

Dunmore Quarry

Annual Review

2017-2018



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1. Introduction

1.1. Purpose/Scope

This report has been prepared to address Annual Review requirements in accordance with Condition 9, of Schedule 5 in Development Consent DA 470-11-2003 for Boral Dunmore Quarry. The review and associated report accounts for the period between 1 July 2017 and 30 June 2018. Condition 9(5) and all other relevant conditions required as part of the Annual Review are outlined in Table 1 with reference to the section of this report where each has been addressed.

Table 1: Relevant Conditions of Approval

Condition of Approval	Condition Requirements	Location within this report
9(5)	<p>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:</p> <ol style="list-style-type: none"> 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: <ul style="list-style-type: none"> • 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. <p>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.</p>	<p>Section 2.1 & 2.4</p> <p>Section 1.2, 2.4, 3.1, 4.1, 4.2, 4.3, 4.4 & 4.5</p> <p>Section 5</p> <p>Sections 3 & 4</p> <p>Sections 3 & 4</p> <p>Sections 2, 3 & 4</p>
4(30)	In each Annual Review, the Applicant must:	Section 2.3

	<ul style="list-style-type: none"> 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. 	
4(51)	The Applicant must include a progress report on the implementation of the Flora and Fauna Management Plan in the Annual Review.	Section 2.4
4(58)	The Applicant must include a progress report on the Rehabilitation Management Plan in the Annual Review.	Section 2.5
4(72)	The Applicant must describe what measures have been implemented to minimise the amount of waste generated by the development in the Annual Review.	Section 2.6.1
4(78)	<p>The Applicant must:</p> <ul style="list-style-type: none"> (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 2.2.1

1.2. Background and Site Description

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 areas known as the Original Dunmore Quarry and the Rail Infrastructure Corporation (RIC) Slot. Currently operations are centred on the Croome West Pit. A summary of all the approvals relevant to the Dunmore Quarry are provided in Table 2.

Table 2: Summary of Approvals

Approval Type	Approval Authority	Approval No.	Date Granted
Development Consent	Department of Planning & Environment	470-11-2003	30/09/2004
Environment Protection Licence (EPL)	Environment Protection Authority	77	31/08/05
Water Extraction Licence	Department of Primary Industries – Water	Water Access Licence No: WAL25152 Approval No: 10WA103611	01/07/2011

Approval of modification 9 of the development consent was granted in September 2017. This modification relates primarily to the western extension of the extraction area referred to as the Croome West Pit.



Figure 1 Dunmore Quarry Site Layout

2. Quarry Operations

2.1. Quarry Development

2.1.1. Last 12 Months

Throughout this reporting period, the site focused on exhausting the remaining resources within the Croome Farm extraction area. The site focused on tidying up all areas and ensured the full extent of material was quarried and that at all extraction limits have been reached. Operations commenced in the Croome West Pit in January 2018. Final earthworks have been completed to the north of the amenity bund.

2.1.2. Next 12 Months

The next 12 months will involve continued extraction to the west of the new deposit. Final earthworks have been completed to the north of the amenity bund and this section will be hydro-seeded in Spring 2018. Vegetation stripping in the Croome West Pit will only occur as required to minimise dust generation. Extraction is occurring straight down the pit to minimise noise and vibration to the local community. The quarry will continue to produce to the consent conditions in order to meet the current market demand

2.2. Production, Sales & Transport

2.2.1. Last 12 Months

Table 3 details the calendar year production figures for the reporting period. In total the quarry produced 1,827,087 tonnes during the reporting period. This is below the potential consented capacity of the quarry of 2.5 million tonnes of quarry product per calendar year. A total of 1,487,121 tonnes of quarry product was sold via road, whilst 213,320 tonnes was transferred to the adjacent Boral owned Dunmore Lakes Sand Project for blending with sand products and internal application. It should be noted that natural sand product is transferred to the quarry for distribution via rail. This product mass has not been represented in Table 3. Table 4 provides the production data as it will be reported to the Division of Resources and Geoscience (DRG) within the Department of Planning and Environment (DPE).

Table 3: Calendar Year Production Data

Month	Production (t)	Sales (t)	
		Road	Transfers
Jan-2017	116,325	86,086	22,296
Feb-2017	158,780	102,825	20,111
Mar-2017	180,471	96,599	13,531
Apr-2017	168,888	91,761	26,732
May-2017	165,869	149,309	18,037
Jun-2017	154,811	120,305	18,012
Jul-2017	132,354	144,928	19,620
Aug-2017	171,287	155,432	18,053
Sep-2017	141,488	120,676	9,039
Oct-2017	159,611	131,233	17,687
Nov-2017	164,269	179,526	13,030
Dec-2017	112,934	108,441	17,172
Total	1,827,087	1,487,121	213,320
		1,700,441	

Table 4: Production Data (DRG Annual Return Format)

Product	Type of Material	Total Sales / Disposals	
		Quantity (Tonnes)	\$ Value of Sale*
Virgin Materials			
Crushed Coarse Aggregates			
Over 75mm	Latite	-	*
Over 30mm to 75mm	Latite	6,568	*
5mm to 30mm	Latite	1,378,831	*
Under 5mm	Latite	441,040**	*
Natural sand	Latite		*
Manufactured Sand	Latite		*
Prepared Road Base & Sub Base	Latite		*
Other Unprocessed Materials	Latite		*
Total		1,826,439	*

*Note: This data is an approximation of FY18 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.*

2.2.2. Next 12 Months

Overall production is dependent on the outcome of planned development consent modifications for the increase in the number of allowable tonnage transported by road (Mod 11). Pending approval, it is expected that production volumes will increase to meet market demand during the 2018-2019 reporting

period production if Mod 11 is approved. If Mod 11 is approved, production will still remain below the 2.5 Mtpa consented production capacity. If Mod 11 is not approved then it is anticipated that 2018-2019 production volumes will remain similar to 2017-18 volumes.

2.3. Water Management

2.3.1. Water Management Plan

The Water Management Plan is currently under review by EMM. The Surface Water Assessment by Royal Haskoning DHV will inform the necessary updates to cover the Mod 9 expansion requirements. The Groundwater Monitoring Program by EMM will also be incorporated into the revised Water Management Plan.

2.3.2. Site Water Balance Review

The site water balance has been reviewed by consultants Royal Haskoning DHV as part of the Surface Water Assessment for Mod 9 as per Schedule 4 Condition 30.

The water balance model Figure 2 outlines the existing water management system, dam capacities and water transfers. The site water demands are presented in Table 5 below.

Table 5: Process Water Use Profiles

Process Water Use	Description	Annual Water Use ¹
Haul road dust suppression	The site operates a 50KL water cart five and a half days per week. Typical daily use rates during dry conditions are: <ul style="list-style-type: none"> • 1.6ML day in summer (2-3 loads an hour over a 13 hour period) • 0.8 ML/day in winter (2 loads an hour over a 8 hour period) 	Between 264 to 291 ML/year for wet (90th percentile) and dry (10th percentile) years respectively. Up to 300ML for extreme dry years. 2017-18 was classified an extreme dry year which corresponds to up to 300 ML/year.
Dust suppression within processing plant	Water is used for conveyor and stockpile dust suppression within the plant. Water meter readings indicate an average daily use rate of 75KL/day	Constant at 27ML/year.

Note 1: The annual water use volumes have been calculated using the site water balance. The annualised figures for haul road dust suppression account for reduced application during wet weather, reduced application rates on Saturdays and no application on Sunday.

The calculated water balance for extreme dry years (rainfall for the year was 627mm; see Section 5.5 for more details) states that total groundwater take via inflows would be up to 300ML. The water balance calculation for dry (10th percentile) years is shown below in Figure 2. More details of the water balance can be found in the Chapter 5.3 in the Surface Water Assessment for Mod 9 located in Appendix A.

2.4. Flora and Fauna Management

2.4.1. Independent Audit of Flora and Fauna Management Plan

In accordance with Condition 4(47), a Flora and Fauna Management Plan (FFMP) was prepared by Arcadis for Boral in 2016 and approved on the 18th of January 2017. An independent audit of the FFMP occurred in the previous reporting period on the 4th of April 2017 as per Schedule 4 Condition 52. A list of recommended actions was suggested and included in the FFMP revision as shown in Table 5.

Table 5 FFMP Independent Audit Recommendations

Issue	Condition	Comment	Response
-	-	Independent Audit undertaken by EPS.	The final paragraph of the Introduction has been updated to reflect the Independent Audit findings and recommendations. Table 10 page 47 details the changes to the FFMP based on the Independent Audit Findings. The audit is attached to the FFMP as Appendix C
1.	4 (49) e)	Condition 49 of the Development Consent DA 470-11-2003 requires "(e) set completion criteria for the compensatory habitat proposal". FFMP 2016 does not appear to contain any completion criteria. Consideration needs to be given to including completion criteria in FFMP 2016;	<p>Completion criteria for the compensatory habitat is provided in section 4.1.1.4 (Future management actions)</p> <p>A completion criterion has been developed with reference to the results of the vegetation assessment of the compensatory habitat area carried out by Good Bush in April 2017.</p> <p>This section will be expanded in the future in response to the requirements of Mod 9 in next revision of the document. This approach has been taken to give Boral and the department the opportunity to assess and reflect on the completion criteria. If both parties are happy with the completion criteria then this will be expanded to Zone 1 (Remnant Conservation Area) and Zone 2 (Offset Area)</p>
2.	4 (49) f)	Similarly, Condition 49 requires "(f) describe how the performance of the compensatory habitat management proposal would be monitored over time". While there is some mention of this in the FFMP 2016, it is recommended that more quantitative and prescriptive measures be considered for inclusion that are measurable and that can be monitored to determine success of whether further improvements are required;	A vegetation assessment is undertaken by Good Bush each year. It includes a full list of species and weeds present in each of the zones. Boral has entered the species lists and approximate frequencies into an excel document which will be monitored over time (after every yearly assessment).
3.	-	Action 6.1 from FFMP 2016 relates to environmental inductions for site staff. At	Revised wording included in section 6.1 is as follows:

		the moment, a literal reading of this requirement would mean that all staff and subcontractors would need to undergo an induction covering FFMP matters that would not necessarily apply to the active operating area. It is recommended that future update of the FFMP be more specific in relation to only applying in instances where staff or subcontractors are likely to interact with FFMP matters;	Environmental induction training will be delivered to all staff and subcontractors involved in any activities and/or management actions relevant to flora and fauna within the Dunmore Hard Rock Quarry site.
4.	-	It is recommended that the Environmental Coordinator develops a specific checklist of project commitments in relation to the FFMP 2016 in order to ensure it is implemented effectively; and	Appendix D includes the environmental checklist for Dunmore Quarry.
5.	-	The critical focus of Dunmore Hard Rock Quarry needs to be on identifying, addressing and funding weed management and bushland restoration in the three conservation areas. As identified in recent reporting by Good Bush and EMM, issues such as fencing repair (to exclude cattle), weed control and supplementary planting need to be pursued and acted upon. It is evident that this is happening, however Dunmore Hard Rock Quarry management needs to remain vigilant and committed to providing the appropriate resourcing to this issue in order to comply with the FFMP 2016 and ensure the desired outcomes are achieved.	Updated site environmental checklist. The checklists has a section which highlights the importance of ensuring that the Good Bush monthly works is done (item 13 in checklist) and followed up on (item 15). This has been stated in table 9, in section 5.4.

The FFMP was revised in response to the audit and updated in June 2018. This updated FFMP has been submitted to DPE for review. The FFMP is expected to be updated again during the next reporting period to capture changes from Mod 9 and reflect site operations. This will be submitted to DPE for review when completed.

2.4.2. Dunmore Quarry Bushland Restoration Project

This project is aimed at restoring the Zone 2 Offset Area as outlined in the Vegetation Assessment by Goodbush in April 2017 which was reported in the FY17 Annual Review.

The objectives of this works program is to undertake bushland restoration works in order to:

- reduce the area of Boral Dunmore Quarry natural areas impacted by Noxious Weeds, WoNs and environmental invasive weeds;
- 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/completion using visual based documentation.

A summary of the results for each subzone of the offset area is shown in Table 6, 7 and 8

Table 6 Melaleuca Armillaris Tall Shrubland Vegetation Assessment

Vegetation Condition		Percentage Cover prior to works	Percentage Cover post works
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of <i>Melaleuca armillaris</i> and <i>Eucalyptus tereticornis</i>	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by <i>Zieria granulata</i> , <i>Dodonea viscosa</i> and <i>Olea europaea</i> subsp. <i>cuspidata</i>	80% native cover 20% weed cover	100% native cover 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by <i>Lantana camara</i> , <i>Indigofera australis</i> and <i>Leucopogon juniperinus</i>	30% native cover 70% weed cover	100% native cover 0% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds such as <i>Bidens pilosa</i> and <i>Tagetes minuta</i>	40% native cover 60% weed cover	80% native cover 60% weed cover

Table 7 Illawarra Subtropical Rainforest Vegetation Assessment

Vegetation Condition		Percentage Cover prior to works	Percentage Cover post works
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of rainforest species such as Red Cedar, Red Ash, Ficus spp.	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by rainforest species such as <i>Guoia semiglauca</i> and <i>Hibiscus heterophyllus</i>	95% native cover 5% weed cover	100% native cover
Shrub layer	The shrub layer surrounding this photo point is dominated by small regenerating rainforest species and Lantana, Wild Tobacco, Cassia	20% native cover 80% weed cover	100% native cover
Ground Layer	The ground layer surrounding this photo point is dominated by regenerating native rainforest trees and ferns as well as a range of annual weeds and invasive vines such as Cape Ivy and Madiera Vine	40% native cover 60% weed cover	70% native cover 30% weed cover

Table 8 Illawarra Grassy Woodland Vegetation Assessment

Vegetation Condition		Percentage Cover prior to works	Percentage Cover post works
Upper Stratum (emergent canopy)	The upper stratum surrounding this photo point is dominated by a tall canopy of <i>Melaleuca armillaris</i> <i>Eucalyptus tereticornis</i>	100% native cover	100% native cover
Mid Stratum (sub canopy)	The mid stratum surrounding this photo point is dominated by <i>Notolea venosa</i> <i>Dodonea viscosa</i> <i>Acaica maidenii</i> <i>Olea europaea</i> subsp. <i>cuspidata</i>	80% native cover 20% weed cover	100% native cover 0% weed cover
Shrub layer	The shrub layer surrounding this photo point is dominated by <i>Lantana camara</i> <i>Indigofera australis</i>	30% native cover 70% weed cover	100% native cover 0% weed cover
Ground Layer	The ground layer surrounding this photo point is dominated by native and weed grasses as well as a range of annual weeds such as <i>Bidens pilosa</i> <i>Tagetes minuta</i>	40% native cover 60% weed cover	80% native cover 20% weed cover

The final report for the completed works for this project is located in Appendix B. A list of management actions have been recommended for completion in Zone 2 during the next reporting period.

- Additional primary weed control within all zones to link fragmented remnants and provide assistance for natural regeneration
- Continued secondary weed control throughout all previously worked areas to continue to assist plant establishment and natural regeneration
- Maintenance of the fencing surrounding the sites to prevent cattle from gaining access to the site

In addition to the above, the restoration project is being expanded into Zone 1 Remnant Conservation Area and Zone 3 Compensatory Habitat Area for the next reporting period. Restoration works will be in accordance to the measures described in the 2017 Vegetation Assessment.

2.4.2.1. Vegetation Clearing

During August 2017, vegetation clearing had occurred at level 4 site (see figure 3) to increase stockpile area for specialised products. The vegetation was cleared as per the sites Flora and Fauna Management Plan, utilising the sites clearing protocol with prior assessments conducted and completed by a qualified ecologist. The vegetation cleared in this area was approximately 0.912 hectares in size and is dominated by dense exotic species Lantana (*Lantana camara*). Other exotic species include:

- Eastern Cassia (*Senna pendula*),
- Castor Oil Plant (*Ricinus communis*),
- Cobbler's Pegs (*Bidens pilosa*),
- Purpletop (*Verbena bonariensis*),
- Caterpillar Grass (*Paspalum dilatatum*); and
- Rhodes Grass (*Chloris gayana*).
- Forest Red Gum (*Eucalyptus tereticornis*),
- Late Black Wattle (*Acacia mearnsii*); and
- Sallow Wattle (*Acacia longifolia*).



Figure 3 Dunmore Quarry Vegetation Clearing Area for Specialty Stockpile

Vegetation was also cleared for the Croome West Expansion as part of development consent Mod 9. Clearing was taken in accordance with the Vegetation Clearing Protocol – Chapter 4 Appendix C of the Dunmore Quarry Flora and Fauna Management Plan (FFMP). The area cleared is shown below in Figure 4.

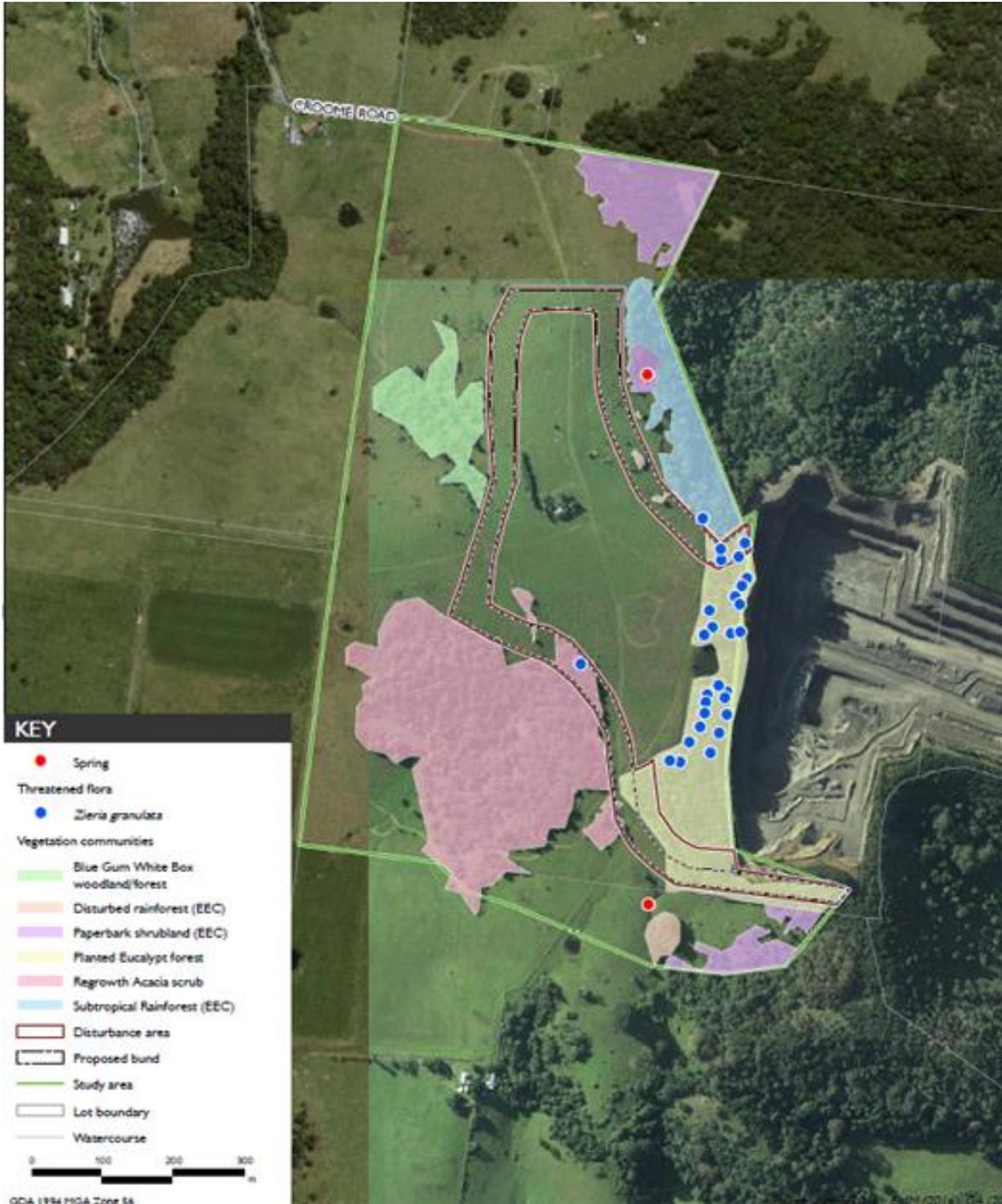


Figure 4 Dunmore Quarry Croome West Vegetation Clearing Area for Mod 9

A pre-clearance survey was undertaken by EMM as part of the Ecological Assessment for Mod 9 and it is summarised below:

- A total of 162 Illawarra Zieria (that were either planted by Boral, or regenerated from these plantings) will be removed as a result of this modification, leaving one plant which will not be impacted following the construction of works associated with Modification 8 or 9.
- This species will be planted on the bund associated with Modification 8 and Boral has demonstrated that planted individuals of this species can persist and spread in regeneration areas.
- Considering this mitigation, the assessments of significance under both TSC Act and the EPBC Act, concluded that there would be no significant impact on the species. No other threatened flora species were recorded within the proposed Croome West Pit or are considered likely to occur.
- No threatened fauna species were recorded within the study area.
- Three threatened birds and four threatened bats are considered to have the potential to occur. However, given that they are wide ranging and highly mobile, the species would not be dependent on the habitats present within the proposed Croome West Pit area.
- It is likely that any threatened species occurrence in the regrowth Acacia scrub, planted Eucalyptus forest and the disturbed rainforest habitat types is intermittent and they are unlikely to rely on the habitat. The assessments of significance under both TSC Act and the EPBC Act concluded that there would be no significant impact on any of the threatened fauna species.

The next reporting period will focus on the re-planting of Illawarra Zieria on the Croome West Amenity Bund. See Section 2.5.3 for more details.

2.5. Rehabilitation Management

2.5.1. Summary

Dunmore Quarry aims to progressively encourage a sustainable vegetative cover in accordance with the rehabilitation objectives for the site, as outlined in the site Rehabilitation Management Plan. Progressive rehabilitation work will be undertaken when reshaped, benched and topsoiled areas become available. Only small areas can currently be rehabilitated to avoid conflict with future extraction and sterilisation of resource production potential.

2.5.2. Rehabilitation Management Progress Report

Most areas of the site are currently operational and as such rehabilitation is not able to commence on the majority of areas 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

and Rehabilitation Management Plan prepared by Arcadis (2016) and the requirements of the Ecological Assessments of Overburden Removal and Placement of Croome West Bund (Mod 8) and Croome West Expansion (Mod 9).

The North Croome Benches were trimmed and aligned to the mining plan. Management of weeds throughout the southern entrance of the RIC zone is ongoing.

The southern section of the Croome Amenity bund was planted out with native Eucalypt Forest species as specified in the Mod 8 Ecology Assessment in April 2018. This is in preparation of the introduction of Zieria seedlings in the next 12 months.

Unusually dry weather throughout the 2017-18 period slowed progress of revegetation of the hydro-seeded southern section. Earthworks were completed to the north of the Croome West Bund and this area will be hydro-seeded in Spring 2018.

2.5.3. Next 12 Months

The next 12 months of rehabilitation measures will involve planting more Eucalypt forest via hydro-seeding in order to offset the clearance of this vegetation type from Mod 8 and 9. The planted Eucalypt offset area will also provide suitable habitat for planting the threatened Illawarra Zieria in order to offset the loss of individuals as a result Mod 8 and Mod 9. The Illawarra Zieria will be planted at a ratio greater than 1:1 to ensure a net gain in the number of individuals. These seedlings are currently being cultivated from cuttings and also breeding from cuttings taken from the North Croom Bench.

It has been demonstrated that the planted Eucalypt forest provides suitable habitat for the Illawarra Zieria due to continued presence of the species several decades after planting and the presence of regenerating individuals from planted parent seeding.

Management of weeds such as Lantana and exotic grasses will help to ensure the continued persistence of the Illawarra Zieria and improve recruitment of seedlings.

2.6. Waste Management

2.6.1. Waste Minimisation Measures

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 441,040 tonnes of quarry fines were produced. Throughout the reporting period 213,320 tonnes was transferred to the adjacent DLSP site for manufactured sand production. In addition, 210,000 tonnes per year is transferred to DLSP for backfilling and progressive rehabilitation.

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. Table 6 below outlines the waste totals and waste types for the reporting period.

Table 6: FY17 Waste Streams and Total

Waste Classification		FY17	FY18
Solid Waste	General Waste Tonnes	45.123	38.032
	Cardboard Tonnes	2.152	1.531
	Timber Tonnes	8.14	13
	Used Oil Filters/ Rags	-	2.4
Liquid Waste	Oil/Oily Water Litres	25,400	43,250
	Effluent Litres	60,000	61,000
	Other Litres	400	0

A separate section has been added in the waste register for this reporting period to capture the collection of used oil filters which is now collected separately and sent to a third party to be recycled.

There was a decrease in general waste and cardboard tonnes collected on site during the reporting period. There was more oil and oily waters litres collected on site and this increase is attributed to increase of earthwork and machinery movements associated with the Mod 9 expansion.

These waste management practices will continue over the next 12 months, with a particular focus on managing quarry fines stock levels and maximising quarry fines transfers for manufactured sand production.

3. Complaints and Community Management

3.1. Complaints Summary and Analysis

Dunmore Quarry maintains a complaints register that identifies actions required to resolve issues and concerns raised by the community. The complaints register is also published on the Boral website. One (1) complaint was received over the reporting period. A summary of complaints received since 2004 is shown below in Figure 5.

The EPA received a phone call and an email regarding dust affecting the local area 3kms from site. This information was forwarded to the environmental coordinator informing of a dust complaint received on the 25th of September 2017.

It was unable to be ascertained if the Dunmore Quarry was solely responsible for the elevated dust 3kms away. All water carts were operational on the day of the dust complaint. No works were being conducted on the dust stockpile (generator of dust) and there were high winds for the day. As a proactive measure the main dust stockpile has been located to bench 4 in an area protected from the wind. The dust stockpile is currently being depleted as it is being moved to DSS and used as VEMN backfilling for the Stage 2 Pond.

Dunmore Quarry Summary of Complaints 2004-2018

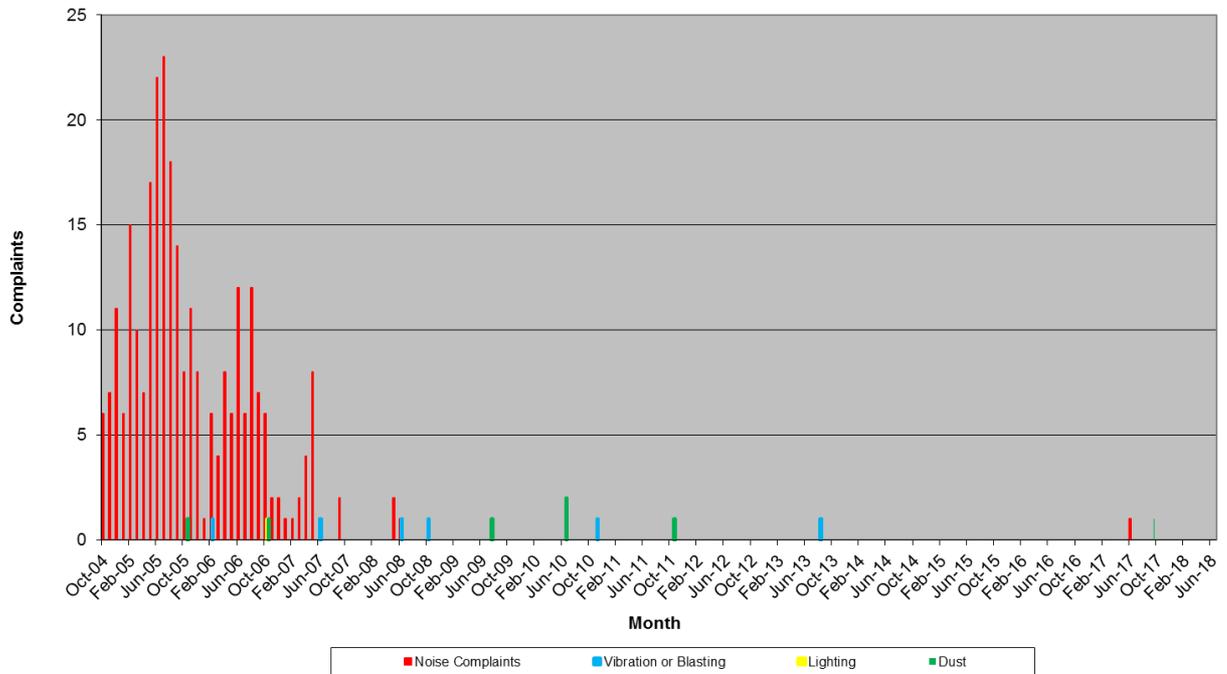


Figure 5 Dunmore Quarry Summary of Complaints

3.2. 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. 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.

The CCC met twice during the 2017-2018 reporting period (August 2017 and February 2018).

4. Environmental Monitoring

4.1. Noise

A noise monitoring program was prepared in recognition of Condition 4(14) to monitor noise at the three receiver locations specified in the consent and EPL. These locations are displayed in Figure 24 in Appendix C. The noise monitoring program includes:

Annual attended noise monitoring surveys were conducted at all receiver locations during winter by a specialist noise consultant (Condition 4(13)).

A Noise Compliance Assessment Report was prepared by SLR Consulting Australia and presents results of attended noise monitoring surveys undertaken during the FY18 reporting period on the 27th of July 2017 at receiver locations A (McParland), K (Stocker) and O (Dunmore Lakes Estate).

The report found that the quarry achieved compliance with the licence noise limits at all locations during all monitoring periods. This is in line with previous reporting periods. The noise levels monitored are consistent with EIS predictions.

Figure 6 provides a graphical representation of the noise monitoring results (estimated Quarry LAeq [15 minute] contribution sourced from Annual Noise Monitoring Assessments) for the life of the project, including linear trend patterns. It is clear that the monitoring results have remained generally consistent with neutral or decreasing trend patterns over the life of the project.

It is noted that on 13/12/2017 the Noise Management Plan was updated and approved to reflect the new requirements associated with the Croome West Expansion (Mod 9). New monitoring points and noise limits will be applicable for the annual noise compliance assessment and will be reported in the next Annual Review.

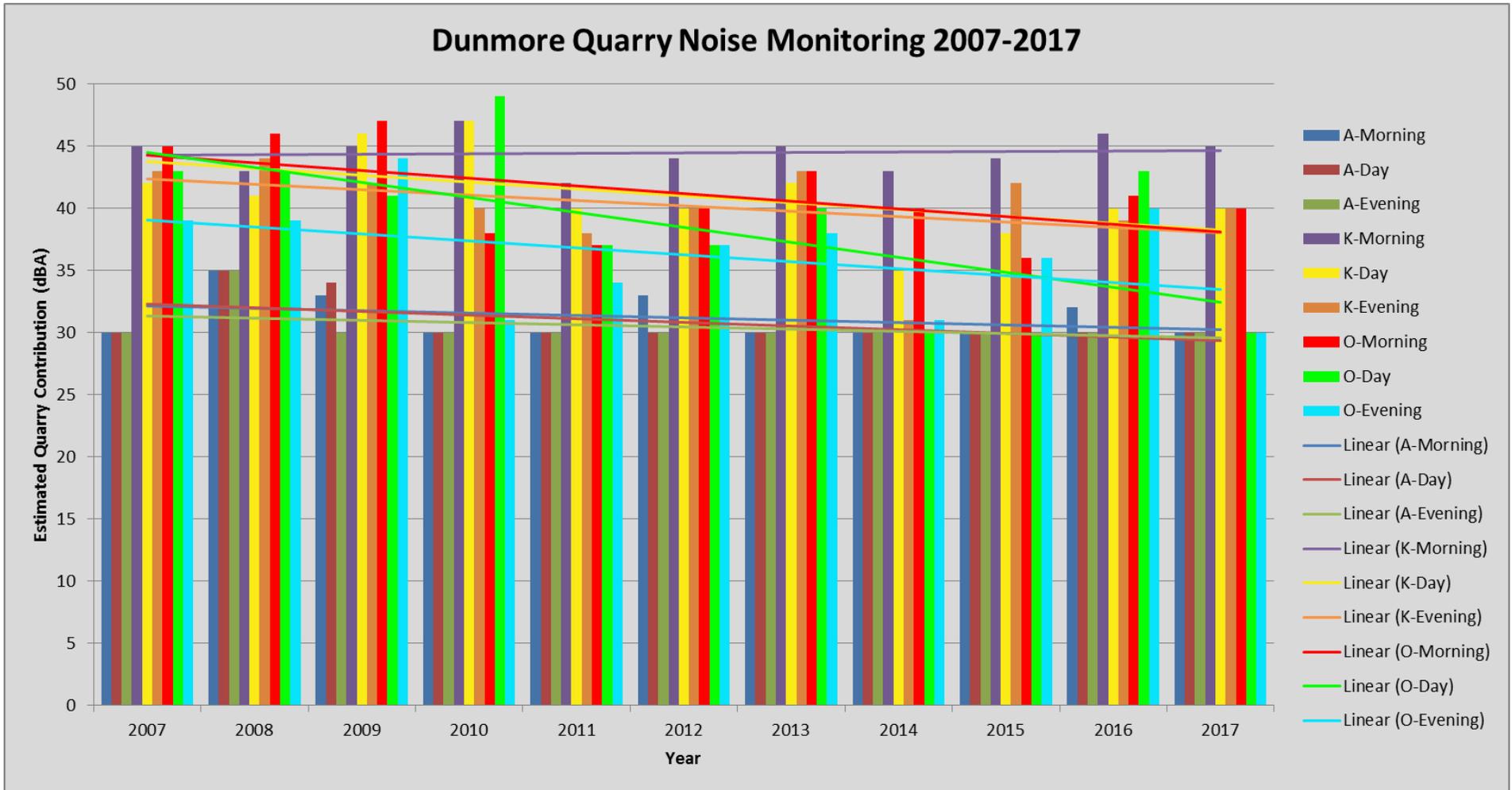


Figure 6 Dunmore Quarry Attended Noise Monitoring Results

4.2. Blasting

A total of 54 blasts were conducted throughout the 2017-2018 reporting period. During the reporting period the monitoring location changed from the MacParland residence to the Benny Residence as per the updated Blast Monitoring Management Plan for Mod 9. A request for variation to EPL 77 was sent on 16th of February 2018. From 16th of February onwards, the Benny residence is used for compliance monitoring. For due diligence the former monitoring point at MacParlands is still monitored however results from 16th of February onwards will not be reported in this annual review. The location of the blast monitoring points is shown in Figure 25 in Appendix C.

Figures 7 to 10 show the blast monitoring at the MacParland and Benny residences during the reporting period. Figure 11 and 12 demonstrate long term historical trends of Overpressure and Ground Vibration respectively.

Six blasts did not exceed trigger levels set on the monitoring instruments indicating they are of low level and in compliance with the assessment criteria. These blasts are represented as absent bars in Figure 6 and 7. There were 37 blasts using the MacParlands monitoring point and 17 blasts which were monitored from the new location at the Benny Residence.

On 27/2/18 there was a ground vibration measurement of 5.590mm/s at the Benny residence which was below the 100 percentile limit of 10mm/s. Ground vibration measurements at MacParlands was measured at 3.050mm/s.

Blast monitoring results were deemed compliant for the reporting period as blast were within limits of 95th percentile limit of 5 mm/s and 100th percentile limits for 10mm/s respectively for the 54 blasts during the reporting period.

Figure 11 and 12 provide a graphical representation of the blast monitoring results for the life of the project. Trend analysis depicts that over the life of the project airblast overpressure and ground vibration have increased marginally overtime but are still on average below the predicted EIS values. This increase is considered a result of the Quarry operations, and therefore blast locations, progressing west and closer to the blast monitoring equipment.

After January 2018 blasts were undertaken on the upper benches of the Croome West Pit which has resulted in higher than average readings for ground vibration. The focus of operations is to move straight down the pit when blasting to minimise this effect. It can be seen in Figure 12 after April ground vibration had returned back to historical levels.

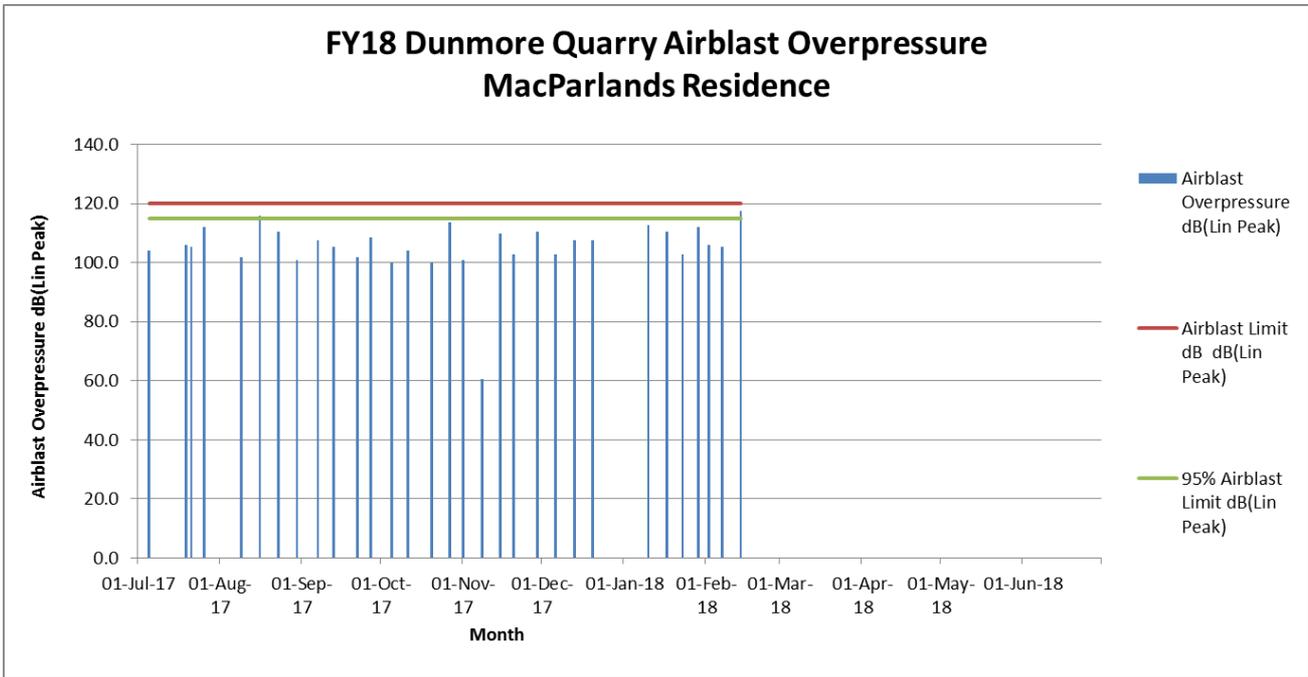


Figure 7 FY18 Airblast Overpressure Monitoring at MacParlands

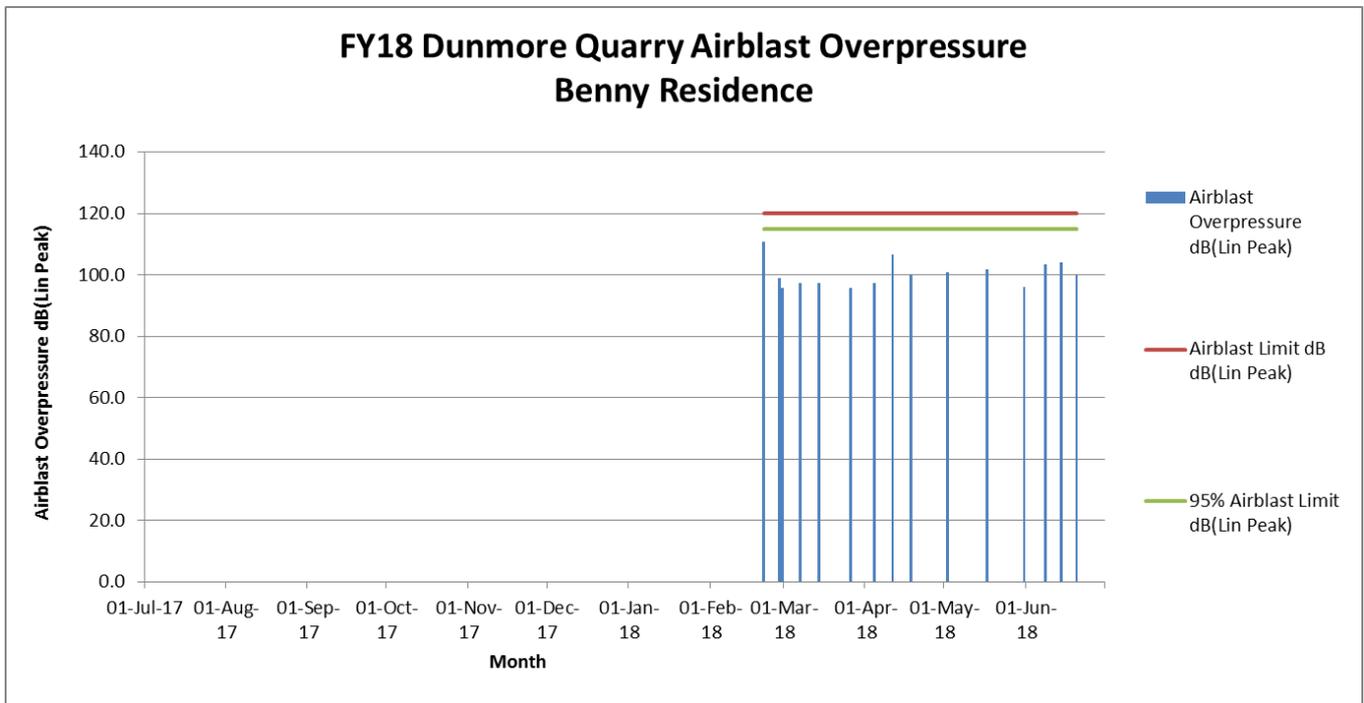


Figure 8 FY18 Airblast Overpressure Monitoring at Benny Residence

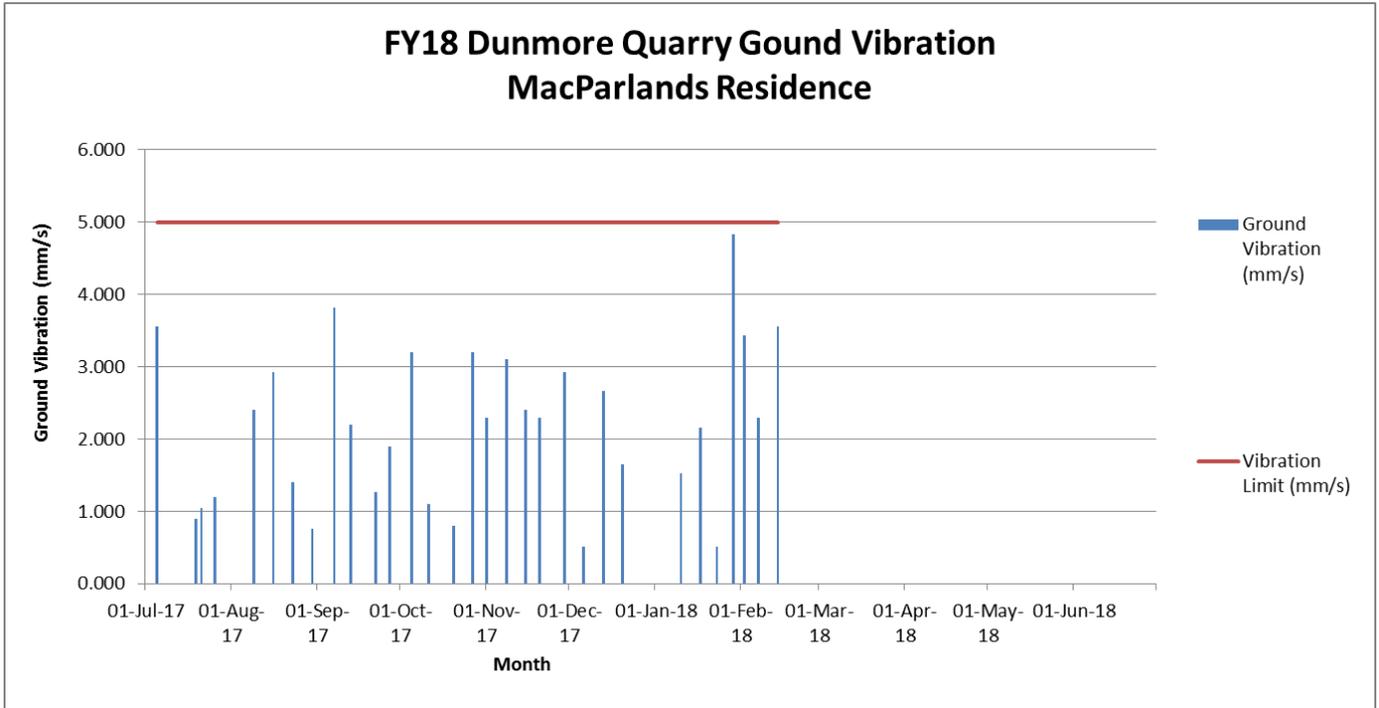


Figure 9 Ground Vibration Monitoring at MacParlands

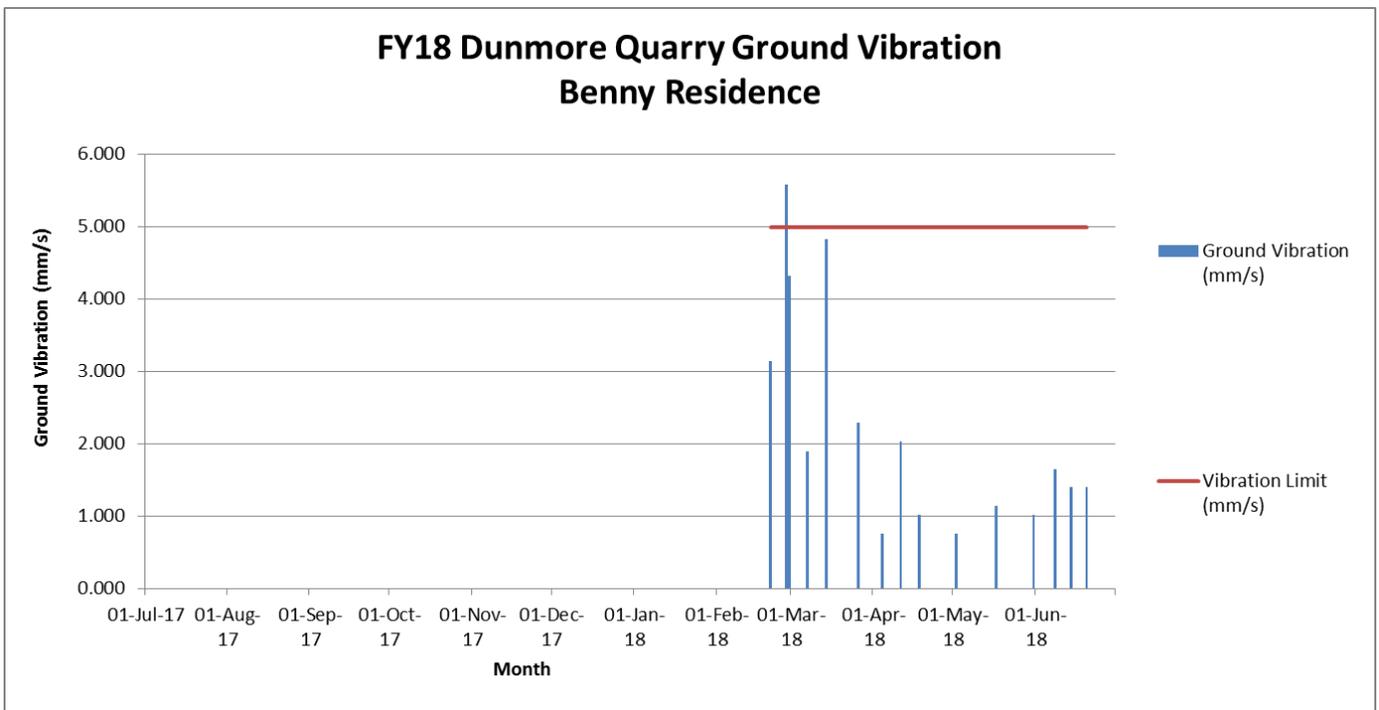


Figure 10 Ground Vibration Monitoring at Benny Residence

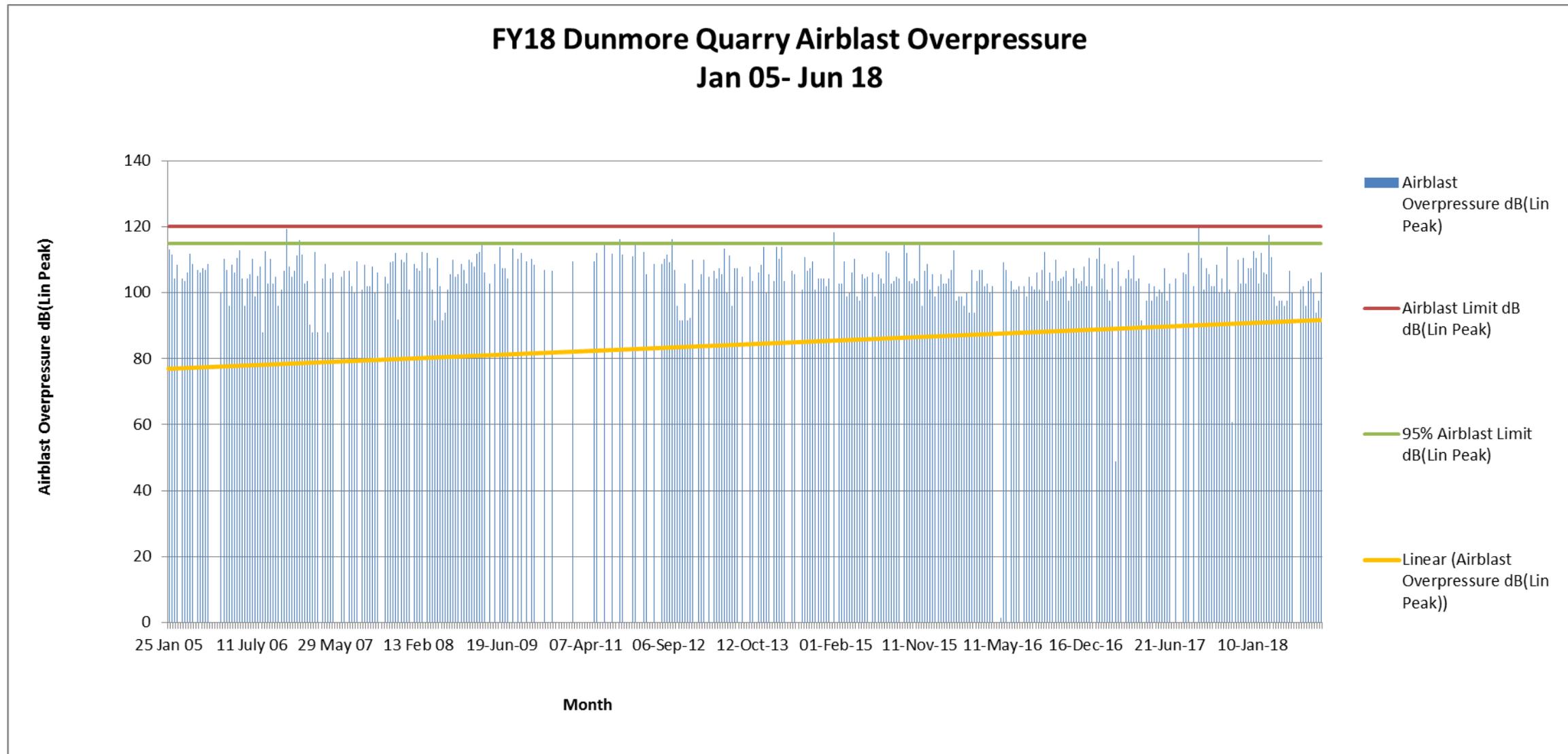


Figure 11 Dunmore Quarry Historical Airblast Overpressure

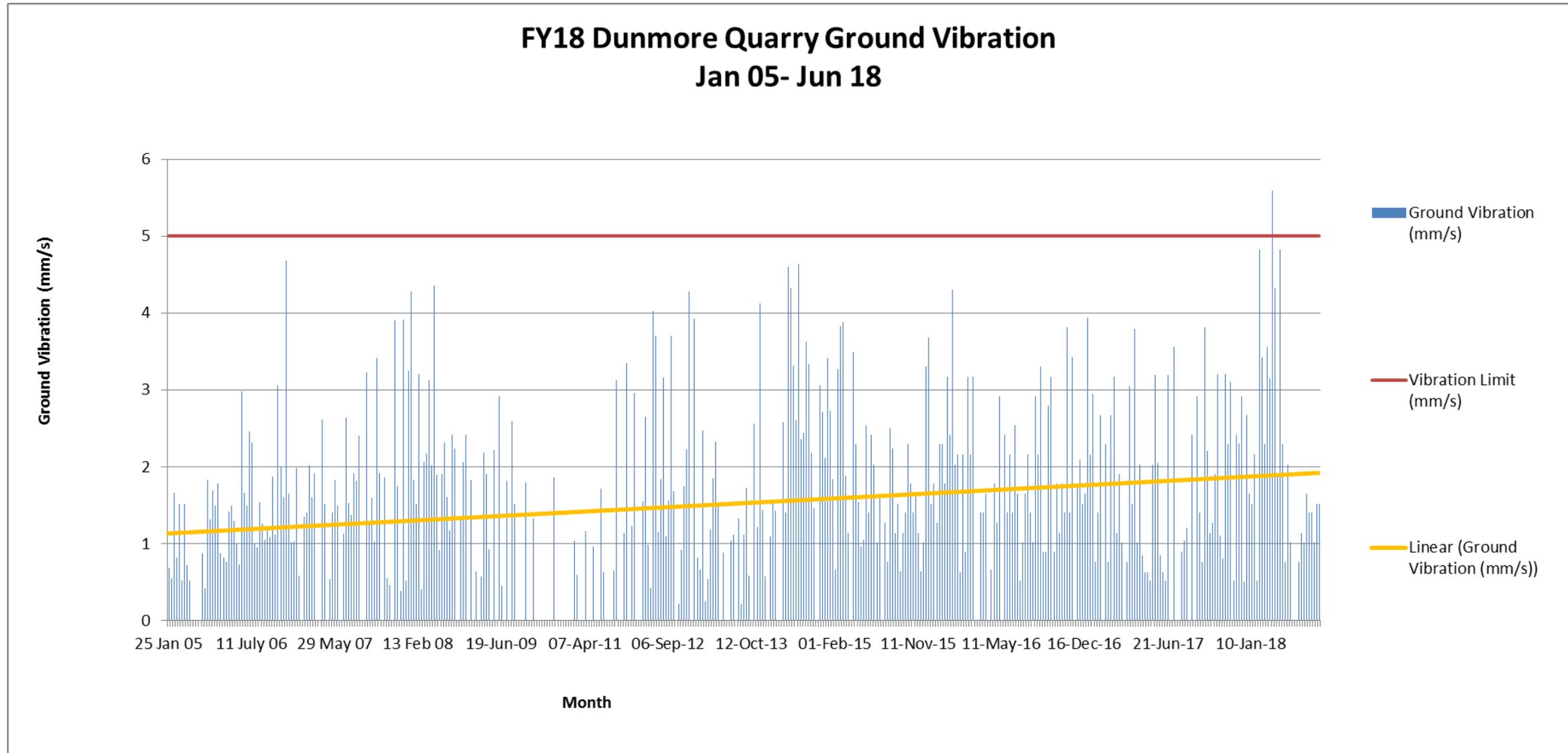


Figure 12 Dunmore Quarry Historical Ground Vibration

4.3. Air Quality

4.3.1. Deposited Dust

The air quality monitoring program includes 4 deposited dust gauges that have been in operation for 12+ years. The location of these dust gauges can be seen Appendix 3. The Air Quality Impact Assessment for the Croome West Expansion (Mod 9) stated that location of Site 1 and 2 will likely need to be revised to accommodate for the westward progression of extractive operations (Ramboll Eviron, 2016).

Two alternate locations (site 1A and site 2A) were set up in April 2018 for comparison purposes until EPL 77 is updated and the Air Quality Management Plan is updated to satisfy the additional requirements for Mod 9. Data for 1A and 2A has been collected for May and June 2018. Air quality monitoring locations are shown in Figure 26 in Appendix C

It is noted that the impact criteria assessment defines dust as insoluble solids. A deposited dust sample is non-discriminate and the surrounding land use of the quarry is predominately farmland and/or wetlands. As a result, there is potential for organic material not associated with quarry activities such as vegetation, bird droppings and dead insects to contribute to the insoluble solids fraction of the sample.

The quarry produces non-combustible latite. Assessing the ash fraction is used as a means to minimise some of the influences on the deposited dust sample from the combustible organic material mentioned above.

Figures 13-16 presents the monthly results of deposition dust monitoring for the 2017-18 reporting period. Table 9 presents the results of deposited dust monitoring during the reporting period as well as averages for previous reporting periods. Dominant wind directions for the month are also shown in Table 9. Figure 17 provides a graphical representation of the annual averages and linear trend patterns for the life of the project at each monitoring location. Appendix D displays the monthly wind roses for the reporting period.

4.3.1.1. Site 1

During the reporting period Site 1 yielded an annual average of 4.39g/m²/month insoluble solids, with an average ash content of 2.95g/m²/month which was above the impact assessment criteria for dust (defined as insoluble solids) of 4g/m²/month annual average. Ash content which is a more reliable estimator of quarry contribution was below 4g/m²/month.

Annual dust deposition was impacted by an outlier measurement in June as shown in Figure 13. Site 1A recorded a measurement of 1.8g/m²/month for insoluble solid content and 1.22g/m²/month for ash indicating that the measurement at Site 1 was an anomaly. Dominant wind direction as indicated in Table 9 for June was from the WSW, SW and SSW. Downwind dust gauges at Site 3 and 4 were

measured at 1.6 g/m²/month for insoluble solids and 1.17g/m²/month for ash and 2.78g/m²/month for insoluble solids and 1.63g/m²/month for ash respectively.

This indicates that the dust generated at Site 1 during June 2018 did not impact on sensitive receivers and that this measurement was an anomaly associated with the proximity of the dust gauge to the works undertaken on the amenity bund during this period.

If Site 1A data is used for June 2018 the annual average is 2.93g/m²/month for insoluble solids and 2.00g/m²/month. This adjusted average has been used in Figure 17 which shows the historical trend over the monitoring program history. Over the life of the project, Site 1 has maintained a relatively stable results and has continued during the FY18 reporting period, the site, however remains slightly higher in comparison to Dunmore Quarry EIS predicted annual dust deposition.

There were four instances during the reporting period where insoluble solids deposition was greater than 4g/m²/month, with one of these occasions having an ash content greater than 4g/m²/month. Site 1 will be relocated to the Site 1A location during the FY19 period.

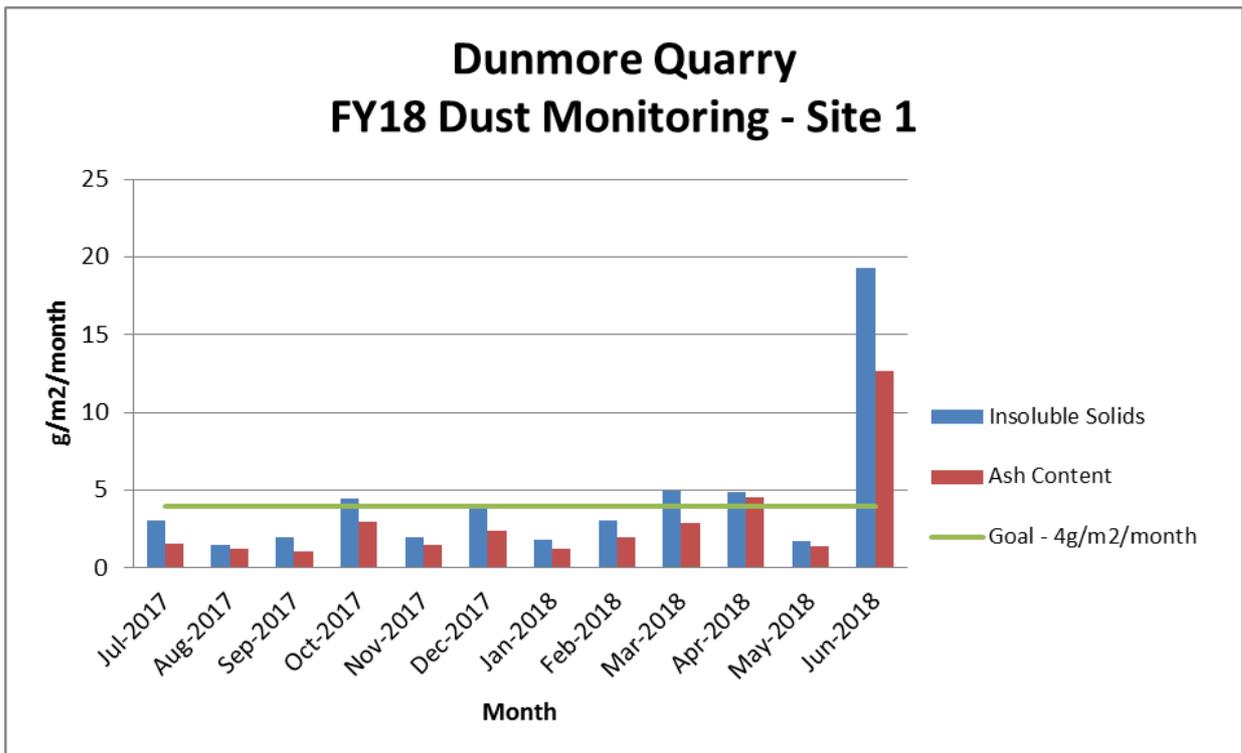


Figure 13 FY18 Dust Monitoring - Site 1

4.3.1.2. Site 2

During the reporting period Site 2 yielded an annual average of 4.39g/m²/month insoluble solids, with an average ash content of 3.30g/m²/month which was above the impact assessment criteria for dust

(defined as insoluble solids) of $4\text{g/m}^2/\text{month}$ annual average. Ash content was below $4\text{g/m}^2/\text{month}$ which is a more reliable estimator of quarry contribution to deposited dust levels.

Figure 14 shows that there were six instances during the reporting period where insoluble solids deposition was greater than $4\text{g/m}^2/\text{month}$, with two of these occasions having an ash content greater than $4\text{g/m}^2/\text{month}$.

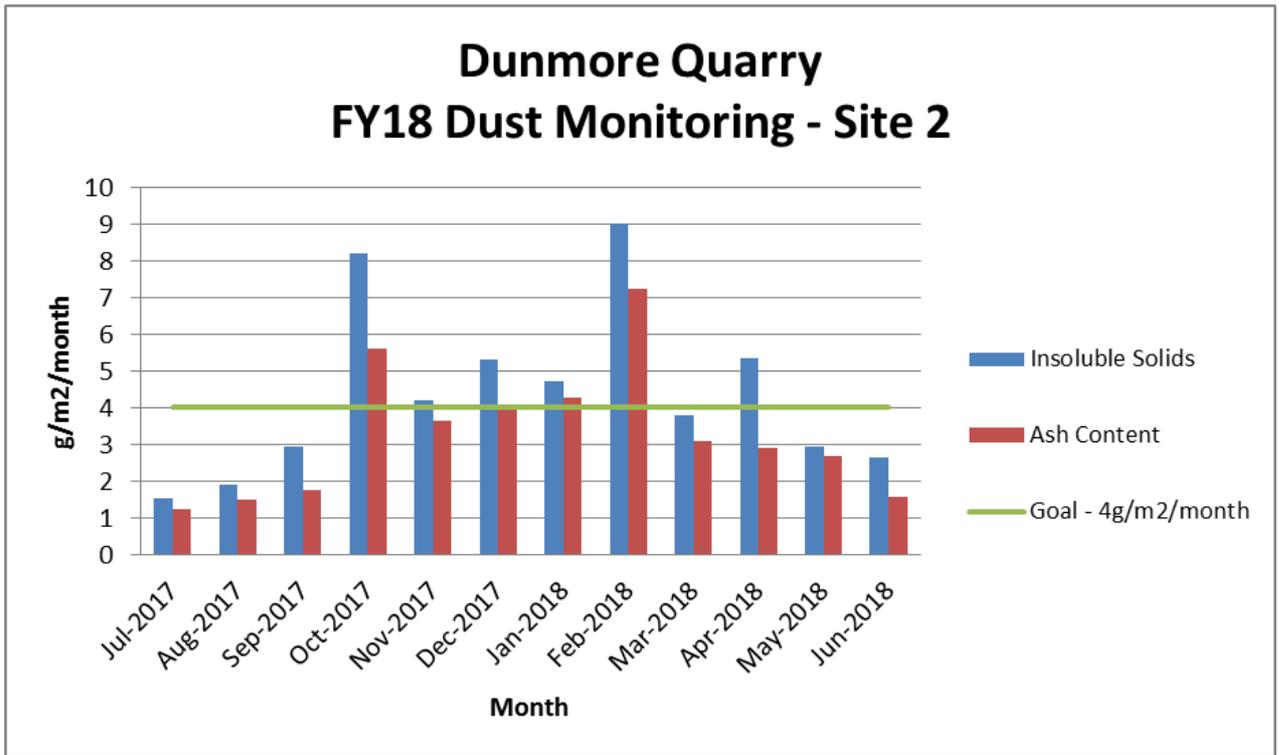


Figure 14 FY18 Dust Monitoring - Site 2

Elevated dust levels are seen through October 2017 through to April 2018 with the exception of March 2018. Table 9 indicates that the dominant wind direction and the direction of strongest wind for this period is WSW and NNE with the strongest winds from the NNE for each of these months with the exception of April 2018.

Site 2 is downwind of the NNE prevailing wind however the location of Site 2 is in close proximity (approximately 100m) from the constructed amenity bund and Mod 9 operations which began in January 2018. In April 2018, both the dominant and strongest wind was from the WSW, upwind of the quarry.

As an upward trend became apparent in repeated measurements over the reporting period Site 1A and Site 2A were installed in April further west as per Mod 9 Air Quality Impact Assessment recommendations to compare dust values. The objective of these additional dust deposition gauges is to confirm that the proximity of Site 1 and 2 to the amenity bund is not representative of dust levels at

sensitive receiver locations. Discussion about the outcome of these investigations will be discussed in Section 4.3.1.5.

Over the life of the project, Site 2 has maintained relatively stable results. During the FY18 reporting period there was a marginal elevation above the general trend and this can be attributed to the construction of the amenity bund over the last two years in close proximity to the deposited dust gauge at Site 2. Site 2 measurements are slightly higher in comparison to Dunmore Quarry EIS predicted annual dust deposition. Site 2 will be relocated to the Site 2A location during the FY19 period.

4.3.1.3. Site 3

Site 3 is shared between the Dunmore Quarry and Dunmore Sand and Soil. During the reporting period, Site 3 yielded an annual average of 2.36g/m²/month insoluble solids, with an average ash content of 1.65g/m²/month which was below the impact assessment criteria for dust (defined as insoluble solids) of 4g/m²/month annual average. Figure 15 shows September 2017 results were marginally above 4g/m²/month for insoluble solids yet below 4g/m²/month ash.

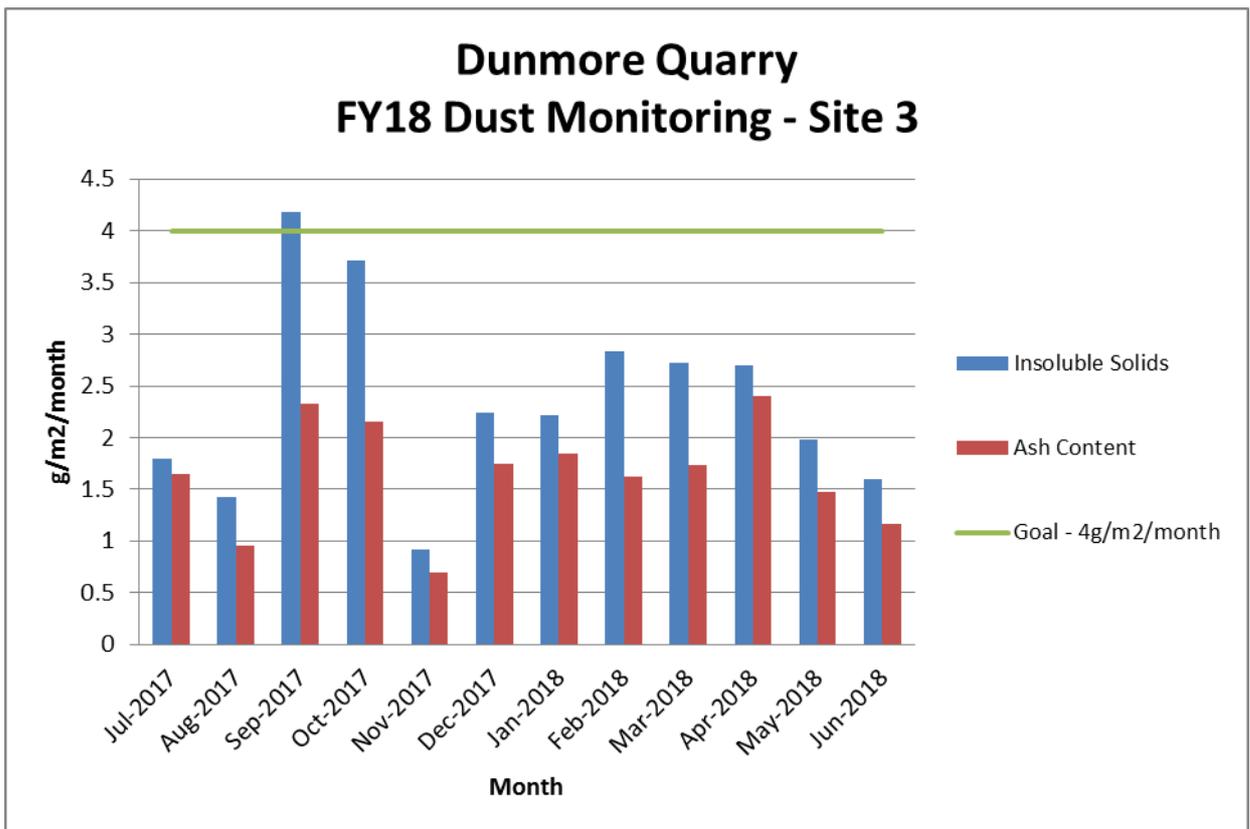


Figure 15 FY18 Dust Monitoring – Site 3

Over the life of the project, Site 3 had been steadily increasing up until its relocation in 2015-16 due to Stage 3 operations at adjacent Dunmore Sand and Soil. After this date, deposited dust values have

been steadily decreasing and has continued during the FY18 reporting period. Site 3 however remains slightly higher in comparison to Dunmore Quarry EIS predicted annual dust deposition.

4.3.1.4. Site 4

Site 4 is shared between the Dunmore Quarry and Dunmore Sand and Soil. During the reporting period, Site 4 yielded an annual average of 2.84g/m²/month insoluble solids, with an average ash content of 1.79g/m²/month which was below the impact assessment criteria for dust (defined as insoluble solids) of 4g/m²/month annual average. Figure 16 shows September 2017 and March 2018 results were above 4g/m²/month for insoluble solids yet below 4g/m²/month ash.

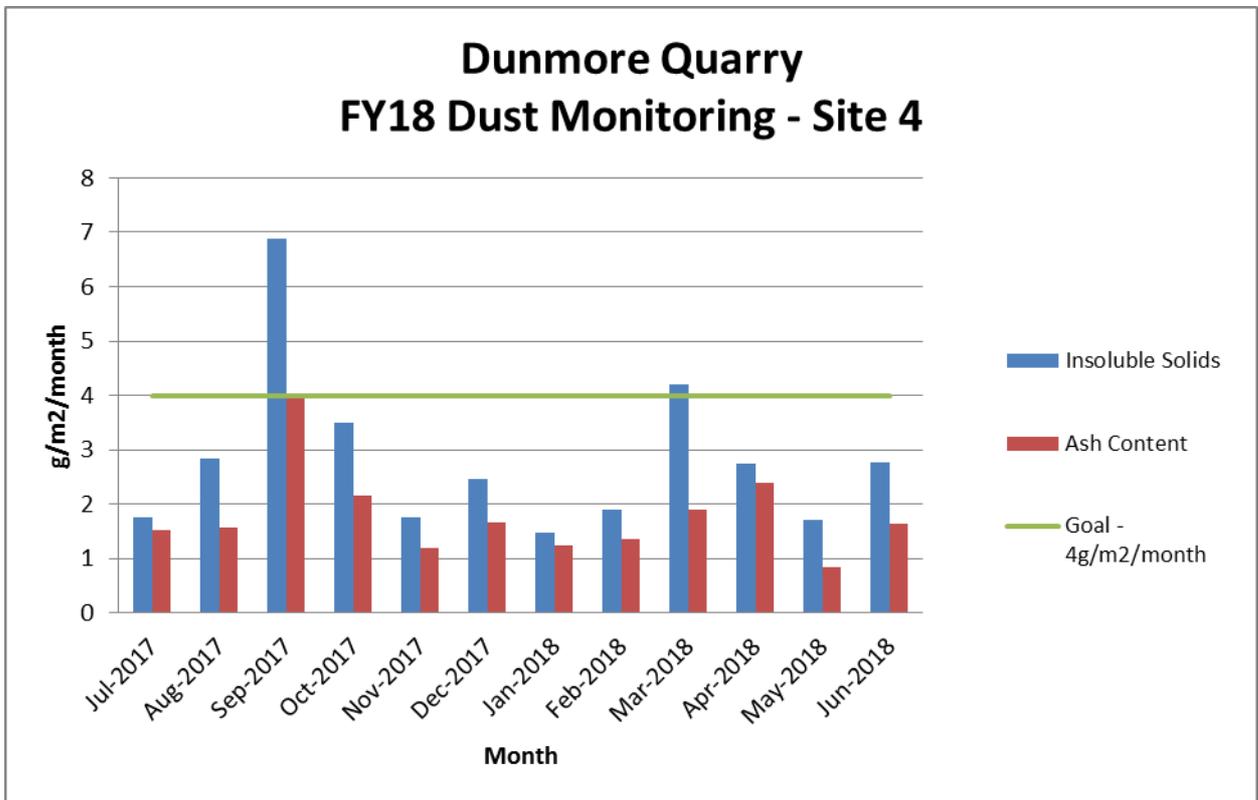


Figure 16 FY18 Dust Monitoring - Site 4

The trend patterns over the life of the project, for both insoluble solids and ash content Site 4, remained relatively neutral with a slight decrease in reporting period averages. The site results continue to remain slightly higher in comparison to Dunmore Quarry EIS predicted dust deposition.

Table 9: Deposited Dust Measurements

Month	Site 1 grams/m ² /month		Site 1 A grams/m ² /month		Site 2 grams/m ² /month		Site 2A 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	Insoluble Solids	Ash	Insoluble Solids	Ash			
2005/2006 Average	5.85	2.66	-	-	4.48	1.67	-	-	4.85	2.22	3.9	1.92			
2006/2007 Average	5.4	2.13	-	-	2.48	1.53	-	-	2.79	1.89	4.31	2.44			
2007/2008 Average	3.26	1.67	-	-	2.37	1.3	-	-	3.89	2.9	5.55	3.17			
2008/2009 Average	6.6	2.63	-	-	3.01	2.1	-	-	3.12	2.17	2.71	1.66			
2009/2010 Average	4.65	3.03	-	-	4.41	2.6	-	-	5.02	3.49	3.15	2.33			
2010/2011 Average	3.35	1.43	-	-	5.86	3.92	-	-	3.43	2.09	2.53	1.6			
2011/2012 Average	3.74	1.92	-	-	3.28	1.7	-	-	5.03	3.44	2.75	1.81			
2012/2013 Average	3.73	1.65	-	-	2.61	1.65	-	-	5.87	3.6	3.36	2.36			
2013/2014 Average	9.56	4.94	-	-	3.63	1.79	-	-	4.61	3.28	3.2	2			
2014/2015 Average	5.63	2.72	-	-	2.38	1.44	-	-	7.36	4.42	3.1	1.98			
2015/2016 Average	5.75	2.09	-	-	3.12	1.77	-	-	8.25	5.53	3.01	1.84			
2015/2016 Adjusted Average	3.46	1.66	-	-	3.12	1.77	-	-	7.2	4.45	3.01	1.84			
2016/2017 Average	2.2	1.42	-	-	3.36	1.96	-	-	2.28	1.56	2.01	1.3			
Jul-2017	3.09	1.52	-	-	1.55	1.23	-	-	1.8	1.65	1.76	1.53	WSW,SW	WSW	132,354
Aug-2017	1.46	1.22	-	-	1.91	1.51	-	-	1.43	0.95	2.84	1.58	WSW,SW	W,WSW,SW	171,287
Sep-2017	1.95	1.04	-	-	2.96	1.76	-	-	4.19	2.33	6.89	4.04	WSW	WSW	141,488
Oct-2017	4.43	2.95	-	-	8.22	5.61	-	-	3.72	2.15	3.49	2.16	WSW,NNE	NNE	159,611
Nov-2017	2.01	1.5	-	-	4.21	3.63	-	-	0.92	0.7	1.77	1.19	WSW,NNE	NNE	164,269
Dec-2017	3.97	2.41	-	-	5.32	4.05	-	-	2.24	1.75	2.47	1.66	WSW,NNE	NNE	112,934
Jan-2018	1.79	1.22	-	-	4.71	4.26	-	-	2.22	1.84	1.47	1.23	WSW,NNE	NNE	116,325
Feb-2018	3.03	2.01	-	-	9.02	7.25	-	-	2.83	1.62	1.89	1.35	WSW,NNE	NNE	158,780
Mar-2018	4.97	2.9	-	-	3.81	3.09	-	-	2.72	1.74	4.21	1.91	WSW,SSW	E	180,471
Apr-2018	4.91	4.56	-	-	5.36	2.91	-	-	2.7	2.4	2.74	2.39	WSW	WSW	168,884
May-2018	1.75	1.41	1.87	1.38	2.96	2.7	1.91	1.41	1.98	1.48	1.72	0.85	WSW,SW	SW,SSW	165,869
Jun-2018	19.35	12.66	1.8	1.22	2.64	1.57	1.43	1	1.6	1.17	2.78	1.63	WSW,SW,SSW	WSW	154,811
2017-2018 Average	4.39	2.95			4.39	3.30			2.36	1.65	2.84	1.79			
2017-2018 Adjusted Average	2.93	2	-	-	4.2	3.14	-	-	2.36	1.65	2.84	1.79			

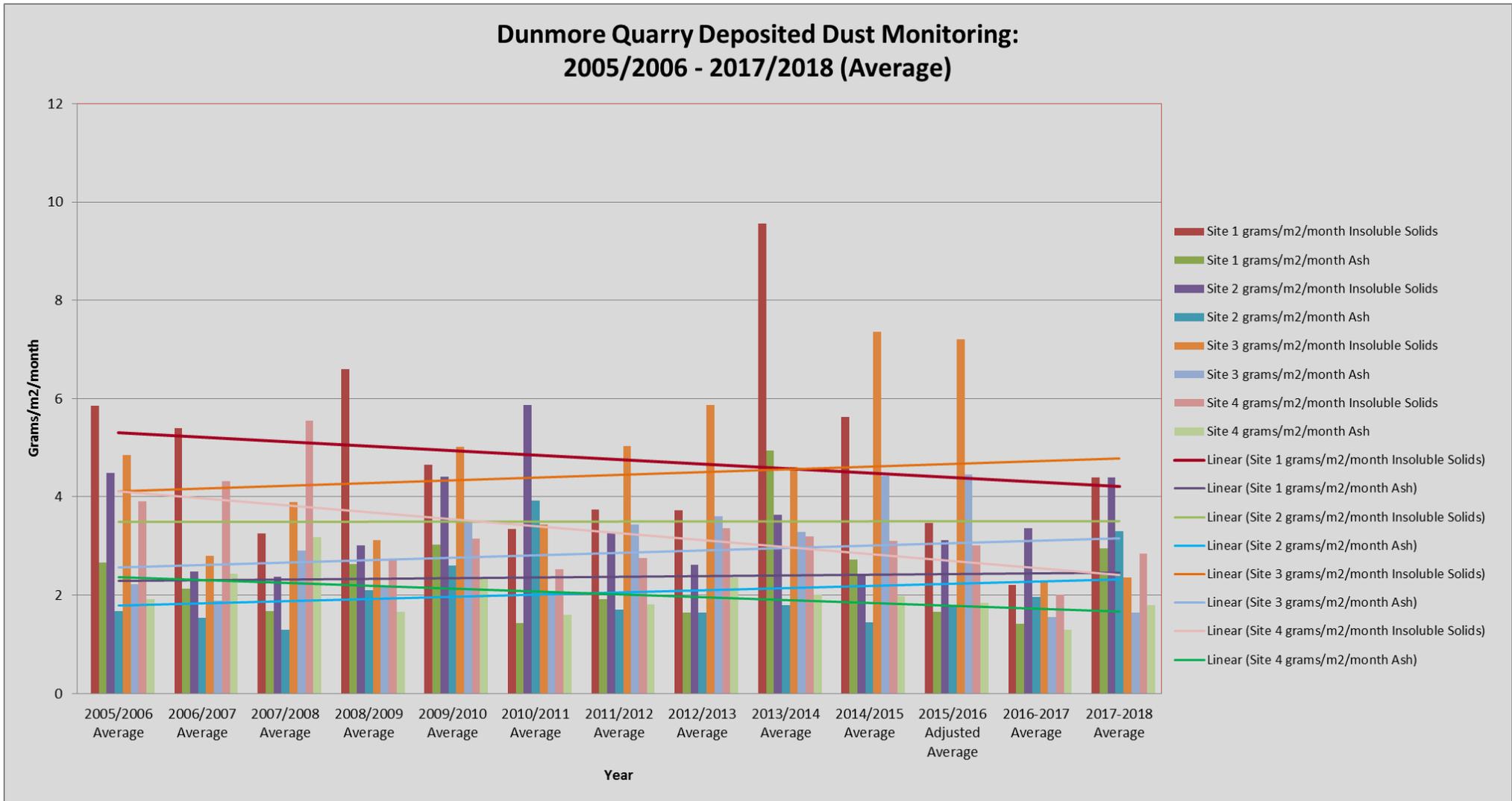


Figure 17 Dunmore Quarry Historical Deposited Dust Monitoring

4.3.1.5. Deposited Dust Summary and Opportunities for Improvement

Annual deposited dust values were marginally above the specified 4g/m²/month as defined as insoluble solids at Site 1 and Site 2 however the ash fraction was below 4g/m²/month for both sites. This suggests that the quarry contribution is limited and that elevated insoluble solids are due to land uses not associated with Dunmore Quarry. Site 3 and 4 were below 4g/m²/month for both the insoluble solid and ash fraction.

Site 1 was impacted by an outlier measurement as described in Section 4.3.1.1 and if this value is excluded and replaced with Site 1A data for June then annual averages for insoluble solids are below impact assessment criteria of 4g/m²/month for insoluble solids.

Furthermore, the location of the dust deposition gauges at Site 1 and 2 are in the immediate vicinity of the Croome West operations and are not representative of the conditions experienced at sensitive receiver locations. Alternate monitors Site 1A and Site 2A were set up in April further west as per Mod 9 Air Quality Impact Assessment recommendation and results were collected for May and June 2018. Results for these months suggest that any elevation of dust levels at Site 1 and Site 2 are localised to the immediate vicinity of operations and quickly settles due to the density of the latite dust. Site 1A and Site 2A has shown no elevated dust measurements above 4g/m²/month.

The Impact Assessment Criteria described in Schedule 4 Condition 22 apply to any residence on privately owned land. Both Croome West properties in the vicinity of Site 1 and 2 were acquired by Boral in September 2016 and as such these limits do not apply.

The Air Quality Management Plan (AQMP) is currently being updated to reflect the new operations of the site and satisfy the extra conditions relating to Schedule 4 Condition 25. A transition to real-time monitoring will form a major element to the new AQMP which will allow a more proactive approach to managing dust emissions on site. The AQMP will be updated in a transitional way to allow for the change over from deposited dust bottles to real-time monitors.

In addition, the location of monitoring sites will be changed in the updated AQMP to be more representative of sensitive receiver locations and EPL 77 will be updated to reflect the new points.

To continue managing air quality and dust levels the site will continue dust management; via maintained dust suppression sprays throughout the processing plant area; application of the water cart on haulage roads and the entrance road and the use of the wheel wash for exiting vehicles. Furthermore, the site will continue to actively manage dust on site through supervisor inspections and control room video surveillance to monitor and react to dust emissions from the plant.

Measures planned for the coming year include:

- Management and maintenance of light vehicle wheel wash facilities
- Continual upgrades of product transfer points (dust baffle & micro spray installation)

- Update the AQMP to include new requirements from Schedule 4 Condition 25 of the consent. This will include the use of real-time continuous monitoring

4.3.2. *PM₁₀*

The monitoring program for finer particulates includes monitoring of dust finer than 10 micron through use of a High Volume Air Sampler (HVAS). The HVAS runs for a 24 hour period every 6 days in accordance with EPL conditions. The location of the HVAS is shown as monitoring point #5 in Figure 26 Appendix C.

The PM₁₀ monitoring results for the 2017-2018 reporting period are represented graphically in Figure 18 and monitoring results for the life of the project are represented in Figure 19.

The annual average of recorded results of was 13.02µg/m³. The lowest recorded result was 0.77µg/m³ on 31 May 2018 and the highest was 39.81µg/m³ on 14 December 2017. These results indicate that PM₁₀ dust levels are well below long term impact assessment criteria; consistent with previous years reporting; and below the EIS predicted maximum 24 hour PM₁₀ concentration and predicted annual average. Furthermore, trend analysis indicates that over the life of the project the sample average has decreased. Throughout the lifetime of the project PM₁₀ concentration is higher in summer months and is lower during the winter which is to be expected.

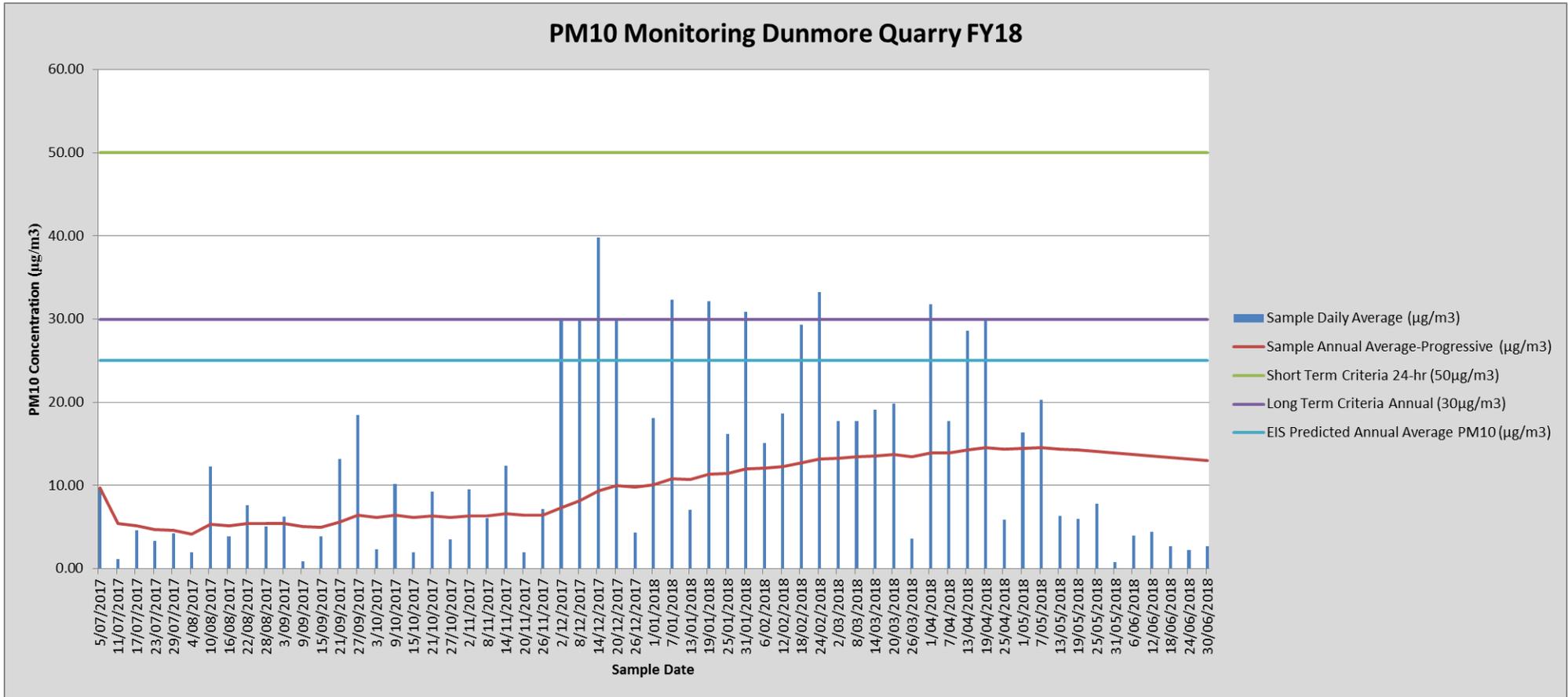


Figure 18 Dunmore Quarry FY18 PM10 Monitoring

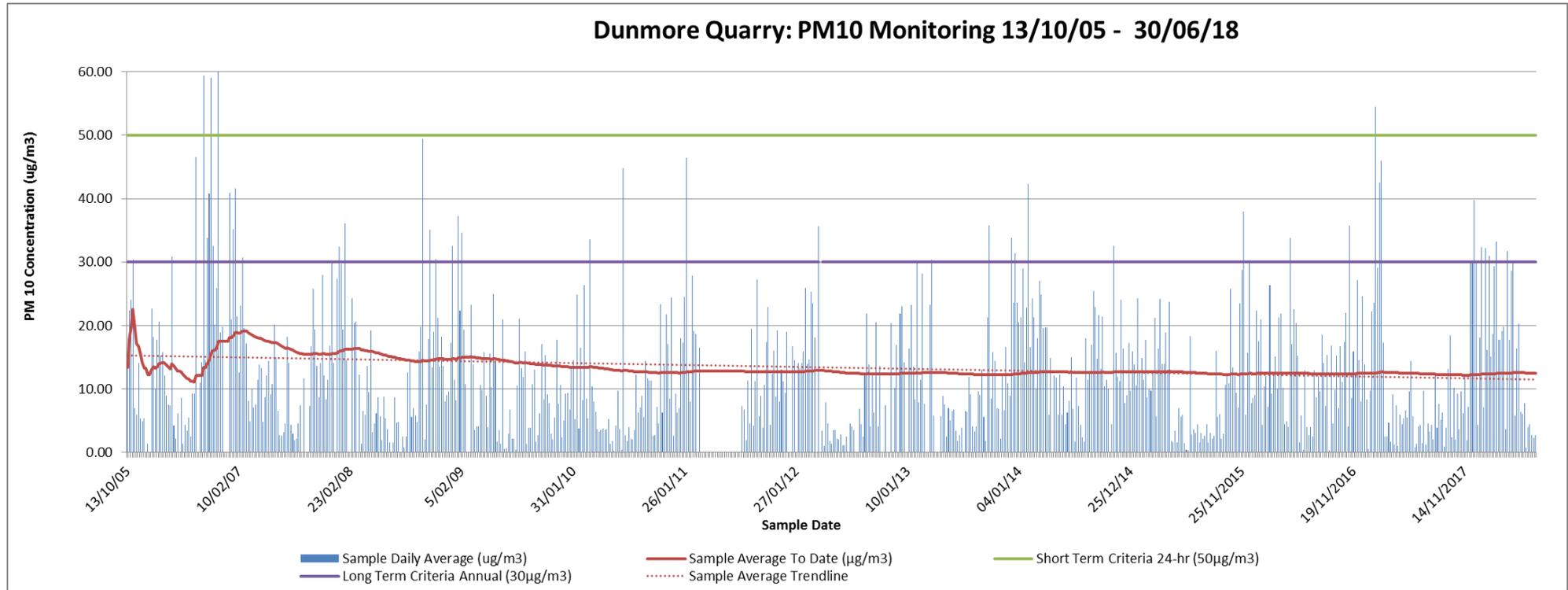


Figure 19 Dunmore Quarry Historical PM10 Monitoring

4.4. Meteorology

A meteorological monitoring station has been operating at Dunmore Quarry since 2002. Table 10 below displays the annual rainfall since FY11 to FY17. Seasonal wind roses showing the local wind movements are available in Appendix D.

Table 10 Dunmore Quarry Rainfall Data

Month	Rainfall (mm)																Site Average	Regional Average
	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18		
July	20	23.5	54.2	41	96	30.5	63.5	35.5	78	194	39	61.7	5	48	97.5	25	57.0	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	68.2	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	49.6	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	68.5	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	93.7	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	89.0	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	76.5	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	147.1	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	136.0	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	91.4	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	68.7	55.8
June	74.5	42	84.4	124	318.5	85.5	67	52	92	89	239	34	76	429	57	133.5	124.8	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	1070.8	925.6

* Source: Bureau of Meteorology, Climate Statistics for Australian Location, Wollongong University 1999-2018.

** Source: Bureau of Meteorology, Climate Statistics for Australian Location, Albion Park (Wollongong Airport. Red) values indicate month received higher than the regional average rainfall.

4.5. Water

4.5.1. Surface Water

4.5.1.1. Lower Dam Water Quality

Water quality results were taken from the lower dam at EPL point 8 on a monthly basis over the reporting period. Water quality in the lower dam was analysed for turbidity, pH, total suspended solids (TSS), conductivity and a visual inspection for oil and grease as part of the monthly sampling routine. Table 11 provides summary monitoring results for the lower dam during this reporting period and for averages for the life of the project. Figures 20 to 23 provide a comparison of the monitoring results for this reporting period with monitoring results of previous reporting periods, and indicate any trends in the monitoring data over the life of the project. The location of water quality monitoring points is shown in Figure 27 in Appendix C

Table 11: Lower Dam Summary

	Year / Month	pH	Conductivity (μ S/cm)	Turbidity (NTU)	TSS (mg/L)	Oil and Grease
Annual Averages	2004-2005*	7.9	-	21	18.4	-
	2005-2006*	8.1	-	3	7.4	-
	2006-2007*	7.2	1093	84	67.2	-
	2007-2008*	7.5	664	62	40.3	-
	2008-2009*	7.6	693	38	14.1	-
	2009-2010	7.6	4210	35.7	18	-
	2010-2011	7.2	601	131.3	38.4	-
	2011-2012	7.6	522	144.7	43.8	-
	2012-2013	7.7	623	340.6	85.9	-
	2013-2014	7.7	609	215.1	87.4	-
	2014-2015	7.9	480	71.7	32	-
	2015-2016	8.0	378	153.2	70.7	-
	2016-2017	8.1	646	76.9	62.5	-
2017-2018 Reporting Period Results	Jul-17	8.4	551	37.4	15	Not Visible
	Aug-17	8.3	509	144	47	>5
	Sep-17	7.9	685	61.8	42	>5
	Oct-17	8.4	642	46	46	>5
	Nov-17	8.2	610	74.3	22	>5
	Dec-17	8.4	266	61	38	>5
	Jan-18	8.3	631	105	58	>5
	Feb-18	8.3	539	72.2	36	>5
	Mar-18	8.2	596	51.9	46	>5
	Apr-18	8.3	708	-	49	>5
	May-18	8	582	105	34	>5
	Jun-18	8	552	14.3	28	>5
2017-2018 Average	8.2	572	70.3	38	>5	

* Denotes background averages

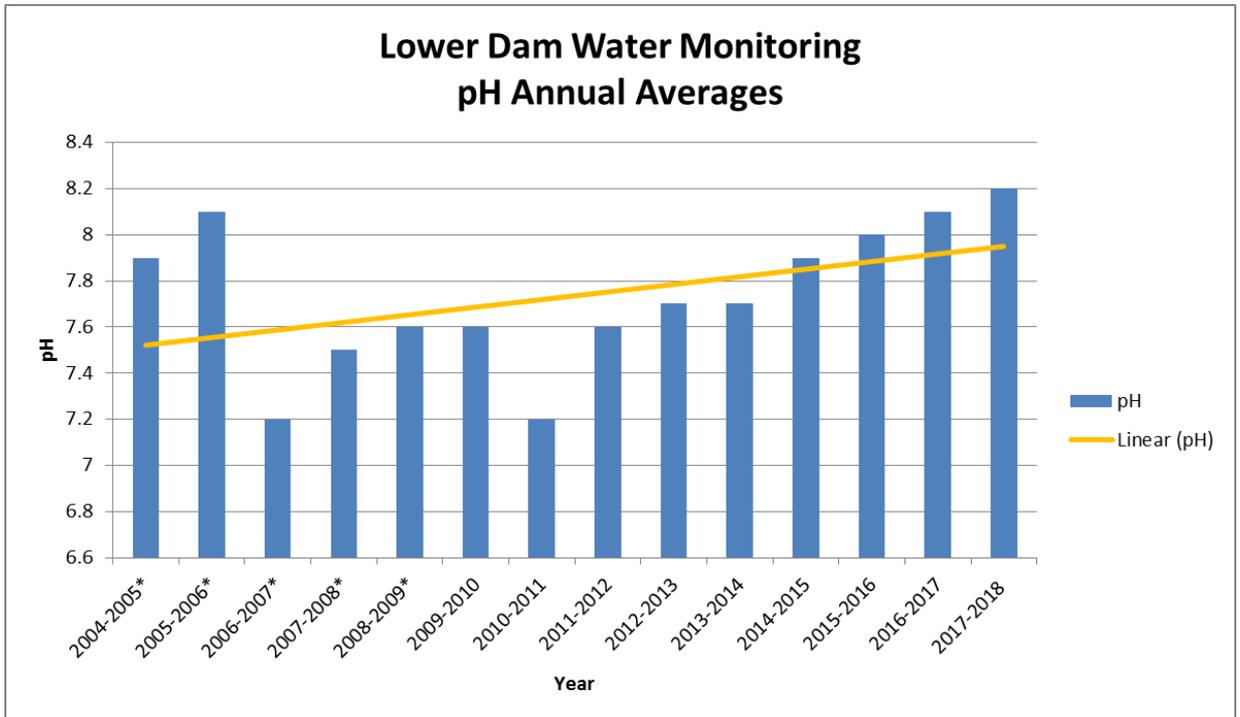


Figure 20 Lower Dam Monitoring pH Annual Averages

Figure 20 indicates the pH levels in the lower dam have remained relatively consistent since the 04/05 reporting period with a slight increase in annual average between FY17 and FY18 reporting period.

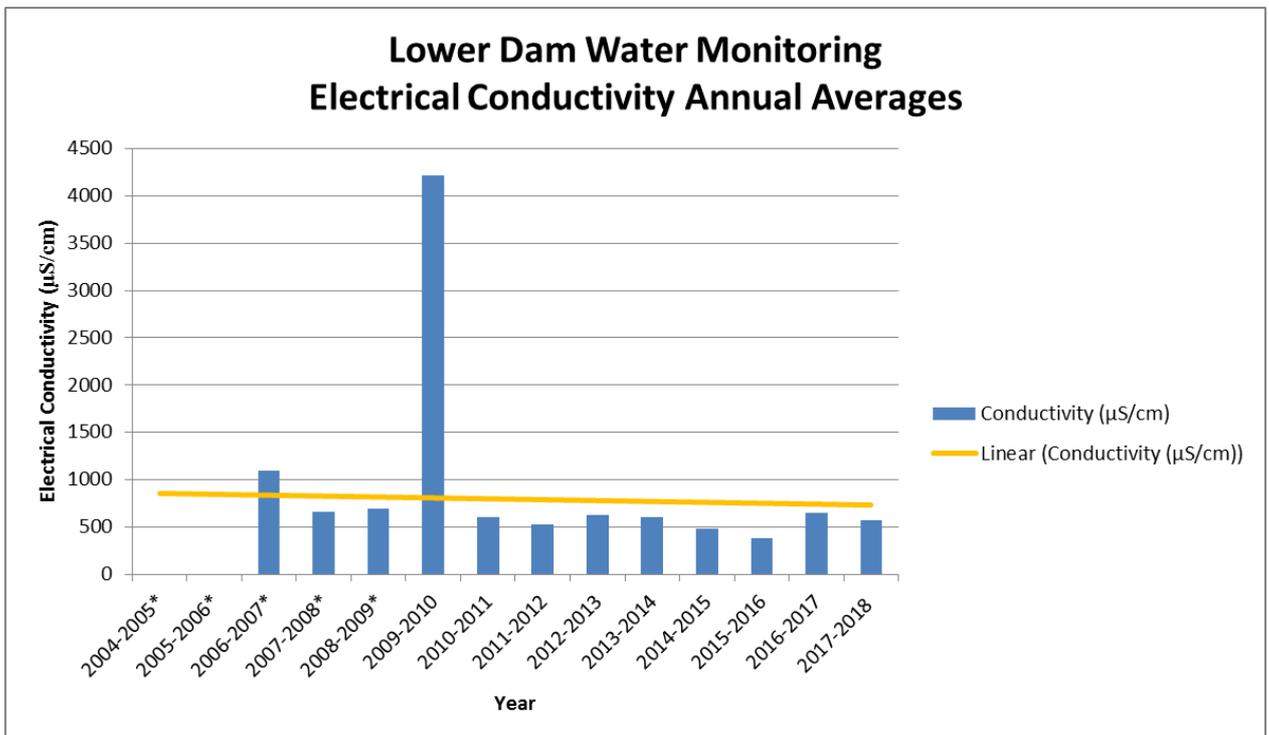


Figure 21 Lower Dam Monitoring Electrical Conductivity Annual Averages

Figure 21 indicates the conductivity levels in the lower dam have remained consistent with previous reporting periods, excluding the 09/10 anomaly.

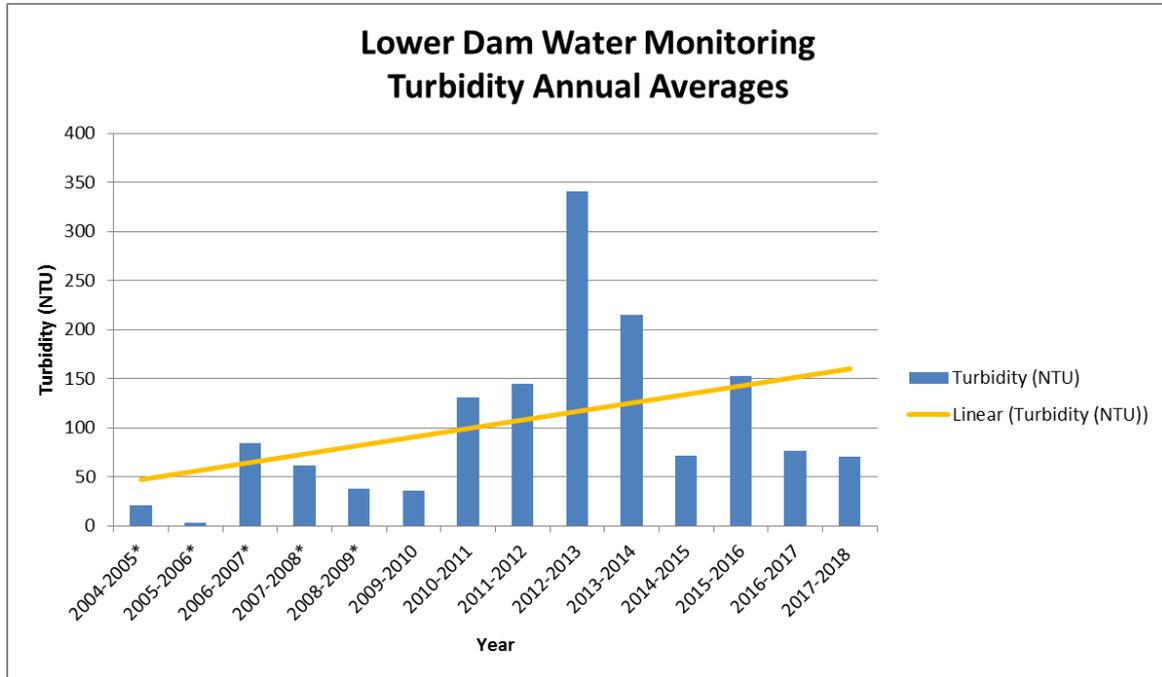


Figure 22 Lower Dam Water Monitoring Turbidity Annual Averages

Figure 22 indicates the average turbidity levels have decreased over the FY18 reporting period compared to last year. The overall trend in turbidity is rising over the lifetime of quarry operations.

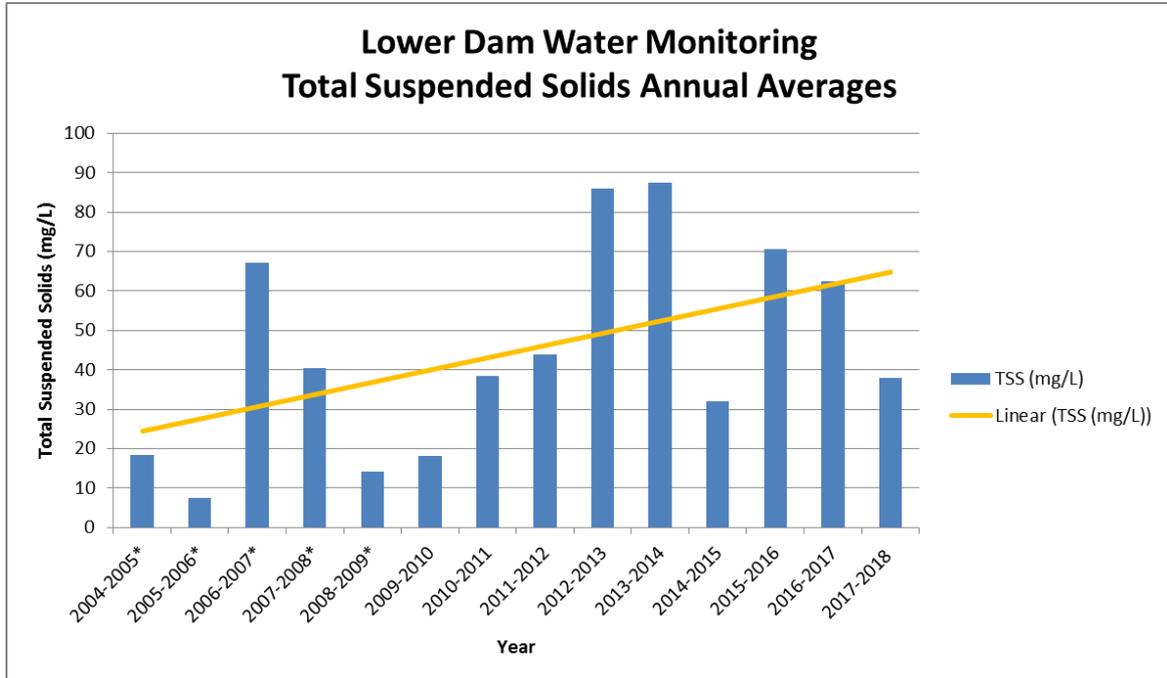


Figure 23 Lower Dam Water Monitoring Total Suspended Solids Annual Averages

Figure 23 indicates the average TSS levels have decrease from FY17 to FY18; again these remain relatively consistent with the previous year averages. Note: there are no relevant predictions provided in the EIS to provide a comparison.

4.5.1.2. Uncontrolled Discharge

During the reported period there were no uncontrolled discharges from the spillway of the lower dam directly into Rocklow Creek. This location is denoted EPL#7 and the location of this site can be seen in Figure 27 Appendix C

There was one instance where floodwaters from Rocklow Creek rose up over the spillway and into the dam, which in turn has overflowed and spilled over. On 18/11/2017 there was 67.5mm of rainfall which led to a backing up of floodwaters through the narrow bend around Rocklow Creek upstream of the spillway. It is likely that during this rainfall event Rocklow Creek floodwaters rose up over the spillway and into the dam, which in turn has overflowed and spilled over. The waters of Rocklow Creek then formed a mixing zone with the waters from the Lower Dam.

Sampling was undertaken the next morning during which time the floodwaters had subsided and the spillway had formed shallow pools of water between the spillway and Rocklow Creek. Due to the low level of the water in the spillway it was not possible to grab a representative sample from EPL#7. A sample was obtained from GS2 which is located at Rocklow Creek adjacent to the spill way (see Figure 27 Appendix C). A summary of the water monitoring associated with this event can be seen in Table 12

Table 12 Uncontrolled Discharge from Lower Dam

Monitoring Location	pH	TSS	Turbidity
Upstream GS1	6.2	19	6.6
GS 2 Rocklow Creek upstream adjacent to spillway	7.3	283	423
Downstream Rocklow Creek EPL#9	6.5	91	77.5

The opportunities for improvement listed below are aimed at addressing this type of event.

4.5.1.3. Opportunities for Improvement

The Lower Dam is being upgraded as a part of the requirements for Mod 9. These changes will minimise the chances of Rocklow Creek floodwaters infiltrating the Lower Dam during high rainfall events. Section 5.1.1 of the Surface Water Assessment for Mod 9 located in Appendix A details the changes to the Lower Dam which is summarised in Table 13 below:

Table 13 Proposed Changes to the Lower Dam for Modification 9

Proposed Change	Outcome
Relocate the dam’s spillway to the southern side of the dam, where Rocklow Creek levels are expected to be lower during material runoff events.	<ul style="list-style-type: none"> Significantly reduce the frequency of Rocklow Creek floodwaters inundating the Lower Dam.
Extend the eastern portion of the dam by 4,000m ² . The dam extension area will be excavated to 2m AHD and is expected to be an ephemeral macrophyte zone.	<ul style="list-style-type: none"> Provide an additional 4ML of storage above 2m AHD Improve the water quality treatment function of the dam
The relocated spillway will have an invert level of 3.3m AHD, which will be 300 mm higher than the existing level.	<ul style="list-style-type: none"> Reduce the frequency of Rocklow Creek floodwaters inundating the Lower Dam. Provide an additional 3 ML of storage above 2m AHD
Following a runoff event, the Lower Dam will be dewatered to 2m AHD or the adjoining Rocklow Creek levels (whichever is greater). Dewatering will occur via pumping to the Middle Dam at a minimum rate of 2.5 ML/day.	<ul style="list-style-type: none"> The sedimentation treatment volume will be dewatered within 5 days as recommended in relevant guidelines

4.5.2. Ground Water

The existing water management plans for Dunmore Quarry stipulate that down gradient data from the Boral owned Dunmore Sand and Soil groundwater monitoring program be reviewed to determine if there is a significant impact on groundwater levels or quality as a result of both operations.

Environmental Earth Sciences NSW were engaged by Boral to undertake a review of the groundwater monitoring data undertaken during the 2017 – 2018 reporting period. The analysis completed by Environmental Earth Sciences indicates the following:

- that influences on groundwater levels are related to recharge from rainfall and more minor tidal influx (this finding is supported by chemical monitoring of tidal seawater intrusion from Rocklow Creek);
- reductions in groundwater levels are related to periods of low rainfall (i.e. not to minor recharge) where the aquifer is slowly draining from Rocklow Creek and the south-east aquifer boundary; and
- water table fluctuations are therefore naturally occurring and cannot be seen to be impacted by dredging activities in the area (except immediately around bore BHD and BHF in immediate proximity to the dredge pond).

As part 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). 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. The main findings for the 2017/18 monitoring year in regards to water levels are:

- groundwater levels in the alluvium at the DSS sites show a direct response to rainfall and minor tidal influences;
- 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 in slight decline at GW1 and GW3 corresponding with a period of below average rainfall. GW2 shows little response to rainfall. The main findings for this monitoring year in regards to water quality are:
 - Groundwater quality at alluvial bore BH-F became slightly more brackish and acidic, likely due to the encroachment of the dredge pond. It has since been decommissioned as a result of the dredge pond expansion. Groundwater quality at other alluvial monitoring sites showed a slight increase in nutrients but was overall consistent with historical data;
 - 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 2017/18 monitoring year 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. The annual groundwater quality results are overall comparable to results from previous monitoring years. Note: there are no relevant predictions provided in the EIS to provide a comparison.

The annual groundwater report is included in Appendix F

5. Compliance

5.1. 2017 Independent Audit Recommendations

An independent environmental audit was conducted in response to Condition 5(10) of the Development Consent. The audit was completed in May 2017 with the associated report issued in August 2017. The response to non-compliances from the Independent Audit was reported in the FY17 Annual Review. Table 14 describes the status of the actions arising from the recommendations from the Independent Audit undertaken in the last reporting period.

Table 14 Status of Actions from Independent Audit Recommendations

Reference	Consent Condition/Issue	Recommendation	Action Completed
DQ1/17	Schedule 3, Condition 6 – Quarrying Operations	The AMER/Annual reviews report on the production and transport figures as financial year, not calendar year. It is recommended reporting is updated to be consistent with the condition which clearly nominates calendar year.	Included in this review in Section 2.2
DQ2/17	Schedule 4, Condition 14 – Noise Monitoring	Review and revise the Noise Monitoring Program in accordance with the Schedule 5, Condition 4 and DP&E request.	The Noise Monitoring Program has been updated and approved on 13/12/2017.
DQ3/17	Schedule 4, Condition 31 – Storm Water Management System	Update the ‘Where addressed in this document’ column of Table 2-1 of the Water Management Plan (Arcadis, 2016) to reference the correct section numbers. Some refer to ‘Section 0’ which is not a component of the report.	EMM have been engaged to update the Water Management Plan for Mod 9. This is expected to be updated during the next reporting period.
DQ4/17	Schedule 4, Condition 33 – Offline Dam	Management action # WMP07 requires a letter report to be issued to the Secretary confirming the Condition 33(a) – (e) have been met. The letter is required to be appended to the WMP and this has not been completed.	When letter is made available, letter to be attached to sites Water Management Plan.
DQ5/17	Schedule 4, Condition 38 – Other Water	Management Works Consider requesting DP&E revises or removes this condition if it has been sufficiently closed out	Currently in discussions with Boral Senior Planning and Development Manager.
DQ6/17	Schedule 4, Condition 40 - Monitoring	Boral consider entering into discussions with DP&E regarding definition of ‘regional’.	Currently in discussions with Boral Senior Planning and Development Manager.

DQ7/17	Schedule 4, Condition 63 – Road Haulage	In case of any future unexpected mud generation along the transport route, Boral is to formulate a temporary solution that prevents mud-tracking onto public roads.	Pollution Incident Management Plan has been updated to include and manage the potential for unexpected mud generation on site.
DQ8/17	Schedule 4, Condition 70 – Waste Minimisation	EPA should be consulted with regards to tyre storage on-site and storage should align with the RFS Fire Safety Guideline for bulk storage of rubber tyres.	Site to initiate discussions with EPA regarding storage of tyres on site. The RFS Safety Guidelines are currently being reviewed on site to ensure correct storage of tyres. A subcontractor Premium Tyres currently removes tyres from site and maintains the Tyre Register.
DQ9/17	Schedule 4, Condition 72 – Reporting	As per the recommendations from previous audit [DQ18/14]: types or weights/volumes of waste generate and recycles could be included in the Annual Review to allow comparison over time, and measurement of the effectiveness of reduction measures.	Completed in Section 2.6.1 of this document.
DQ10/17	Schedule 5, Condition 4 – Revision of Strategies, Plans and Programs	Ensure all documents are reviewed in accordance with this condition of consent. Update the relevant management plans to contain information on timing of review.	All management plans to be reviewed in accordance with the consent.

5.2. Management Plan Updates

The Noise Management Plans was updated and approved in 13/12/2017.

The Flora and Fauna Management Plan (FFMP) has been updated in response to the Independent Audit of the Flora and Fauna Management Plan undertaken on 4th April 2017 and was submitted on the 4th of June 2018.

All other management plans are currently being reviewed and updated in response to the Mod 9 expansion which inserted several new conditions into the consent.

During the reporting period the site obtained multiple modifications to its development consent, and site management and staff also changed. All of the site current management plans are currently under review and where required are being updated. The updated management plans will be submitted to the Department for review as they are completed. All management plans are expected to be updated in the next reporting period

6. 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 the Croome West Expansion Modification 9 was approved which represents a major extension to the quarry resource.

The 2017-18 revolved around addressing a number of opportunities for improvement which were identified from the Independent Environmental Audit. The next reporting period will contain a strong focus on maintaining regulatory compliance and updating management plans to reflect the Mod 9 operations.

Appendix A Surface Water Assessment

Appendix B Bushland Restoration Project Annual Report

Appendix C Dunmore Quarry Monitoring Locations

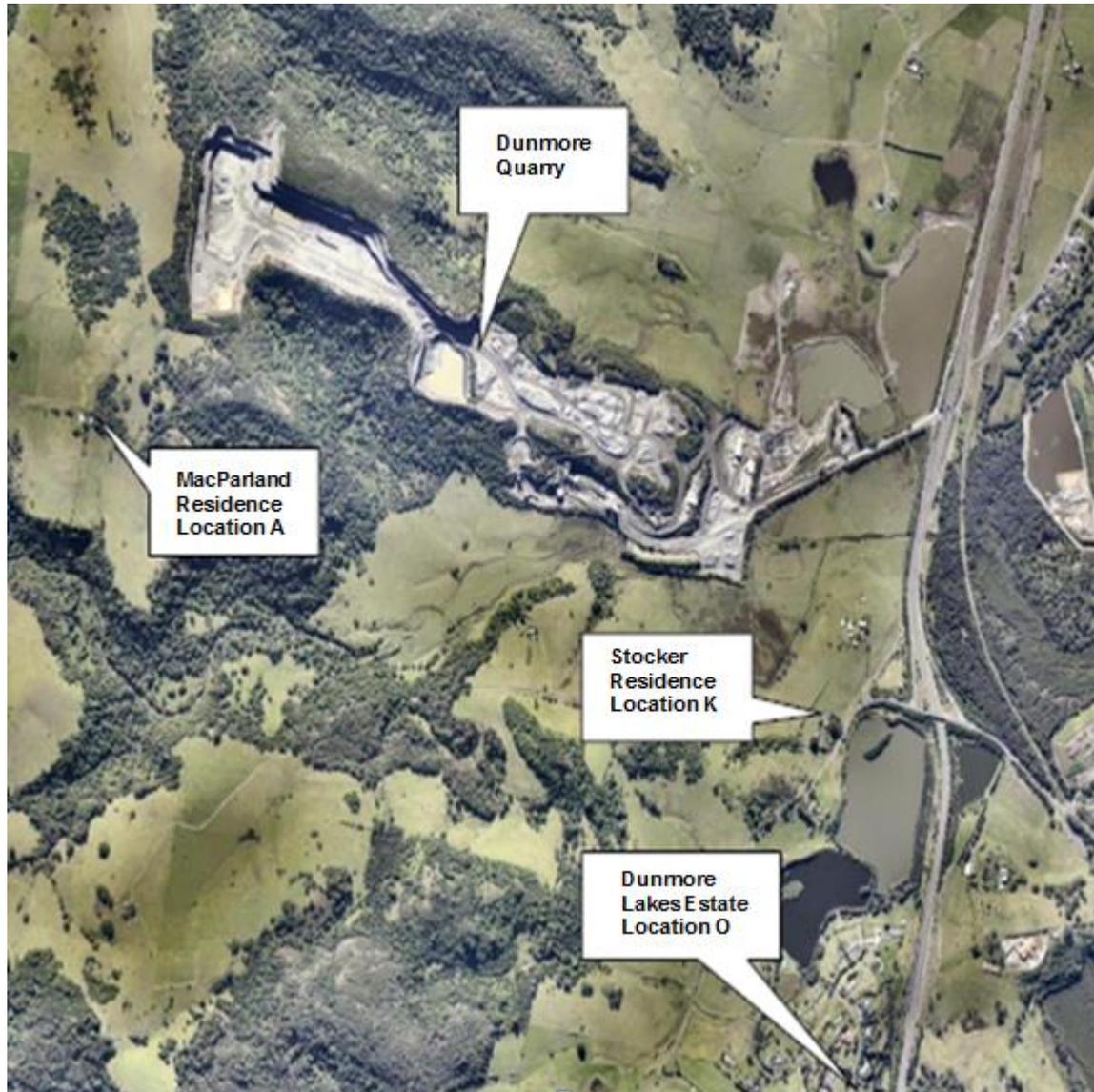


Figure 24 Annual Noise Monitoring Locations



Figure 25 Dunmore Quarry Blast Monitoring Locations

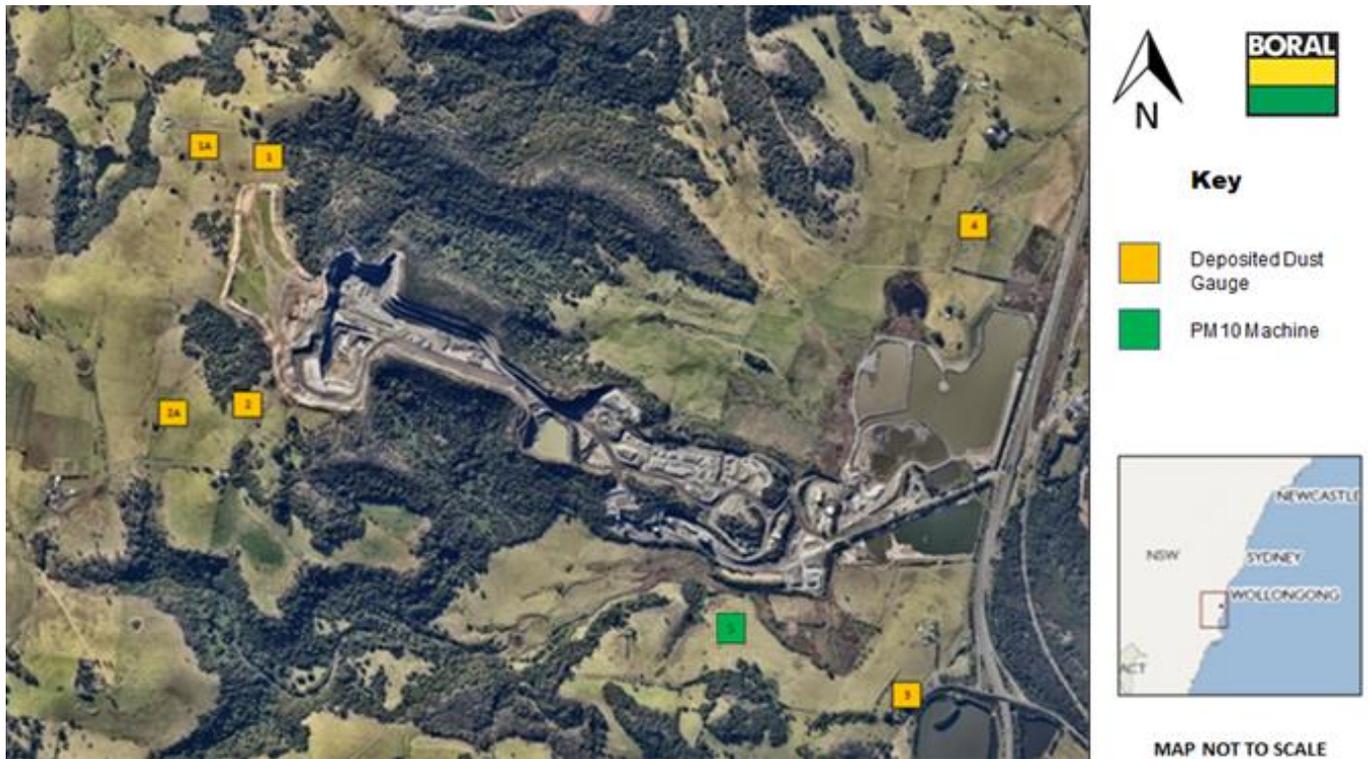


Figure 26 Dunmore Quarry Air Quality Monitoring Locations

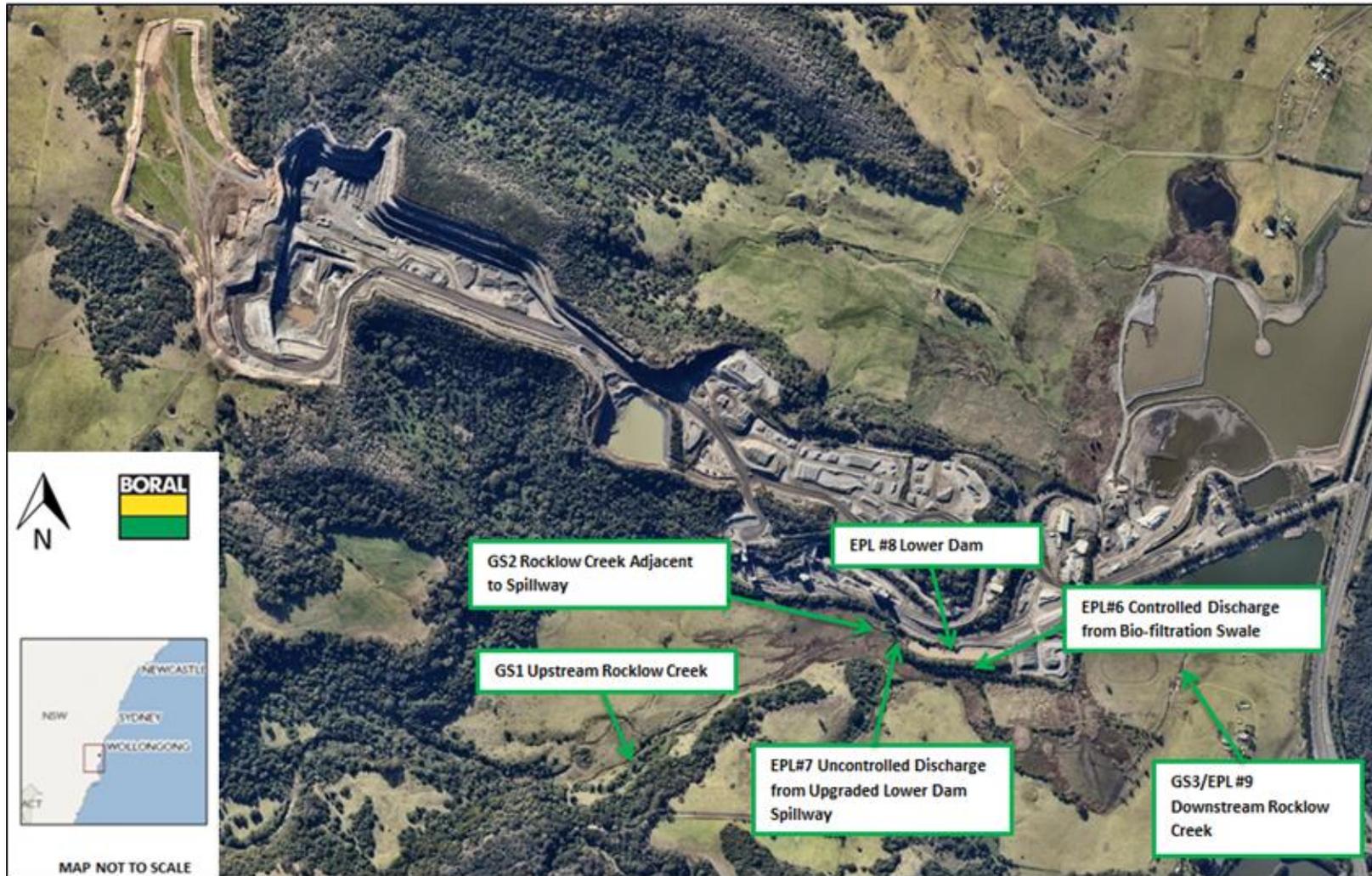
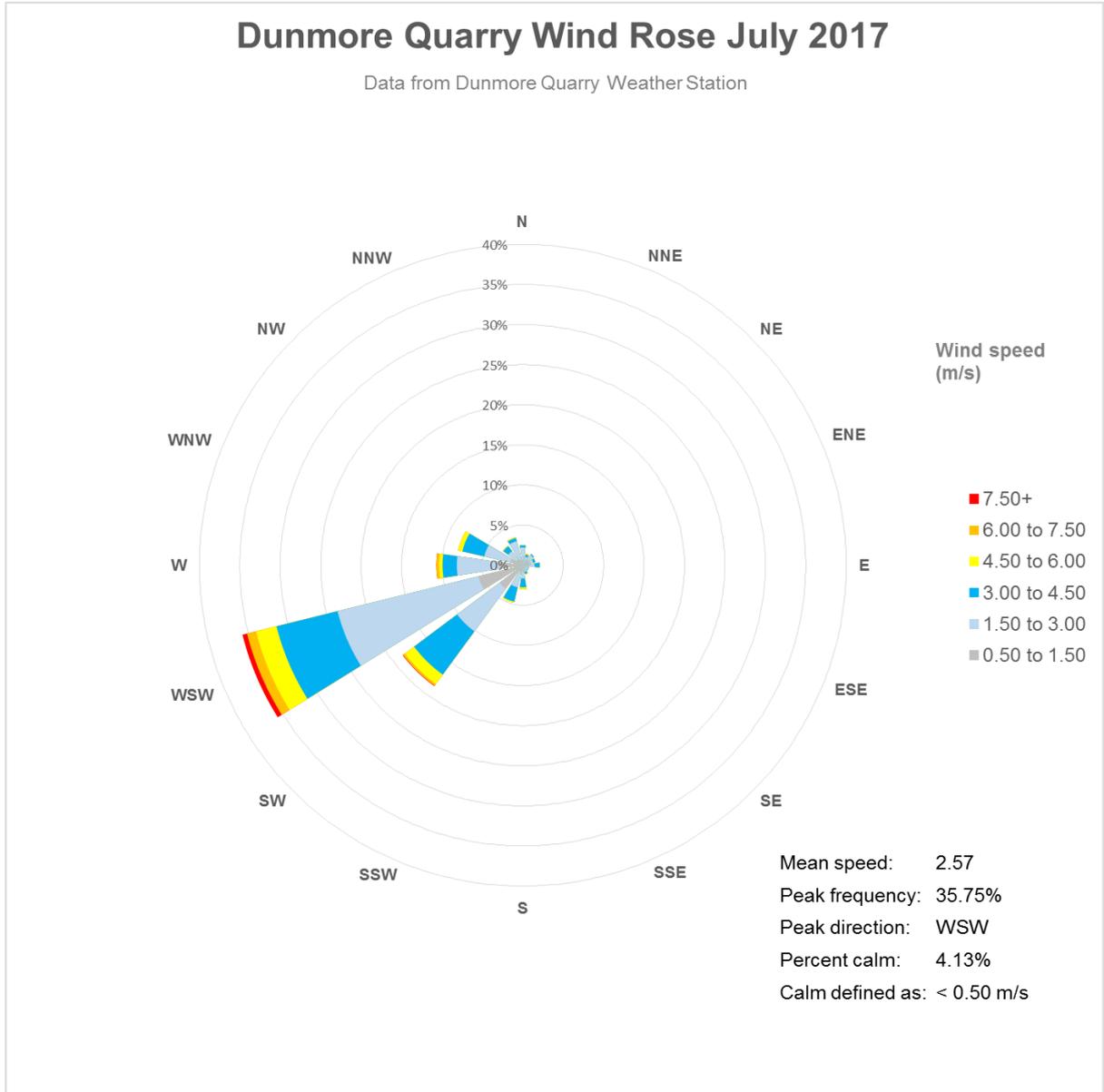


Figure 27 Dunmore Quarry Surface Water Monitoring Locations



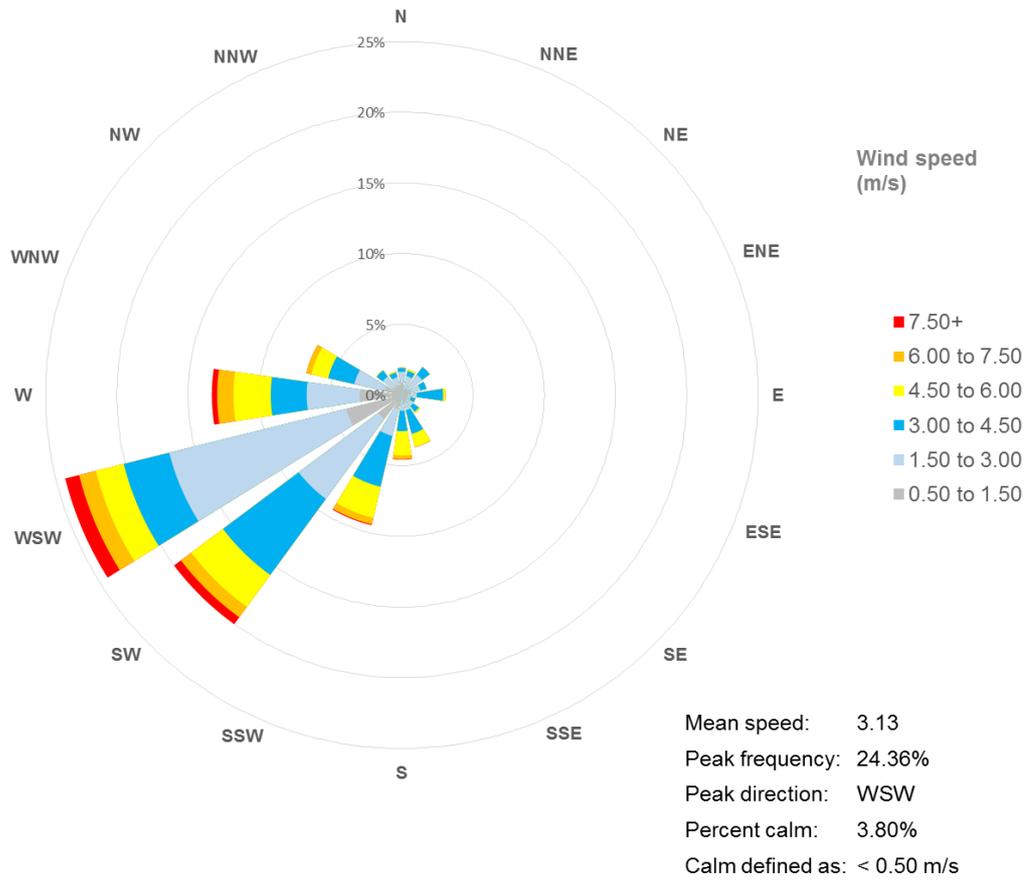
Figure 28 Dunmore Quarry Groundwater Monitoring Locations

Appendix D Dunmore Quarry Wind Roses



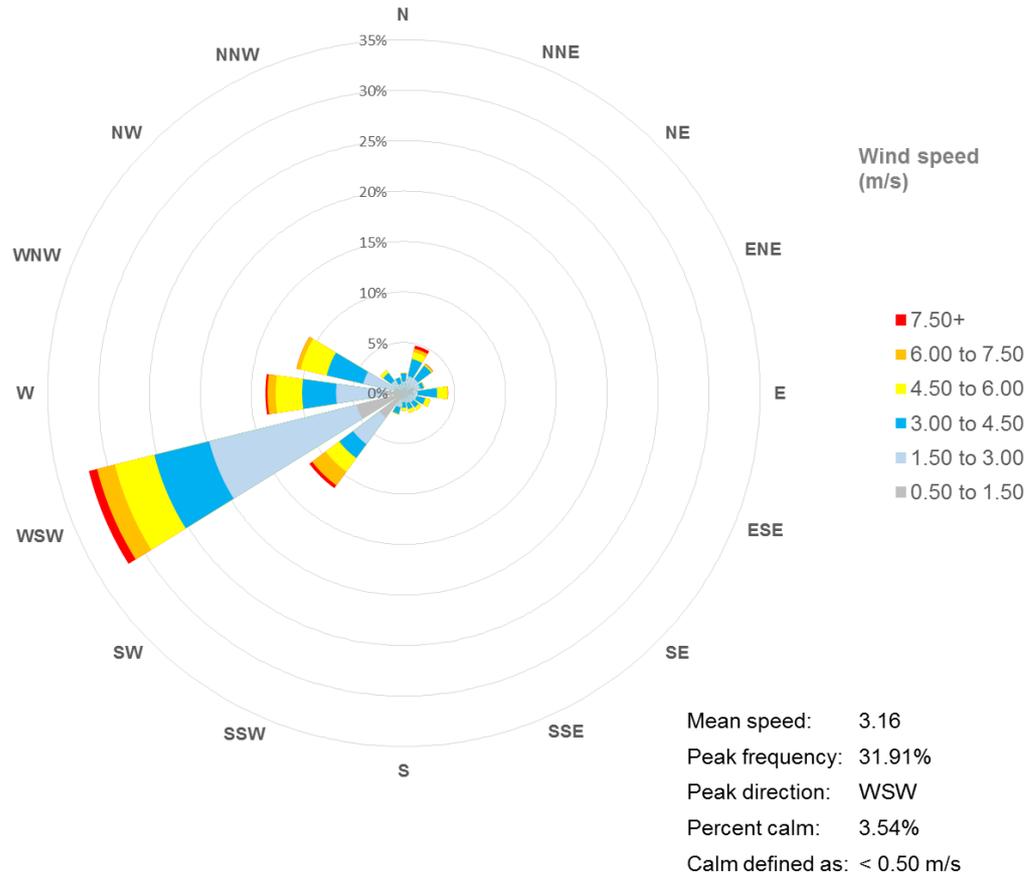
Dunmore Quarry Wind Rose August 2017

Data from Dunmore Quarry Weather Station



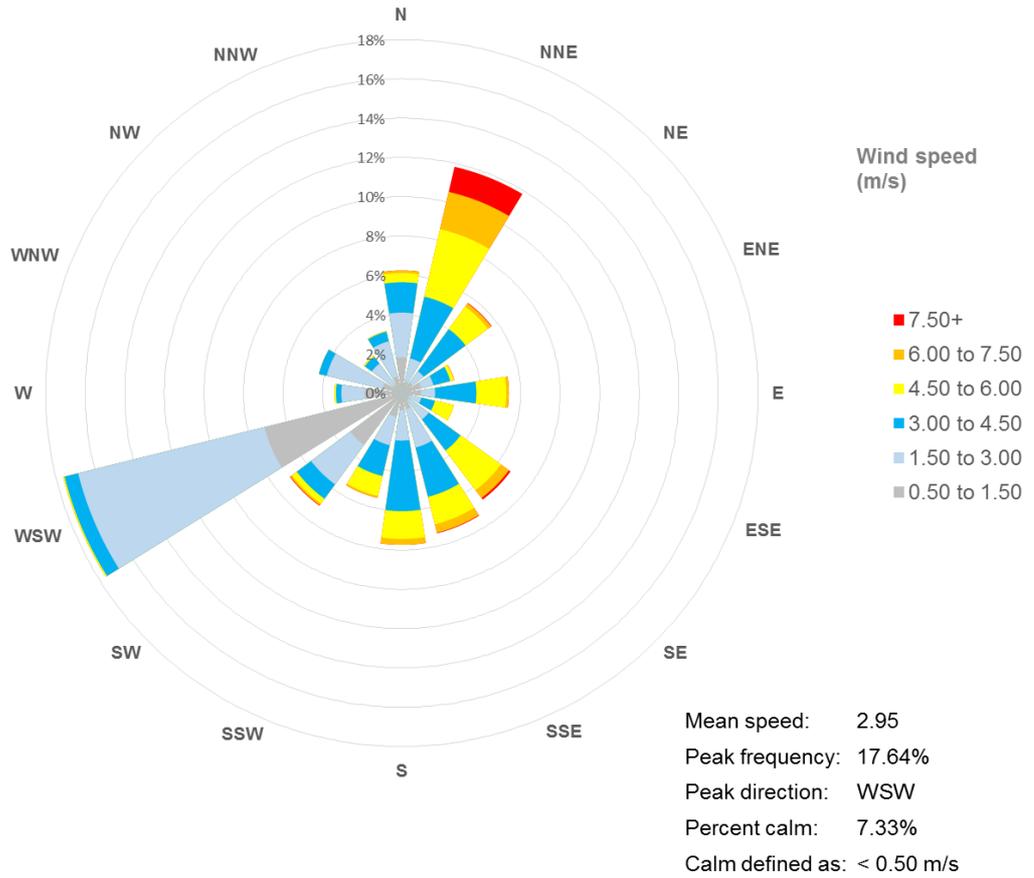
Dunmore Quarry Wind Rose September 2017

Data from Dunmore Quarry Weather Station



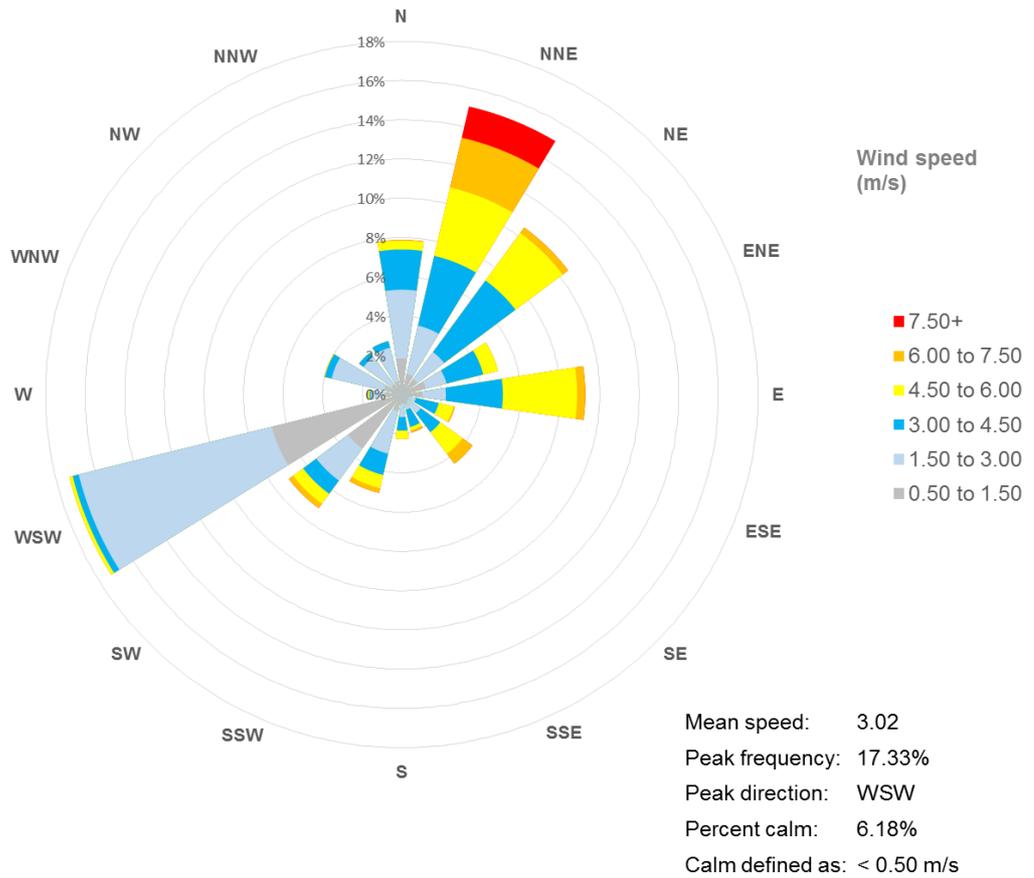
Dunmore Quarry Wind Rose October 2017

Data from Dunmore Quarry Weather Station



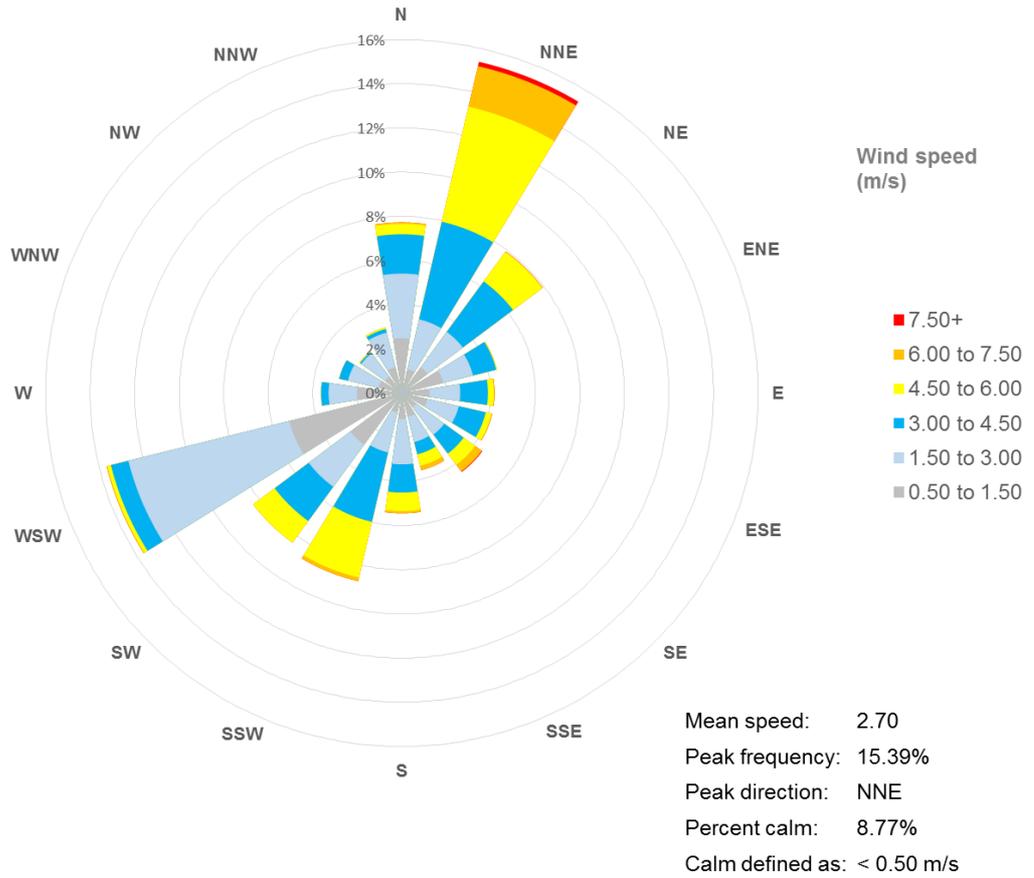
Dunmore Quarry Wind Rose November 2017

Data from Dunmore Quarry Weather Station



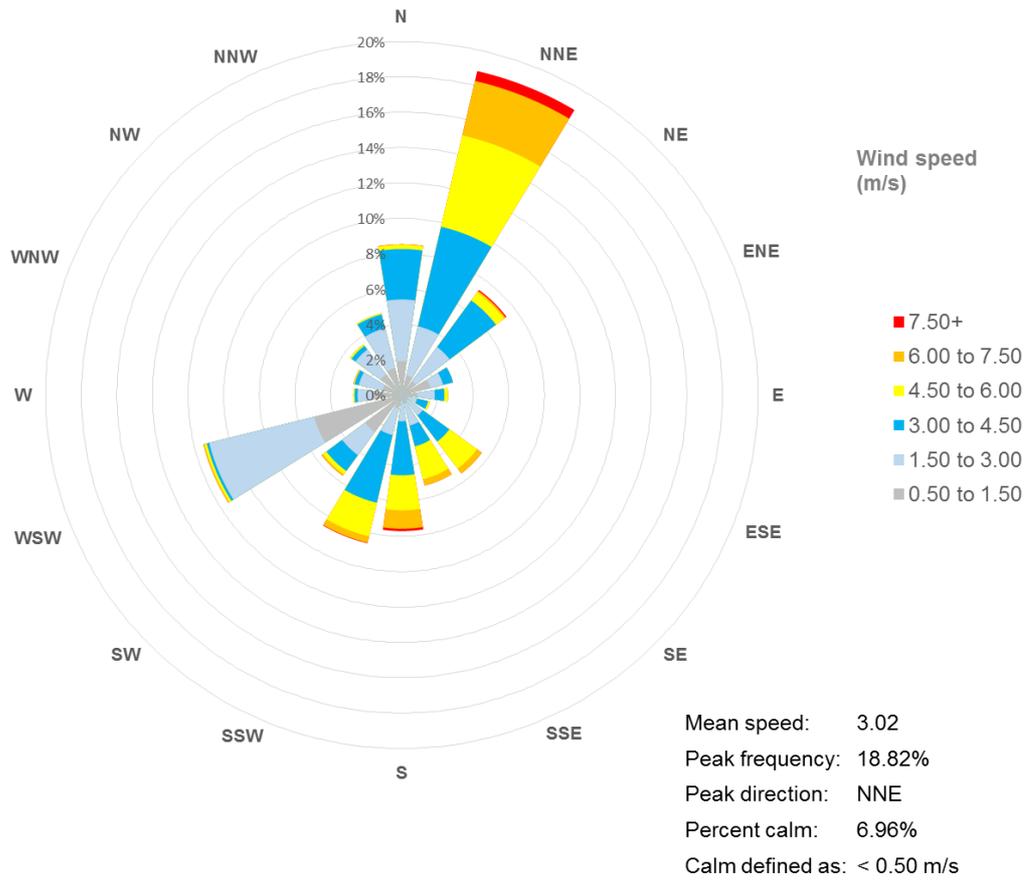
Dunmore Quarry Wind Rose December 2017

Data from Dunmore Quarry Weather Station



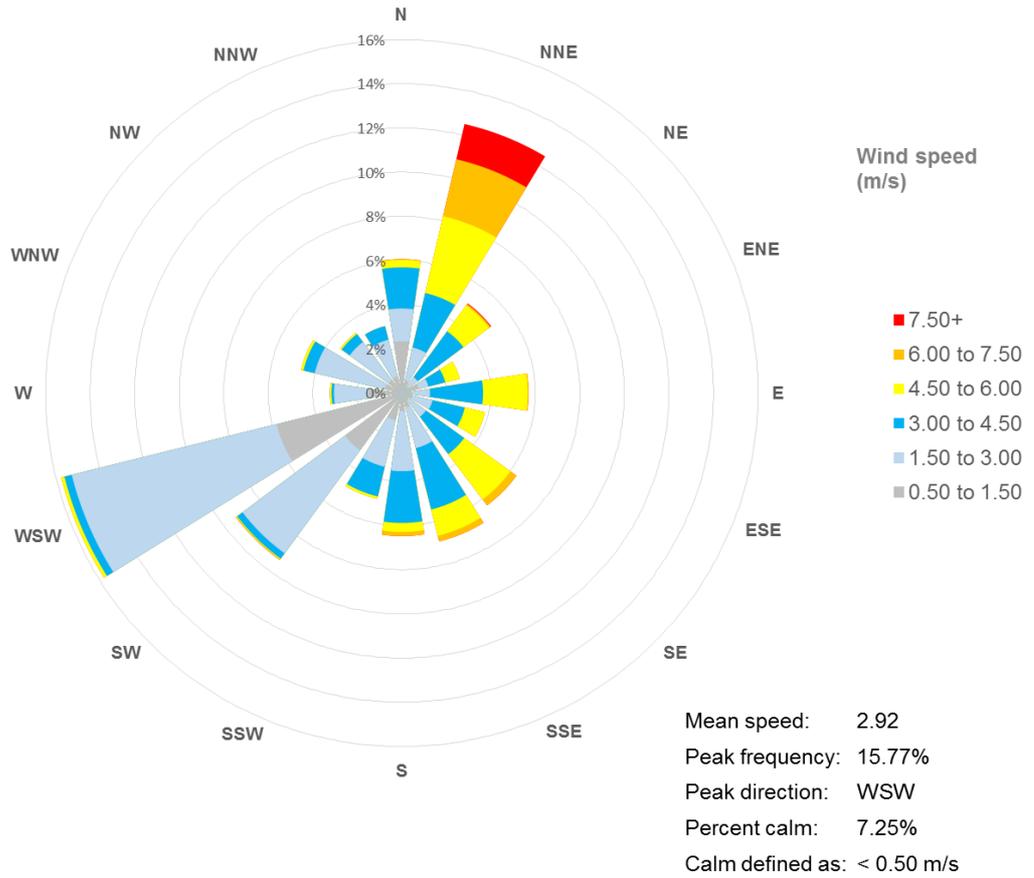
Dunmore Quarry Wind Rose January 2018

Data from Dunmore Quarry Weather Station



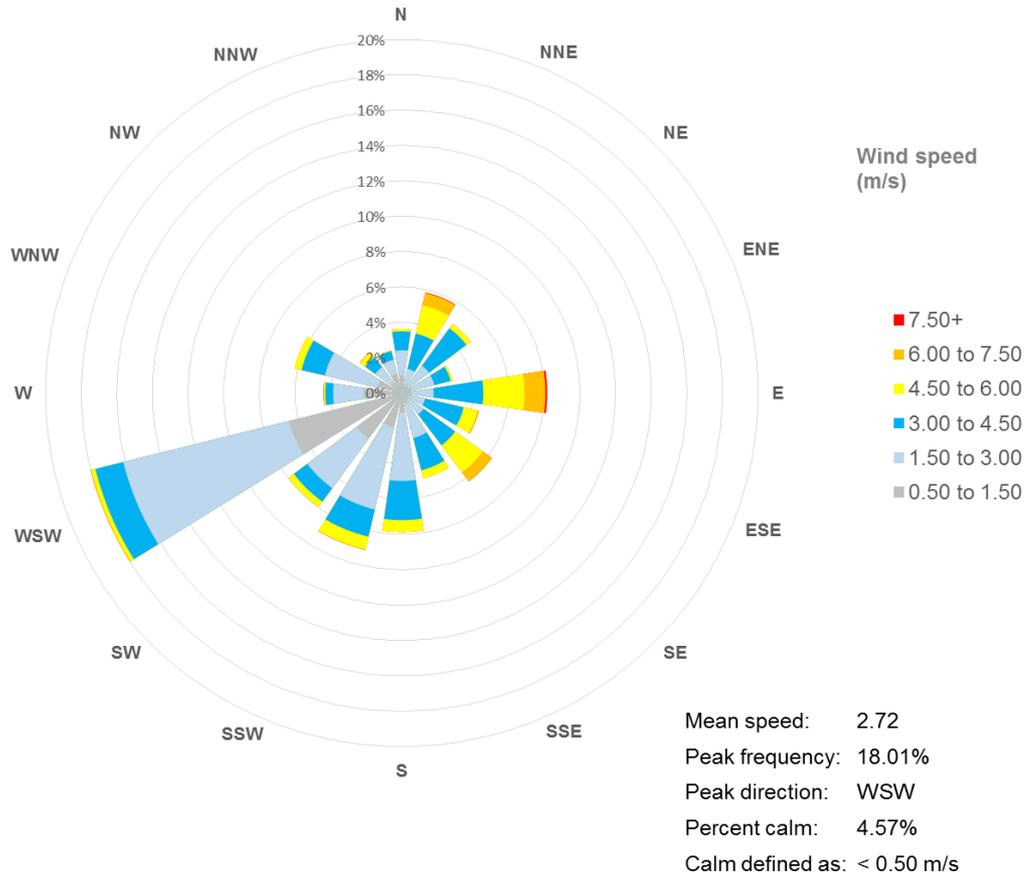
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Data from Dunmore Quarry Weather Station



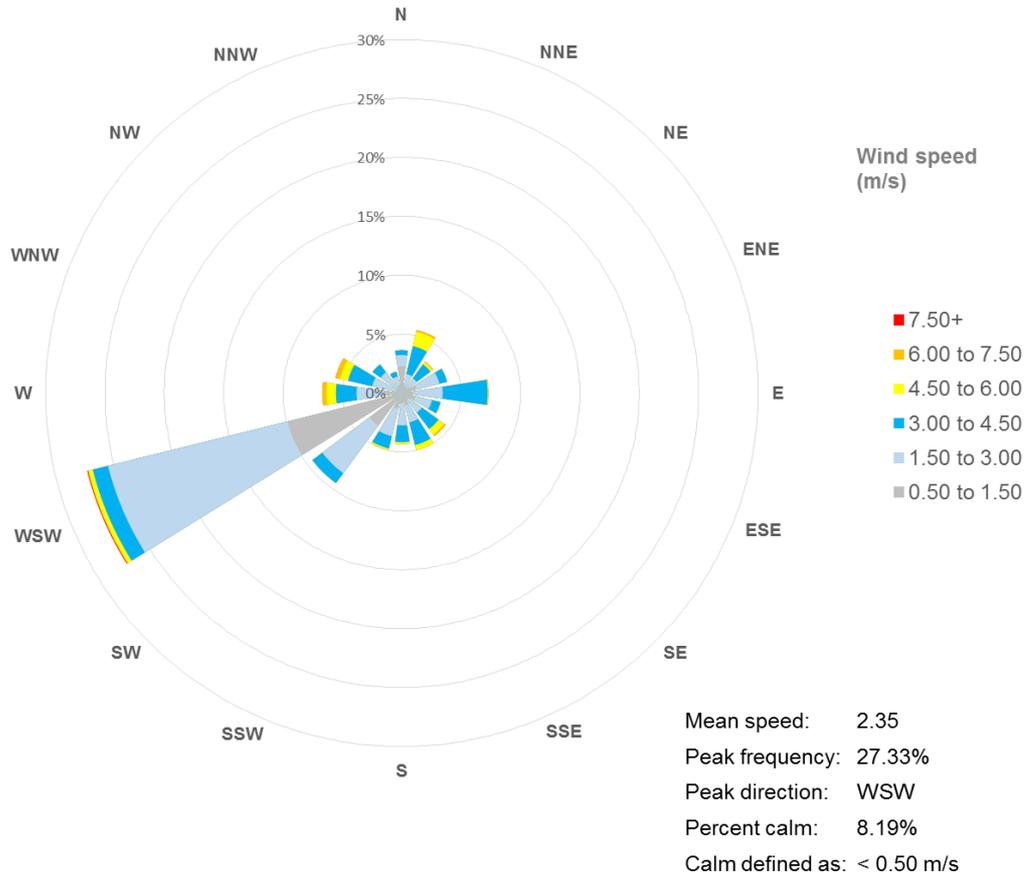
Dunmore Quarry Wind Rose March 2018

Data from Dunmore Quarry Weather Station



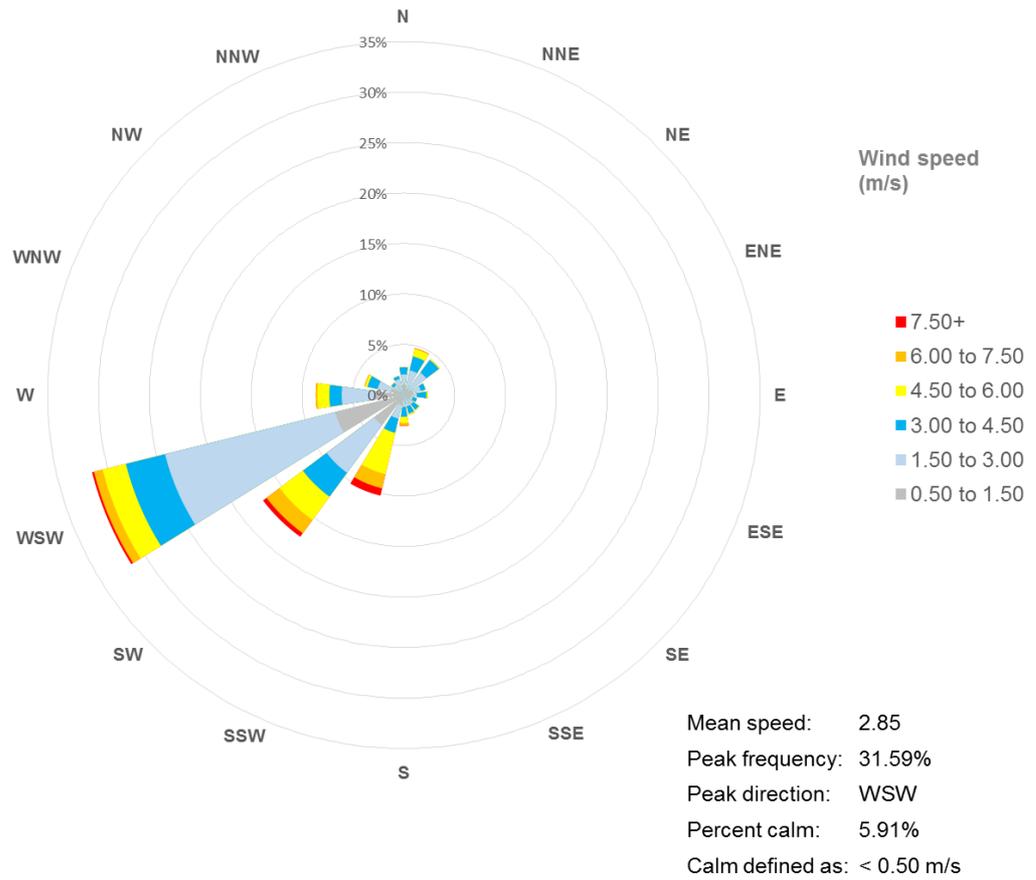
Dunmore Quarry Wind Rose April 2018

Data from Dunmore Quarry Weather Station



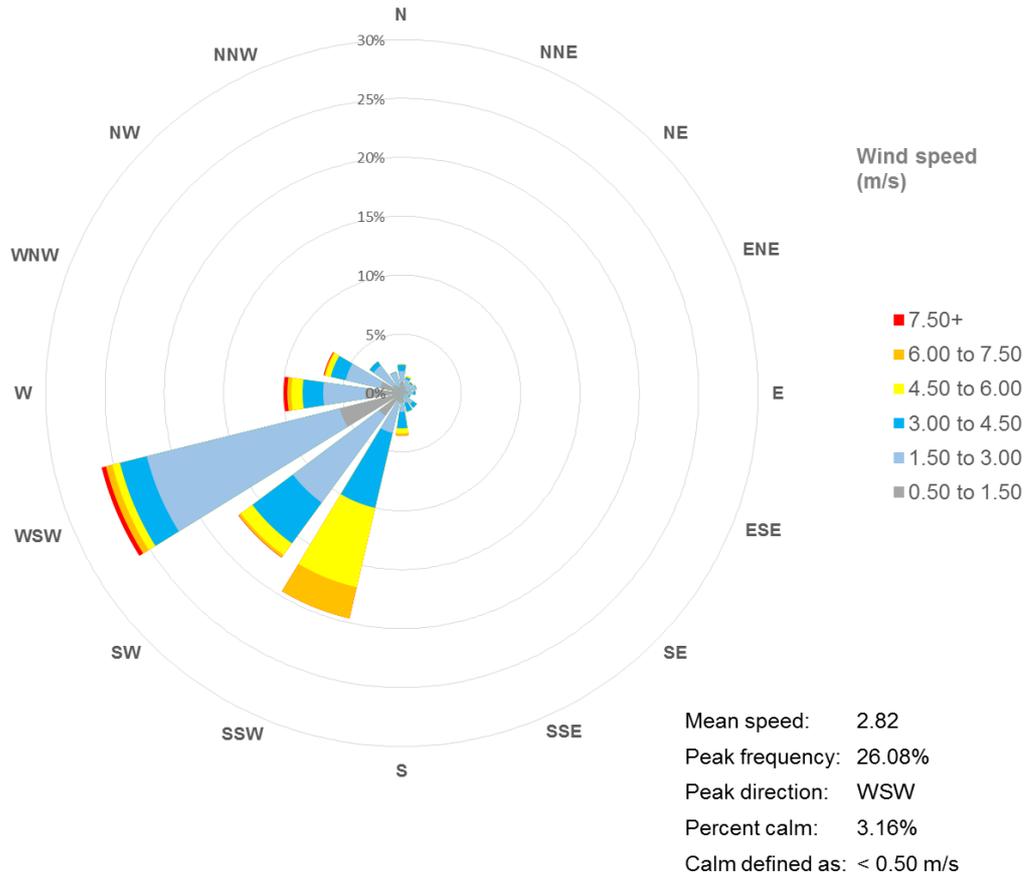
Dunmore Quarry Wind Rose May 2018

Data from Dunmore Quarry Weather Station



Dunmore Quarry Wind Rose June 2018

Data from Dunmore Quarry Weather Station



Appendix E Annual Noise Assessment Report

Appendix F Annual Groundwater Monitoring Report