CADIA VALLEY OPERATIONS
REVIEW OF DEPOSITED DUST
JULY 2019 TO JUNE 2020

Cadia Valley Operations

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1 INTRODUCTION

Todoroski Air Sciences have investigated the deposited dust monitoring data collected during the July 2019 to June 2020 period for the Cadia Valley Operations. Deposited dust levels are recorded at eight locations surrounding the Cadia Valley Operations and three locations surrounding the Dewatering Facility at Blayney.

Figure 1-1 and **Figure 1-2** shows the approximate location of each of the monitoring stations reviewed.

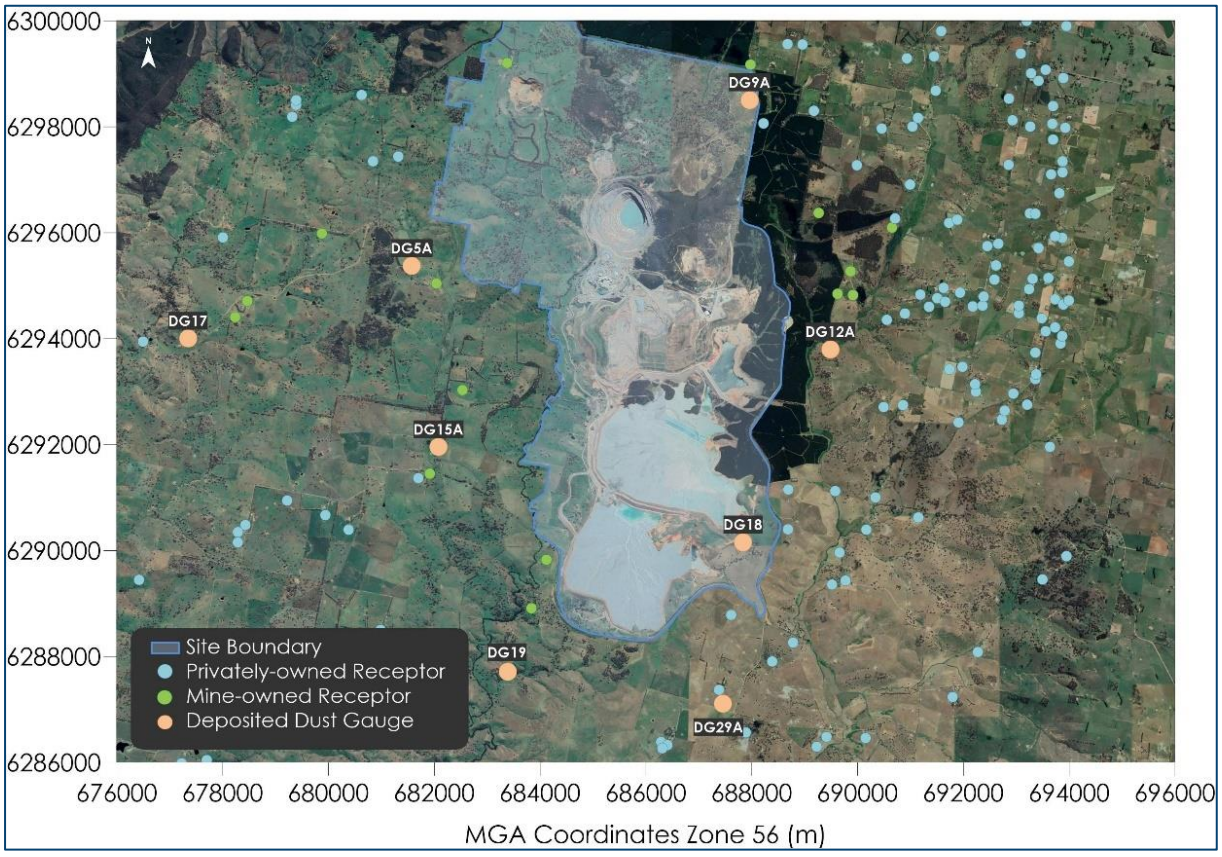

Figure 1-1: Cadia Valley Operations monitoring locations

Figure 1-2: Dewatering facility monitoring locations

2 AIR QUALITY CRITERIA

The applicable annual average deposited dust criteria for Cadia Valley Operations as per PA 06_0295 is summarised in **Table 2-1**.

Table 2-1: Long term impact assessment/ land acquisition criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m²/month	[a] 4 g/m²/month

g/m²/month = grams per square metre per month.

Notes:

a. *Total impact (i.e. incremental increase in concentrations due to the project plus background concentrations due to all other sources).*

b. *Incremental impact (i.e. incremental increase in concentrations due to the project 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.*

3 DEPOSITED DUST DATA

Table 3-1 summarises the deposited dust monitoring data for the July 2019 to June 2020 period.

Figure 3-1 and **Figure 3-2** graphically present the monthly deposited dust monitoring data for Cadia Valley Operations and the Dewatering Facility, respectively.

It is noted that the annual sampling period for the deposited dust monitoring is not per the standard calendar annual period (1 January to 31 December) with bottle exchanges on approximately the first day of the month. Also, the exposure times for some of the deposited dust monitoring samples were longer than the typical exposure period of a month. It is recommended that deposited dust gauge monitoring be conducted as per the applicable AS 3580.10.1:2003 standard which states; "*For routine monitoring programs, the period of exposure is typically 30 ±2 days*" and "*Deposit gauges should be changed on the first day of each month or as near as possible to the first day of each month*".

Several deposited dust monitoring samples in **Table 3-1** were contaminated or deemed invalid due to broken glassware, contamination from insects or influenced by a local sources such as local farming activity or activity occurring at the exploration shed near DG5A which skewed the results. The calculated annual average results in **Table 3-1** indicate the DG5A, DG9A, DG12A, DG15A, DG17, DG29A, DGL06 and DGL08 monitors recorded total annual average levels above the relevant criterion of 4g/m^2/month.

Table 3-1: Cadia Valley Operations monthly deposited dust monitoring data (g/m^2/month)

Month	DG5A	DG9A	DG12A	DG15A	DG17	DG18	DG19	DG29A	DGL06	DGL08	DGL09
Jul-19	1	0.6	0.7	1.5	1.6	0.2	0.5	0.4	0.8	0.8	0.5
Aug-19	1	6.2	1.5	0.8	1.3	3.7	1.3	0.9	1.3	1.2	1.2
Sep-19	19.2c	3.4	3.9	2.7	3.2	5.4	2.3	4.2	3.5	4.3	3.3
Oct-19	6.1	6.3	7	5.4	7	4.6	5.3	8	3.6	4.6	4.8
Nov-19	4.9	16.2c	7	4.9	6.7	4.6	2.4	5.2	4.3	3.8	4.6
Dec-19	6.9	4	-	5	4.2	4.4	5.7	6.8	4.8	4.8	3.9
Jan-20	31.4c	9.1	2	10.6	12.9	10.5	8.6	13	6.7	12.4	6.4
Feb-20	21.7c	9.7	14	15.9	17.9	-	11.6	25.3	16	14.3	13.9
Mar-20	6.6	1.8	27.6c	4.9c	4.2	3.1	4	4.8	2.2	2.2	1.9
Apr-20	2.2	1.2	2.8	3.3	1	1	1	1.4	1.3	1.3	0.7
May-20	3.1	23.2c	1.1	1.5	1	1.9	0.8	1.2	0.6	0.7	0.5
Jun-20	1.2	58.4c	0.7	1.5	0.5	0.8	0.5	1	0.5c	0.4c	0.4
Annual Average	**5.3**	**4.7**	**4.1**	**4.8**	**5.1**	3.7	3.7	**6.0**	**4.1**	**4.6**	3.5

c - Sample contaminated/ invalid, not included in annual average calculation

A review of the monthly data presented in **Figure 3-1** and **Figure 3-2** show a peak in the recorded deposited dust levels during January 2020 and February 2020 which coincides with periods of bushfires affecting NSW and also a dust storm (**NSW DPIE, 2020**) which could have contributed to these results. These events affected the region as both the monitors at the Cadia Valley Operations and the Dewatering Facility (located approximately 26 kilometres away) show a similar peak in deposited dust levels. If these periods were considered extraordinary events and excluding the results for January and February the annual average calculation, all monitors would result in annual average level of less that 4g/m^2/month.

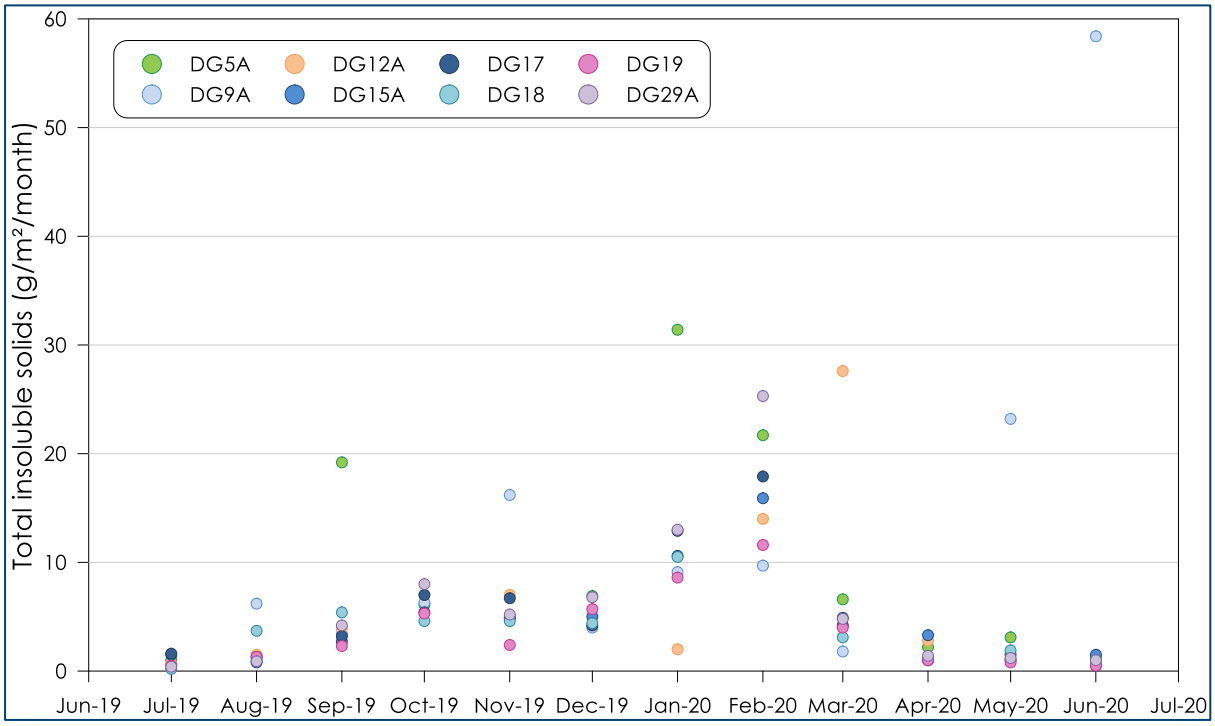

Figure 3-1: Monthly deposited dust results for Cadia Valley Operations

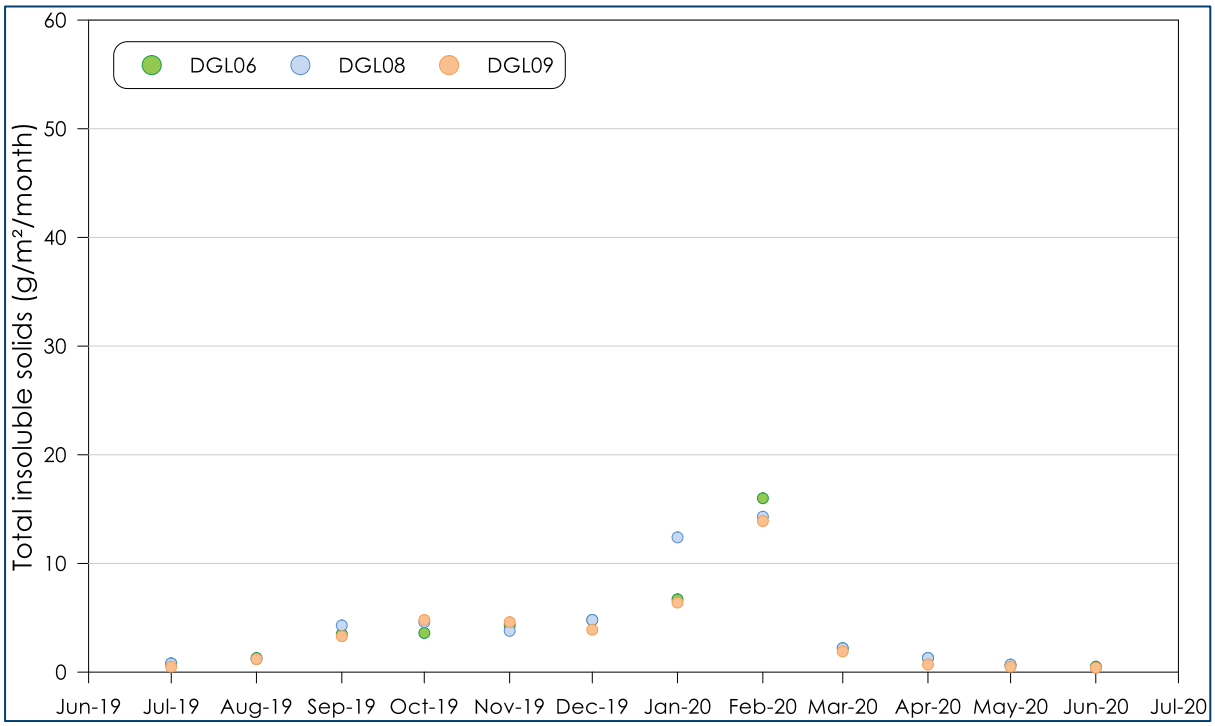

Figure 3-2: Monthly deposited dust results for Dewatering Facility

Figure 3-3 presents annual windrose plots of the meteorological data collected at the Ridgeway and Southern Lease Boundary (SLB) weather stations during the July 2019 to June 2020 period. Winds predominantly originated along a southwest and northeast axis.

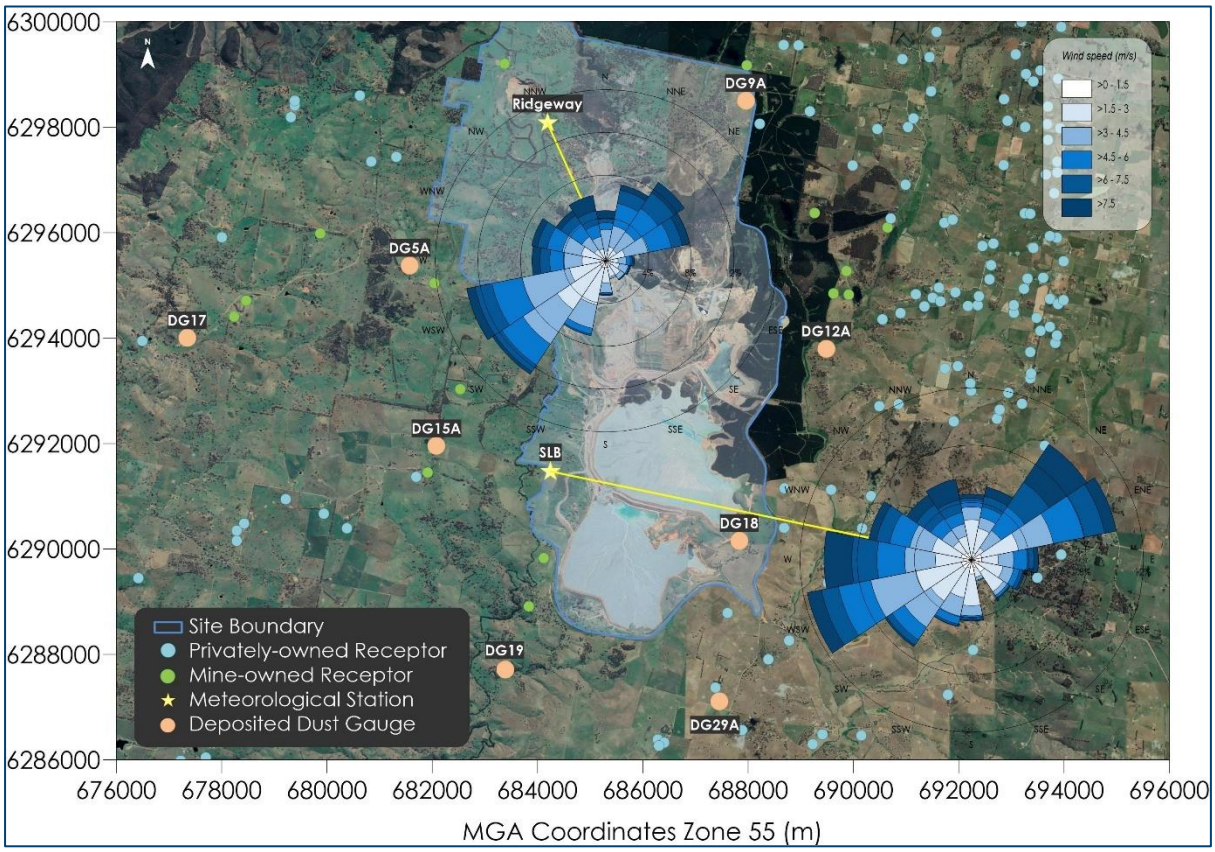

Figure 3-3: Windroses for July 2019 to June 2020

4 ANNUAL AVERAGE DESPOSITED DUST INVESTIGATION

The aim of this investigation is to determine the potential contribution of Cadia Valley Operations to the annual average deposited dust levels recorded at the monitors, and in particular the DG5A, DG9A, DG12A, DG15A, DG17, DG29A, DGL06 and DGL08 monitors. The approach generally follows the evaluation of annual deposited dust monitoring data presented in the *Cadia Valley Operations Air Quality Monitoring Program* (**Cadia Valley Operations, 2018**).

The monthly contribution of Cadia Valley Operations was estimated to be the monthly ash concentrations recorded by each monitor minus the underlying background levels. These levels include the contribution from all sources surrounding the monitors and would also include the contribution associated with regional sources such as dust storms, bushfires, and other extraordinary events.,

The background levels for each month were taken to be the average level recorded by the monitors in the network which were upwind of Cadia Valley Operations (or the Dewatering Facility) for more than 80% of the time during each monthly sampling period. That is, these monitors experience wind blowing from the Cadia Valley Operations (or the Dewatering Facility) and transporting dust, for less than 20% of the time. The hourly wind direction data from the Cadia Valley Operations on-site weather station

was used to calculate the period during which this occurred and would account for the range of different wind conditions experienced.

Table 4-1 shows the percentage of time each monitor is downwind of Cadia Valley Operations (or the Dewatering Facility) the monthly deposited ash content, the calculated monthly background levels for either the Cadia Valley Operations or the Dewatering Facility and the estimated contribution of Cadia Valley Operations (or the Dewatering Facility) to the deposited dust levels recorded at the monitors for each month during the review period.

The maximum annual average estimated contributions are less than the incremental criteria of 2g/m^2/month at each of the monitors, including the DG5A, DG9A, DG12A, DG15A, DG17, DG29A, DGL06 and DGL08 monitors. This would indicate that the elevated background levels and/or other (local) sources were the likely primary cause of the exceedance of the cumulative criterion at the monitors.

Table 4-1: Cadia Valley Operations contribution to measured deposited dust levels

Month	DG5A	DG9A	DG12A	DG15A	DG17	DG18	DG19	DG29A	DGL06	DGL08	DGL09
	Percentage of time downwind (%)										
Jul-19	23%	18%	44%	38%	22%	49%	30%	19%	12%	21%	13%
Aug-19	17%	28%	48%	19%	14%	57%	17%	23%	8%	23%	11%
Sep-19	22%	26%	52%	24%	18%	60%	13%	21%	8%	23%	10%
Oct-19	24%	24%	37%	36%	20%	45%	27%	20%	11%	32%	7%
Nov-19	13%	24%	51%	19%	9%	65%	17%	26%	4%	26%	12%
Dec-19	8%	32%	-	12%	6%	67%	11%	21%	2%	11%	13%
Jan-20	22%	19%	45%	47%	19%	36%	39%	18%	13%	43%	7%
Feb-20	28%	20%	33%	40%	26%	-	26%	20%	16%	27%	8%
Mar-20	31%	17%	25%	57%	28%	34%	46%	12%	21%	43%	6%
Apr-20	17%	15%	39%	42%	16%	63%	42%	18%	11%	37%	8%
May-20	17%	22%	39%	25%	14%	55%	23%	31%	9%	33%	13%
Jun-20	30%	15%	27%	46%	24%	31%	40%	14%	16%	40%	2%
Month	**Monthly deposited dust monitoring data – ash content (g/m²/month)**										
Jul-19	0.7	0.5	0.4	1.2	1.0	0.1	0.2	0.3	0.5	0.4	0.4
Aug-19	0.7	4.4	1.3	0.5	0.8	2.6	1.0	0.7	0.9	0.9	1.0
Sep-19	-	2.5	3.2	1.7	2.2	4.4	1.4	3.2	2.3	3.2	2.6
Oct-19	5.0	5.0	5.5	4.3	5.3	3.4	3.9	6.1	2.8	3.3	3.8
Nov-19	3.8	-	5.7	2.0	4.9	3.4	1.4	3.7	3.3	3.1	3.4
Dec-19	2.7	1.8	-	2.4	1.8	2.8	3.2	4.6	3.3	2.6	2.4
Jan-20	-	7.2	1.0	8.7	11.1	9.2	7.3	11.3	4.7	4.7	3.9
Feb-20	18.6	7.7	11.4	12.8	15.8	-	10.2	22.1	13.7	12.7	11.8
Mar-20	-	1.1	-	-	2.7	2.0	2.1	3.4	1.4	1.5	1.1
Apr-20	1.6	0.8	0.8	2.8	0.6	0.5	0.5	0.8	0.9	0.8	0.4
May-20	2.0	-	0.8	1.0	0.7	1.3	0.6	0.8	0.3	0.5	0.3
Jun-20	0.7	-	0.3	1.2	0.3	0.4	0.3	0.5	-	-	0.2
Month	**Estimated Background – CVO / Dewatering Facility***	**Maximum estimated contribution to monitor (g/m²/month)**									
Jan	0.4 / 0.4	0.3	0.1	0.1	0.9	0.6	0.0	0.0	0.0	0.1	0.0	0.0
Feb	0.8 / 0.9	0.0	3.7	0.6	0.0	0.0	1.9	0.2	0.0	0.0	0.0	0.0
Mar	1.8 / 2.4	-	0.7	1.4	0.0	0.4	2.6	0.0	1.4	0.0	0.8	0.1
Apr	3.4 / 3.3	1.6	1.6	2.1	0.9	1.9	0.0	0.5	2.7	0.0	0.0	0.5
May	3.0 / 3.4	0.8	-	2.7	0.0	1.9	0.3	0.0	0.7	0.0	0.0	0.0
Jun	2.5 / 2.7	0.2	0.0	-	0.0	0.0	0.2	0.7	2.1	0.0	0.0	0.0
Jul	9.9 / 4.3	-	0.0	0.0	0.0	1.2	0.0	0.0	1.4	0.4	0.4	0.0
Aug	7.7 / 12.8	10.9	0.0	3.7	5.1	8.1	-	2.5	14.4	0.9	0.0	0.0
Sep	2.2 / 1.1	-	0.0	-	-	0.5	0.0	0.0	1.1	0.4	0.4	0.0
Oct	0.9 / 0.6	0.6	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.2	0.2	0.0
Nov	1.4 / 0.3	0.6	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Dec	0.5 / 0.2	0.1	-	0.0	0.6	0.0	0.0	0.0	0.0	-	-	0.0
Annual average	**2.9 / 2.7**	1.7	0.7	1.0	0.9	1.2	0.5	0.3	2.0	0.2	0.2	0.1

* The average of the levels where monitors were downwind of Cadia Valley Operations/ Dewatering Facility for less than 20% of the time in the monitoring period was taken to be the background

5 SUMMARY AND CONCLUSIONS

This investigation has estimated the contribution due to activity at Cadia Valley Operations to the elevated annual average deposited dust levels recorded during the July 2019 to June 2020 period. The annual average data indicate several monitors recorded total annual average levels above the relevant criterion of 4g/m^2/month during the period.

A review of the deposited dust monitoring data indicated that during the January 2020 and February 2020 periods, all monitors recorded an increase in levels which suggests they were influenced by a regional event. Excluding these data from the annual average calculation would result in an annual average level of less than 4g/m^2/month for all monitors.

Nevertheless, this analysis has included this data and found the estimated annual average contribution from activity at the Cadia Valley Operations and also the Dewatering Facility to be below the incremental criterion of 2g/m^2/month at each of the monitors and thus the Cadia Valley Operations and the Dewatering Facility are not considered to be a significant contributor to the measured deposited dust levels.

6 REFERENCES

Cadia Valley Operations (2018)

"Cadia Valley Operations Air Quality Monitoring Program", prepared by Cadia Valley Operations, June 2018.

NSW DPIE (2020)

"Dustwatch Report January 2020", prepared by NSW Department of Planning, Industry and Environment, February 2020.