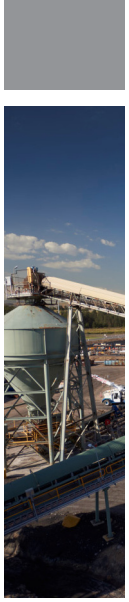
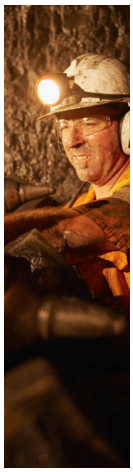
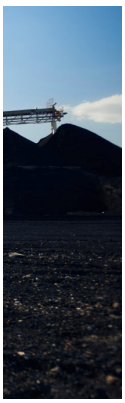


Ashton-Ravensworth Underground Mine Integration Modification

Ashton Coal Project Modification Report

APPENDIX C

Air Quality Review

YANCOAL
兖煤澳大利亚有限公司

TODOROSKI AIR SCIENCES
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9 November 2021

Phil Brown
Ashton Coal Operations Pty Ltd
Glennies Creek Road
Camberwell NSW 2330

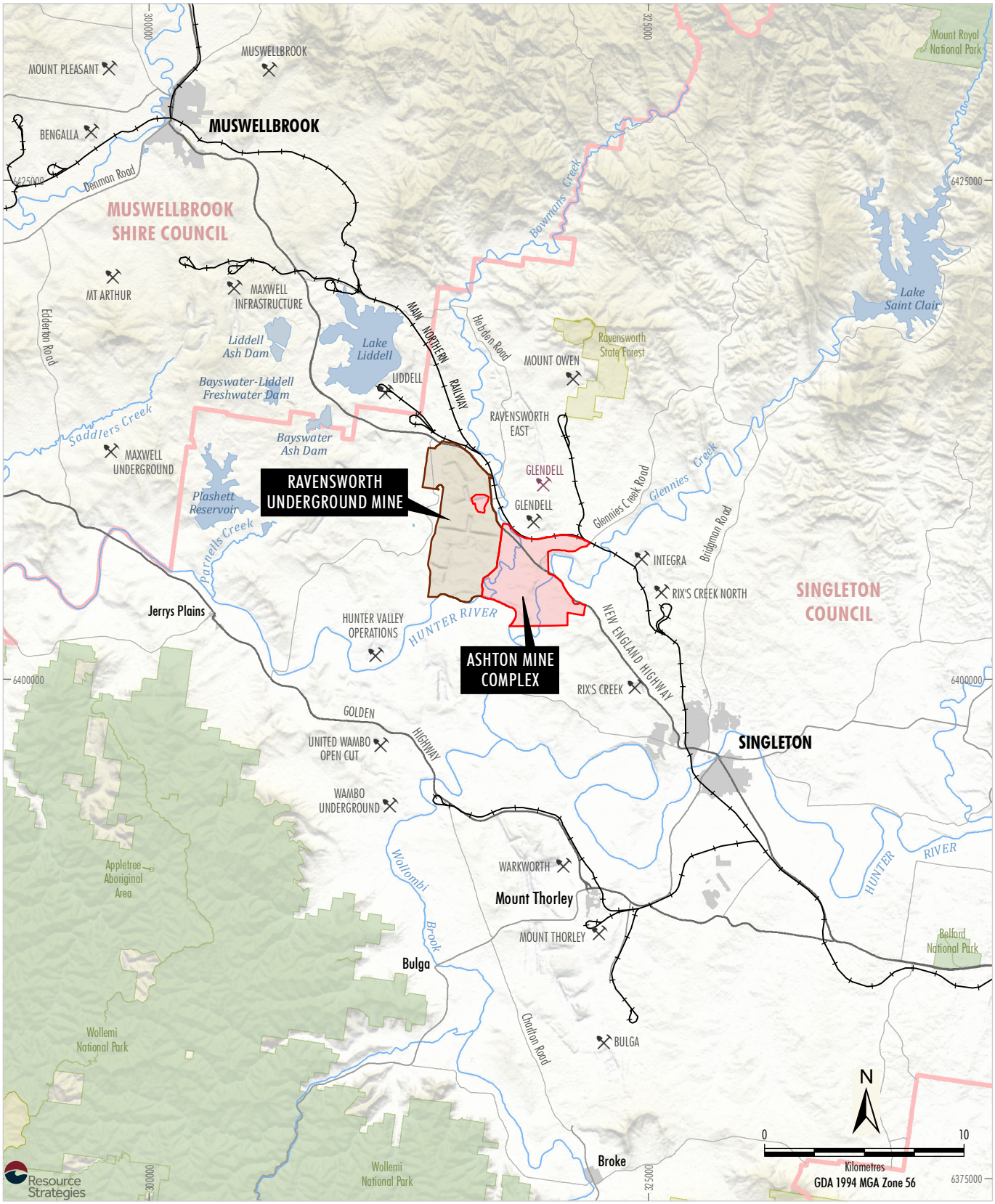
RE: Air Quality Review – Ashton Ravensworth Underground Integration Modification

Dear Phil,
Todoroski Air Sciences has been engaged by Ashton Coal Operation Pty Ltd (ACOL) to assess the potential for air quality impacts to arise due to the proposed Ashton-Ravensworth Underground Integration Modification (hereafter referred to as the Modification). The assessment investigates the likely change in air emissions associated with the modifications relative to the existing and approved operations including those for surrounding mines.

Background
The Ashton Coal Project is located approximately 14 kilometres (km) north-west of the village of Camberwell, in the Upper Hunter Valley in New South Wales (NSW) (refer to **Figure 1**). The Ashton Coal Project includes the completed Ashton North East Open Cut (NEOC), an underground coal mine (the Ashton Underground Mine), a Coal Handling and Preparation Plan (CHPP) and a rail siding. The NEOC is currently used to store coarse rejects and is approved to store tailings. The Ashton Coal Project operates in accordance with DA 309-11-2001-i (as modified).

Project Approval 08_0182 was granted for Ashton's South East Open Cut (SEOC) Project in 2015 (modified 2018) however the project has not yet commenced. The Ashton Mine Complex includes the Ashton Coal Project and the SEOC Project. ACOL is the operator of the Ashton Mine Complex and is a wholly owned subsidiary of Yancoal Australia Ltd (Yancoal).

It is understood that Yancoal's preferred pathway for continued operations at the Ashton Mine Complex is to utilise the existing Ashton Mine Complex infrastructure, equipment and workforce to mine a portion of the approved Ravensworth Underground Mine (RUM) resource and to not proceed with the SEOC Project. This means that the proposed Modification would result in a large reduction in the approved air emissions (and hence air impacts – dust and greenhouse gas [GHG]) for the Ashton Mine Complex.



LEGEND

- Mining Operation
- Proposed Mining Operations (Application Lodged)
- Local Government Area
- State Forest
- National Parks and Wildlife Estate
- Ashton Mine Complex - Mining and Exploration Tenement Area
- Ravensworth Underground Mine - Mining and Exploration Tenement Area

Source: NSW Spatial Services (2021)

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ASHTON - RAVENSWORTH UNDERGROUND MINE INTEGRATION MODIFICATION

Regional Location

Figure 1

Modification Description

Modifications are proposed to the Ashton Coal Project Development Consent DA 309-11-2001-i and the RUM Development Consent DA 104/96, to integrate components of the Ashton Coal Project and the RUM. The Modification would allow ACOL to access and mine coal resources at the RUM that are approved to be mined under DA 104/96.

The modifications to the Ashton Coal Project Development Consent DA 309-11-2001-i would involve the following:

- underground connection from the existing Ashton Underground Mine workings to the approved RUM in the Pikes Gully and Middle Liddell coal seams via first workings;
- receipt of run-of-mine (ROM) coal mined in the RUM Pikes Gully and Middle Liddell coal seams for handling, processing and transportation using the existing Ashton Coal Project infrastructure;
- management of RUM ROM coal coarse rejects and tailings by emplacement in the NEOC void and at the Ravensworth Void 4 Tailings Dam;
- receipt and management of water and gas from the ACOL-operated portion of the RUM;
- extension of mining operations until approximately December 2035; and
- other administrative changes to facilitate management of the ACOL-operated portion of the RUM and integration with the Ashton Coal Project, such as integrated environmental management plans as appropriate.

The modifications to the RUM Development Consent DA 104/96 would involve the following:

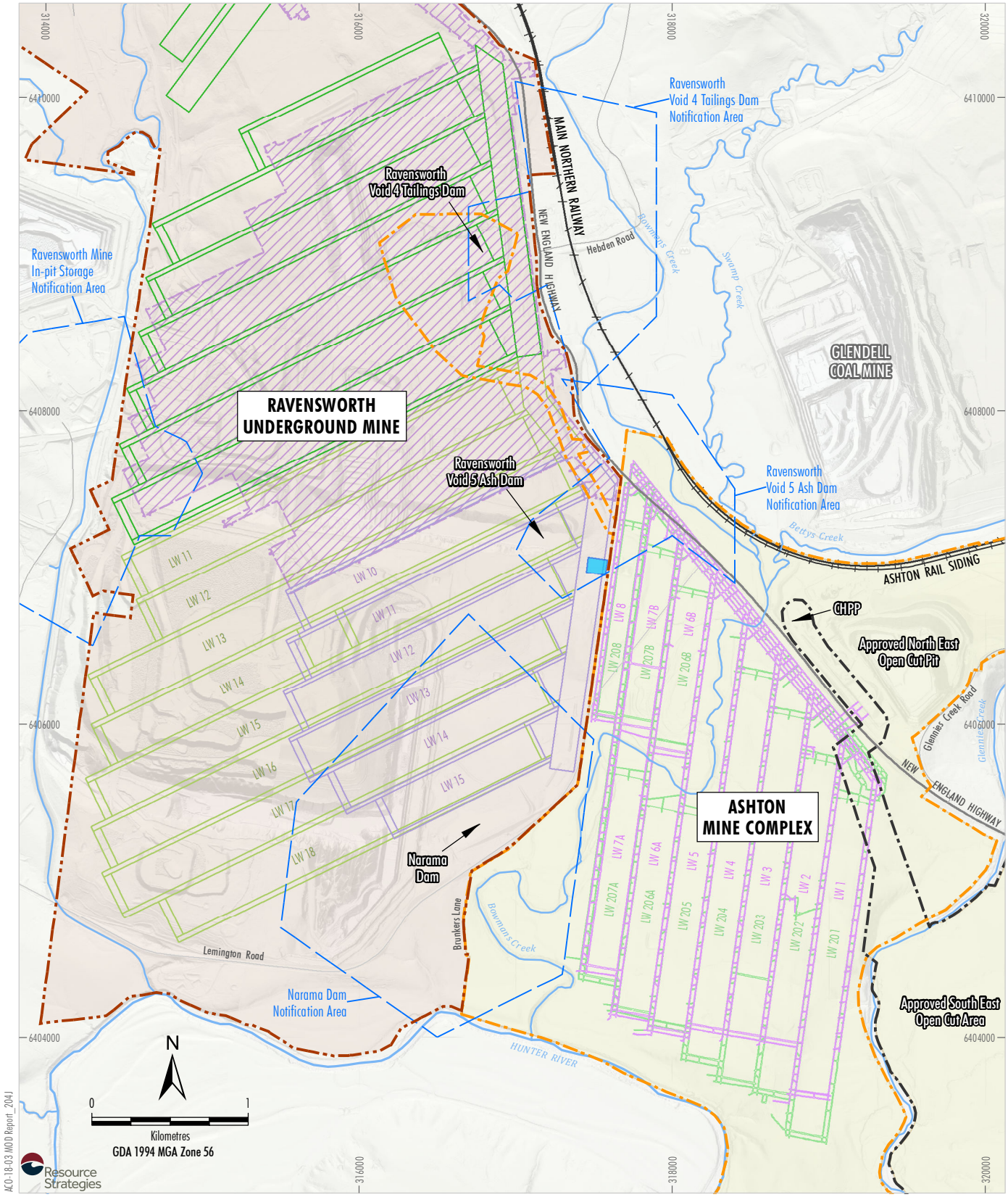
- transfer of ROM coal from the RUM Pikes Gully and Middle Liddell coal seams to the Ashton Coal Project for handling, processing and transport;
- minor changes to the approved Pikes Gully Seam Longwalls 10-15 (narrowing and shortening of some longwall panels) and Middle Liddell Seam Longwalls 14-18 (shortening of some longwall panels);
- transfer of water and gas from the ACOL-operated portion of the RUM to the Ashton Coal Project;
- minor adjustment to the gas and ventilation management infrastructure to ensure continued safe operation of the ACOL-operated portion of the RUM;
- extension of mining operations until 31 December 2032; and
- other administrative changes to facilitate management of the ACOL-operated portion of the RUM and integration with the Ashton Coal Project, such as integrated environmental management plans (as appropriate).

The current Ashton mining operations are approved until 26 February 2024 or for a period of 12 years following recommencement of open cut mining operations (i.e. SEOC Project) at the Ashton Mine Complex, whichever is longer.

The Modification seeks to continue to operate the Ashton Coal Project for approximately 12 years from February 2024 until December 2035. There would be no change in existing surface activities at the Ashton Coal Project, other than prolonging their life. No change in the Ashton Underground Mine footprint or approved throughput is sought and there would not be any increase in annual coal extraction rates or the rate of emissions (or any existing impacts), with no change in its existing surface activities, air emissions or air impacts, (there would, however, be a large reduction in the approved Ashton Mine Complex air emissions due to the SEOC Project not proceeding).

This report includes a review of dust emissions and impacts associated with the Modification. The report separately reviews potential GHG emissions associated with the Modification.

Figure 2 presents the approved longwall layout and **Figure 3** presents an indicative Modification general arrangement.



LEGEND

- Dam Notification Area
- Ashton Mine Complex
  - Ashton Coal Project Development Consent Boundary
  - South East Open Cut Approval Boundary
  - Ashton Mine Complex
  - Pikes Gully Seam Longwall Layout
  - Upper Lower Liddell Seam Longwall Layout
- Ravensworth Underground Mine
  - Ravensworth Underground Mine Development Consent Boundary
  - Existing Shaft 5 Location
  - Completed Pikes Gully Seam Workings
  - Approved Pikes Gully Seam Longwall Layout
  - Approved Middle Liddell Seam Longwall Layout
  - Approved Upper Liddell Seam Longwall Layout

NOTE

The approved Upper Liddell and Lower Barrett Seams at the Ashton Coal Project and approved Lemington and Barrett Seams at the Ravensworth Underground Mine are not shown on this figure.

Source: NSW Spatial Services (2021); Dams Safety NSW (2020)

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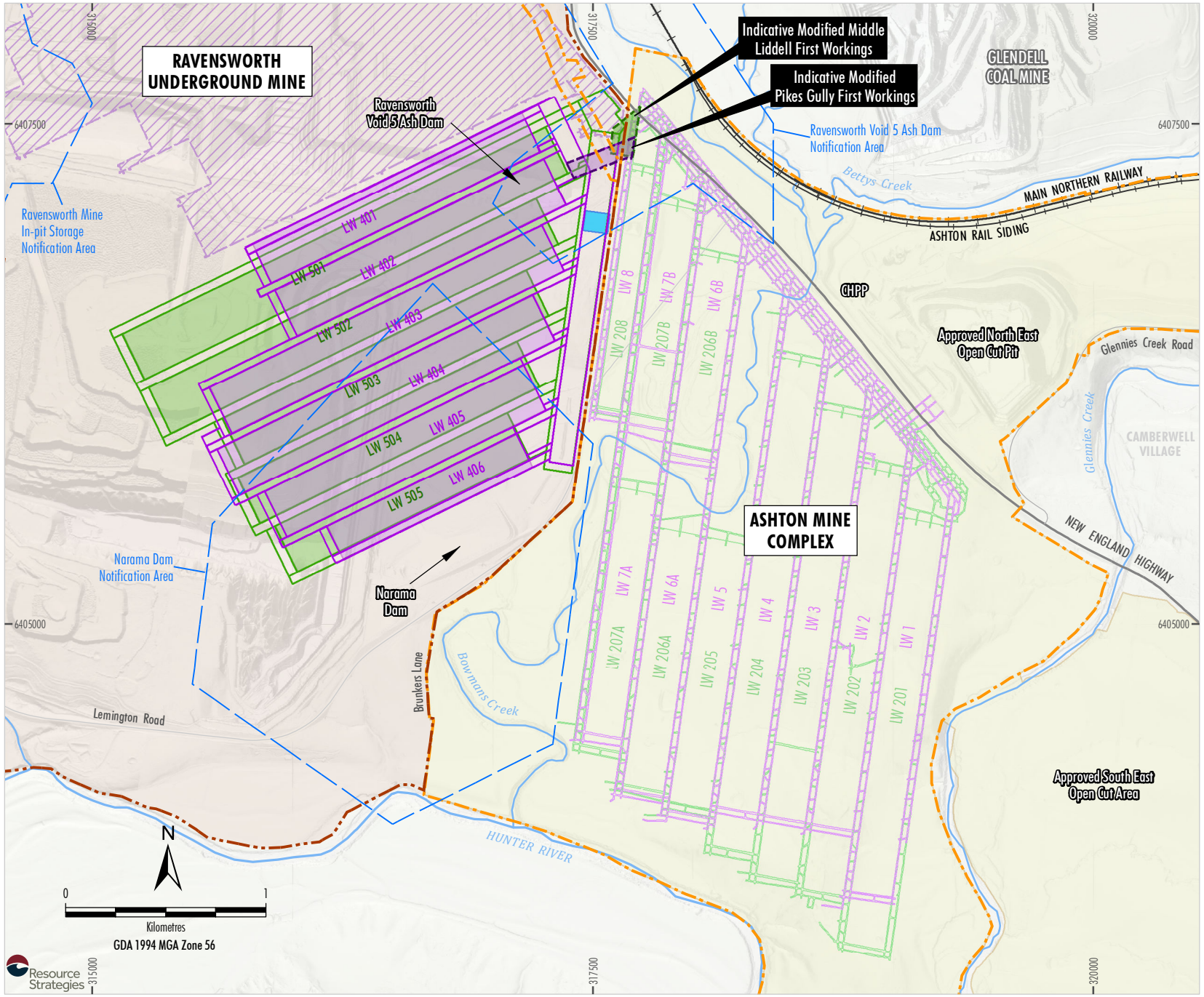
ASHTON - RAVENSWORTH UNDERGROUND MINE INTEGRATION MODIFICATION

Approved Longwall Layouts

Figure 2



LEGEND

Dam Notification Area

Ashton Mine Complex

- Ashton Coal Project Development Consent Boundary
- Ashton Mine Complex
- Pikes Gully Seam Longwall Layout
- Upper Lower Liddell Seam Longwall Layout

Ravensworth Underground Mine

- Ravensworth Underground Mine Development Consent Boundary
- Completed Pikes Gully Seam Workings
- Existing Shaft 5 Location

Proposed Modification

- Indicative Pikes Gully Seam Longwall Layout
- Indicative Modified Pikes Gully First Workings
- Indicative Middle Liddell Seam Longwall Layout
- Indicative Middle Liddell Seam First Workings

NOTE
The approved Upper Liddell and Lower Barrett Seams at the Ashton Coal Project and approved Lemington and Barrett Seams at the Ravensworth Underground Mine are not shown on this figure.

Source: NSW Spatial Services (2021); Dams Safety NSW (2020)

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ASHTON - RAVENSWORTH UNDERGROUND MINE INTEGRATION MODIFICATION

Indicative Modification General Arrangement

Figure 3

Assessment of potential dust impacts

The Modification does not seek to increase the ROM coal extraction rate for the approved Ashton Coal Project and hence the Modification would not result in any increase to the existing Ashton Coal Project dust emission rates or impacts. There would however be a significant decrease in the future approved emissions resulting from not commencing the SEOC Project Approval (08_0182).

The dust emissions associated with the approved operations have been obtained from the Air Quality Impact Assessment – Ashton Coal South East Open Cut Mine (**PAE Holmes, 2009**) and the Air Quality Review – Ashton Coal Project Modification 5 (**Todoroski Air Sciences, 2016**). The Modification 5 Air Quality Review assessed:

- Ashton Underground Mine ROM coal extraction up to 5 million tonnes per annum (Mt/annum)[1]; and
- SEOC Project ROM coal extraction up to 3.6 Mt/annum.

Table 1 presents a comparison of the estimated total suspended particulate (TSP) emissions associated with the approved Ashton Coal Project and the approved SEOC Project. Full details of the emissions sources and their emission rates are set out in **Attachment 1**.

The data indicate that the approved Ashton Coal Project annual emission rate is only a small fraction of Ashton Mine Complex's total approved emissions and therefore proceeding with the Modification instead of the SEOC Project approval would result in a reduction in the approved emissions of 89 to 95%. As the SEOC Project is not operating, there would in practice be no change in the existing Ashton Coal Project emissions due to the Modification.

Table 1: Comparison of estimated TSP emission rate for the proposed Modification

Activity	Approved Ashton Coal Project	Approved Operations (Ashton Coal Project and SEOC)			
		Year 1	Year 3	Year 5	Year 7
Total TSP emissions (kg/year)	116,741	1,646,925	2,166,712	2,350,776	1,044,064
% Existing vs approved TSP emissions		7%	5%	5%	11%

kg/yr – kilograms per year.

In order to assess any potential change in impacts from the extension of mine life under the Modification, existing assessments for other mines have been reviewed to consider the effects in these future years. **Table 2** presents the most current estimate of future cumulative emissions modelled for mines in this area, including the Ashton Coal Project and other mines in the vicinity of Ashton Mine Complex's operations. The data is from the Glendell Continued Operations Project Air Quality Impact Assessment (**Jacobs, 2019**).

[1] Note that the Year 1 SEOC Project modelling only considered a rate of 3 Mt/annum for the Ashton Underground Mine ROM coal extraction.

Table 2: Estimated TSP emissions from nearby mining operations (kg/year)

Mining operation	Year 2033	Relative percentage of total
Rix's Creek North	2,163,828	10.8%
Rix's Creek South	2,635,613	13.2%
Mt Owen	2,548,710	12.7%
Glendell	5,017,124	25.0%
Ravensworth Operations	7,440,069	37.1%
Integra Underground	115,112	0.6%
Ashton Coal Project	114,937	0.6%
Total	**20,035,393**	**100.0%**

The estimated TSP emissions rates for Ashton Coal Project by Jacobs (**2019**) are very similar to those for the approved operations presented in **Table 1** (Jacobs [**2019**] calculates approximately 1.5% less emissions). This is a small difference in the relatively small quantum of emissions that relate to the Ashton Coal Project, and is likely due to the use of slightly different wind speed in the Jacobs calculations (i.e. as needed for a different modelling year), and/or some slightly different assumptions or rounding being applied.

Figure 4 presents the contribution of surrounding mines to the predicted annual average levels of particulate matter with an equivalent aerodynamic diameter of 10 micrometres (µm) or less (PM_{10}) at a privately owned residence (identified as receptor ID 156 in Jacobs (**2019**), which is Receiver 35 in the Ashton Coal Project Development Consent), located in the centre of Camberwell. **Figure 4** is as presented in the Glendell Continued Operations Project Response to Submissions (**Umwelt, 2020**). Note that Jacobs (**2019**) and Umwelt (**2020**) relate to the same Environmental Impact Statement for the Glendell Continued Operations Project. Receptor ID 156 is listed as being subject to acquisition and is representative of Camberwell.

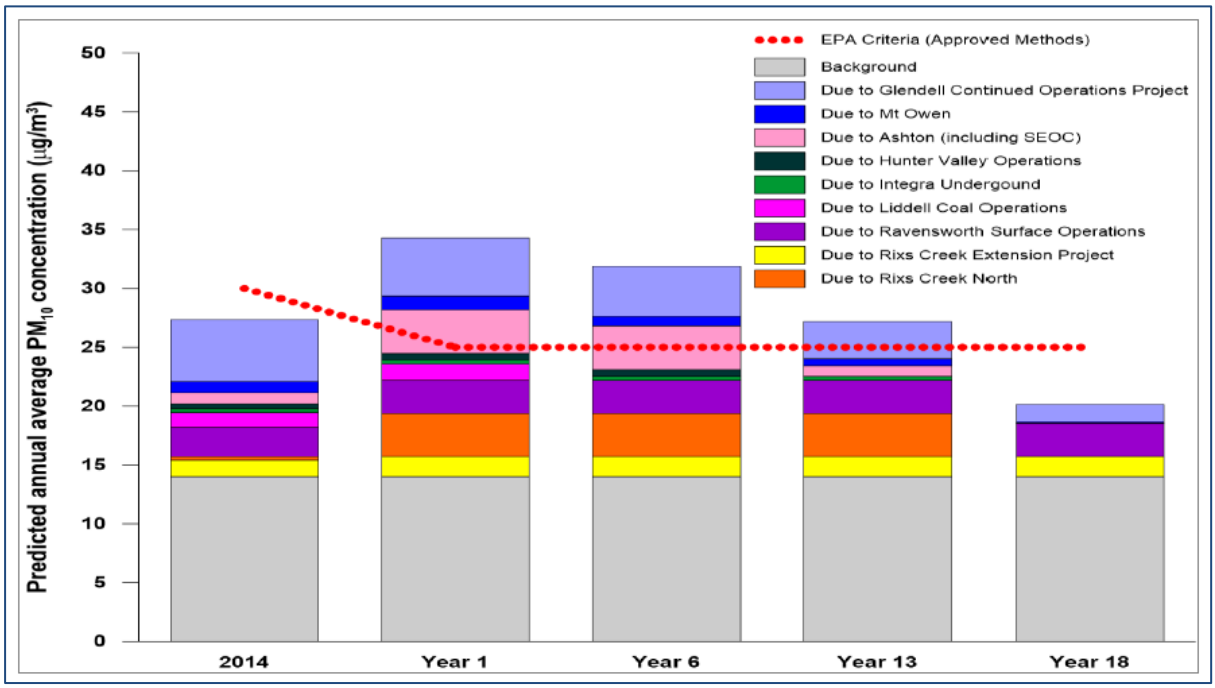

Figure 4: Predicted annual average PM_{10} concentrations in Camberwell (Property ID 156) Source: Umwelt, 2020

It is understood that the assessed Glendell Continued Operations Project Year 1 is equivalent to calendar year 2021, Year 6 is equivalent to 2026, Year 13 is equivalent to 2033 and Year 18 is equivalent to 2038. Note that only Year 1 (2021) and Year 6 (2026) estimations include the Ashton SEOC Project.

The data show the contribution from only the Ashton Coal Project in Year 2014 and in Year 13 (2033). The data indicate that in 2033, the Ashton Coal Project contribution to the total impacts at this receptor is minor and that there would likely be exceedances of the annual average PM_{10} level at receptor ID 156 for the existing and approved operations regardless of the contribution for Ashton Coal Project, or not.

The data show a general trend of decreasing cumulative levels over time as various open cut operations cease. The data also show that even if the proposed Modification continued until 2038 (Year 18), it would not alter the findings of the Jacobs report (**2019**) because its impacts are simply too small.

The above also applies for particulate matter with an equivalent aerodynamic diameter of 2.5µm or less ($PM_{2.5}$). For operational years prior to Year 13, not commencing the SEOC Project means that the $PM_{2.5}$ levels presented in Jacobs (**2019**) would be lower. For example, **Figure 4** shows that the Ashton Coal Project makes a PM_{10} contribution of approximately 0.8 micrograms per cubic metre (µg/m^3) in Camberwell in 2014 and also Year 13 (i.e. the years with only the Ashton Coal Project operating). This would be equivalent to a contribution of approximately 0.2µg/m^3 for $PM_{2.5}$. This contribution would also arise in Year 18 (2038) due to this Modification. Accordingly, Appendix G of Jacobs (**2019**) shows that the cumulative predicted annual average $PM_{2.5}$ impact in Year 18 without the Modification is 7.0µg/m^3, and this would be approximately 7.2µg/m^3, a level below the applicable criterion of 8µg/m^3 if the Modification were to be approved. The Jacobs results also show that when only the Ashton Coal Project is present, no other privately owned receptors within Camberwell village would experience an exceedance of the annual average $PM_{2.5}$ criterion due to the contribution from the Ashton Coal Project in Year 13, and that levels would be lower in future years.

It can therefore be concluded that the continuation of the Ashton Coal Project consent (DA 309-11-2001-i) until 2035 is unlikely to have any significant impact on cumulative dust levels at one of the nearest and most impacted privately owned private receptors to the Ashton Coal Project.

PM_{10} contribution analysis

An analysis was undertaken for the latest year period (October 2020 to September 2021) to calculate ACOL's contribution to the annual average PM_{10} levels recorded at nearby TEOM monitors.

An upwind/downwind analysis methodology was adopted whereby the contribution to a monitor for each 24-hour period is estimated to be the total concentration recorded by the monitor during the times when it was downwind of the Ashton Coal Project minus the underlying background levels recorded at the upwind monitor. The contribution for every 24-hour monitoring period is then averaged over the year to calculate the annual average contribution.

Figure 5 presents the location of the Site 7, Site 9 and Site 10 TEOM monitors in the ACOL air quality monitoring network. The Site 9 and Site 10 TEOMs are compliance monitors while Site 7 is a management monitoring location and is not used for compliance purposes. Site 10 TEOM is a representative monitor for Camberwell village.

Figure 5: Location of PM_{10} TEOM monitors

Table 3 presents the calculated contributions from the existing Ashton Coal Project operations to the annual average (October 2020 to September 2021) PM_{10} levels recorded at the TEOM monitors.

Table 3: Ashton Coal Project contribution to the annual average PM_{10} TEOM monitors (October 2020 to September 2021)

Monitor	Annual average PM_{10} (µg/m³)	Estimated maximum contribution to annual average PM_{10} level (µg/m³)	Estimated maximum contribution as percentage of total
Site 7	19.5	0.8	4.3%
Site 9	23.9	0.5	2.0%
Site 10	20.9	2.3	10.9%

This upwind/downwind contribution estimation methodology is conservative as it assumes that the entire difference between the upwind level and the level at the monitor in question is attributable to the Ashton Coal Project and does not take into account other potential sources, for example, the calculated contribution at Site 10 would include some impact from localised sources of woodsmoke at Camberwell village.

The data indicate that the maximum Ashton Coal Project annual average PM_{10} contribution at Site 10 including other sources was 2.3µg/m^3. This level is higher than the mine only contribution of 0.8µg/m^3 estimated by Jacobs (**2019**), nonetheless both demonstrate that the Ashton Coal Project's contribution to the annual average PM_{10} level at Site 10 would be relatively minor.

Given that Ashton Coal Project's contribution to cumulative PM_{10} levels is relatively minor and open cut activities are no longer proposed, it is recommended to align the Ashton Coal Project Development Consent DA 104/96 criteria for 24-hour average PM_{10} impacts with those for other underground mines in the area such as the Integra Underground Project and Maxwell Underground Coal Mine Project (i.e. using incremental impact criteria only).

Assessment of potential greenhouse gas impacts

The GHG emissions associated with the Modification would result from the extraction of ROM coal in the RUM approved Pikes Gully and Middle Liddell coal seams and processing of this coal at the Ashton Coal Project. These emissions have already been assessed and approved under Development Consent DA 104/96.

A comparison of approved ROM coal resources for the RUM, Ashton Coal Project and SEOC Project compared to that planned for extraction under the Modification is summarised below. The associated GHG emissions estimates are also presented.

The extraction of the ROM coal from the RUM was originally proposed in the Nardell Underground Coal Mine Environmental Impact Statement (**HLA-Envirosciences Pty Limited, 1996**) and approved under the Development Consent DA 104/96. The total ROM coal resource approved for extraction at the RUM is 114.4Mt. Prior to RUM operations entering care and maintenance in 2014, ROM coal in the Pikes Gully Seam was extracted in Longwalls 1-9.

A summary of the total approved, previously mined (completed) and proposed Modification ROM coal resource recovery is provided in **Table 4**.

Table 4: Ravensworth Underground Mine – Approved, Completed and Modification ROM Coal Resources

RUM Seam	Approved RUM (Mt)	Completed RUM (Mt)	Remaining RUM (Mt)	Proposed Modification (Mt)
Lemington	5.6	0	5.6	0
Pikes Gully	30.6	21.3^	9.3	9.3
Upper Liddell	7.9	0	7.9	0
Middle Liddell	31.3	0	31.3	10.1
Barrett	39.0	0	39.0	0
Total	**114.4**	**21.3**	**93.1**	**19.4**

^ Conservatively, it is assumed that the entire approved tonnage of ROM coal in the Pikes Gully Seam would be extracted, however, actual tonnages may be less than stated.

As shown in **Table 4**, the planned ROM coal to be recovered over the Modification represents only 20.8% of the remaining approved ROM coal resource (93.1Mt).

The amount of GHG emissions likely to be generated due to the Modification, has been estimated based on the historical GHG emission estimates for Ashton Coal Project and the projected ROM coal production.

Table 5 presents a summary of the most recent Scope 1 and Scope 2 GHG emissions for the Ashton Coal project and corresponding annual ROM coal extraction rates. It is noted that GHG emissions are calculated over a financial year period for *National Greenhouse and Energy Reporting Act 2007* reporting purposes whereas annual ROM coal is reported per calendar year.

Table 5: Ashton Coal Project GHG emissions

Calendar year	ROM coal (Mt) extracted in reporting period	Product coal (Mt)	Financial Year	Scope 1 (MtCO2-e)	Scope 2 (MtCO2-e)	Total (Scope 1 + 2) (MtCO2-e)
2013	2.75	1.29	2013/2014	0.40	0.04	0.44
2014	2.77	1.34	2014/2015	0.30	0.04	0.34
2015	3.00	1.38	2015/2016	0.39	0.34*	0.42
2016	2.38	1.56	2016/2017	0.34	0.04	0.38
2017	2.79	1.54	2017/2018	0.26	0.04	0.29
2018	1.96	0.83	2018/2019	0.22	0.04	0.25
2019	2.04	0.84	2019/2020	0.20	0.03	0.23
2020	3.38	1.60	2020/2021	0.41	0.04	0.45
Average	**2.63**	**1.29**	**Average**	**0.31**	**0.04**	**0.35**

Source: data has been obtained from the ACOL Annual Reviews (2014 to 2021)

Note that the averages presented in the table may not exactly equal the average of the values presented due to rounding

*This value appears to be incorrect and has not been included in the calculated average.

Based on the data in **Table 5**, the average Scope 1 and Scope 2 emission rate for the Ashton Coal Project is 0.13Mt CO_2-e per Mt ROM coal. An average Scope 3 emission rate of 0.36Mt CO_2-e per Mt product coal is calculated based on the calculations presented in the SEOC Air Quality Impact Assessment (**PAEHolmes, 2009**). Assuming a similar emission rate for the mining of the RUM coal resource enables a comparison to be made of total GHG emissions for the remaining approved RUM and modified RUM.

Table 5 indicates that the average ratio of product coal to ROM coal is approximately 49%. This ratio has been used to estimate the product coal tonnages from the ROM coal for the remaining approved RUM and modified RUM.

Table 6 presents a summary of the estimated GHG emissions for the remaining approved RUM and ACOL-operated portion of the RUM (i.e. the Modification). The total estimated GHG emissions for the ACOL-operated portion of the RUM would be approximately 6.0Mt CO_2-e and represents approximately 20.8% of the emissions associated with the remaining approved RUM coal resource.

Table 6: Estimated GHG for the remaining approved RUM and modified RUM

Parameter	Remaining RUM	Proposed Modification
ROM coal (Mt)	93.1	19.4
Product coal (Mt)	45.8	9.5
Scope 1 & 2 (MtCO2-e)	12.4	2.6
Scope 3 (MtCO2-e)	16.5	3.4
Total GHG emissions (MtCO2-e)	**28.9**	**6.0**

In addition, the total Scope 1, 2 and 3 GHG emissions associated with the SEOC Project per the Air Quality Impact Assessment (**PAEHolmes, 2009**) is 35.1Mt CO_2-e. Under Yancoal's preferred pathway for continued operations at the Ashton Mine Complex, ACOL would utilise the existing Ashton Coal Project infrastructure, equipment and workforce to mine part of the approved RUM and would not proceed with the SEOC Project. Therefore, 35.1Mt CO_2-e emissions would be avoided by not commencing the SEOC Project.

ACOL would continue to utilise various mitigation measures to minimise the overall generation of GHG emissions including:

- Capture and flare (where possible) RUM gas at the existing Ashton Coal Project flaring plant (i.e. gas would be transferred from RUM area back to the Ashton Coal Project).

- Goaf drainage network bores will be constructed for mine goaf gas management. Treatment of the goaf gas will be through flaring where possible.
- Flaring of gas extracted from gas drainage bores, will be undertaken where feasible (e.g. where flow rate or gas bore location allows), to reduce GHG emission.
- Energy efficient equipment will be specified for all new and upgraded mobile or fixed plant.

Summary and Conclusions

Activities associated with the proposed Modification would not lead to any increase in annual dust emission rates from the existing operations and are predicted to generate significantly less emissions than the approved operations due to not commencing the SEOC Project approval (08_0182).

A review of recent air quality impact assessments that cumulatively include the operation of the Ashton Coal Project in 2033 (which reflects the later life operations of the Modification) indicate that the Modification would not have any significant impact on future cumulative dust levels at the nearest private receptor locations in Camberwell. As the Ashton Coal Project's impact at the most effected privately-owned receptor would not be significant, there would not be any significant impacts on future cumulative dust levels at other surrounding privately-owned receptor locations for the Modification. The available data show that the Modification would not alter the findings of the most recent cumulative assessment of the locality (**Jacobs, 2019**).

It is concluded that the proposed Modification would not result in any additional impact relative to the existing and approved operations, and that it would reduce the total approved future emissions from the Ashton Mine Complex due to not commencing the SEOC Project approval.

The Modification is also predicted to generate significantly less GHG emissions than the approved operations due to a reduction in the approved RUM resources to be extracted and from not commencing the SEOC Project approval.

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

Katie Trahair

Aleks Todoroski

References

ACOL (2014)

"Ashton Coal Project Annual Environmental Management Report 2013", Ashton Coal Operations Limited, 2014

ACOL (2015)

"Ashton Coal Project Annual Environmental Management Report 2014", Ashton Coal Operations Limited, March 2015

ACOL (2016)

"Ashton Coal Operations Limited 2015 Annual Review", Ashton Coal Operations Limited, March 2016.

ACOL (2017)

"Ashton Coal 2016 Annual Review", Ashton Coal Operations Limited, March 2017.

ACOL (2018)

"Ashton Coal 2017 Annual Review", Ashton Coal Operations Limited, March 2018.

ACOL (2019)

"Ashton Coal 2018 Annual Review", Ashton Coal Operations Limited, March 2019.

ACOL (2020)

"Annual Review for the Ashton Coal Project 1 January 2019 – 31 December 2019", compiled by R.W. Corkery & Co Pty Limited for Ashton Coal Operations Limited, March 2020.

ACOL (2021)

"Annual Review for the Ashton Coal Project 1 January 2020 – 31 December 2020", compiled by R.W. Corkery & Co Pty Limited for Ashton Coal Operations Limited, March 2021.

HLA-Envirosciences Pty Limited (1996)

"Environmental Impact Statement Proposed Nardell Underground Mine Ravensworth, New South Wales", prepared by HLA-Envirosciences Pty Limited on behalf of Nardell Coal Corporation Pty Ltd, July 1996

Jacobs (2019)

"Glendell Continued Operations Project Air Quality Impact Assessment", prepared by Jacobs on behalf of Umwelt for Mt Owen Pty Ltd, November 2019.

PAE Holmes (2009)

"Air Quality Impact Assessment Ashton South East Open Cut Mine", prepared by PAE Holmes on behalf of Wells Environmental Services for Ashton Coal Operations Limited, October 2009.

Todoroski Air Sciences (2016)

"Air Quality Review – Ashton Coal Project Modification 5", prepared by Todoroski Air Sciences on behalf of Yancoal, April 2016.

Umwelt (2020)

"Glendell Continued Operations Project Response to Submissions", prepared by Umwelt on behalf of Glencore, May 2020.

Attachment 1: Comparison of estimated TSP emission rate for the proposed Modification

Activity	Underground operations Emissions (kg/year)	Emissions from Approved Ashton operations (Underground + SEOC) (kg/year)			
		Year 1	Year 3	Year 5	Year 7
Topsoil Removal - Dozers/Excavators stripping topsoil	-	2,039	2,039	2,039	-
Topsoil removal - Sh/Ex/FELs loading topsoil	-	804	2,260	2,612	-
Topsoil removal - Hauling topsoil to emplacement area	-	10,378	35,270	49,189	-
Topsoil removal - Emplacing topsoil at emplacement area	-	804	2,260	2,612	-
OB - Drilling	-	11,943	11,943	11,943	11,943
OB - Blasting	-	21,825	21,825	21,825	21,825
OB - Excavator loading OB to haul truck	-	73,685	72,761	72,761	37,092
OB - Hauling to emplacement areas	-	669,098	1,080,725	1,146,313	342,042
OB - Emplacing at emplacement areas	-	73,685	72,761	72,761	37,092
OB - Dozers on OB	-	11,967	11,967	11,967	11,967
CL - Dozers ripping/pushing/clean-up	-	48,852	48,852	48,852	48,852
CL - Sh/Ex/FELs loading open pit coal to trucks	-	164,392	173,881	192,072	63,051
CL - Hauling open pit coal to ROM pad	-	63,065	55,587	78,946	28,795
CL - Unloading ROM to ROM stockpiles	-	20,496	21,679	23,947	7,861
CL - Loading ROM directly to hopper to be crushed	-	49,318	52,164	57,622	18,915
CL - Loading from stockpile to crusher using FELs	-	115,075	121,717	134,450	44,136
CL - Crushing ROM	-	7,906	8,362	9,237	3,032
CL - ROM hopper unloading coal to conveyor 1	-	29,280	30,970	34,210	11,230
CL - Conveyor to CHPP	-	993	993	993	993
CL - Unloading to transfer point 1	-	640	677	747	245
CL - Unloading to transfer point 2	-	640	677	747	245
CL - Unloading to transfer point 3	-	640	677	747	245
CL - Unloading to transfer point 4	-	640	677	747	245
CL - Unloading to transfer point 5	-	640	677	747	245
CL - Unloading to CHPP	-	914	967	1,068	351
CL - Unloading underground coal to CHPP	50,000	30,000	50,000	50,000	50,000
CL- Handle coal at CHPP (100%)	1,561	1,850	2,527	2,629	1,911
CL- Rehandle coal at CHPP (+10%)	156	185	253	263	191
CL - Loading product coal to trains	948	1,134	1,492	1,513	1,161
CL - Loading rejects and tailings to haul trucks	399	473	-	-	-
CL - Hauling rejects and tailings to NEOC voids	18,006	21,348	-	-	-
Cl - Unloading rejects and tailings to NEOC voids	399	473	-	-	-
WE - OB dump area	-	63,773	139,810	128,947	114,230
WE - Open pit	-	58,517	51,859	99,864	97,762
WE - ROM stockpiles	10,232	10,232	10,232	10,232	10,232
WE - Product stockpiles	3,504	3,504	3,504	3,504	3,504
WE - Dam construction	-	1,051	-	-	-
Grading roads	-	43,132	43,132	43,132	43,132
Upcast Vent	31,536	31,536	31,536	31,536	31,536
Total TSP emissions (kg/yr)	**116,741**	**1,646,925**	**2,166,712**	**2,350,776**	**1,044,064**
% Existing vs approved total TSP emissions	-	7%	5%	5%	11%

Sh – Shovel, Ex – Excavator, FEL – Front-end Loader, OB – Overburden, CL – Coal, WE – Wind erosion