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/m²/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/m²/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/m²/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/m²/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/m²/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/m²/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/m²/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/m²/month)	3.2	2		1.7	3.7	2.2	5.2	4.1	6.6	1.3
2019 Annual Average Total Insoluble Matter (g/m²/month)	5.3	2.7		2.3	4.6	3.1	5.9	3.3	5.5	1.6
2020 Annual Average Total Insoluble Matter (g/m²/month)	1.7	1.9		2.9	-	2.3	4.1	2.6	3.8	1.7
2021 Annual Average Total Insoluble Matter (g/m²/month)	2.9	1.7		1.1	-	1.7	3.0	1.4	1.5	1.0

Notes: Grey shaded cells indicated compliance dust depositional monitoring sites. 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. DG10 was decommissioned in 2020.

Summary of TSP and PM_{10} Results

Monitoring Locations#							
EPL 12425 ID No.	**13**	**-**	**20**	**27**	**-**	**25**	**28**
Monitoring ID No.	**HV1**	**HV3^**	**HV4**	**HV5**	**TEOM1^**	**TEOM3**	**TEOM4**
2012 Results							
PM_{10} (µg/m³) recorded range*	2.8 – 21.7	-	12.0 – 21.8	**	3.4 - 60.3	**	**
PM_{10} (µg/m³) annual average	9.1	-	9.7	**	9.7	**	**
TSP (µg/m³) recorded range*	-	1.9 – 47.0	-	-	-	-	-
TSP (µg/m³) annual average	-	18.8	-	-	-	-	-
2013 Results							
PM10 (µg/m³) 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/m³) annual average	10.84	-	12.4	15.71	18.5	13.1	16.8
TSP (µg/m³) recorded range*	-	3.1 – 77.6	-	-	-	-	-
TSP (µg/m³) annual average	-	27.45	-	-	-	-	-
2014 Results							
PM10 (µg/m³) 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/m³) annual average	11.15	-	11.95	14.58	17.3	13.2	13.5
TSP (µg/m³) recorded range*	-	7.20 – 59.0	-	-	-	-	-
TSP (µg/m³) annual average	-	23.09	-	-	-	-	-

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

Monitoring Locations#							
EPL 12425 ID No.	**13**	**-**	**20**	**27**	**-**	**25**	**28**
Monitoring ID No.	**HV1**	**HV3^**	**HV4**	**HV5**	**TEOM1^**	**TEOM3**	**TEOM4**
2015 Results							
PM10 (µg/m³) 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/m³) annual average	9.99	-	11.52	11.68	14.1	11.26	14.16
TSP (µg/m³) recorded range*	-	3.7 – 68.7	-	-	-	-	-
TSP (µg/m³) annual average	-	22.74	-		-	-	-
2016 Results							
PM10 (µg/m³) 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/m³) annual average	9.78	-	11.69	13.95	15.0	10.2	11.3
TSP (µg/m³) recorded range*	-	3.9 – 82.0	-	-	-	-	-
TSP (µg/m³) annual average	-	27.59	-	-	-	-	-
2017 Results							
PM10 (µg/m³) 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/m³) annual average	12.2	-	16.7	16.6	18.4	9.5	12.8
TSP (µg/m³) recorded range*	-	10.1 - 142.0	-	-	-	-	-
TSP (µg/m³) annual average	-	38.1	-	-	-	-	-
2018 Results							
PM10 (µg/m³) recorded range*	2.1 – 168	-	2.6 – 208	2.1 – 167	2.5 – 206.6	0.1 – 143.3	0.1 – 156.8
PM10 (µg/m³) annual average	23.3	-	24.76	16.9	22.1	14.4	18.0
TSP (µg/m³) recorded range*	-	5.6 – 237	-	-	-	-	-
TSP (µg/m³) annual average	-	45.7	-	-	-	-	-
2019 Results							
PM10 (µg/m³) recorded range*	2.8 - 196	-	3.6 - 207	3.0 - 195	0.6 – 107.8	3.0 – 242.8	3.8 – 273.1
PM10 (µg/m³) annual average**	16.1	-	17.8	23.8	^^	14.6	22.9
TSP (µg/m³) recorded range*	-	11.7 - 309	-	-	-	-	-
TSP (µg/m³) annual average	-	^^	-	-	-	-	-
2020 Results							
PM10 (µg/m³) recorded range*	2.2 – 59.1	-	1.9 - 106	3.4 – 66.2	-	0 – 331.0	2.38 – 416.15
PM10 (µg/m³) annual average**	13.52	-	18.71	17.37	-	26.5	19.58
TSP (µg/m³) recorded range*	-	8.1 - 143	-	-	-	-	-
TSP (µg/m³) annual average	-	46.41	-	-	-	-	-

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

2021 Results							
PM10 (µg/m³) recorded range*	2.8 – 30.3	-	3.0 – 38.6	3.0 – 38.6	-	1.0 – 86.6	1.8 – 139.5
PM10 (µg/m³) annual average**	9.50	-	14.77	8.6	-	8.6	11.91
TSP (µg/m³) recorded range*	-	-	-	-	-	-	-
TSP (µg/m³) annual average	-	-	-	-	-	-	-

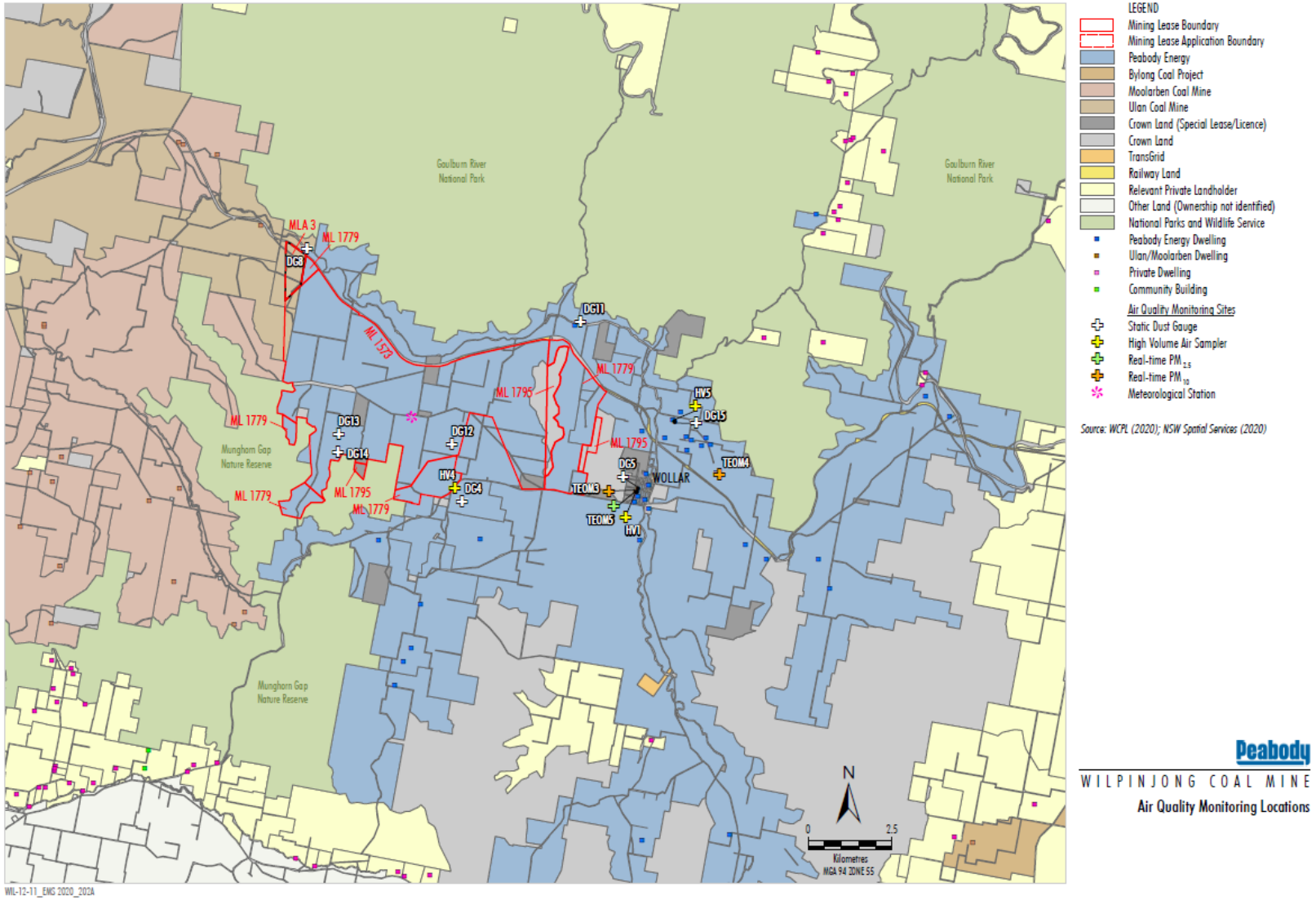
Notes: * Data presented is the range of minimum and maximum 24-hour averages and includes all extraordinary events in 2019 and 2020. ^ Data recorded at these sites is not for compliance, but for management purposes only (in August 2020 both HV3 and TEOM 1 were decommissioned due to mining operations commencing in Pit 8). ^^Insufficient data for annual average calculation, data unavailable after 22 August 2019. # Refer to **Figure below.** **Annual averages exclude extraordinary events in 2019 & 2020.

Summary $PM_{2.5}$ Results

Monitoring Locations#	
EPL 12425 ID No.	**29**
Monitoring ID No.	**TEOM 5**
2019 Results	
PM2.5 (µg/m³) recorded range*	1.1 – 196.5
PM2.5 (µg/m³) annual average **	6.8
2020 Results	
PM2.5 (µg/m³) recorded range*	9.15 – 196.45
PM2.5 (µg/m³) annual average **	5.8
2021 Results	
PM2.5 (µg/m³) recorded range*	0.2 – 82.4
PM2.5 (µg/m³) annual average **	4.44

Notes: * Data presented is the range of minimum and maximum 24-hour averages and includes all extraordinary events from 2019 - 2021. ** Annual averages exclude extraordinary events from 2019 - 2021.

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
- Static Dust Gauge
- High Volume Air Sampler
- Real-time $PM_{2.5}$
- Real-time PM_{10}

Source: WCPL (2020); NSW Spatial Services (2020)

Peabody
WILPINJONG COAL MINE
Wollar Environmental Monitoring Sites

Air Quality Monitoring Data Review
Wilpinjong 2021

AIR QUALITY MONITORING DATA REVIEW WILPINJONG 2021

Wilpinjong Coal Pty Ltd

8 March 2022

Job Number 18120907C

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Air Quality Monitoring Data Review
Wilpinjong 2021

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1 INTRODUCTION

Todoroski Air Sciences has 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 2021 calendar period and includes a comparison between the measured dust levels and the modelled predictions for the Year 2020 per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

The modelled "Year 2020" is considered representative of mining activity occurring during the 2021 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) and deposited dust gauges. The location of the air quality monitors relative to WCM is presented in **Figure 2-1**. While the Wollar Village $PM_{2.5}$ monitor is listed as a compliance monitor in the AQMP, it is noted that the consent conditions do not include criteria for $PM_{2.5}$. It is also noted that although the DG4 is listed as a compliance monitor, there are no longer private residences in the vicinity of this monitors (refer to the property ownerships maps provided in **Appendix A**) and thus it may be more appropriate to use this monitor for management purposes.

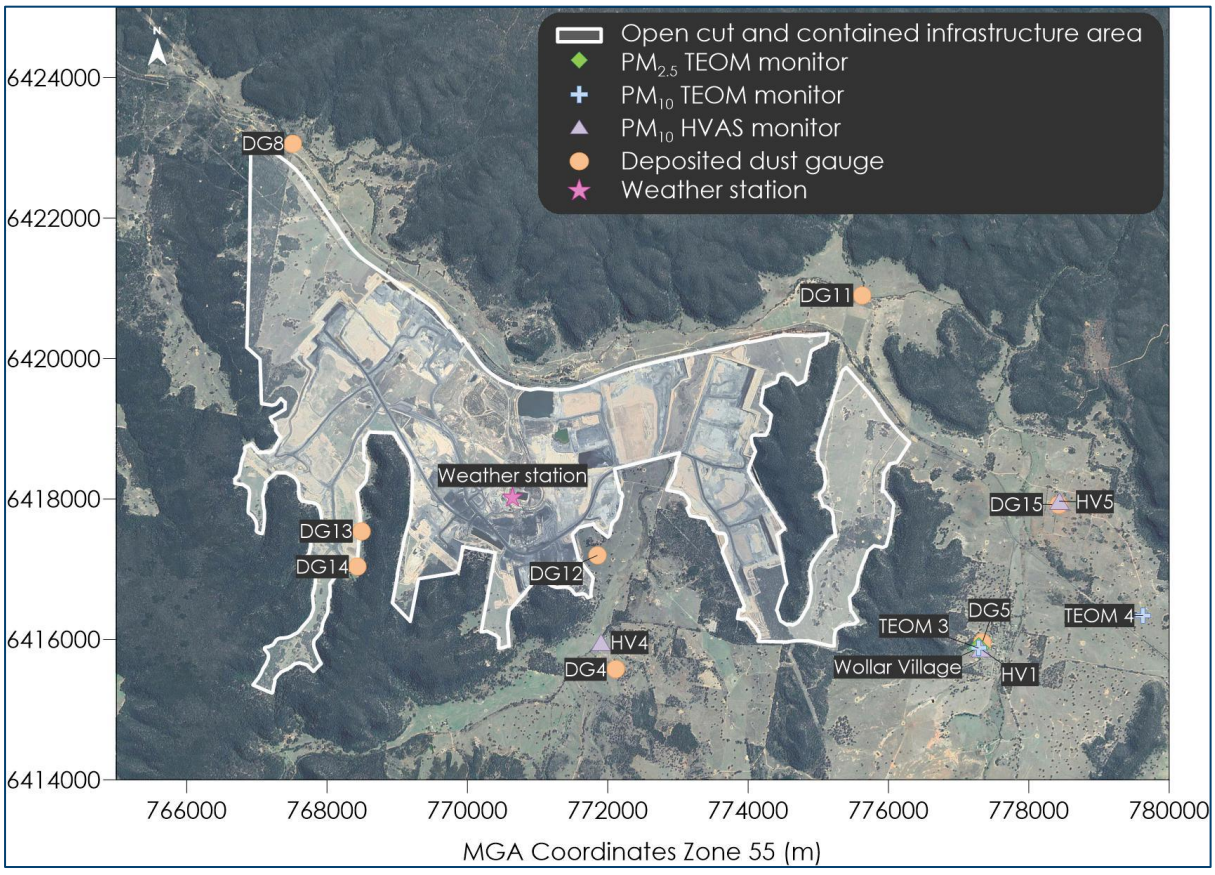

Figure 2-1: WCM setting and air quality monitoring network

Notes:

- Data from DG4, DG5, DG8, DG11, DG15, HV1, HV5, TEOM3, TEOM4 and Wollar Village (TEOM5 $PM_{2.5}$) are used for ***compliance monitoring*** against the Air Quality Assessment Criteria in accordance with Condition 17, Schedule 3 of SSD-6764;
- Data from HV4, DG12, DG13 and DG14 are used for management monitoring purposes.

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 Development Consent

Table 3-1 summarises 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 NEMP air quality standards

Table 3-2 summarises the air quality standards per the National Environment Protection (Ambient Air) Measure (NEPM) (**NEPC, 2021**). The NEPM standards were adopted by WCM for the assessment of $PM_{2.5}$.

Table 3-2: NEPM air quality standards

Pollutant	Averaging Period	Maximum concentration standard
Particles as PM_{10}	Annual	25 µg/m³
	24-hour	50 µg/m³
Particles as $PM_{2.5}$	Annual	8 µg/m³
	24-hour	25 µg/m³

3.1.3 NSW EPA impact assessment criteria

Table 3-3 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 adopting the NEPM standards for $PM_{2.5}$ and reducing the annual average PM_{10} criteria from a level of 30µg/m³ to 25µg/m³.

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

Pollutant	Averaging Period	Impact [1]	Criterion
Total suspended particulates (TSP)	Annual	Total	90 µg/m³
Particulate Matter < 10µm (PM_{10})	Annual	Total	25 µg/m³
	24-hour	Total	50 µg/m³
Particulate Matter < 2.5µm ($PM_{2.5}$)	Annual	Total	8 µg/m³
	24-hour	Total	25 µg/m³
Deposited Dust [2]	Annual	Incremental	2 g/m²/month
		Total	4 g/m²/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**

3.1.4 Summary of applicable criteria for this assessment

Table 3-4 summarises the applicable air quality criteria for this assessment.

Table 3-4: Air quality impact assessment criteria used in this assessment

Pollutant	Averaging Period	Source	Concentration
Particulate Matter < 2.5µm ($PM_{2.5}$)	24-hour	EPA/NEPM	25µg/m³
	Annual Average	EPA/NEPM	8µg/m³
Particulate Matter < 10µm (PM_{10})	24-hour	Development consent	50µg/m³
	Annual Average	Development consent	30µg/m³
Total Suspended Particulates (TSP)	Annual Average	Development consent	90µg/m³
Deposited Dust	Annual Average	Development consent	4g/m²/month

4 METEOROLOGICAL DATA

Table 4-1 presents the total cumulative annual rainfall recorded by WCM from 2015 to 2021. The 942.4 millimetres (mm) of rainfall recorded in 2021 was similar to the level recorded in 2020. Lower rainfall in previous years (2017 to 2019) was attributed to drought conditions.

Table 4-1: Total annual rainfall (mm)

Year	Total rainfall (mm)
2015	772.2
2016	817.0
2017	531.4
2018	487.8
2019	265.6
2020	915.8
2021	942.4

Annual and seasonal windroses have been prepared from the available data collected at the WCM weather station for the 2021 period and are presented in **Figure 4-1**.

Analysis of the windroses shows 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 autumn and spring wind distributions are similar to the annual distribution. In summer, winds are predominantly from the east and east-northeast. During winter, winds are primarily from the west, west-northwest and west-southwest.

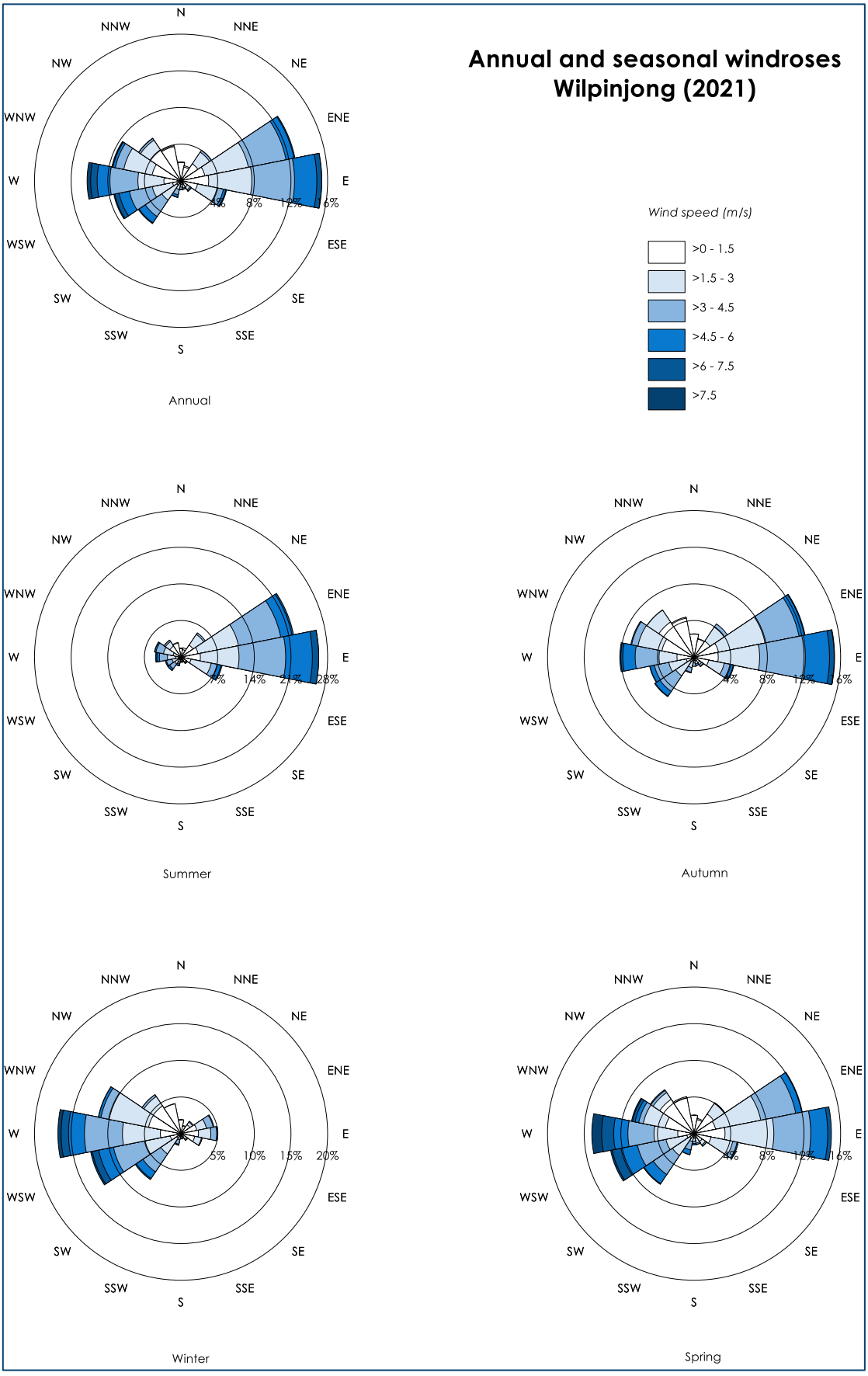

Figure 4-1: Annual and seasonal windroses for Wilpinjong (2021)

5 AIR QUALITY MONITORING DATA

This section reviews the available ambient monitoring data collected from the WCM ambient air quality monitoring network for the 2021 calendar period and compares it with the long-term data.

The main sources of particulate matter in the wider area of the WCM include active mining from 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.

It is noted that in 2021 there were two days considered to be "extraordinary events" for WCM, 28/04/2021 and 29/04/2021. These days were considered extraordinary events due to smoke associated with nearby hazard reduction burns.

As per Development Consent SSD-6764, the air quality criteria exclude extraordinary events. This assessment presents both the annual averages calculated for all days and excluding these extraordinary event days.

5.1 $PM_{2.5}$ 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 (previously known as TEOM 5) was established to determine if there is any correlation between the measured levels and WCM activities under applicable prevailing meteorological conditions.

A summary of the available $PM_{2.5}$ monitoring data is presented in **Table 5-1**. Recorded 24-hour average $PM_{2.5}$ concentrations are presented graphically in **Figure 5-1**.

The 2021 annual average $PM_{2.5}$ concentrations for "all days" and excluding extraordinary events were below the relevant criterion of 8µg/m³. The annual average $PM_{2.5}$ levels in 2021 are lower than the levels in previous years. This decrease is likely due to the ending of drought conditions and a significant reduction in the frequency of extraordinary events.

The 24-hour average $PM_{2.5}$ concentrations were above the relevant criterion of 25µg/m³ for two days in 2021. These two days were considered to be extraordinary events, which are excluded from the air quality criteria in **Table 3-1**, due to smoke from hazard reduction burns.

It can be seen in **Figure 5-1** that the $PM_{2.5}$ levels during the 2019/2020 bushfire season are significantly elevated compared with the rest of the data.

Table 5-1: Summary of ambient $PM_{2.5}$ levels - Wollar Village

Year	Annual average (µg/m³)		Maximum 24-hour average (µg/m³)		No. days > NEPM standard (25µg/m³)	
2018	6.6		**35.6**		5	
2019	**15.2**	*6.8	**196.5**	*23.0	32	*0
2020	6.5	*4.9	**81.0**	*23.7	11	*0
2021	4.4	*4.1	**82.4**	*20.4	2	*0

* Excluding extraordinary events

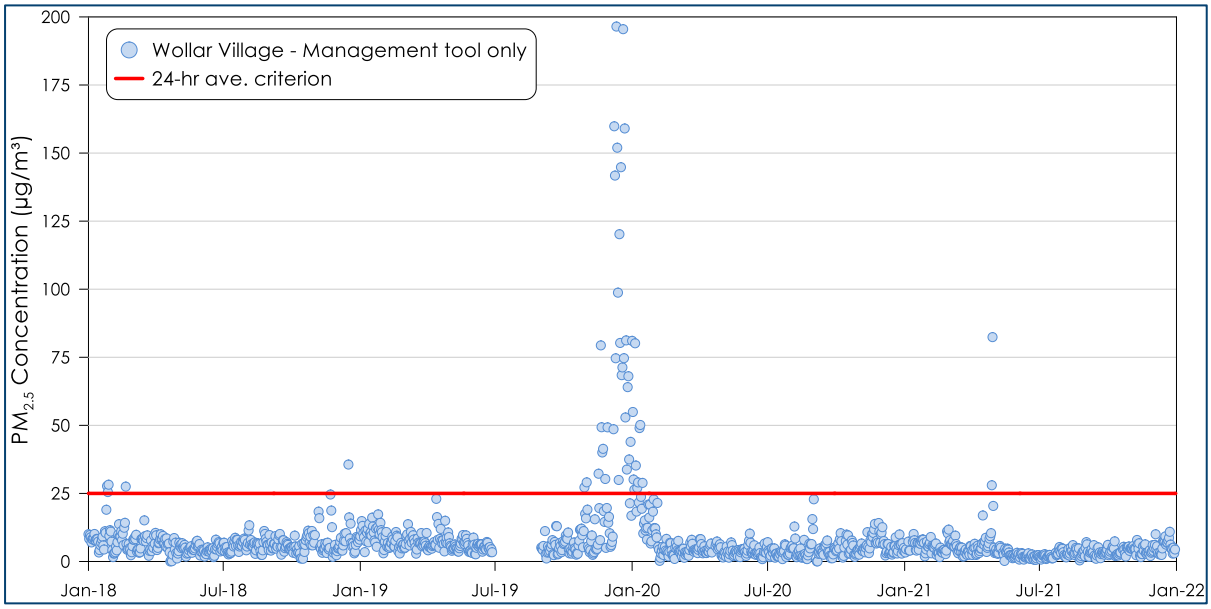

Figure 5-1: 24-hour average $PM_{2.5}$ concentrations at TEOM monitors

5.2 PM_{10} monitoring

A summary of the available PM_{10} monitoring data for the TEOMs and HVAS monitors is presented in **Table 5-2**. It is noted that HVAS monitors are run for a 24-hour period once every six days and thus the annual average levels are calculated from the HVAS run days (every sixth day) whereas the annual average levels for TEOM monitors are calculated over every day of the year.

Annual averages for the TEOM monitors have been calculated for all days and excluding extraordinary event days. No extraordinary events were identified on HVAS run days and thus only one average is presented.

The 2021 annual average PM_{10} concentrations were below the relevant Consent criterion of 30µg/m³. The annual average PM_{10} levels in 2021 are lower than the levels in previous years. This decrease is likely due to the ending of drought conditions and a significant reduction in the frequency of extraordinary events.

The 24-hour average PM_{10} concentrations were above the relevant criterion of 50µg/m^3 for one day in 2021 at TEOM3 and TEOM4. This day was considered to be an extraordinary event due to smoke from hazard reduction burns, and is excluded from the air quality criteria in **Table 3-1**.

Table 5-2: Summary of ambient PM_{10} levels

Year	Annual average PM_{10} (µg/m³)										
	TEOM 3		TEOM 4		HV1		HV4		HV5		Criterion
2015	11.7		9.4		9.8		11.5		11.8		25 / 30
2016	10.2		11.3		9.8		11.7		13.9		25 / 30
2017	9.5		12.8		12.3		16.7		16.7		25 / 30
2018	14.4		18.0		19.7		24.1		25.0		25 / 30
2019	27.9	*14.6	**32.9**	*22.9	29.8	*16.1	**33.4**	*17.8	**37.1**	*23.8	25 / 30
2020	12.6	*9.2	19.6	*15.4	13.5	*11.6	18.7	*15.8	17.4	*15.9	25 / 30
2021	8.6	*8.3	11.9	*11.5	9.6		11.5		14.3		25 / 30
Year	**Maximum 24-hour average PM_{10} (µg/m³) (No. of days > criterion)**										
	TEOM 3		**TEOM 4**		**HV1**		**HV4**		**HV5**		**Criterion**
2015	**78.5 (1)**		**77.3 (1)**		29.3		40		35.3		50
2016	34.4		**51.1 (1)**		23		25.2		34.2		50
2017	**52.2**		**50.9 (1)**		28.2		**69.1 (1)**		**55.4 (1)**		50
2018	**143.3 (5)**		**156.8 (11)**		**168 (3)**		**208 (2)**		**167 (5)**		50
2019	**242.8 (38)**	*40.1 (0)	**273.1 (64)**	***101.7 (12)**	**196.0 (8)**	*40.3 (0)	**207.0 (8)**	*38.0 (0)	**195.0 (12)**	***61.0 (4)**	50
2020	**331.0 (9)**	*33.5 (0)	**416.2 (16)**	***52.1 (1)**	**59.1 (1)**	28.6 (0)	**106.0 (3)**	**64.0 (1)**	**66.2 (1)**	38.7 (0)	50
2021	**86.6 (1)**	*25.1 (0)	**139.5 (1)**	*35.0 (0)	30.3		34.5		38.6		50

* Excluding extraordinary events

Long-term 24-hour average PM_{10} records for the TEOM and HVAS monitors are presented in **Figure 5-2** and **Figure 5-3** respectively.

Figure 5-2 and **Figure 5-3** follow similar trends and show that the PM_{10} levels during the 2019/2020 bushfire season are significantly elevated compared with the rest of the data.

The rolling annual average PM_{10} concentrations for the TEOM and HVAS monitors from 2016 to 2021 are presented in **Figure 5-4**.

The rolling annual average levels in **Figure 5-4** generally show a trend of increasing levels, with the monitors all showing a sudden increase in levels at the end of 2019 associated with the 2019/2020 NSW bushfires and a sharp drop towards the end of 2020 as the majority of the bushfire affected days are no longer included in the rolling annual average. The annual average PM_{10} levels in 2021 are lower than the levels in 2017 to 2020. This decrease is likely due to the ending of drought conditions and a significant reduction in the frequency of extraordinary events.

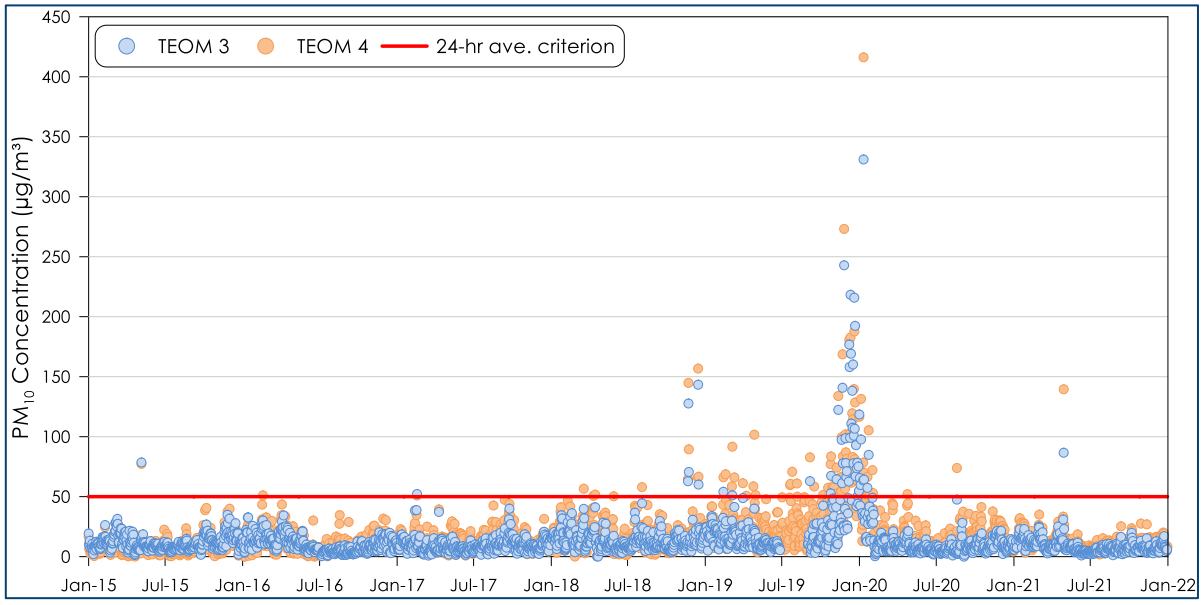

Figure 5-2: 24-hour average PM_{10} concentrations at TEOM monitors 2015 to 2021

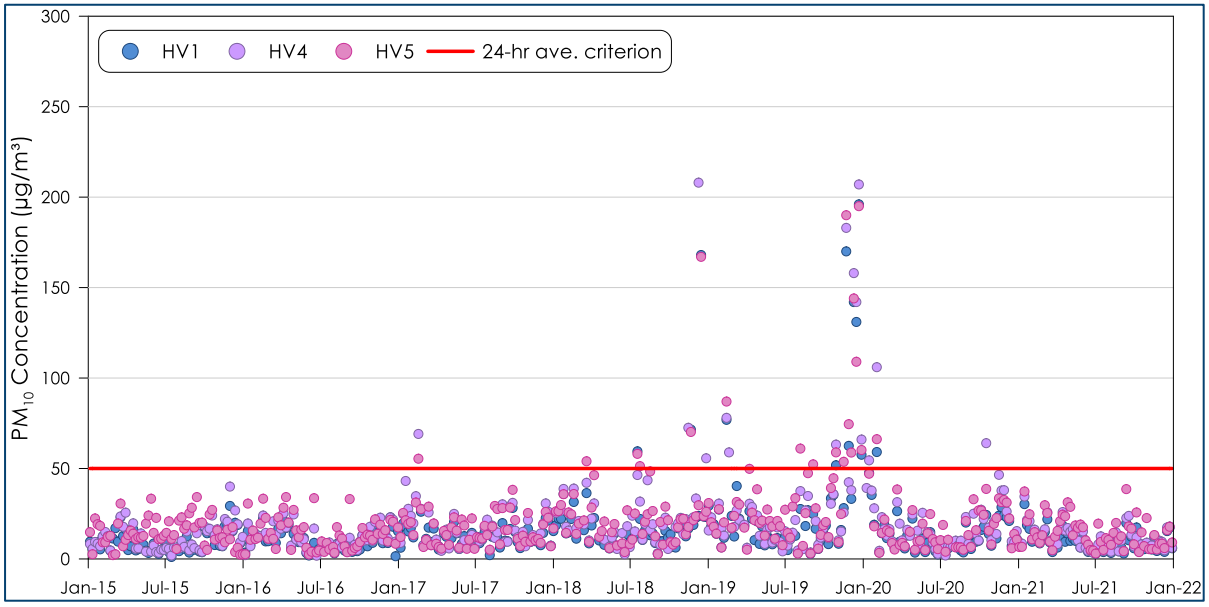

Figure 5-3: 24-hour average PM_{10} concentrations at HVAS monitors 2015 to 2021

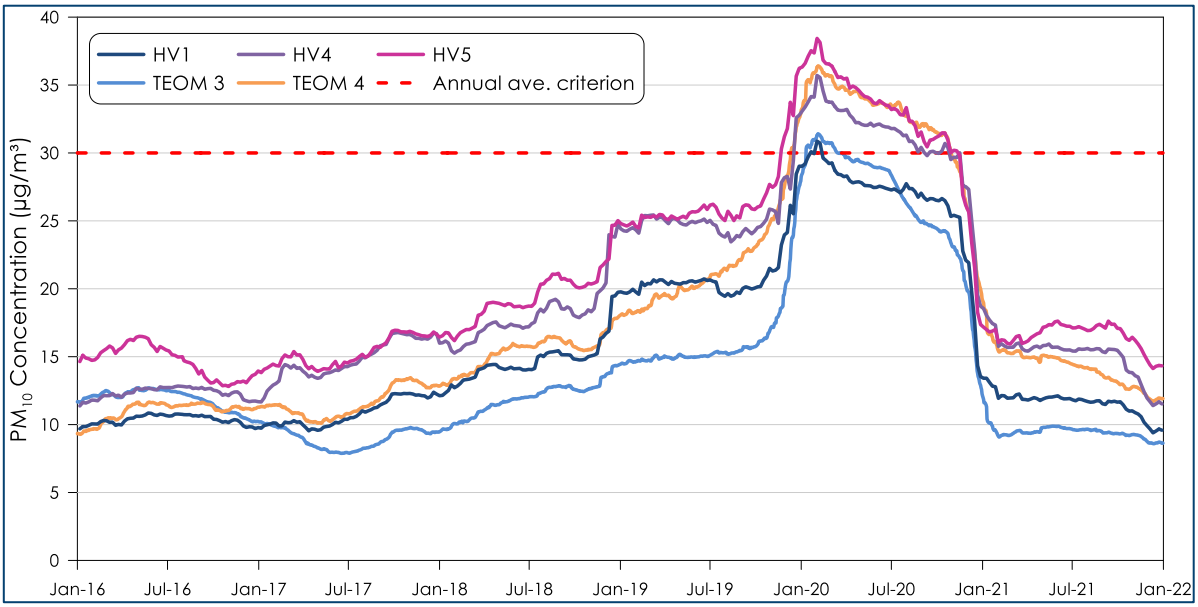

Figure 5-4: Rolling annual average PM_{10} concentrations at TEOM and HVAS monitors

5.3 Deposited dust

Table 5-3 presents the annual average deposited dust levels for all WCM deposited dust gauges during 2021. Monitors DG4, DG5, DG8, DG11 and DG15 are compliance monitors for assessment against the Air Quality Assessment Criteria in accordance with Condition 17, Schedule 3 of SSD-6764.

When the measured cumulative annual average deposited dust level at a compliance monitors is below the criterion of 4g/m^2/month it is generally inferred that compliance with Condition 17, Schedule 3 of SSD-6764 is achieved. If the cumulative criterion is exceeded, the applicant would need to show compliance with the maximum (incremental) increase in the deposited dust level of 2g/m^2/month due to the project alone activities.

Currently, the nearest privately owned residence to the DG4 monitor is located over 5km away in the Wollar Village (refer to the property ownerships maps provided in **Appendix A**) and thus the DG4 monitor is no longer considered to be representative of dust levels at privately owned residences. As such, it may be more appropriate to use DG4 as a management monitor rather than a compliance monitor.

DG12, DG13 and DG14 are used for management purposes to monitor dust levels at heritage sites located near mining activities. Dust monitoring of heritage sites occurs within 1km of mining activities.

The results in **Table 5-3** indicate that deposited dust levels are below the relevant cumulative criterion of 4g/m^2/month at relevant compliance monitors in 2021 and thus it is considered that compliance with Condition 17, Schedule 3 of SSD-6764 is achieved.

Table 5-3: Summary of deposited dust annual average levels (g/m²/month)

Year	DG4	DG5	DG8	DG11	DG12	DG13	DG14	DG15
2015	1.1	0.9	1.2	2.3	3.6	**7.5**	1.4	0.9
2016	0.7	1.3	1.1	**4.6**	2.5	**33.8**	**4.8**	1.6
2017	1.3	1.4	1.9	1.8	3.7	**10.5**	**26.3**	1.2
2018	3.2	2.0	1.7	2.2	**5.2**	**4.1**	**6.6**	1.3
2019	**5.3**	2.7	2.3	3.1	**5.9**	3.3	**5.5**	1.6
2020	1.7	1.9	2.9	2.3	**4.1**	2.6	3.8	1.7
2021	2.9	1.7	1.1	1.7	3.0	1.4	1.5	1.0

The monthly deposited dust levels for the compliance monitors are presented graphically in **Figure 5-5**. An elevated level of 15.2 g/m^2/month was recorded at DG4 in November 2021. The sample analysis indicated that 75% of the deposited dust (total insoluble matter) was 75% organic material and thus it was considered that the elevated level was not due to mining operations.

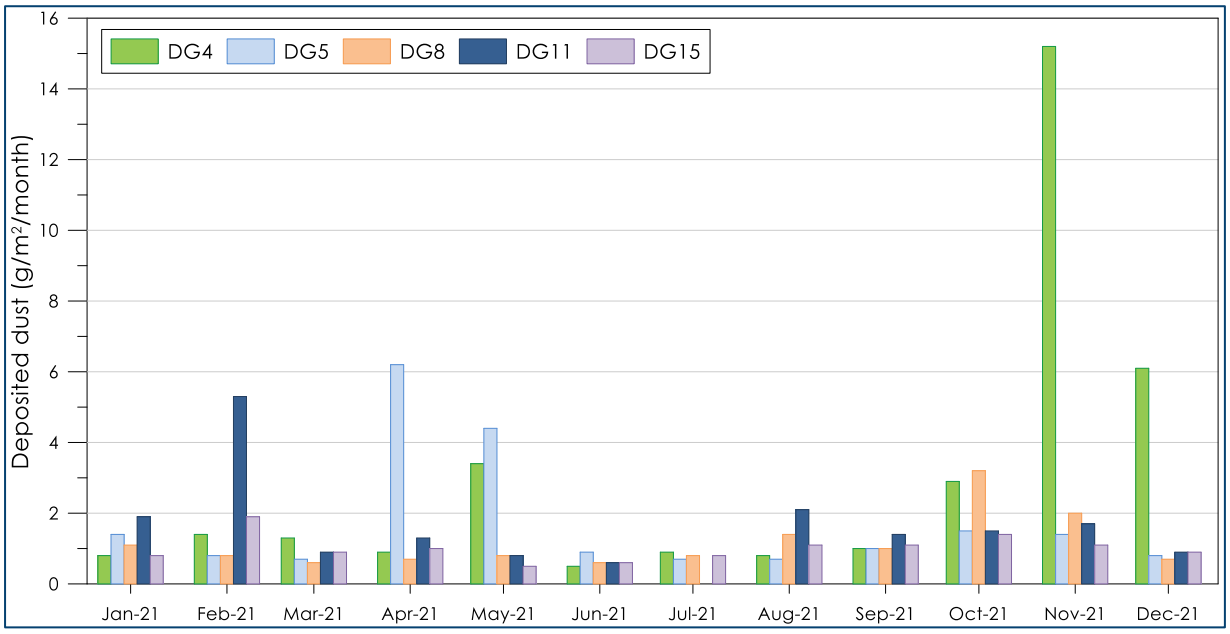

Figure 5-5: Monthly average deposited dust levels

6 COMPARISON BETWEEN MEASURED DATA AND MODELLED RESULTS

Monitoring data collected as part of the WCM ambient air quality monitoring network during 2021 was compared with modelling predictions for the "Year 2020" per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

6.1 Annual average PM_{10}

Figure 6-1 presents the measured 2021 annual average PM_{10} data excluding extraordinary events superimposed over the dispersion modelling contours for the "Year 2020". The measured and predicted data in the figure include dust levels from WCM and other sources.

Figure 6-1 shows that the annual average PM_{10} measured levels in 2021 are generally 4 to 8.5µg/m^3 lower than the model predictions.

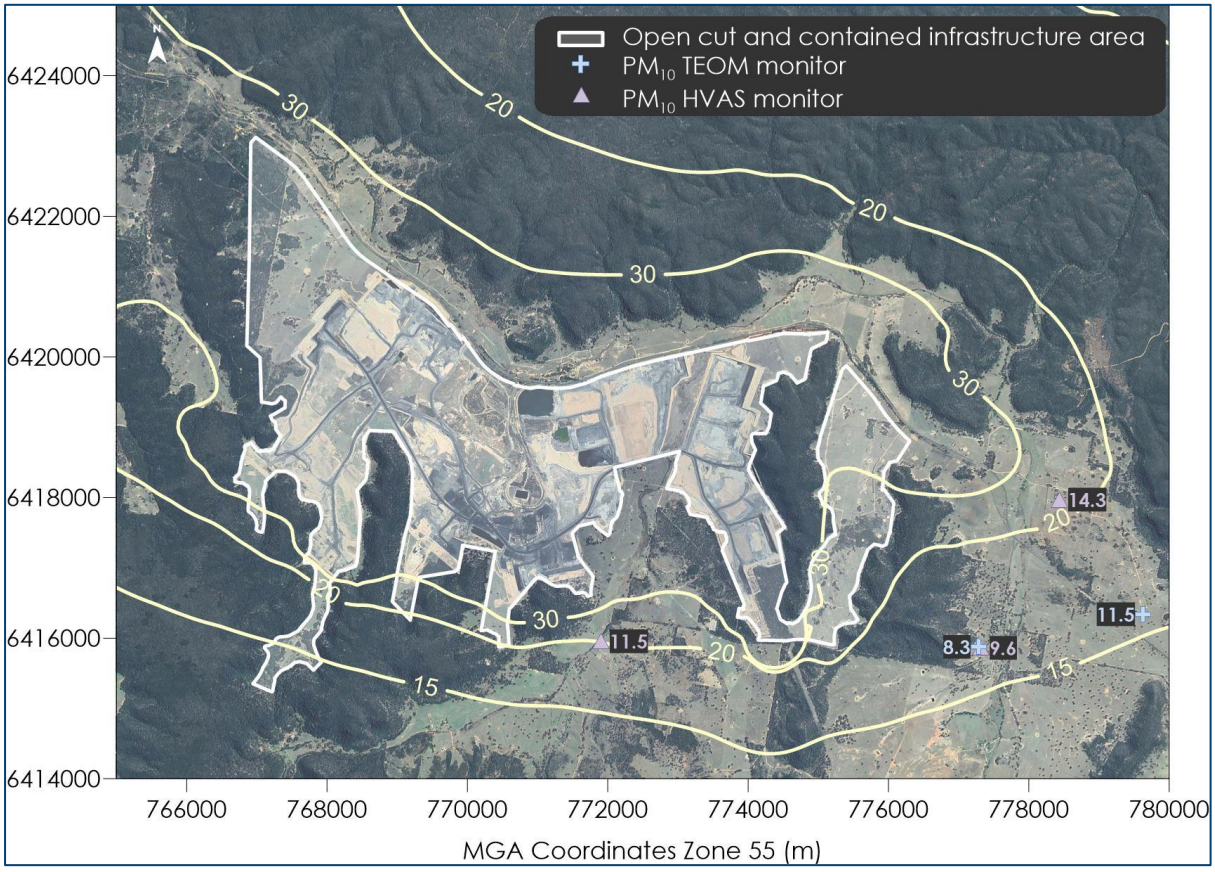

Figure 6-1: Annual average PM_{10} monitoring data for 2021 superimposed over the predicted PM_{10} annual average modelling contour ("Year 2020" WCM plus other mines and background)

6.2 Annual average $PM_{2.5}$

Figure 6-2 presents an overlay of the measured 2021 annual average $PM_{2.5}$ data over the dispersion modelling predictions for "Year 2020". The measured result is well below the annual average criterion of 8µg/m^3 and is typical of a small village in NSW.

The measured level at the Wollar Village is slightly higher than the modelled results by approximately 0.4µg/m^3. The $PM_{2.5}$ monitor would be influenced by non-modelled local $PM_{2.5}$ sources such as combustion engines, transport movements and various human activities.

The modelling does not account for excess dust from the human activities in the village. 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.

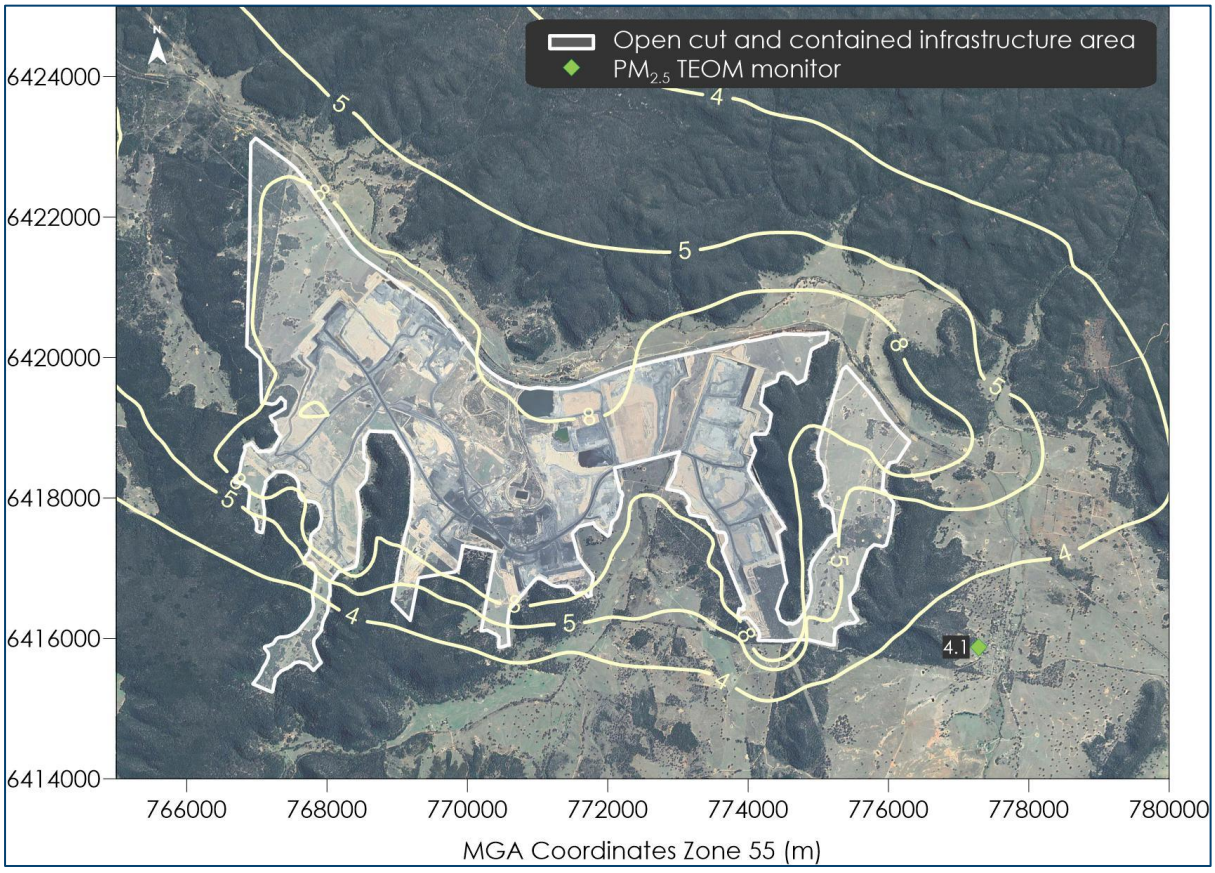

Figure 6-2: Annual average $PM_{2.5}$ monitoring data for 2021 superimposed over the predicted $PM_{2.5}$ annual average modelling contour ("Year 2020" WCM plus other mines and background)

6.3 Annual average deposited dust

Figure 6-3 presents an overlay of the measured 2021 annual average deposited dust levels over the dispersion modelling contours for "Year 2020".

The annual average measured levels in 2021 are generally well aligned with the modelled predictions. It is noted that DG4 recorded a level approximately 1.5g/m^2/month higher than the predicted level while DG13 and DG14 recorded levels approximately 2.5 g/m^2/month and 4 g/m^2/month lower than the model predictions, respectively. We note that deposited dust gauge readings can be significantly influenced by very local sources, and this cannot be reasonably factored into any modelling.

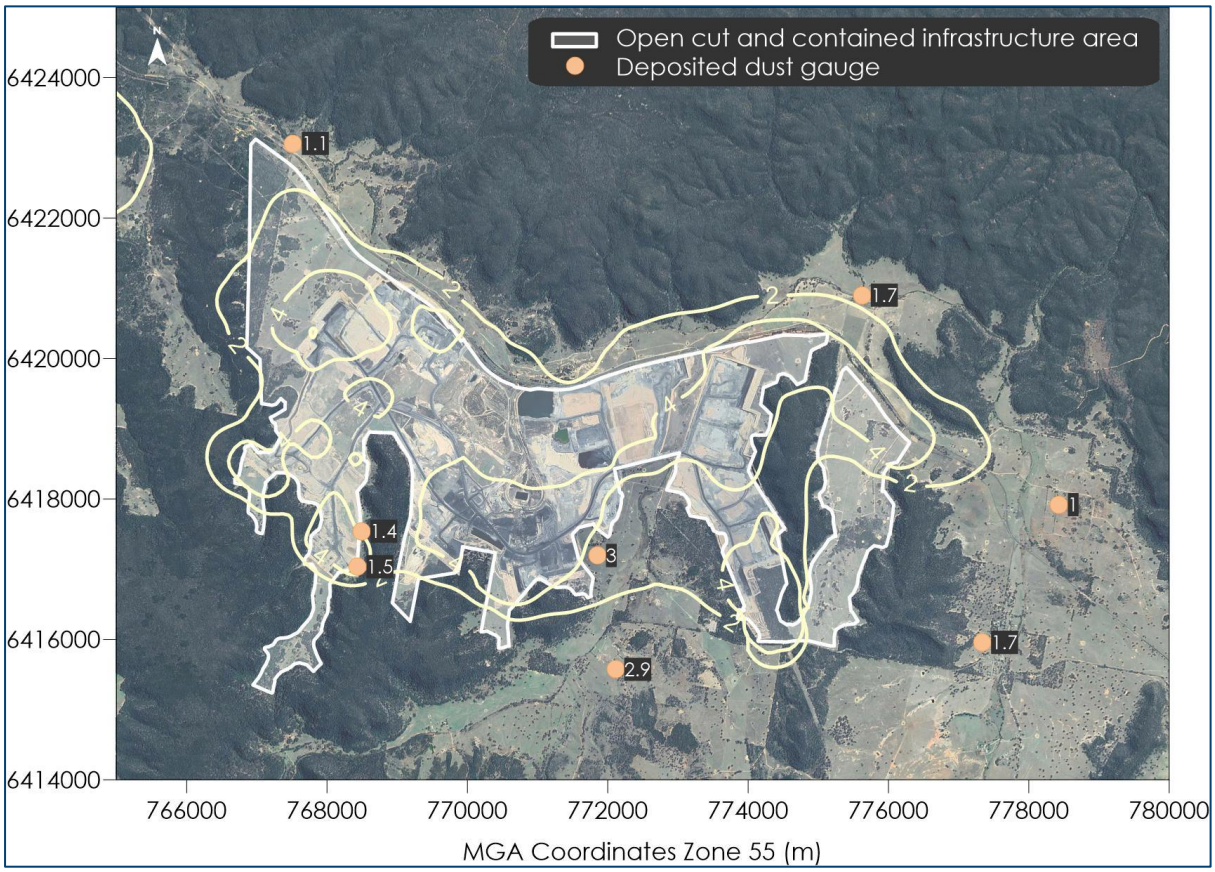

Figure 6-3: Annual average deposited dust monitoring data for 2021 superimposed over the predicted deposited dust annual average modelling contour ("Year 2020" WCM plus other mines and background)

7 SUMMARY AND CONCLUSIONS

This report has analysed the monitoring data recorded at the WCM for the 2021 calendar period and provides a comparison between the measured dust levels with the modelled predictions for the Year 2020 per the *Air Quality and Greenhouse Gas Assessment Wilpinjong Extension Project* (**Todoroski Air Sciences, 2015**).

The analysis shows that there was generally reasonable agreement between the annual average modelling predictions and the measured results in 2021.

This report has also presented a review of the 2021 data against the long-term data. The analysis shows that the annual average levels were below the relevant criteria and generally lower than in previous years.

There were two days with elevated 24-hour average $PM_{2.5}$ levels at the Wollar Village monitor and one day with elevated 24-hour average PM_{10} levels at the TEOM3 and TEOM4 monitors. These days were considered to be extraordinary events due to impacts from smoke associated with hazard reduction burns and thus there were considered to have been no instances of non-compliance with the applicable 24-hour average criteria in 2021.

8 REFERENCES

NEPC (2021)

"National Environment Protection (Ambient Air Quality) Measure", National Environment Protection Council, May 2021.

NSW EPA (2017)

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

Peabody Energy (2021)

"Air Quality Management Plan WI-ENV-MNP-0004", Peabody Energy, June 2021.

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.

Appendix A: Property ownership maps

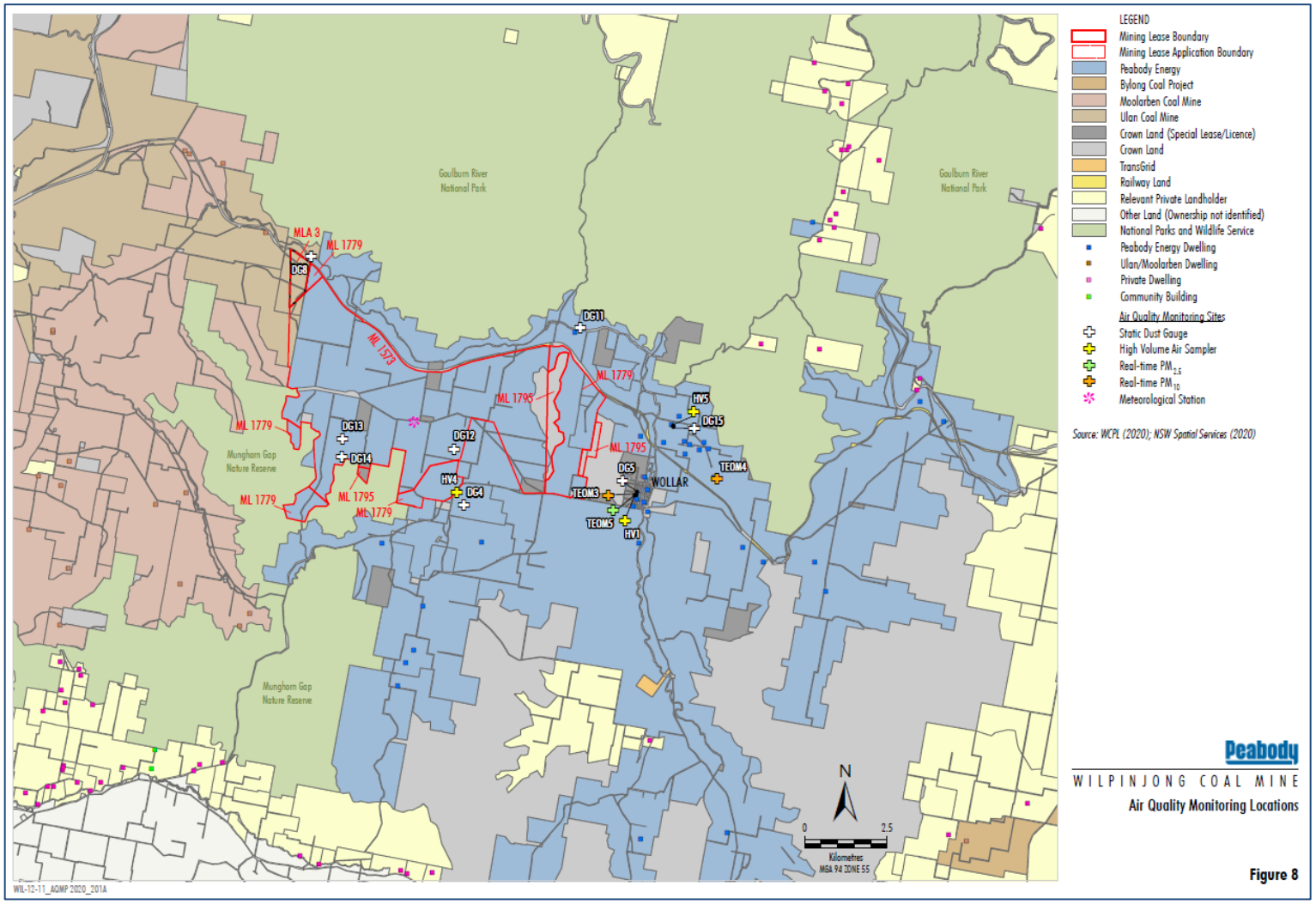

Figure A-1: Property ownership in relation to the air quality monitoring network (Source: Peabody Energy, 2020)

Figure A-2: Property ownership in relation to the air quality monitoring network – Wollar Village (Source: Peabody Energy, 2020)