APPENDIX 3B – AIR QUALITY MONITORING DATA

Summary of Annual Average Dust Deposition

EPL 12425 ID No.	3	4	-	6	-	9	10	11	12	26
Monitoring ID No.	DG4	DG5	DG7*	DG8	DG10	DG11	DG12	DG13	DG14	DG15
2011 Annual Average Total Insoluble Matter (g/m^2/month)	0.40	1.13	1.22	0.94	3.02	1.30	3.73	1.95	1.88	
2012 Annual Average Total Insoluble Matter (g/m^2/month)	2.80	0.73	1.52	1.03	1.19	1.41	6.52	2.38	2.18	
2013 Annual Average Total Insoluble Matter (g/m^2/month)	1.20	0.60		1.43	2.04	1.98	3.26	1.94	1.04	1.00
2014 Annual Average Total Insoluble Matter (g/m^2/month)	1.68	0.83		1.48	3.31	1.28	3.28	2.81	1.43	0.85
2015 Annual Average Total Insoluble Matter (g/m^2/month)	0.90	0.80		1.09	3.61	1.94	2.91	5.91	1.16	0.75
2016 Annual Average Total Insoluble Matter (g/m^2/month)	1.30	1.34		1.10	1.88	4.18	2.48	33.81	4.80	1.64
2017 Annual Average Total Insoluble Matter (g/m^2/month)	1.3	1.4		1.9	4.3	1.8	3.7	10.5	26.3	1.2
2018 Annual Average Total Insoluble Matter (g/m^2/month)	3.2	2		1.7	3.7	2.2	5.2	4.1	6.6	1.3

Notes: Green shaded cells indicated internal dust depositional monitoring sites at heritage sites. *At the end of the 2012 reporting period DG7 was relocated from the Mittaville Property to Araluen Road. Araluen Road is situated to the north east of Wollar Village. The new dust gauge is identified as DG15.

Summary of TSP and PM_{10} Results

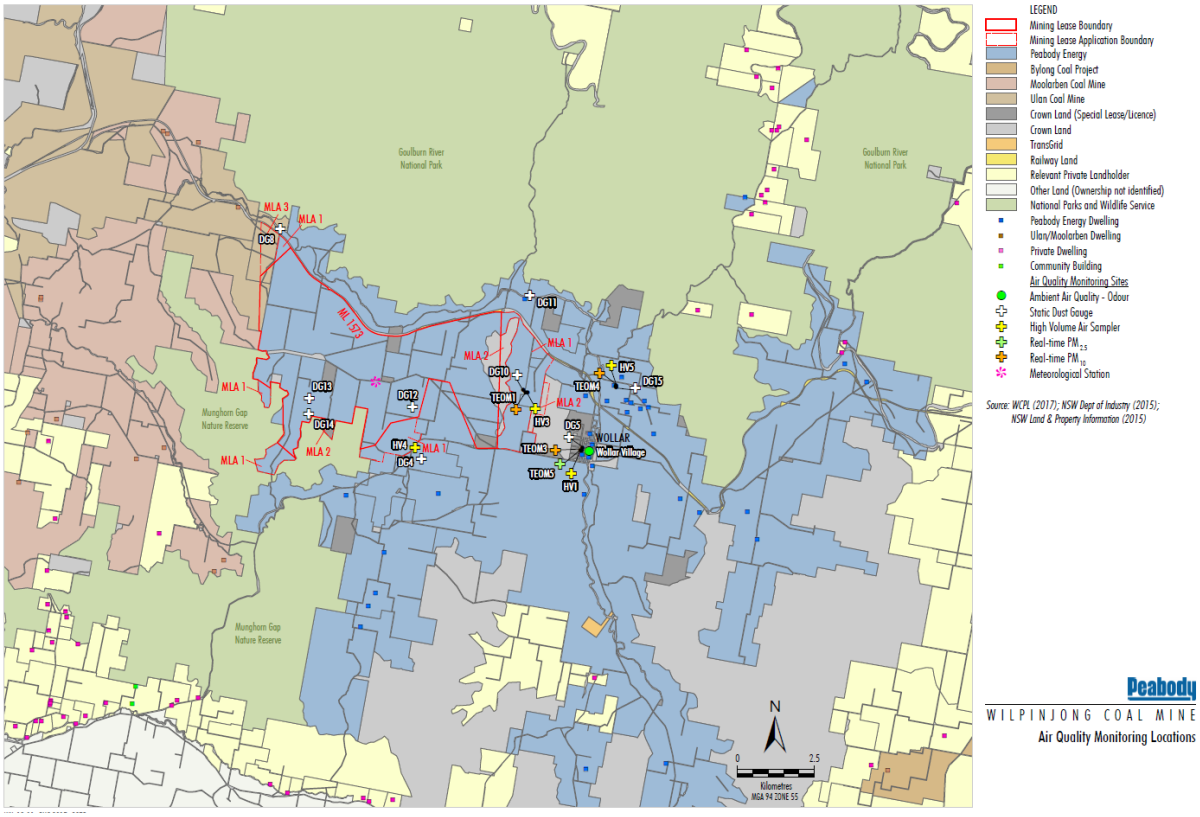
Monitoring Locations#							
EPL 12425 ID No.	13	19	20	27	-	25	28
Monitoring ID No.	HV1	HV3	HV4	HV5	TEOM1^	TEOM3	TEOM4
2012 Results							
PM_{10} (µg/m^3) recorded range*	2.8 – 21.7	-	12.0 – 21.8	**	3.4 - 60.3	**	**
PM_{10} (µg/m^3) annual average	9.1	-	9.7	**	9.7	**	**
TSP (µg/m^3) recorded range*	-	1.9 – 47.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	18.8	-	-	-	-	-
2013 Results							
PM10 (µg/m^3) recorded range*	1.2 – 43.7	-	2 – 55.1	1.8 – 49.8	3.0 – 82.5	2.4 – 55.6	0.7 – 68.9
PM10 (µg/m^3) annual average	10.84	-	12.4	15.71	18.5	13.1	16.8
TSP (µg/m^3) recorded range*	-	3.1 – 77.6	-	-	-	-	-
TSP (µg/m^3) annual average	-	27.45	-	-	-	-	-
2014 Results							
PM10 (µg/m^3) recorded range*	1.70 - 41.20	-	1.80 – 37.70	2.80 – 47.80	1.8-69.5	2.65 – 59.12	1.18 – 53.96
PM10 (µg/m^3) annual average	11.15	-	11.95	14.58	17.3	13.2	13.5
TSP (µg/m^3) recorded range*	-	7.20 – 59.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	23.09	-	-	-	-	-

Summary of TSP and PM_{10} Results (Continued)

Monitoring Locations#							
EPL 12425 ID No.	**13**	**19**	**20**	**27**	**-**	**25**	**28**
Monitoring ID No.	**HV1**	**HV3**	**HV4**	**HV5**	**TEOM1^**	**TEOM3**	**TEOM4**
2015 Results							
PM10 (µg/m^3) recorded range*	1.1 – 29.3	-	1.9 – 40.0	1.0 – 35.3	2.2 – 87.8	1.4 – 78.5	0.1 – 77.3
PM10 (µg/m^3) annual average	9.99	-	11.52	11.68	14.1	11.26	14.16
TSP (µg/m^3) recorded range*	-	3.7 – 68.7	-	-	-	-	-
TSP (µg/m^3) annual average	-	22.74	-		-	-	-
2016 Results							
PM10 (µg/m^3) recorded range*	1.5 – 23.0	-	1.8 – 25.2	2.5 – 34.2	3.3 – 41.7	0.4 – 34.4	0.0 – 51.1
PM10 (µg/m^3) annual average	9.78	-	11.69	13.95	15.0	10.2	11.3
TSP (µg/m^3) recorded range*	-	3.9 – 82.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	27.59	-	-	-	-	-
2017 Results							
PM10 (µg/m^3) recorded range*	2.1 - 28.2	-	4.5 - 69.1	5.1 - 55.4	2.9 - 86.7	0.9 - 52.2	0.9 - 50.9
PM10 (µg/m^3) annual average	12.2	-	16.7	16.6	18.4	9.5	12.8
TSP (µg/m^3) recorded range*	-	10.1 - 142.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	38.1	-	-	-	-	-
2018 Results							
PM10 (µg/m^3) recorded range*	2.1 – 168.0	-	2.6 – 208.0	2.1 – 167.0	2.5 – 206.6	0.1 – 143.3	0.1 – 156.8
PM10 (µg/m^3) annual average	23.3	-	24.76	16.9	22.1	14.4	18.0
TSP (µg/m^3) recorded range*	-	5.6 – 237.0	-	-	-	-	-
TSP (µg/m^3) annual average	-	45.7	-	-	-	-	-

Notes: * Data presented is the range of minimum and maximum 24-hour averages. ^ Data recorded at these sites is not for compliance, but for management purposes only. # Refer to **Figure below.**

Air Quality Monitoring Stations



Air Quality Monitoring Stations (Wollar)

LEGEND

- Peabody Energy
- Crown Land (Special Lease/Licence)
- Crown Land
- Railway Land
- Relevant Private Landholder
- 1 Landholder Reference Number
- Peabody Energy Dwelling
- Community Building
- Private Dwelling

Special Lease/Licence Holder

Noise Monitoring Sites
- Attended Noise
- Real-time Noise

Blasting Monitoring Sites
- Fixed Blast

Air Quality Monitoring Sites
- Ambient Air Quality - Odour
- Static Dust Gauge
- High Volume Air Sampler
- Real-time $PM_{2.5}$
- Real-time PM_{10}

Source: WCPL (2017); NSW Dept of Industry (2015); NSW Land & Property Information (2016)

Peabody
WILPINJONG COAL MINE
Wollar Environmental Monitoring Sites

2018 Ambient Air Quality Monitoring Reports

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 14184.

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st January 2018 – 31st January 2018

Report No.: DAT12888

Report issue date: 28th February 2018

Maintenance contract: MC951

ECOTECH PTY LTD. ABN: 32005752081
1492 Ferntree Gully Rd, Knoxfield VIC. 3180. AUSTRALIA
Tel No: 1300 364 946 Fax No: 1300 668 763
Email ecotech@ecotech.com WEB www.ecotech.com

Customer Details	
Customer	Peabody Energy Australia
Contact name	Clark Potter
Address	Locked Bag 2005, Mudgee 2850 NSW
Email	cpotter@peabodyenergy.com
Phone	+61 (02) 6370 2527

Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT12888	28/02/2018	Elmira Parto

Report by **Elmira Parto**

Approved by **Jon Alexander**

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1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene, *p*-Xylene, wind speed and wind direction.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for January 2018. Data capture for the different pollutants is presented in Table 9.

Xylene data monitored at the Wollar station is not included for this month as the data is pending further investigation into instrument performance and calibration. Data will be issued on completion of this investigation.

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for January 2018.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

3.0 Monitoring and Data Collection

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 21th June 2017 to assess for compliance with *AS/NZS 3580.1.1:2016 "Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment"*.

The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2016*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Gill Windsonic
Wind Direction (10m)	Gill Windsonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX	Manufacturer's Instructions	Gas Chromatography Synspec CG955 Series Manual
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Jan-18.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5-minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One-hour averages are calculated based on a clock hour. One-day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	0.030	ppm	None
NO_2	1 hour	0.120	ppm	1 day a year
SO_2	1 hour	0.200	ppm	1 day a year
SO_2	1 day	0.080	ppm	1 day a year
SO_2	1 year	0.020	ppm	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
NO_2 (EC9841)	ppm	0.001 ppm	± 0.016 ppm K factor of 2.01	0 ppm to 0.500 ppm
SO_2 (EC9850)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
H_2S	ppm	1 ppb	15.2% of reading or ± 0.019 ppm, whichever is greater K factor of 2	0.000 ppm to 0.500 ppm
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
Vector Wind Speed	m/s	0.1 m/s	±0.01 m/s or 2.0% of reading, whichever is greater (K factor of 1.96)	0 m/s to 60 m/s
Vector Wind Direction	Deg	1 deg	±2 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every night for NO, NO_2, NO_x and SO_2, every 2nd night for H_2S and weekly for BTX.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, H_2S and BTX

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	00:45 to 01:25 every day	N/A
SO_2	00:45 to 01:25 every day	23:45 to 23:50 every day
H_2S	01:35 to 02:35 every 2nd day	23:45 to 23:50 every day
BTX	03:45 to 6:10 weekly	N/A

5.3. Maintenance

Scheduled visits were made:

- 10/01/2018 a 3 monthly maintenance was performed
- 11/01/2018 a monthly and a 2 yearly maintenance completed for H_2S and wind sensors respectively. Wind sensors were swapped out and sent for wind tunnel calibration (ID 15-1290 was transferred in and ID 13-1120 was transferred out).

Unscheduled visits were made:

- 2/01/2018 a remote calibration performed to adjust the H_2S span
- 3/01/2018 to reboot the locked up wind sensors.
- 30/01/2018 to reset the BTX analyser and H_2S convertor after a power interruption caused them to be lock up.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	10/01/2018	6-monthly	10/01/2018	Monthly
SO_2	10/01/2018	6-monthly	10/01/2018	Monthly
H_2S	30/01/2018	Un-scheduled	30/01/2018	Monthly
BTX	10/01/2018	3-monthly	10/01/2018	Yearly
Wind Sensor	11/01/2018	2-yearly	19/05/2017	2-yearly

6.0 Results

6.1. Data Capture

Data capture is based on 1-hour averages, calculated from 5-minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 9 displays data capture statistics for January 2018. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	96.1
SO_2	95.6
H_2S	**87.5**
Benzene	**89.8**
Toluene	**89.8**
p-Xylene	**TBA**
WS, WD	**91.6**

6.2. Graphic Representations

Validated 5-minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

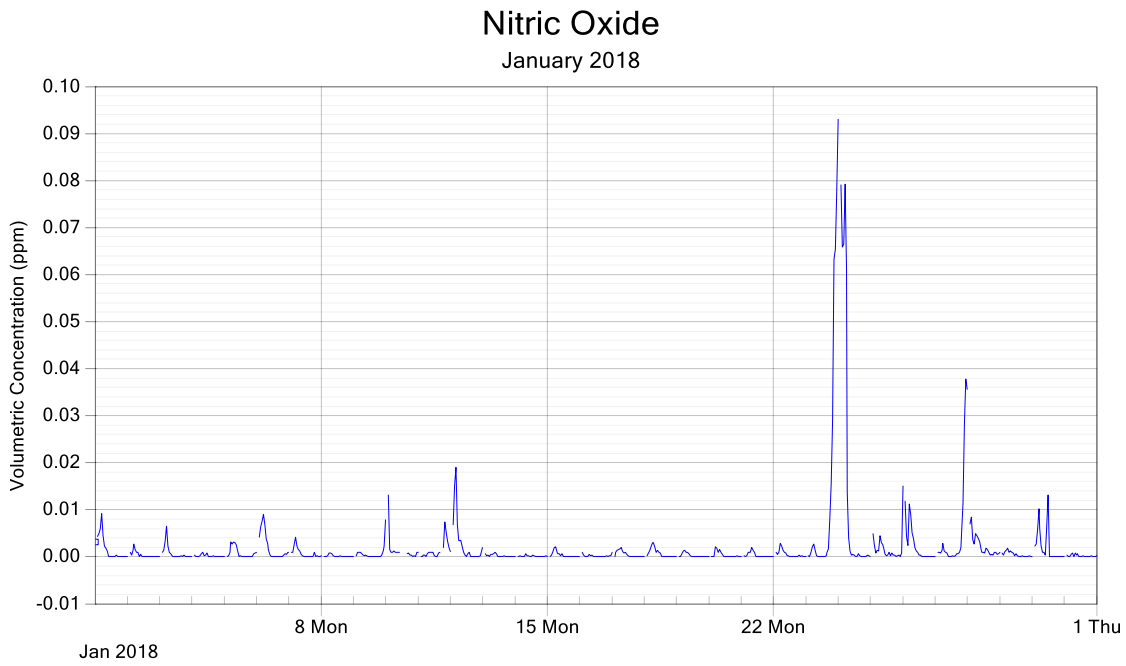

Figure 2: NO 1-hour averaged data

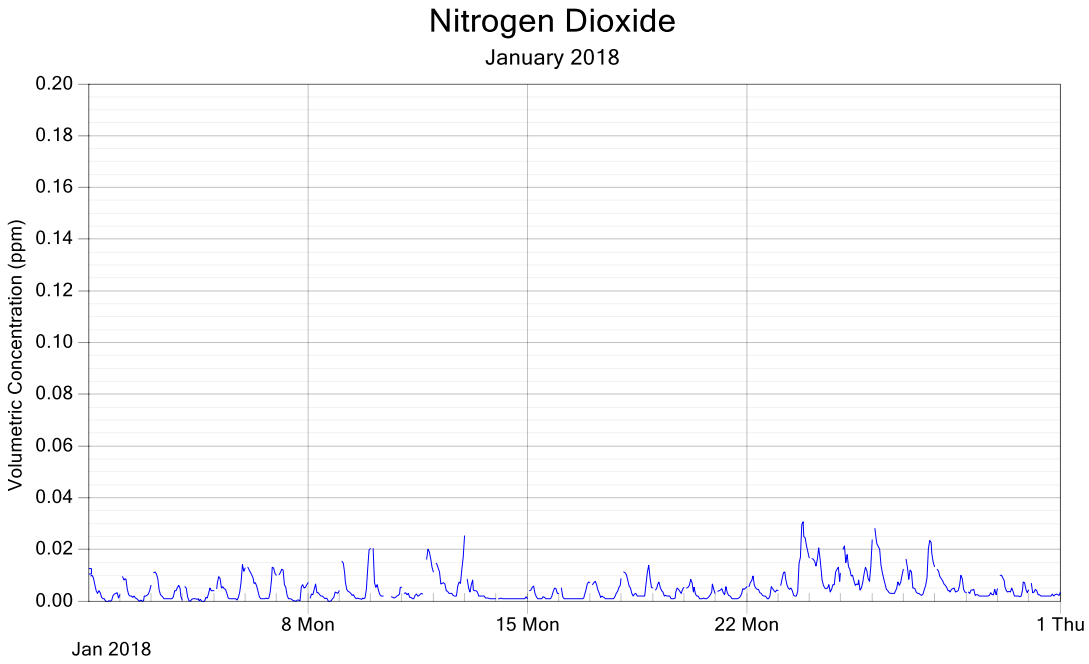

Figure 3: NO_2 1-hour averaged data

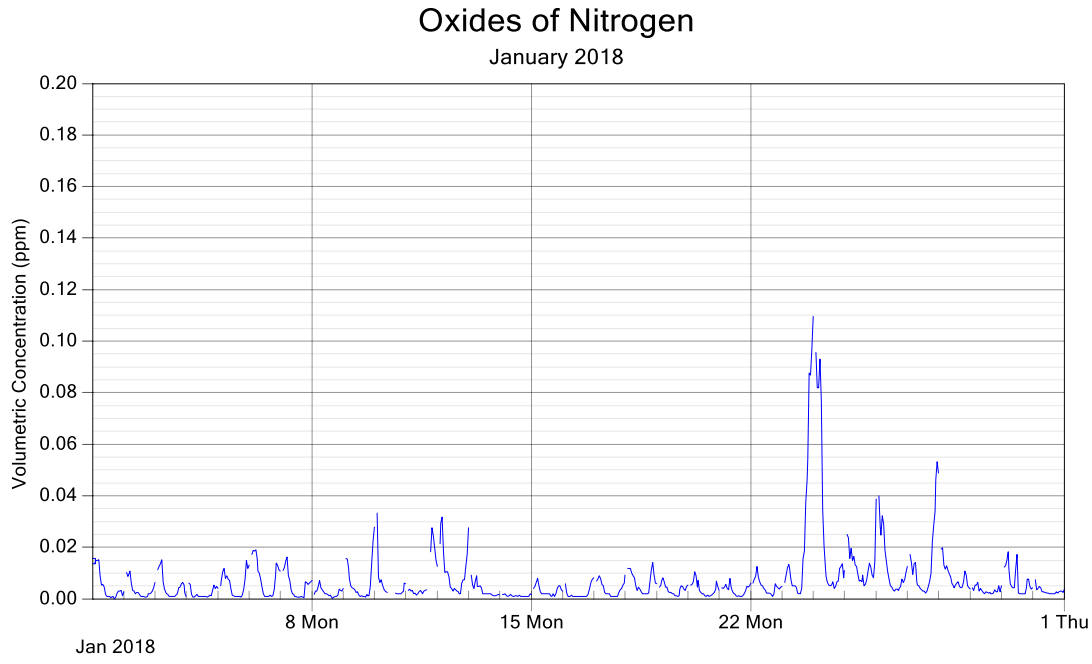

Figure 4: NO_X 1-hour averaged data

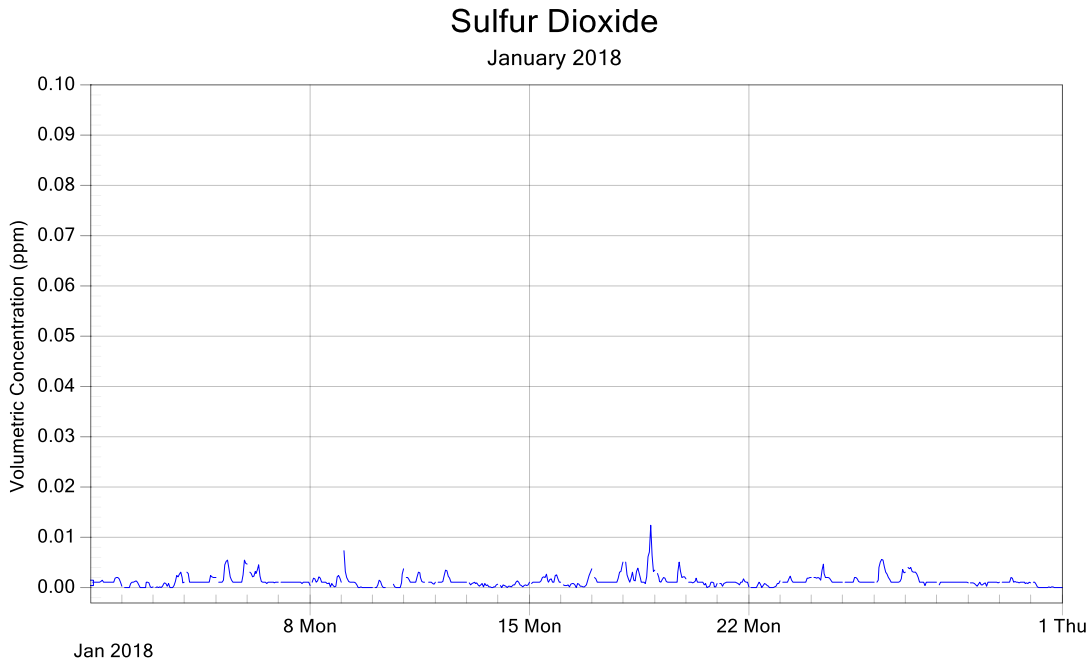

Figure 5: SO_2 1-hour averaged data

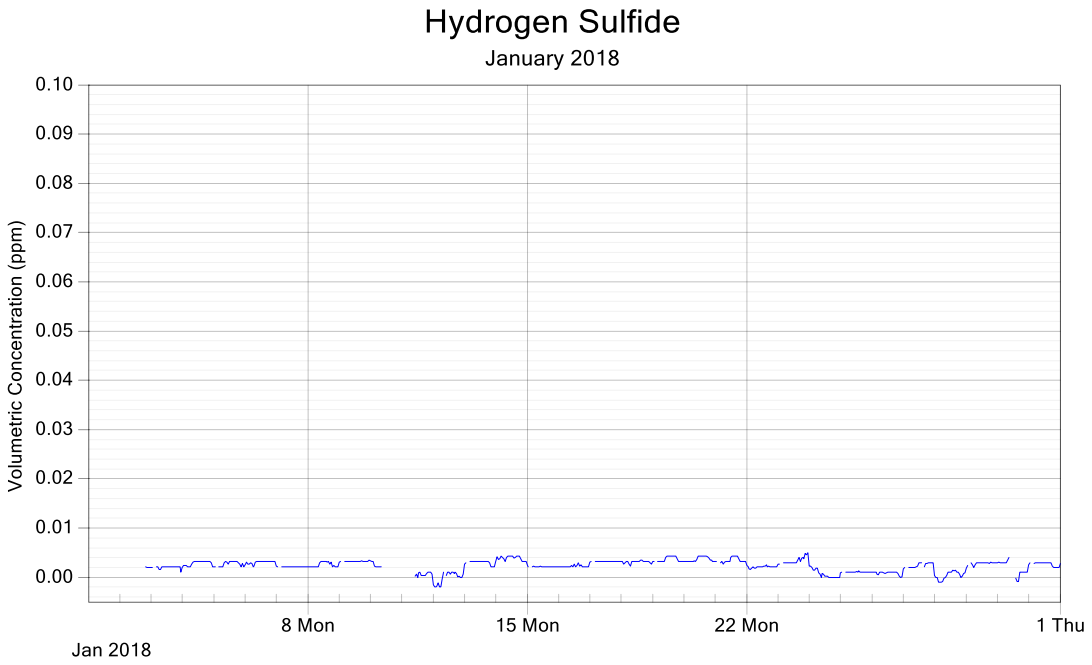

Figure 6: H_2S 1-hour averaged data

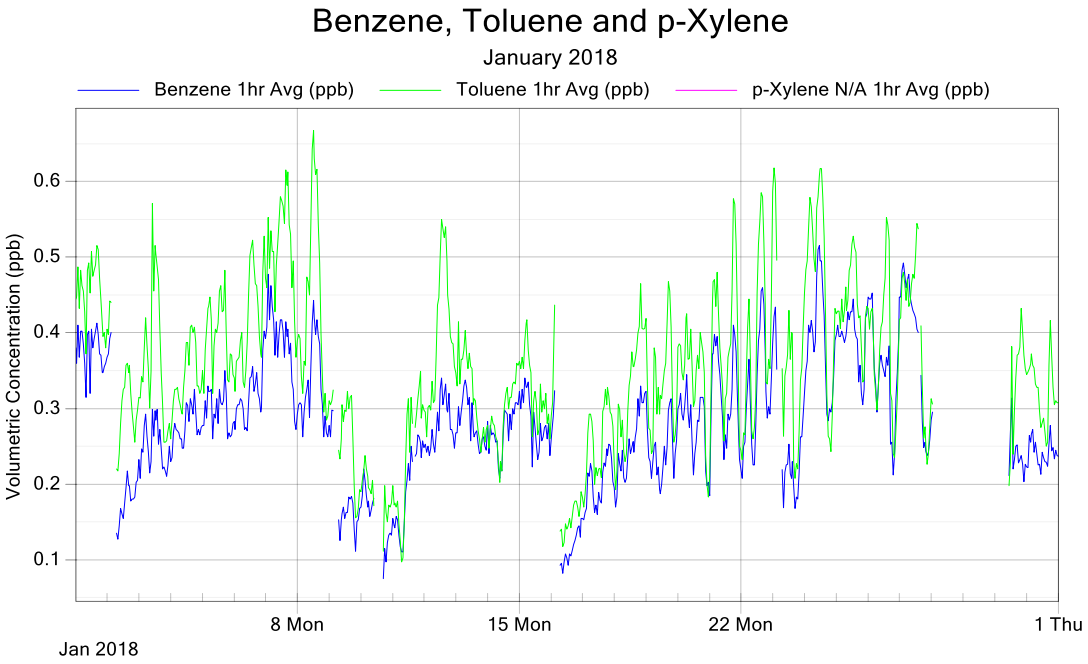

Figure 7: BTX 1-hour averaged data [2]

[2] Xylene data is under investigation

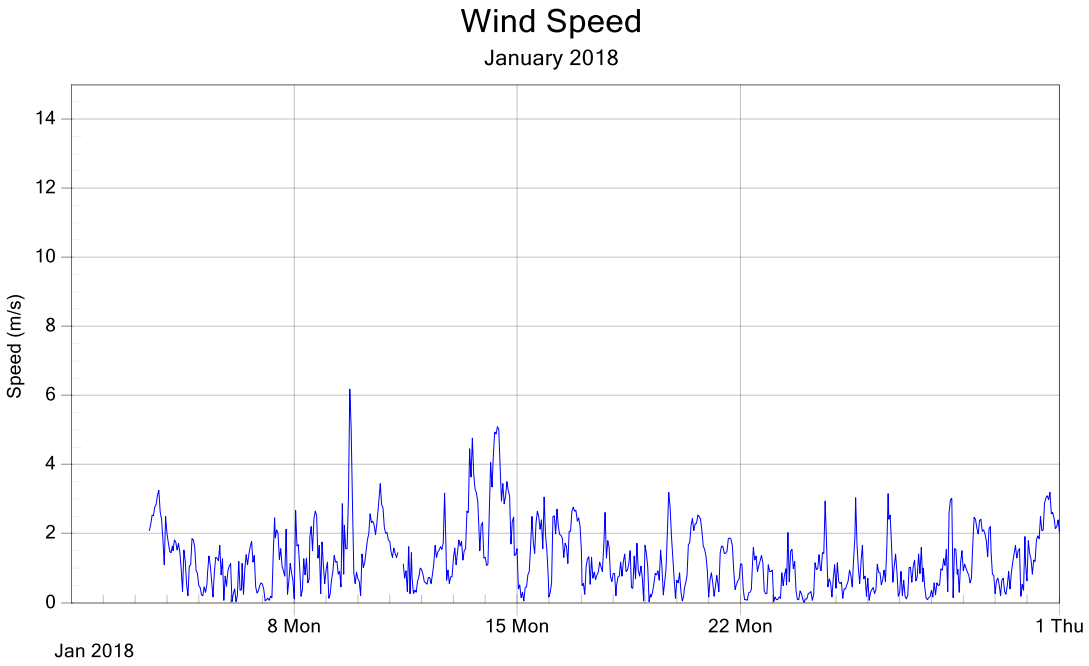

Figure 8: WS 1-hour averaged data

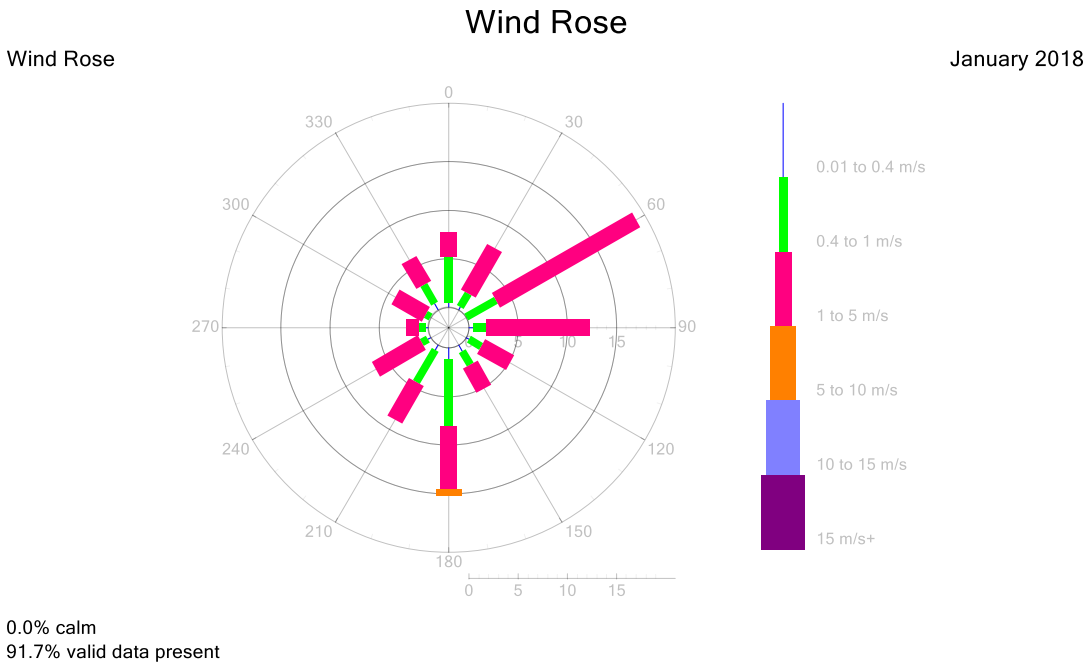

Figure 9: Wind Rose

7.0 Valid Data Exception Tables

The table below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/01/2018 0:00	3/01/2018 9:55	Wind sensors stalled after power failure on 26/12/2017	WS,WD	EP	14/02/2018
1/01/2018 0:00	1/02/2018 0:00	Data under investigation	Xylene	EP	14/02/2018
1/01/2018 0:05	2/01/2018 18:30	Calibration check outside of tolerance	H_2S	EP	14/02/2018
2/01/2018 3:45	23/01/2018 6:25	Automatic calibration check and subsequent instrument stabilisation every 7 days	Benzene, Toluene	EP	14/02/2018
2/01/2018 11:35	2/01/2018 11:35	Data transmission error	WS,WD, H_2S, Benzene, Toluene	EP	14/02/2018
2/01/2018 18:35	2/01/2018 19:35	Non-scheduled maintenance - Remote calibration to adjust the span	H_2S	EP	14/02/2018
3/01/2018 3:40	10/01/2018 9:25	Static multiplier of 1.08 applied to data	H_2S	EP	14/02/2018
3/01/2018 10:00	3/01/2018 11:10	Non-scheduled maintenance - Reboot wind sensors	WS,WD	EP	14/02/2018
10/01/2018 9:30	10/01/2018 16:55	Scheduled 3 monthly maintenance	NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene	EP	14/02/2018
10/01/2018 17:00	11/01/2018 6:40	Calibration check outside of tolerance	H_2S	EP	14/02/2018

Start Date	End Date	Reason	Change Details	User Name	Change Date
11/01/2018 6:45	11/01/2018 10:00	Scheduled 2 yearly maintenance for wind sensors - H2S analyser calibration performed and wind sensors swapped and sent for wind tunnel testing (Instrument ID: 15-1290 transferred in and ID 13-1120 transferred out)	WS,WD, H_2S	EP	14/02/2018
11/01/2018 16:40	28/01/2018 2:15	Intermittent possible power failure and subsequent instrument stabilisation and running additional background check	WS,WD, NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene	EP	14/02/2018
13/01/2018 3:40	23/01/2018 2:30	Static multiplier of 1.09 applied to data	H_2S	EP	14/02/2018
24/01/2018 0:10	24/01/2018 23:45	Static offset of 0.003 ppm applied to correct the baseline	H_2S	EP	14/02/2018
28/01/2018 2:00	30/01/2018 10:15	BTX analyser locked up after power interruption	BTX	EP	14/02/2018
30/01/2018 10:10	30/01/2018 13:50	Non-scheduled maintenance	WS,WD, SO_2, H_2S, Benzene, Toluene	EP	14/02/2018

8.0 Report Summary

The data capture for most of the parameters a Wollar was below 95% for the reporting month. The exceptions were SO_2 and NO, NO_2, NO_x Please refer to Data Capture Percentage Table 9 for details; and Table 10 for valid data exceptions.

Xylene data monitored at the Wollar station is not included for this month as the data is pending further investigation into instrument performance and calibration. Data will be issued on completion of this investigation.

Measurement of a number of parameters in this report does not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

----------END OF REPORT----------

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero-signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

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Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

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Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

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Warm up after power interruption refers to the start-up period of an instrument after power has been restored.

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 14184.

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st February 2018 – 28th February 2018

Report No.: DAT13017

Report issue date: 28th March 2018

Maintenance contract: MC951

ECOTECH PTY LTD. ABN: 32005752081
1492 Ferntree Gully Rd, Knoxfield VIC. 3180. AUSTRALIA
Tel No: 1300 364 946 Fax No: 1300 668 763
Email ecotech@ecotech.com WEB www.ecotech.com

Customer Details	
Customer	Peabody Energy Australia
Contact name	Clark Potter
Address	Locked Bag 2005, Mudgee 2850 NSW
Email	cpotter@peabodyenergy.com
Phone	+61 (02) 6370 2527

Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT13017	28/03/2018	Elmira Parto

Report by **Elmira Parto**

Approved by **Jon Alexander**

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List of Tables

1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene, *p*-Xylene, wind speed and wind direction.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for February 2018. Data capture for the different pollutants is presented in Table 9.

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2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for February 2018.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

3.0 Monitoring and Data Collection

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 21th June 2017 to assess for compliance with *AS/NZS 3580.1.1:2016 "*Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment".

The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2016*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Gill Windsonic
Wind Direction (10m)	Gill Windsonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX	Manufacturer's Instructions	Gas Chromatography Synspec CG955 Series Manual
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Feb-18.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5-minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One-hour averages are calculated based on a clock hour. One-day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	0.030	ppm	None
NO_2	1 hour	0.120	ppm	1 day a year
SO_2	1 hour	0.200	ppm	1 day a year
SO_2	1 day	0.080	ppm	1 day a year
SO_2	1 year	0.020	ppm	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
NO_2 (EC9841)	ppm	0.001 ppm	± 0.016 ppm K factor of 2.01	0 ppm to 0.500 ppm
SO_2 (EC9850)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
H_2S	ppm	1 ppb	15.2% of reading or ± 0.019 ppm, whichever is greater K factor of 2	0.000 ppm to 0.500 ppm
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
Vector Wind Speed	m/s	0.1 m/s	±0.01 m/s or 2.0% of reading, whichever is greater (K factor of 1.96)	0 m/s to 60 m/s
Vector Wind Direction	Deg	1 deg	±2 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every night for NO, NO_2, NO_x and SO_2, every 2nd night for H_2S and weekly for BTX.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, H_2S and BTX

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	00:45 to 01:25 every day	N/A
SO_2	00:45 to 01:25 every day	23:45 to 23:50 every day
H_2S	01:35 to 02:35 every 2nd day[2]	23:45 to 23:50 every day
	02:35 to 03:30 every 2nd day[3]	22:50 to 22:55 every day
BTX	03:45 to 6:10 weekly	N/A

5.3. Maintenance

Two remote calibrations were performed for H2S analyser on:

- 07/02/2018 and 12/02/2018 to adjust the drifted span

Scheduled visits were made over three days:

- 20/02/2018 a monthly maintenance (day one) was performed. H_2S analyser was replaced (ID: 97-0372 was transferred in and ID:97-0373 was transferred out)
- 21/02/2018 monthly maintenance continued (day two) to install a UPS power and NO_x and SO_2 analysers calibration

[2] From 01/02/2018 until 20/02/2018

[3] From 21/02/2018 until 1/03/2018

- 22/02/2018 monthly (day three) maintenance completed for H_2S and BTX analysers. Original wind sensors returned from wind tunnel calibration (ID: 13-1120 was transferred in and ID: 15-1290 was transferred out).

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	21/02/2018	Monthly	21/02/2018	Monthly
SO_2	21/02/2018	Monthly	21/02/2018	Monthly
H_2S	22/02/2018	Monthly	22/02/2018	Monthly
BTX	22/02/2018	Monthly	22/02/2018	Yearly
Wind Sensor	22/02/2018	2-yearly	12/02/2018	2-yearly

6.0 Results

6.1. Data Capture

Data capture is based on 1-hour averages, calculated from 5-minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 9 displays data capture statistics for February 2018. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**67.3**
SO_2	**94.4**
H_2S	**92.0**
Benzene	**94.8**
Toluene	**94.8**
p-Xylene	TBA
WS, WD	98.8

6.2. Graphic Representations

Validated 5-minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

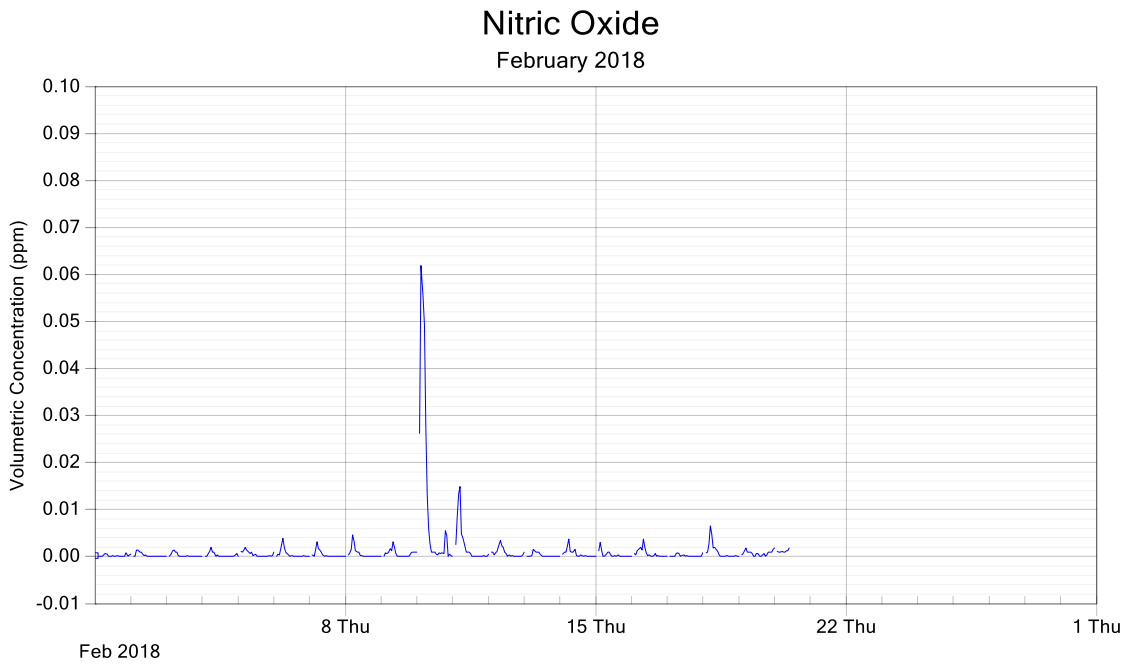

Figure 2: NO 1-hour averaged data

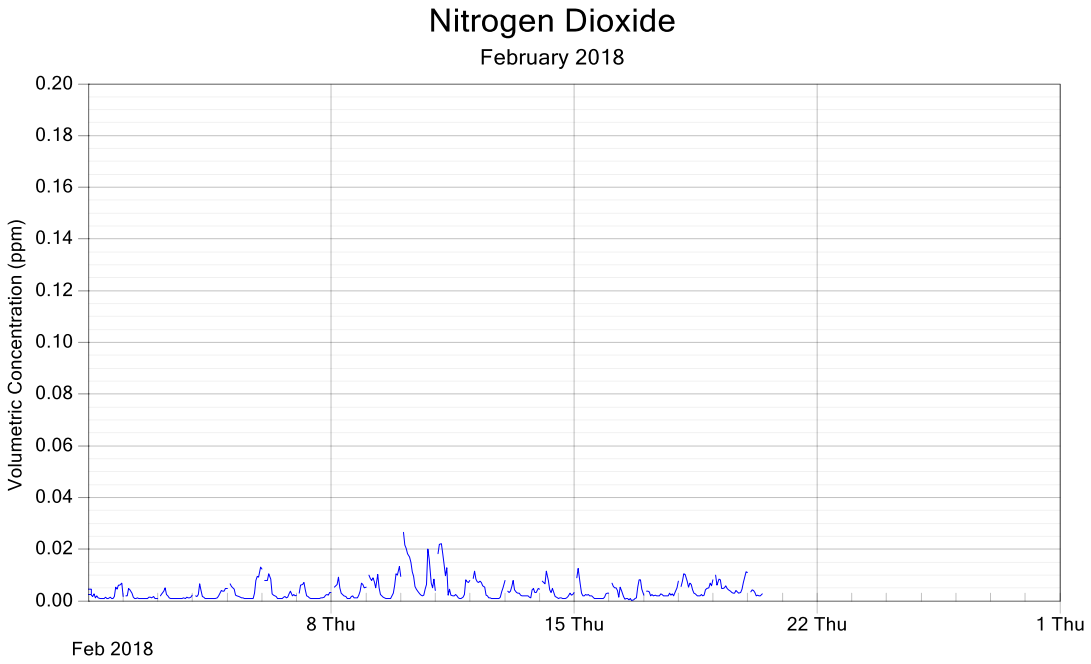

Figure 3: NO_2 1-hour averaged data

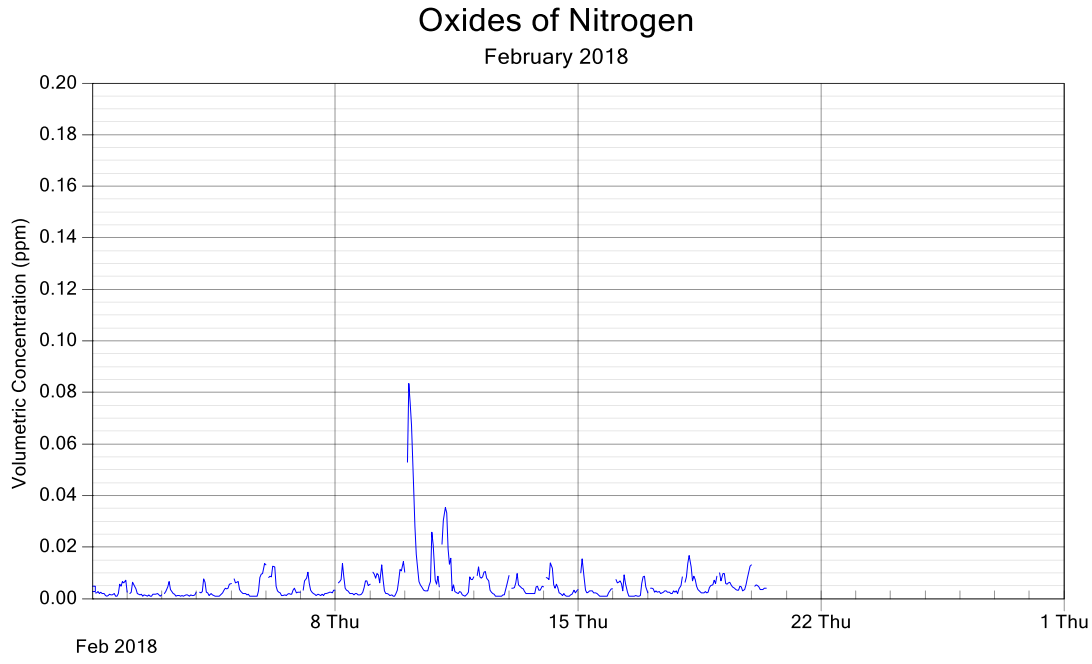

Figure 4: NO_X 1-hour averaged data

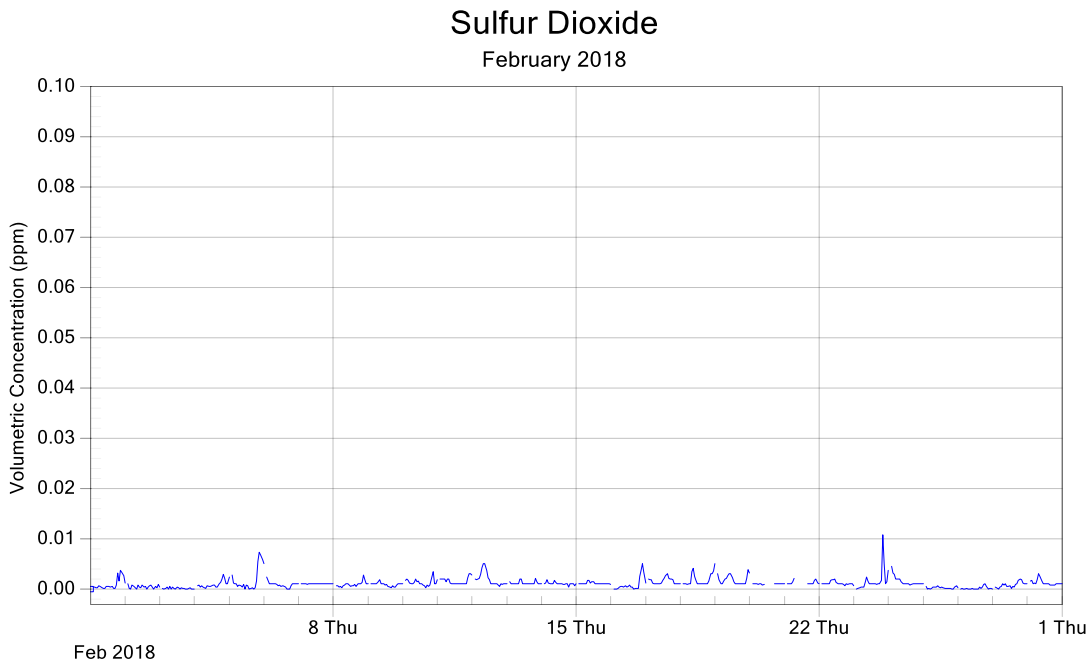

Figure 5: SO_2 1-hour averaged data

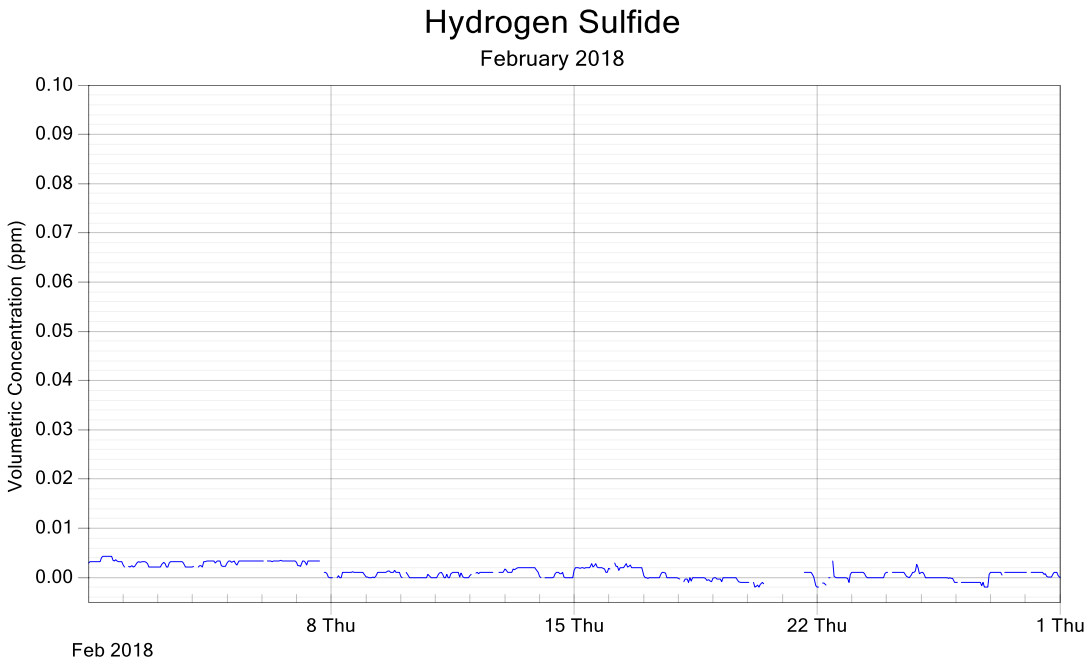

Figure 6: H_2S 1-hour averaged data

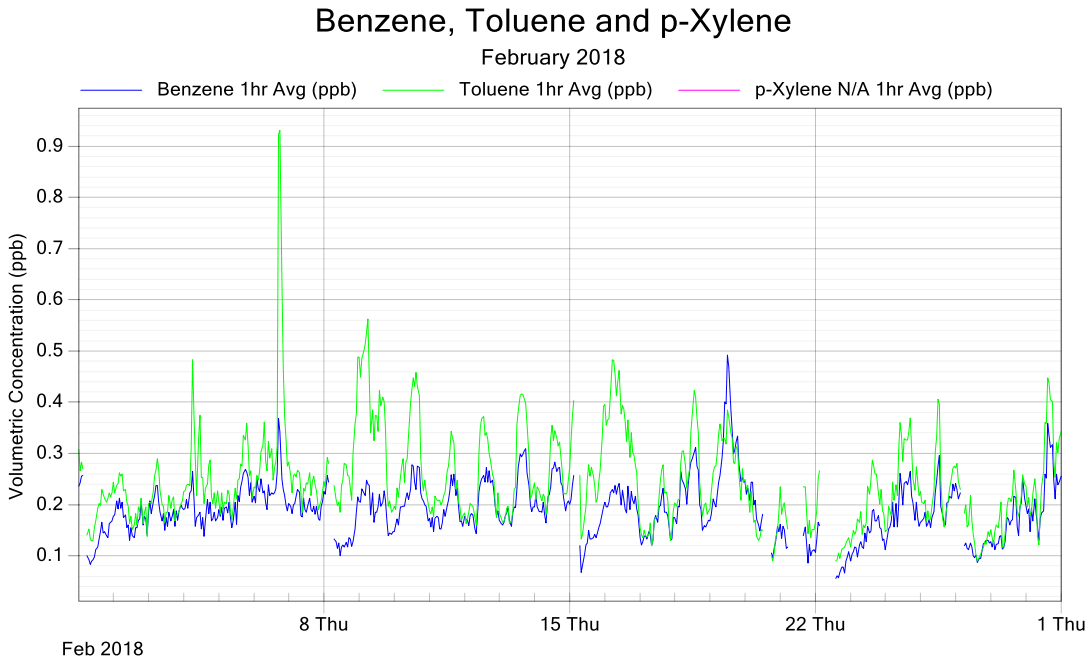

Figure 7: BTX 1-hour averaged data [4]

[4] Xylene data is under investigation

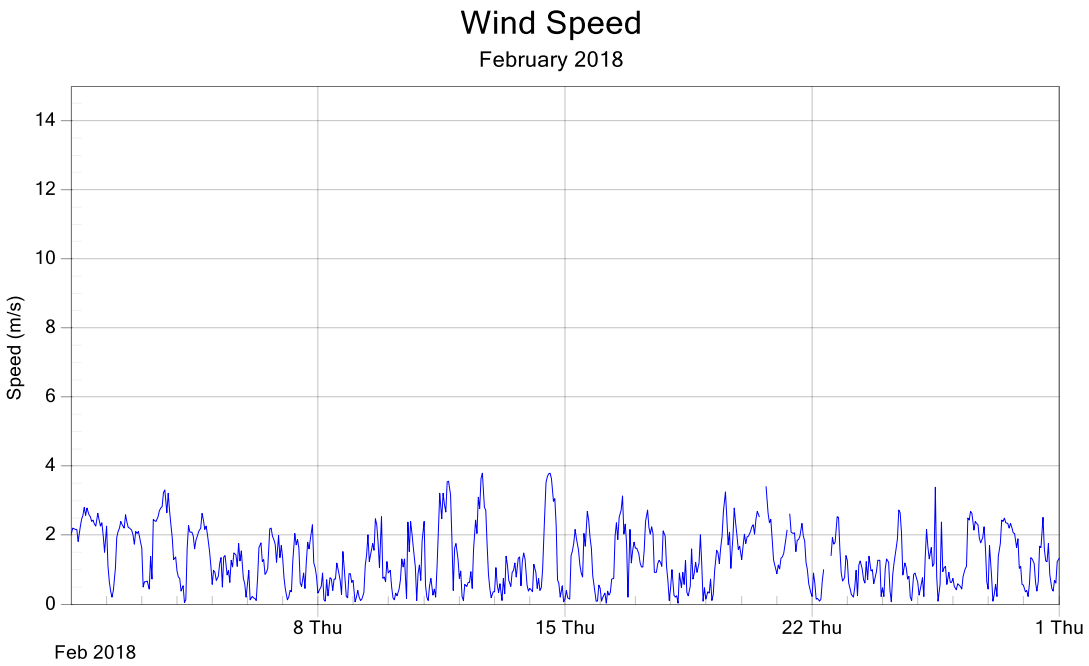

Figure 8: WS 1-hour averaged data

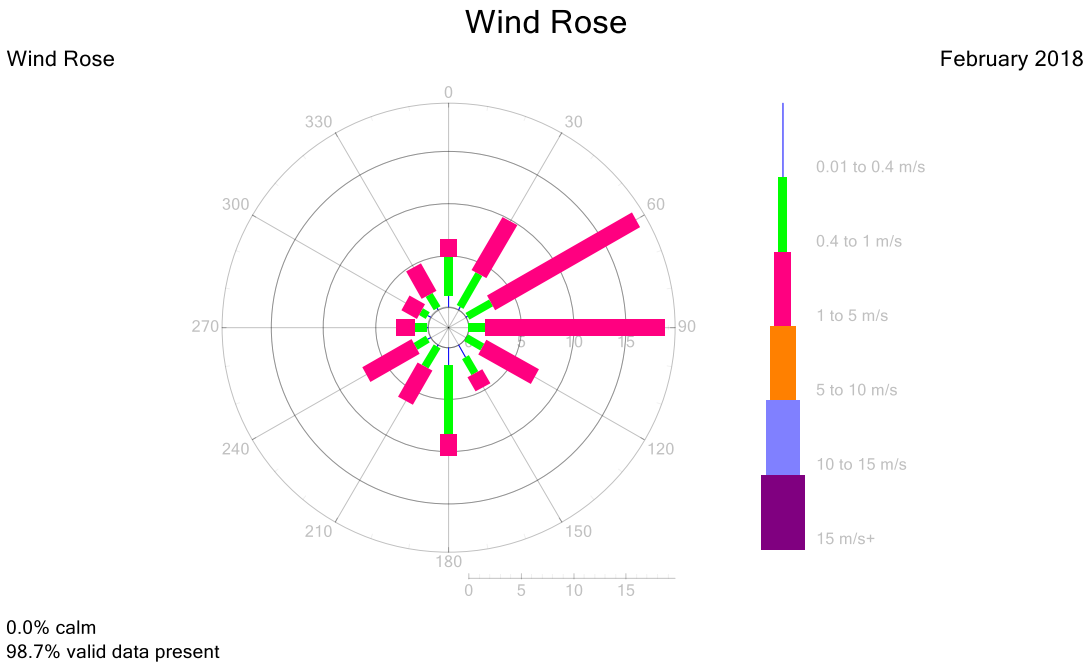

Figure 9: Wind Rose

7.0 Valid Data Exception Tables

The table below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
31/01/2018 3:35	7/02/2018 17:10	Linear multiplier A= 1.05 and B=1.13 applied to correct the span drift	H_2S	EP	20/03/2018
1/02/2018 0:00	1/03/2018 0:00	Data under investigation	Xylene	EP	20/03/2018
1/02/2018 3:45	26/02/2018 5:55	Automatic calibration check and subsequent instrument stabilisation every 7 days	Benzene, Toluene	EP	20/03/2018
7/02/2018 17:15	7/02/2018 18:35	Remote calibration performed to adjust the drifted span for H_2S and subsequent instrument stabilisation	All channels	EP	20/03/2018
12/02/2018 16:55	12/02/2018 19:50	Remote calibration performed	H_2S	EP	20/03/2018
16/02/2018 23:15	16/02/2018 23:25	Unrealistic spike	Benzene	EP	20/03/2018
20/02/2018 11:40	20/02/2018 19:45	Scheduled maintenance - H_2S analyser removed (ID:97-0372 was transferred in and ID:97-0373 was transferred out), 3 monthly tasks were completed for Zero Air Supply.	All channels	EP	20/03/2018
20/02/2018 16:05	1/03/2018 0:00	Instrument fault	NO, NO_2, NO_x	EP	20/03/2018
20/02/2018 19:50	21/02/2018 7:45	Instrument stabilisation following the maintenance	H_2S	EP	20/03/2018

Start Date	End Date	Reason	Change Details	User Name	Change Date
21/02/2018 5:50	21/02/2018 8:00	Additional automatic calibration check and subsequent instrument stabilisation	BTX	EP	20/03/2018
21/02/2018 7:50	21/02/2018 15:45	Non-Scheduled maintenance - UPS installed	All channels	EP	20/03/2018
21/02/2018 15:15	22/02/2018 7:35	Static offset 0.001 ppm applied to correct the baseline	H_2S	EP	20/03/2018
22/02/2018 7:10	22/02/2018 13:25	Scheduled maintenance - Original wind sensor returned from calibration and installed (ID:13-1120 was transferred in and ID:15-1290 was transferred out), BTX and H_2S analysers calibrated.	WS,WD, H_2S, Benzene, Toluene	EP	20/03/2018

8.0 Report Summary

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Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 14184.

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st March 2018 – 31st March 2018

Report No.: DAT13084

Report issue date: 27th April 2018

Maintenance contract: MC951

ECOTECH PTY LTD. ABN: 32005752081
1492 Ferntree Gully Rd, Knoxfield VIC. 3180. AUSTRALIA
Tel No: 1300 364 946 Fax No: 1300 668 763
Email ecotech@ecotech.com WEB www.ecotech.com

Customer Details	
Customer	Peabody Energy Australia
Contact name	Clark Potter
Address	Locked Bag 2005, Mudgee 2850 NSW
Email	cpotter@peabodyenergy.com
Phone	+61 (02) 6370 2527

Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT13084	27/04/2018	Elmira Parto

Report by **Elmira Parto**

Approved by **Jon Alexander**

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Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 21th June 2017 to assess for compliance with *AS/NZS 3580.1.1:2016 "*Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment".

The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2016*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Gill Windsonic
Wind Direction (10m)	Gill Windsonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
	Ecotech Laboratory Manual	In-house method 6.1 Oxides of nitrogen by chemiluminescence
SO_2	AS 3580.4.1-2008	Methods for sampling and analysis of ambient air. Method 4.1: Determination of sulfur dioxide – Direct reading instrumental method
	Ecotech Laboratory Manual	In-house method 6.2 Sulfur dioxide by fluorescence
H_2S	Ecotech Laboratory Manual	In-house method 6.5 Hydrogen sulfide by fluorescence
BTX	Manufacturer's Instructions	Gas Chromatography Synspec CG955 Series Manual
Vector Wind Speed (Horizontal)	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.1 Wind speed (Horizontal) by anemometer
Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Mar-18.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5-minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One-hour averages are calculated based on a clock hour. One-day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	0.030	ppm	None
NO_2	1 hour	0.120	ppm	1 day a year
SO_2	1 hour	0.200	ppm	1 day a year
SO_2	1 day	0.080	ppm	1 day a year
SO_2	1 year	0.020	ppm	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
NO_2 (EC9841)	ppm	0.001 ppm	± 0.016 ppm K factor of 2.01	0 ppm to 0.500 ppm
SO_2 (EC9850)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
H_2S	ppm	1 ppb	15.2% of reading or ± 0.019 ppm, whichever is greater K factor of 2	0.000 ppm to 0.500 ppm
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
Vector Wind Speed	m/s	0.1 m/s	±0.01 m/s or 2.0% of reading, whichever is greater (K factor of 1.96)	0 m/s to 60 m/s
Vector Wind Direction	Deg	1 deg	±2 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every night for NO, NO_2, NO_x and SO_2, every 2nd night for H_2S and weekly for BTX.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, H_2S and BTX

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	00:45 to 01:25 every day	N/A
SO_2	00:45 to 01:25 every day	23:45 to 23:50 every day
H_2S	01:35 to 02:35 every 2nd day[2]	23:45 to 23:50 every day
	02:35 to 03:30 every 2nd day[3]	22:50 to 22:55 every day
BTX	03:45 to 6:10 weekly	N/A

5.3. Maintenance

Scheduled visits were made over two days:

- 28/03/2018 a monthly maintenance (day one) was performed. Internal leak was found in NO_x analyser and fixed.
- 29/03/2018 monthly maintenance continued (day two) for the all gas analysers to complete the calibration.

[2] From 01/02/2018 until 20/02/2018

[3] From 21/02/2018 until 1/03/2018

- 22/02/2018 monthly (day three) maintenance completed for H_2S and BTX analysers. Original wind sensors returned from wind tunnel calibration (ID: 13-1120 was transferred in and ID: 15-1290 was transferred out).

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	29/03/2018	Monthly	29/03/2018	Monthly
SO_2	29/03/2018	Monthly	29/03/2018	Monthly
H_2S	29/03/2018	Monthly	29/03/2018	Monthly
BTX	29/03/2018	Monthly	29/03/2018	Yearly
Wind Sensor	29/03/2018	2-yearly	12/02/2018	2-yearly

6.0 Results

6.1. Data Capture

Data capture is based on 1-hour averages, calculated from 5-minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 9 displays data capture statistics for March 2018. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**8.0**
SO_2	95.6
H_2S	96.3
Benzene	96.1
Toluene	96.1
p-Xylene	TBA
WS, WD	99.2

6.2. Graphic Representations

Validated 5-minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

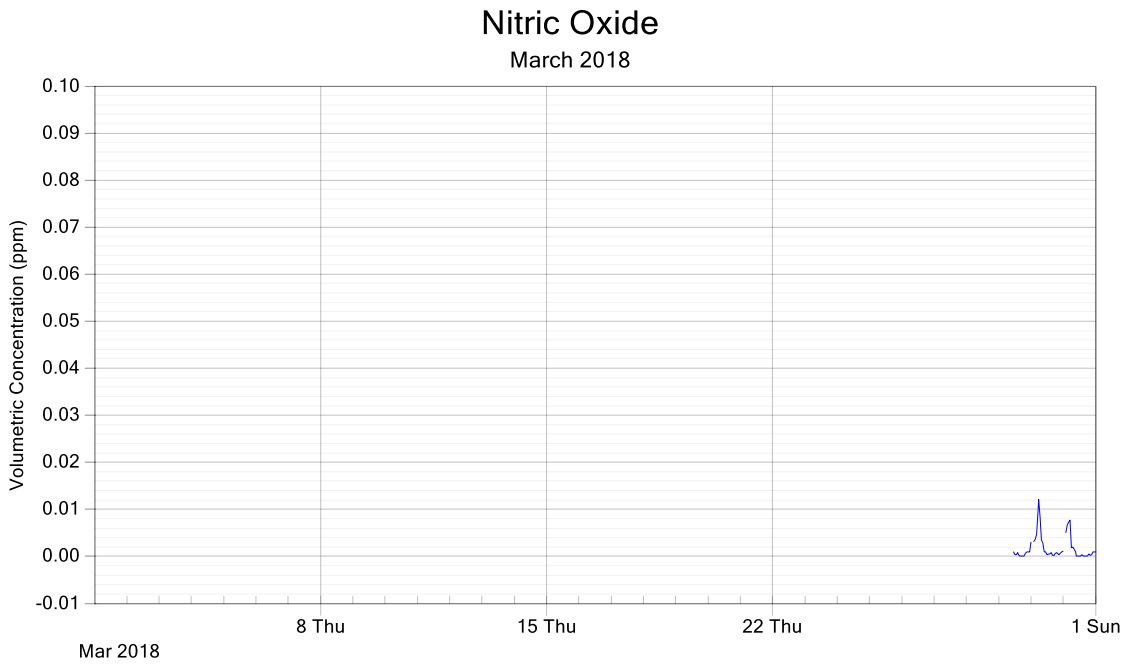

Figure 2: NO 1-hour averaged data

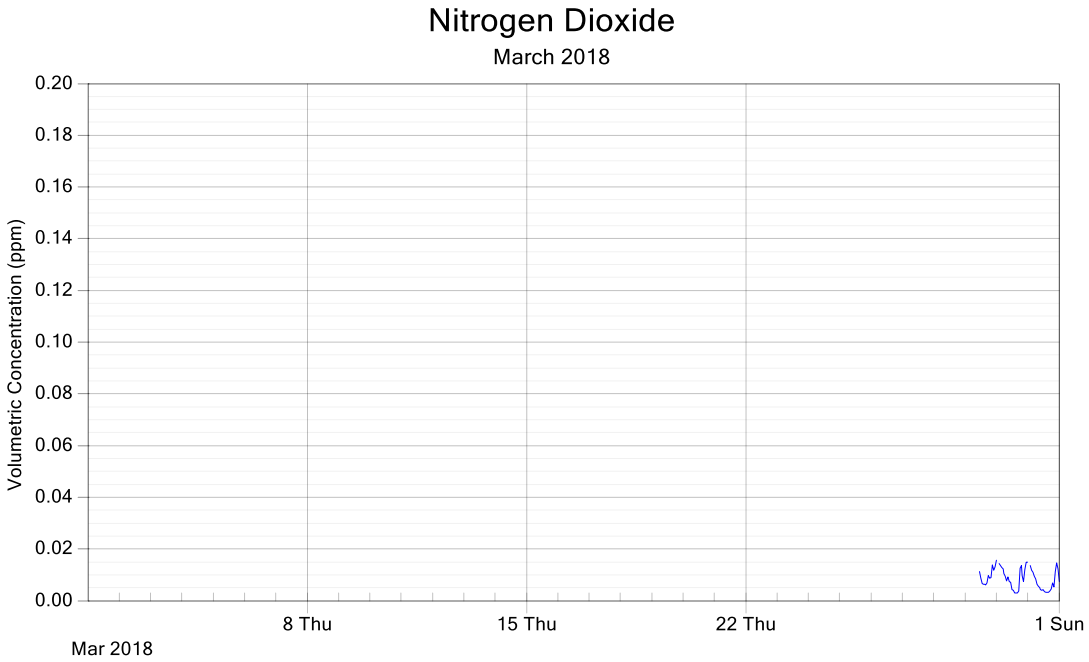

Figure 3: NO_2 1-hour averaged data

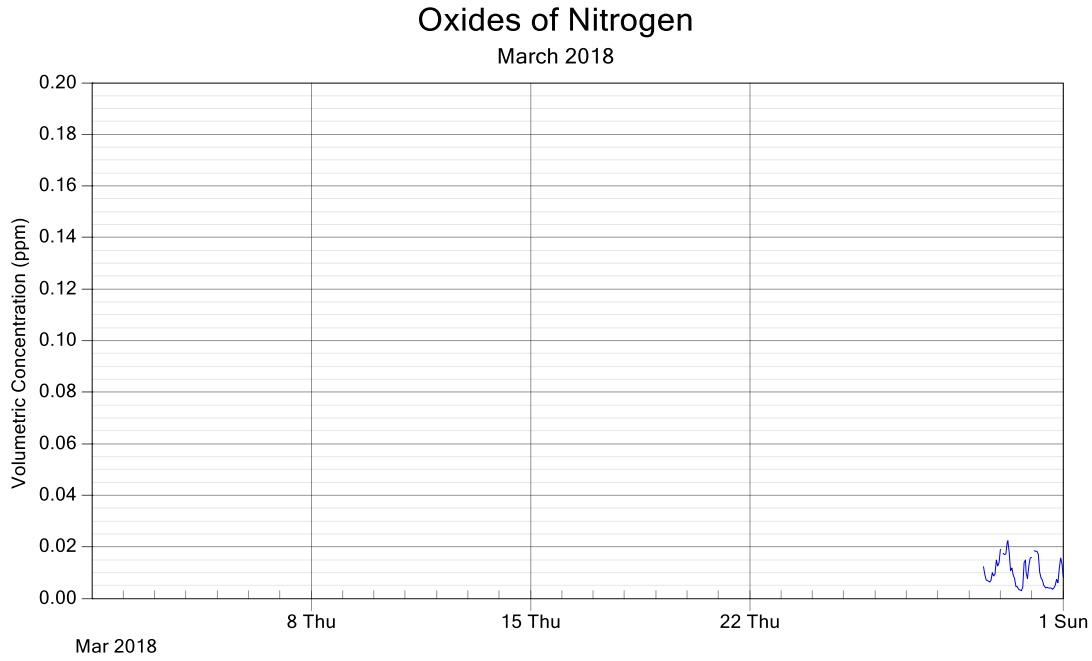

Figure 4: NO_X 1-hour averaged data

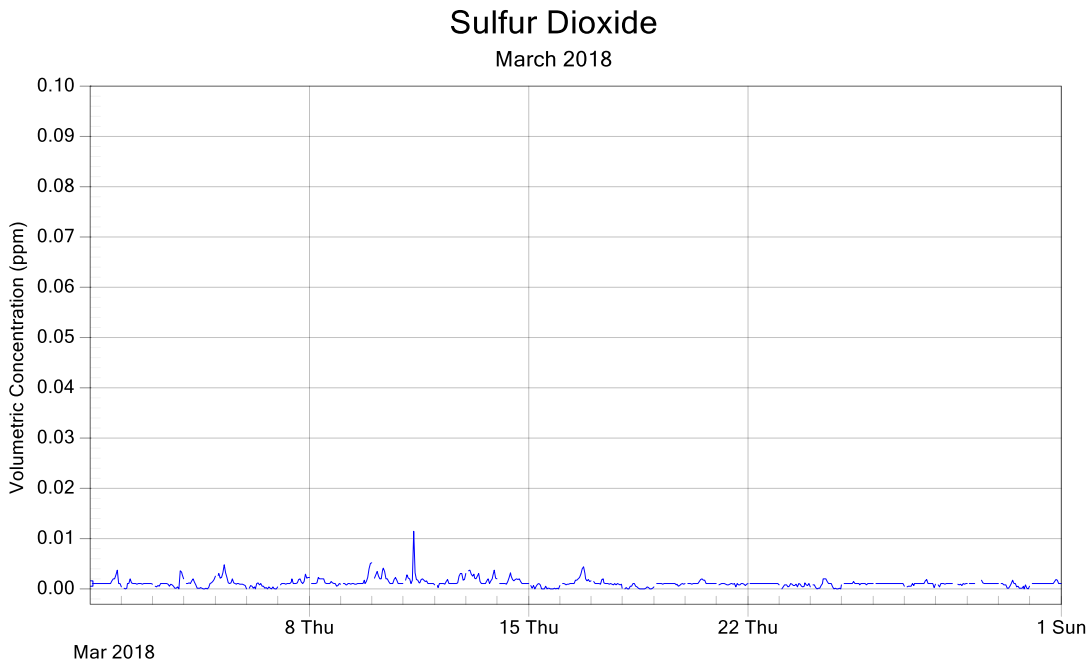

Figure 5: SO_2 1-hour averaged data

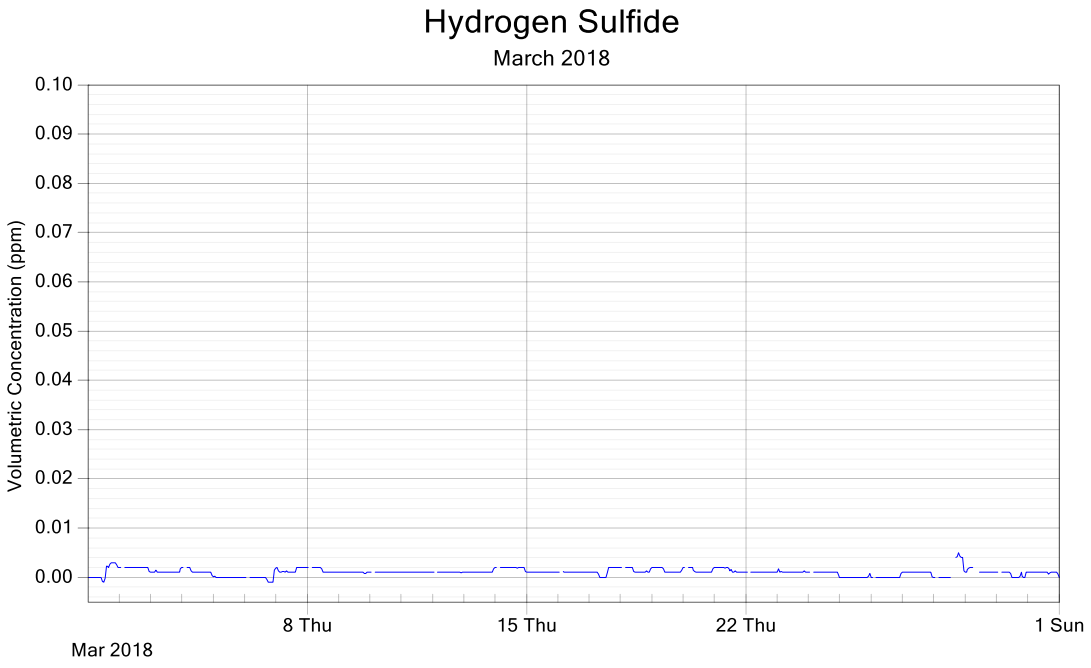

Figure 6: H_2S 1-hour averaged data

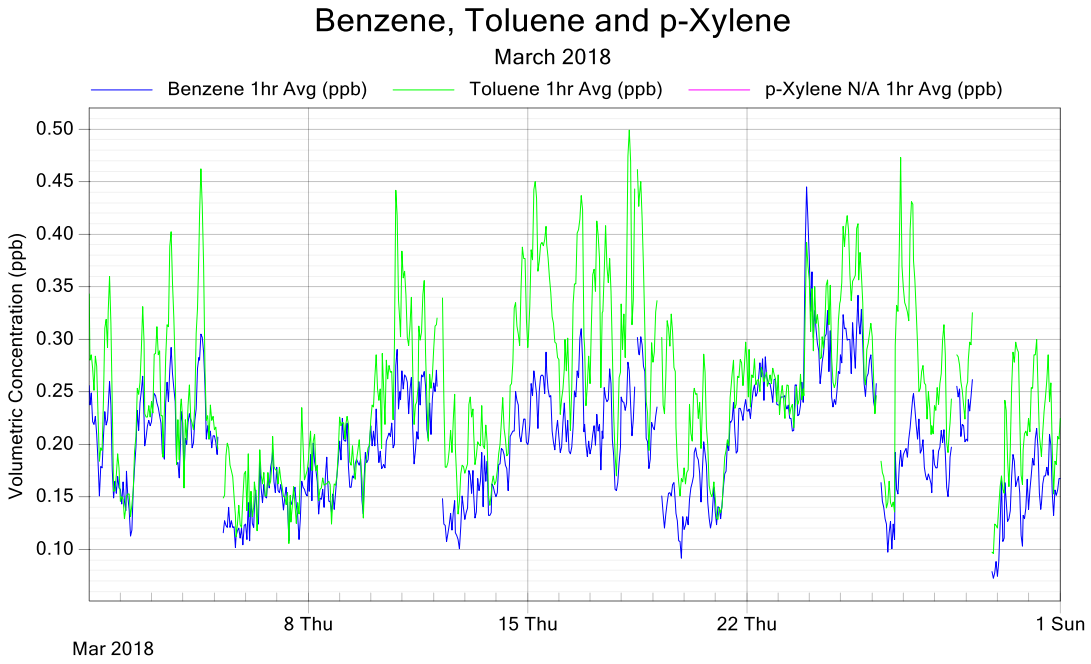

Figure 7: BTX 1-hour averaged data [4]

[4] Xylene data is under investigation

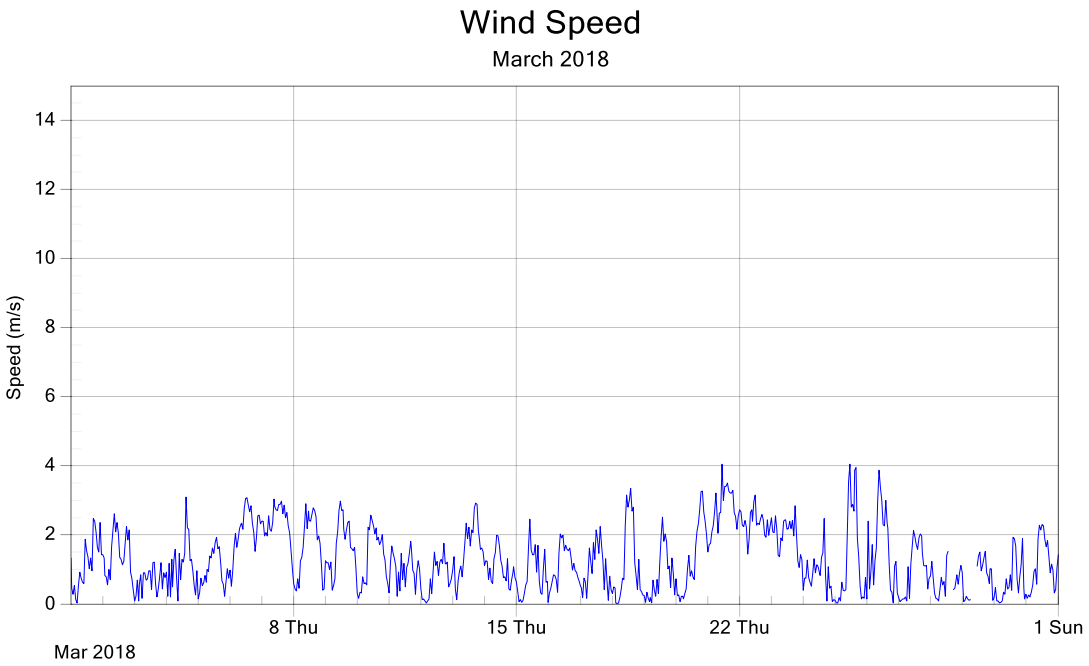

Figure 8: WS 1-hour averaged data

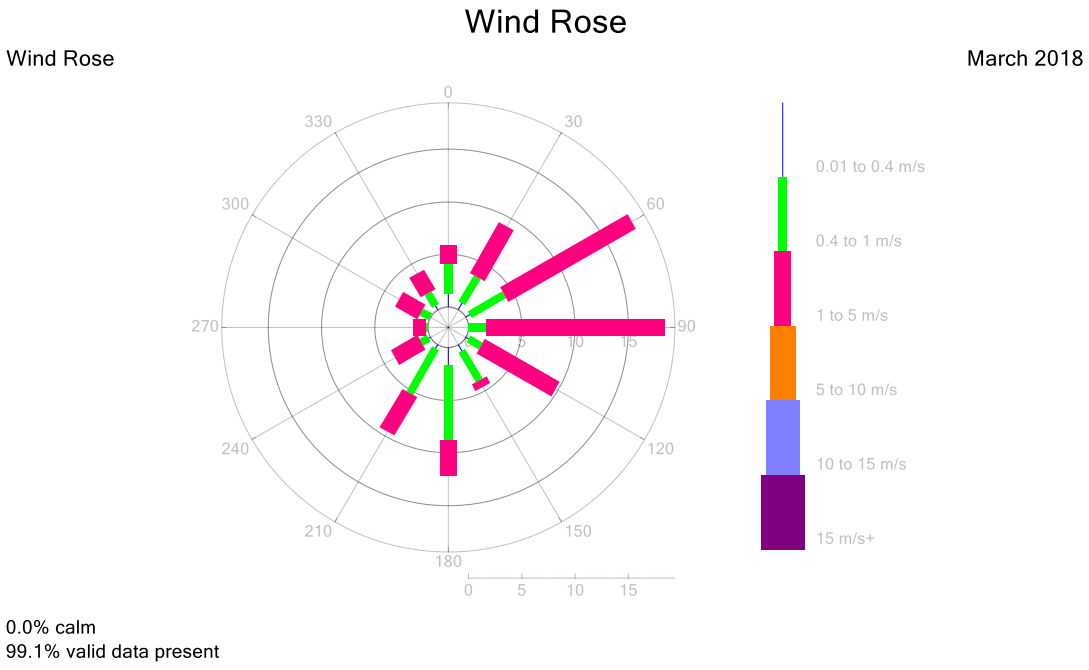

Figure 9: Wind Rose

7.0 Valid Data Exception Tables

The table below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/03/2018 0:00	28/03/2018 14:05	Instrument fault- Internal leak identified	NO, NO_2, NO_x	EP	21/04/2018
1/03/2018 0:00	1/04/2018 0:00	Data under investigation	Xylene	EP	21/04/2018
1/03/2018 0:00	1/04/2018 0:00	Automatic calibration check and subsequent instrument stabilisation every 7 days	Benzene, Toluene	EP	21/04/2018
18/03/2018 10:45	18/03/2018 11:25	Additional automatic calibration check and subsequent instrument stabilisation	BTX	EP	21/04/2018
28/03/2018 14:10	28/03/2018 17:10	Scheduled monthly maintenance (Part1) and subsequent instrument stabilization – Internal leak for NO_x analyser resolved	All channels	EP	21/04/2018
28/03/2018 17:15	29/03/2018 7:20	Instrument in calibration mode	NO, NO_2, NO_x	EP	21/04/2018
29/03/2018 6:00	29/03/2018 19:30	Scheduled monthly maintenance (Part2) and subsequent instrument stabilisation - Calibration cycle extended for better stabilisation result	BTX	EP	21/04/2018
29/03/2018 7:25	29/03/2018 11:00	Scheduled monthly maintenance (Part2) and subsequent instrument stabilisation - Calibration cycle extended for better stabilisation result	All channels	EP	21/04/2018
30/03/2018 5:40	30/03/2018 5:40	Unrealistic readings	NO, NO_2, NO_x	EP	21/04/2018

8.0 Report Summary

The data capture for most of the parameters a Wollar was above 95% for the reporting month. The exception was NO, NO_2 and NO_x data. Please refer to Data Capture Percentage Table 9 for details; and Table 10 for valid data exceptions.

Xylene data monitored at the Wollar station is not included for this month as the data is pending further investigation into instrument performance and calibration. Data will be issued on completion of this investigation.

Measurement of a number of parameters in this report do not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

----------END OF REPORT----------

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero-signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments, there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was switched off due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the start-up period of an instrument after power has been restored.

Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation No. 14184.

Peabody Energy

Wilpinjong Coal
Wollar

Ambient Air Quality Monitoring

Validated Report

1st April 2018 – 30th April 2018

Report No.: DAT13184

Report issue date: 28th May 2018

Maintenance contract: MC951

ECOTECH PTY LTD. ABN: 32005752081
1492 Ferntree Gully Rd, Knoxfield VIC. 3180. AUSTRALIA
Tel No: 1300 364 946 Fax No: 1300 668 763
Email ecotech@ecotech.com WEB www.ecotech.com

Customer Details	
Customer	Peabody Energy Australia
Contact name	Clark Potter
Address	Locked Bag 2005, Mudgee 2850 NSW
Email	cpotter@peabodyenergy.com
Phone	+61 (02) 6370 2527

Revision History			
Revision	**Report ID**	**Date**	**Analyst**
0	DAT13184	28/05/2018	Elmira Parto

Report by **Elmira Parto**

Approved by **Jon Alexander**

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List of Tables

1.0 Executive Summary

Peabody Energy has commissioned Ecotech P/L to conduct air quality monitoring for the Wilpinjong Mine at Wollar. Measured parameters at Wollar are NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene, *p*-Xylene, wind speed and wind direction.

The Wollar station was commissioned in March 2013.

This report presents the data collected from the Wollar station for April 2018. Data capture for the different pollutants is presented in Table 9.

2.0 Introduction

Ecotech Pty Ltd was commissioned by Peabody Energy to provide monitoring and data reporting for the Wilpinjong Mine at Wollar, located as detailed in Table 1. Ecotech commenced data collection from the Wilpinjong Station on the 1st March 2013.

This report presents the data for April 2018.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured;
- Complies with NATA accreditation requirements, where applicable.

3.0 Monitoring and Data Collection

3.1. Siting Details

The Wilpinjong Mine consists of one ambient air quality monitoring station. The station location and siting details are described below.

Table 1: Wilpinjong Mine monitoring site location

Site Name	Geographical Coordinates	Height Above Sea Level (m)
Wollar	Lat: -32.360105 Long: 149.949509	366

A siting audit was conducted on 21th June 2017 to assess for compliance with *AS/NZS 3580.1.1:2016 "*Methods for sampling and analysis of ambient air – guide to siting air monitoring equipment".

The station is classified as a neighbourhood station according to *AS/NZS 3580.1.1:2016*.

Figure 1: Wilpinjong Mine Monitoring Station Location

3.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at Wilpinjong Mine monitoring station. Appendix 1 defines any abbreviated parameter names used throughout the report.

For meteorological sensors, the elevation given in the table below is the height above ground level at the monitoring station.

Table 2: Parameters measured at the Wilpinjong Mine monitoring station

Parameter Measured	Instrument and Measurement Technique
BTX (Benzene, Toluene and *p*-Xylene)	Synspec GC955 - Gas Chromatography
H_2S	Ecotech EC9852 - fluorescence
NO, NO_2, NO_x	Ecotech EC9841 gas phase chemiluminescence
SO_2	Ecotech EC9850 – fluorescence
Wind Speed (horizontal, 10m)	Gill Windsonic
Wind Direction (10m)	Gill Windsonic

3.3. Data Collection Methods

Table 3 below shows the methods used for data collection. Any deviations from the stated methods are detailed in section 3.3.1.

Table 3: Methods

Parameter Measured	Data Collection Methods Used	Description of Method
NO, NO_2, NO_x	AS 3580.5.1-2011	Methods for sampling and analysis of ambient air. Method 5.1: Determination of oxides of nitrogen – chemiluminescence method
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Vector Wind Direction	AS 3580.14-2014	Methods for sampling and analysis of ambient air. Method 14: Meteorological monitoring for ambient air quality monitoring applications
	Ecotech Laboratory Manual	In-house method 8.3 Wind direction by anemometer

3.3.1. Compliance with Standards

Unless stated below, parameters are monitored at the Wilpinjong Mine site according to the methods detailed in Table 3 above.

- Measurement of benzene, toluene and *p*-xylene (BTX) is not covered by Ecotech's NATA scope of accreditation.
- Measurement of H_2S is not covered by Ecotech's NATA scope of accreditation due to calibration gas used for the calibration of H_2S analyser was expired from 1/04/2018.

3.3.2. Data Acquisition

Data acquisition is performed using a PC based WinAQMS logger (using WinAQMS® Version 2.0) situated at the monitoring site. Each logger is equipped with a 3G modem for remote data collection. The recorded data is remotely collected from the AQMS logger on a daily basis (using Airodis™ version 5.1) and stored at Ecotech's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

3.4. Data Validation and Reporting

3.4.1. Validation

The Ecotech ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Ecotech ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g. backed by maintenance notes, calibration sheets etc.) in the database for flagging any data as invalid.

Details of all invalid or missing data are recorded in the Valid Data Exception Tables.

Validation is performed by the analyst, and the validation is reviewed. Graphs and tables are generated based on the validated five-minute data.

3.4.2. Reporting

The reported data is in a Microsoft Excel format file named "*Wilpinjong Coal Validated Data Report Apr-18.xls*". The Excel file consists of 5 Excel worksheets:

1. Cover
2. 5-minute Averages
3. Hourly Averages
4. Daily Averages
5. Valid Data Exception Table

The data contained in this report is based on Australian Eastern Standard Time.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period.

Averaging periods of eight hours or less are reported for the end of the period, i.e. the hourly average 02:00 is for the data collected from 01:00 to 02:00. One-hour averages are calculated based on a clock hour. One-day averages are calculated based on calendar days.

4.0 Air Quality Goals

The air quality goals for pollutants monitored at the Wilpinjong Wollar monitoring station are based on the Australian National Environmental Council (NEPC) Ambient Air Quality (NEPM). These air quality goals are shown in Table 4 below.

Table 4: Wilpinjong Air Quality Goals (NEPM)

Parameter	Time Period	Exceedence Level	Units	Maximum allowable exceedences
NO_2	1 year	0.030	ppm	None
NO_2	1 hour	0.120	ppm	1 day a year
SO_2	1 hour	0.200	ppm	1 day a year
SO_2	1 day	0.080	ppm	1 day a year
SO_2	1 year	0.020	ppm	None

4.1. Air Quality Summary

Table 5 below, details any exceedences of the NEPM Standard that were observed during this reporting period.

Table 5: Exceedences Recorded

Parameter	Time Period	Value of Exceedence	Date of Exceedence
NO_2	1 hour	-	-
SO_2	1 hour	-	-
SO_2	1 day	-	-

5.0 Calibrations and Maintenance

5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 6: Units and Uncertainties

Parameter	Units	Resolution	Uncertainty	Measurement Range[1]
NO, NO_x (EC9841)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
NO_2 (EC9841)	ppm	0.001 ppm	± 0.016 ppm K factor of 2.01	0 ppm to 0.500 ppm
SO_2 (EC9850)	ppm	0.001 ppm	± 0.014 ppm K factor of 2.01	0.000 ppm to 0.500 ppm
H_2S	ppm	1 ppb	15.2% of reading or ± 0.019 ppm, whichever is greater K factor of 2	0.000 ppm to 0.500 ppm
Benzene, Toluene and *p*-Xylene (BTX)	ppb	0.03 ppb	15.1% of reading or 3.8ppb, whichever is greater K factor of 2	0 ppb to 300 ppb
Vector Wind Speed	m/s	0.1 m/s	±0.01 m/s or 2.0% of reading, whichever is greater (K factor of 1.96)	0 m/s to 60 m/s
Vector Wind Direction	Deg	1 deg	±2 deg K factor of 2.11	0 deg to 360 deg Starting threshold: 0 m/s

[1] Uncertainties may not be calculated based on the full measurement range. Uncertainty for NO, NO_2 and NO_x by EC 9841 and SO_2 by EC9850 are calculated based on a measurement range of 0-125 ppb.

5.2. Automatic Checks

Automatic span and zero calibration checks run every night for NO, NO_2, NO_x and SO_2, every 2nd night for H_2S and weekly for BTX.

Background checks run each night for SO_2 and H_2S.

See Table 7 below for additional details. Data points associated with these checks are invalidated but are not referred to in the Valid Data Exception Tables.

Table 7: Automatic checks for NO, NO_2, NO_x, SO_2, H_2S and BTX

Parameter	Span / Zero cycle time (approximate)	Background cycle time (approximate)
NO, NO_2, NO_x	00:45 to 01:25 every day	N/A
SO_2	00:45 to 01:25 every day	23:45 to 23:50 every day
H_2S	02:35 to 03:30 every 2nd day	22:50 to 22:55 every day
BTX	03:45 to 6:10 weekly	N/A

5.3. Maintenance

Two Scheduled and one non-scheduled visits were made during April 2018:

- 17/04/2018 a monthly maintenance (day one) was performed. SO_2 analyser calibrated.
- 18/04/2018 monthly maintenance continued (day two) for the all gas analysers to complete the calibration.
- 20/04/2018 a non-scheduled maintenance was performed to restore power and communication to the site.

5.3.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to further validation, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

Table 8 indicates when the gas and meteorological equipment was last maintained / calibrated.

Table 8: Wilpinjong Wollar Maintenance Table

Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration	Calibration Cycle
NO, NO_2, NO_x	18/04/2018	Monthly	18/04/2018	Monthly
SO_2	17/04/2018	Monthly	17/04/2018	Monthly
H_2S	18/04/2018	Monthly	18/04/2018	Monthly
BTX	18/04/2018	Monthly	18/04/2018	Yearly
Wind Sensor	17/04/2018	2-yearly	12/02/2018	2-yearly

6.0 Results

6.1. Data Capture

Data capture is based on 1-hour averages, calculated from 5-minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:
Data capture = (Reported air quality data / Total data) x 100%
Where:

- Reported air quality data = Number of instrument readings which have been validated through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of instrument readings since the start of the term assuming no maintenance, errors, loss of data or calibration.

Table 9 displays data capture statistics for April 2018. **Bold** values in the table indicate data capture below 95%.

Details of all invalid or missing data affecting data affecting data capture are included in the Valid Data Exception Tables, and attached Excel file.

Table 9: Data Capture for Wilpinjong Wollar Station

Parameter	Data Capture %
NO, NO_2, NO_x	**83.6**
SO_2	**82.8**
H_2S	**83.2**
Benzene	**81.2**
Toluene	**81.2**
p-Xylene	**36.9**
WS, WD	**87.3**

6.2. Graphic Representations

Validated 5-minute data for NO, NO_2, NO_x, SO_2, H_2S, Benzene, Toluene and *p*-Xylene were used to construct the following graphical representations.

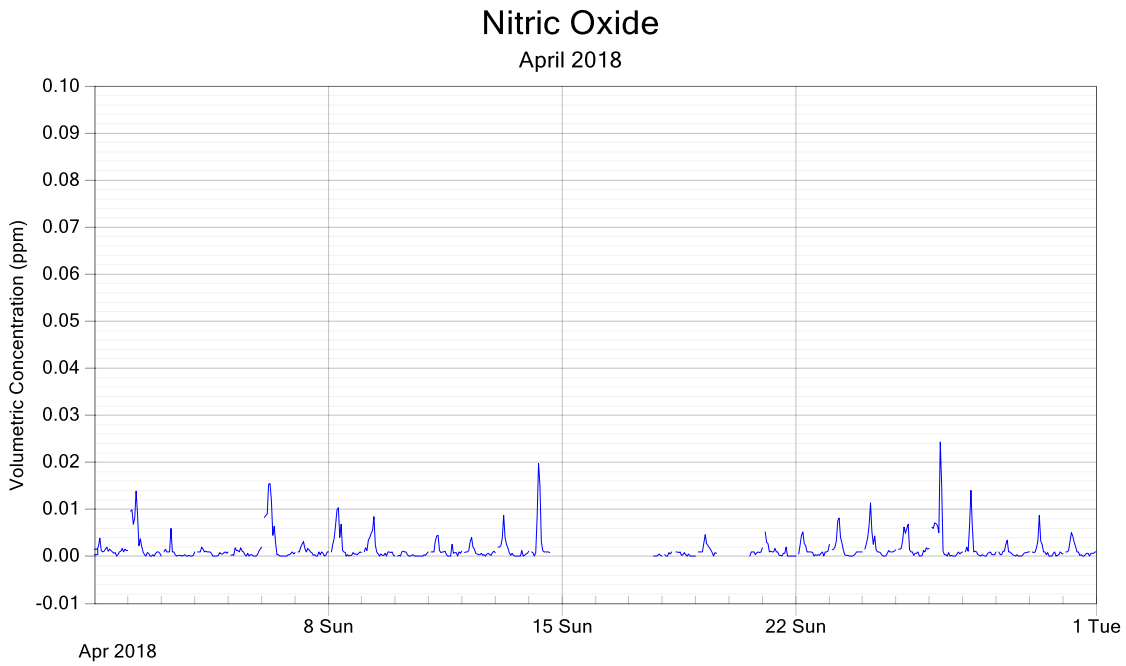

Figure 2: NO 1-hour averaged data

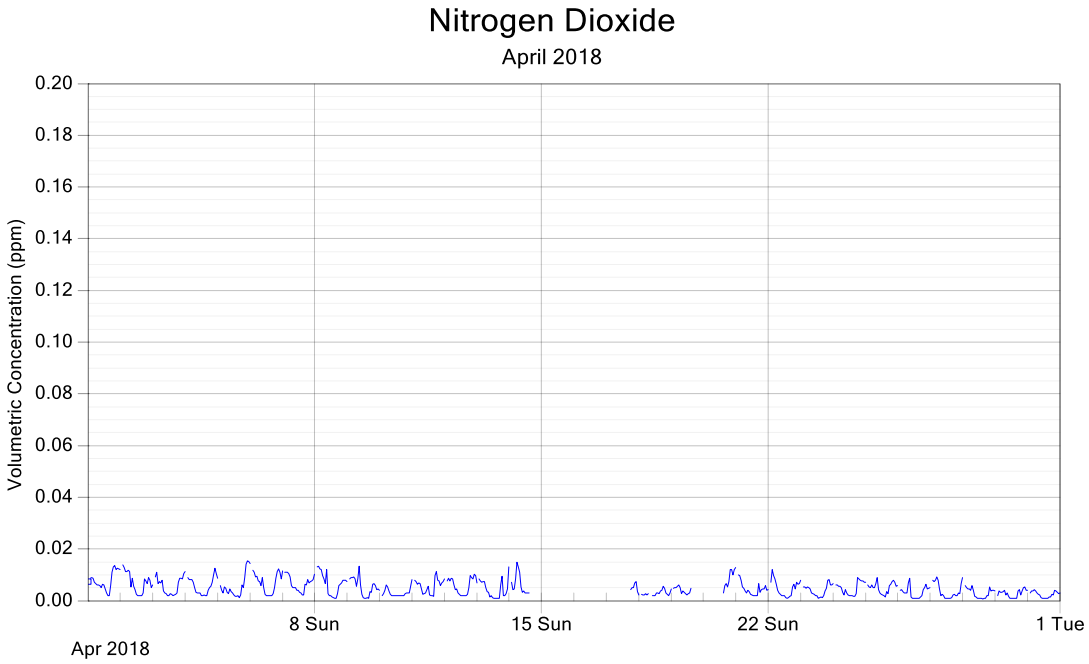

Figure 3: NO_2 1-hour averaged data

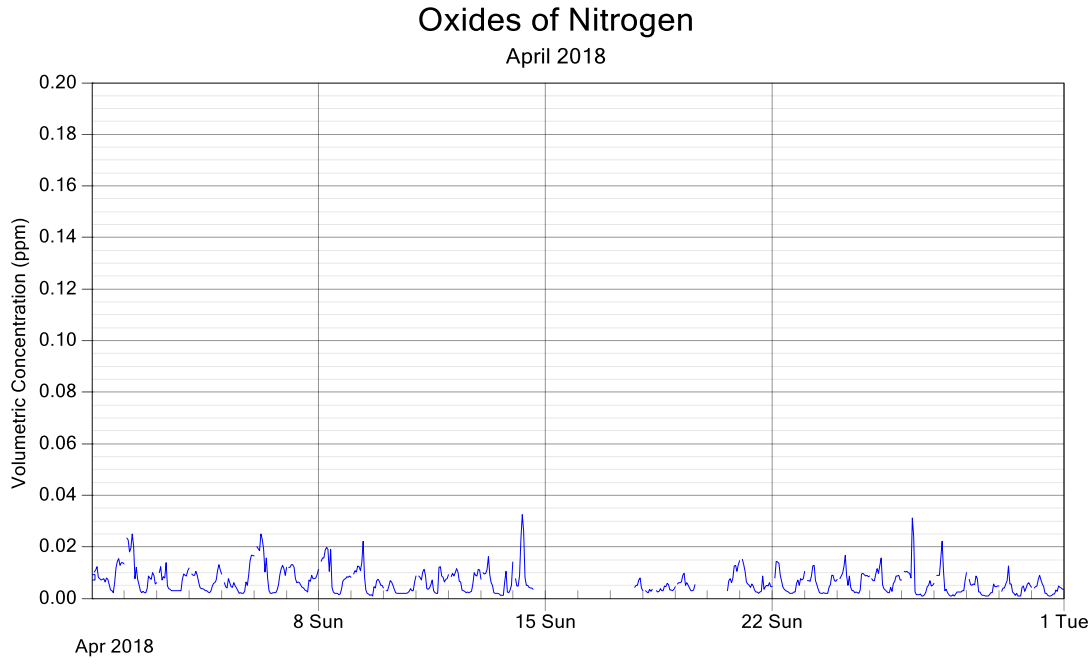

Figure 4: NO_X 1-hour averaged data

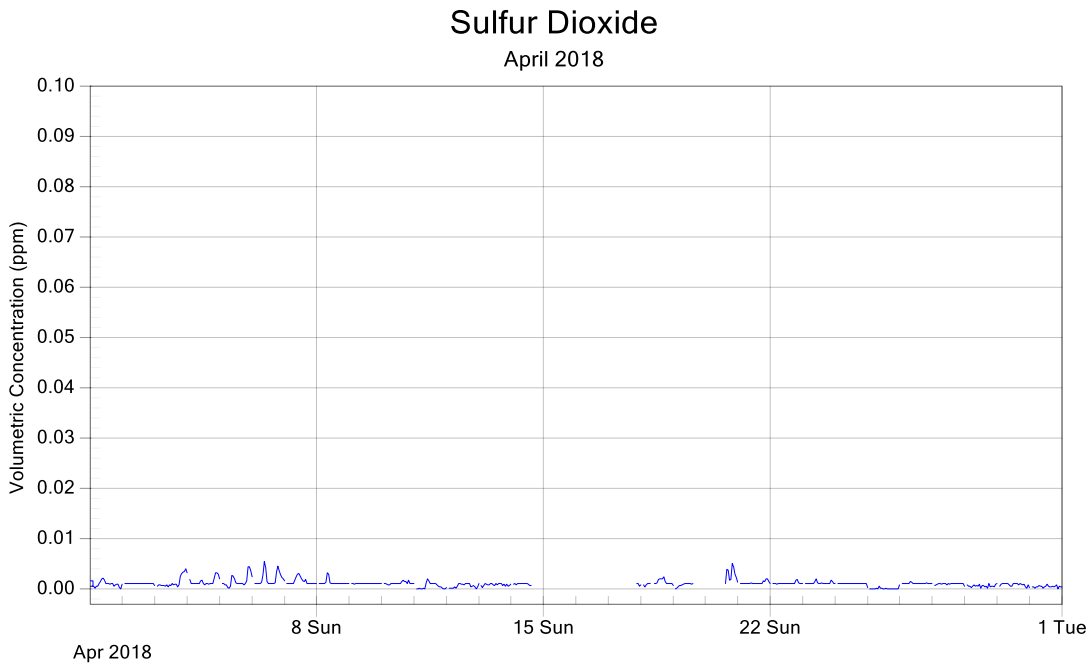

Figure 5: SO_2 1-hour averaged data

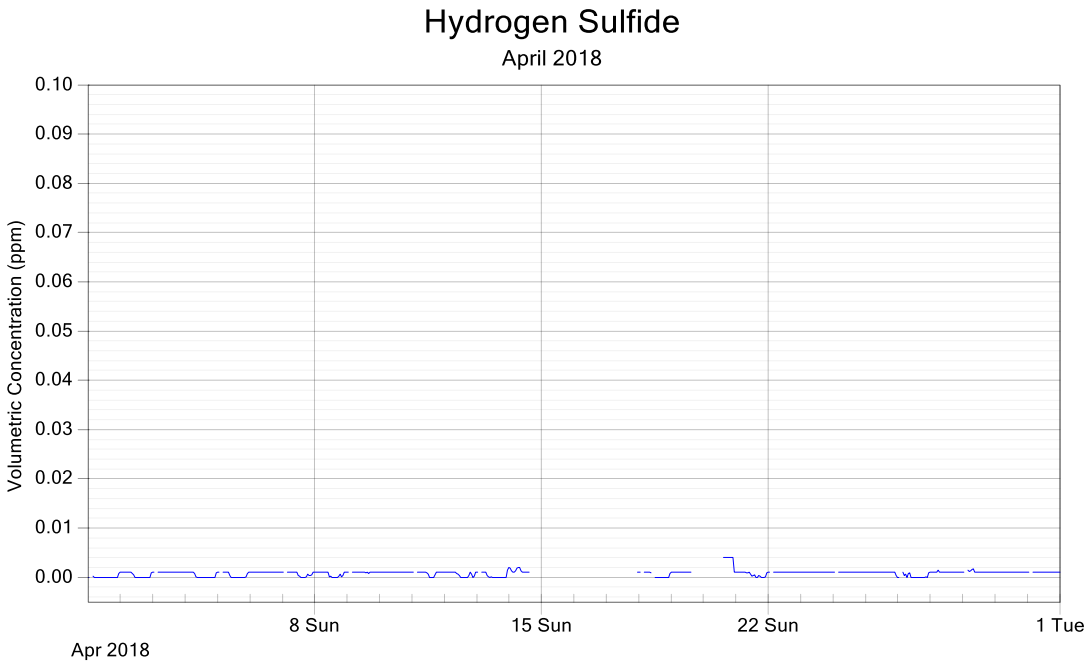

Figure 6: H_2S 1-hour averaged data

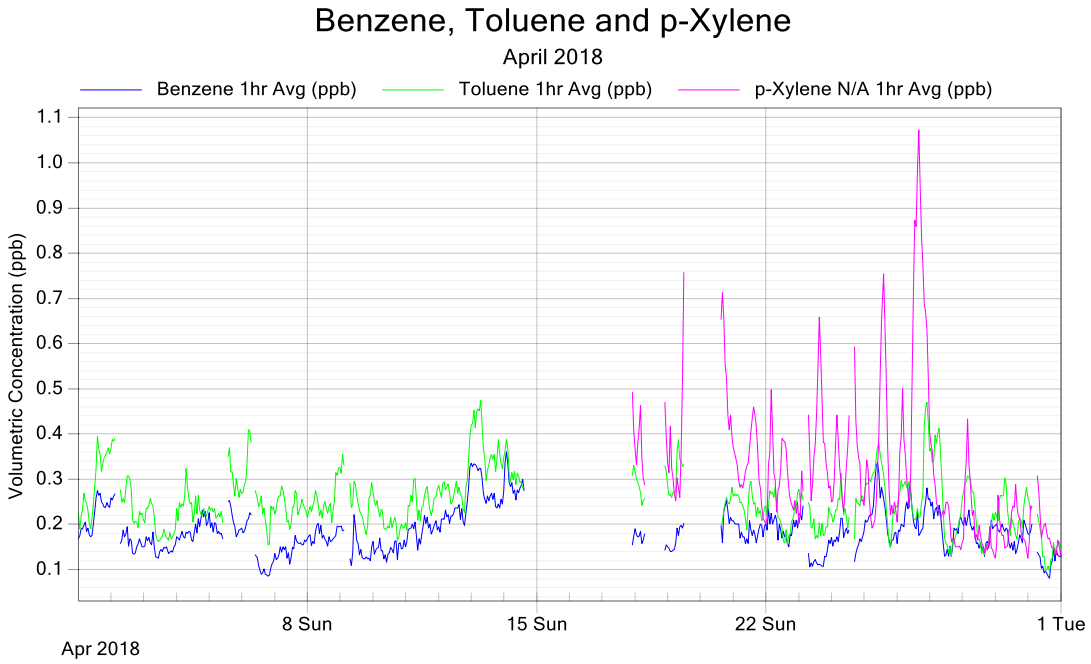

Figure 7: BTX 1-hour averaged data [2]

[2] Xylene data is under investigation

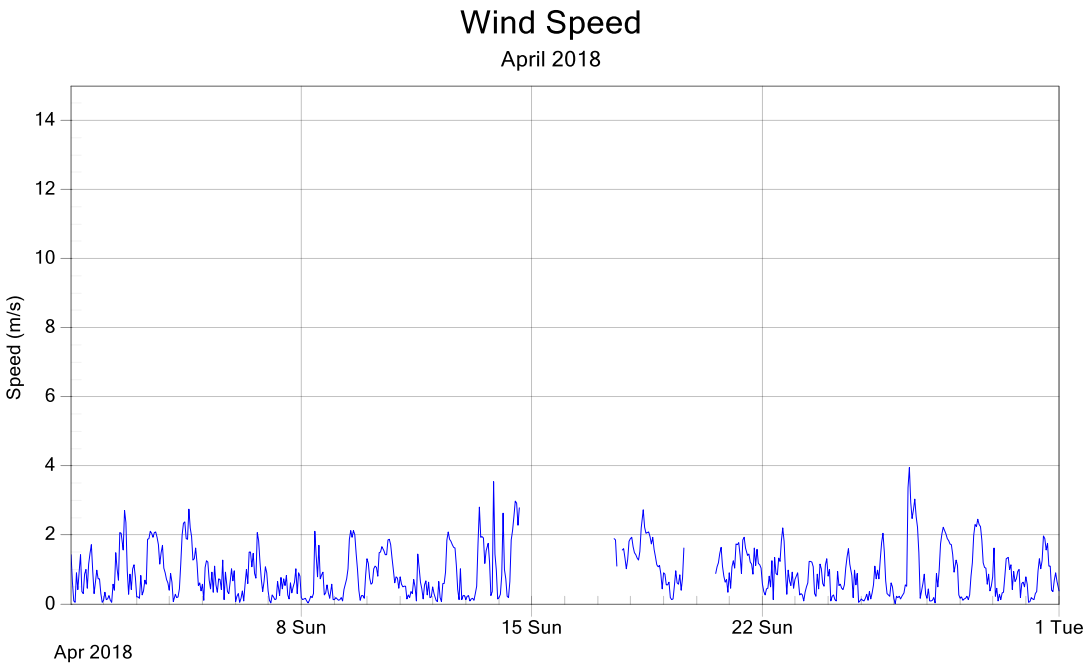

Figure 8: WS 1-hour averaged data

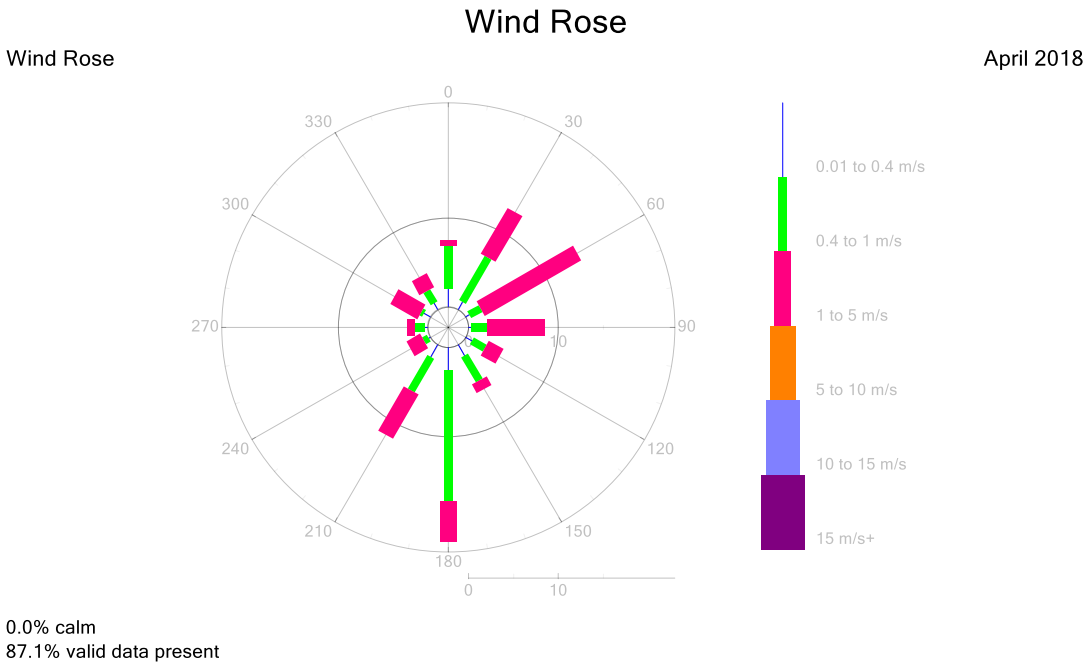

Figure 9: Wind Rose

7.0 Valid Data Exception Tables

The table below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Wollar Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
1/04/2018 0:00	14/04/2018 16:10	Unrealistic data - Data affected by variations in the temperature inside the shelter	Xylene	EP	15/05/2018
2/04/2018 3:45	30/04/2018 6:55	Automatic calibration check and subsequent instrument stabilisation every 7 days	BTX	EP	15/05/2018
14/04/2018 15:55	17/04/2018 11:50	Power interruption	All channels	EP	15/05/2018
17/04/2018 11:55	17/04/2018 22:45	Scheduled monthly maintenance (Part1) and subsequent instrument stabilisation	BTX, H_2S, SO_2, NO, NO_2, NO_x	EP	15/05/2018
18/04/2018 8:10	18/04/2018 21:25	Scheduled monthly maintenance (Part2) and subsequent instrument stabilisation	All channels	EP	15/05/2018
19/04/2018 16:00	20/04/2018 14:05	Power interruption	All channels	EP	15/05/2018
20/04/2018 14:10	20/04/2018 15:10	Non-scheduled maintenance and instrument stabilisation - Power restored	BTX, H_2S, SO_2, NO, NO_2, NO_x	EP	15/05/2018
20/04/2018 23:10	21/04/2018 22:45	Static offset +0.003 ppm applied to correct the baseline	H_2S	EP	15/05/2018
23/04/2018 3:45	23/04/2018 6:40	Additional automatic calibration check and subsequent instrument stabilisation	BTX	EP	15/05/2018

8.0 Report Summary

The data capture for all of the parameters a Wollar was below 95% for the reporting month. Please refer to Data Capture Percentage Table 9 for details; and Table 10 for valid data exceptions.

Measurement of a number of parameters in this report do not comply with applicable standards and/or is not covered by Ecotech's NATA scope of accreditation. Please refer to section 3.3.1 for details.

----------END OF REPORT----------

Appendix 1 - Definitions & Abbreviations

BTX	Benzene, Toluene and *p*-Xylene
H_2S	Hydrogen sulfide
m/s	Metres per second
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
ppb	Parts per billion
SO_2	Sulphur dioxide
WD	Vector Wind Direction
WS	Vector Wind Speed

Appendix 2 - Explanation of Exception Table

Automatic background check refers to when analyser samples zero air and measures the level of the concentration voltage. This voltage is taken as the zero-signal level and this value is subtracted from any subsequent readings as an active zero compensation. This is the analyser's fine zero measurement.

Calibration check outside tolerance refers to when the calibration values are outside the tolerance limits set for the precision check.

Calibration correction factor applied to data refers to an offset or multiplier applied to the data. This operation may be performed for a number of reasons including: (a) when a clear trend / drift outside the tolerance limit can be demonstrated by repeated operation precision checks, (b) when a correction is required on previously logged data due to a calibration check being outside the allowable tolerance

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments, there may be a stabilisation period before normal operation commences.

Data affected by environmental conditions – wind speed / wind speed gust spike refers to when a one-off high reading occurs due to a natural occurrence such as a bird sitting on the wind sensor, or some other event causing the readings to spike.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger / instrument was switched off due to maintenance.

Overnight span/zero out of tolerance refers to when the span/zero reading measured by the analyser during an automatic precision check falls outside of the expected concentration limits.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Remote Calibration refers to when a technician remotely connects to the station and manually performs a span check.

Static offset or multiplier refers to when a single offset or multiplier has been applied to the data between two points either to increase or decrease the measured value.

Warm up after power interruption refers to the start-up period of an instrument after power has been restored.

Air Quality MOnitoring data Review
Wilpinjong 2018

AIR QUALITY MONITORING DATA REVIEW WILPINJONG 2018

Wilpinjong Coal Pty Ltd

20 March 2019

Job Number 18120907

Prepared by
Todoroski Air Sciences Pty Ltd
Suite 2B, 14 Glen Street
Eastwood, NSW 2122
Phone: (02) 9874 2123
Fax: (02) 9874 2125
Email: info@airsciences.com.au

Air Quality Monitoring Data Review
Wilpinjong 2018

DOCUMENT CONTROL

Report Version	Date	Prepared by	Reviewed by
DRAFT - 001	07/03/2019	K. Trahair & P Henschke	A Todoroski
DRAFT - 002	15/03/2019	P Henschke	A Todoroski
FINAL - 001	20/03/2019	A Todoroski	

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1 INTRODUCTION

Todoroski Air Sciences have prepared this report for Wilpinjong Coal Pty Ltd (hereafter referred to as the Proponent). The report presents a review and analysis of the dust monitoring data recorded as part of the Wilpinjong Coal Mine (WCM) air quality monitoring network for the 2018 calendar period and includes a comparison between the measured dust levels and the modelled predictions for the Year 2018 per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

The modelled Year 2018 is considered representative of mining activity occurring during the 2018 calendar period at the WCM.

2 PROJECT SETTING AND DESCRIPTION

The WCM is located in the Western Coalfields of New South Wales (NSW), approximately 40 kilometres (km) northeast of Mudgee and approximately 2.5km west-northwest of Wollar (see **Figure 2-1**). National Parks and reserves, agricultural activities and coal mining operations dominate the land use in the surrounding area.

The WCM is bounded by the Goulburn River National Park to the north, the Munghorn Gap Nature Reserve to the southwest and Moolarben Coal Operations (MCO) to the west. To the east and southeast of the mine, the land is predominantly zoned for agricultural use, along with areas of Crown Land.

The WCM ambient air quality monitors include High Volume Air Samplers (HVAS), Tapered Element Oscillating Microbalances (TEOMs) (both PM_{10} and $PM_{2.5}$), and deposited dust gauges. The location of the air quality monitors relative to WCM is presented in **Figure 2-1**.

The nearest privately-owned receptors to the WCM are located in Wollar and are shown in **Figure 2-1**.

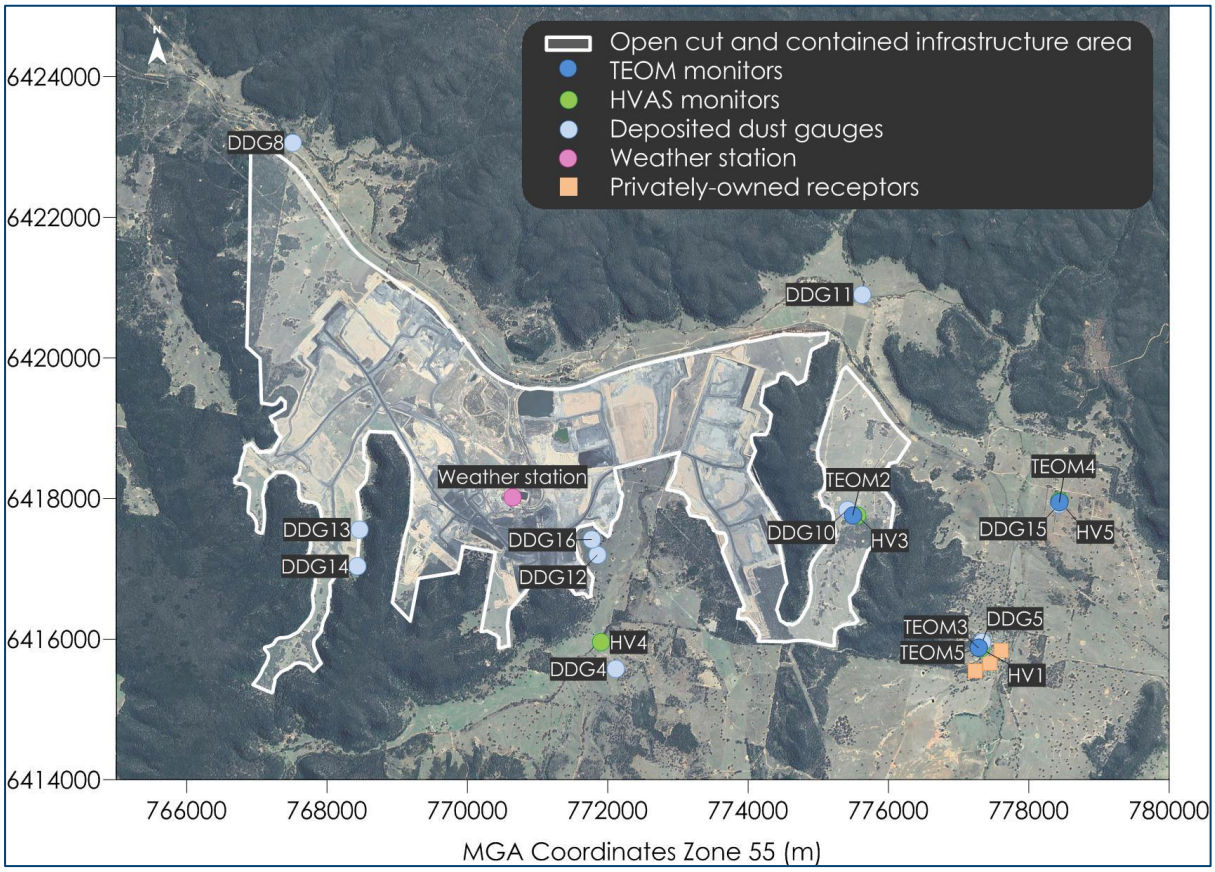

Figure 2-1: WCM setting and air quality monitoring network

Notes:

- Data from DDG4, DDG5, DDG8, DDG11, HV1, HV4, HV5, TEOM3 and TEOM4 for ***compliance monitoring*** against the Air Quality Assessment Criteria in accordance with Condition 17, Schedule 3 of SSD-6764;
- Data from DDG12, DDG13, DDG14, DDG16 for dust monitoring of Aboriginal heritage sites;
- Data from TEOM2, TEOM 5*, DDG10, and HV3 for management purposes; and
- Data from DDG15 for monitoring to the nearest non-mine owned residence to the east of WCM.

(*TEOM 5 measures $PM_{2.5}$ and will start to be used for compliance and management purposes in 2019, via a TARP).

3 AIR QUALITY CRITERIA

The sections below identify the key pollutants currently being monitored at the WCM air quality monitoring sites (refer to **Figure 2-1**) and the applicable air quality criteria.

3.1 Particulate Matter

Particulate matter consists of particles of varying size and composition. The total mass of all particles suspended in air is defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (µm) as in practice particles larger than 30 to 50µm will settle out of the atmosphere too quickly to be regarded as air pollutants.

The TSP is defined further into two sub-components. They are PM_{10} particles, particulate matter with aerodynamic diameters of 10µm or less, and $PM_{2.5}$, particulate matter with aerodynamic diameters of 2.5µm or less.

Particulate matter, typically in the upper size range, that settles from the atmosphere and deposits on surfaces is characterised as deposited dust. The deposition of dust on surfaces may be considered a nuisance and can adversely affect the amenity of an area by soiling property in the vicinity.

3.1.1 DP&E air quality criteria

Table 3-1 summarise the air quality goals that are relevant to particulate pollutants as outlined in the WCM Development Consent (SSD-6764).

The development consent outlines that the applicant shall ensure that all reasonable and feasible avoidance and mitigation measures are employed so that the particulate emissions generated by the operation do not exceed the criteria listed in **Table 3-1** at any residence on privately-owned land.

Table 3-1: Air quality criteria - SSD-6764

Pollutant	Averaging period	[d] Criterion	
Particulate Matter < 10µm (PM_{10})	Annual	[a] 30 µg/m³	
	24 hour	[a] 50 µg/m³	
Total suspended particulates (TSP)	Annual	[a] 90 µg/m³	
[c] Deposited Dust	Annual	[b] 2 g/m²/month	[a] 4 g/m²/month

Notes:

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to other sources).

[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.

[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed to by the Secretary.

3.1.2 NSW EPA impact assessment criteria

Table 3-2 summarises the current air quality goals that are relevant to particulate pollutants as outlined in the NSW Environment Protection Agency (EPA) document "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*" (**NSW EPA, 2017**).

It should be noted the current NSW EPA air quality impact assessment criteria were updated after the Project was approved, and thus differ from the development consent criteria by including new criteria for $PM_{2.5}$ and a reduction in the annual average PM_{10} criteria from a level of 30µg/m³ to 25µg/m³.

Table 3-2: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Impact [1]	Criterion
Total suspended particulates (TSP)	Annual	Total	90 µg/m^3
Particulate Matter < 10µm (PM_{10})	Annual	Total	25 µg/m^3
	24-hour	Total	50 µg/m^3
Particulate Matter < 2.5µm ($PM_{2.5}$)	Annual	Total	8 µg/m^3
	24-hour	Total	25 µg/m^3
Deposited Dust [2]	Annual	Incremental	2 g/m^2/month
		Total	4 g/m^2/month

[1] At nearest existing or likely future off-site sensitive receptor

[2] Dust is assessed as insoluble solids as defined by AS 3580.10.1 – 1991 (AM-19)

Source: **NSW EPA, 2017**

4 AIR QUALITY MONITOIRNG DATA

The main sources of particulate matter in the wider area of the WCM include active mining from other coal mine operations, agricultural activities, emissions from local anthropogenic activities (such as motor vehicle exhaust, dust from dirt roads, and domestic wood heaters) and various other rural activities.

This section reviews the available ambient monitoring data collected from the WCM ambient air quality monitoring network for the 2018 calendar period.

4.1 $PM_{2.5}$ Monitoring

There are no specific $PM_{2.5}$ air quality impact assessment criteria in WCM Development Consent SSD-6764. WCM adopted the National Environmental Protection Measures (NEPM) standard for $PM_{2.5}$ in the WCM Air Quality Management Plan (AQMP). The data from monitoring PM $_{2.5}$ in the Village of Wollar is recorded to establish if there is any correlation between WCM activities under applicable prevailing meteorological conditions.

A summary of the available $PM_{2.5}$ monitoring data is presented in **Table 4-1**. Recorded 24-hour average $PM_{2.5}$ concentrations are presented graphically in **Figure 4-1**.

A review of **Table 4-1** indicates that the annual average $PM_{2.5}$ concentration was below the relevant NSW EPA criterion of 8µg/m^3. The maximum 24-hour average $PM_{2.5}$ concentrations exceeded the current NSW EPA criterion of 25µg/m^3 on five occasions during 2018.

It can be seen from **Figure 4-1** the maximum $PM_{2.5}$ levels occur during the summer months indicating that these levels are likely due to bushfires or regional dust events during the warmer periods.

Table 4-1: Summary of ambient $PM_{2.5}$ levels for 2018

Monitor	Annual average (µg/m^3)	Maximum 24-hour average (µg/m^3)	No. days >25µg/m^3
TEOM5	7	36	5

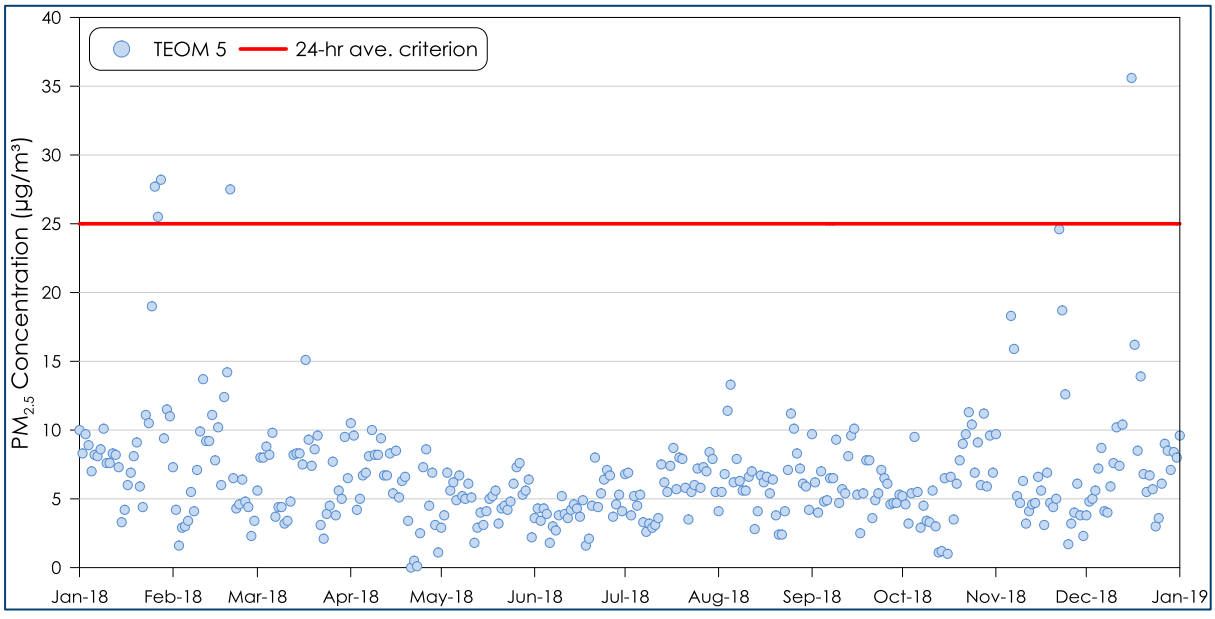

Figure 4-1: 24-hour average $PM_{2.5}$ concentrations at TEOM monitors

4.2 PM_{10} monitoring

A summary of the available PM_{10} monitoring data for the TEOMs and HVAS monitors is presented in **Table 4-2**. Recorded 24-hour average PM_{10} concentrations for the TEOM and HVAS monitors are presented in **Figure 4-2** and **Figure 4-3** respectively. The rolling annual average PM_{10} concentrations for the TEOM and HVAS monitors are presented in **Figure 4-4**.

It is noted that TEOM 2 is located in Slate Gully (the now approved Pit 8) and is to be removed in 2019/20 (refer to **Figure 2-1**). As described in the AQMP, TEOM 2 only used for management purposes and not a compliance based monitor.

A review of **Table 4-2** indicates that the annual average PM_{10} concentrations did not exceed the relevant NSW EPA criterion of 25µg/m^3 or the development consent criterion of 30µg/m^3. The 24-hour average PM_{10} concentrations recorded at the monitoring stations exceeded the criterion of 50µg/m^3 on a number of occasions during the review period.

Of these occasions, the majority of elevated recordings are due to extraordinary regional events associated with bushfires or regional dust events and are excluded from the air quality criteria in **Table 3-1**. An analysis of each of the elevated recordings is presented in the following section.

Table 4-2: Summary of ambient PM_{10} levels for 2018

Monitor	Annual average (µg/m^3)	Maximum 24-hour average (µg/m^3)	No. days >50µg/m^3
TEOM2*	22	207	19
TEOM3	14	143	5
TEOM4	18	157	11
HV1	19	168	3
HV4	23	208	2
HV5	25	167	5

*Monitor for management purposes (non-compliance).

Figure 4-2 and **Figure 4-3** follow similar trends as expected and show periods of notably elevated levels in November and December 2018. The rolling annual average levels in **Figure 4-4** show a very gradual increase in level over the annual period for the monitors, with the HVAS monitors all showing a sudden increase in December due to a regional dust event.

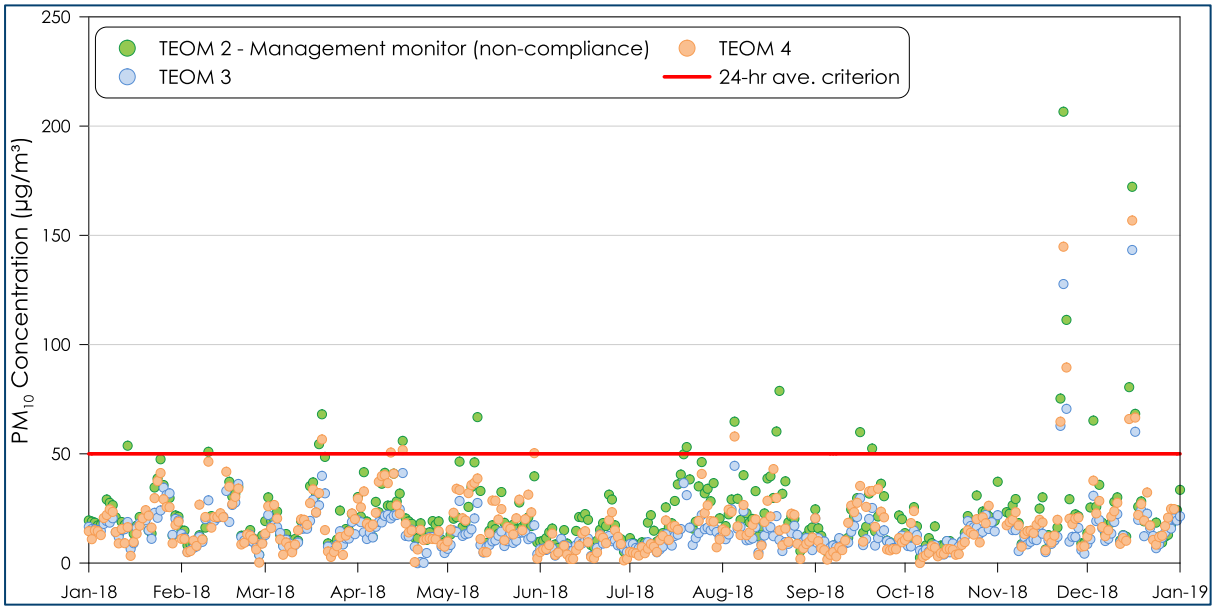

Figure 4-2: 24-hour average PM_{10} concentrations at TEOM monitors

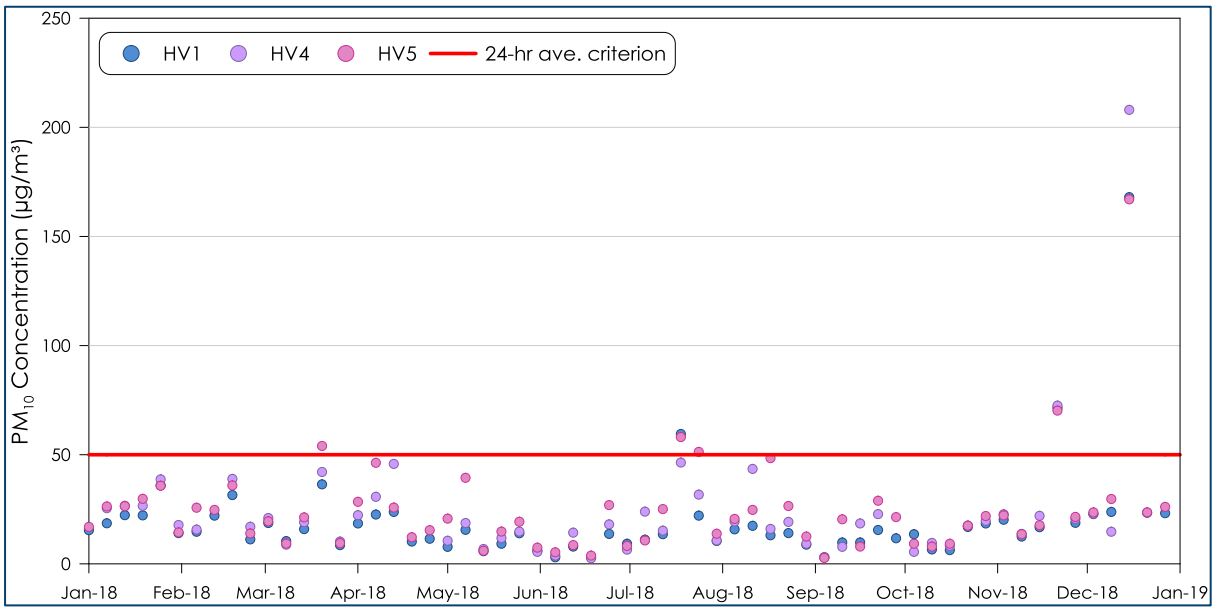

Figure 4-3: 24-hour average PM_{10} concentrations at HVAS monitors

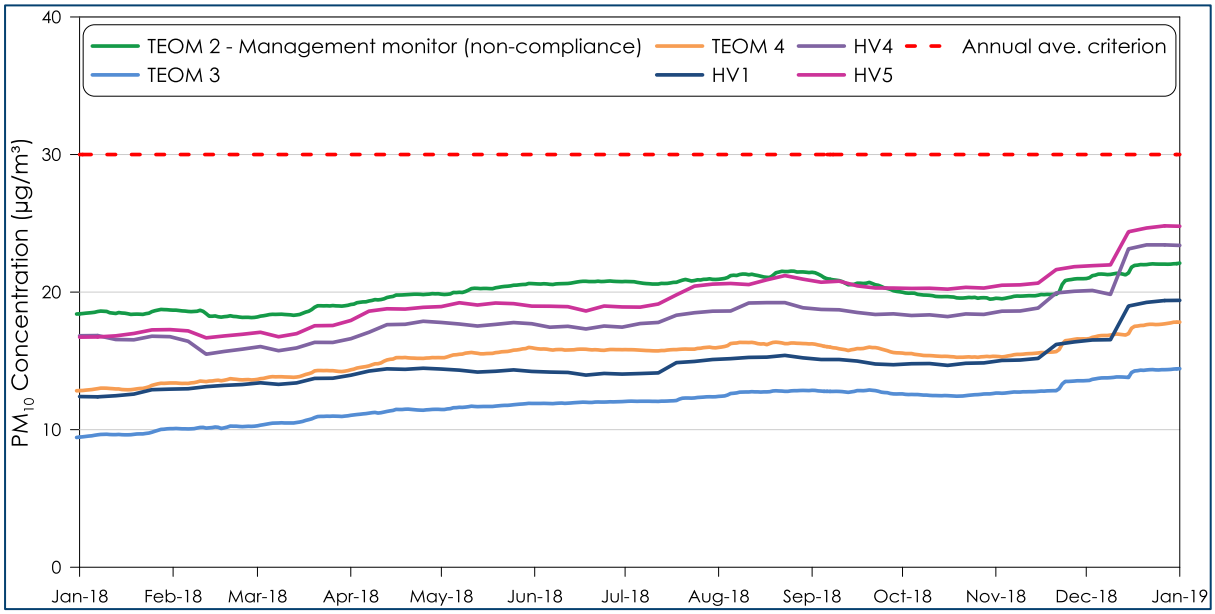

Figure 4-4: Rolling annual average PM_{10} concentrations at TEOM monitors

4.2.1 Analysis of elevated PM_{10} levels

Each of the elevated PM_{10} recordings at the WCM monitors during 2018 were investigated and the analysis is summarised in **Table 4-3**.

As noted previously, the table shows the majority of the elevated PM_{10} levels recorded at the WCM PM_{10} monitors were identified at the time to be due to high regional dust levels associated with a dust storm or regional dust event. The NSW EPA was notified on each of these days (refer to **Table 4-3**). The remaining four days were investigated, and the potential cause of each elevated level described in the following sections.

On 20 March 2018, the HV5 monitor recorded a level of 54µg/m³. The likely cause of this elevated level is residual, resuspended dust from the regional dust event which occurred the previous day on the 19 March 2018. This regional dust event originated from the southwest of NSW, moving northwards with a frontal system from the 18 March 2018. The dust reached Sydney and Newcastle early on the 19 March 2018 and the Hunter Valley and Wilpinjong area by the middle of the day. It is likely that the dust lingered in the area or was been resuspended and thus contributed to the elevated reading for the 20 March 2018.

On 29 May 2018, the TEOM4 monitor recorded a level of 50.3µg/m³. Local dust originating from the unsealed Araluen Road was identified by WCM as main contributor on this day leading to the elevated level at the TEOM4 monitor.

On 18 July 2018, the HV1 and HV5 monitors recorded a level of 59.5µg/m³ and 58.1µg/m³, respectively. A review of PM_{10} levels recorded at the NSW OEH Bathurst, Wybong and Merriwa on this day suggest a regional dust event as all of these stations recorded levels above 50µg/m³.

On 24 July 2018, the HV5 monitor recorded a level of 51.3µg/m³. The other PM_{10} monitors at WCM and the nearest NSW OEH monitors all recorded levels below 50µg/m³. A windrose for this day is presented in **Figure 4-5**. The data shows that the wind conditions on this day recorded a high

proportion of winds from the west. This would indicate the WCM would have been upwind of the HV5 monitor approximately 63% of time on this day.

WCM's estimated maximum contribution to the 24-hour average level recorded at the HV5 monitor was determined by the period in which it was downwind of WCM. The maximum contribution to the HV5 monitor is approximately 32.3µg/m^3 or 63% of the 51.3µg/m^3 recorded on the 24 July 2018.

Table 4-3: Summary of elevated 24-hour average PM_{10} levels at WCM

Date	Monitor(s) affected	Likely cause of elevated reading
19/03/2018	TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
20/03/2018	HV5	Likely due to Regional dust event from previous day
11/04/2018	TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
15/04/2018	TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
29/05/2018	TEOM 4	Local dust from unsealed Araluen Road
18/07/2018	HV1 & HV5	Regional dust event as identified by NSW OEH monitors (Bathurst, Wybong and Merriwa)
24/07/2018	HV5	Potential contribution from WCM estimated as 32.3µg/m^3
4/08/2018	TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
21/11/2018	TEOM 3, TEOM 4, HV1, HV4 & HV5	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
22/11/2018	TEOM 3 & TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
23/11/2018	TEOM 3 & TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
14/12/2018	TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
15/12/2018	TEOM 3, TEOM 4, HV1, HV4 & HV5	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event
16/12/2018	TEOM 3 & TEOM 4	EPA and relevant government departments notified by WCM of high regional PM_{10} dust levels - Regional dust event

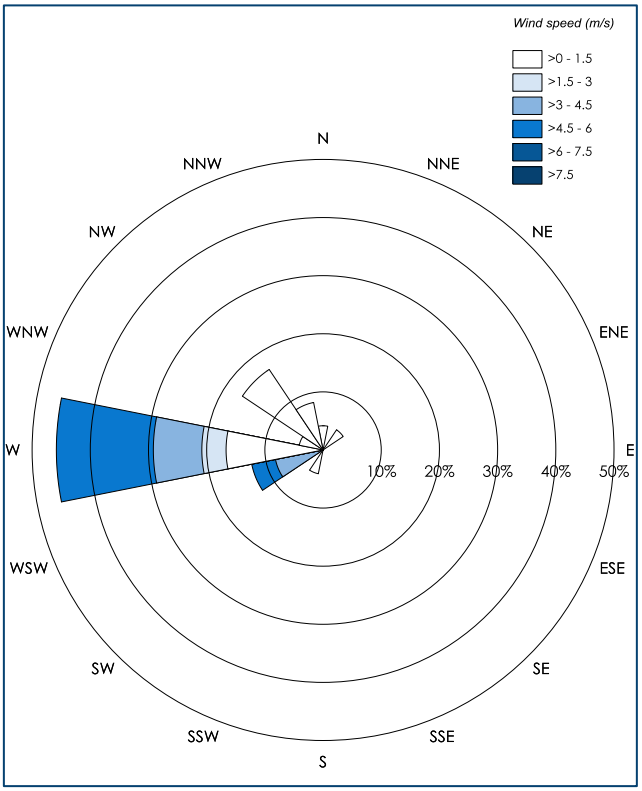

Figure 4-5: Windrose for Wilpinjong – 24 July 2018

4.3 TSP monitoring

HV3 is located in Pit 8 of the approved WEP mining area. At the end of 2018, Pit 8 had not commenced development for mining. Data from HV3 is recorded for management purposes only and is not a compliance based monitor, as described in the AQMP.

The recorded 24-hour average TSP concentrations are presented in **Figure 4-6**. The annual average TSP concentration for the HV3 monitor is 45µg/m^3 which is below the criterion of 90µg/m^3.

It can be seen from **Figure 4-6** the recorded 24-hour average TSP concentrations follow a generally similar trend to the PM_{10} monitoring with the highest level recorded in December 2018 during a regional dust event occurring 14 to 16 December 2018.

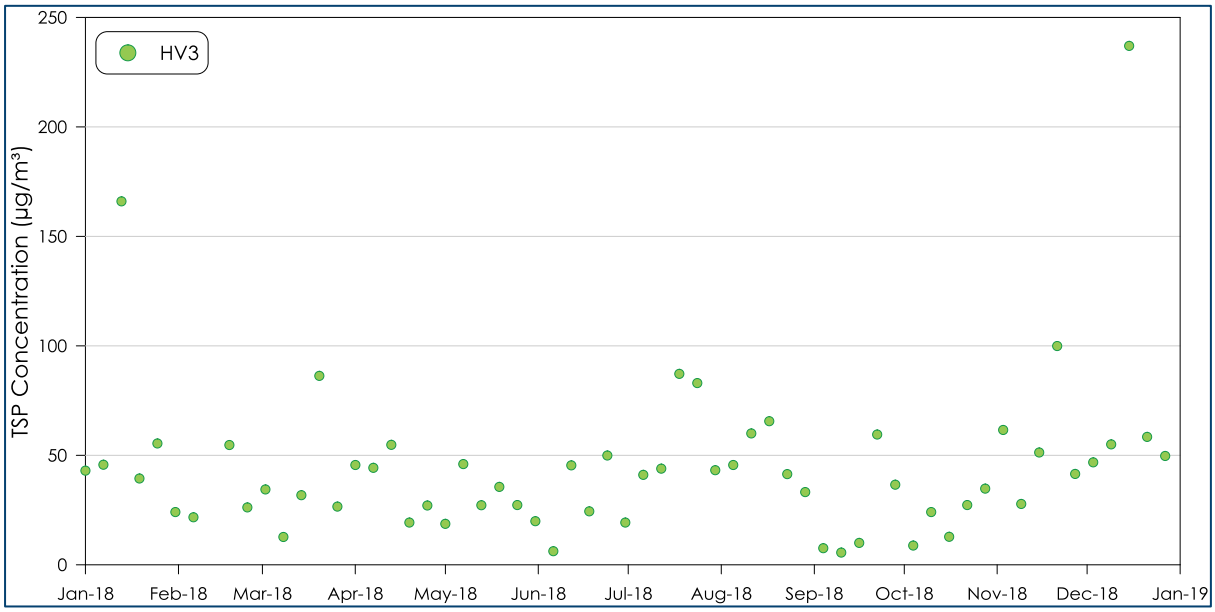

Figure 4-6: 24-hour average TSP concentrations at HVAS monitors

4.4 Deposited dust

Table 4-4 presents the annual average deposited dust levels for all of the WCM deposited dust gauges during 2018. The tabled results include results for management dust gauges (DDG10, DDG12, DDG13, DDG14, DDG15 and DDG16) which include those used for monitoring levels at heritage sites located near mining activities. The data from these monitors are not representative of dust levels near receptors, and are only used for diagnostic operational purposes and not compliance evaluation.

The results in **Table 4-4** indicate that deposited dust levels are below the relevant criterion of 4g/m^2/month (apart from the diagnostic monitors of course).

Based on the positioning of the compliance monitors at WCM, it can be assumed that the DDG8 monitor is sufficiently away from mining activity and is generally represented of background levels for the area. On this basis, the potential incremental contribution from WCM can be estimated as the level recorded at the compliance monitors minus the level at DDG8. The resulting incremental levels would below the relevant criterion of 2g/m^2/month and indicate compliance with the criterion in **Table 3-1**.

The monthly deposited dust levels for the compliance monitors are presented graphically in **Figure 4-7** and indicate levels were higher during the summer months compared to the winter months.

Table 4-4: Summary of deposited dust levels for 2018 (g/m²/month)

Compliance Monitor	Annual average
DDG4	3.2
DDG5	2.0
DDG8	1.7
DDG11	2.2
Management monitor (non-compliance)	**Annual average**
DDG10	3.7
DDG12^	5.2
DDG13^	4.1
DDG14^	6.6
DDG15	1.3
DDG16^	-*

*Insufficient data to calculate annual average ^ Dust monitoring of heritage sites occurs when within 1km of active mining

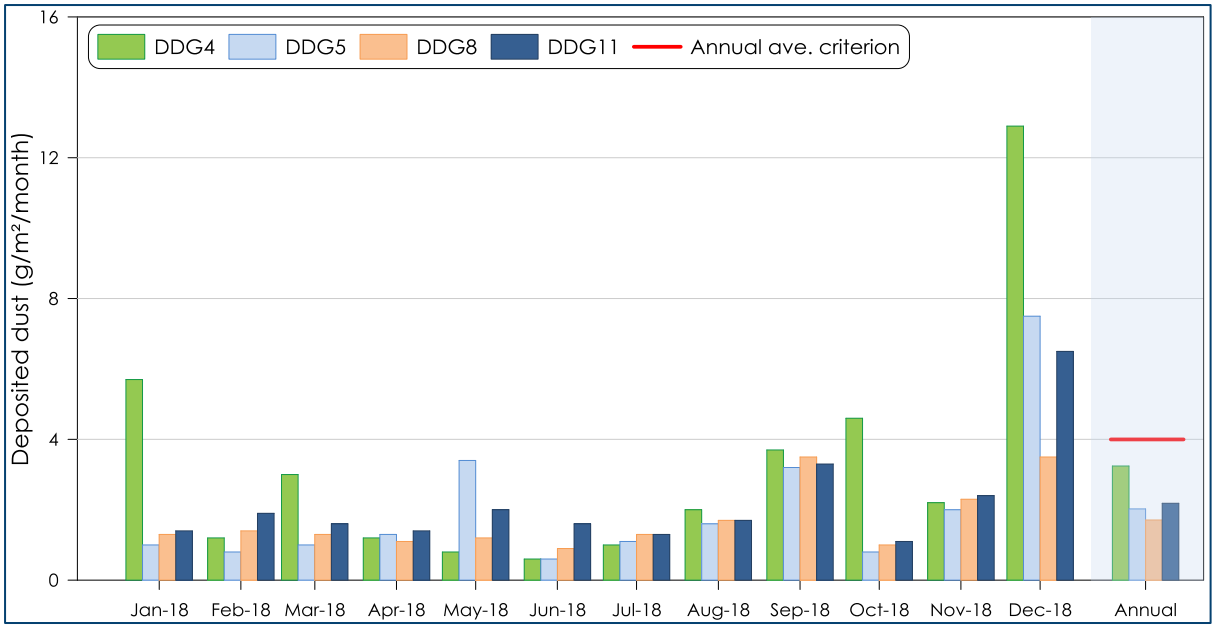

Figure 4-7: Monthly average deposited dust levels

5 METEOROLOGICAL DATA

Annual and seasonal windroses have been prepared from the available data collected at the WCM weather station for the 2018 period, and are presented in **Figure 5-1**.

The total cumulative annual rainfall recorded by WCM for the year was 487.8 millimetres (mm), well below the average long-term cumulative annual average rainfall (in the vicinity of WCM) ranging from 587.7mm to 651.5mm (WEP EA) and well below the annual rainfall record of 531.4mm recorded in 2017.

Analysis of the windroses show that on an annual basis the predominant wind flows at the WCM weather station are along a general east to west axis, which is expected considering the wider terrain features of the area. Very few winds originate from the northern and southern sectors.

The summer winds are predominately from the east-northeast and east. The autumn and spring wind distribution is similar to the annual distribution with winds from the east and east-northeast, followed by winds ranging from the northwest to the west. During winter, winds are primarily from the west, west-northwest and northwest.

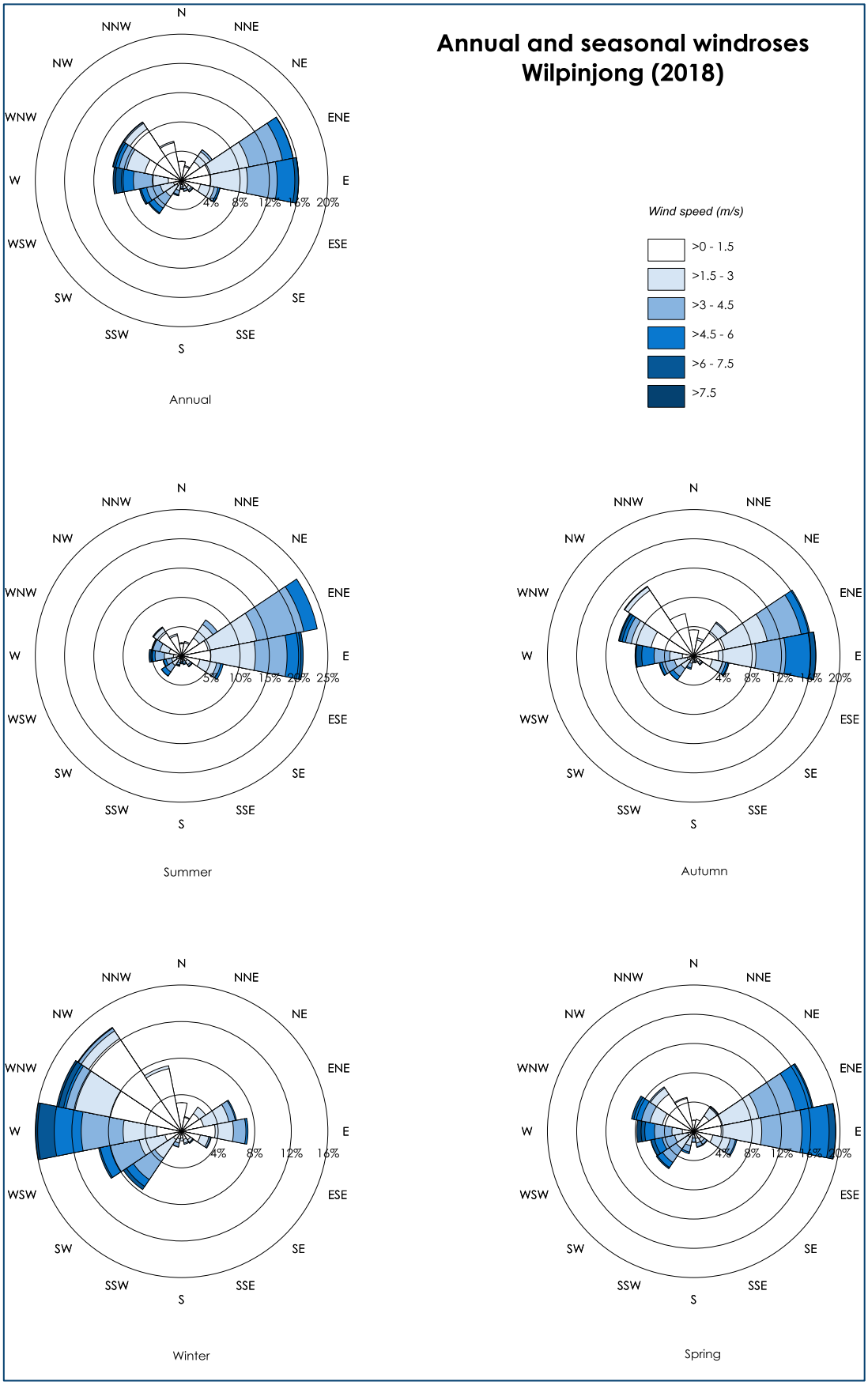

Figure 5-1: Annual and seasonal windroses for Wilpinjong (2018)

6 COMPARISON BETWEEN MEASURED DATA AND MODELLED RESULTS

Monitoring data collected as part of the WCM ambient air quality monitoring network during 2018 was compared with modelling predictions for the Year 2018 per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

It is noted based on the satellite imagery in **Figure 2-1** (which is understood to have been taken in September 2018) the location of mining activity is different to the modelled locations for the Year 2018 scenario.

The modelled locations for the Year 2018 scenario include mining activity extending into Pit 8 however the September 2018 satellite imagery indicates mining did not occur in that location in 2018. WCM have confirmed that during the 2018 period no mining and/or disturbance activities were undertaken in the Pit 8 mining area, and confirmed that agricultural activities were undertaken in the area associated with Pit 8 during the reporting period. Also, the modelling does not include mining activity in some part of the mine that did occur.

Due to this, there will be differences between the measured and modelled data. However, for the purposes of this comparison, the modelled Year 2018 is the most representative of the mining activity during the 2018 calendar period and was used as the basis for the comparison.

It needs to be noted that short term, 24-hour average dust levels are heavily influenced by background dust levels due to bushfires, regional dust event, dust storms and other factors that vary greatly day to day and year to year (say in a drought year). An important factor is the exact location of mining activity on a given day. The modelling has activity fixed in one place for a full year, and uses a year of historical weather data, this it cannot exactly predict 24-hour levels on every day, but does provide a good indication.

6.1 Annual average PM_{10}

Figure 6-1 presents the measured 2018 annual average PM_{10} data superimposed over the dispersion modelling contours for the Year 2018. The measured and predicted data in the figure include dust levels from WCM and other sources.

The levels measured by the TEOM monitors (positioned to the left of the symbol) and the HVAS monitors (positioned to the right of the symbol) are shown in **Figure 6-1**. It is noted that the TEOM monitors recorded lower annual average levels compared to the co-located HVAS monitors.

Figure 6-1 shows there is generally a good correlation between the modelling results and the recorded levels at the air quality monitors. This is especially so when considering that the modelling is based on mining activity in Pit 8 to the east that did not occur in practice (and thus the modelling over predicts in that area), and also as the modelling does not have mining activity in the central southern areas that did occur in other areas (and thus slightly under predicts in those areas). The predicted levels in the Village of Wollar, which is relatively well removed form mining activity are consistent with the measured data.

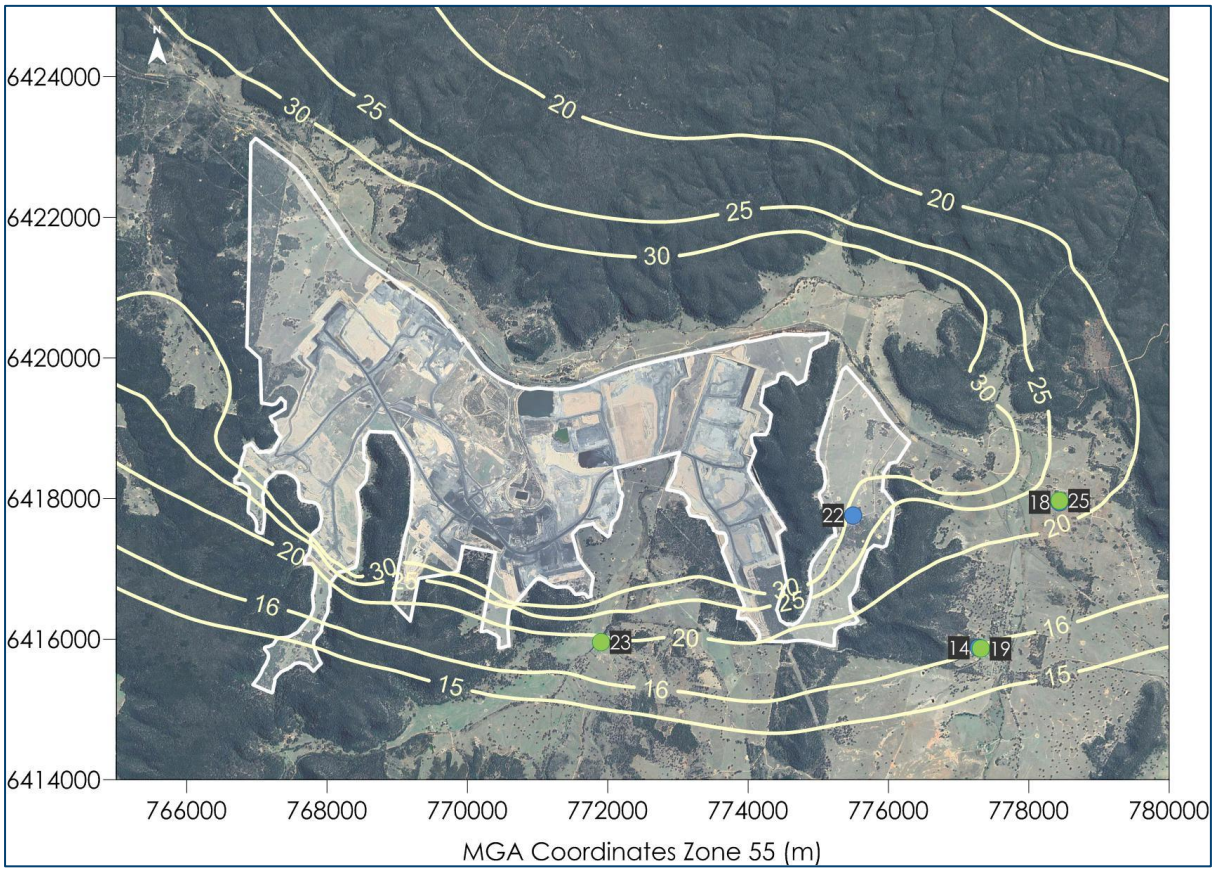

Figure 6-1: Annual average PM_{10} monitoring data for 2018 superimposed over the predicted PM_{10} annual average modelling contour (Year 2018 WCM plus other mines and background)

6.2 24-hour average PM_{10}

Figure 6-2 presents an overlay of the maximum measured 24-hour average PM_{10} data, over the incremental dispersion modelling predictions for WCM alone for Year 2018. The November and December 2018 data have been excluded as they appear to be significantly influenced by bushfires or regional dust events (refer to **Section 4.1**). The levels measured by the TEOM monitors (positioned to the left of the symbol) and the HVAS monitors (positioned to the right of the symbol) are shown in **Figure 6-2**.

As outlined previously, there are limitations to how precisely any model can predict short-term dust levels day to day in the future, largely due to the influence of a highly variable short term background dust levels. However, the measured levels are in general agreement with the model predictions when considering that the model predictions only relate to mine emissions, and no other dust.

If accounting for background dust levels and dust from other sources, it becomes clear that the modelled results would over predict the mine contribution at the three monitors nearest the mine. Specifically, the predicted levels excluding background are above the measured levels at two locations, and approximately 8µg/m^3 below background at a third location. Background 24-hour PM_{10} levels would be greater than 8µg/m^3 on the day of most mine impact. In the Village of Wollar, the predicted levels are approximately 15 to 30µg/m^3 less than the measured levels, which is consistent with the underlying background levels, and any additional dust arising from the township itself.

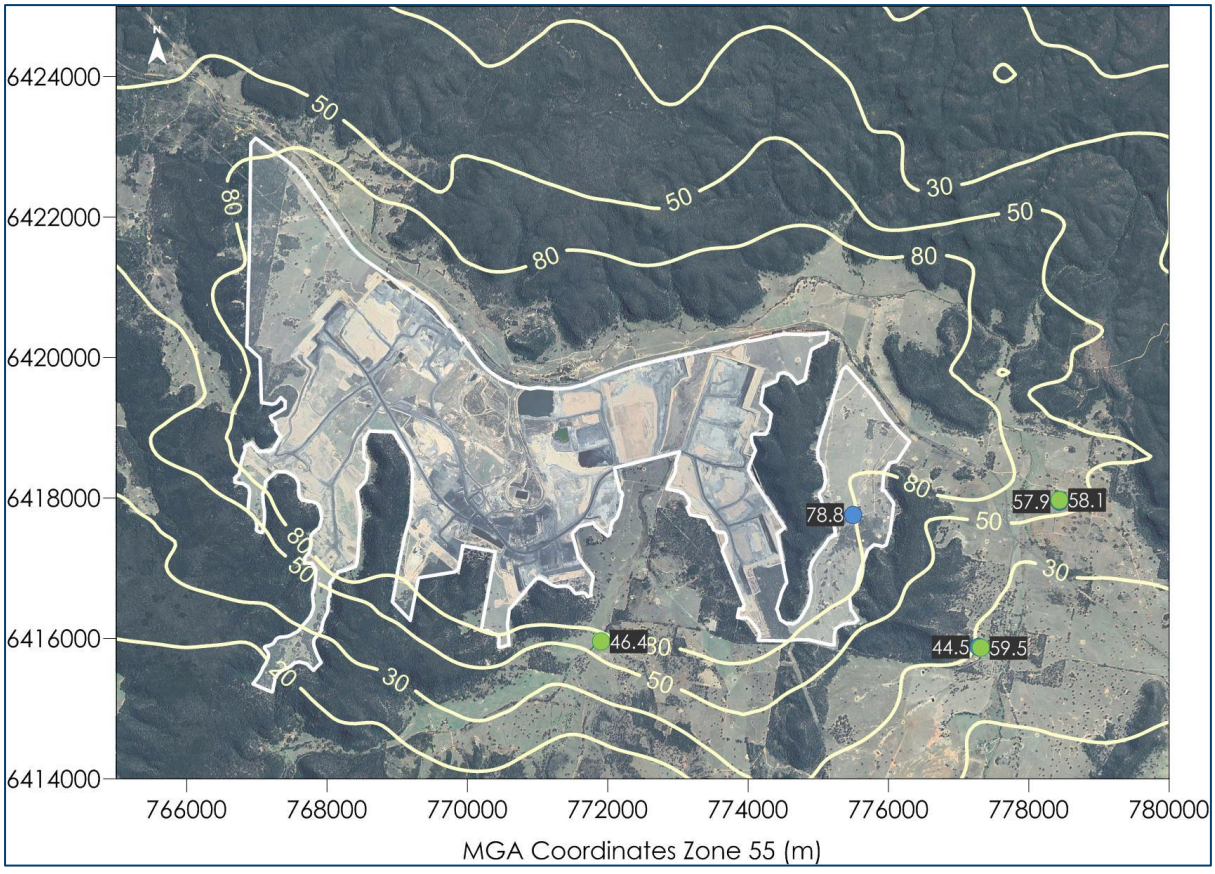

Figure 6-2: 24-hour average PM_{10} monitoring data for 2018 (excluding November and December) superimposed over the predicted PM_{10} 24-hour average modelling contour (Year 2018 WCM incremental impact)

6.3 Annual average $PM_{2.5}$

Figure 6-3 presents an overlay of the measured 2018 annual average $PM_{2.5}$ data over the dispersion modelling predictions for Year 2018. The measured result is below the criteria and is typical of a small village, or levels in the clean parts of urban areas in NSW.

The measured levels are higher than the modelled results by approximately 3 to 4µg/m^3. The $PM_{2.5}$ monitor is located in the Village of Wollar and will be influenced by non-modelled local $PM_{2.5}$ sources such as combustion engines, transport movements and various human activities. As noted in **Section 4.4** the $PM_{2.5}$ levels across the region are also likely to have been influenced by bushfires or regional dust events which contribute to the measured levels and have not been accounted for in the modelling predictions.

The modelling does not account for excess dust from the human activities in the village, or bushfires and dust storms. The difference between the measured and modelled results is consistent with the difference in $PM_{2.5}$ levels measured in small populated areas and those outside of the populated areas and near mines in the Hunter Valley.

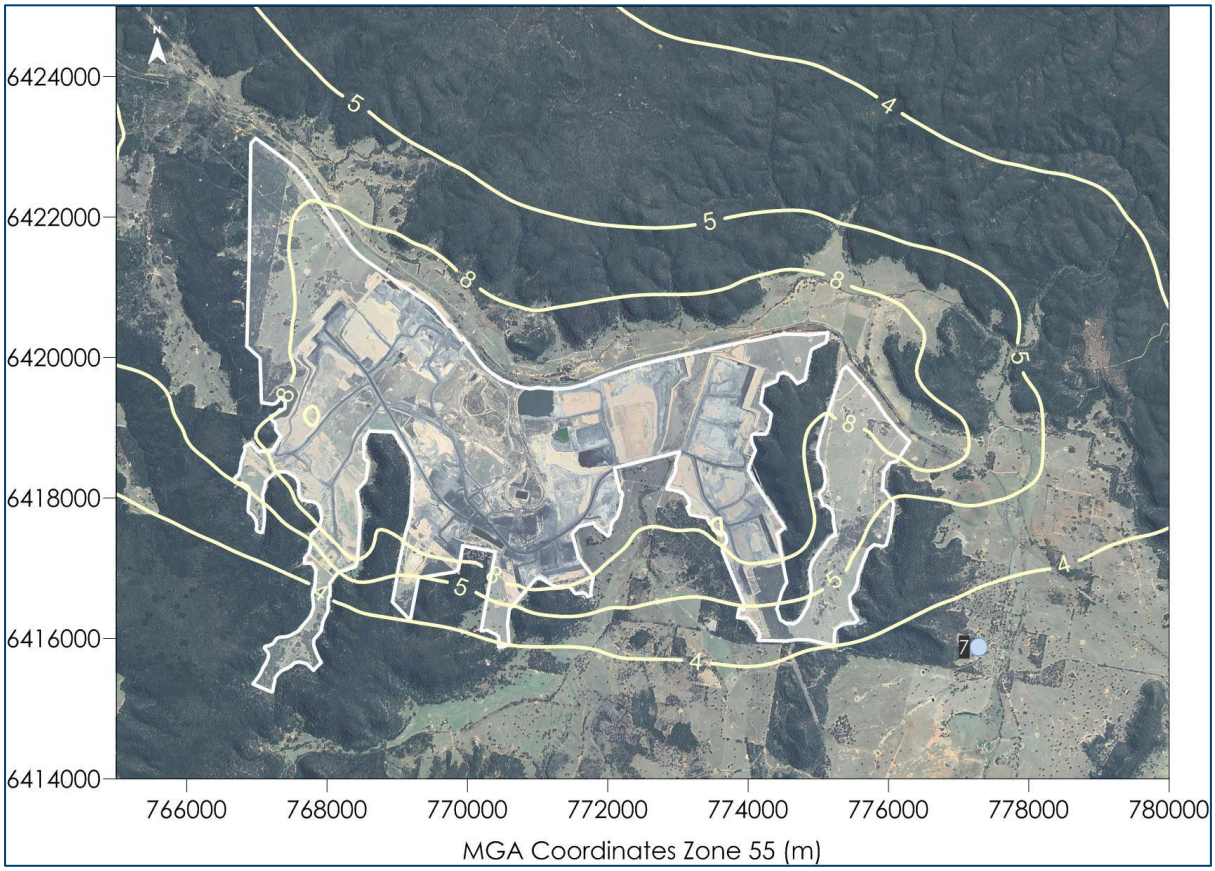

Figure 6-3: Annual average $PM_{2.5}$ monitoring data for 2018 superimposed over the predicted $PM_{2.5}$ annual average modelling contour (Year 2018 WCM plus other mines and background)

6.4 Annual average TSP

Figure 6-4 presents an overlay of the measured 2018 annual average TSP data over the dispersion modelling predictions.

WCM monitoring network includes only one TSP monitor for the comparison and shows that the measured level is in close agreement with the modelled result.

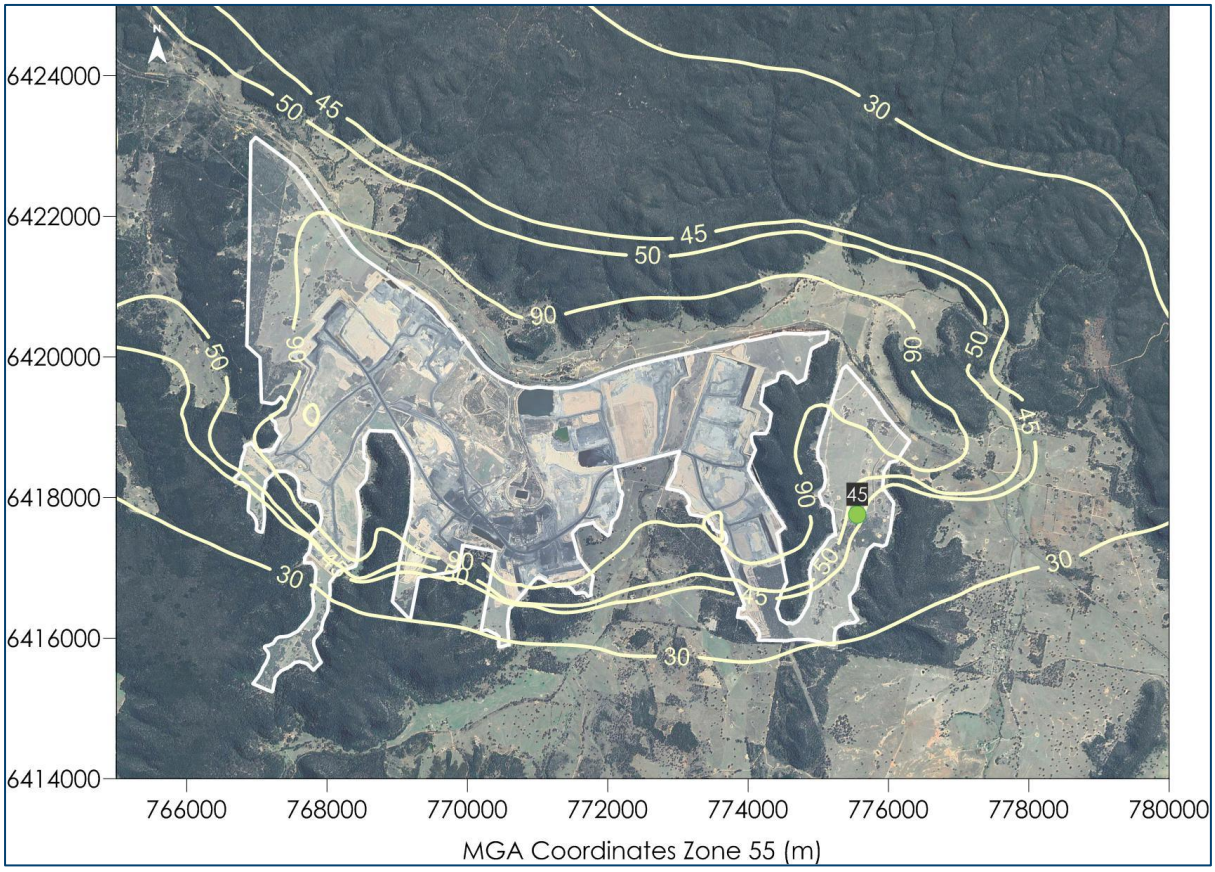

Figure 6-4: Annual average TSP monitoring data for 2018 superimposed over the predicted TSP annual average modelling contour (Year 2018 WCM plus other mines and background)

6.5 Annual average deposited dust

Figure 6-5 presents an overlay of the measured 2018 annual average deposited dust levels over the dispersion modelling contours for Year 2018.

The measured levels are generally in agreement with the model predictions for most of the deposited dust gauges. We note that deposited dust gauge readings can be significantly influenced by very local sources and this cannot be reasonably factored in any modelling.

Levels near Pit 8 are overestimated by the modelling as there was no actual activity in Pit 8) and levels in the central southern parts are underestimated as there was actual activity in these areas that is not in the model. Levels that were half the criteria value, but higher than the predicted levels were recorded at the Village Wollar, as would be expected due to the additional influence of human activities.

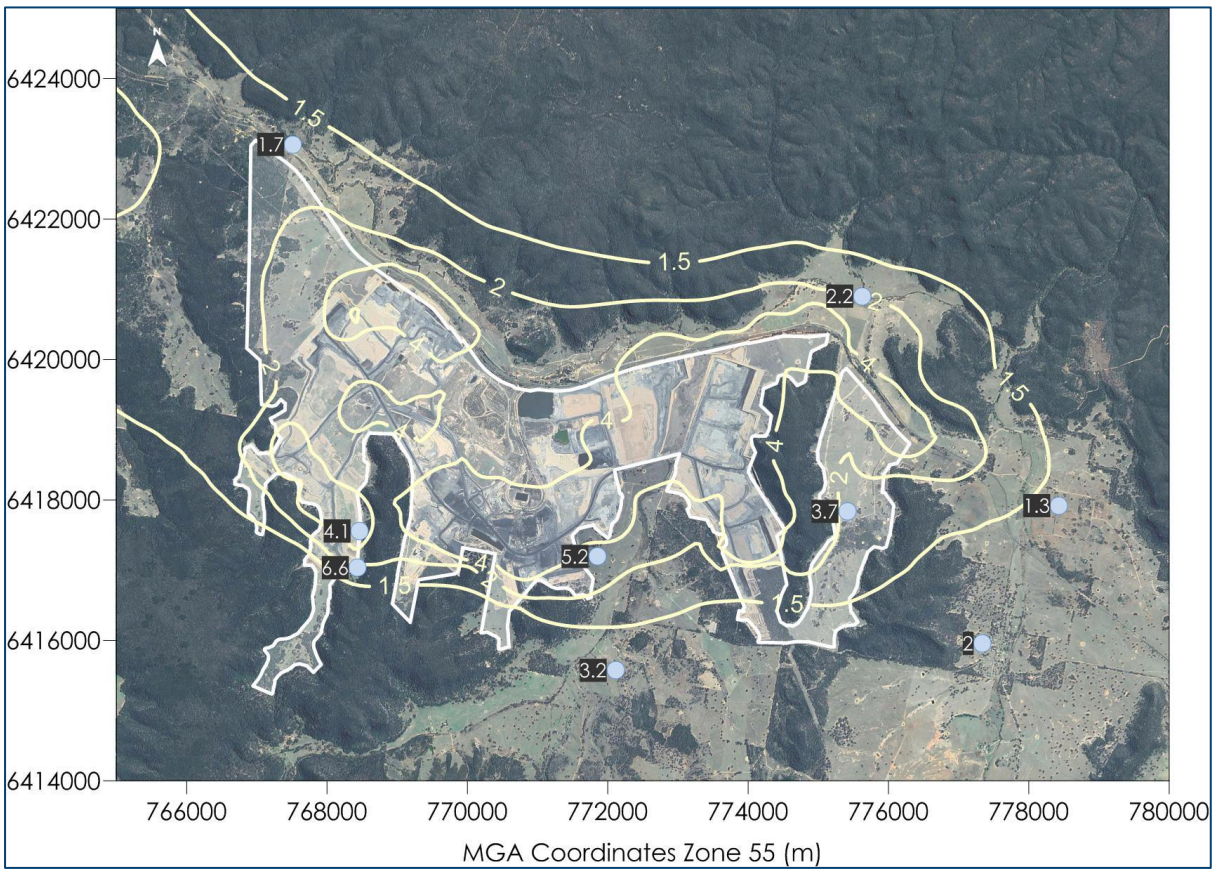

Figure 6-5: Annual average deposited dust monitoring data for 2018 superimposed over the predicted deposited dust annual average modelling contour (Year 2018 WCM plus other mines and background)

7 SUMMARY AND CONCLUSIONS

This report has analysed the monitoring data recorded at the WCM for the 2018 calendar period and provides a comparison between the measured dust levels with the modelled predictions for the Year 2018 per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

Expected discrepancies arise due to the modelling results including activity in pits where no mining actually occurred (and vice-versa), but also because 2018 was a relatively dry, hot, drought year with multiple bushfires, regional dust events and dust storms that cannot be reasonably considered by modelling conducted years beforehand.

Overall however, the analysis shows there was generally good agreement between the modelling predictions and the measured results.

8 REFERENCES

NSW EPA (2017)

"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales", NSW Environment Protection Authority, January 2017.

Todoroski Air Sciences (2015)

"Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project", prepared for Wilpinjong Coal Pty Ltd by Todoroski Air Sciences, November 2015.