mlcm of waste will be required to be dozed in the highwall, endwall and low walls to ensure a consistent slope angle within the final void.

The base of the dozed final void would be approximately 20 m above the base of the original void with depths ranging from RL 180 m to 240 m. An estimated cost to complete this option has been calculated using an excavator and trucks for rehandle of the upper benches, drill and blast to achieve the slopes below the final highwall and endwall and dozers for total reshaping. This option using the 'Blast and Doze' method was nominated for the development of the final void in consideration of economic cost and environmental constraints associated with each, including overburden volumes, overburden rehandle requirements and the potential coal resource sterilisation. This option is reflected in the conceptual final landform shown on **Figure 3**.

Section 8.21.7 of the EIS Option 1 is the preferred option for the Project should no further approvals to continue mining be sought or granted beyond Year 24. The final void will be stabilised in the following manner (following consultation with relevant regulators):

- The low wall will be battered back from the angle of repose to ensure the long term geotechnical stability of the face, with the determination of geotechnical stability and recommendations as to the final slope undertaken by a qualified geotechnical engineer;
- The final void will have the majority of the highwall blasted back to improve the safety and stability to an angle of repose of between 23 and 25 degrees;
- The endwalls proposed for the final void will be blasted back to improve the safety and stability to an angle of repose of approximately 33 degrees;
- Surface water drainage on and over the low wall will be minimised through the construction of drainage control structures which diverts the catchment where possible away from the final void and back into the surface water drainage system; and
- Erosion of the low wall will be controlled by limiting the length of slope through the use of contour drains and by the establishment of suitable vegetation.

The above features are highlighted in **Figure 3** which also shows the final dozed profile of the final void. The base of the dozed final void is approximately 20 m above the base of the original Year 24 Mine Plan with depths ranging from 180 m to 240 m.

A cost of $44 Million (M) (all costs in this response are at 2012 $AU) has been estimated to complete this option using an excavator and trucks for rehandle of the upper benches, drill and blast to achieve the slopes below the final highwall and endwall and dozers for total reshaping.

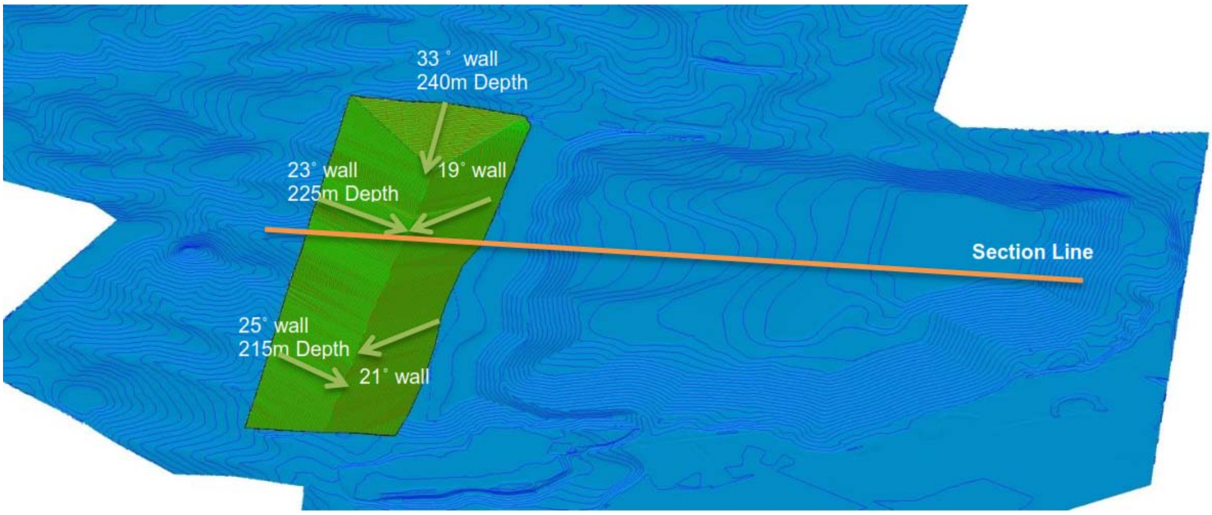

Figure 3
Project Final Void (Option 1)

3.2.2 Option 2 – Backfill the void to the Original Surface Level

Option 2 analysed backfilling the void to original surface level and is the most unreasonable and costly option considered. This option would require the rehandle of overburden material from the OEA after coal extraction has been completed. The required volume to backfill the void to original surface level has been calculated to be 339 Mlcm. This material would be required to be sourced from the already rehabilitated and shaped OEAs and would require the rehandle of 785 ha of shaped material (see yellow area on **Figure 4**).

This option was rejected as it was deemed not economically feasible. It would also result in the disturbance of future rehabilitation.

An estimated cost of $1,017 M to complete this option has been calculated using an excavator and trucks to move the waste back into the void.

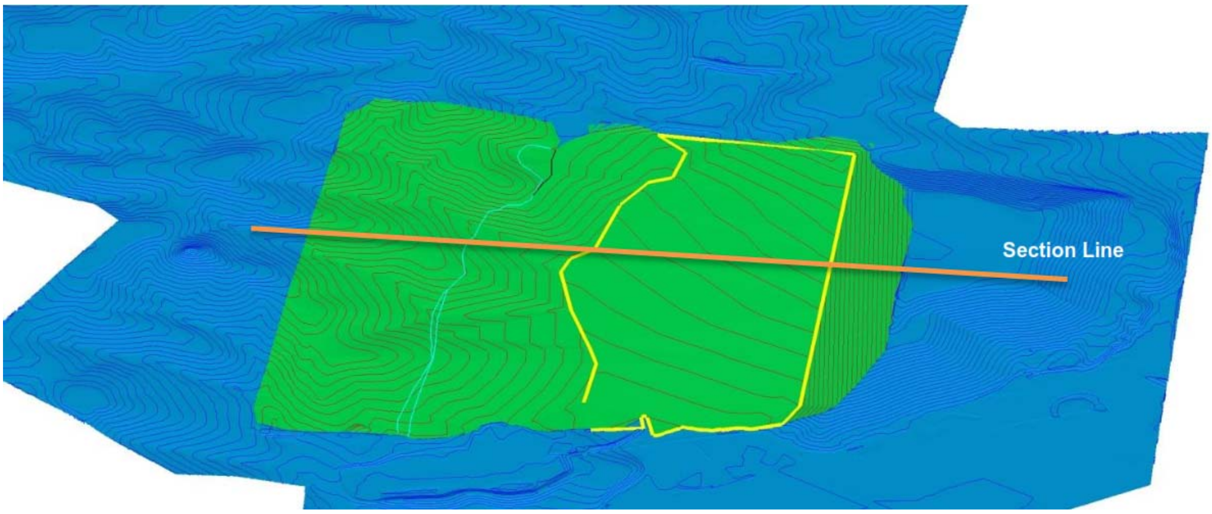

Figure 4
Back Fill to Original Surface (Option 2)

3.2.3 Option 3 - Backfill to re-establish Natural Drainage

Option 3 considered the minimum backfill required to fill the void and maintain drainage so that the final surface does not hold water. This option requires 292 Mlcm of backfill. No dozer push is required for this option as the 10 degree slopes can be formed as part of the dumping operation, rather than pushing down from the highwall (see **Figure 5**).

However, this option was rejected as it was deemed not economically feasible and, as with Option 2, would also result in disturbance of future rehabilitation.

An estimated cost to complete this option has been calculated at $876 M using an excavator and trucks to move the waste back into the void.

Figure 5
Minimum Back Fill (Option 3)

3.2.4 Option 4 - Raise the Pit Floor in Last Six Strips

Another option considered was to adjust the mine plan to raise the pit floor during the last six strips in order to reduce the size of the final void and hence reduce the amount of rehandle required to backfill the final void. This option would reduce the open pit void at the end of mining by 217 Mlcm (to 122 Mlcm). **Figure 6** presents a reduced final void with the pit floor raised to the Vaux seam (VA1C2 ply).

The available waste in the area from the open void to the Dry Creek alignment using the 'free draining' surface as a floor is 28.5 Mlcm. This indicates that the spoil room generated by lifting the floor cannot be effectively utilised, as the bulk of the waste that has been emplaced above the "free draining surface" occurred early in the mine life.

This method to reduce the size of the final void also sterilises coal. Raising the floor to the Vaux seam would sterilise over 4 Mt of ROM coal per strip (total of 24.89 Mt of ROM coal), which had an average excellent strip ratio of 2.3:1 bcm/t.

The cost of moving the overburden material back into the void would be higher, due to the increased haul distances involved and has been calculated at approximately $488 M.

This option would result in the loss of the maximum recovery of a valuable coal resource in an area that has long been set aside for mining by the NSW government on land acquired by BMC for the specific purpose of the continuation of coal mining.

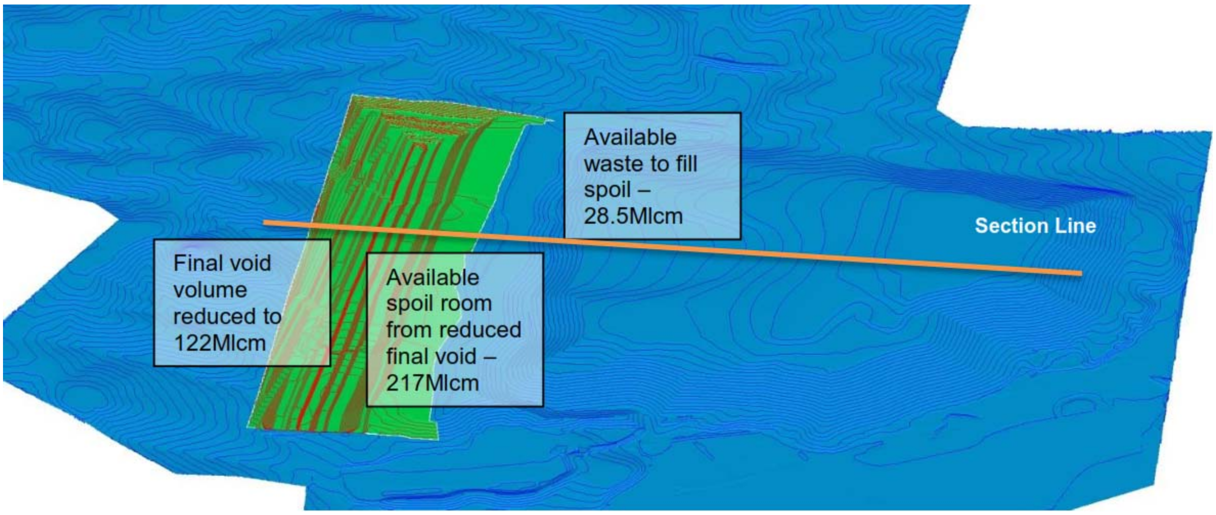

Figure 6
Raise Pit Floor (Option 4)

3.3 FINAL VOID CONCLUSION

An additional coal resource is known to occur generally to the west of the Disturbance Boundary that, subject to market factors and resource confirmation, BMC will seek the relevant approval for the extraction of these additional resources in the future. However, should a future approval not be sought or approval not be granted, a single final void has been developed for the Project following the completion of mining in Year 24 (Option 1).

The detailed final void options analysis undertaken indicated that the Project Conceptual Final Landform (Option 1) will require significant financial contribution (estimated at $44 M) to complete the necessary earthworks.

Table 7 presents a comparison of the costs estimates associated with Option 1 with comparison to each of the alternative final void options discussed in this letter.

Table 7 identifies that the alternative options considered for the final void would result in a significant increase in the cost of completion of the works. Not only would there be significant additional financial costs associated with these alternative options, the following implications would also be realised:

- Options 2 - 4 would result in the backfilling of the void either entirely or partially which would impede any future approvals (should it be sought);
- Options 2 - 4 would result in significant rehandle of emplaced overburden and disturbance of established rehabilitation when compared to Option 1. Associated with additional rehandle of overburden would be additional environmental implications and costs primarily associated with amenity impacts; and
- Option 4 would result in the reduction in the scheduled Project ROM coal extraction levels by approximately 25 Mt.

With consideration of economic cost and environmental constraints associated with each, including overburden volumes, overburden rehandle requirements and the potential coal resource sterilisation, Option 1 associated with the developed of a single stable final void provides the best overall outcome for the environment and community.

As committed to in the Bengalla EIS and RTS, should a future approval not be sought and/or granted, BMC will develop in consultation with relevant regulators, a Rehabilitation Management Plan within 7 years of mine closure. When complete, the Rehabilitation Management Plan will detail specific management actions associated with the development of the Option 1 final landform.

Table 7
Final Void Options – Cost Comparison

Final Void Option	Waste Volume (Mlcm)	Total Waste Cost ($M)
Blast & Doze (Option 1)	27	44
Backfill to Original Surface (Option 2)	339	1,017
Minimum Backfill (Option 3)	292	876
Raise Pit Floor (Option 4)	122	488

** All costs in this response are at 2012 $AU)*

4 DEVELOPMENT CONSENT AMENDMENTS

This section of the response details suggested amendments to the draft development consent relevant to air quality for DP&E's consideration.

4.1 SCHEDULE 3 TABLES 1 – 3

Table 1 of the draft development consent conditions should be amended as follows:

- Since the publication of the EIS and RTS, it is noted that Receptor ID 110S should be positioned south of the location shown in the EIS on Block ID 109. Property (109) (with a residence) would be subject to acquisition (upon request) due to the impacts equivalent to that depicted for 110S in relation to slight exceedances of cumulative PM_{10} 30 µg/m^3 in Year 24 as identified in the EIS.
- Property 164 is currently listed in Table 1 as predicted to exceed relevant noise criteria. The EIS does not predict any exceedances of noise criteria for this receiver. As such, this property should be removed from Table 1.

Tables 1 to 3 of the draft development consent conditions and their notes will be required to be updated

4.2 SCHEDULE 3, CONDITION 17

Table 9 of the draft development consent conditions and its notes will be required to be updated.

4.3 SUMMARY

When the Final Policy is formally issued (following consideration and incorporation of consultation from the public exhibition which closed on 2 December 2014), the modelling in this report may be updated and various draft development consent conditions will require review. Further, as discussed in **Section 2.3.4**, this may also require further refinement of the model.

5 CONCLUSION

We trust this letter adequately responds to DP&E's issues. Should you have any queries in relation to this letter, please do not hesitate to contact us on 02 6575 2000.

Yours faithfully
HANSEN BAILEY

Jason Martin	Dianne Munro
Senior Environmental Scientist	*Principal*

Appendix A

Letter from DP&E dated 25 November 2014

NSW GOVERNMENT | Planning & Environment

Resource Assessments
Contact: Kane Winwood
Phone: (02) 9228 6298
Fax: (02) 9228 6466
Email: kane.winwood@planning.nsw.gov.au

Mr Craig White
Bengalla Mining Company Pty Limited
Locked Mail Bag 5
MUSWELLBROOK NSW 2333

Dear Mr White

Bengalla Continuation Project (SSD 5170)
Additional Information Request

As you would be aware, the Department of Planning and Environment has completed its preliminary assessment of the merits of the Bengalla Continuation Project, and has forwarded its assessment to the Planning Assessment Commission (PAC) for review.

While the Department has recommended approval of the project, subject to strict conditions, the Department's preliminary assessment has also identified a number of issues that warrant further consideration.

In this regard, it would be appreciated if you would provide the following additional information to the Department as soon as practicable:

- sufficient information on the predictions for project-alone 24-hour PM_{10} concentrations for vacant land to allow the Department to determine the properties that may be entitled to acquisition in accordance with the NSW Government's *Voluntary Land Acquisition and Mitigation Policy* (see attached); and
- reasonable and feasible options for minimising the size of the final void, including details about the economic, operational and environmental cost and benefits of the options considered.

The Department's assessment also identified that the project is predicted to result in significant exceedances of the noise and/or dust criteria at a number of nearby private residences. In accordance with the *Voluntary Land Acquisition and Mitigation Policy*, BMC is encouraged to use its best endeavours to negotiate with these potentially affected landowners to either acquire the land and/or enter into a negotiated agreement with the landowners. This process should commence immediately, and be resolved to the greatest extent practicable, prior to the determination of the development application.

In the meantime, I recommend that you contact the Department to clarify what information should be provided, the likely timing for providing this information, and how this information would be integrated into the assessment process for the project.

I have arranged for Mr Kane Winwood to assist you in this regard.

Yours sincerely

Michael

25.11.14

Mike Young
Manager
Mining Projects

Appendix B

Bengalla Continuation – Dust Mitigation Strategy for Short-term Dust Impacts

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5 December 2014

Dianne Munro
Principal
Hansen Bailey
Via email: dmunro@hansenbailey.com.au

RE: Bengalla Continuation – Dust mitigation strategy for short-term dust impacts

Dear Dianne,

Todoroski Air Sciences has quantitatively assessed the effectiveness of the predictive/reactive dust mitigation strategies proposed by the Bengalla Mine to minimise potential short-term dust levels at receptors due to the mine. This letter provides an update to the previous modelling results which did not quantify the dust levels that would arise from the use of predictive/ reactive dust management strategies.

Background

The dispersion modelling predictions presented in the *Air Quality Impact and Greenhouse Gas Assessment Continuation of Bengalla Mine* **(Todoroski Air Sciences, 2013)**, (AQIA) indicated the potential for elevated dust levels to occur at nearby sensitive receptor locations for only a few brief periods during the assessed years. Predictive/ reactive mitigation strategies that would reduce these short term elevated dust levels were proposed in the AQIA, and the mine committed to implementing the strategies. The potential effects of the proposed strategies in reducing the predicted short-term (24-hour) dust levels were not explicitly assessed in the AQIA as the predicted elevated 24-hour average levels at all but two receptors (156s and 161) were in compliance with the then applicable criteria for project approval.

However, in November 2014, the NSW Government changed its policy, making the air quality criteria for mining projects more stringent. Per the current draft of the new revised policy (assuming the version current as at 24 November 2014), (Integrated Mining Policy) there is now potential scope that the predicted elevated levels in the AQIA may exceed the new criteria at a significant number of receptors. This is because the new criteria does not permit any 24-hour average PM_{10} level above $50\mu g/m^3$ due to the mine in isolation.

The new policy also outlines the potential need to acquire vacant land that is partially affected by a mining project. It is noted that the current draft of the new IMP policy sets up a situation that may conflict with other pertinent policy, such as the EPA Approved Methods guidelines.

Thus it is considered prudent to quantify whether the new criteria would be met by the proposed Project when the originally proposed strategies are considered in the modelling results. These strategies have thus been considered at the receptors that the new policy indicated may be affected.

Original Assessment

The AQIA **(Todoroski Air Sciences, 2013)** outlined that at some receptors, elevated short term dust levels due to the mine occurred in the predicted results largely due to a combination of the conservative estimates of dust emissions, the alignment of the fixed positions of the modelled mining activities (the sources were in alignment in a row such that a south east wind would exaggerate the impact affecting receptors to the north west) and the inherent conservative nature of the regulatory model used. All of these factors meant that the predicted results would tend to over-estimate the likely actual emissions which may occur in the real-world.

It was anticipated that during the actual operation of the mine, potential short-term dust impacts would be unlikely, however any potential short term effects would be effectively managed through a predictive/ reactive dust mitigation strategy.

The proposed predictive/ reactive dust mitigation strategy would utilise a combination of predictive dust forecasting tools with real-time ambient dust monitoring to identify in advance when elevated short term impacts are likely to occur and thus allow the mine to take actions reduce dust levels at these times. The actions applied may include the relocation of some equipment or the temporary cessation of mining activities during periods of potential impacts.

Such strategies have been developed by TAS for a number of mines. The strategies have operated at coal mines in the Hunter Valley for several years, and have proven success in mitigating potential short term impacts.

Assessment

The receptor locations with potential to exceed the new short-term PM_{10} criteria were examined to evaluate the effectiveness of the proposed predictive/ reactive dust mitigation strategy for the proposed Project, (see **Figure 1**). These included Receptor 29 to the east of the mine in Year 4 and Year 8 and at Receptors 156S, 156E, 161, 167, 222, 230 and 286 in areas to the west and northwest of the mine in Year 24.

An assessment of vacant land was also conducted per the current draft of the IMP, however given the short time available between the announcement of the new IMP and the scheduled PAC hearing it has not been possible to conduct ta suitable modelling assessment that would correctly present the actual impact reductions that the already proposed mitigation strategy would achieve on vacant land.

The original AQIA air dispersion modelling results, without predictive/ reactive mitigation strategies in place, were initially examined. An analysis of the meteorological conditions found that potentially elevated dust levels occurred infrequently for a few hours at a time under poor air dispersion conditions when the wind was blowing from the mine to the receptors (see **Figure 2**).

It is important to note that it is inappropriate to limit mine operations on the basis of a specified range of wind speed and wind direction values. The reason for this is that wind speed and wind direction are only indicators of air dispersion, and there may only be poor air dispersion (and potentially elevated dust as a result) for a small fraction of the time that the wind is in the specified wind speed and wind direction range, and in any case this would be constantly changing as the position of mining activity moves over time relative to a receptor. Because wind speed and wind direction conditions are generally poor indicators of air dispersion conditions and hence potential air impacts, more reliable predictive air dispersion modelling and reactive real-time monitoring systems have been developed in order to manage potential impacts.

The predicted potential short term effects occurring at Receptor 29 during Year 4 and Year 8 were found to occur on the one modelling day with effects lasting approximately six and seven hours respectively.

For Project Year 24 the predicted effects at the selected sensitive receptors tended to occur between four and 14 hours at a time depending on the location and in total would occur for less than 1% of the time annually. These periods of potentially elevated dust all tended to occur during the early morning and late evening and night periods when air dispersion conditions are poor.

Predictive/ reactive dust mitigation strategies can be used to manage these short-term potential elevated dust levels at receptors. Such systems can predict the expected conditions on any given day and identify where and when over the coming day(s) that potentially elevated levels of dust may occur. This information means that the day's mining activities can be adjusted to minimise potential dust impacts by positioning fleet and restricting activities at certain times and/or within certain locations.

Real-time air quality monitoring systems are also used to implement reactive dust management measures in response to changing operations, air dispersion and other factors that may lead to elevated dust levels. Real-time dust monitoring is used to activate dust mitigation strategies in real-time when pre-set dust trigger levels are recorded. These systems are used in conjunction with a predictive strategy.

The predictive system provides forewarning to the mine of a potential issue, and allows the mine to take pre-emptive actions to prevent dust emissions occurring in the first instance. The reactive system acts as a fail-safe, such that if a real-time response trigger level is exceeded, the Project would be required to relocate or shutdown fleet until monitoring indicates that dust levels have fallen below the real-time response trigger.

To assess the effectiveness of these dust mitigation measures in mitigating the predicted worst case elevated dust levels, air dispersion modelling was conducted identically to that used in the air quality assessment (**Todoroski Air Sciences, 2013**), except that the operation of a predictive/ reactive strategy was applied in the model.

This was coded conservatively in the modelling, generally per a likely reactive strategy, whereby mining activities were temporarily ceased after an elevated one-hour average or rolling 24-hourt average level arose. It is important to note that:

- the modelling and analysis does not "erase" dust already in the air and allows this airborne dust to continue to travel towards receptors well after any mitigation actions are taken;
- the modelling is conservative, in that full operations continue for one hour after an elevated trigger level is reached. This is done to reflect the potential for delays in reacting to a trigger. (Note that a predictive strategy would have mitigation action in place before the elevated level occurs, resulting in even lower levels than those presented in the analysis);
- the modelling does not simply remove high dust values from the predicted results, rather it considers the diurnally varying dust emissions correctly, adjusting only the mine sources that can be controlled by the mine; and
- dust emissions due to wind erosion from the active areas and all activities associated with the CHPP were assumed to continue to operate at all times.

This modelling and analysis serves to demonstrate the proposed reactive dust mitigation measures that include cessation of activities associated with mining operations, whereas in reality Bengalla would investigate and cease and/or relocate specific fleet as pro-actively and/or reactively required to minimise potential adverse dust impacts based on the predicted levels and/or real-time dust measures.

A comparison of the predicted 24-hour average PM_{10} levels with and without the implementation of a reactive dust mitigation strategy is presented in **Figures 3** to **5** for Year 4, 8 and 24 respectively. For each of these figures, the predicted 24-hour average PM_{10} isopleth from the AQIA (without mitigation effects considered in the modelling) is overlaid with the revised isopleth (with consideration of mitigation effects) in order to clearly show the effects of implementing the proposed dust mitigation strategy.

Table 1 presents a summary of the predicted 24-hour average PM_{10} levels with and without consideration of the dust mitigation strategy at the key sensitive receptor locations. The 'without mitigation' values reflect the levels presented in the AQIA. The results show that with the short-term elevated PM_{10} levels can be maintained within the new more stringent criteria with the application of the proposed dust mitigation strategy.

Table 1: Summary of predicted 24-hour PM_{10} levels at selected sensitive receptors (µg/m^3)

Receptor ID	Year 4		Year 8		Year 24	
	Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
29	**53**	34	**57**	38	-	-
156S	-	-	-	-	**60**	48
156E	-	-	-	-	**52**	40
161	-	-	-	-	**63**	47
167*					**56**	**54**
222	-	-	-	-	**55**	35
230	-	-	-	-	**80**	39
286	-	-	-	-	**55**	27

* Note that at the time of the AQIA Receptor 161 was a shed, but now appears to be a dwelling. The results at this location are estimated on the basis of the modelled isopleths.

The modelling results demonstrate that with the use of a predictive/ reactive mitigation strategy the dust levels would not exceed the 24-hour average PM_{10} criteria of 50µg/m^3 at any of the key receptor locations with potential for such impacts to arise. As impacts at all other receptors would be lower, it is therefore reasonable to conclude that the Project can minimise and prevent the potential for adverse dust levels occurring at all of the sensitive receptor locations.

New Receptor 167 is an exception to the comments above. Results for all years are shown for the new Receptor 167 in **Table 2**. The results show that there may be effects in Year 24 per the new policy. Analysis shows that Receptor 167 is predicted to experience four days of dust levels above 50µg/m^3 in Year 24 without mitigation. There has been insufficient time available to conduct the analysis required to determine how many less days of dust above 50µg/m3 would be experienced as a result of consideration of the proposed mitigation.

Table 2: Predicted 24-hour PM_{10} levels at new Receptor 167 ($\mu g/m^3$)

Receptor ID	Year1 Without mitigation	Year4 Without mitigation	Year8 Without mitigation	Year15 Without mitigation	Year24 Without mitigation	Year24 with mitigation
167	15	23	33	39	**56**	**54**

It is noted that Receptor 167 is new since the time of the original assessment and is only affected per the new policy in the final years of the Project which are represented by Year 24.

However, the dust mitigation measures examined in this report are the same as was proposed in the AQIA, and this assessment is provided to quantify that the effect of the proposed predictive/ reactive dust mitigation, and to confirm that the strategy will be able to maintain impacts below the new more stringent criteria (except at Receptor 167).

An assessment of vacant land indicates that two adjacent lots, 215 and 216 owned by Almond, could potentially be impacted on one or more days above a 24-hour average PM_{10} level of 50µg/m^3. Lots 217 and adjacent owned by Bates and lots 174 and adjacent owned by Moore could also be potentially impacted but are part of other mines zone of acquisition.

It is noted that to develop a detailed air dispersion model for a significant new or modified mine generally takes several months of work and requires a team of mine planners and others to make adjustments in the mine design and management strategy as necessary to meet the necessary goals and policies.

Given the time available, it is not possible to conduct more than one iteration of modelling necessary to consider the mitigation strategy, thus only the first pass estimate of the reductions that the strategy would deliver can be presented in this report. In our opinion, with adequate time to permit the more detailed assessment necessary to present the effects of a predictive/ reactive management strategy, it may be that impacts could be managed to within the new IMP criteria.

Overall, as stated in the AQIA, the project has proposed to update the existing real time systems and to implement advanced predictive dust management systems to allow mine operators to pre-emptively act to manage potential impacts. Real-time dust monitors with an alarm feature would also be commissioned to inform operations when actions to reduce dust may be needed.

The time available has allowed the Project to demonstrate a reactive strategy would manage mining operations in this manner on a day-by-day basis to meet all of the applicable criteria (except in Year 24 at Receptor 167 and on some vacant land as outlined). It is however likely that with refinement of a predictive strategy impacts could be managed altogether.

Please feel free to contact us if you need to discuss (or require clarification on) any aspect of this report.

Yours faithfully,

Todoroski Air Sciences

Aleks Todoroski

Philip Henschke

References

Todoroski Air Sciences (2013)

Air Quality Impact and Greenhouse Gas Assessment Continuation of Bengalla Mine", prepared for Hansen Bailey by Todoroski Air Sciences, July 2013

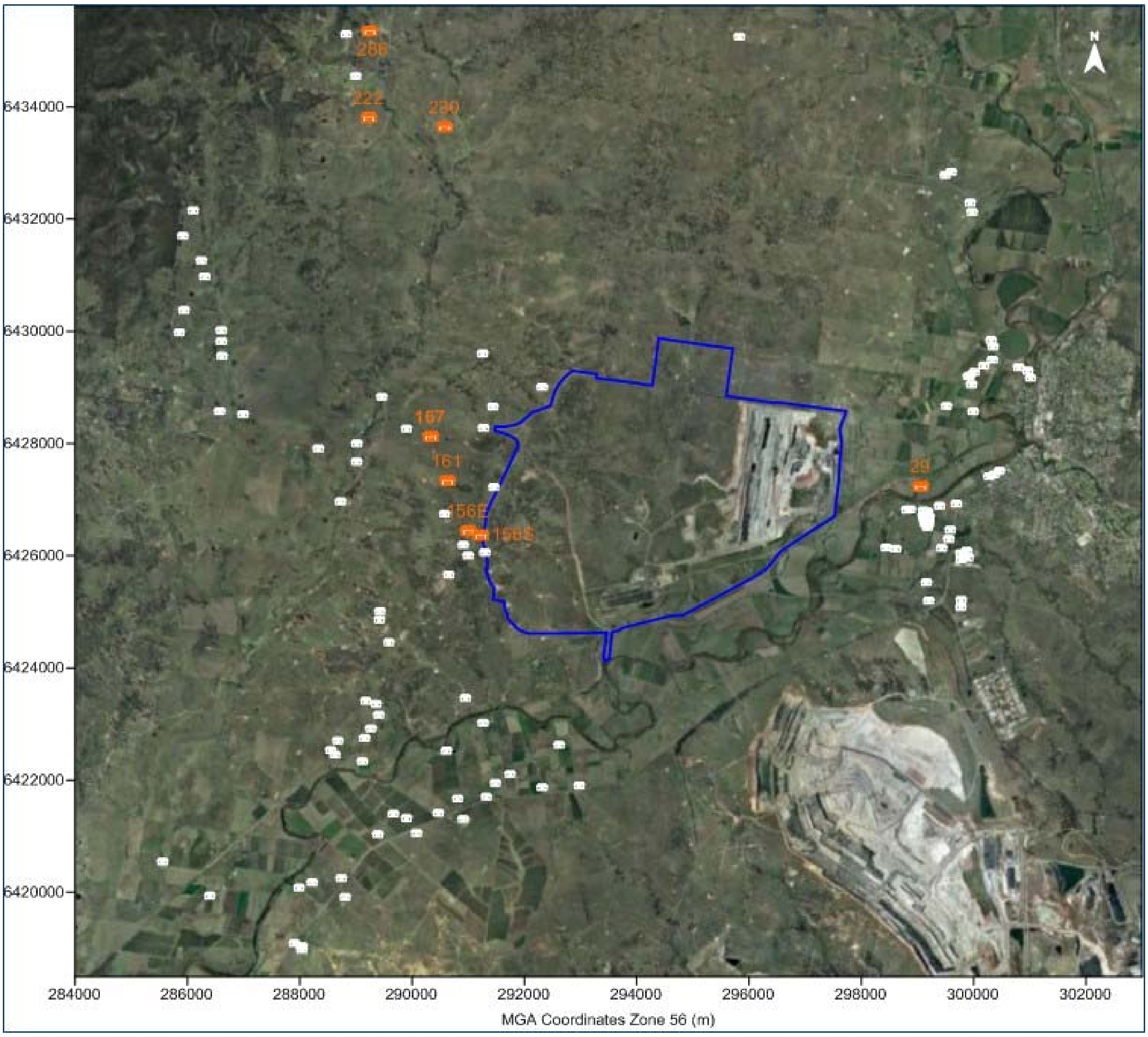

Figure 1: Sensitive receptor locations for investigation of potential short-term dust impacts (shown in Orange with labels)

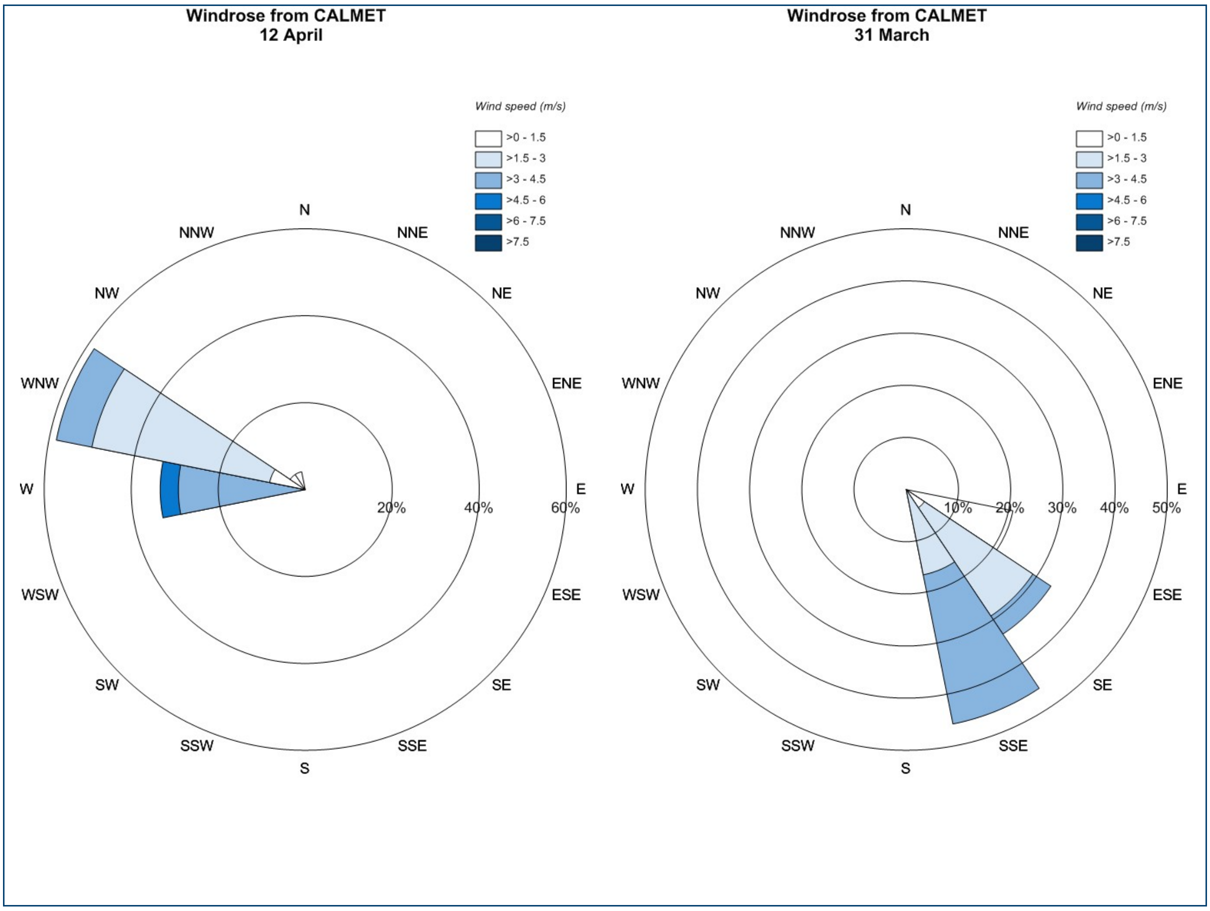

Figure 2: Examples of wind conditions that occurred at the time of elevated dust levels

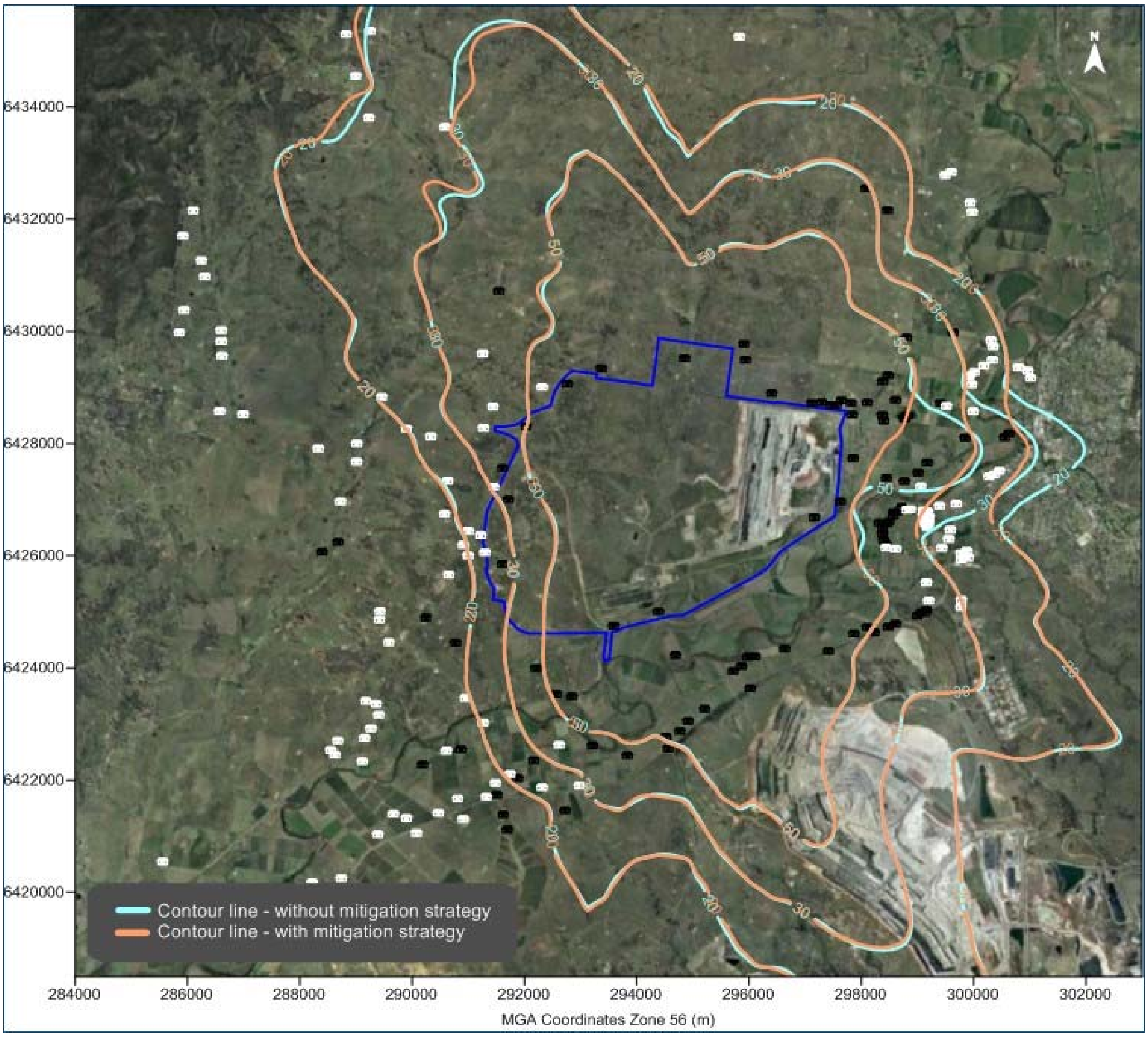

Figure 3: Comparison of predicted 24-hour PM_{10} levels for Year 4

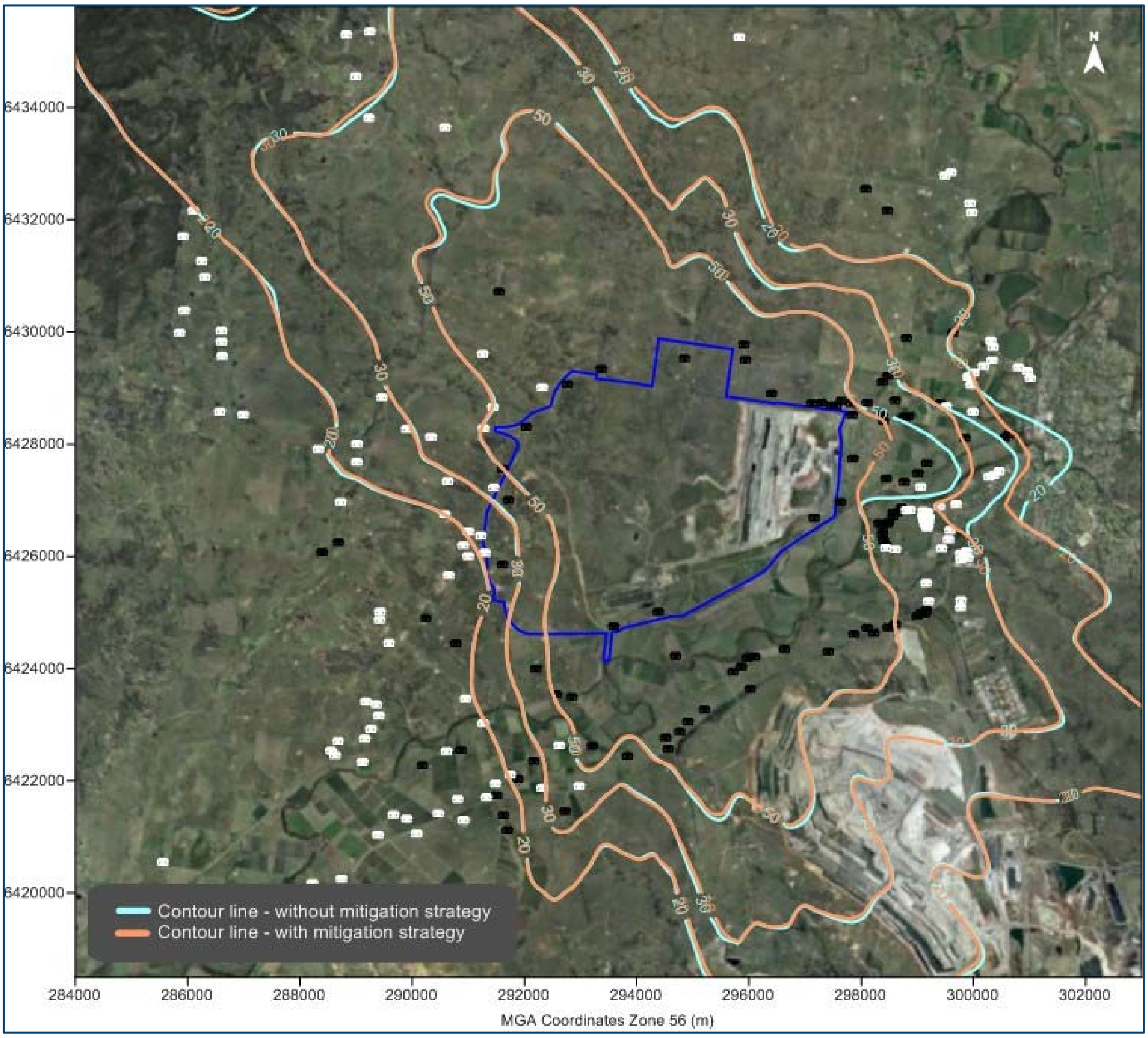

Figure 4: Comparison of predicted 24-hour PM_{10} levels for Year 8

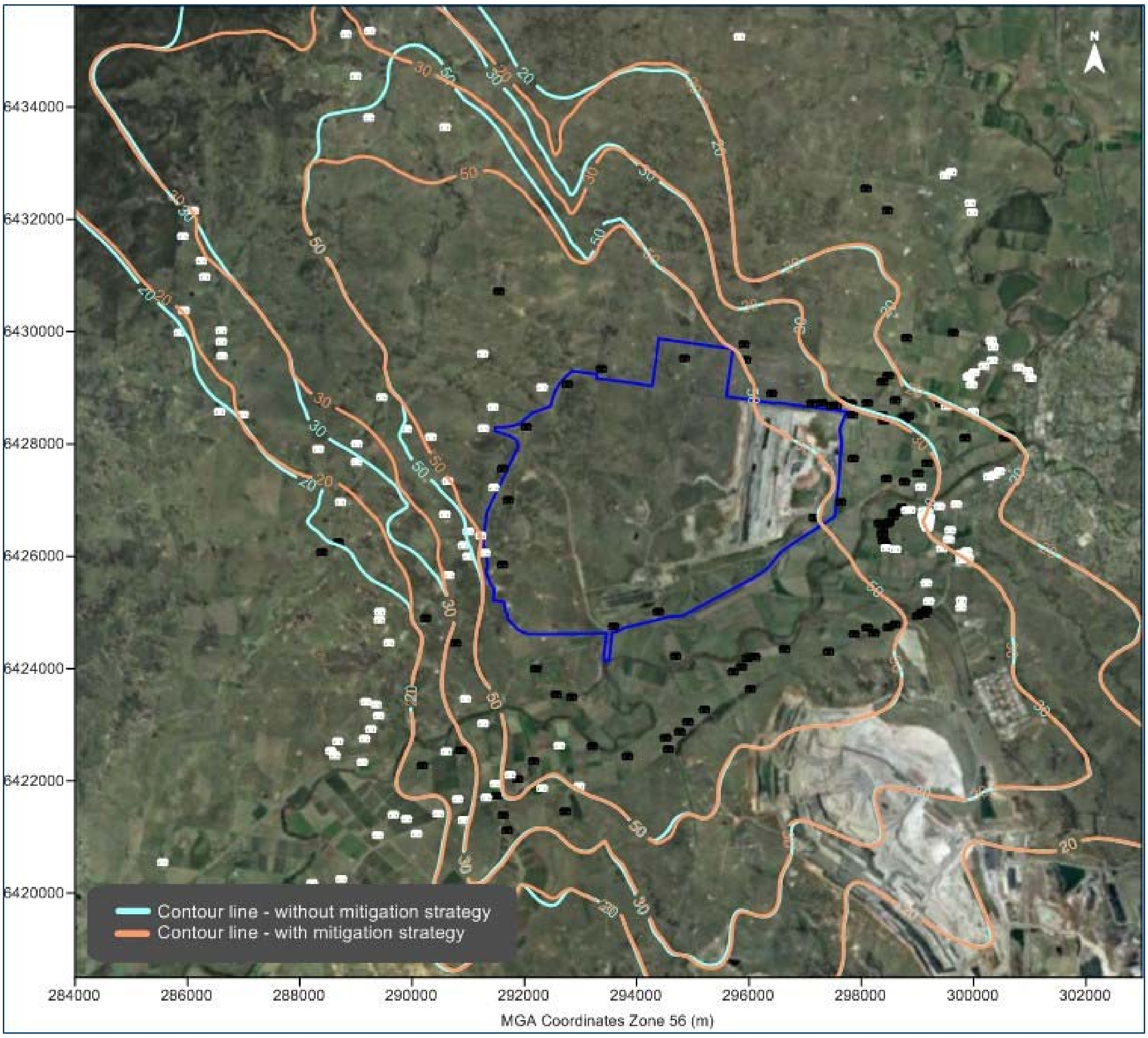

Figure 5: Comparison of predicted 24-hour PM_{10} levels for Year 24