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Boral Dunmore Hard Rock Quarry

Annual Review

1 July 2018 – 30 June 2019

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Table 1 Document Control Sheet

Document Control				
Version	Prepared by	Approved by	Date	Distribution
1.0 (Draft)	Ben Williams Environmental Co-ordinator Dunmore Quarry	Brodie Bolton Quarry Manager	September 2019	Internal distribution for review
1.1 (Final)	Ben Williams Environmental Co-ordinator Dunmore Quarry	Brodie Bolton Quarry Manager	30 September 2019	• Department of Planning, Industry and Environment • Environmental Protection Agency • Shellharbour City Council • Dunmore Quarry CCC • Online at https://www.boral.com.au/locations/boral-dunmore-operations

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Commonly Used Abbreviations

ACHMP	Aboriginal and Cultural Heritage Management Plan
ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
AR	Annual review
AS	Australian Standard
BFMP	Bushfire Management Plan
BMP	Blast Management Plan
BOS	Biodiversity Offset Strategy
CCC	Community Consultative Committee
DA 470-11-2003	The development application for the Dunmore Hard Rock Quarry operated by Boral Resources (NSW) Pty Ltd
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry and Environment
EPA	Environmental Protection Authority
EPA&A Act	Environmental Planning and Assessment Act 1979
EPL 77	Environmental Protection Licence for the Dunmore Hard Rock Quarry operated by Boral Resource (NSW) Pty Ltd
FFMP	Flora and Fauna Management Plan
FY19	Financial Year 2019 (1 July 2018 – 30 June 2019)
HVAS	High Volume Air Sampler
LOR	Limit of Reporting
ML	Megalitres
NATA	National Association of Testing Authorities
NMP	Noise Management Plan
NRAR	Natural Resource Access Regulator
NTU	Nephelometric Turbidity Units
PIRMP	Pollution Incident Response Management Plan
PM10	Particulate Matter (10 microns in diameter)
POEO Act	Protection of the Environment Operations Act 1997
S5.C9	Used to refer to a particular condition in DA-470-11-2003 (in this case Schedule 5, Condition 9).
TSP	Total Suspended Particulates
TSS	Total Suspended Solids

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WMP	Water Management Plan
WQO	Water Quality Objectives
µg/m3	Micrograms per cubic metre

1. Purpose and Scope

In addition to determining compliance of the operation, DA 470-11-2003 Schedule 5 Condition 9 (S5.C9) requires that the AR reports on specific components of the operation.

S5.C9 and all other relevant conditions required to be addressed as part of the AR are outlined in Table 2 with reference to the section of this report where each has been addressed. The timeframe for the annual review is the 2019 Financial Year which is 1 July 2018 – 30 June 2019.

Table 2 Relevant Conditions relating to the Annual Review

Condition of Approval	Condition Requirements	Location within this report
S5.C9	By the end of September each year, or other timing as may be agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. The review must: a) Describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year; b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against the: • Relevant statutory requirements, limits or performance measures/criteria; • Requirements of any plan or program required under this consent; • Monitor results of previous years; and • Relevant predictions in the document listed in condition 2 of schedule 3; c) Identify any non-compliance over the last financial year, and describe what actions were (or are being) taken to ensure compliance; d) Identify any trends in the monitoring data over the life of the development; e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development. The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.	Section 5.7 Section 5 Section 7 Section 5 Section 5 Section 8
S4.C29	In each Annual Review, the Applicant must: a) Recalculate the site water balance for the development; and b) Provide information on evaporative losses, dust suppression, dam storage levels and implications of obtaining any water supplies from off-site; and c) Evaluate water take against licencing requirements.	Section 5.5.3

S4.C51	The Applicant must include a progress report on the implementation of the Flora and Fauna Management Plan in the Annual Review.	Section 5.7 and Appendix G
S4.C58	The Applicant must include a progress report on the Rehabilitation Management Plan in the Annual Review.	Section 5.7
S4.C72	The Applicant must describe what measures have been implemented to minimise the amount of waste generated by the development in the Annual Review.	Section 5.9
S4.C78	The Applicant must: (a) provide annual production data to the DRE using the standard form for that purpose; and (b) include a copy of this data in the Annual Review.	(Provided to the DRE) Section 3.4

Copies of the AR will be submitted to the DPIE and made available to the public at on the Dunmore Quarry website.

https://www.boral.com.au/locations/boral-dunmore-operations

Key contacts associated with the management of the Quarry operations, environment, safety and stakeholder relationships are provided in Table 3.

Table 3: Key Contact Details for Dunmore Quarry

Contact	Position	Contact Details
Brodie Bolton	Quarry Manager	Tel: (02) 4237 2000 Email: brodie.bolton@boral.com.au
Ben Williams	Environmental Co-ordinator	Tel: (02) 4237 8414 Email: ben.williams@boral.com.au
Paul Jackson	Stakeholder Relations Manager	Tel: (02) 9033 5215 Email: paul.jackson@boral.com.au

2. Introduction

The Dunmore Hard Rock Quarry, owned and operated by Boral Resources (NSW) Pty Ltd, is located at Tabbita Road Dunmore, approximately 12 kilometres north-west of Kiama in the Shellharbour Local Government Area. The Quarry produces hard rock from Bumbo Latite Member, a fine-grained intermediate volcanic rock similar to basalt, which is crushed to produce coarse aggregates, road construction materials and fines.

Development Consent (DA 470-11-2003), issued 19 November 2004 by the Minister for Infrastructure and Planning, allows Boral to produce up to 2.5 million tonnes of quarry product a calendar year (Mtpa), and transport it offsite by road and rail to local and regional markets.

Dunmore Hard Rock Quarry (the site) covers approximately 248 hectares and is surrounded by private property, predominantly agricultural grazing land and tracts of remnant native vegetation, to the south, north and west (The Boral owned and operated Dunmore Lakes Sand Project adjoins the site to the east).

The extraction method involves drilling and blasting to produce broken rock, that is transported to the primary crusher feed bin. The primary-crushed rock is further reduced in size in a series of crushers, before being conveyed to the tertiary screen house where the crushed rock is sized according to product specifications. The sized products are then stockpiled within the various stockpile areas on site, until they are transported to local and regional markets.

During the reporting period extraction has occurred in the area known as the Croome West Pit. Approval of the most recent modification, MOD 11 was granted in March 2019.

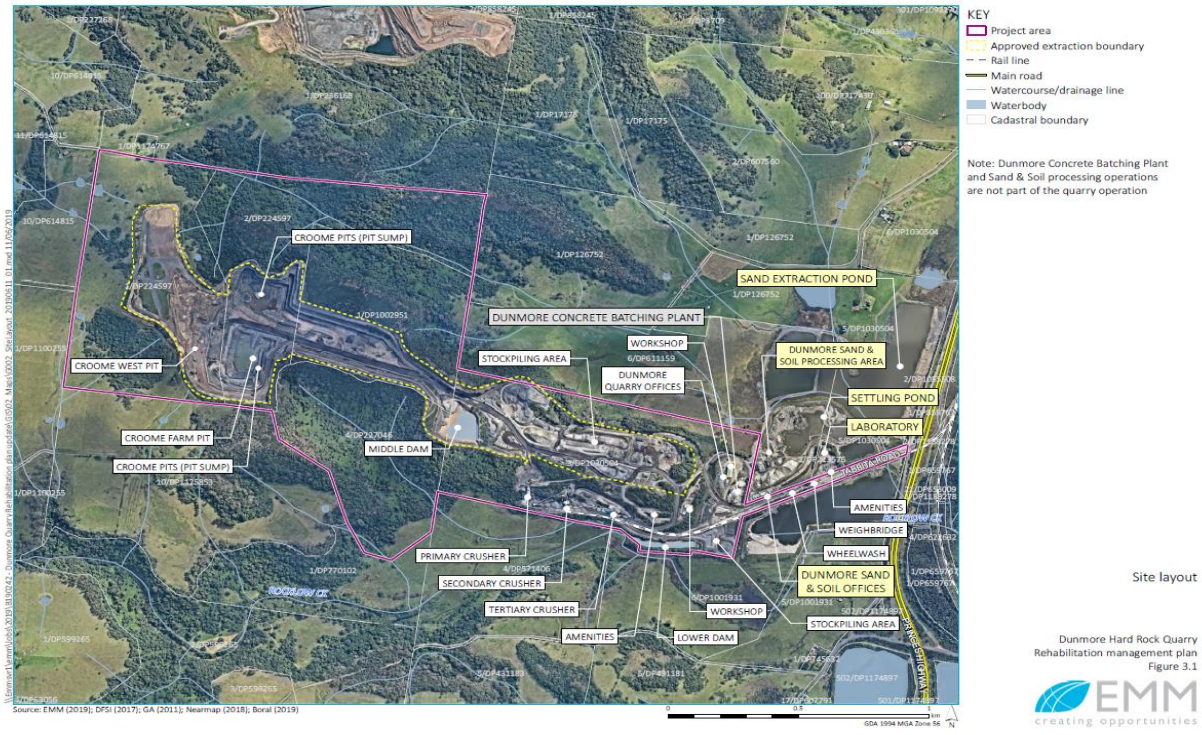

Figure 1: Dunmore Quarry Site Layout

2.1. Approvals

Dunmore Quarry operates under a number of regulatory approvals and licences which are summarised in Table 4 below.

Table 4: List of Relevant Approvals for Dunmore Quarry

Approval	Detail	Regulatory Authority
DA 470-11-2003 Modification 11	Quarry operating conditions as granted by DPIE. The current consent has been updated to remove the restriction of road transport within this reporting period. The current modification (MOD 11) was granted in March 2019.	NSW Department of Industry, Planning and Environment
EPL 77	The EPL is issued for the scheduled activity of: Crushing, Grinding, Separation and Extractive activities for tonnages up to 2 million tonnes per annum as defined by the EPA anniversary date 31 August.	NSW Environmental Protection Authority
Water Access Licence WAL#25152 Ref# 10AL103610	Extraction of water from the Lower Dam. This allows for 227ML per annum to be extracted from Rocklow Creek. Since 2008 the Lower Dam has been taken offline from Rocklow Creek as part of MOD 2	NSW Office of Water

A copy of DA 470-11-2003 and EPL77 is available on request or can be accessed through the Boral Dunmore website:
https://www.boral.com.au/locations/boral-dunmore-operations

3. Quarry Operations

3.1. Operations the last 12 months

Extraction has continued in the Croome West Pit moving primarily straight down the face of to minimise noise and dust impacts. Extraction is moving slowly north-west. Overburden placement has occurred in the northern section of the formerly mined Croome pit. Production for the last financial year was approximately 2,028,544 tonnes with the majority of that production servicing Sydney / Illawarra area.

The blending plant approved as part of MOD 7 begun construction with completion expected within the next reporting period. The tertiary screen house was re-cladded as part of regular maintenance works.

3.2. Operations in the next 12 months

During FY20, production will continue with the Croome West Pit moving gradually north-west and down the existing face.

3.3. Modifications Approved in the Last 12 months.

Under conditions of its Development Consent (DA 470-11-2003), the quarry is approved to produce 2.5 million tonnes per annum (Mtpa) and transport by road or rail. Due to the volume of aggregate

required to supply Sydney infrastructure projects and maximised production at Peppertree Quarry, there is limited additional Boral terminal capacity in Sydney available for Dunmore Quarry trains.

Accordingly, MOD 11 was sought to remove the restriction on road transport which had previously been capped at 1.5 Mtpa. This modification was approved in 15 March 2019.

During the reporting period the DPIE has approved the following management plans

Biodiversity Offset Strategy (part of FFMP) – approved 21/5/19

- Air Quality Management Plan – approved 21/5/19
- Blast Management Plan – approved 19/6/19
- Flora and Fauna Management Plan – approved 19/6/19

The following management plans have been submitted to DPIE and Boral is awaiting feedback

- Rehabilitation Management Plan – submitted 14/6/19
- Water Management Plan – submitted 14/6/19

The following management plans were reviewed and assessed that no changes were required to satisfy MOD 11 requirements

- Bushfire Management Plan
- Noise Management Plan

3.4. Production and Sales and Transport Last 12 months

Calendar year production data is shown below in Table 5. Financial Year production data is shown in Table 6.

Table 5 Calendar Year Production Data

Month	Production (t)	Sales (t)	
		Road	Transfers
Jan-2018	127,617	101,572	8,872
Feb-2018	176,280	126,920	23,356
Mar-2018	203,685	136,415	16,458
Apr-2018	182,061	126,541	16,879
May-2018	193,498	156,510	22,111
Jun-2018	172,736	109,951	14,278
Jul-2018	182,198	149,137	15,695
Aug-2018	199,206	157,559	12,595
Sep-2018	176,065	165,504	7,269
Oct-2018	142,028	173,110	7,198
Nov-2018	169,348	161,984	8,461
Dec-2018	103,822	114,297	1,265
Total	2,028,544	1,679,500	154,437
		1,833,937	

Table 6 FY19 Production Data

Month	Production (t)	Sales (t)	
		Road	Transfers
Jul-2018	182,198	149,137	15,695
Aug-2018	199,206	157,559	12,595
Sep-2018	176,065	165,504	7,269
Oct-2018	142,028	173,110	7,198
Nov-2018	169,348	161,984	8,461
Dec-2018	103,822	114,297	1,265
Jan-2019	165,472	105,088	10,298
Feb-2019	171,887	136,540	14,488
Mar-2019	150,849	127,759	21,166
Apr-2019	116,324	103,425	9,133
May-2019	142,810	185,458	15,587
Jun-2019	153,975	160,167	9,873
Total up to MOD 11 approval	1,310,026	1,163,219	77,269
		1,240,488	
FY 19 Total	1,873,984	1,740,028	133,028
		1,873,056	

As discussed in Section 3.1, the restriction of road transport was removed as part of MOD 11 approval in 15 March 2019. The production figures for FY19 were below the consent limits of 2.5 Mtpa for the current reporting period.

Future reporting of production data in subsequent AR will be in FY format for consistency with requirements to report in the DRG format. A summary of the production reported to the DRG format is shown in Table7.

Table 7 Production Data DRG Format

		Total Sales / Disposals	
Product	**Type of Material**	**Quantity (Tonnes)**	**$ Value of Sale***
Virgin Materials Crushed Coarse Aggregates			
Over 75mm	Latite	60,833	*
Over 30mm to 75mm	Latite	30,901	*
5mm to 30mm	Latite	1,000,209	*
Under 5mm	Latite	197,602**	*
Natural sand	Latite		*
Manufactured Sand	Latite		*
Prepared Road Base & Sub Base	Latite	436,873	*
Other Unprocessed Materials	Latite		*
Total		1,739,875	*

Note: This data is an approximation of FY19 production data and is subject to change.

**This information is commercially sensitive and has been omitted.*

*** This product is not part of the total sales*

3.5. Production, Sales and Transport next 12 months

Production has been forecasted to be below FY19 numbers for the upcoming FY20 reporting period to the Sydney market with a slight increase in local infrastructure works in the Illawarra. Predicted production tonnage is approximately 1.2 to 1.6 Mt however production will be set to market demand which may fluctuate over the next 12 months. A new docketing and weighbridge system has been introduced business wide at Boral in July 2019 (outside of this reporting period).

4. Actions Required From the Previous Annual Review

Table 8 lists specific actions arising from the previous Annual Review.

Table 8 Actions Required From 2017-18 Annual Review

Proposed Activities from FY18 AR	Status	Where discussed
Finalise suite of management plans for MOD 8 and 9 operations.	A suite of management plans were approved post MOD11 and Boral is still awaiting feedback from DPIE for the Rehabilitation Management Plan and Water Management Plan	Section 3.3
Finalise offset approach with DPE regarding offset arrangements for Mod 8 and 9 via the Bodiversity Offset Strategy (BOS).	BOS was approved in May, payment into the BCT will be undertaken in the next reporting period.	Section 5.7
Addition primary weed control within all zones to link fragmented remnants and provide assistance for natural regeneration.	Goodbush has undertaken primary weed control in required zones.	Appendix G details the outcomes of the primary and secondary weed control works
Continued secondary weed control throughout all previously worked area to assist plant establishment and regeneration	Goodbush has undertaken secondary weed control in required zones.	As above
Maintenance of the fencing around zone	Repairs have been made to fence lines around the Compensatory Habitat Area. Despite this cattle are still gaining access through some fences. Further fence repairs will continue in the next reporting period and education for tenanted owners will be undertaken to reduce cattle intrusion.	Section 5.7.2
Install controls to prevent dumping throughout Rocklow Rd	Signage had been installed around access roads to deter dumping. Despite these measures dumping is still prevalent. The installation of cameras will have to be undertaken during the next reporting period.	Section 5.7.3 and Section 5.7.4

	Controls will be continue to be monitored for effectiveness.	
Hydro-seed the northern section of the Croome West Amenity Bund	Hydro-seeding was undertaken in November 2018 and April 2019. More hydro-seeding works have been scheduled for spring 2019. A contract for maintenance work is currently being devised with bush regeneration contractors.	Section 5.7.2
Upgrade the water management system of the site and upgrade the Lower Dam pending the approval of the WMP.	As per condition S4.C35A improvement works cannot begin until the Lower Dam Transition Plan (sub-plan attached to WMP) is approved. In the interim the water management system will continue to run as per the approved Water Management Plan (Arcadis 2016). Consultation with EPA and DPIE will continue in regards to the approval of the WMP.	Section 5.5.5

5. Environmental Performance

Dunmore Quarry has comprehensive management and monitoring programs which collect information and data for the assessment of environmental impacts, regulatory compliance and performance against continual improvement objectives. Specific Management Plans define the framework for measuring environmental performance and compliance with statutory requirements for each relevant aspect of environmental performance and are available on the Dunmore website.

https://www.boral.com.au/locations/boral-dunmore-operations

5.1. Meteorological Monitoring

An onsite weather station is located at Dunmore which collects a range on meteorological parameters. The location of the weather station is shown in Figure 6 in Appendix A.

There is no prescribed impact assessment criteria and meteorological monitoring is used to provide background information for management of the site. A detailed summary of the FY19 and historical rainfall data can be found in in Appendix A.

5.1.1. Meteorological Monitoring Long Term Analysis and Trends

The highest rainfall was experienced in late spring and early summer which is line with historical site and regional averages. Overall FY19 was below site and regional averages which is consistent with other regional areas in southern NSW.

Prevailing winds were from the WSW during the majority of the year with the exception of the summer months. In summer the prevailing wind tended to be from the N or NNE. There was a lower percentage of calm conditions with no/low wind in winter. This is consistent with historical trends for the site and the region generally.

5.1.2. Meteorological Monitoring Summary and Opportunity for Improvement

A new weather system is being constructed as part of the transition to real time air quality monitoring. An app system will run alongside this system which will allow the integration of wind data to the monitors. This app system will allow more intuitive access to monitoring data to inform operations.

5.2. Air Quality

Two methods of monitoring air quality is used at Dunmore Quarry. Deposited dust gauges are used to measure deposited dust every 30 days (+/- 2 days). A High Volume Air Sampler (HVAS) is used to measure the fine particulate matter under 10 microns (PM10) every 6 days. All monitoring points were below the required assessment criteria for deposited dust, PM10 and TSP for the reporting period.

5.2.1. Deposited Dust Monitoring Assessment Criteria

Relevant deposited dust impact assessment criteria applies to a residence on privately owned land. Monitoring points 1, 2 and 4 are not located in direct vicinity of residences. It is important to note that the assessment criteria refers to an annual averaging period (i.e. a monthly average over the last 12 months). Impact assessment criteria is shown in Table 9 below.

Table 9 Deposited Dust Impact Assessment Criteria

Pollutant	Averaging Period	Criterion	
Deposited dust[c]	Annual	2g/m2/month[b]	4g/m2/month[a,d]

- a Cumulative impacts (i.e. increases in concentration due to development plus all other sources)
- b Incremental impact (i.e. increases in concentration alone, with zero allowable exceedences of criteria over the life of the development.
- c Deposited dust is defined as insoluble solids
- d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary.

5.2.2. Deposited Dust Monitoring FY19 Performance Review

All monitoring points were below the required assessment criteria or dust measured as insoluble solids over the annual averaging period. All sites also were below 4g/m2/month for ash fraction which excludes the organic (combustible) component of the sample such as vegetation, bird droppings and insects. These organic contaminants within the sample are typically representative of the surrounding wetlands and farmland which the monitors are located within.

A summary of results for each monitoring location is shown in Table 7 below. A monthly breakdown of each site and summary graphs is located in Appendix B.

Table 10 FY19 Deposited Dust Monitoring Summary

Month	**Site 1** grams/m^2/month		**Site 2** grams/m^2/month		**Site 3** grams/m^2/month		**Site 4** grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash
18/19 Average	3.05	1.84	2.95	1.92	3.66	2.01	2.81	1.59

A state wide dust storm was experienced regionally from 12-14th of February which caused elevated readings for February at most sites. Despite this, annual averages were still below impact assessment criteria. Images of the dust storm is shown in Figure 30 and 31 in Appendix B.

5.2.3. Particulate Monitoring Impact Assessment Criteria

The impact assessment criteria for Particulate Monitoring is shown below in Table 11.

Table 11 Particulate Matter Impact Assessment Criteria

Pollutant	**Averaging Period**	**Criterion**
PM10	Annual	[a,d] 25 µg/m³
PM10	24 hour	[b]50 µg/m³
TSP	Annual	[a,d] 90 µg/m³
PM2.5*	Annual	[a,d] 8 µg/m³

- *a Cumulative impacts (i.e increases in concentration due to development plus all other sources)*
- *b Incremental impact (i.e increases in concentration alone, with zero allowable exceedences of criteria over the life of the development.*

- *d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary.*

*Please note that the requirement to monitor PM2.5 was inserted as a condition post MOD 9 approval. The requirement to monitor in real-time was also inserted as a consent condition as part of MOD 9. The new AQMP was approved in May 2019 and the installation of real-time monitors capable of measuring TSP, PM10 and PM2.5 is due to occur in the next reporting period.

5.2.4. Particulate Matter FY19 Performance Review

TSP concentrations are not measured in the vicinity of the quarry, however annual average TSP concentrations can be derived based on typical ratios of PM10/TSP. Rural areas (such as the Dunmore Quarry), typically experience a PM10/TSP ratio of 0.4. This ratio has been applied to the annual average PM10 concentrations to derive a representative TSP background concentration in µg/m³. This methodology is in-line with the method used by Ramboll in the Mod 9 Environmental Assessment.

The annual average PM10 measurement for the reporting period from monitoring point 5 was below impact assessment criteria for 25 µg/m³ for PM10 and 90 µg/m³. PM10 measurements were also similar to Albion Park annual averages. Summary of FY19 particulate matter is shown below in Table 12.

Table 12 FY 19 Particulate Matter Summary

Pollutant	Dunmore Quarry FY19 Average (µg/m³)	Albion Park FY19 Average	Dunmore Quarry Long Term Average (µg/m³)
PM10	18.57	17.8	12.95
Derived TSP	46.43	44.5	32.38

There was one (1) reading above short term PM criteria recorded at the monitoring point. On 1/02/19 a reading recorded at the HVAS located at monitoring point 5 had a reading of 81.47ug/m3. An investigation was undertaken of the operations and ambient conditions experienced on 1 February. Findings were sent to DPIE and EPA within 7 days of receiving these results. To summarise:

- Alerts were received on February 1 indicating that regional air quality exceeded PM10 national standards the day previously.
- The plant was shut down for scheduled maintenance all day on February 1 2019. No production occurred during this time. Haul road and water cart operation continued as per normal operations.
- Weather data recorded on the Dunmore Quarry Weather Station indicate that the prevailing wind was from the S/SSW which were not from the direction of the quarry.

As a result of these investigations it has been determined that the elevated measurements of PM10 at Monitoring point 5 are not due quarry operations but are reflective of the regionally high ambient PM10 levels above the 50µg/m3 which led to the elevated reading on the HVAS. This was investigation was reported to DPIE and EPA as per S5.C7.

Figures 33 and 34 in Appendix B shows the regional alerts sent out from the OEH demonstrating the high PM10 values experienced throughout the region on 31/1/19 and 1/2/19.

Summary Tables and graphs showing the PM10 measurements throughout the reporting period can be found in Appendix B.

5.2.5. Air Quality Long Term Analysis and Assessment

The site has been collecting deposited dust data since 2002. A graph of long term trends can be found in Figure 25 in Appendix B and shows that typically deposited dust has typically decreased over time.

A graph showing measured deposited dust vs production is presented in Figure 26-29 in Appendix B. Since the cladding of the primary crusher in 2010 there has been no correlation between production tonnes and measured deposited dust.

A general trend which has been observed is that typically measured deposited dust is higher in dry summer months than winter months which is to be expected. This trend is also confirmed with PM10 measurements and is generally reflective of regional conditions as a whole. Figure 35 in Appendix B shows a 90 day average which demonstrates clearly defined seasonal variations in PM10 measurements.

The seasonal fluctuation in PM10 measurements shows a clear trend that PM10 values are typically higher in the dry periods in summer and are lower in winter. This fluctuation is mirrored by Albion Park PM10 measurements available on the OEH website.
https://www.environment.nsw.gov.au/AQMS/search.htm

These trends indicate the measured PM10 and deposited dust values are typically influenced more from ambient local conditions than quarry operations.

5.2.6. Air Quality Summary and Opportunities for Improvement

New consent conditions were inserted as part of MOD 9 which requested the used of real time monitors to measure TSP, PM10 and PM2.5. After approval of the AQMP in May 2019, this system will be upgraded. As of time of writing (September) these machines have been purchased and the transition phase will begin during the next reporting period.

The transition to real-time monitors will allow a proactive approach to managing air quality based on real time data and management actions via a Trigger Action Response Plan (TARP). Management responses are outlined when real time data is trending upwards. The new monitoring methodology will focus more towards monitoring particulates rather than deposited dust. The deposited dust monitoring program will be discontinued after the transition to real time monitoring is complete as per the approved AQMP. Details of the updated air quality management plan and the new monitoring system is available on the Dunmore website.

5.3. Noise

Annual Noise Monitoring is undertaken annually in winter to determine quarry contribution to noise to private residence. The current reporting period was the first instance where the new monitoring points were assessed post MOD 9 approval. Monitoring results demonstrated compliance with prescribed assessment criteria during all monitored time periods.

5.3.1. Noise Impact Assessment Criteria

S4C4 outlines the relevant noise assessment criteria to be adopted for the annual monitoring in Table 13 below.

Table 13 Noise Limits for Dunmore Quarry

Receiver Location	Noise Limits dB (A)					
	LAeq (15 minute)				LAeq (1 minute)	
	Day	Evening	Night	Shoulder	Night	Shoulder
Location K Stocker Residence	49	44	38	47	48	55
Location O Dunmore Lakes	49	44	38	47	48	55
Location J Creagan Residence	Negotiated Agreement in Place					
Location AA	38	38	38	38	45	45
Locations AB and T	36	36	36	36		
Location D,F,G and Z	40	40	40	40		
Location S	37	37	37	37		
Other privately owned residence	35	35	35	35		

5.3.2. Noise Performance FY19 Review

A summary of the attended noise monitoring results against the modelled MOD 9 quarry operations is shown below in Table 14.

Table 14 Summary of FY19 Noise Monitoring Results.

Post Modification 9 Noise Monitoring Results NM1 (representative of resident K and O)				
	Day	Evening	Morning Shoulder	
Noise	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(1min)
Limit	**49**	**44**	**47**	**55**
Predicted	35	35	35	
2018	40	40	40	50
Post Modification 9 Noise Monitoring Results NM2 (representative of resident S)				
	Day	Evening	Morning Shoulder	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(1min)
Limit	**37**	**37**	**37**	**45**
Predicted	35	35	35	
2018	30	30	30	32
Post Modification 9 Noise Monitoring Results NM3 (representative of resident T)				
	Day	Evening	Morning Shoulder	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(1min)
Limit	**36**	**36**	**36**	**45**
Predicted	35	35	35	

2018	35	35	35	40
Post Modification 9 Noise Monitoring Results NM4 (representative of resident G,D,Z)				
	Day	Evening	Morning Shoulder	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(1min)
Limit	**40**	**40**	**40**	**45**
Predicted	35	35	35	
2018	30	30	30	30
Post Modification 9 Noise Monitoring Results NM1 (representative of resident F, AA,AB)				
	Day	Evening	Morning Shoulder	
	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(1min)
Limit	**40**	**40**	**40**	**45**
Predicted	35	35	35	
2018	30	30	30	30

Note that follow up monitoring was undertaken at NM3 due to temperature inversion condition outside of assessment criteria during the initial round of monitoring.

5.3.3. Noise Long Term Analysis and Assessment

It is not possible to compare long term values for the assessed locations as the current reporting period was the first year in which these monitoring points were operation with the exception of NM1 which corresponds to the previous monitoring point Location K.

Results were compared against MOD 9 Dunmore Quarry noise contribution modelling results which shows noise monitoring results were generally within the predicted modelled results with the exception of Location K.

Location K is located in close proximity to Boral owned operation at Dunmore Sand and Soil and Dunmore Concrete Batching Plant so it is expected that measured noise levels are above modelled MOD 9 Dunmore Quarry contributions. 2018 results were still within relevant noise limits and were lower than historical averages. A summary table of noise monitoring results at Location K is shown in Table 30 in Appendix C

5.3.4. Noise Summary and Opportunities for Improvement

Improvements to the weather station are schedule in as part of the updates to the air quality monitoring network. This will allow access to real-time weather data which will assist site management to more efficiently identify and react to adverse meteorological condition such as inversions which may amplify any generated noise.

5.4. Blasting

S4C16 and S4.C17 outline the blast monitoring parameters which are assessed at the nearest receiver at the Benny Residence. Monitoring at the Benny residence indicated compliance with all relevant blast parameters during the reporting period. Monitoring Points are shown in Figure 37 I Appendix D.

5.4.1. Blasting Impact Assessment Criteria

S4C16 and S4.C17 outline the blast monitoring parameters which are assessed at the nearest receiver at the Benny Residence. These parameters are reproduced below in Table 15.

Table 15 Blasting Limits Dunmore Quarry

Airblast Overpressure	Allowable exceedances
120 ((dB(Lin Peak))	0 (absolute limit)
115 ((dB(Lin Peak))	5% of the total number of blasts over a period of 12 months
Ground Vibration	**Allowable exceedances**
10mm/s	0 (absolute limit)
5mm/s	5% of the total number of blasts over a period of 12 months

In addition, the approved Blast Management Plan outlines monitoring which will be undertaken to preserve the heritage value of the old flour mill at the MacParlands residence. The following blast parameters were adopted.

Table 16 Blast Limits at MacParland Residence

Airblast Overpressure	Allowable exceedances
130 ((dB(Lin Peak))	5% of the total number of blasts over a period of 12 months
Ground Vibration	**Allowable exceedances**
30mm/s	5% of the total number of blasts over a period of 12 months

5.4.2. Blasting Performance Review

All blasts within the reporting period were compliant with criteria described in Table 15. Figure 2 and 3 shows a summary of the FY19 blast monitoring results for Airblast overpressure and ground vibration respectively.

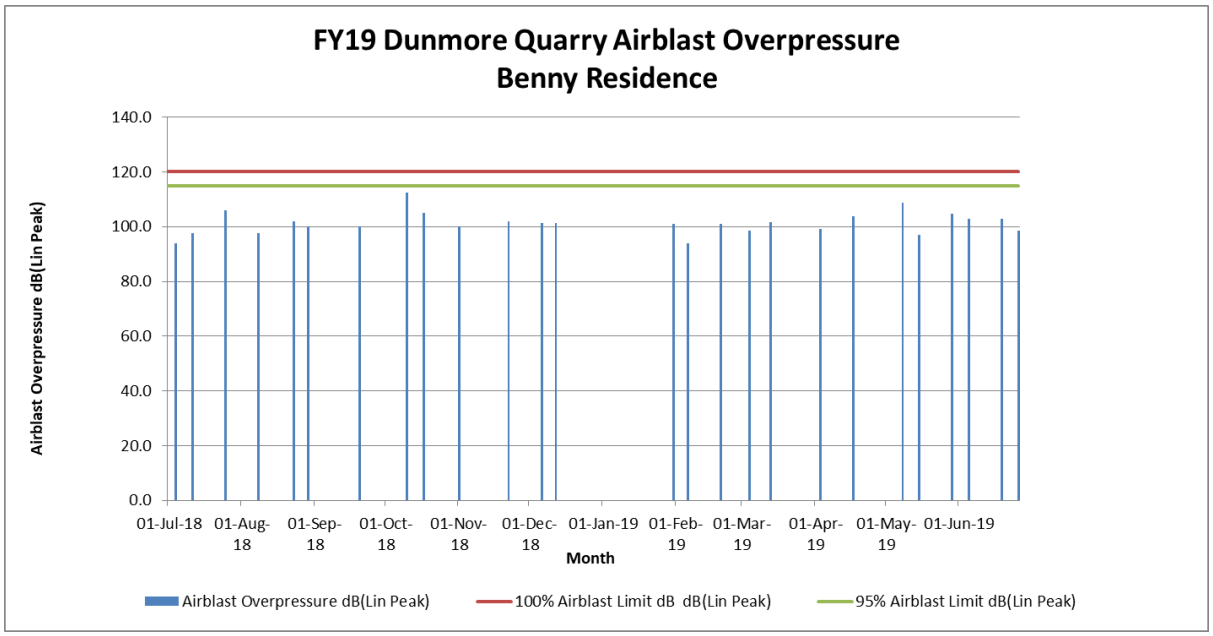

Figure 2 FY19 Airblast Overpressure Benny Residence

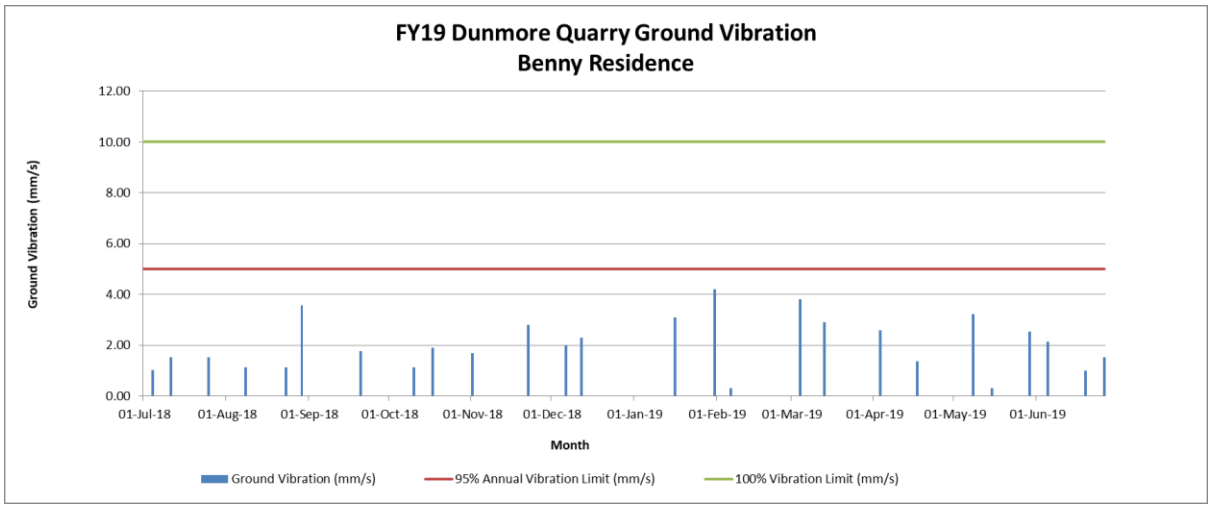

Figure 3 FY19 Ground Vibration Benny Residence

5.4.3. Blast Long Term Analysis and Assessment

Figure 38 and 39 in Appendix D show historical monitoring results and associated trends. It is important to note that the compliance monitoring point changed from the MacParland monitoring point to the Benny Monitoring point in February 2018 in the last reporting period. The MacParland property was acquired by Boral in September 2016.

There has been a slight upward trend of blast monitoring results since 2005 which is to be expected as operations moved west-ward towards the former MacParland monitor. In the last reporting period blast monitoring results were below what has been typically measured in previous years.

5.4.4. Blast Summary and Opportunities for Improvement

Focus on the next 12 months will centre on consolidating actions detailed in the updated BMP. A dilapidation report has been scheduled in at the MacParland property to ensure heritage values are conserved as per the approved Blast Management Plan.

5.5. Surface Water Management

An updated Water Management Plan was submitted to the department in the last reporting period but has yet to be approved. As a result, the monitoring and operations for the FY19 follow procedures outlined in the Arcadis Dunmore Quarry Water Management Plan (2016).

During normal operations, the Lower Dam is kept offline to Rocklow Creek however in the case of high rainfall there is potential for floodwaters to back up around the narrow bend of the creek and inundate the Lower Dam, causing it to fill and create a mixing zone with waters from Lower Dam, compromising its storage capacity. Upgrades to the water management plan detail a range of improvements to prevent such a phenomenon as described in Section 5.5.5.

During site discharge events, water quality monitoring results downstream of the Lower Dam at Rocklow Creek (GS-3) was below limits for TSS. Any elevated TSS measurements were restricted to the immediate vicinity of the spillway (EPL7) and floodwater mixing zone (GS-2).

Figure 40 in Appendix E outlines the monitoring points for the most recently approved WMP.

5.5.1. Water Quality Impact Assessment Criteria

S4.C28 defers discharge limits to the limits imposed by EPL77 which states that the site will comply with discharge limits from condition L2.4 and Section 120 of the POEO Act. EPL77 describes discharge limits at the licenced discharge point for controlled discharge at the site at via the bio-filtration swale at EPL6. Total Suspended Solids must not exceed 50mg/L at this point. A second discharge point is nominated in EPL77 for uncontrolled discharge at the spillway at the Lower Dam at EPL7.

Monthly monitoring is undertaken at the Lower Dam at GS-1, GS-2 and GS-3 at Rocklow Creek to determine ambient conditions upstream, in the immediate vicinity of the Lower Dam spillway and downstream respectively.

Monitoring is also undertaken daily during any discharge event via either the licenced discharge mechanism at EPL6 or uncontrolled discharge at EPL7 as well as the upstream and downstream points at Rocklow Creek to determine if any impacts to water quality has occurred.

5.5.2. Surface Water Performance Review

Lower Dam water quality at EPL 8 is shown below in Table 17.

Table 17 Lower Dam Monthly Monitoring Results

Year / Month	pH	TSS (mg/L)	Turbidity (NTU)	Conductivity (uS/cm)	Oil and Grease
Jul-18	8.7	32	58.4	647	Not Visible
Aug-18	7.7	8	24.5	583	Not Visible
Sep-18	8	15	29.6	581	Not Visible
Oct-18	8.2	32	40.3	719	Not Visible
Nov-18	8.4	49	83.8	718	Not Visible
Dec-18	8.6	23	54.1	704	Not Visible
Jan-19	8.4	33	40	653	Not Visible
Feb-19	8.1	46	54.8	839	Not Visible
Mar-19	8	24	31.4	706	Not Visible
Apr-19	8.2	23	24	690	Not Visible
May-19	8.2	200	257	695	Not Visible
Jun-19	8.7	26	32.6	724	Not Visible
2018-2019 Average	8.3	42.6	60.9	688.3	>5

Typically water quality parameters were within TSS discharge limits within the Lower Dam for the reporting period with the exception of the May monitoring period which was undertaken on 4/6/19 during a period of intense rain. It is important to note that discharge limits do not apply to the Lower Dam. During typical operations the Lower Dam is offline to Rocklow Creek.

No controlled discharges via the bio-filtration swale at EPL6 were initiated during the reporting period. Typically the bio-filtration swale at EPL6 is not utilised as a discharge mechanism as water infiltrates back into the Lower Dam, reducing the effectiveness of the bio-filtration swale as a discharge mechanism. This issue has been highlighted in the updated water management plan and this discharge point is proposed to be decommissioned with the site not undertaking controlled discharge out of EPL6.

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A summary table of the associated monitoring points upstream and downstream of the Lower Dam is shown below in Table 18-20.

Table 18 Upstream Rocklow Creek Monthly Water Quality

Monitoring Point GS-1 Rocklow Creek Upstream of the Lower Dam Ambient Conditions						
Date		pH	TSS (mg/L)	Turbidity (NTU)	Conductivity (uS/cm)	Oil and Grease
July Monthly	6/08/2018	6.5	13	7.5	473	NV
August Monthly	5/09/2018	6.6	11	11.7	483	NV
September Monthly	4/10/2018	6.5	70	13.9	541	NV
October Monthly	2/11/2018	6.6	10	4.4	513	NV
November Monthly	29/11/2018	6.4	125	20	472	NV
December Monthly	19/12/2018	6.8	20	7.2	490	NV
January Monthly	18/01/2019	6.7	14	4.6	439	NV
February Monthly	6/03/2019	6.7	68	34.3	528	NV
March Monthly	29/03/2019	6.8	5	1	474	NV
April Monthly	2/05/2019	7.1	5	1	404	NV
May Monthly	4/06/2019	7.4	94	26.1	498	NV
June Monthly	2/07/2019	6.5	5	2.3	490	NV
Average		6.7	37	11	483	NV

Table 19 Rocklow Creek near Spillway Monthly Water Quality

Monitoring Point GS-2 Rocklow Creek Near Spillway Ambient Conditions						
Date		pH	TSS (mg/L)	Turbidity (NTU)	Conductivity (uS/cm)	Oil and Grease
July Monthly	6/08/2018	7.1	5	4.2	596	NV
August Monthly	5/09/2018	8.5	14	48.2	574	NV
September Monthly	4/10/2018	7.4	18	12.4	594	NV
October Monthly	2/11/2018	6.8	9	4.7	553	NV
November Monthly	29/11/2018	6.9	41	18.9	546	NV
December Monthly	19/12/2018	8.6	20	7.2	557	NV
January Monthly	18/01/2019	6.7	39	11.8	500	NV
February Monthly	6/03/2019	7.4	29	11.8	775	NV
March monthly	29/03/2019	6.6	12	5.7	507	NV
April Monthly	2/05/2019	7.5	29	7	474	NV
May Monthly	4/06/2019	8.1	136	144	746	NV
June Monthly	2/07/2019	6.7	5	2.5	524	NV
Average		7.4	30	23	570	

Table 20 Rocklow Creek Downstream Monthly Water Quality

Monitoring Point GS-3 Rocklow Creek Downstream at Property Boundary						
Date		pH	TSS (mg/L)	Turbidity (NTU)	Conductivity (uS/cm)	Oil and Grease
July Monthly	6/08/2018	Site dry				NV
August Monthly	5/09/2018	Site dry				NV
September Monthly	4/10/2018	Site dry				NV
October Monthly	2/11/2018	7.4	14	15.3	641	NV
November Monthly	29/11/2018	7.8	18	11.8	39500	NV
December Monthly	19/12/2018	6.5	58	43.8	641	NV

January Monthly	18/01/2019	7.1	11	6.9	556	NV
February Monthly	6/03/2019	Site dry				NV
March Monthly	29/03/2019	7.2	18	-	650	NV
April Monthly	2/05/2019	7.8	19	17.6	524	NV
May Monthly	4/06/2019	7.2	24	13.8	736	NV
June Monthly	2/07/2019	7.5	10	9.9	656	NV
Average		7.3	18.4	16.2	3241	NV

Monthly monitoring results at Rocklow Creek indicate the following:

- Ambient conditions upstream of the Lower Dam at GS-1 are occasionally elevated compared to the WQOs and discharge limits. This is likely due to the area being utilised for active cattle grazing. Cattle tend to stir up water during grazing and are often observed within Rocklow Creek during monthly sampling events.
- Ambient conditions in the vicinity of the mixing zone at GS-2 are typically within discharge limits with the exception of high rainfall events when floodwater are present.
- Ambient conditions at GS-3 at downstream Rocklow Creek are generally within discharge parameters. This location is sometimes dry, affected by saline tidal inflow and impacted by cattle grazing. During dry periods water level tends to be quite low. Cattle tend to stir up water during grazing and are often observed within Rocklow Creek during monthly sampling events.

Overall there were three (3) rainfall events which led to discharge from the Lower Dam via the spillway at EPL 7 on five (5) days. Two (2) of these rainfall events were outside the 95th percentile 5 day rainfall design capacity of the Lower Dam (90.7mm). Daily monitoring results associated with these events is summarised in the Table 21 below.

Table 21 Discharge Monitoring Summary

		pH				TSS(mg/L)				Turbidity(NTU)			
Rainfall	Date	GS1	EPL7	GS2	GS3	GS1	EPL7	GS2	GS3	GS1	EPL7	GS2	GS3
104.0	6/1/19	6.7	7.7	7.4	7.3	39	101	34	16	18.1	207	105	21.8
109.0	18/3/2019	6.9	7.8	7.0	7.0	38	28	30	24	21.5	100	32.5	19.5
109.0	19/3/2019	6.6	8.1	6.9	7.4	6	56	37	11	6.1	99.6	54.2	8.6
73.5	4/6/2019	7.4	8.2	8.1	7.2	94	141	136	24	26.1	226	144	13.6
73.5	5/6/2019	7.5	8.2	8.0	7.7	7	98	87	32	2.2	154	132	23.7

The discharge water quality monitoring results can be summarised below:

- TSS water quality parameters are occasionally elevated upstream of the Lower Dam at GS-1. This is likely due to the area being utilised for cattle grazing. Cattle tend to stir up water during grazing and are often observed within Rocklow Creek during sampling events.
- Occasionally TSS is elevated above discharge limits for TSS in the immediate vicinity of the spillway (EPL7) and Rocklow Creek mixing zone (GS-2) due to the inundation of floodwaters of Rocklow Creek.
- TSS water quality parameters met compliance limits downstream at Rocklow Creek at GS-3 in all instances of monitoring during discharge events from the Lower Dam during the reporting period.

- The monitoring results during high rainfall events and overtop events indicated that impacts are limited to the discharge mixing zone in the immediate vicinity of the spillway, with no impacts further downstream at Rocklow Creek due to suspended solids and minimal turbidity impacts. Average turbidity during rain events is still comparable with ambient averages from monthly monitoring.
- Downstream of the Lower Dam and the vicinity of the Lower Dam is surrounded by wetlands which remove any localised suspended solids rapidly before they impact Rocklow Creek downstream at GS-3.

There was one instance were the Lower Dam was unable to hold up to the 95th percentile 5 day rainfall event of 90.7mm as outlined in S4.C32. A notification was provided to the EPA within 7 days of the event and investigation of the overtop event on the 4th and 5th of June. An investigation report was provided once monitoring results were available.

Floodwaters from Rocklow Creek had risen up over the spillway and into the Lower Dam, which in turn, overflowed and spilled over. The floodwaters of Rocklow Creek then formed a mixing zone with the waters from the Lower Dam. Turbid water was visible both downstream and upstream of the spillway near the mixing zone at GS-2. Improvements to the WMP submitted to the department address methods to reduce instances of floodwater from Rocklow Creek inundating the Lower Dam, compromising its storage capacity.

A summary of the investigation report was submitted to the EPA and at time of writing Boral is still awaiting feedback from the EPA.

5.5.3. Water Balance

The updated WMP outlined a range of water balance scenarios based on different climate conditions. The dry year scenarios (10th percentile 791mm rainfall) best reflects rainfall for the FY19 period (which was 890mm). As a result the process water use was modelled to be 188ML for the reporting period. Licenced surface water take from WAL#25152 is 227ML. As such FY19 water balance results determine compliance with water take licence requirements.

The majority of surface water runoff from the quarry is captured in the site water management dams. Captured surface water runoff is either used as process water within the quarry operation, lost to evaporation or seepage, or discharged to receiving waters.

The capture of surface water runoff in the water management dams is considered to be excluded works under Water Management (General) Regulation 2011, Schedule 1, item 3 (dams solely for the capture, containment or recirculation of drainage). Accordingly, no WALs are required for the capture of surface water in the Middle Dam and Croome Pits.

Historically, all process water has been extracted from Lower Dam with most of the water expected to have been drawn from the Rocklow Creek alluvium via groundwater ingress into the dam.

5.5.4. Surface Water Long Term Analysis and Assessment

Figure 41-44 in Appendix E shows historical averages and trends for Lower Dam Water Quality Monitoring.

Lower Dam water quality monitoring was consistent with the previous period and was generally consistent the annual averages in the last 4 years. Historical trends of turbidity and TSS are generally

increasing due to the higher annual averages in 2012-13 and 2013-14 where multiple high rainfall floods occurred within the Illawarra. Typically in wetter years Lower Dam turbidity and TSS is on average which is to be expected as its purpose is a sediment capture dam.

5.5.5. Surface Water and Opportunities for Improvement

A new water management system was devised as part of the MOD 9 Surface Water Assessment where a number of improvements were proposed. It is a requirement of S4C35A that the Lower Dam is not altered until approval of the Lower Dam Transition Plan is obtained. The improvements to the water management system outlined in the updated WMP will reduce the instances where Rocklow Creek inundates the Lower Dam causing it to fill up. A summary of these improvements is reproduced in Table 22 below.

It is expected that feedback will be provided during the next reporting period and pending approval these works will be undertaken.

Table 22 Proposed Water Management Improvements in Updated WMP

Proposed Modification	Outcome
Relocate spillway to south-east side of the dam where Rocklow Creek levels are expected to be lower during large runoff events. Relocate primary sedimentation chamber to western end of dam. Raise embankment at existing spillway location from 2.8 to 4.0 m AHD.	• Significantly reduce the frequency of uncontrolled inflows from Rocklow Creek inundating the Lower Dam. • Improve water treatment function of Lower Dam during Rocklow Creek flood events. • Inflows will occur at the opposite end of the dam to outflows, resulting in longer residence time and improved sediment treatment function. • Provide vehicle access to primary sedimentation chamber to allow for sediment removal as required
Extend the dam footprint to the east by approximately 1,600m2 and excavate to 2.0 m AHD.	• Provide an additional 1.1 ML of storage above 2.0 m AHD. • Establish a macrophyte zone near the dam outlet.
The relocated spillway will have an invert level of 3.1 m AHD1, which will be 300 mm higher than the existing level (2.8 m AHD).	• Reduce the frequency of Rocklow Creek floodwaters inundating the Lower Dam. • Provide an additional 2.0 ML of storage above 2.0 m AHD.
Establish macrophyte zone within extended dam footprint area.	• Provide beneficial water quality treatment during significant rainfall (discharge) events.

Notes: 1. The spillway level of 3.1 m AHD represents the highest permanent water level proposed for the Lower Dam.

A numbering of new metering regulations will be rolled out by NRAR during the next reporting period which will require upgrades to the metering system utilised at the quarry.

5.6. Groundwater Management

As a result of the Dunmore Quarry Western Expansion, EMM Consulting Pty Ltd has published an annual groundwater monitoring report using the established down gradient bores at Dunmore Sand and Soil (DG-31, DG-59 and BH-F and 3 established up gradient bores at Dunmore Quarry (GW-1, GW-2 and GW-3).

Location of Groundwater monitoring locations and the final report is contained within Appendix F

The monitoring bores are located up hydraulic gradient from current quarrying activities and are therefore considered representative of baseline conditions (both water levels and quality).

Groundwater monitoring for the up gradient bores includes six-hourly groundwater level measurements and six monthly groundwater sampling events.

5.6.1. Groundwater Impact Assessment

Groundwater impacts relating to quality and water levels downgradient are assessed in relation to the up-gradient (baseline) conditions located in bores GW-1, GW-2 and GW-3 and against the site conceptual model which was formulated as part of the MOD 9 Croome West Expansion.

5.6.2. Groundwater FY19 Performance Review

The main findings of the monitoring results within the FY19 reporting period are summarised below:

Groundwater levels are recorded every six-hours allowing water level trends to be identified in the alluvium and the Bumbo Latite. Six monthly sampling of water quality at all sites also established useful trends.

The main findings for the 2018/2019 monitoring year regarding water levels are:

- Groundwater levels in the alluvium at the DSS sites show a direct response to rainfall and minor tidal influences; and
- Groundwater levels in the Bumbo Latite monitoring bores vary spatially between the three monitoring bores. Groundwater levels are the highest at monitoring bore GW2 (128 mAHD) and lower at monitoring bores GW1 (between 100 mAHD and 110 mAHD) and GW3 (105 m AHD). Groundwater levels are steady after a slight decline at GW1 and GW3 corresponding with continued below average rainfall. GW2 shows little response to rainfall.

The main findings for this monitoring year regarding water quality are:

- Groundwater quality at the alluvial monitoring sites was consistent with historical data, except DG-31 showing chlorine anions dominant over bicarbonate in this monitoring year. The newly monitored DG-17 has elevated phosphorus in comparison to the rest of the alluvial sites; and
- Groundwater quality in the Bumbo Latite is marginal to brackish, of near neutral to alkaline pH. Groundwater in the latite is dominated by sodium and bicarbonate and is elevated in silica reflecting the mineralogy of the host rock. Dissolved metals and nutrients are detected at overall low concentrations. Groundwater quality remains constant and was comparable to results from the previous monitoring years.

The results for the 2018/19 monitoring year are consistent with the conceptual model for the project.

5.6.3. Groundwater Long Term Analysis and Assessment

The results for the FY19 monitoring are in agreement with the conceptual model for the project. This data will inform the updated Water Management Plan for Mod 9 operations which will include a groundwater monitoring program as per Schedule 4 Condition 44.

5.6.4. Groundwater Opportunities for improvement

Another groundwater bore will be identified to replace DG59 which was demolished as part of dredging operations at the adjacent DLSP.

5.7. Flora and Fauna Management and Rehabilitation

Most areas of the site are currently operational and as such rehabilitation is not able to commence on the majority of areas within the quarry until the completion of extraction activities. When practical, progressive rehabilitation of the site will be undertaken in conjunction with on-going quarrying works. Rehabilitation activities undertaken to date have been in accordance with the updated Flora and Fauna Management by EMM (2019) and Rehabilitation Management Plan prepared by Arcadis (2016).

There are three (3) designated conservation areas for Dunmore Quarry as shown in Figure 4 below.

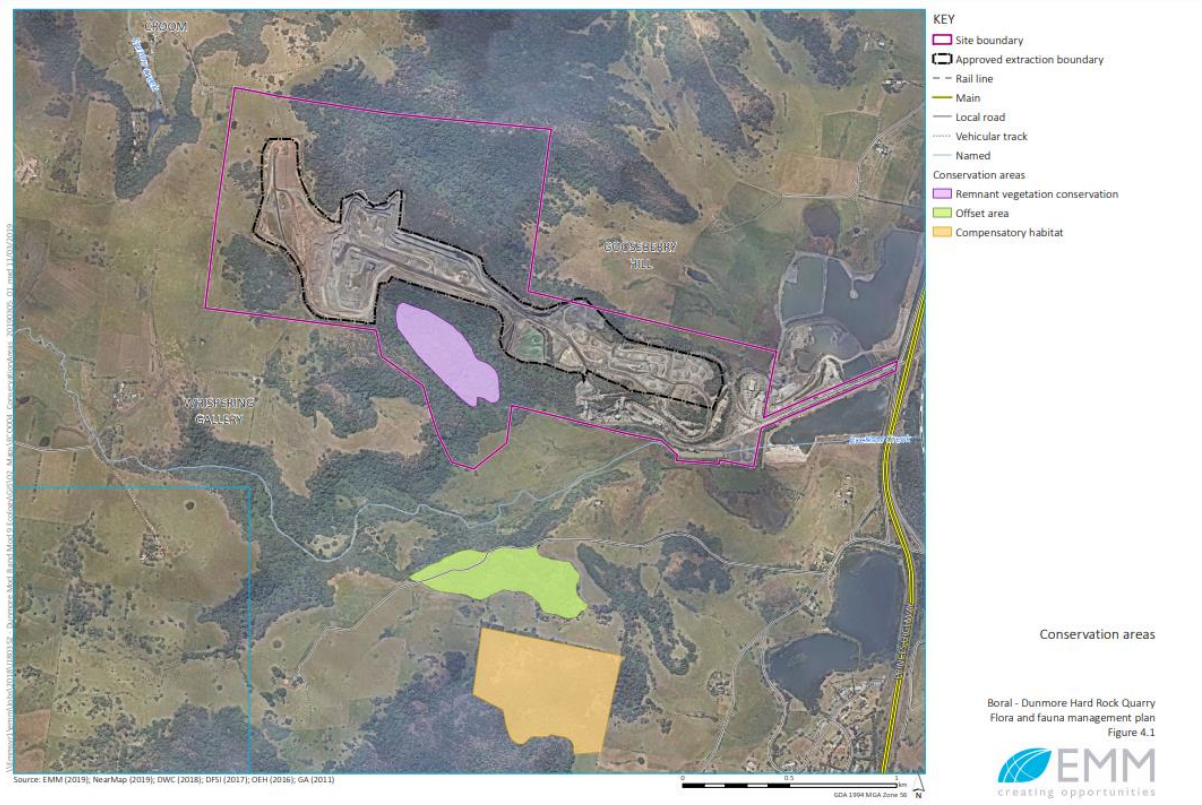

Figure 4 Location of Dunmore Quarry Conservation Areas

These are the Compensatory Habitat Area (CHA), Remnant Vegetation Conservation Area (RCVA) and Offset Area (OA). Works in the last reporting period focussed on the CHA and OA.

In the last 12 months rehabilitation within the quarry itself has continued on the Croome West amenity bund. Hydro-seeding took place in the northern section of the bund in November 2018 and April 2019 with more infill seeding to occur in the next reporting period.

5.7.1. Rehabilitation Assessment Criteria

During the reporting period the FFMP was being updated by Boral and reviewed by OEH/DPIE. Rehabilitation Assessment criteria continued under the recommendations of the vegetation assessment undertaken in 2017. A summary of this criteria is summarised below:

- Protect and enhance the remnants of the existing vegetation communities: Illawarra Dry Subtropical Rainforest, Illawarra Grassy Woodland and Melaleuca Armillaris Tall
- Shrubland

- To reduce the area of Boral Dunmore Quarry natural areas impacted by Noxious Weeds, WoNs and environmental invasive weeds.
- Treat significant woody weeds throughout establishing 10 – 15 year old revegetation areas to assist development and establishment
- To improve connectivity between local remnant bushland fragments through weed
- control activities, regeneration and planting
- Assist natural regeneration by removing significant weed species using bush
- regeneration techniques and methods
- Monitor works, progress and completing using visual based documentation

5.7.2. Rehabilitation Performance Review

A summary of the bushland regeneration works undertaken within the Offset Area and Compensatory Habitat Area is outlined in Bushland Restoration Project Final Report in Appendix G

5.7.3. Rehabilitation Long Term Analysis and Assessment

Summaries of progress against previous years' work is detailed in the vegetation condition assessment within Appendix G. To summarise;

- In the OA, dry conditions resulted in very little weed regrowth effectively breaking the seed cycle in previously worked areas. Secondary weed control reinforced the disruption of the weed seed cycle.
- Due to the dry spell there was little regeneration of native species although the rainforest zone show good recruitment within canopy areas.
- Primary weed control has been carried out within all fragments of the CHA and have now been linked in one continuous management areas.
- In the CHA, primary weed control has focused within the northwest of the site and will expand into further zones. Within worked areas photo-point monitoring showed a reduction of woody weeds in the mid stratum, ground and shrub layer.

5.7.4. Rehabilitation Summary and Opportunities for Improvement

Completion criteria was designed in the updates to the FFMP which was approved in June 2019. The next 12 months will focus on progress towards attaining the completion criteria for applicable areas.

The following completion criteria are outlined for the Compensatory Habitat Area:

- establishment of a dominant native canopy cover across the Compensatory Habitat Area, as per below:
    - midstory canopy cover of 50% for areas of Melaleuca Armillaris Tall Shrubland; and
    - overstory canopy cover of 15% for areas of Illawarra Lowlands Grassy Woodland;
- removal of woody weeds across the Compensatory Habitat Area; and
- reduction in exotic groundcover to less than 30% over five consecutive monitoring periods.
- Once these completion criteria have been met, no further management of this area is required under this FFMP and Conditions 46(a) and 49 are deemed to have been satisfied.

The following completion criteria are outlined for the Remnant Vegetation Conservation Area:

- maintenance of high-quality intact remnants, with no significant change in cover of native species;
- establishment of a dominant native canopy cover of 15% in the lower (south-eastern) portion of the Remnant Vegetation Conservation Area; and

- Establishment of a predominantly native (>50%) groundcover, with maintenance of this native groundcover over five consecutive monitoring periods.

Once these completion criteria have been met, no further management of this area is required under this FFMP, and Conditions 46(b) and 50 are deemed to have been satisfied.

There is no completion criteria set for the offset area as the area is managed via an in-perpetuity arrangement via a conservation agreement. A Conservation Agreement between the Minister administering the National Parks and Wildlife Act (1974) and Boral Resources for Dunmore Quarry was signed by NSW Minister for the Environment on February 2011. The NSW Minister for the Environment confirmed signing the Dunmore Quarry Conservation Agreement, and acknowledged that the Conservation Agreement satisfied condition 46A of DA 470-11-2003, for the long term security of the Offset Area.

For the bio-diversity offset strategy as art of MOD 8 and 9 operations Boral will pay into the BCT as per approved arrangements contained within the FFMP.

5.8. Heritage Conservation

Kelleher Nightingale Consulting Pty Ltd was engaged by Boral to undertake a detailed Aboriginal archaeological assessment and prepare an Aboriginal Cultural Heritage Assessment Report (CHAR) to inform the Modification 9 EA.

An Aboriginal Cultural Heritage Management Plan was subsequently prepared for the project, detailing the required Aboriginal heritage management and mitigation measures. The plan was prepared in consultation with OEH and Registered Aboriginal Parties in accordance with condition 64 of the Modification 9 consent (approved September 2017) and is available on the Boral Dunmore webiste.

The archaeological salvage program was completed in October 2017 (outside the current reporting period) in accordance with the MOD 9 conditions of approval, requirements of the AHMP and approved salvage methodology outlined in the CHAR.

Archaeological salvage excavation and mitigation for the impact of the Croome Farm Pit expansion project on Aboriginal heritage has been completed for Croome West AFT 1 (AHIMS 52-5-0851) and Croome West AFT 2 (AHIMS 52-5-0850). Archaeological excavation and mitigation was not required for Croome West AFT 3 (AHIMS 52-5-0849).

Boral is committed to effective consultation with the local Aboriginal community regarding their activities and Aboriginal cultural heritage values. Registered Aboriginal Parties have been consulted and provided with an opportunity to participate in the assessment and management of Aboriginal heritage values. Consultation with Registered Aboriginal Parties has followed OEH consultation requirements as applicable Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW 2010a). Registered Aboriginal stakeholders participated in the salvage excavations.

Specific management and mitigation measures to be implemented prior to development impact included salvage excavation of sites or areas of archaeological significance: Croome West AFT 1 (AHIMS 52-5-0851) (CW1); Croome West AFT 2 (AHIMS 52-5-0850) (CW2).

The salvage operations of these study areas has mitigated the identified Aboriginal heritage constraints prior to any pre-construction or construction activities which may harm Aboriginal objects at these site locations. A total of 1,188 artefacts were recovered during the salvage

excavation program undertaken in October 2017 (outside of this reporting period), with 76 m2 excavated across the two sites.

A draft report has been completed in September 2018 by Kelleher Nightingale and management actions are summarised below:

In accordance with the AHMP, salvaged Aboriginal objects will be managed at a temporary storage location for analysis and reporting purposes and lodged for long term management with the Australian Museum. Deposition of the significant archaeological assemblage at the Australian Museum ensures ongoing access and appreciation of the artefact assemblage for current and future generations.

The short term management of excavated Aboriginal objects is as follows:

- Any Aboriginal objects that are removed from the land by actions authorised by the project approval, must be moved as soon as practicable to the temporary storage location (see below) for analysis, reporting and preparation for the long term management of the Aboriginal objects.
- The temporary storage location is: Kelleher Nightingale Consulting Pty Ltd, Level 10, 25 Bligh Street, Sydney NSW 2000.
- Any Aboriginal objects stored at the temporary storage location must not be further harmed, except in accordance with the conditions of the approval.

The long term management of excavated Aboriginal objects is as follows:

Once all analysis has been completed, recovered objects will be lodged with the Australian Museum in accordance with the Australian Museum Archaeological Collection Deposition Policy

For the next reporting period focus will be on consultation with relevant parties to finalise the draft salvage report and commence with the long term management actions detailed above. Once finalised the report will be published on the Boral Dunmore website Areas of new disturbance will continue to be monitored for any unexpected finds as per the ACHMP.

5.9. Waste Management

Boral is committed to continuing non-production waste management minimisation in accordance with the waste hierarchy, and minimising the amount of waste sent to landfill. To achieve this, all liquid and solid wastes are classified and sorted so they can be appropriately re-used or recycled. Waste is managed by appropriately licenced sub-contractors and entered into a waste tracking register.

5.9.1. Waste Minimisation

Boral is committed to ensuring its extraction and processing activities produces minimal waste rock material. Approximately 30% of the hard rock processed at Dunmore Quarry becomes material of less than 4mm in diameter, which is known as quarry fines. In the past, quarry fines were considered a product waste and stockpiled due to having no steady market, however the material is now used in manufactured sand (as opposed to natural sand) production. Dunmore Quarry transfers quarry fines to the Boral owned Dunmore Lakes Sand Project (DLSP) site for blending to produce manufactured sand.

During the reporting period, 36,000 tonnes of quarry fines was transferred to the adjacent DLSP site for manufactured sand production, backfilling and progressive rehabilitation.

New recycling bins have been commissioned in high pedestrian areas outside the office to encourage the recycling of applicable waste.

5.9.2. Waste Tracking Register

A detailed breakdown of the waste collected on-site during the reporting period is shown below in Table 23. Yearly trends are shown in Table 24.

Table 23 FY19 Waste Tracking Register

Month	General Waste (t)	Cardboard (t)	Commingle (t)	Timber (t)	Scrap Metal (t)	Oil Rag (t)***	Oil Filter (t) **	Oil/Oily Waters (L)	Effluent (L)
Jul-18	8.178	0	0.135	1.68	7.06	0.08	0.032	3800	15,500*
Aug-18	8.513	0.085	0.09	1.86	8.3	0	0	4100	15,500*
Sep-18	1.953	0.183	0.09	0	9.34	0.08	0.032	3700	15,500*
Oct-18	1.651	0.16	0.045	0.82	0	0.08	0.032	4400	16000
Nov-18	1.85	0.09	0.135	1.08	7.3	0.08	0.032	3600	17000
Dec-18	1.537	0	0.045	0	5.8	0	0	4000	16000
Jan-19	3.677	0.289	0	0	0	0.08	0.032	3100	21000
Feb-19	5.83	0.005	0.09	1	7.14	0	0	4400	14000
Mar-19	0.965	0.118	0	0	8.92	0.08	0.032	4200	10000
Apr-19	0	0	0	0	2.7	0	0	3900	13000
May-19	7.66	0	0	6.8	53.66	0.08	0.072	4100	18000
Jun-19	0	0	0	0	0	0.08	0.032	3600	15000
Total	**41.814**	**0.93**	**0.63**	**13.24**	**110.22**	**0.64**	**0.296**	**46900**	**140000**

*Effluent data for July -September 2018 is unavailable, substituted with the average monthly total for October 2018 - June 2019.
** Based on an average weight of 0.004 tonne per filter bin
*** Based on an average weight of 0.04 tonne per filter bin

Table 24 Waste Tracking Annual Trends

Waste Classification		FY17	FY18	FY19
Solid Waste	General Waste (t)	45.123	38.032	41.814
	Cardboard Tonnes (t)	2.152	1.531	0.93
	Timber Tonnes (t)	8.14	13	13.24
	Comingle Recycling (t)			0.63
	Used Oil Filters/ Rags (t)	-	2.4	0.936
	Scrap Metal (t)			110
Liquid Waste	Oil/Oily Water Litres (L)	25,400	43,250	46,900
	Effluent Litres (L)	60,000	61,000	140,000
	Other Litres (L)	400	0	0

5.9.3. Waste Tracking Opportunities for Improvement

More improvements have been planned for the next reporting period to encourage the use of recycling office waste by making more recycling bins available. Further work will continue with subcontractors to optimise the record keeping for waste collection.

5.10. Incident and Emergency Response Management

The following management actions were undertaken in regards to incident and emergency response.

- The Pollution Incident Response Management Plan was updated in October 2018. The current version is available online at.
- A Site Emergency Response Plan is available onsite in order to outline procedures in the case
- A Bushfire Management Plan was updated to inform protocols in place in the case of a fire on-site or in the surrounding areas.
- Vehicle pedestrian safety audit was undertaken during the reporting period. Car park and traffic areas were refurbished to remove pedestrian and vehicle interactions wherever possible.

5.11. Dangerous and Hazardous Goods Storage

Storage of dangerous goods and hazardous material have continued as per established operations. All dangerous goods and chemicals are handled and transported in accordance with the AS1940 and AS25956 and the Dangerous Goods Code and S4.C72.

6. Community

The Dunmore Quarry Community Consultative Committee (CCC) continues to serve as a valuable dialogue between Boral and the local community with valuable input and feedback being provided by the community regarding quarry operations and plans. The CCC is run as per S5.C6 and the Departments Community Consultative Committee Guidelines for State Significant Developments (2016).

Members include:

- An independent chairperson
- At least 2 representatives from Boral (typically the environmental co-ordinator and quarry manager)
- A member from Shellharbour City Council
- Three local community representatives

Members are informed of the environmental performance of the site, provided with an update on operations and given a chance to tour the site and ask questions they may have regarding the operation. CCC members have also been diligent in disseminating the information from the meetings to other interested community members in the local area. The minutes of each meeting is published in the Boral website.

https://www.boral.com.au/locations/boral-dunmore-operations

The CCC met twice during the FY19 reporting period (August 2018 and February 2019).

6.1.1. Environmental Complaint Management

Insert tables, no formal complaints received in the FY19 reporting period. Discuss trends from table which will be same as last year.

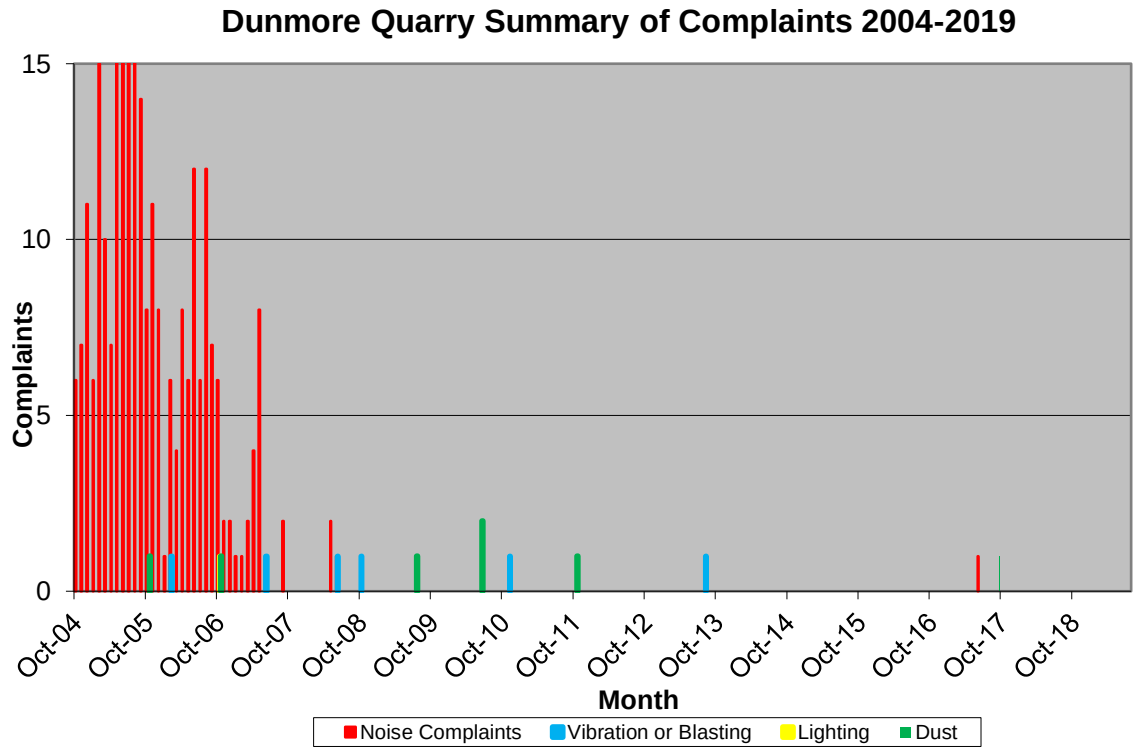

Figure 5 Dunmore Quarry Summary of Complaints

7. Summary of Regulatory Notifications

One regulatory notification was received during the last reporting period. A formal warning letter was received from the EPA on 16 April 2019 for a failure to comply with licence condition R4.1. This condition requires Boral to report to the EPA within 7 days of a monitoring blast exceeding the 95% limits for Airblast overpressure and/or ground vibration.

This was reported by Boral to the EPA in the 2017-18 Annual Return that on two occasions in February the 95 percentile limit was reached and were not reported within the 7 day timeframe.

Boral did not exceed these limits for more than 5% of the total blasts during the Annual Return reporting period.

In the formal warning letter, the EPA invited Boral to undertake a review of Condition R4.1 and whether it is considered appropriate or relevant to quarry operations. Boral exercised this option and met with the EPA on 4 June 2019 and requested a variation to remove this condition which was granted.

The requirement to report an exceedance of 100% limits for blasting to the EPA within 7 days is still in place.

8. Activities to be completed by next reporting period.

The following actions are scheduled for completion in the next reporting period:

- 2020 Independent Audit
- Dilapidation report for flour mill at McParlands
- Weather station upgrades and Real time monitor installation
- Install cameras on Rocklow Road to deter illegal dumping.
- Continue rehabilitation and revegetation through offset areas
- Continue hydroseeding and maintenance of Croome West Bund
- Upgrades to lower dam (depending on direction/status of approval of WMP.
- Continue correspondence with DPE/EPA in reference to Lower Dam Transition Plan and Dam upgrades.
- Update metering to align with new regulations rolling out in December 2019.
- Finalise draft salvage report and publish on Dunmore website
- Commence with long term management strategies regarding storage of Aborigial artefact as per ACHMP and finalised salvage report.

9. Conclusion

Dunmore Quarry has continued to focus on ensuring the environment and neighbouring community are not adversely impacted by quarry operations. Throughout this reporting period extraction and processing of quarry materials has remained consistent with previous years. During the reporting period MOD 11 was approved.

The 2018-19 revolved around enacting a number of major operational and procedural changes as part of the updated environment management plans for the MOD 9 Croome West Expansion. The next reporting period will contain a strong focus on maintaining regulatory compliance and optimising management actions established in the FY19 reporting period.

10. Appendix A Meteorological Monitoring

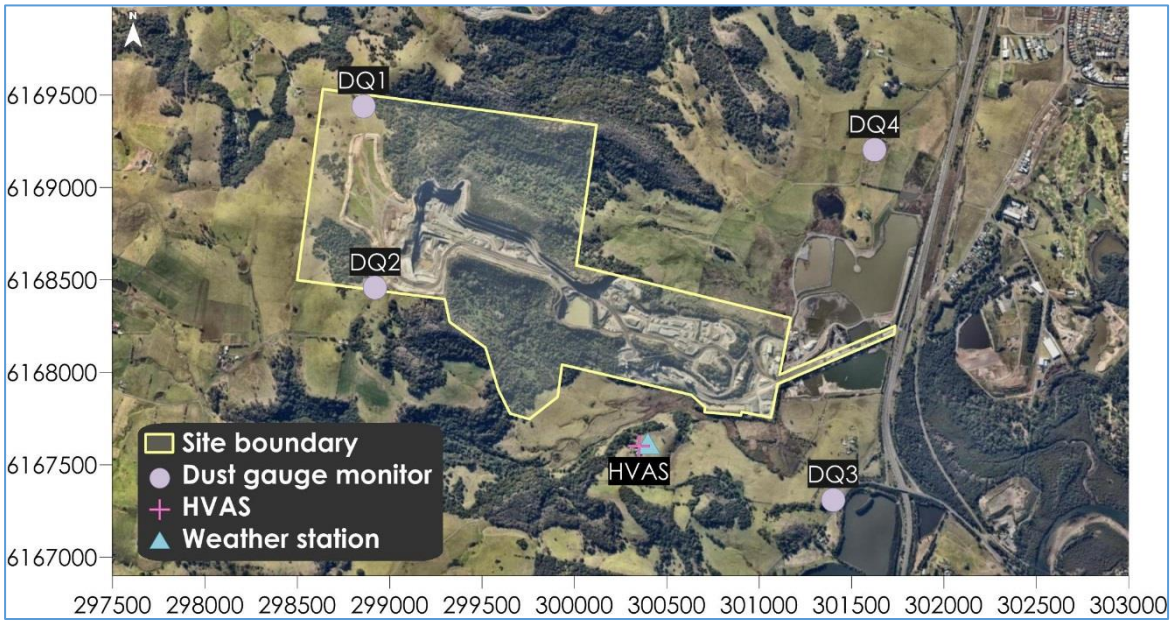

Figure 6 Weather Station Location

A monthly review of weather data is undertaken by the environmental co-ordinator. Important meteorological conditions assessed are rainfall, wind speed direction and atmospheric stability.

Rainfall data has been collected since FY2003. A summary of the rainfall measured from the Dunmore Quarry weather station is shown below in Table 25. Shown in red are the dates where rainfall was above the regional average.

Table 25 FY19 Monthly Rainfall Summary

	Rainfall (mm)		
Month	FY19	Site Average	Regional Average
July	6	54.0	49
August	31	66.0	53.5
September	41.5	49.2	42.7
October	128	72.0	64.5
November	92	93.6	83.1
December	90.5	89.1	67
January	143.5	80.5	72.9
February	35.5	140.5	140.5
March	156.5	137.2	122.3
April	48.5	88.9	73.8
May	13.5	65.5	55.8
June	103	123.6	93.7
Total	889.5	1060.1	925.6

Table 26 Dunmore Weather Station Historical Rainfall Summary

	Rainfall (mm)																		
Month	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	Site Average	Regional Average
July	20	23.5	54.2	41	96	30.5	63.5	35.5	78	194	39	61.7	5	48	97.5	25	6	54.0	49
August	13.5	38.5	23	3	42.5	58.5	39	0.5	72	85.5	4.5	17	252	327	76	39	31	66.0	53.5
September	14	7.5	40.6	33	101	39	56	19.5	145.5	58.5	11.5	85.5	48.7	82	51	1	41.5	49.2	42.7
October	6.5	49	245.4	48	0	17	79	125.5	126	124.5	83.5	6.5	102.5	36.5	32	14.5	128	72.0	64.5
November	17	149.5	126.8	144.5	39.5	161.5	46.5	65	198	163.5	25	173	24	48	33	85	92	93.6	83.1
December	70	40.5	136.2	36.5	54	120	112.5	80.5	147.5	63	32	70.5	233.5	116.5	58	53	90.5	89.1	67
January	68	30.5	128.8	90	0	65.5	9.5	79	59.5	50.5	183	43.5	192.5	155.5	32.5	36	143.5	80.5	72.9
February	112	70	180.4	87.1	186.5	351.5	107.5	197.5	48	257.5	142.5	59	112.5	29.5	283	128.5	35.5	140.5	140.5
March	121	84	118	43.5	67.5	36.5	39	74	362.5	196	23.5	326	57	145	441	41.5	156.5	137.2	122.3
April	91.5	200	24.4	8	145	90.5	106	63	37.4	87.5	136	64.5	305	37.5	40.5	26.1	48.5	88.9	73.8
May	427.5	43.5	85.6	65.5	23	8	20	80.5	58.3	9.5	81	13	53.5	35.5	51.5	44	13.5	65.5	55.8
June	74.5	42	84.4	124	318.5	85.5	67	52	92	89	239	34	76	429	57	133.5	103	123.6	93.7
Total	1036	778.5	1248	724.1	1074	1064	745.5	872.5	1425	1379	1001	954.2	1462	1490	1253	627.1	889.5	1060.1	925.6

The measured wind conditions experience on site for FY19 is shown below in Table 27. Monthly wind roses and seasonal wind roses are shown in Figure 7to Figure 19.

Table 27 Summary of Monthly Wind Data

Period	Mean Speed (m/s)	Peak Frequency (%)	Peak Direction	Percent Calm (%)
July	2.53	34.14	WSW	2.86
August	3.29	29.03	WSW	2.52
September	2.77	25.10	WSW	4.58
October	2.99	12.37	WSW	5.48
November	3.01	15.38	WSW	5.24
December	2.48	17.78	WSW	7.53
January	2.28	13.10	NNE	14.42
February	2.74	13.80	N	11.64
March	2.63	14.52	WSW	12.33
April	1.97	26.67	WSW	13.92
May	2.47	33.13	WSW	8.90
June	2.42	27.53	SW	12.85

Note: Wind measurements are taken over a 15 minute interval. Calm is defined as less than 0.3m/s.

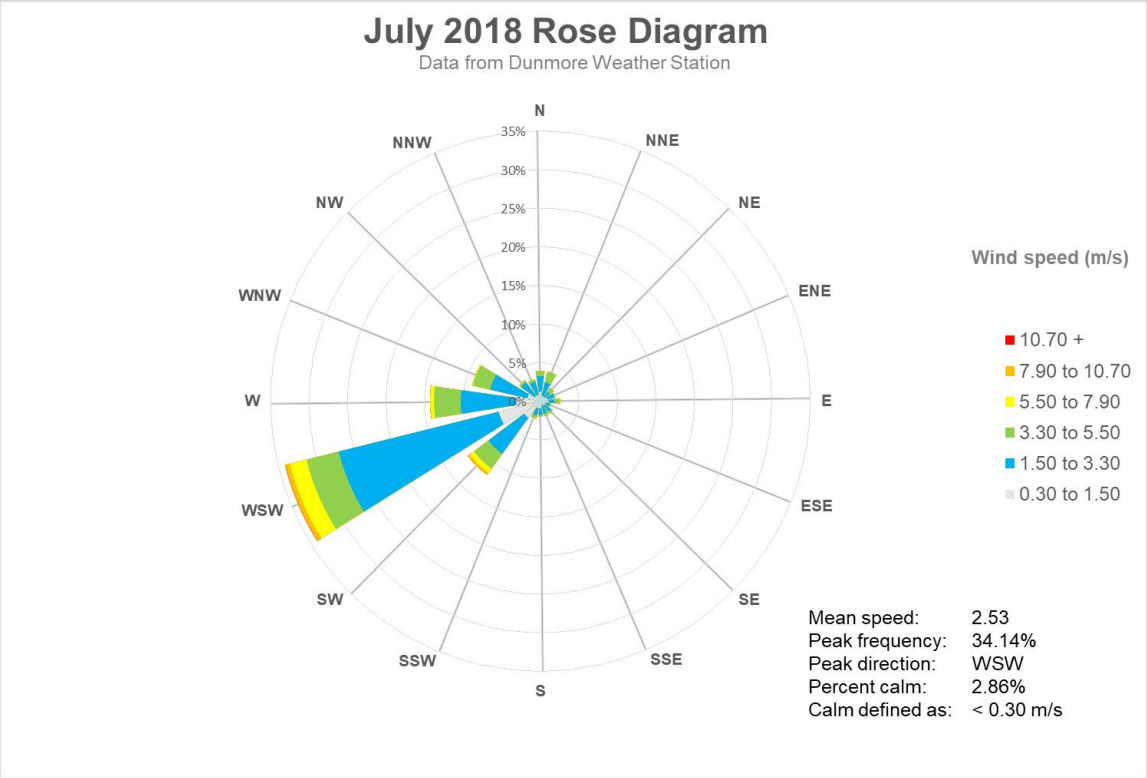

Figure 7 July Wind Rose Data

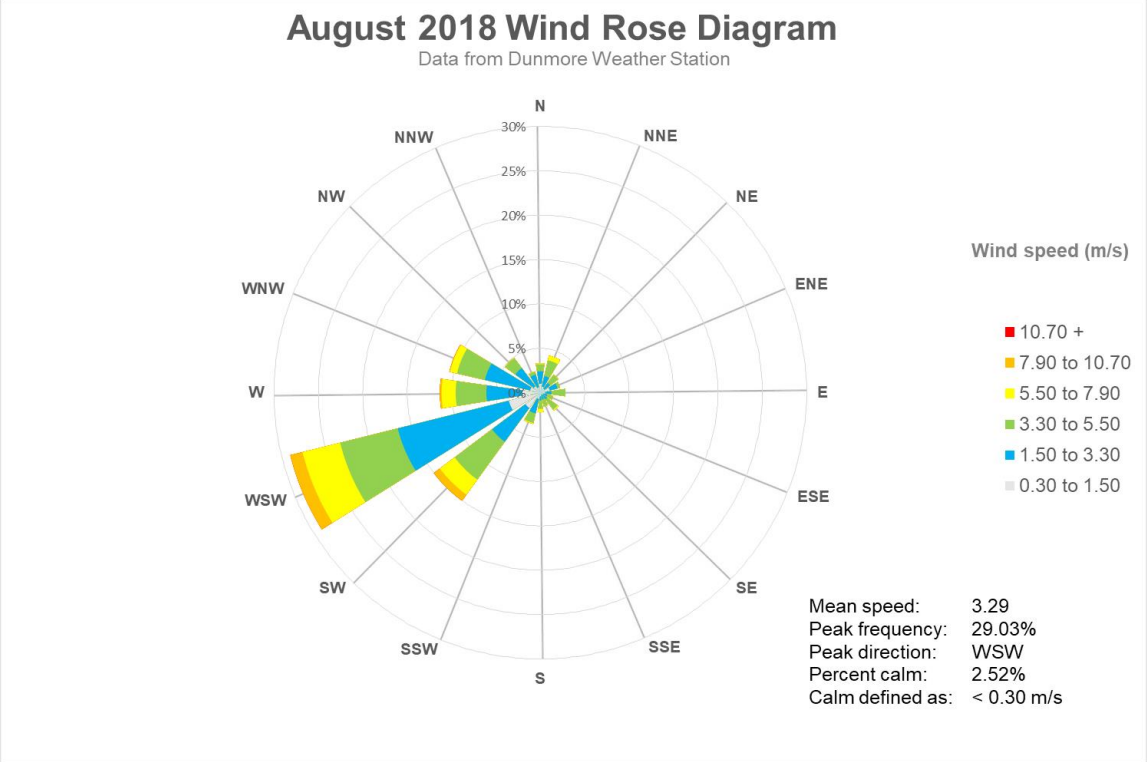

Figure 8 August Wind Rose Data

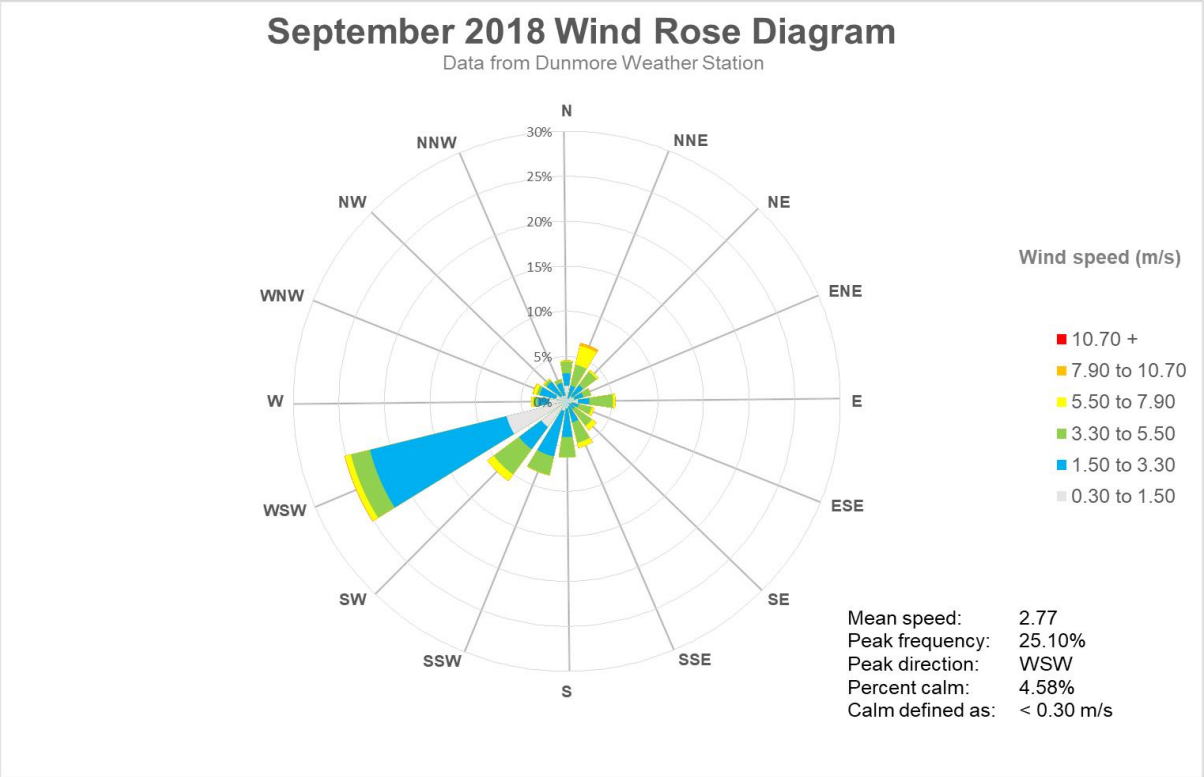

Figure 9 September Wind Rose Data

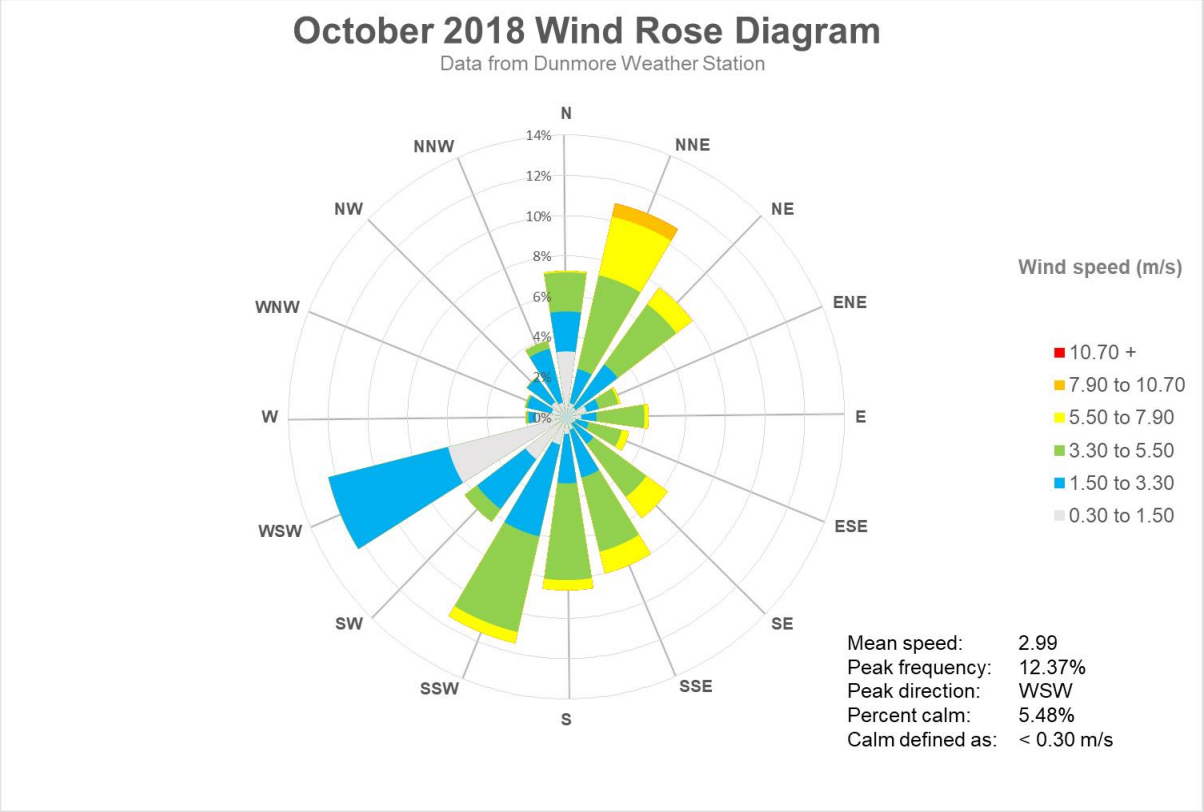

Figure 10 October Wind Rose Data

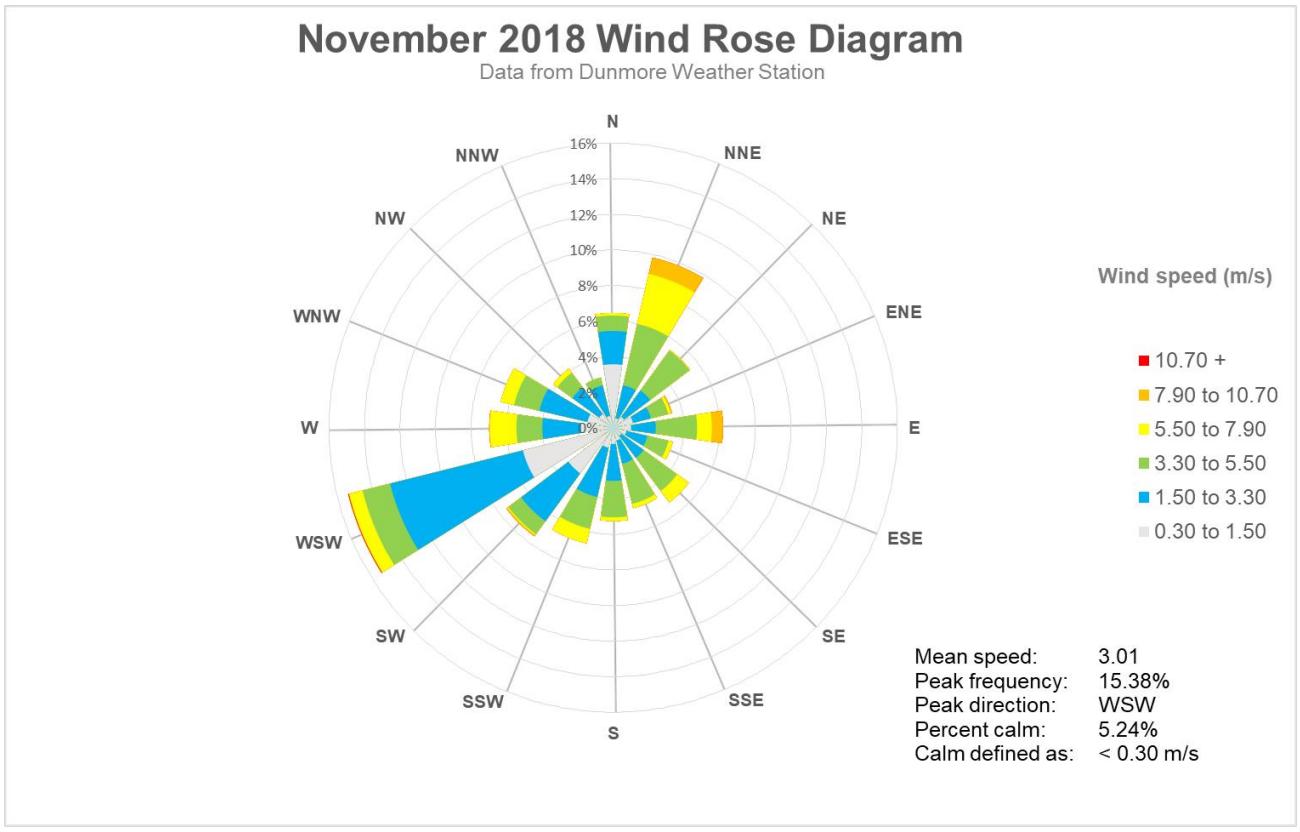

Figure 11 November Wind Rose Data

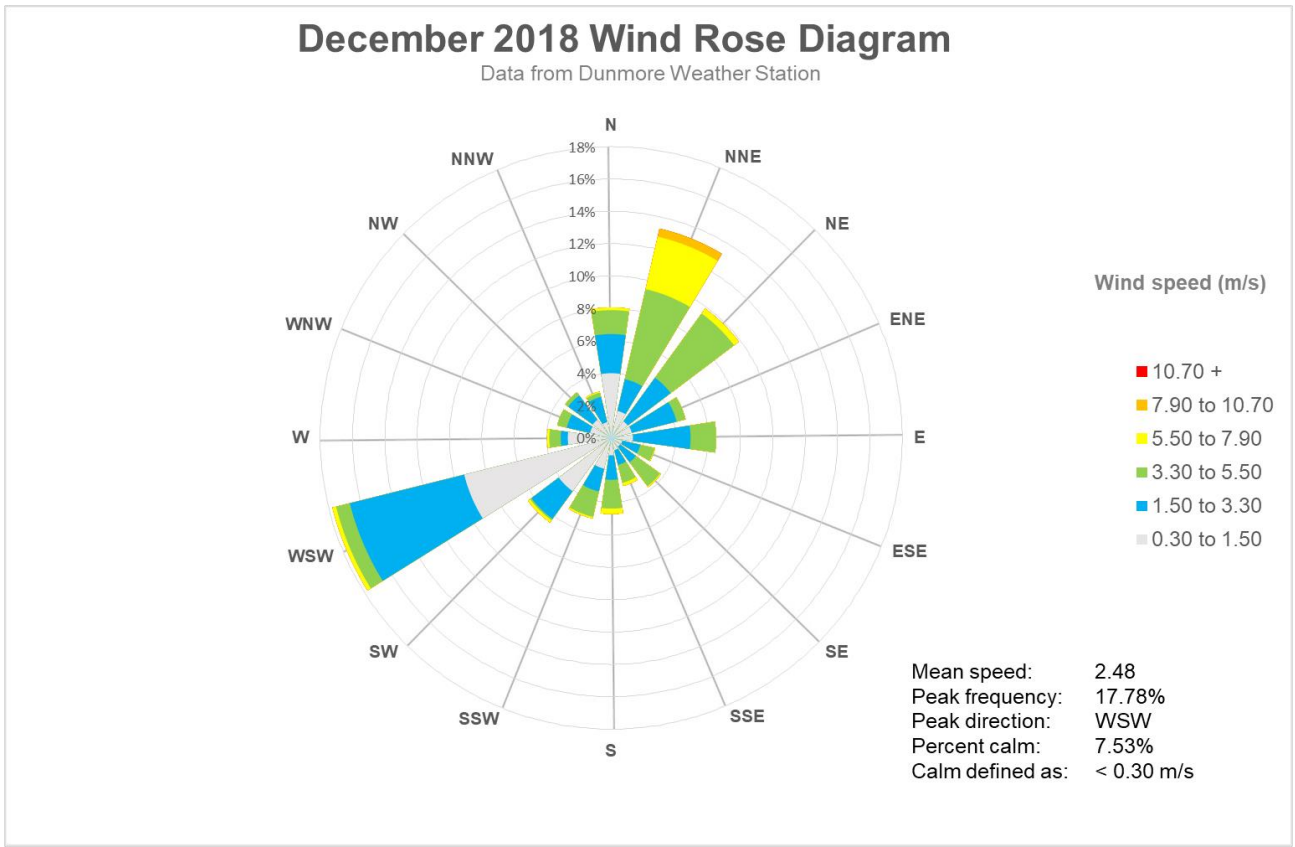

Figure 12 December Wind Rose Data

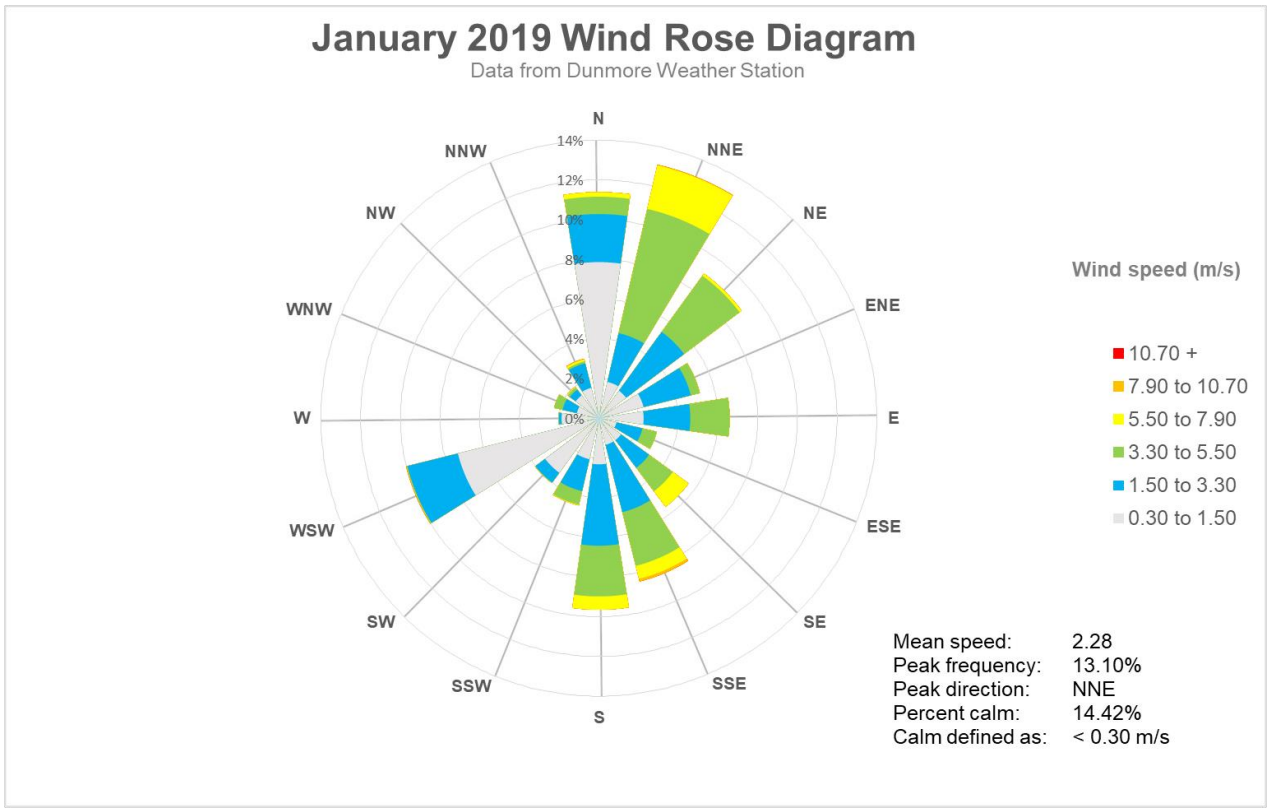

Figure 13 January Wind Rose Data

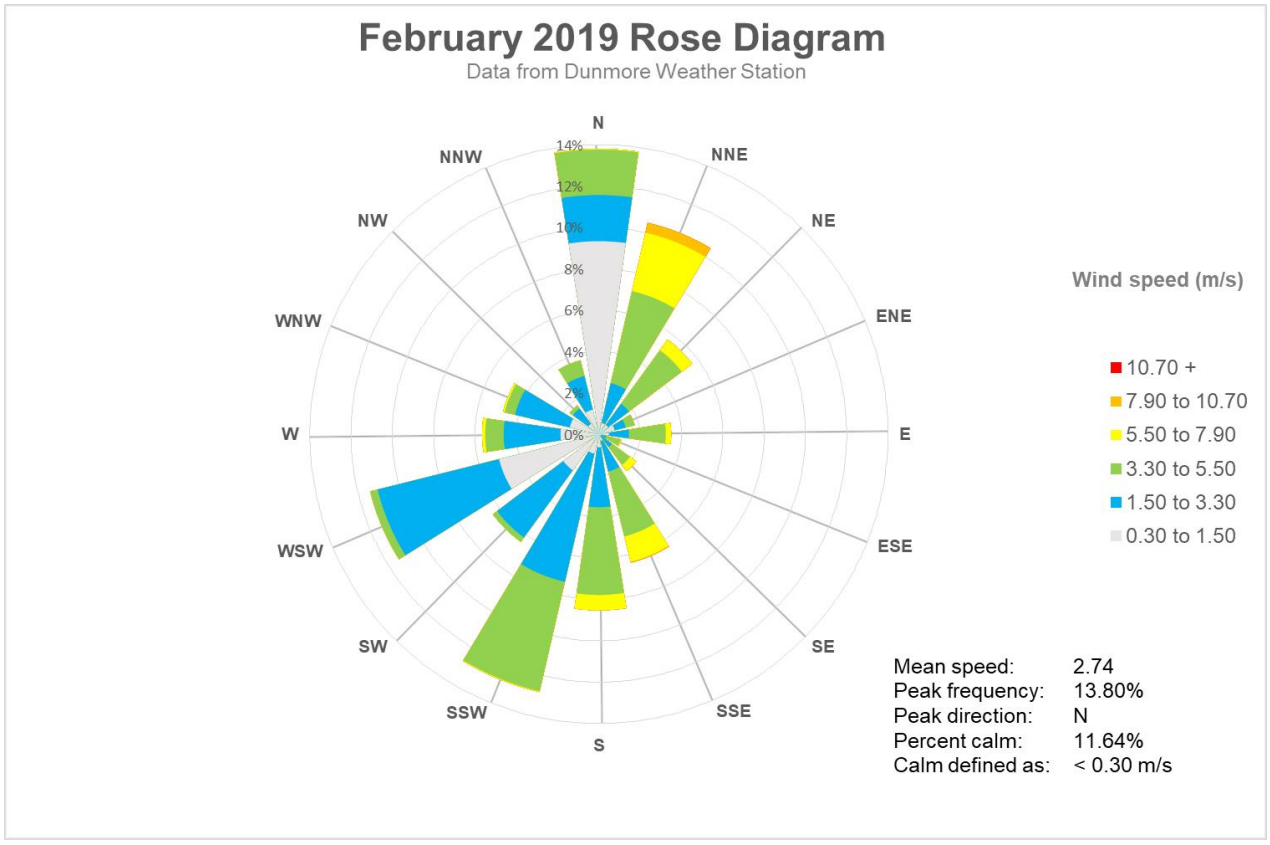

Figure 14 February Wind Rose Data

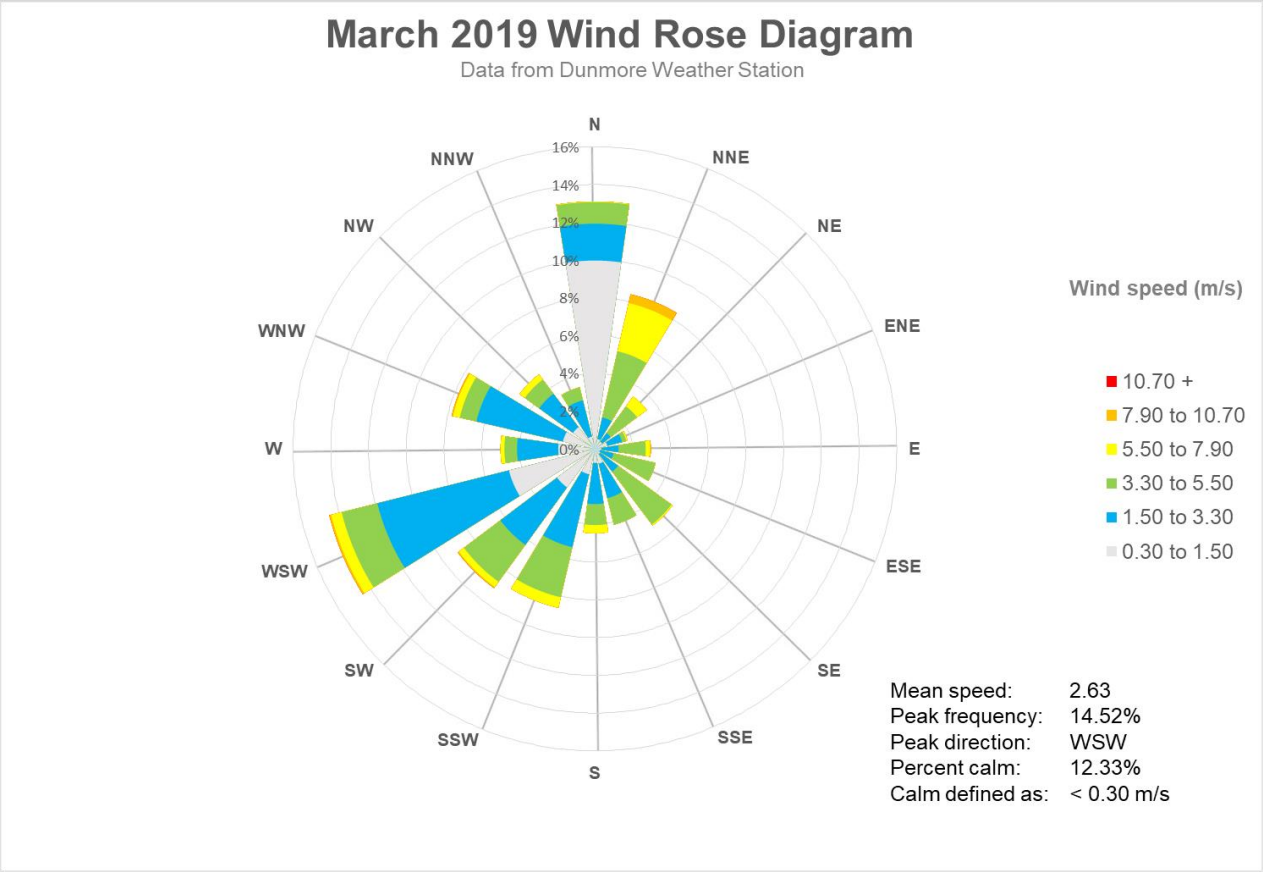

Figure 15 March Wind Rose Data

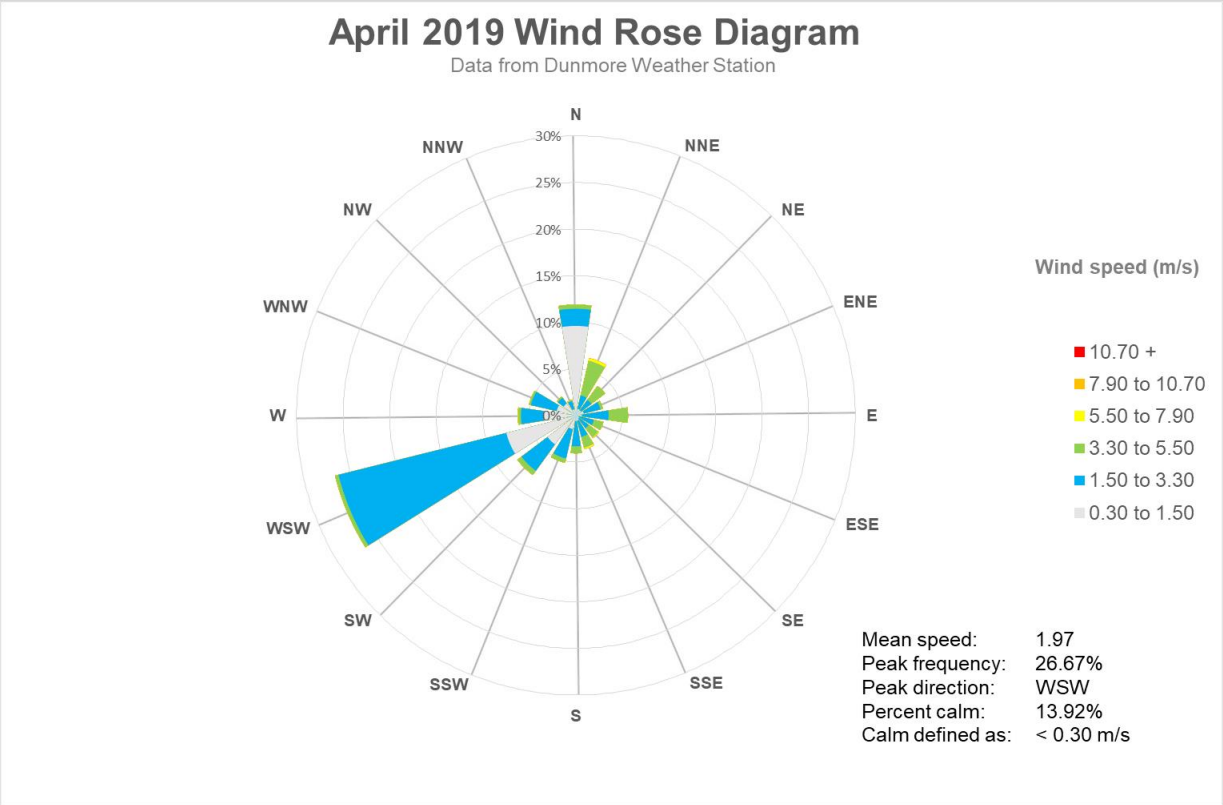

Figure 16 April Wind Rose Data

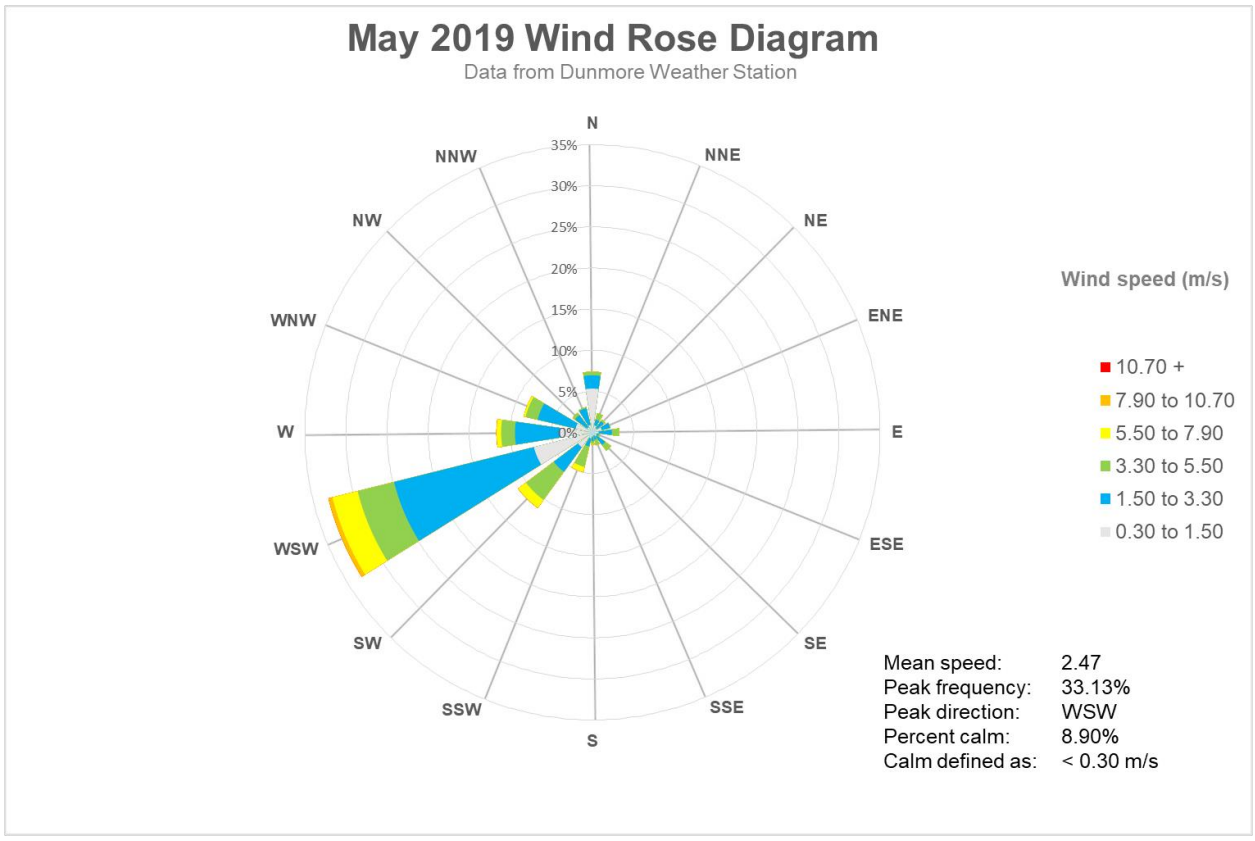

Figure 17 May Wind Rose Data

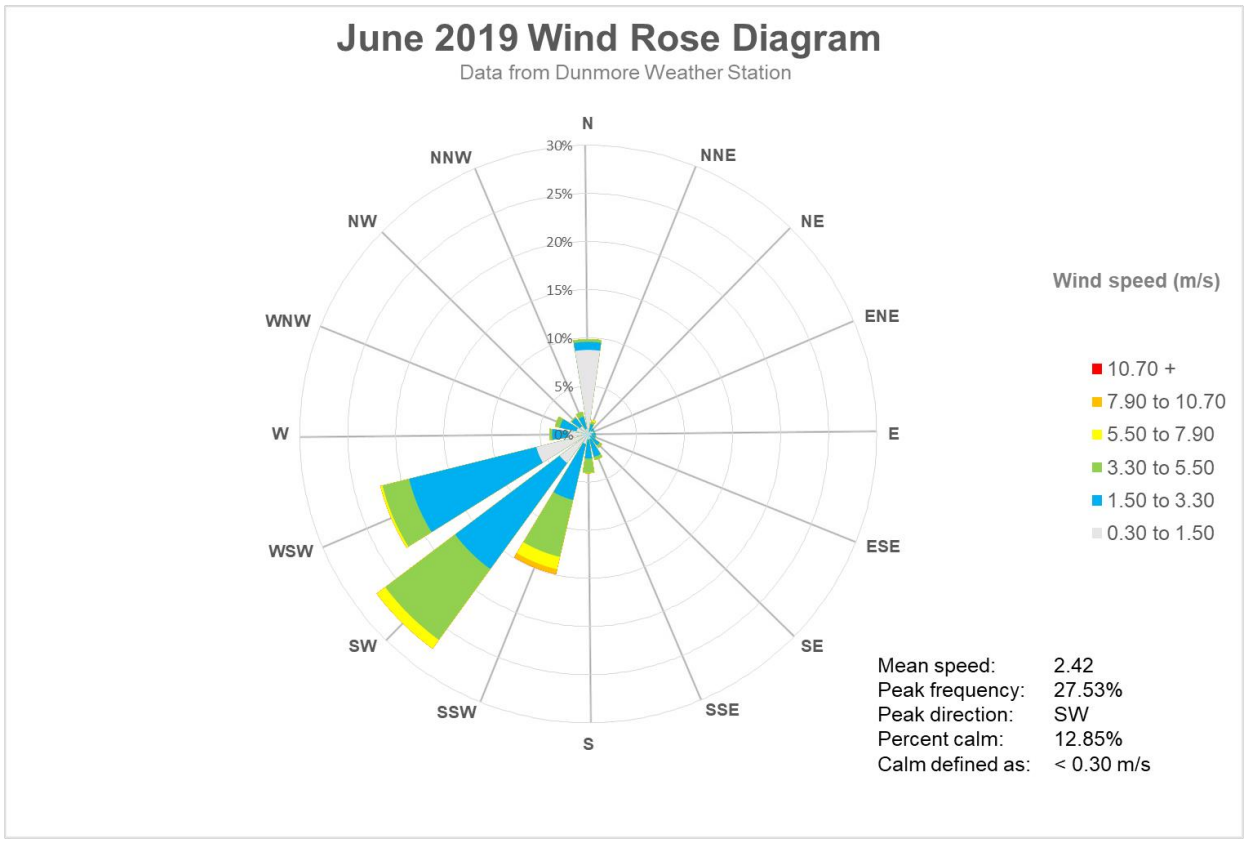

Figure 18 June Wind Rose Data

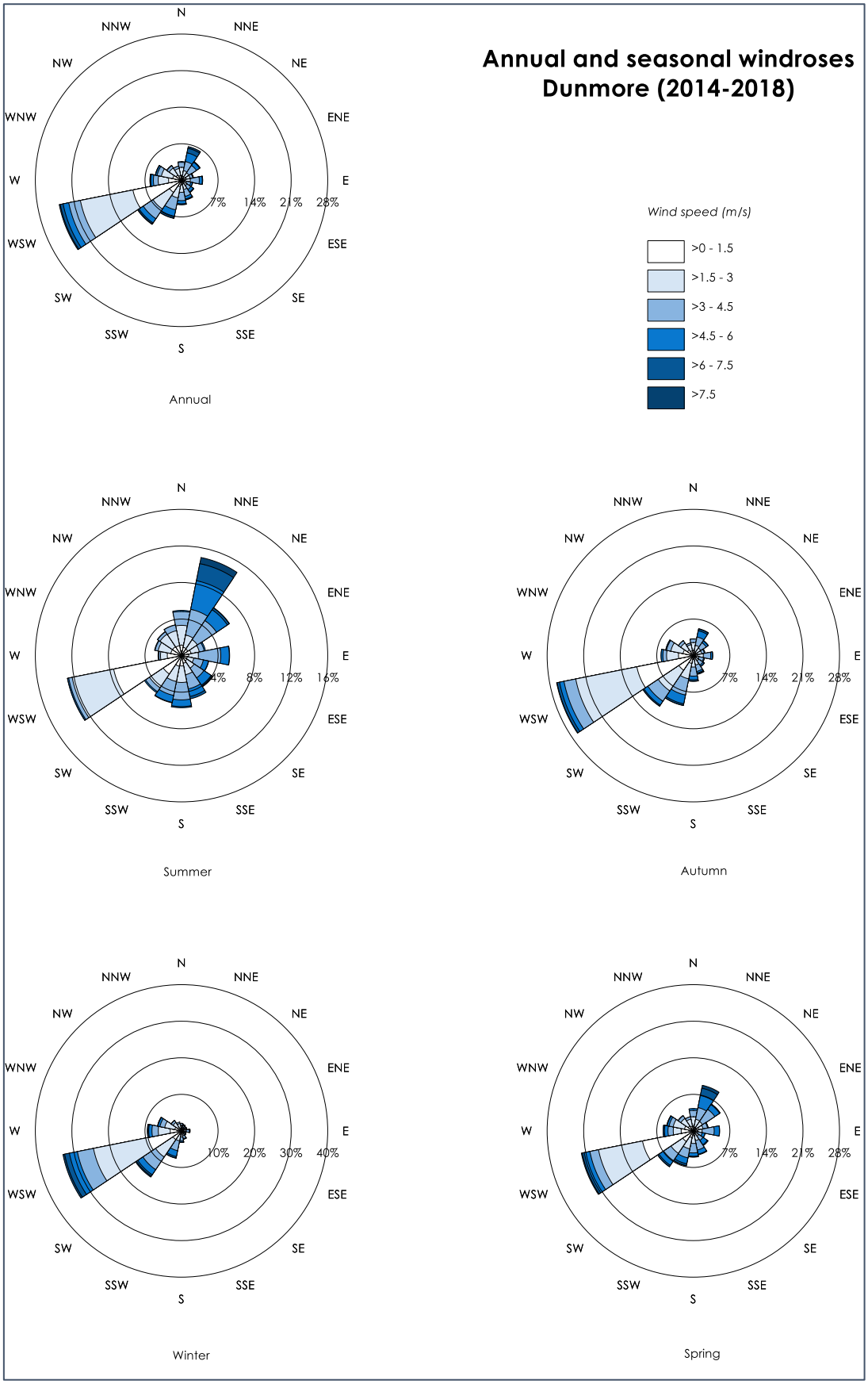

Figure 19 Annual and Seasonal Wind Roses

11. Appendix B Air Monitoring Information

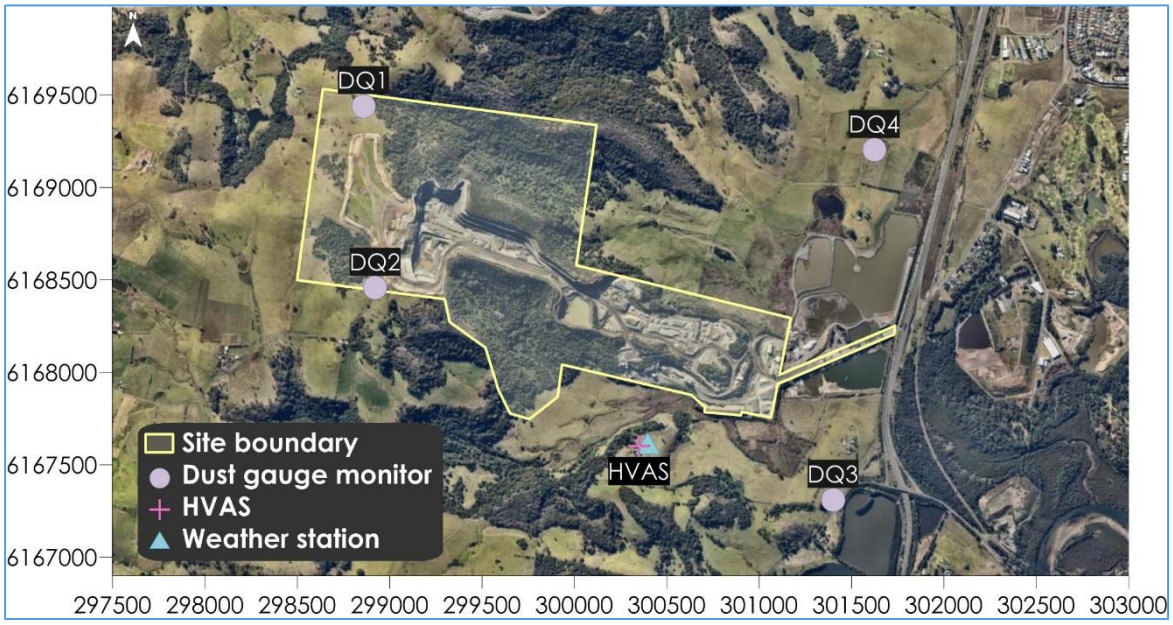

Figure 20 FY19 Air Quality Monitoring Points

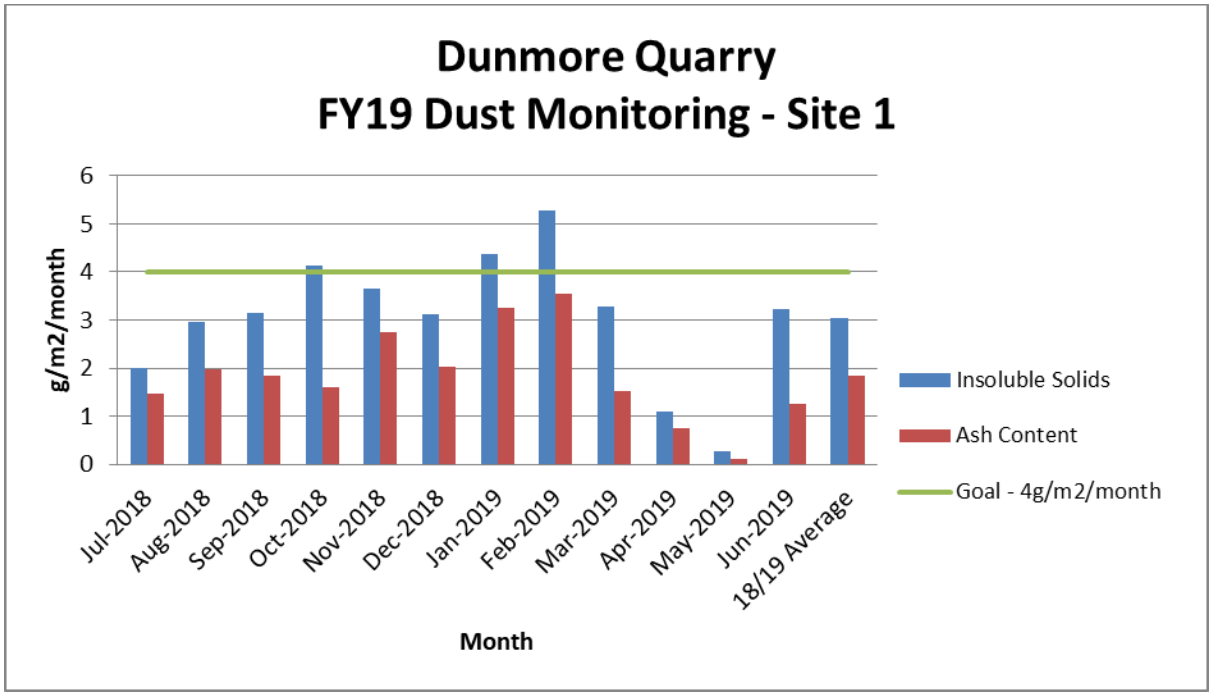

Figure 21 FY19 Site 1 Deposited Dust Results

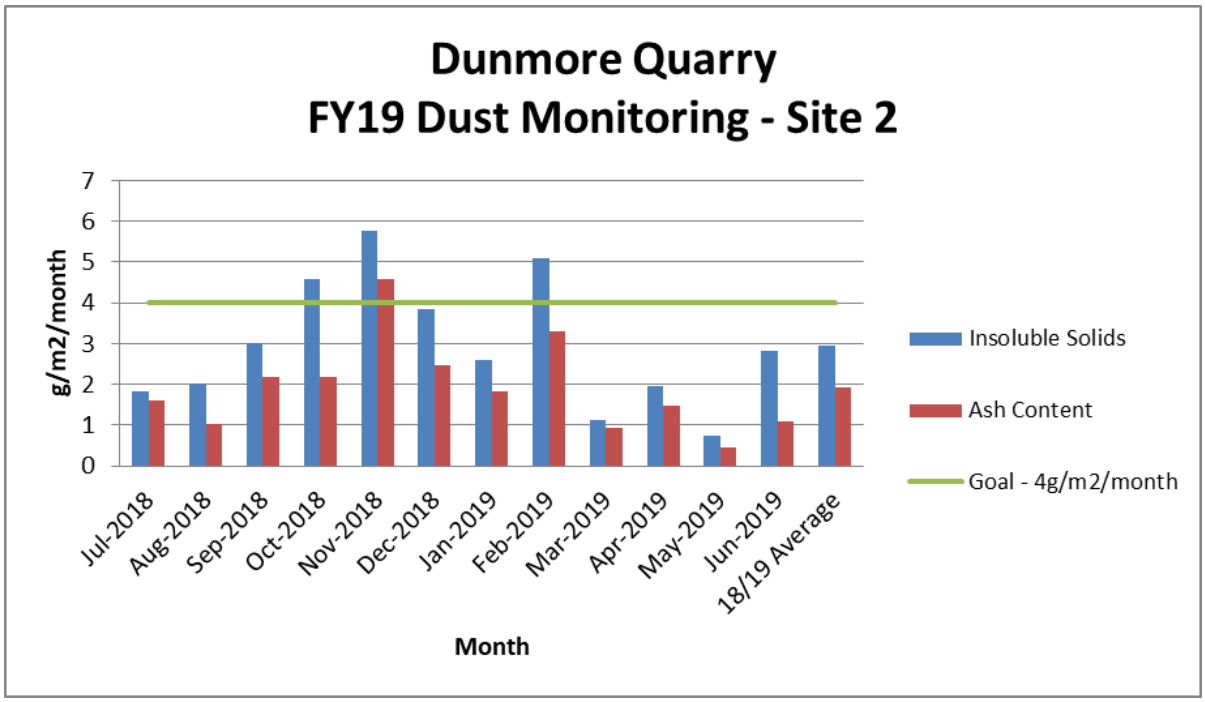

Figure 22 FY19 Site 2 Deposited Dust Results

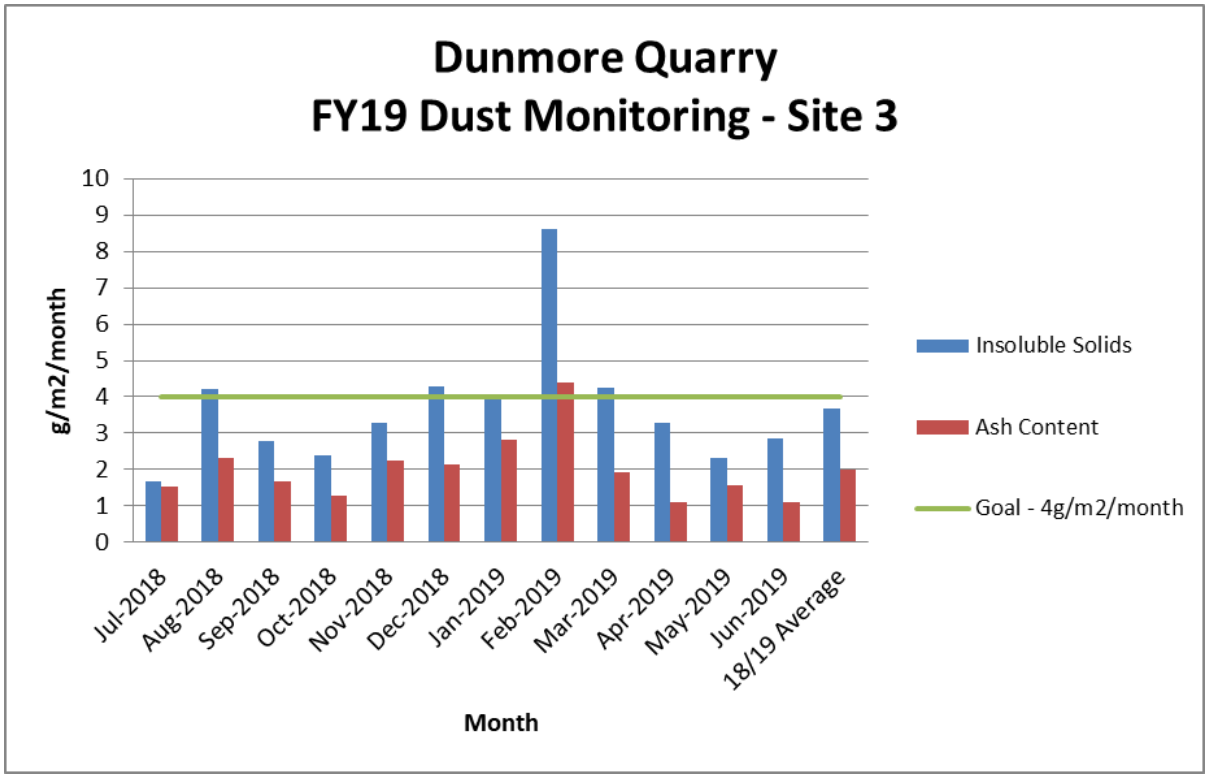

Figure 23 FY19 Site 3 Deposited Dust Results

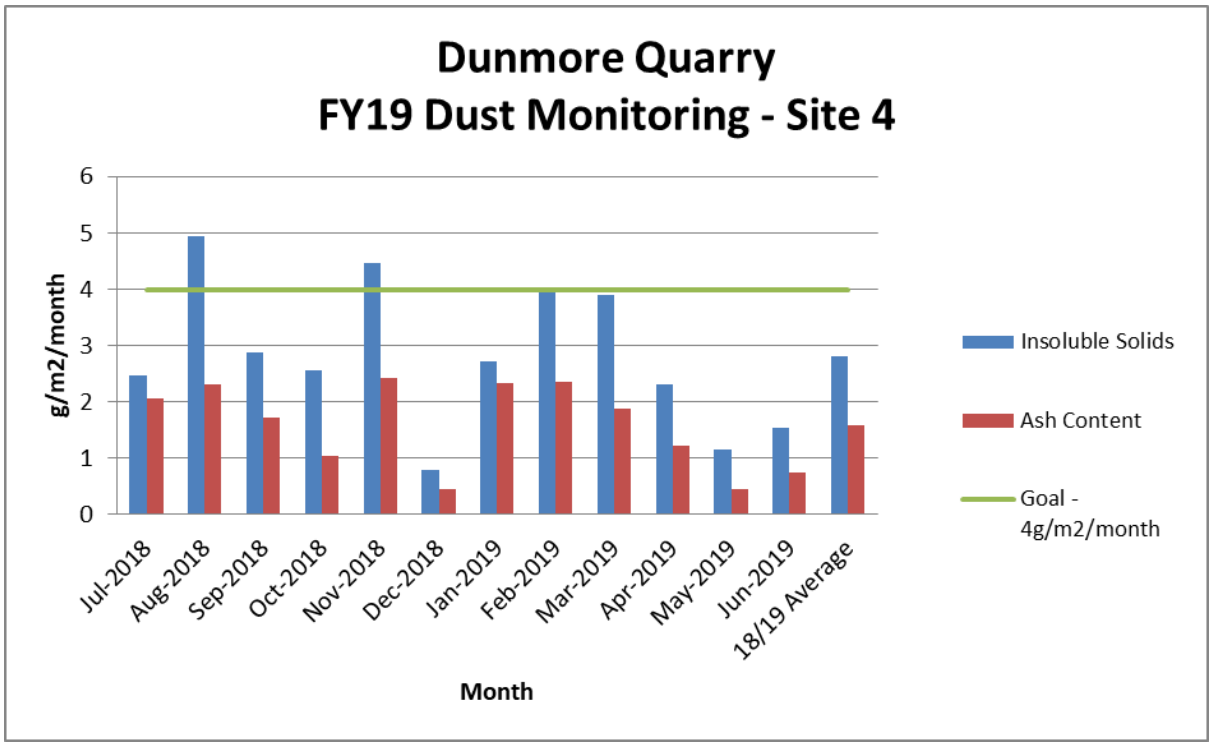

Figure 24 FY19 Site 4 Deposited Dust Results

Table 28 Dunmore Quarry Deposited Dust Historical Summary

Month	Site 1 grams/m^2/month		Site 2 grams/m^2/month		Site 3 grams/m^2/month		Site 4 grams/m^2/month		Dominant Wind Direction	Direction of Strongest Winds	Production Tonnes (t)
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash			
05/06 Average	5.85	2.66	4.48	1.67	4.85	2.22	3.9	1.92			
06/07 Average	5.4	2.13	2.48	1.53	2.79	1.89	4.31	2.44			
07/08 Average	3.26	1.67	2.37	1.3	3.89	2.9	5.55	3.17			
08/09 Average	6.6	2.63	3.01	2.1	3.12	2.17	2.71	1.66			
09/10 Average	4.65	3.03	4.41	2.6	5.02	3.49	3.15	2.33			
10/11 Average	3.35	1.43	5.86	3.92	3.43	2.09	2.53	1.6			
11/12 Average	3.74	1.92	3.28	1.7	5.03	3.44	2.75	1.81			
12/213 Average	3.73	1.65	2.61	1.65	5.87	3.6	3.36	2.36			
13/14 Average	9.56	4.94	3.63	1.79	4.61	3.28	3.2	2			
14/215 Average	5.63	2.72	2.38	1.44	7.36	4.42	3.1	1.98			
15/16 Adjusted Average	3.46	1.66	3.12	1.77	7.2	4.45	3.01	1.84			
16/17 Average	2.2	1.42	3.36	1.96	2.28	1.56	2.01	1.3			
17/18 Average	2.93	2	4.2	3.14	2.36	1.65	2.84	1.79			
Jul-2018	2	1.47	1.84	1.6	1.67	1.53	2.46	2.06	WSW(34%)	WSW	182,198
Aug-2018	2.95	1.97	2.03	1.03	4.23	2.33	4.95	2.32	WSW(29%)	WSW,SW	199,206
Sep-2018	3.16	1.84	3.01	2.17	2.8	1.69	2.87	1.73	WSW(25%)	WSW,SW	176,065
Oct-2018	4.12	1.61	4.58	2.19	2.39	1.27	2.57	1.05	WSW(12%)	NNE	142,028
Nov-2018	3.66	2.74	5.76	4.58	3.29	2.24	4.47	2.43	WSW(15%)	NNE	169,348
Dec-2018	3.12	2.04	3.83	2.48	4.3	2.14	0.79	0.45	WSW(18%)	NNE,E	103,822
Jan-2019	4.37	3.24	2.6	1.84	3.93	2.82	2.71	2.34	NNE(13%)	SSE,NNE	165,472
Feb-2019	5.29	3.55	5.09	3.29	8.62	4.4	4.02	2.36	N(14%)	NNE	171,887
Mar-2019	3.29	1.53	1.13	0.92	4.25	1.94	3.89	1.88	WSW(15%)	NNE	150,849
Apr-2019	1.09	0.75	1.97	1.46	3.28	1.09	2.31	1.23	WSW(27%)	-	116,324
May-2019	0.28	0.11	0.73	0.45	2.33	1.58	1.15	0.44	WSW(33%)	WSW	142,810
Jun-2019	3.23	1.25	2.82	1.08	2.86	1.09	1.54	0.75	WSW(28%)	SSW	153,975
18/19 Average	3.05	1.84	2.95	1.92	3.66	2.01	2.81	1.59			

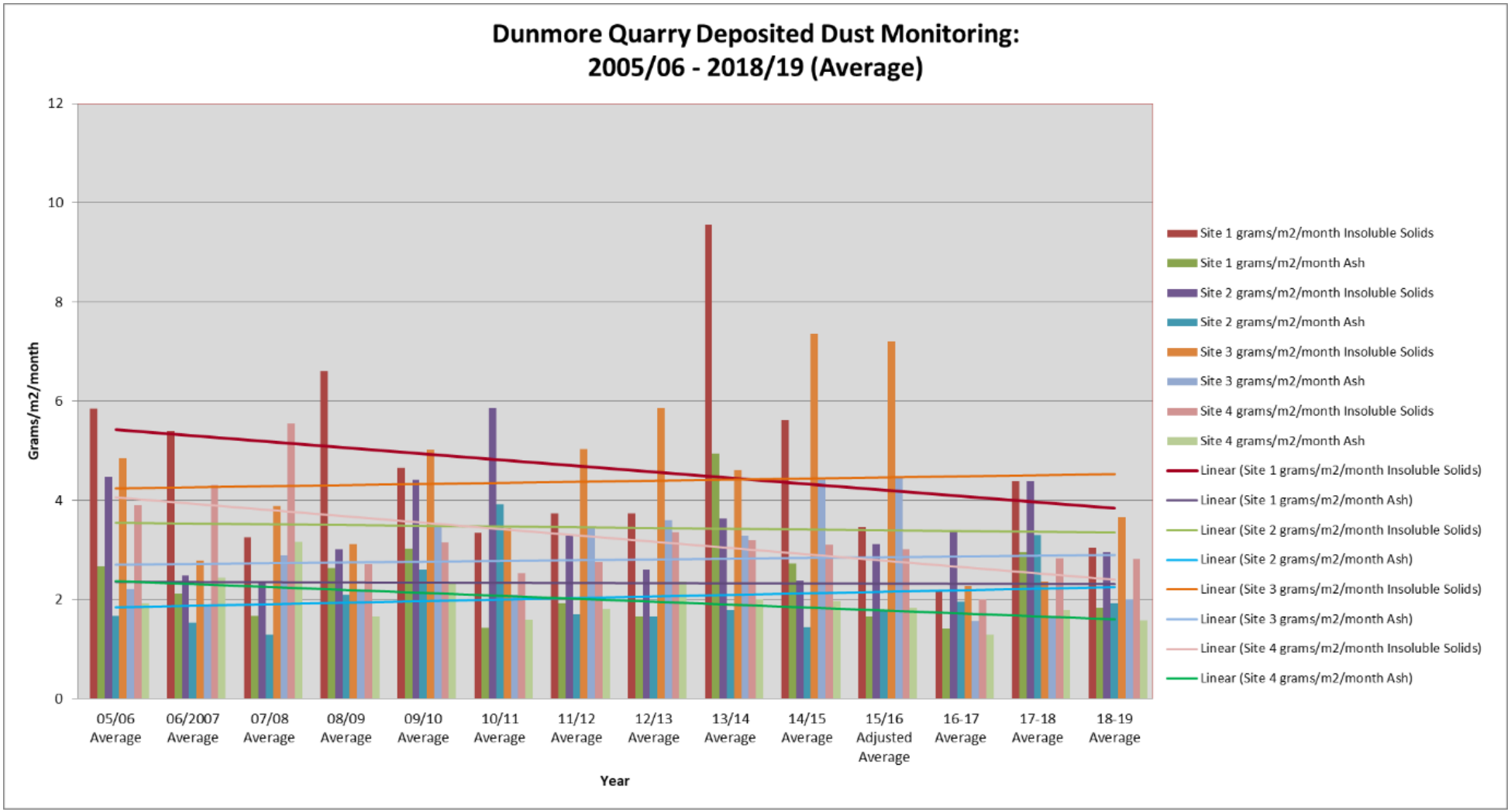

Figure 25 Dunmore Quarry Deposited Dust Summary and Trends

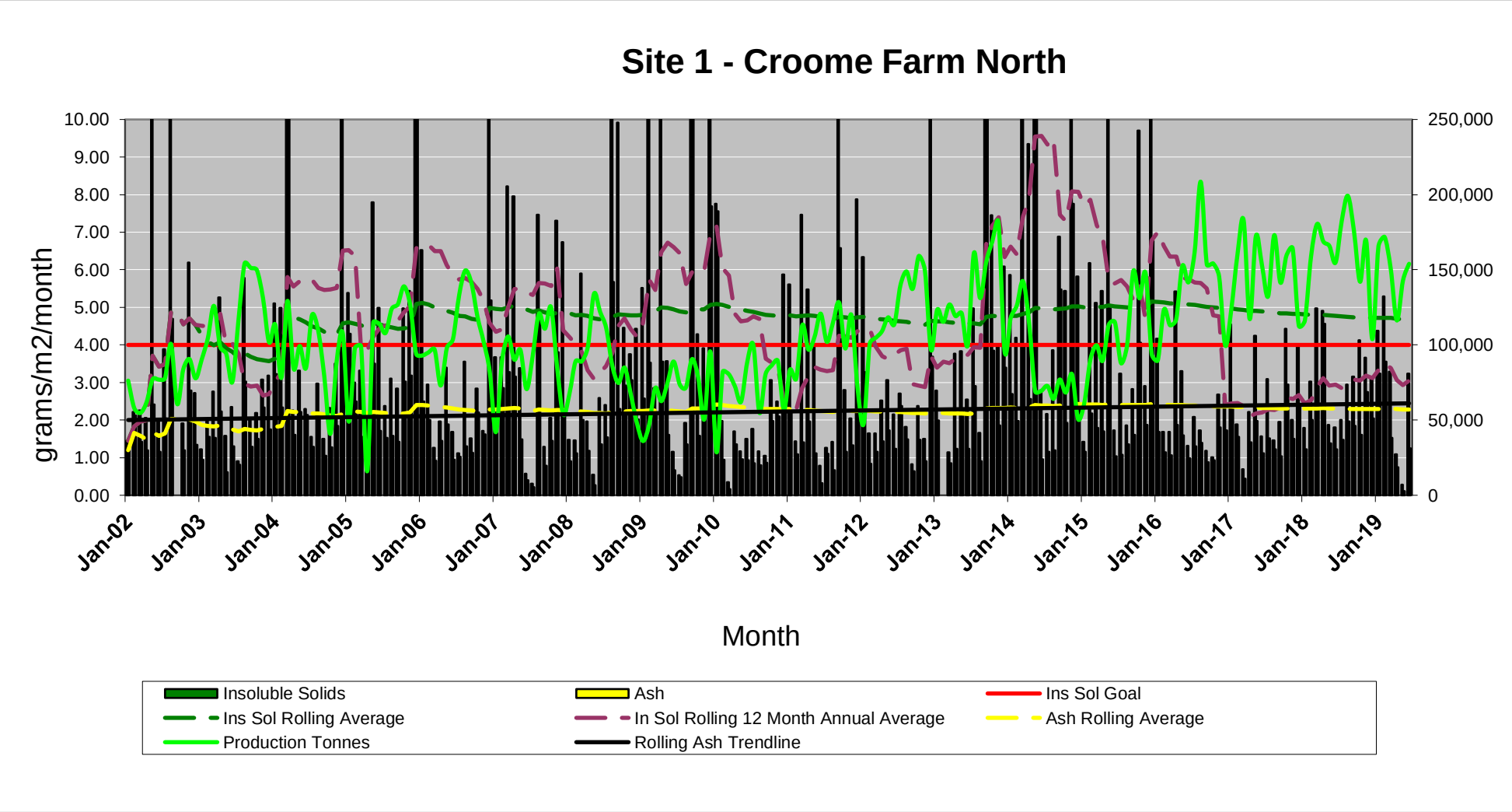

Figure 26 Site 1 Deposited Dust Historical Results VS Production

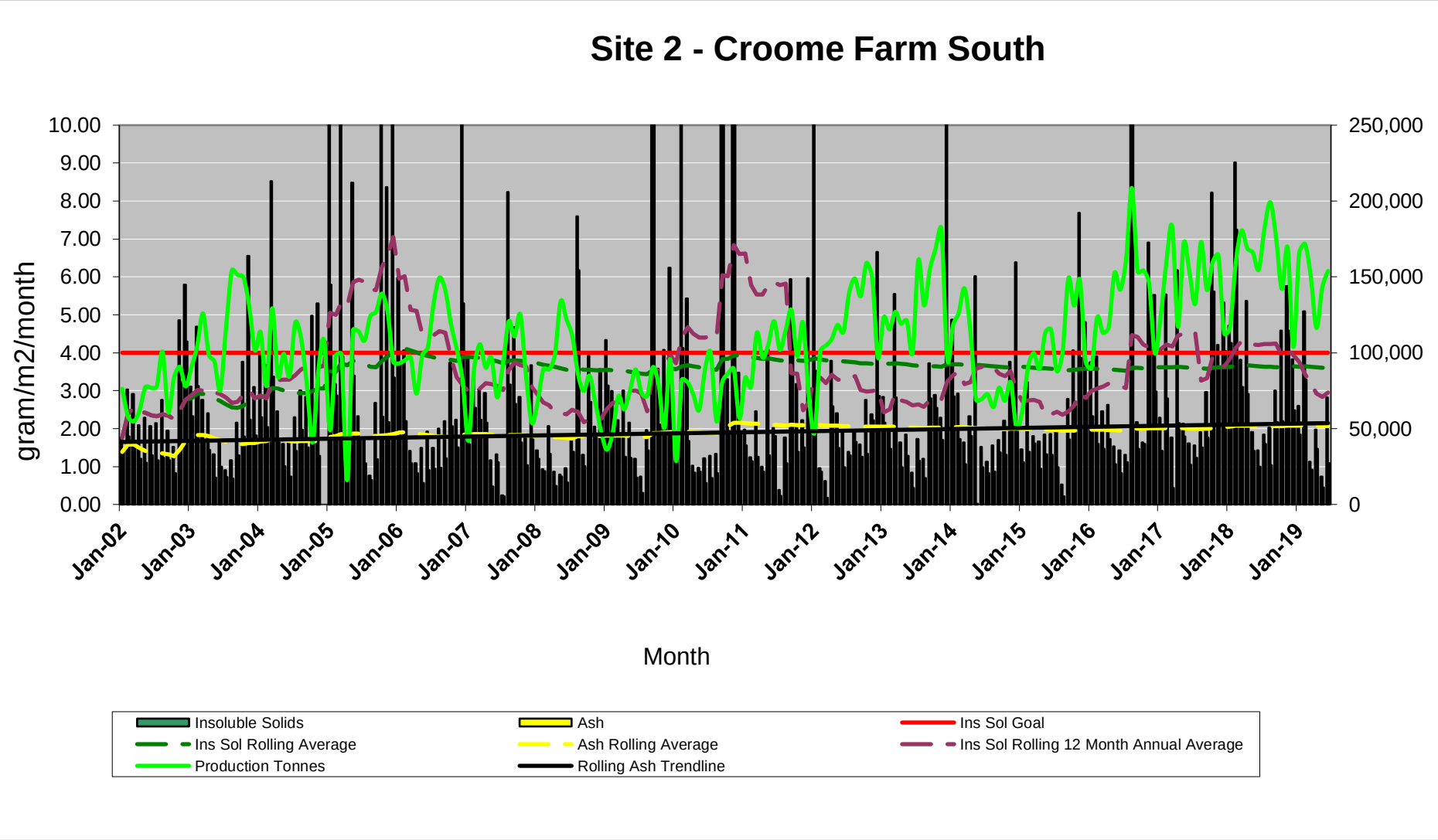

Figure 27 Site 2 Deposited Dust Historical Results VS Production

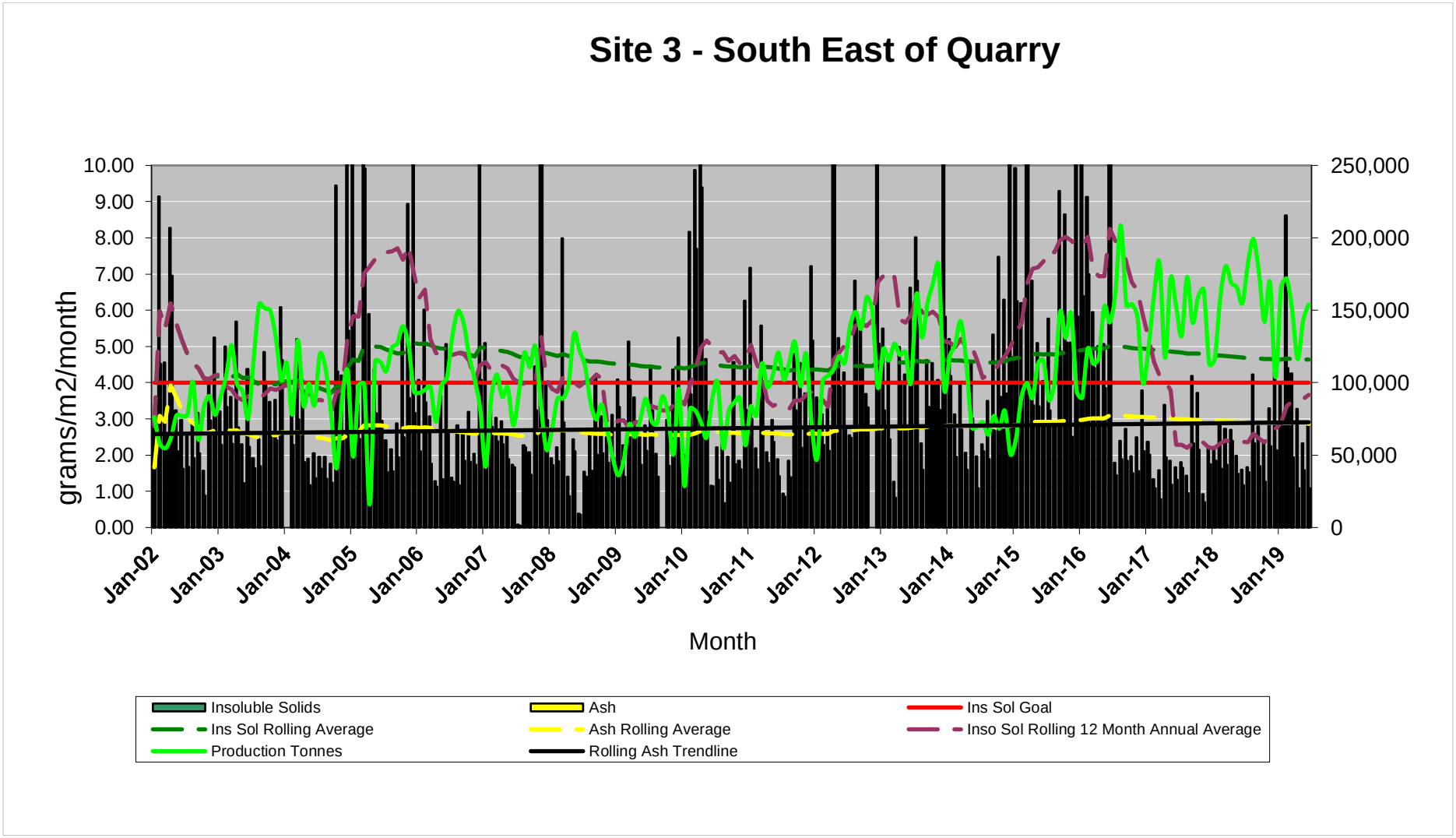

Figure 28 Site 3 Deposited Dust Historical Results VS Production

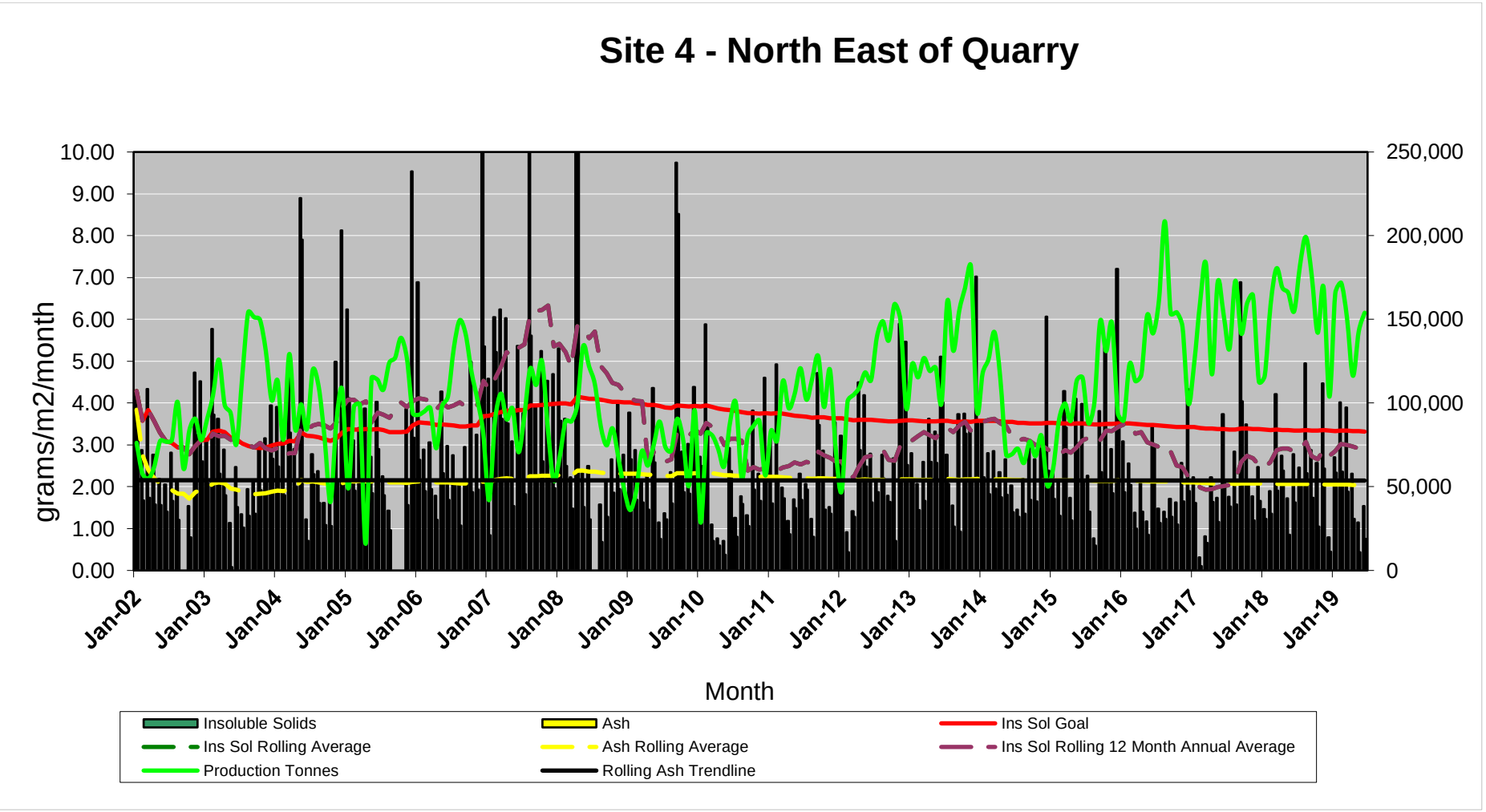

Figure 29 Site 4 Deposited Dust Historical Results VS Production

Figure 30 Dust Storm 12-14th February

Figure 31 Extent of Dust Storm 12-14th February

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Table 29: FY19 Dunmore PM10 Results

Sample				Criteria		
	Date	Sample Daily Average (µg/m$^{3)}$	Sample Average To Date (µg/m^3)	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)
Jul-18	6/07/2018	6.36	12.43	50	30	13.16
Jul-18	12/07/2018	3.57	12.41	50	30	13.15
Jul-18	18/07/2018	25.79	12.43	50	30	13.52
Jul-18	24/07/2018	5.11	12.42	50	30	13.53
Jul-18	30/07/2018	20.02	12.43	50	30	13.83
Aug-18	5/08/2018	6	12.42	50	30	13.73
Aug-18	11/08/2018	13.07	12.42	50	30	13.88
Aug-18	17/08/2018	10.46	12.42	50	30	13.93
Aug-18	23/08/2018	4.81	12.41	50	30	13.93
Aug-18	29/08/2018	5.46	12.40	50	30	13.91
Sep-18	4/09/2018	12.67	12.40	50	30	14.11
Sep-18	10/09/2018	12.67	12.40	50	30	14.25
Sep-18	16/09/2018	11.71	12.40	50	30	14.23
Sep-18	22/09/2018	12.24	12.40	50	30	14.13
Sep-18	28/09/2018	36.06	12.43	50	30	14.69
Oct-18	4/10/2018	36.06	12.47	50	30	15.12
Oct-18	10/10/2018	10.43	12.46	50	30	15.26
Oct-18	16/10/2018	29	12.49	50	30	15.59
Oct-18	22/10/2018	17.47	12.49	50	30	15.82
Oct-18	28/10/2018	7.9	12.49	50	30	15.79
Nov-18	3/11/2018	24.24	12.51	50	30	16.09
Nov-18	9/11/2018	16.82	12.51	50	30	16.17
Nov-18	15/11/2018	6.18	12.50	50	30	16.24
Nov-18	21/11/2018	19.01	12.51	50	30	16.44
Nov-18	27/11/2018	26.44	12.53	50	30	16.37
Dec-18	3/12/2018	14.38	12.53	50	30	16.11
Dec-18	9/12/2018	24.36	12.55	50	30	15.85
Dec-18	15/12/2018	20.95	12.56	50	30	15.71
Dec-18	21/12/2018	11.23	12.56	50	30	15.82
Dec-18	27/12/2018	30.6	12.59	50	30	16.03
Jan-19	2/01/2019	22.64	12.60	50	30	15.87
Jan-19	8/01/2019	25.55	12.62	50	30	16.18
Jan-19	14/01/2019	30.42	12.64	50	30	16.15
Jan-19	20/01/2019	15.81	12.65	50	30	16.14
Jan-19	26/01/2019	37.2	12.68	50	30	16.24
Feb-19	1/02/2019	81.47	12.78	50	30	17.35
Feb-19	7/02/2019	16.46	12.78	50	30	17.31
Feb-19	13/02/2019	16.04	12.79	50	30	17.09
Feb-19	19/02/2019	26.15	12.80	50	30	16.97
Feb-19	25/02/2019	16.93	12.81	50	30	16.96
Mar-19	3/03/2019	11.53	12.81	50	30	16.86
Mar-19	9/03/2019	22.58	12.82	50	30	16.91
Mar-19	15/03/2019	14.91	12.83	50	30	16.83

Mar-19	21/03/2019	10.64	12.82	50	30	16.95
Mar-19	27/03/2019	16.82	12.83	50	30	16.70
Apr-19	2/04/2019	10.7	12.82	50	30	16.58
Apr-19	8/04/2019	25.91	12.84	50	30	16.54
Apr-19	14/04/2019	14.56	12.84	50	30	16.28
Apr-19	20/04/2019	12.18	12.84	50	30	16.39
Apr-19	26/04/2019	19.96	12.85	50	30	16.45
May-19	2/05/2019	34.46	12.88	50	30	16.68
May-19	8/05/2019	11.65	12.88	50	30	16.77
May-19	14/05/2019	16.76	12.89	50	30	16.95
May-19	20/05/2019	22.4	12.90	50	30	17.19
May-19	26/05/2019	14.8	12.90	50	30	17.43
Jun-19	1/06/2019	15.92	12.91	50	30	17.63
Jun-19	7/06/2019	9.45	12.90	50	30	17.71
Jun-19	13/06/2019	30.97	12.93	50	30	18.18
Jun-19	19/06/2019	6.18	12.92	50	30	18.25
Jun-19	25/06/2019	21.87	12.93	50	30	18.57

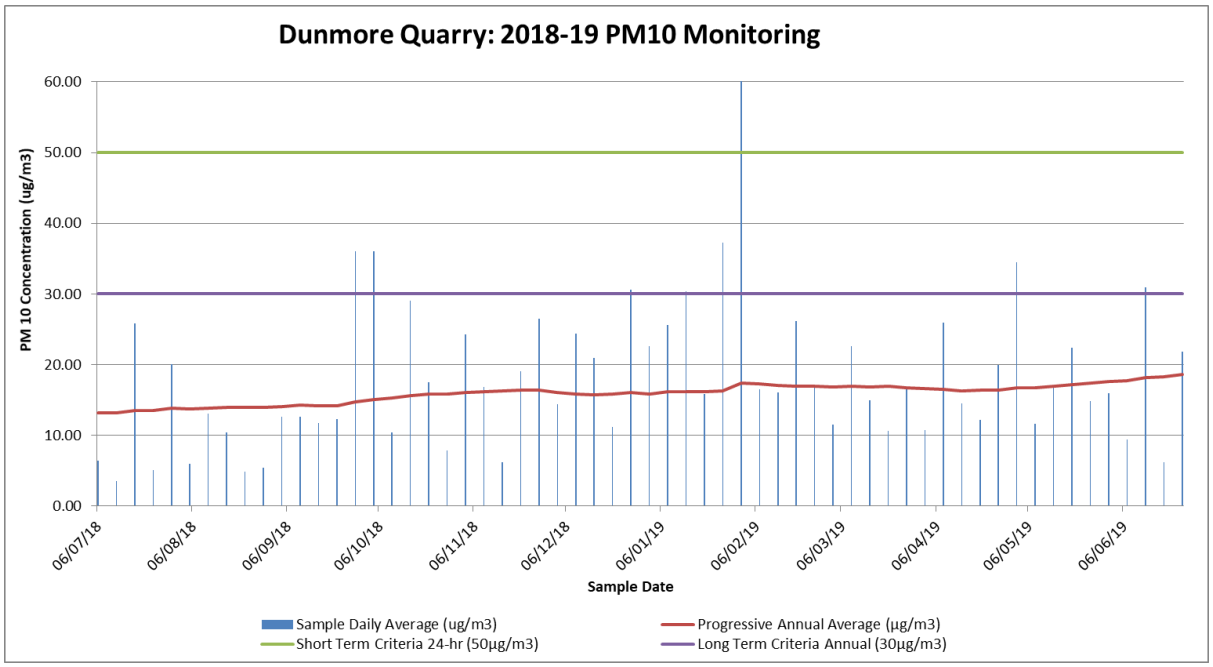

Figure 32 FY19 Dunmore PM10 Results

Thursday 31 January 2019 13 - 14 pm

Pollutants		Ozone (O3)	Ozone (O3)	Nitrogen Dioxide (NO2)	Visibility (NEPHM)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Particles (PM10)	Particles (PM2.5)	Site AQI	Regional AQI
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	rolling 24-hour average	rolling 24-hour average	highest level at the site	highest level for the region
Sydney East	Randwick	55	55	4	6		0	62	46	62	
	Rozelle	49	51	2	7	3	0	70	46	70	
	Lindfield	46	48	2	6		0	45		48	70
	Chullora	49	52	3	7	2	1	55	48	55	
	Earlwood	50	54	3	8			53	41	54	
	Macquarie Park	45	48	1	7	3	0	38	35	48	
Sydney North-west	Parramatta North	41	46	8	8	2	0	57	43	57	
	Richmond	40		0	6			53	47	53	
	St Marys	41	48	0	6			58	51	58	64
	Vineyard										
	Prospect	46	49	0	7	1	0	64	49	64	
Sydney South-west	Bargo	35	42	0	10		0	70	62	70	
	Bringelly	38	46	0	7		0	67	49	67	
	Camden	36	47	1	9	2		55	46	55	80
	Campbelltown West	36	50	3	10	4		58	64	64	
	Liverpool	49	57	2	9	2	0	70		70	
	Oakdale	57	80	0	8			47	60	80	
Illawarra	Wollongong	67	66	3	14	2	1	102	58	102	
	Kembla Grange	36	47	1	13			107	66	107	107
	Albion Park Sth	39	46	0	12		0	100	65	100	
Lower Hunter	Wallsend	41	47	2	8		0	57	40	57	
	Newcastle	40	45	3	7	4	0	83	45	83	83
	Beresfield	34	42	2	8		0	51	39	51	
Central Coast	Wyong	27	33	1	7	2	0	49	36	49	49
Central Tablelands	Bathurst							42	21	42	42
Northern Tablelands	Armidale				6			17	28	28	28
North-west Slopes	Gunnedah	29	34	2				37	24	37	
	Narrabri							26	21	26	50
	Tamworth							50	33	50	
South-west Slopes	Albury							58	36	58	226
	Wagga Wagga Nth							226	72	226	
Upper Hunter - Muswellbrook	Muswellbrook			1			0	85	38	85	85
Upper Hunter - Singleton	Singleton			1			0	61	42	61	61

Figure 33 Regional PM10 values 31 January 2019

Friday 1 February 2019 13 - 14 pm

Pollutants		Ozone (O3)	Ozone (O3)	Nitrogen Dioxide (NO2)	Visibility (NEPHM)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Particles (PM10)	Particles (PM2.5)	Site AQI	Regional AQI
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	rolling 24-hour average	rolling 24-hour average	highest level at the site	highest level for the region
Sydney East	Randwick	20	25	2	9		0	62	33	62	
	Rozelle	16	20	7	11	2	0	67	33	67	
	Lindfield	19	23	4	10		0	57		57	67
	Chullora	17	22	5	10	0	0	55	29	55	
	Earlwood	19	23	2	10			53	33	53	
	Macquarie Park	17	22	4	11	3	0	52	33	52	
Sydney North-west	Parramatta North	16		4	10	0		65	34	65	
	Richmond	18	23	3	11		0	41	27	41	
	St Marys	19	24	1	10			47	18	47	65
	Vineyard										
	Prospect				8			57	29	57	
Sydney South-west	Bargo	17	22	2	8		0	34	20	34	
	Bringelly	19	23	2	10		0	44	25	44	
	Camden	19	22	1	9	12		34	23	34	56
	Campbelltown West	19	23	3	10	2		50	43	50	
	Liverpool	16	20	4	11	2	0	56	43	56	
	Oakdale	20	23	1	9			28	27	28	
Illawarra	Wollongong	21	24	3	12	1	0	57	38	57	
	Kembla Grange	21	24	0	10			60	31	60	60
	Albion Park Sth	20	24	0	10		0	52	43	52	
Lower Hunter	Wallsend	23	26	1	13		0	51	22	51	
	Newcastle	22	27	1	18	3	0	73	35	73	73
	Beresfield	23	25	0	13		0	55	31	55	
Central Coast	Wyong	20	24	3	10	1	0	42		42	42
Central Tablelands	Bathurst							43	21	43	43
Northern Tablelands	Armidale				10			25	43	43	43
North-west Slopes	Gunnedah	34	41	1				37	24	41	
	Narrabri							37	30	37	50
	Tamworth							50	26	50	
South-west Slopes	Albury							47	31	47	70
	Wagga Wagga Nth							70	18	70	
Upper Hunter - Muswellbrook	Muswellbrook			4			4	55	21	55	55
Upper Hunter - Singleton	Singleton			1			1	39	24	39	39

Figure 34 Regional PM10 values 1 February 2019

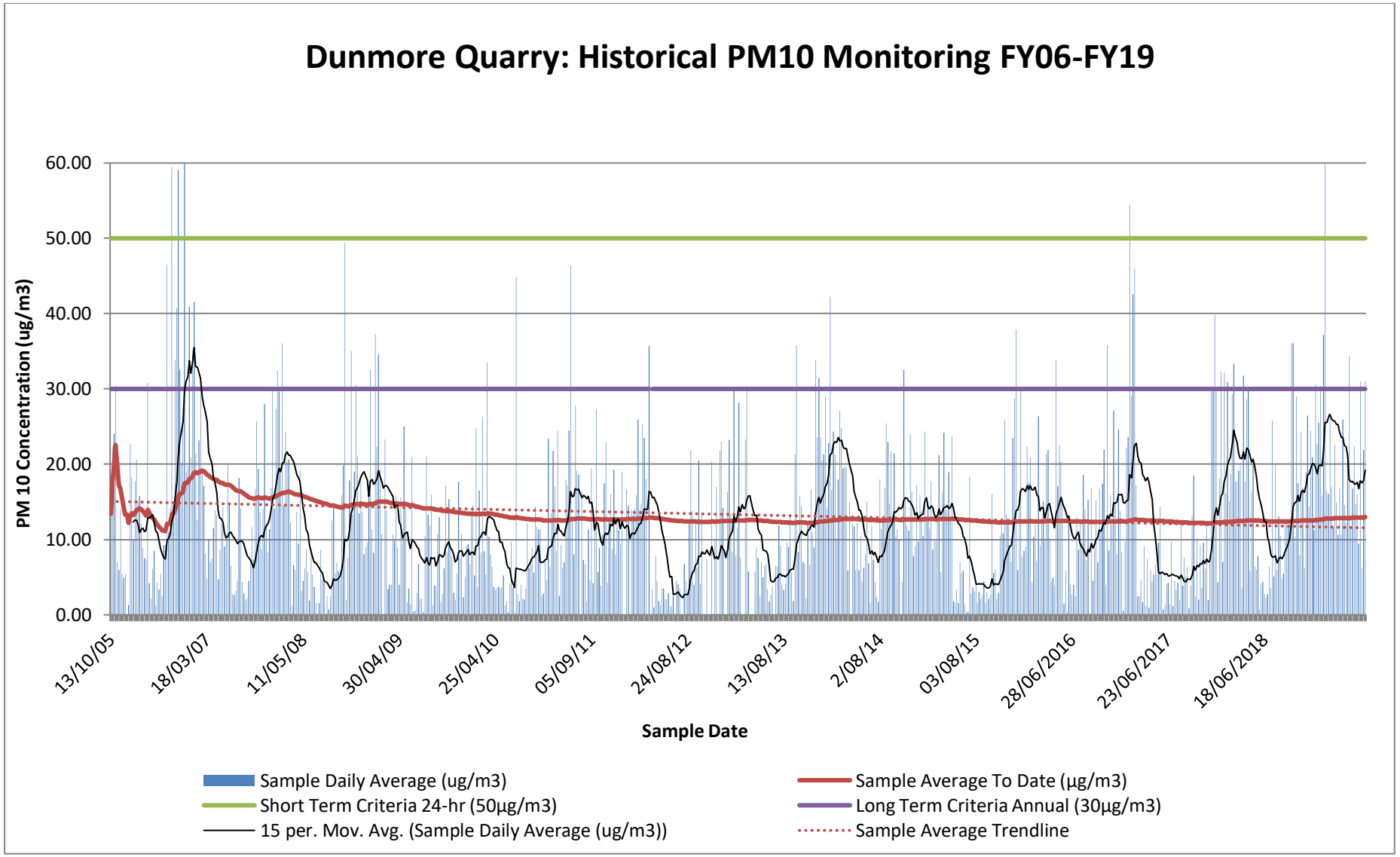

Figure 35 Dunmore Historical PM10 Results

12. Appendix C Noise Monitoring Information

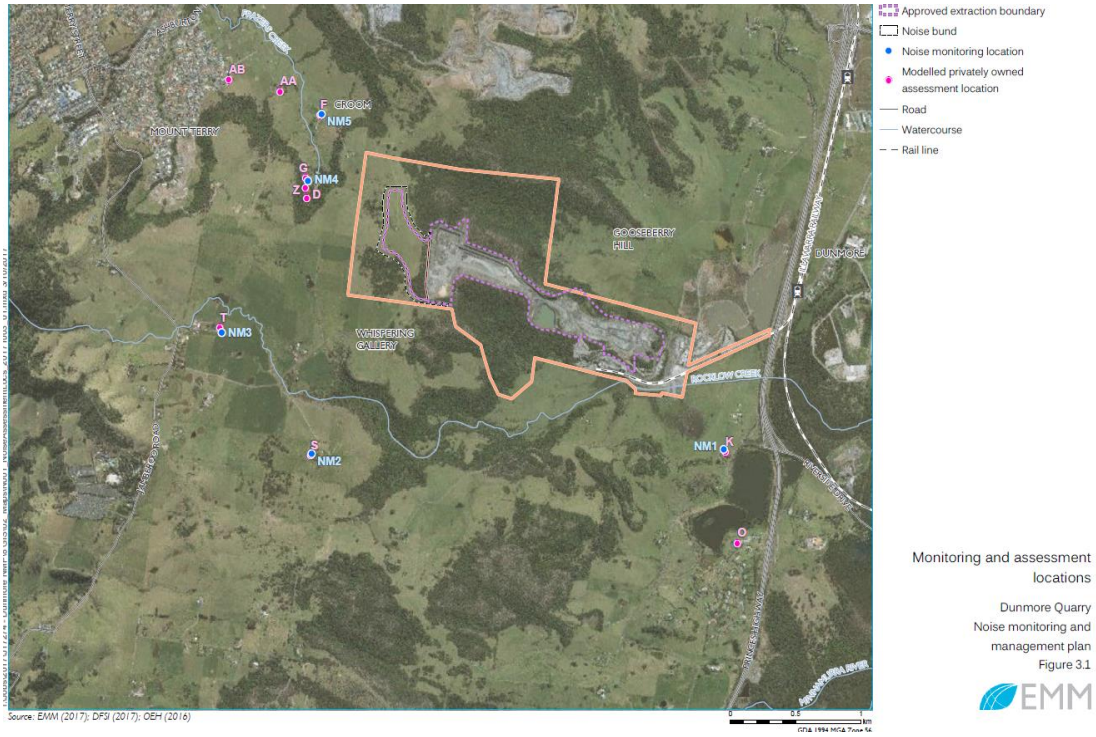

Figure 36 Noise Monitoring Locations

Table 30 Location K Historical Noise Monitoring Results

Year	K-Morning dB LAeq(15min)	K-Day dB LAeq(15min)	K-Evening dB LAeq(15min)
Limit	**47**	**49**	**44**
2007	45	42	43
2008	43	41	44
2009	45	46	42
2010	47	47	40
2011	42	40	38
2012	44	40	40
2013	45	42	43
2014	43	35	31
2015	44	38	42
2016	46	40	39
2017	45	40	40
2018	40	40	40

13. Appendix D Blast Monitoring Information

Monitoring Station	Entry Address	Station Description	GPS Coordinates
A	Entry is from the end of Croome Road.	The monitoring position is located approx. 115m South East of the Benny residence on the Boral property line.	Latitude: -34.599995065 Longitude: 150.800225506
B	Entry is from the rear gate of the quarry or alternately from Croome Vale Road.	The monitoring position is located approx. 85m North of the McParland residence on a solid rock floater.	Latitude: -34.60787 Longitude: 150.805488

Figure 37 Blast Monitoring Locations

The Benny residence is the monitoring point for the purposes of compliance. Updates to the blast monitoring plan have detailed that the MacParland monitoring point will continue to be monitored for the purposes of heritage conservation. Table 31 show the blast results for the Benny monitoring point for the reporting period. A historical summary and trend lines is presented in Figure 38 and 39. Blast monitoring results at the MacParland monitoring point is presented in Table 32.

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Table 31 FY19 Benny Blast Monitoring Data

Benny Residence			Airblast Overpressure	100% Limit	95% Annual Limit	Ground Vibration	95% Annual Limit	100% Vibration Limit
Date	Time	Blast ID	*dB(Lin Peak)*			*(mm/s)*		
04-Jul-18	14:31	DQ18-24	94.0	120	115	1.02	5	10
11-Jul-18	14:38	DQ18-26	97.5	120	115	1.52	5	10
25-Jul-18	15:13	DQ18-27	106.0	120	115	1.52	5	10
08-Aug-18	13:05	DQ18-29	97.5	120	115	1.14	5	10
23-Aug-18	12:16	DQ18-30	101.9	120	115	1.14	5	10
29-Aug-18	12:51	DQ18-31	100.0	120	115	3.56	5	10
20-Sep-18	9:20	DQ18-33	100.0	120	115	1.78	5	10
10-Oct-18	12:38	DQ18-34	112.3	120	115	1.14	5	10
17-Oct-18	14:04	DQ18-35	104.9	120	115	1.90	5	10
01-Nov-18	15:06	DQ18-36	100.0	120	115	1.70	5	10
22-Nov-18	12:34	DQ18-37	101.9	120	115	2.80	5	10
06-Dec-18	14:28	DQ18-38	101.3	120	115	2.00	5	10
12-Dec-18	14:35	DQ18-39	101.3	120	115	2.30	5	10
16-Jan-19	13:19	DQ19-01	NT	120	115	3.10	5	10
23-Jan-10	13:05	DQ-19-03	101.0	120	115	2.70	5	10
31-Jan-19	12:20	DQ-19-02	101.0	120	115	4.20	5	10
06-Feb-19	10:56	DQ-19-04	94.0	120	115	0.30	5	10
13-Feb-19	12:13	DQ-19-06	NT	120	115	NT	5	10
20-Feb-19	13:45	DQ-19-05	101.0	120	115	NT	5	10
04-Mar-19	12:26	DQ-19-07	98.4	120	115	3.80	5	10
13-Mar-19	14:44	DQ-19-08	101.6	120	115	2.90	5	10
03-Apr-19	13:04	DQ-19-09	99.1	120	115	2.60	5	10
17-Apr-19	13:26	DQ-19-10	103.9	120	115	1.37	5	10
08-May-19	13:43	DQ19-11	108.6	120	115	3.22	5	10
15-May-19	12:18	DQ19-13	97.1	120	115	0.30	5	10
29-May-19	9:21	DQ19-14	104.6	120	115	2.54	5	10
05-Jun-19	13:26	DQ19-12	102.9	120	115	2.14	5	10
19-Jun-19	12:51	DQ19-15	102.9	120	115	1.01	5	10

26-Jun-19	12:02	DQ-19-16	98.6	120	115	1.54	5	10

NT denotes the blast did not trigger a reading on monitoring equipment.

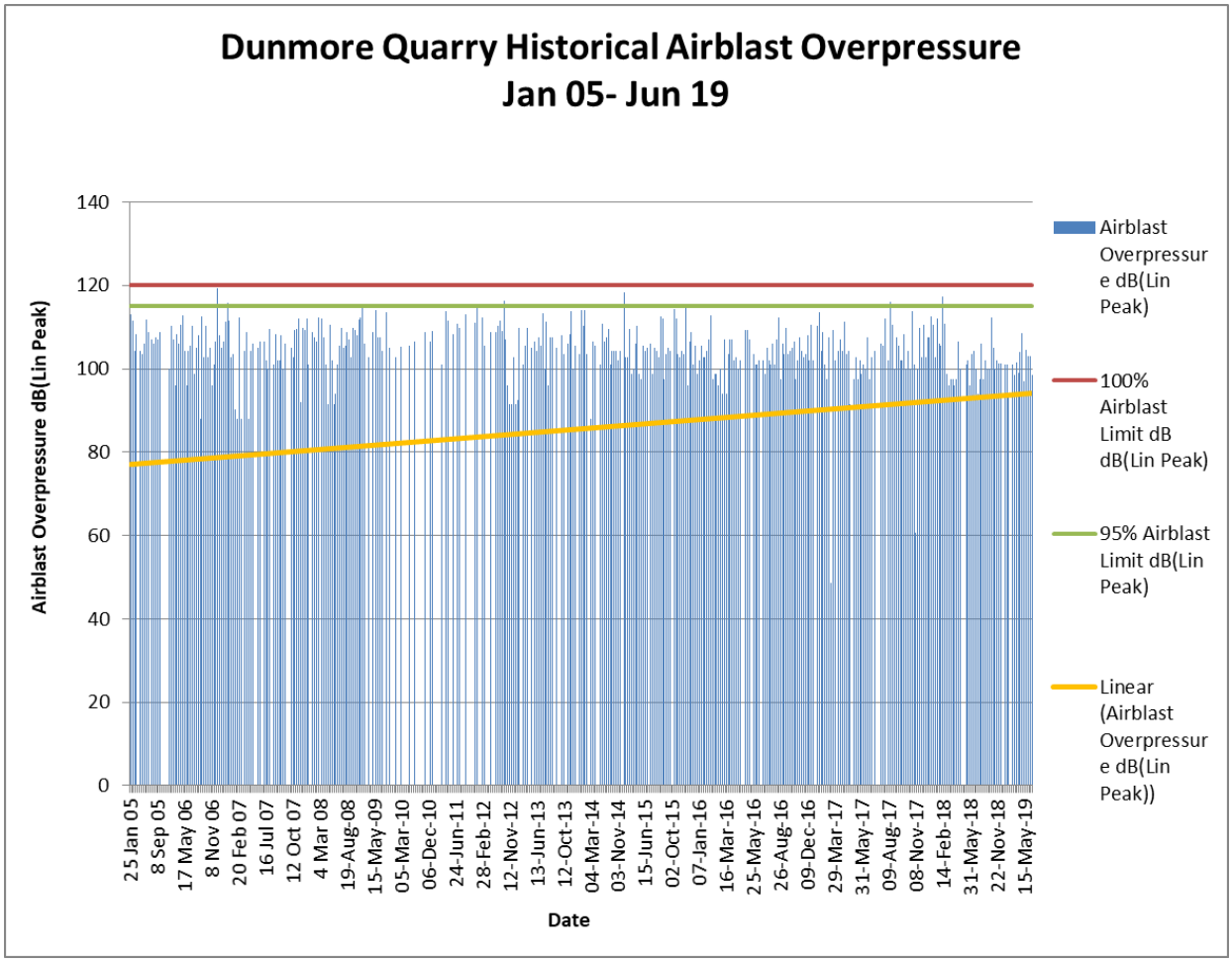

Figure 38 Airblast Overpressure Historical Trends

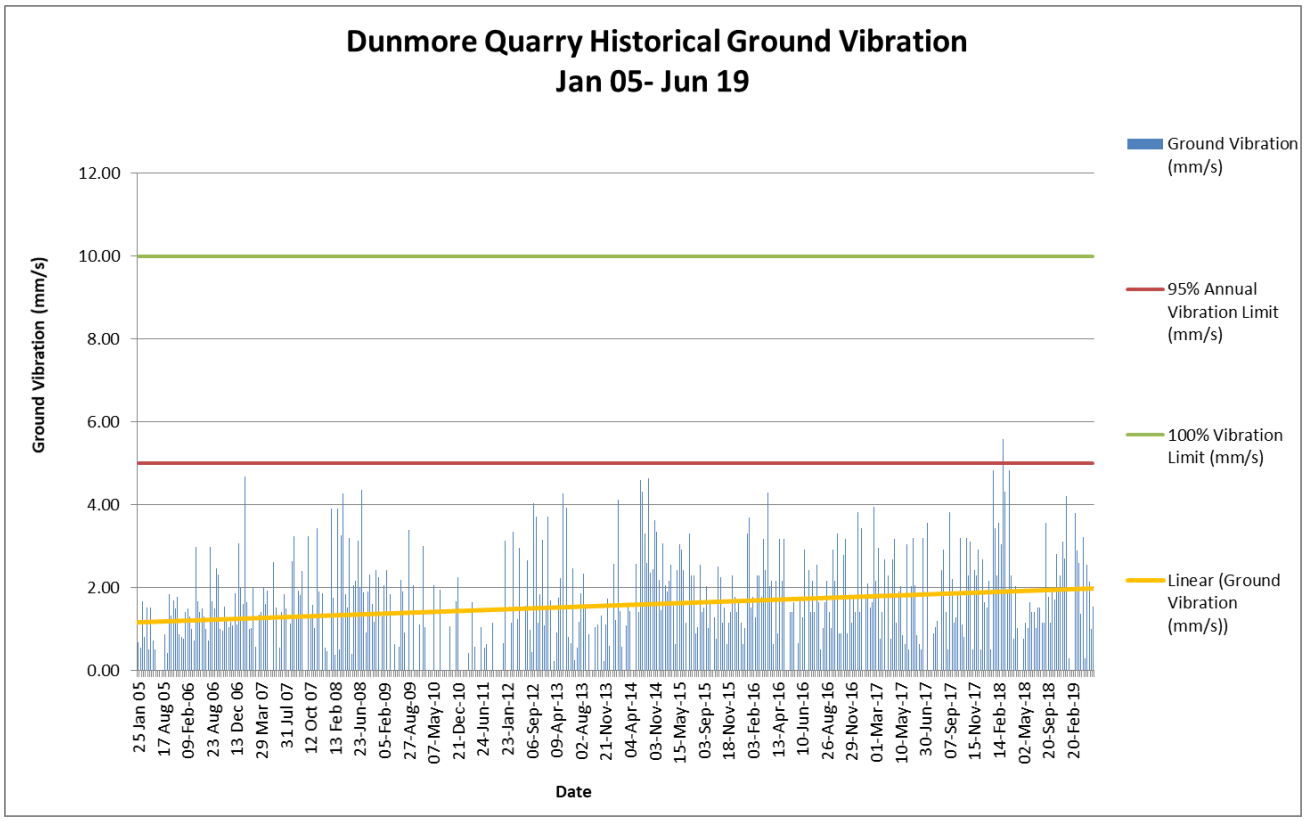

Figure 39 FY19 Ground Vibration Historical Trends

Table 32 FY19 MacParland Blast Monitoring Data

MacParland Residence			Airblast Overpressure	95% Annual Limit	Ground Vibration	95% Annual Limit
Date	Time	Shot ID	*dB(Lin Peak)*		(mm/s)	
11-Jul-18	14:38	DQ18-26	110.9	130	5.970	30
25-Jul-18	15:13	DQ18-27	111.8	130	3.300	30
01-Aug-18	14:53	DQ18-28	108.8	130	1.400	30
08-Aug-18	13:05	DQ18-29	109.9	130	1.780	30
23-Aug-18	12:16	DQ18-30	103.5	130	2.410	30
29-Aug-18	12:51	DQ18-31	98.8	130	3.560	30
20-Sep-18	9:20	DQ18-33	104.2	130	4.700	30
10-Oct-18	12:38	DQ18-34	Data not available on Blast	130	Data not available on Blast	30
17-Oct-18	14:04	DQ18-35	113.3	130	5.080	30

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01-Nov-18	15:06	DQ18-36	114	130	4.06	30
22-Nov-18	12:34	DQ18-37	114.0	130	5.33	30
06-Dec-18	14:28	DQ18-38	113.0	130	3.750	30
12-Dec-18	14:35	DQ18-39	107.6	130	1.080	30
16-Jan-19	13:19	DQ19-01	103.0	130	3.330	30
31-Jan-19	12:20	DQ-19-02	108.3	130	4.190	30
23-Jan-10	13:05	DQ-19-03	102.9	130	4.380	30
06-Feb-19	10:56	DQ-19-04	101.2	130	1.110	30
13-Feb-19	12:13	DQ-19-06	105.6	130	3.200	30
20-Feb-19	13:45	DQ-19-05	102.9	130	2.750	30
04-Mar-19	12:26	DQ-19-07	111.4	130	5.940	30
13-Mar-19	14:44	DQ-19-08	106.9	130	5.740	30
03-Apr-19	13:04	DQ-19-09	109.6	130	10.700	30
17-Apr-19	13:26	DQ-19-10	114.1	130	5.700	30
08-May-19	13:43	DQ19-11	114.8	130	9.270	30
15-May-19	12:18	DQ19-13	97.4	130	0.660	30
29-May-19	9:21	DQ19-14	113.5	130	6.630	30
05-Jun-19	13:26	DQ19-12	107.7	130	5.390	30
19-Jun-19	12:51	DQ19-15	106.8	130	5.470	30
26-Jun-19	12:02	DQ-19-16	106.7	130	1.770	30

14. Appendix E Surface Water Monitoring Information

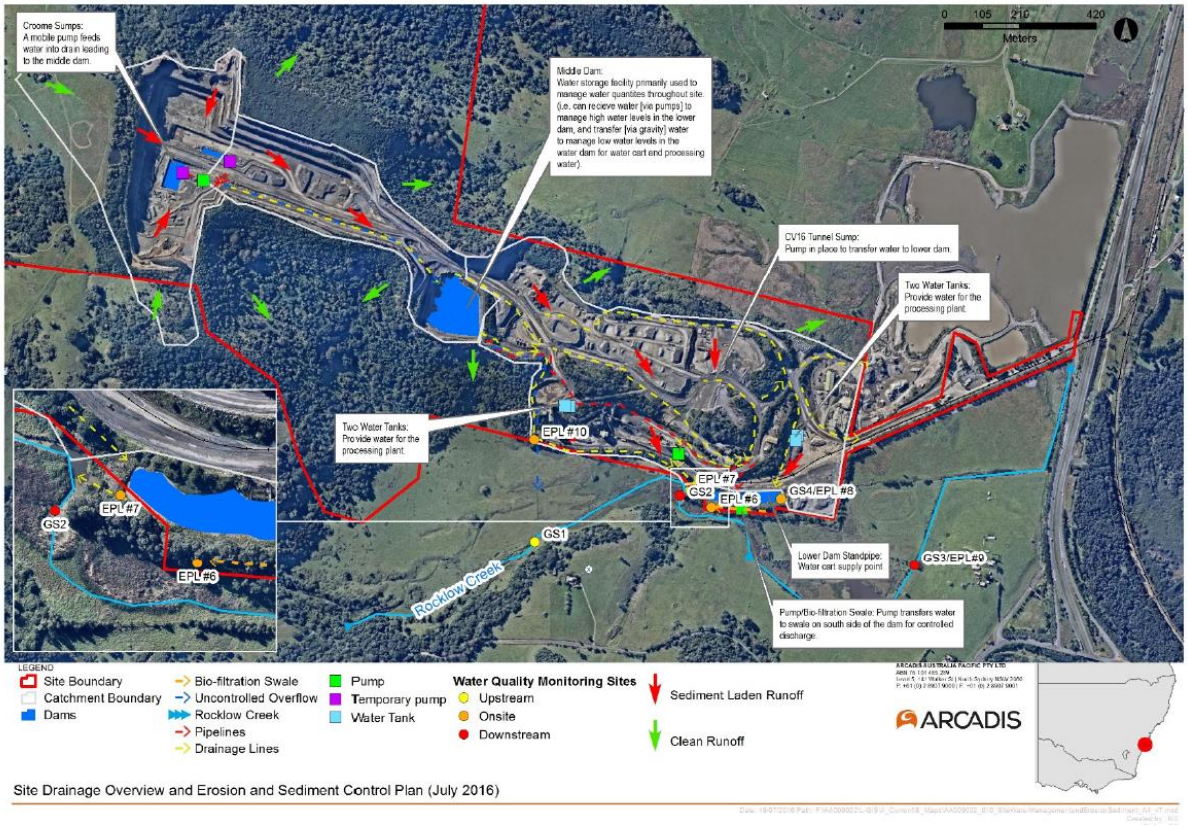

Figure 40 Surface Water Monitoring Locations

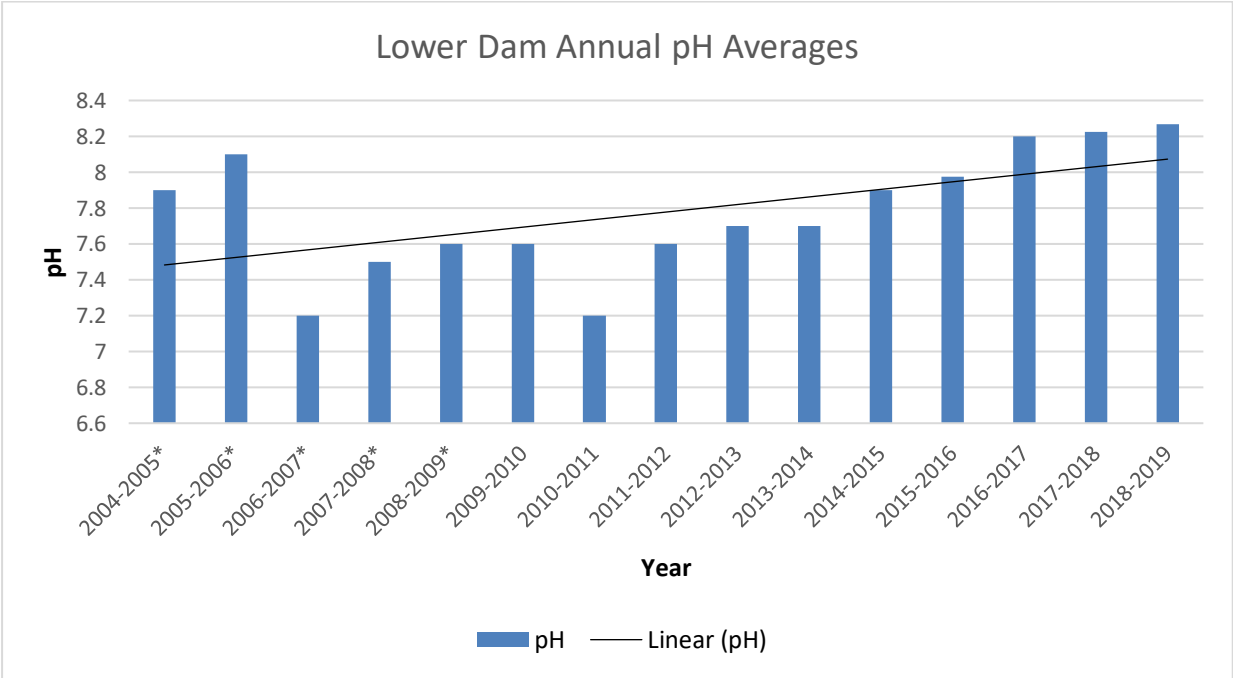

Figure 41 Lower Dam pH Trends

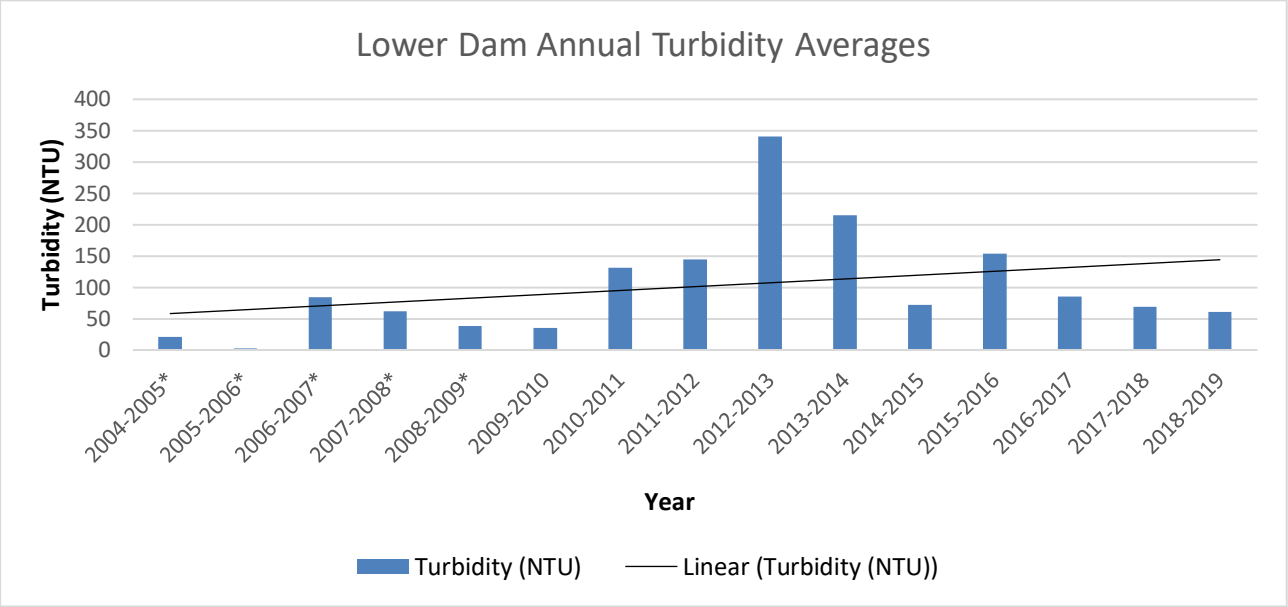

Figure 42 Lower Dam Turbidity Trends

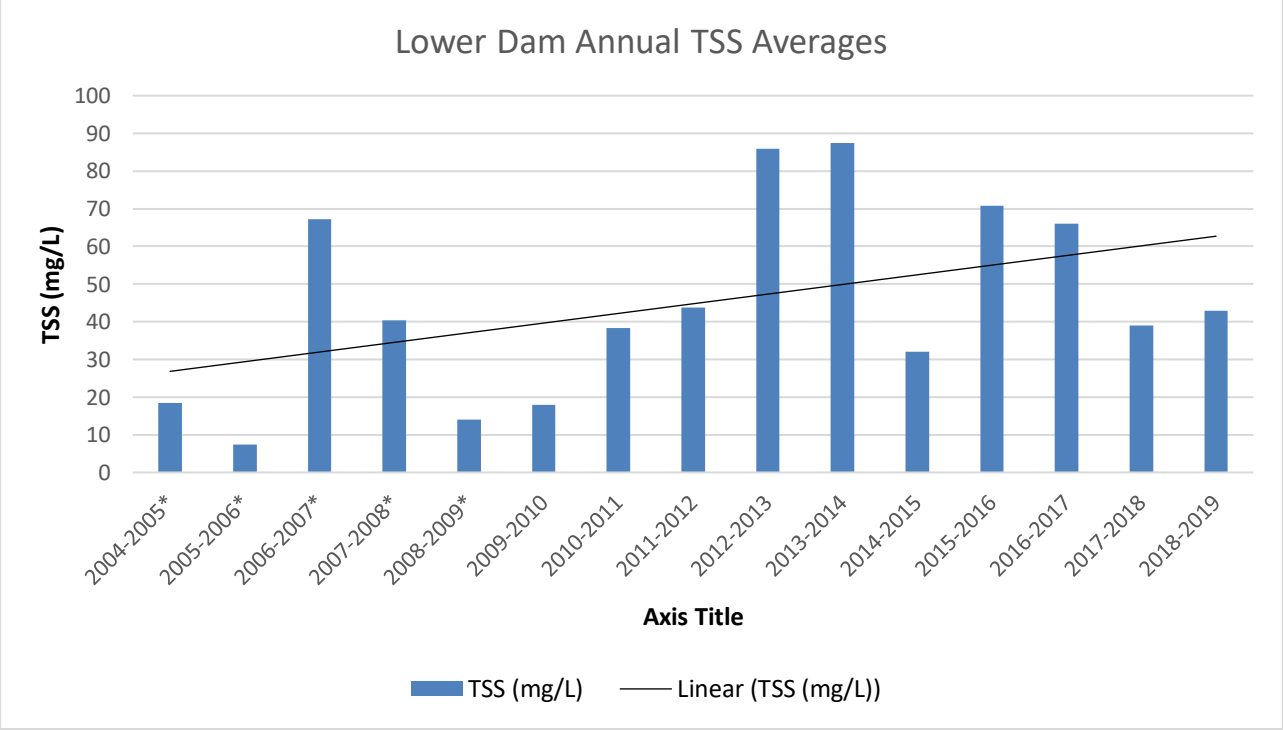

Figure 43 Lower Dam TSS Trends

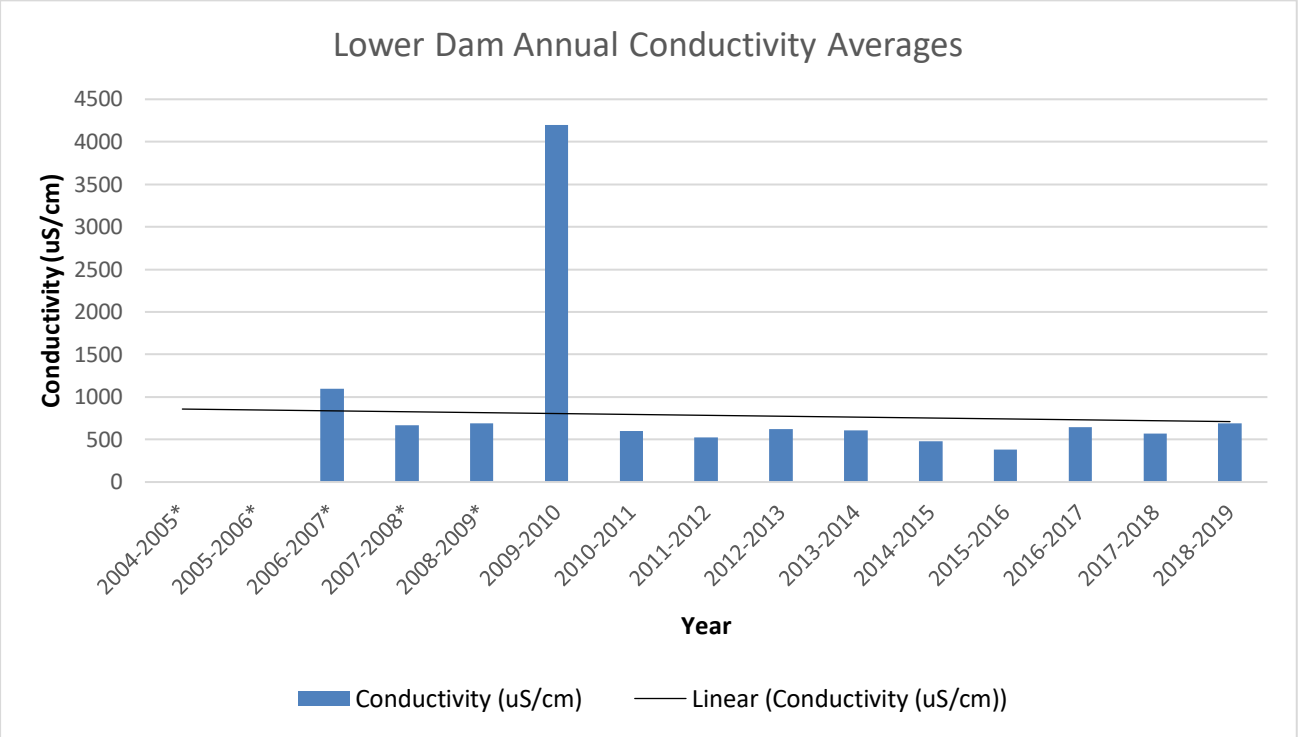

Figure 44 Lower Dam Conductivity Trends

15. Appendix F Annual Groundwater Monitoring Report

16. Appendix G Dunmore Bushland Restoration Report