PARTICULATE MATTER BEST MANAGEMENT PRACTICE POLLUTION REDUCTION PROGRAM

ASHTON COAL OPERATIONS PTY LTD

4th July 2012

Job Number 12050093

Prepared by

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Particulate Matter Best Management Practice Pollution Reduction Program - Ashton Coal Operations Pty Ltd

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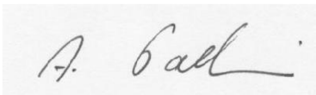
Signature: 

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 OBJECTIVE

Todoroski Air Sciences (TAS) has completed a review of the particulate emissions from Ashton Coal Underground Mine.

The review is focused on estimating annual particulate emissions quantities from the mine operations, as required to prepare a response to the Best Management Practice (BMP) Pollution Reduction Program (PRP) placed on the Ashton Underground Mine NSW Office of Environment and Heritage (OEH) environmental protection licence number 11879 and the matters raised in the licence variation notice dated 02 December 2011 (Notice number 1500513).

1.1 OEH Requirements

U1	**Coal Mine Particulate Matter Control Best Practice**
U1.1	The Licensee must conduct a site specific Best Management Practice (BMP) determination to identify the most practicable means to reduce particle emissions.
U1.2	The Licensee must prepare a report which includes, but is not necessarily limited to, the following: - identification, quantification and justification of existing measures that are being used to minimise particle emissions; - identification, quantification and justification of best practice measures that could be used to minimise particle emissions; - evaluation of the practicability of implementing these best practice measures; and - a proposed timeframe for implementing these best practice measures. In preparing the report, the Licensee must utilise the document entitled *Coal Mine Particulate Matter Control Best Practice – Site Specific Determination Guideline – November 2011*.
U1.3	All cost related information is to be included as Appendix 1 of the Report required by condition U1.2 above.
U1.4	The Report required by condition U1.2 must be submitted by the Licensee to the Office of Environment and Heritage's Regional Manager Hunter, at PO Box 488G, NEWCASTLE WEST 2302 by 29 June 2012.
U1.5	The report required by condition U1.2 above, except for cost related information contained in Appendix 1 of the Report, must be made publicly available by the Licensee on the Licensee's website by 6 July 2012.

2 BACKGROUND

Ashton Coal Operations Pty Limited (ACOL) operates the Ashton Coal Project (ACP) approximately 14km west of Singleton in the Hunter Valley, NSW (**Figure 1**). ACOL is a wholly owned subsidiary of Yancoal Australia Limited (Yancoal), which is the majority (90%) joint venture owner of the mine.

The ACP comprises an open cut mine, an underground mine, a coal handling and preparation plant (CHPP), rail loading facilities, run-of-mine (ROM) and product coals stockpiles, and various surface support infrastructure and facilities (**Figure 2**). Development consent (DA 309-11-2001) for the ACP was granted by the Minister for Planning in October 2002. The ACP is approved to produce up to 5.45Mtpa of ROM coal up to February 2024.

Construction of the open cut mine commenced in 2002, and ceased coal production in September 2011. The mine void will be used for rejects and tailings emplacement for the remaining life of the underground mine. During 2012 rehabilitation was completed for all available areas of the open cut mine, including material stockpiled for capping of the final rejects and tailings emplacement and final landform.

Since the closure of the completion of the open cut in 2011 the ACOL only include comprise an underground mine. The underground mine is a longwall operation which is approved to mine coal from the Pikes Gully (PG), Upper Liddell (ULD), Upper Lower Liddell (ULLD) and Lower Barrett (LB) coal seams (in descending order). Development of the underground mine commenced in the PG seam in 2005. The general longwall layout comprises eight longwall panels (LW1, LW2, LW3, LW4, LW5, LW6A & 6B, LW7A & 7B and LW8). In 2012, longwall extraction in the PG seam will be completed and the longwall miner will be relocated to the ULD seam.

3 DUST EMISSION ESTIMATION APPROACH AND POTENTIAL CONTROL OPTIONS

This section briefly presents the dust emission estimation approach and potential control options for each major mining activity at the Ashton Coal Operations. Three size fractions of dust were considered: total suspended particulate (TSP – all dust that can become, and stay, airborne), inhalable particulate (PM_{10} – dust with aerodynamic diameter less than or equal to 10 μm), and respirable particulate ($PM_{2.5}$ - dust with aerodynamic diameter less than or equal to 2.5 μm).

Based on the review of available information and information gathered during the site visit, the following activities were identified as the potential fugitive dust sources:

- Loading/Unloading of ROM Coal;
- Wind Erosion;
- Hauling Rejects; and
- Rehandle coal at CHPP.

Numerous methods are available to control dust emissions from these dust sources. The potential dust controls that could be applied to the different activities at this facility (including controls currently in use) and their calculated effectiveness are presented in the following sub sections.

USEPA AP42 emission factors were used to estimate potential dust emissions from each type of activity based on the current level of each activity and the available data. As it would appear that the relevant AP42 emission factor for wind erosion is based on data obtained from inactive exposed areas, the NSW State Pollution Control Commission (SPCC) emission factor was used to estimate wind erosion from active exposed areas (such as the mine pit).

3.1 Material Handling (Coal)

Potential dust emissions are estimated using the AP42 equation presented in the following table.

Table 3-1: Fugitive dust control methods and efficiencies for material handling (coal) operations

Material	Pollutant	AP42 Equation	Unit	Assumptions
Coal	TSP	$EF = \frac{0.58}{M^{1.2}}$	kg/hour	Moisture content = 8%
	PM_{10}	$EF = \frac{0.75 \times 0.0596}{M^{0.9}}$	kg/hour	
	$PM_{2.5}$	$EF = \frac{0.019 \times 0.58}{M^{1.2}}$	kg/hour	

The contributing factors that affect fugitive dust emissions calculations from material handling (coal) operations are the quantity of material moved and the moisture content of the material. The most common practice to reduce fugitive dust from materials handling is to increase the inherent moisture content of the material. However, this is not possible for ROM coal, and for Product coal the moisture content must also be maintained such as to provide for safe handling: the coal must not turn into a slurry or slump, or bind to material handling equipment.

Another factor that can be considered to reduce potential fugitive emissions from material handling is to minimise the material drop heights. However, it is noted that no data are available to quantify the emission reduction with the use of these control measures. The control measures identified from the literature review are summarised in the following table.

Table 3-2: Fugitive dust control methods and efficiencies for material handling (coal) operations

Best Management Practice	Description	Emission Reduction	Applied at Ashton Underground Coal mine?	Comments
Avoid material transfer during high wind conditions	Involves shutting down or modifying activities	No Data	Yes	Current practice considers effect of meteorological conditions on levels of dust. Real time weather and dust monitoring is in place and operational.
Minimise drop height	When loading a truck or stockpile	No Data[a]	Yes	Studies have shown this to be effective, but no emissions estimation equation is available
Water sprays on ROM Pad	Via fixed or sprays or water cart	50%	Yes	Water spray currently installed and operational for ROM, to increase moisture content
Bypass stockpile	Bypass product coal stockpiles	>99%	Yes	There are various surge bins and load out bins that effectively replace stockpiles, as part of the CHPP design.
Bucket-wheel, portal or bridge reclaimer with water application	Significant infrastructure for unloading from coal stockpile	50% (Katestone 2011)	No	Refer to Section 4.2

Best Management Practice	Description	Emission Reduction	Applied at Ashton Underground Coal mine?	Comments
Variable height stacker at coal stockpiles	Allows unloading of coal with reduced drop height	25% (Katestone 2011)	No	Refer to Section 4.2
Water sprays		50% (Katestone 2011)	Yes	Current practice on all coal stockpiles
Telescopic chute with water sprays	Allows unloading of coal with reduced drop height	75% (Katestone 2011)	No	Refer to Section 4.2

[(a)] Katestone (2011) states that 30% control efficiency can be achieved by reducing the drop height from 3m to 1.5m.

3.2 Hauling on Unpaved Roads

Potential dust emissions are estimated using the equations presented in the following table.

Table 3-3: Fugitive dust control methods and efficiencies hauling operations

Material	Pollutant	AP42 Equation	Unit	Variable
Coal or Overburden	TSP	$EF = \frac{0.4536}{1.6093} \times 4.9 \times \left(\frac{S}{12}\right)^{0.7} \times \left(M \times \frac{1.1023}{3}\right)^{0.45}$	kg/VKT	Silt content S=2.3% M= Gross weight of haul trucks
	PM_{10}	$EF = \frac{0.4536}{1.6093} \times 1.5 \times \left(\frac{S}{12}\right)^{0.7} \times \left(M \times \frac{1.1023}{3}\right)^{0.45}$	kg/VKT	
	$PM_{2.5}$	$EF = \frac{0.4536}{1.6093} \times 0.15 \times \left(\frac{S}{12}\right)^{0.7} \times \left(M \times \frac{1.1023}{3}\right)^{0.45}$	kg/VKT	

Emissions from hauling operations on unpaved roads depend on the silt content of the haul roads, vehicle weight, travel distance, frequency of vehicle movement and vehicle speed. Available control options span broad ranges in terms of cost, efficiency and applicability. For example, traffic controls provide moderate emission reductions but may be unviable commercially and difficult to enforce. Paving of haul roads is not feasible for hauling overburden in open cut mines.

Based on the available information in the literature, potential dust emissions from hauling operations on unpaved roads can be minimised using the following options:

- Vehicle restrictions;
- Surface improvements; and
- Surface treatments.

A summary of these control options is provided in the following table.

Table 3-4: Fugitive dust control methods and efficiencies hauling operations

Best Management Practice	Available methods and description	Emission Reduction	Applied at Ashton Underground Coal mine?	Comments
Vehicle restriction	Limit number of vehicles on the road	Linear	Yes	Ashton Optimises the loading capacity , number of return trips, travel distance of haul trucks. Only 2 trips per hour are needed.
	Minimise travel distance			
	Limit vehicle speed limit	44% (Golder Associates 2010) 40-85% (Katestone 2011)	Yes	Truck speed at Ashton is limited to 50 km/hr
	Grader speed reduction	Exponential with speed	Yes	Grader speed is maintained below 8 km/hr
Surface improvements	Pave surface road	>90% (Katestone 2011)	No	Not feasible, refer to **Section 4.2**
	Adding gravel or slag to a surface	No Data	No	Generally unviable due to tyre damage and wear, or due to the cost of importing and spreading material, See **Section 4.2**
Surface treatment	Wet suppression (watering)	67-99% (see section 2.5.1)	Yes	Ashton has excess water cart capacity when assessed against the calculated requirements and regularly waters haul roads to minimise dust.
	Chemical stabilisation/treatment	84% (Katestone 2011)	No	Control efficiency varies with type of chemical, application rate and frequency of application, generally commensurate or better control can be achieved by watering of active areas, see **Section 4.2**
Other	Use larger vehicles to minimise number of trips	Linear	Yes	Ashton Coal uses 170t load capacity trucks for hauling rejects and optimises the loading capacity, number of return trips, travel distance of haul trucks. Only 2 trips per hour are needed
	Use conveyors in place of haul roads	>95% (Katestone 2011)	Yes	Ashton Coal uses conveyors for all ROM and product coal transfers

3.2.1 Wet suppression on unpaved roads

The control efficiency achieved by watering is estimated based on the following empirical formula (**Buonicore and Davis, 1992**).

$$CE = 100 - \frac{0.8pdt}{i} \qquad \textbf{(Equation 1)}$$

CE = average control efficiency (%)

p = potential average hourly daytime evaporation rate (mm/hr)

d = average hourly daytime traffic rate (/hr)

t = time between applications

i = application intensity (L/m^2)

The coal rejects material handled on an annual basis at Ashton Underground Coal mine and the capacity of haul trucks was used to estimate the average traffic rate of the haul roads and was calculated to be 2 trips per hour. The average daily evaporation rate, from the Bureau of Meteorology

Jerrys Plains weather station, on an annual basis was found to be 4.3mm and ranges from 2.0mm to 7.1mm on a daily maximum average basis during winter and summer respectively. Using **Equation 1** and maximum daily average evaporation of 7.1 mm, a matrix was developed to determine the required water application rate and intensity to achieve optimum control efficiency.

Table 3-5: Estimated haul road control efficiency (%) - summer day

Application frequency (per hour)	**Control Efficiency (%)**				
	Application rate (L/hr/m^2)				
	0.25	0.5	0.75	1	2
1	96%	98%	99%	99%	99%
2	92%	96%	97%	98%	99%
4	84%	92%	95%	96%	98%
6	76%	88%	92%	94%	97%
8	67%	84%	89%	92%	96%

The results indicate that high levels of haul road dust control (>90%) can be achieved at the Ashton Underground Coal Mine even with relatively low application frequencies at typical application rates. This arises as the utilisation of the haul road (two movements per hour) is low, for example, when compared with a higher intensity mines that may have 30 to 50 movements per hour.

3.3 Wind Erosion

Dust can be generated from stockpiles and open areas due to the action of wind with sufficient velocity to release material from the surface. Potential wind erosion at the site occurs from active stockpiles and active exposed areas, therefore the emissions from wind erosion have been calculated using the SPCC emission factors. The SPCC emission factor of 0.4 kg/ha/hr was used to estimate potential dust emissions from active mining areas

Several factors that can reduce wind erosion are as follows.

- Material surface that is compacted or kept moist; and,
- Reduced exposed/active surface areas.

These factors translate to the dust control measures that can be applied to both stockpiles and open areas are presented in **Table 3-6** and **Table 3-7**.

Table 3-6: Fugitive dust control methods and efficiencies for wind erosion from exposed areas

BMP	Available methods and description	Emission Reduction	Applied at Ashton Underground Coal mine?	Comments
Surface stabilisation	Wet suppression (watering) Maintain visible crust to reduce wind erosion in exposed areas and stockpiles. Apply water on the exposed areas before and during high wind event. Rainfall also creates crusting and surface sealing, and reduces the area susceptible to wind erosion.	50% (Katestone 2011)	Yes	ACOL has water sprays operating on all coal stockpiles. Where accessible during periods of high winds water carts are used to spray exposed stockpiles that have not already been vegetated.
	Chemical stabilisation/treatment	70-84% (Katestone 2011)	No	Refer to Section 4.2
	Paving and cleaning	>95% (Katestone 2011)	Yes	Heavily trafficked areas are paved and cleaned
	Apply gravel	84% (Katestone 2011)	No	Not viable to import gravel Refer to **Section 4.2.**
Wind barrier	Wind barrier or fences perpendicular to the prevailing wind direction	30-80% (Katestone 2011)	No	Not viable in a compact mine, refer to **Section 4.2**

Table 3-7: Fugitive dust control methods and efficiencies for wind erosion from stockpiles

BMP	Available methods	Emission Reduction	Applied at Ashton Underground Coal mine?	Comments
Surface stabilisation	Wet suppression (watering)	50% (Katestone 2011)	Yes	Ashton has water sprays for its stockpile areas. These sprays cover and can saturate the entire surface and are likely to have >50% control.
	Surface crusting	95% (Katestone 2011)	No	Not applicable to active coal stockpiles; not considered further.
	Chemical stabilisation/ treatment	80-99% (Katestone 2011)	No	Not applicable to active coal stockpiles; not considered further.
Wind speed reduction	Vegetative wind breaks	30% (Katestone 2011)	No	All overburden stockpiles are vegetated. Ashton ROM stockpile is located below ground level and is shielded by the highwall to some degree. This has a similar in effect to vegetative screens. Small-site limitations do not permit vegetation wind breaks; not considered further.
	Wind screen or wind fences	75-80% or greater (Katestone 2011)	No	All overburden stockpiles are vegetated. Not applicable to active coal stockpiles, not considered further.
	Preshaping/ orientation	<60% (Katestone 2011)	No	All overburden stockpiles are vegetated. The stockpiles are designed to be below ground level or as far from receptors as possible. The small-site limitations do not permit this approach; not considered further.
Avoidance	Bypassing stockpiles	100% (Katestone 2011)	Yes	There are various surge bins and load out bins that effectively replace stockpiles, as part of the CHPP design.

4 EMISSIONS INVENTORY

4.1 Baseline Emission Inventory (No control)

Table 4-1 presents a summary of the estimated potential annual emission of particulates from the process or activities at this facility. The estimations are based on the equations and assumptions outlined in **Section 3**. The data are sorted in descending order by the total potential TSP emission (kg/ year). The estimated emissions presented in this table represent the potential emissions if no mitigation measures were applied.

Table 4-1: Summary of Total dust emissions (No control)

Activity	Estimated Annual Emission (kg)			Contribution (% of Total)		
	TSP	PM10	PM2.5	TSP	PM10	PM2.5
Loading/unloading	280,205	48,126	6,466	67.2%	56.4%	68.8%
Hauling	111,481	24,546	2,455	26.7%	28.8%	26.1%
Wind Erosion	25,299	12,649	481	6.1%	14.8%	5.1%
Other	324	153	23	0.1%	0.2%	0.2%
Total	416,985	85,322	9,402			

4.2 Emission Inventory for Current Operations (Current controls)

Ashton Coal Underground Mine is currently applying control measures to minimise dust emissions from all mining activities. Key control measures applied on the major dust sources are listed in **Table 4-2**.

Table 4-2: Current control measures for major dust sources at Ashton Underground Coal mine

Activity	BMP	Control measure	Emission reduction (%)
Hauling	Vehicle Restriction	Minimise the travel distance	Current practice, change from "no control" case cannot be quantified
		Maintain grader speed below 8 km/hr	
	Surface treatments	Watering the haul road appropriately.	≥90%[1]
Loading /Unloading	Avoidance	Avoid material transfer during high wind speed condition, or bypass stockpiles.	Not quantifiable as no "baseline"
	Watering	Spray water on material handling areas and stockpiles during high wind speed conditions	Not quantifiable
	Other	Minimise drop height	Not quantifiable
Wind erosion	Wet suppression	Apply water on the exposed areas and stockpiles before and during high wind events	50%
	Surface stabilisation	Expedited rehabilitation and planting/ seeding	100% to areas that are rehabilitated, not quantifiable as no "baseline"

[1]calculated based on 0.4 l/m^2 water application every four hours on haul roads for reject transport. It is noted that transportation of all ROM and product coal is conducted via conveyors to minimise potential dust generation.

Table 4-3 presents a summary of the calculated annual of particulate emissions from the current activities at this facility. The estimations are based on the equations and assumptions outlined in **Section 3** along with the control measures presented in **Table 4-2**. The data are sorted in descending order per total potential TSP emission (kg/ year).

Table 4-3: Summary of Total dust emissions (Current controls)

Activity	Estimated Annual Emission (kg)			Contribution (% of Total)		
	TSP	PM10	PM2.5	TSP	PM10	PM2.5
loading/unloading	183,270	33,930	4,625	93.1%	90.1%	94.0%
hauling	11,148	2,455	245	5.7%	6.5%	5.0%
Wind Erosion	12,649	6,325	240	6.1%	14.8%	4.7%
Other	324	153	23	0.2%	0.4%	0.5%
Total	207,067	42,709	5,110			

The PRP is focused on the top four dust generating activities. Based on the calculated emissions presented in **Table 4-3**, focus was given to identify the additional control measures that can be used to minimise potential dust emissions from the top four activities below:

- Loading/unloading of ROM and Product coal;
- Wind erosion;
- Hauling of rejects; and,
- Other minor dust generating activities including rehandling of ROM coal at CHPP.

These four activities account for all potential dust generating activities at the site.

4.3 Analysis of Potential Control Measures

The following aspects are examined in order of highest to lowest emissions for the top four sources of dust.

4.3.1 Loading/Unloading Operation

Based on the information presented in **Section 3**, and **Section 4** the additional control measures that can be considered to minimise dust generation potential from Loading/Unloading Operation include.

- Option 1: Use of a variable height stacker at product coal stockpiles (not feasible)
- Option 2: Use of Telescopic chute with water sprays at Product coal stockpile (not feasible)
- Option 3: Bucket-wheel, portal or bridge reclaimer (not feasible)

Option 1: Use of a variable height stacker at product coal stockpiles. This option is not feasible as the mine infrastructure is already in place, and the benefit would be marginal at best as the product coal moisture content ranges between 8.5-10.5% and has water sprays that essentially envelop the stockpile. Due to this only minor emissions related to loading of the stockpile arise, and no tangible benefit would be realised.

Option 2: Use of Telescopic chute with water sprays at Product coal stockpile is not feasible for the same reasons as the variable height stacker. Note that Water sprays on coal stockpiles are operated automatically during high wind speed conditions;

Option 3: Bucket-wheel, portal or bridge reclaimer with water application for unloading coal stockpiles is not feasible for the same reasons as above.

4.3.2 Hauling on unpaved roads

Based on the information presented in **Section 3** and **Section 4**, the additional control measures that can be considered to minimise dust generation potential from hauling operations on paved roads include.

- Option 1: Surface improvements - pave or cover road surface with gravel;
- Option 2:
  a) Optimise the water application rate and frequency of water application to ensure dust emissions are consistently at the minimum levels; and,

  b) Chemical suppression/treatment of haul roads;

Option 1 has the potential to reduce the dust generation from hauling operations by over 90% relative to the uncontrolled case. However, this level of control is equal to the level of control that would be achieved by watering. The potential benefit is therefore no greater than the existing watering controls, and as watering and sweeping would still be required with this option to achieve the >90% control level, it would not be viable and is not considered further.

Option 2 is the current method for controlling the dust emissions from hauling operations. Based on the techniques described in the literature for estimating the control efficiency of wet suppression on haul roads, it is estimated that Ashton Coal Underground mine is currently capable of achieving a control efficiency of 90% or greater by watering the haul roads with its available resources. The estimated water application rates required to achieve a control efficiency of 90% or greater were calculated based on the equation presented in **Section 3.5.1.** The results are detailed in **Table 4-4**.

Table 4-4: Calculated water application rate to maintain 90% or greater control efficiency on haul roads

Month	Average Evaporation rate (mm/day)	Frequency	Application rate (L/m^2)	Control efficiency (%)
January	7.1	4	0.4	90
February	6	4	0.4	91
March	5	5	0.4	90
April	4	6	0.4	91
May	2.9	9	0.4	92
June	2	12	0.4	94
July	2.3	12	0.4	93
August	2.6	10	0.4	93
September	3.7	7	0.4	92
October	5.3	5	0.4	90
November	6.5	4	0.4	91
December	6.6	4	0.4	91

Current operating practice is to utilise one water cart on the haul road. The calculations shown in **Table 4-4** are based on the water application rates and frequency required to maintain a high level of control efficiency (>90%). It can be seen that to maintain a high level of control, the frequency of water application during the dryer periods is higher, but is still quite low, once every 4 hours.

Given the single short haul road and the excess water cart availability (there are three water carts), there does not appear to be any impediment to maintaining high levels of dust control (>90%) using the available water cart resources. The main factor for the ability to achieve a high level of control is that there is a very low rate of haul road use, 2 trips per hour.

Watering alone, using the available resources can achieve control efficiencies of 90% or greater. This means that there would be limited value in considering chemical controls in this case where there is no shortfall of water or resources to deliver the water and achieve control that is above best practice levels.

It is noted that the three water carts are also used for watering the exposed areas around the infrastructure, workshops and so on, and there is no documented procedure for prioritising the water cart use.

Therefore, there may be some scope to optimising the effectiveness of the current watering management regime applied to haul roads and watering of other exposed areas.

Optimising the current watering regimes may mean not applying excessive water (which can damage road surfaces) and ensuring sufficient water and equipment is used as required on haul roads (and exposed areas) to consistently maintain the highest levels of dust control according to the prevailing conditions. This may entail tailoring watering to correspond with evaporation rate data, dustiness forecasts and the like.

4.3.3 Wind erosion

Based on the information presented in **Section 3** and **Section 4**, the additional control measures that can be considered to minimise dust generation potential from the exposed areas of the rejects dump, and areas around the mine infrastructure.

- Option 1: Wind barriers or fences;
- Option 2: Gravel or similar surface; and,
- Option3: Chemical controls

Option1: Wind erosion from reject dumping areas can theoretically be controlled with wind barriers or fences; structures much like silt fences erected perpendicular to the prevailing wind direction. This however is not feasible over large areas that change in the short term.

The rejects area is at the base of a deep pit and is routinely covered with additional wet rejects, or is actually under water which would be more effective in controlling dust than shielding offered by barriers and fences, therefore this option is not considered further.

Option2: Gravel surfacing would not be viable in the rejects dump as it is continually added to with wet "gravel-like" reject materials. However, gravel surfacing may be useful for some exposed areas around infrastructure or parking pads where the gravel can stabilise the surface and reduce potential wind action on silty material. It is noted however that currently all light vehicle car parks and light service roads around the infrastructure areas and access to the much of the Underground area are already sealed surfaces.

Option 3: Chemical controls involve the spraying of chemical agents to stabilise the material surface and minimise wind erosion. This is not a viable method for the rejects dump, as it is continually added to with wet rejects, rendering any surface treatment unviable.

Chemical controls on exposed areas would only be viable for areas left exposed for relatively long periods. In regard to such areas, these are best managed by rehabilitation, which is applied at Ashton and is 100% complete, and effectively 100% control.

The potential effectiveness of chemical controls in the relatively small exposed areas around infrastructure items has been considered in comparison to the current use of a small (35,000 litre) water cart that is used to water these areas. The small cart permits access into more confined areas and under conveyors etc as necessary to water close to the infrastructure plant. Similar to the haul road watering efficiency, this water cart is able to regularly saturate all the areas frequently and it is likely that chemical controls would be of limited use.

Nevertheless, as part of a review of its watering regime and the development of a protocol to optimise watering for haul roads and exposed areas it is anticipated that it would be identified whether there is any potential gain in control efficiency over watering for such areas that can be made, for example for gravel surfacing and chemical controls. If it is found that it is possible to improve on the current levels of control, the outcomes of the review would be provided as an addendum to this PRP.

Summary

From the analysis above, the controls that were considered feasible were applied to the calculated emissions, and the results are shown in **Table 4-5.**

The only parameters that would influence the analysis and that can be reasonably quantified and controlled, relate to the watering efficiency of the haul roads and exposed surfaces. It is noted that the net control effectiveness of the feasible additional control measures are unlikely to increase the calculated control efficiency and therefore the results at this time remain unchanged.

The effect of optimised watering regimes is unlikely to significantly alter the control level that would be calculated using the equations, but it may result in actual improvements at the site by ensuring that excess or insufficient watering does not arise and that resources are allocated to best effect.

Table 4-5: Summary of total dust emissions (with BMP control)

Activity	Estimated Annual Emission (kg)			Contribution (% of Total)			Control level (%)		
	TSP	PM10	PM2.5	TSP	PM10	PM2.5	TSP	PM10	PM2.5
loading/unloading	183,270	33,930	4,625	93.1%	90.1%	94.0%	35%	29%	28%
hauling	11,148	2,455	245	5.7%	6.5%	5.0%	90%	90%	90%
Wind Erosion	12,649	6,325	240	6.1%	14.8%	4.7%	50%	50%	50%
Other	324	153	23	0.2%	0.4%	0.5%	0%	0%	0%
Total	207,067	42,709	5,110	100.0%	100.0%	100.0%	50%	50%	46%

5 CONCLUSION

The study found that the current controls at Ashton Underground coal mine are generally consistent with Best Management Practice for the control of dust emissions. There are numerous controls that the operation undertakes to manage dust, such as use of wind activated sprinklers, bypassing stockpiles, covered conveyors and so on as detailed in this report. The mine operates a proactive dust control system where weather predictions are taken in to consideration when planning the day's activities. This process was considered to be more essential during the operation of the open cut however is still implemented in the ongoing operation of the underground mine coal handing facilities and construction activities that may be associated with these. The mine also operates a reactive dust control system to manage dust emissions. The mine regularly triggers blanketing water sprays on stockpiles, additional watering on exposed surfaces or ceases operation in response to elevated levels of background dust, and prevailing winds identified by the real-time dust and weather monitoring system implemented at the site.

Whilst the calculated levels of control for water application are calculated to exceed 90% (best practice), there is currently no documented procedure at Ashton underground Coal Mine for the optimal use of water carts for watering haul roads and exposed areas. Therefore, to ensure the consistent application of best practice watering regimes, it is proposed that a review of the current practice in this regard be conducted and that a procedure to document the optimised use of watering on haul roads and exposed areas would be developed as a result of this PRP. If the review finds scope for any further potential improvements, for example with the use of gravel surfacing or chemical controls, an addendum to this PRP review would be provided.

6 REFERENCES

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"Air Pollution Engineering Manual". Air and Waste Management Association.

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Katestone (2011)
"NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining", Katestone Environmental Pty Ltd, June 2011.

FIGURES

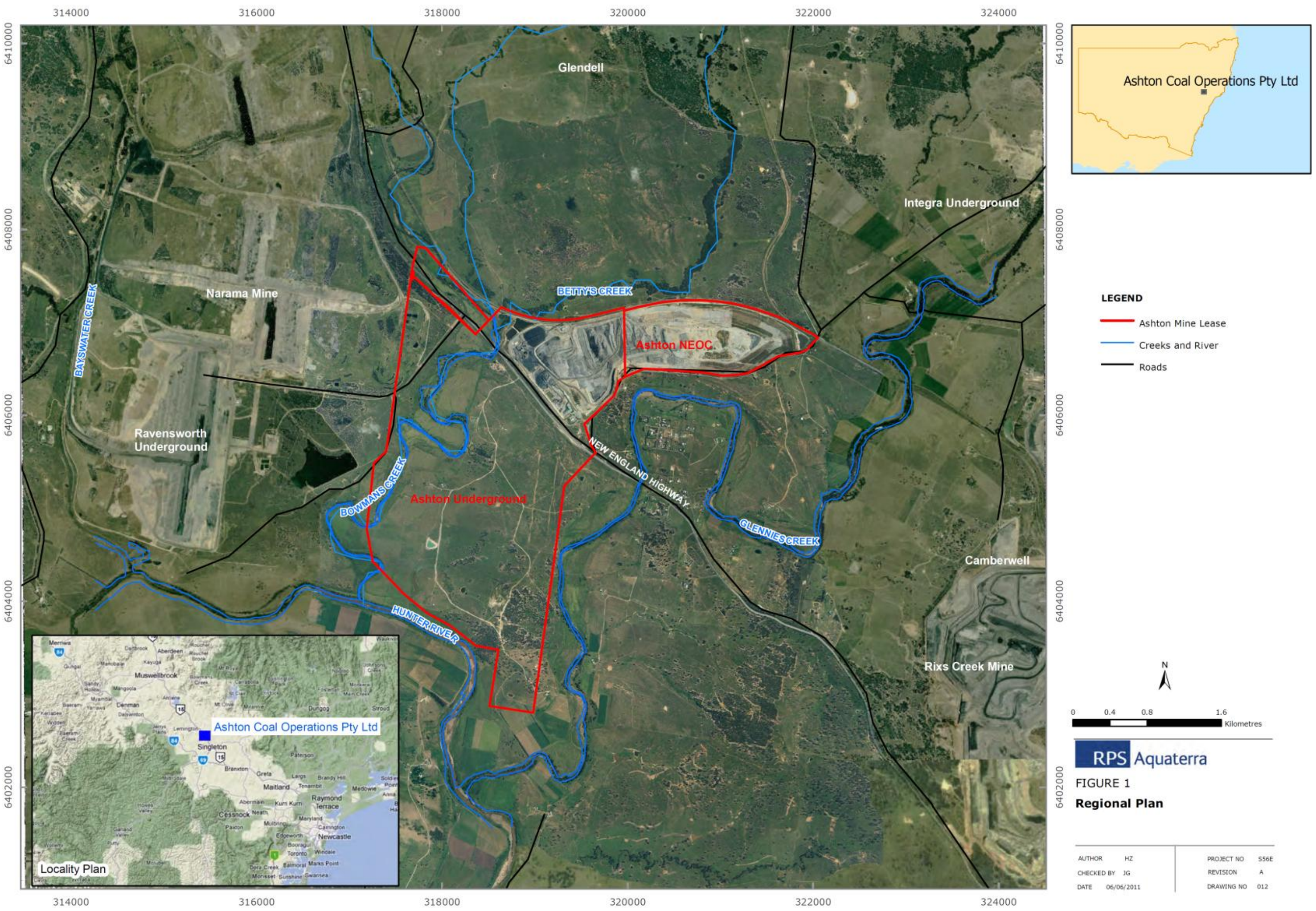

Figure 1: Site location

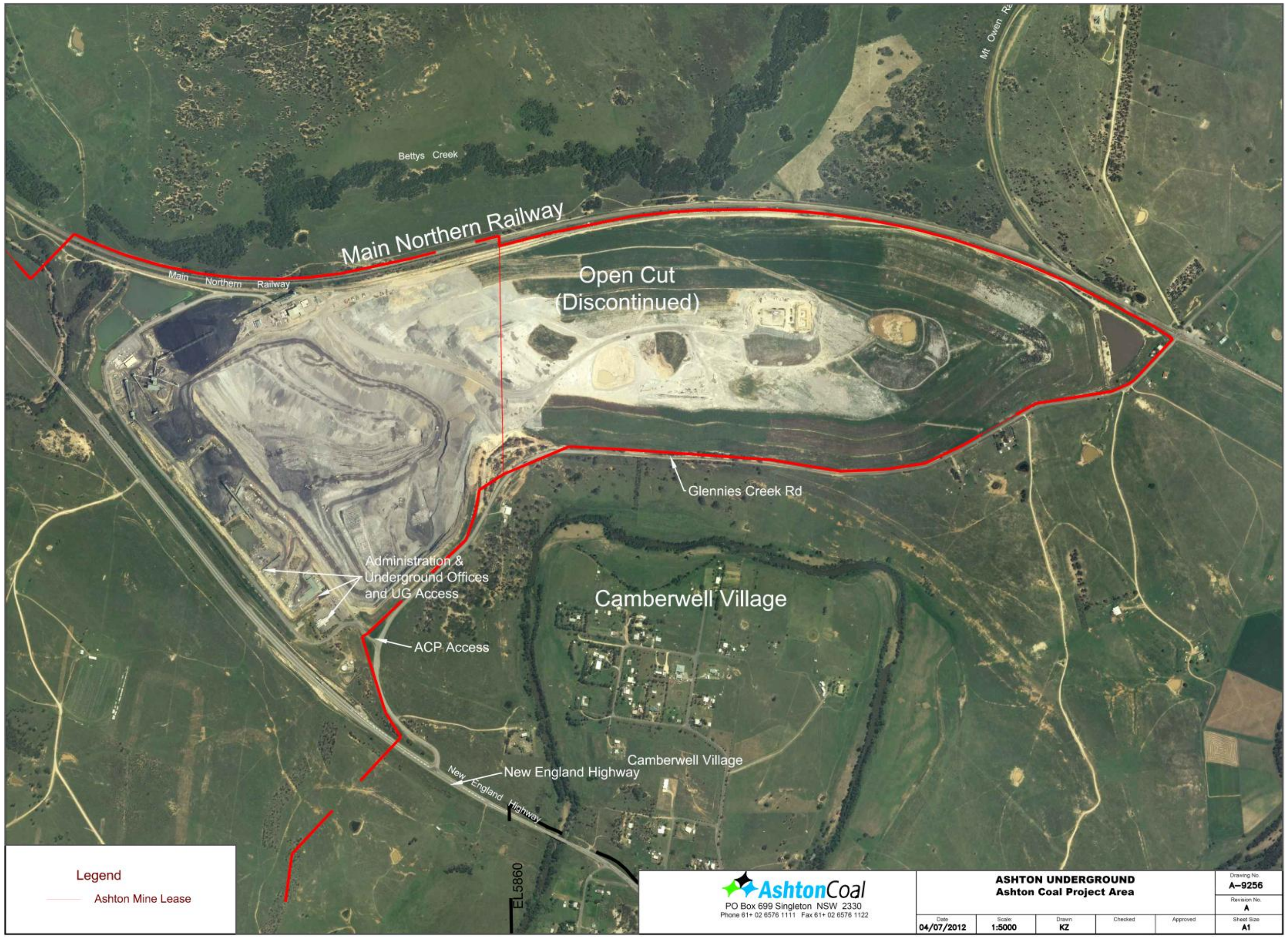

Figure 2: Site layout