DA 315-7-2003 (MOD 5) Annual Review

Schedule 6 Condition 5

Prepared for Luddenham Operations Pty Ltd

September 2023

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Luddenham Operations Pty Ltd

J190749 RP77

September 2023

Version	Date	Prepared by	Reviewed by	Comments
1	15 September 2023	Cale Kennedy	Philip Towler	Draft for client review
2	27 September 2023	Cale Kennedy	Philip Towler	Final

Approved by

Phil Towler
Associate Director
27 September 2023

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

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1 Introduction

Luddenham Operations Pty Ltd is the operator of the Luddenham Quarry situated at 275 Adams Road, Luddenham NSW 2745 (the site), which is approved to extract and transport up to 300,000 tonnes per annum of clay and shale products in accordance with State significant development consent DA 315-7-2003 (MOD 5).

In accordance with Schedule 6, Condition 5 of DA 315-7-2003 (MOD 5), this Annual Review assesses the environmental performance of the site between the reporting period of 30 September 2022 to 31 August 2023.

Coombes Property Group engaged EMM Consulting Pty Ltd to complete the 2022–2023 Annual Review (AR) on their behalf.

2 Conditions of consent

Table 2.1 Conditions of consent and location within the Annual Review

Schedule	Condition	Description	Report location
Schedule 3	8	The Applicant must provide annual production data to the [Regional NSW – Mining, Exploration and Geoscience] MEG, in the manner required, on the standard form supplied for that purpose. These data are also to be included in the Annual Review.	Refer to Section 3.1
Schedule 4	11	The Applicant must regularly consult with adjoining property owners to ensure property management issues including maintenance of common fences, weed control measures, and bushfire management are coordinated. Details of this consultation are to be reported in the Annual Review.	Refer to Section 3.2
Schedule 4	21B	The Applicant must report on water extracted from the site each year (direct and indirect) in the Annual Review, including water taken under any water licence.	Refer to Section 3.6.1iii
Schedule 4	30 (e)	Report on waste minimisation and management in the Annual Review.	Refer to Section 3.3
Schedule 4	42 (b)	Procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch) and publishing a summary of these records in the Annual Review.	Refer to Section 3.4
Schedule 6	5 (a)	***By the end of September 2016 and each year following, or other timing as may be agreed by the Planning Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:*** • describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year	Refer to Section 3.5
Schedule 6	5 (b)	• include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against: – the relevant statutory requirements, limits or performance measures/criteria – the monitoring results of previous years – the relevant predictions in the document/s listed in condition 2 of Schedule 3	Refer to Section 3.6 Refer to Section 3.7
Schedule 6	5 (c)	• identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance	Refer to Section 3.8 Refer to Chapter 4
Schedule 6	5 (d)	• identify any trends in the monitoring data over the life of the development	Refer to Section 3.6
Schedule 6	5 (e)	• identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies	Refer to Section 3.6
Schedule 6	5 (f)	• describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	Refer to Section 3.8
Schedule 6	6	Copies of the Annual Review must be made available to Council and any interested person upon request.	Refer to Section 3.9

Table 2.1 Conditions of consent and location within the Annual Review

Schedule	Condition	Description	Report location
Schedule 6	15 (a)	From 30 September 2016 and for the duration of the development, the Applicant must: • make copies of the following publicly available on its website: – the document/s listed in condition 2 of Schedule 3 – current statutory approvals for the development – approved strategies, plans and programs required under the conditions of this consent – a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs – a complaints register, which is to be updated monthly – the Annual Reviews of the development (for the last 5 years) – any Independent Environmental Audit of the development, and the Applicant's response to the recommendations in any audit – any other matter required by the Planning Secretary	Refer to Section 3.9
Schedule 6	15 (b)	– keep this information up-to-date, to the satisfaction of the Planning Secretary.	Refer to Section 3.9

3 Annual Review conditions requirements

3.1 Mining, exploration and geoscience reporting

CPG are required to include MEG data within the Annual Review (development consent Schedule 3, Condition 8). Table 3.1 and Table 3.2 show the lease details and royalties related to the project respectively.

Table 3.1 Lease details

Lease detail	Description
Lease name	Mining Lease (ML) 1816 (1992)
Return type	Non-coal Mineral Annually (01/07/2022 – 30/06/2023)
Mineral/extraction	CLAY SHALE
Royalty regime	Quantum Royalty
Royalty rate	$0.35 per tonne

Table 3.2 Royalty (1 July 2022 – 30 June 2023)

Royalty	Tonnes	Australian Dollars ($AUD)
Productions		
Ore produced		
Concentrates produced		
Export sales		
Local sales and other disposals	138,029	448,594.25
Purchases		
Net disposals	138,029	448,594.25
Closing stock		
Opening stock		
Minerals recovered	138,029	448,594.25
Deductions		
Gross invoice value of contained mineral		
Invoiced off-site concentrate treatment charges		
Minerals recovered		448,594.25
Direct on-site treatment expenses		
Realisation		
On-site administration		

Table 3.2 Royalty (1 July 2022 – 30 June 2023)

Royalty	Tonnes	Australian Dollars ($AUD)
Depreciation		
Total deductions		
Ex mine value		448,594.25
	Royalty Due	48,310.15

Refer to Appendix A for the report downloaded from the Royalty online services portal.

3.2 Stakeholder consultation

Continued consultation with surrounding sensitive receivers will be completed when required in accordance with Schedule 4, Condition 11 and the Environmental Management Strategy (EMS) (EMM 2021). Compliance against project requirements in shown in Table 3.3.

Table 3.3 Stakeholder consultation

Item	Requirement	Response (as advised by CPG)
1	Luddenham Operations will regularly consult with adjoining property owners to ensure property management issues including maintenance of common fences, weed control measures, and bushfire management are coordinated. Details of this consultation will be reported in the Annual Review.	No formal consultation undertaken this year – no issues raised by neighbours. Fences are all in good condition and no issues with weeds, noise and dust have been raised.
2	General enquiries from the local community will be recorded in a community engagement register, which will also include any copies of formal correspondence, and responded to by the site environmental representative or operations manager within 5 days of the enquiry.	No enquiries submitted from the public this year.
3	Luddenham Operations will consult with the wider local community on an 'as needs' basis. The need for this wider consultation will be determined based on queries or complaints made to the quarry.	As no queries and/or complaints were received from CPG within the reporting period, wider local community consultation was not considered necessary.

3.3 Waste management

Due to the limited activities that occurred on-site during the reporting period, no industrial waste was produced within the year. Extracted quarry material was the only material transported from site.

Minor amounts of general waste were produced by employees (i.e. kitchen scraps and paper etc.) which were disposed of in co-mingle waste bins and removed under general council practices.

3.4 Traffic and material movement procedures

In accordance with Schedule 4, Condition 42 (b) CPG have developed a Road Transport Protocol (EMM 2021) which outlines procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch).

The transportation and recording of material, including incidents and reporting, must comply with the procedures outlined within the Luddenham Quarry Road Transport Protocol (EMM 2021). The transportation procedure is shown in Appendix B.

Note: as advised by CPG, information has been requested from the quarry operator, however is not yet available as of the date of this report.

3.5 Development and rehabilitation

Over the past 12 months, activities on site included:

- relocation of existing clay and shale stockpiles
- removal of existing clay and shale stockpiles
- no rehabilitation works were undertaken during this period.

Over the next 12 months, activities on site will consist of:

- clay and shale extraction activities
- relocation of clay and shale stockpiles
- removal of clay and shale stockpiles.

Rehabilitation of the site will not commence until the end of extraction activities. This is anticipated to occur in late 2024. Appendix C provides a progressive overview of the site in May 2022 when compared to May 2023.

Other than general maintenance activities, no weed control has been completed during the reporting period.

3.6 Environmental monitoring

This section summarises the findings of the environmental monitoring reports completed as part of the AR.

3.6.1 Water

A water quality monitoring program was developed for the Soil and Water Management Plan (SWMP) (EMM 2021) for the site. The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring. Monitoring locations are detailed within Appendix D.

The first three quarterly groundwater monitoring events were not undertaken for the annual review period due to the damaged monitoring sites awaiting rehabilitation. One monitoring round from the SWMP monitoring program was undertaken for this annual review period:

- Surface water and groundwater monitoring – 24 August 2023. Four surface water sites were sampled along with all three groundwater monitoring sites following the rehabilitation of BSM1 and BSM2. Manual water level measurements were taken from each of the groundwater bores.

Surface and groundwater samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Sydney, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

Appendix D details the monitoring completed for this Annual Review.

i Surface water

The following receiving water exceedances were noted:

- Ammonia exceeded the trigger value at the downstream/impact site. However, poorer water quality was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance.
- Nitrogen in both oxidised and total form exceeded the trigger values at the downstream/impact site. Exceedances were also noted at the upstream/control site, however poorer water quality was noted downstream. Concentrations of nitrogen recorded within Oaky Creek are the lower end of the recorded baseline range.
- Phosphorus exceeded the trigger value at the downstream/impact site. No exceedances were noted at the upstream/control site. Concentrations of phosphorus recorded within Oaky Creek are around the median of the recorded baseline range.
- Copper exceeded trigger values at the downstream/control site. An exceedance was also noted at the upstream/control site, however poorer water quality was noted downstream. Concentrations of copper recorded within Oaky Creek are the lower end of the recorded baseline range.
- Zinc exceeded the trigger value at the downstream/impact site. No exceedances were noted at the upstream/control site. Concentrations of nitrogen recorded within Oaky Creek are around the median of the recorded baseline range.

As no discharge has occurred from the site water management system and significant inflow from the neighbouring Western Sydney Airport occurs upstream of the impact monitoring site, is it is unlikely that the quarry is the source of downstream/impact site exceedances that are not consistent with the upstream/control site. Noting that the Western Sydney Airport development has sediment basin which overflows into Oaky Creek on the north-eastern side of the quarry (down stream).

ii Groundwater

A groundwater monitoring bore network was installed before quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores were drilled and installed to a depth of approximately 30 m into the Bringelly Shale with the overlying unconsolidated material cased off. The monitoring bores were sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

During the 2021–2022 annual review, two sites (BSM1 and BSM2) were reported to be damaged and not producing representative results. It is noted that these sites have recently been replaced with new bores, with the first sampling event from these locations being taken on the 24th of August 2023.

Key observations of groundwater levels during the annual review period include:

- Groundwater levels are significantly higher than the baseline trends due to wetter than average climate conditions between 2020 and 2022.
- The groundwater level in BSM3 trends slightly down from the previous review period due to an easing of climate conditions.
- Levels recorded in the newly constructed bores (BSM1 and BSM2) are elevated above baseline trends and the previous review period.

A review of water quality results from the newly constructed bores (BSM1 and BSM2) showed water quality for some analytes that are not consistent with baseline data trends, notably:

- Electrical conductivity in BSM1 was 963 µS/cm compared to a baseline median of 23,100 µS/cm.
- Total nitrogen in BSM2 was 237 mg/L. No baseline data exists for nitrogen; however, nitrogen levels have historically been less than 8.2 mg/L within bores on site during operation.

It is suspected that new bores BSM1 and BSM2 may have not been developed following the recent construction and likely contain trapped surface water or residual drilling fluid, producing unrepresentative results.

Exceedances related to BSM2 and the comparison to upgradient bores BSM1 are not assessed in this report due to suspected unrepresentative results. The following exceedances relative to default guideline trigger values were noted:

- Iron exceeded the trigger value at BSM3 with a concentration of 1.29 mg/L. Iron is known to be present in groundwater near the site with the baseline data set median concentration noted as 8.5 mg/L.
- Zinc exceeded the trigger values at all three sites. A concentration of 0.027 mg/L was noted at BSM3 which is below the baseline median of 0.06 mg/L.
- Oil and grease were above detection limits at BSM1 and BSM3. The source of oil and grease at BSM3 is unknown. Since commencement of operations oil and grease within groundwater has been below detection. The presence of oil and grease within BSM3 may be linked to potential well contamination.

As no quarrying activities below groundwater level are currently being undertaken, the potential for impacts to groundwater quality is limited. Trigger value exceedances over default guideline values are consistent with baseline trends and are unlikely to be related to the project. The oil and grease detection at BSM3 is inconclusive and may be a result of well cross contamination.

Groundwater quality exceedances were noted for iron and zinc. However, concentrations were consistent with baseline data trends. Oil and grease was above detection at two groundwater sites, however, suspected to be related to well contamination. Some nutrients and toxicants copper and zinc were elevated within the receiving water samples, though consistent with baseline data trends.

Considering the baseline data trends and currently limited site activities, it is unlikely that exceedances are related to the quarry. The following recommendations are made for future monitoring rounds:

- Water quality results from newly constructed bores BSM1 and BSM2 are not consistent with other sites and the baseline data range (low EC reported at BSM1 and high nitrogen levels reported at BSM2). To ensure representative samples are collected during the next quarterly monitoring round, the following options are recommended:
  - All bores on site should be developed with a compressor truck to remove any potential contamination within the wells and increase well efficiency.
  - Should unrepresentative samples continue to be collected, low flow sampling with a bladder pump could be undertaken during subsequent rounds to limit the collection of well water in samples.

iii Water extraction, usage and discharge

CPG are required to report on water extracted from the site within the reporting period (Schedule 4 Condition 21 (b)). Table 3.4 shows the water locations and usage for the site.

Table 3.4 Water extraction and usage

Project Location	Water Usage	Comment(s)
Water management dam	4.3 ML/year	Dust suppression water sourced from surface water run-off.

CPG have advised that:

- no water was discharged off-site during the reporting period
- no water was sourced from bores (under water licence WAL43685 Certificate of Title).

3.6.2 Air quality

i Deposited Dust

The air quality monitoring network consists of three dust deposition gauges (DDGs) installed, operated and analysed in accordance with AS 3580. 10. 1 2003. Static dust monitoring sites were chosen at locations adjacent to sensitive receivers in proximity to the works in accordance with the approved Air Quality Management Plan (AQMP).

Appendix E.1 details the monitoring completed within the reporting period.

Dust deposition gauges were used to monitor deposited dust between the 30 September 2020 to the 24 August 2023.

Table 2.1 outlines the results of the monitoring completed within the reporting period.

Table 3.5 Dust deposition gauge monitoring data

Dust Deposition Gauge	Installation Date	Removal date	Number of days	Insoluble solids ($g/m^2/mth$)	Annual average dust criteria ($g/m^2/mth$)	Rolling average
DG01	18/10/2022	21/11/2022	34	0.5	4	1.1
	21/11/2022	15/12/2022	24	0.2		
	15/12/2022	19/01/2023	35	1.1		
	20/06/2023	20/07/2023	28	0.4		
	20/07/2023	24/08/2023	35	2.8		
DG02	18/10/2022	21/11/2022	34	0.4	4	1.2
	21/11/2022	15/12/2022	24	2.3		
	15/12/2022	19/01/2023	35	2.1		
	20/06/2023	20/07/2023	28	0.3		
	20/07/2023	24/08/2023	35	2.2		
DG03	18/10/2022	21/11/2022	34	1.0	4	1.3
	21/11/2022	15/12/2022	24	2.3		
	15/12/2022	19/01/2023	35	1.3		

Table 3.5 Dust deposition gauge monitoring data

Dust Deposition Gauge	Installation Date	Removal date	Number of days	Insoluble solids (g/m²/mth)	Annual average dust criteria (g/m²/mth)	Rolling average
	20/06/2023	20/07/2023	28	0.7		
	20/07/2023	24/08/2023	35	1.2		

Note(s)

1. No monitoring was completed during the period between 19 January 2023 to 20 June 2023 as no operational works were being completed by the quarry operator; only care and maintenance activities occurred during this time.
2. The following periods exceeded the sample exposure for *Australian Standard (AS) 3580.10.1 – 2016 Methods for sampling and analysis of ambient air, Method 10.1: Determination of particulate matter - Deposited matter - Gravimetric method* allowances for 30 days + / - 2 days:
   a. 21 November 2022 to 15 December 2022 due to Christmas break.
   b. 15 December 2022 to 19 January 2023 due to Christmas break.
3. Monitoring was not completed beyond the 24 August 2023 as results would not have been received in time to include within this report.

Figure 3.1 is a visual representation of the data presented in Table 2.1.

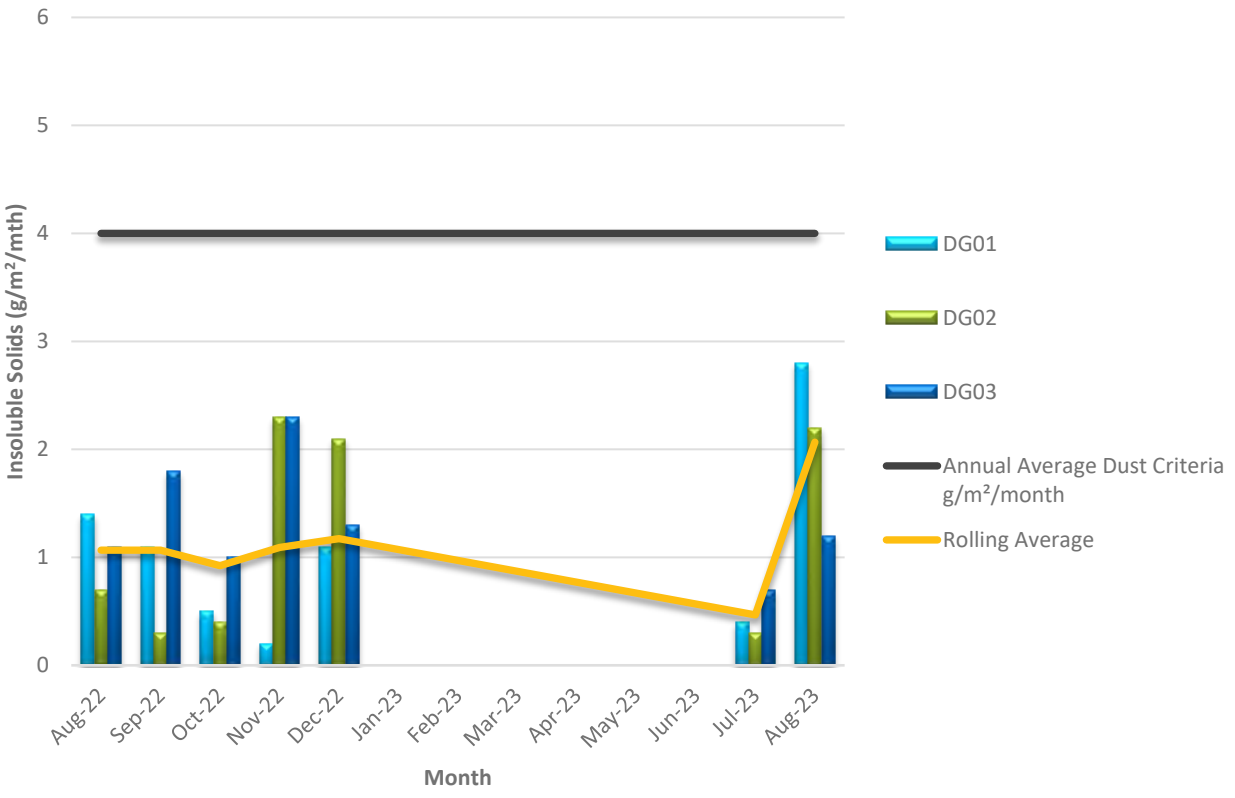

Figure 3.1 Dust deposition gauge results

All DDG monitoring completed over the reporting period was compliant with total dust deposition criteria (4.0 g/m²/month). The monitoring completed is consistent with historical data prior to this reporting period.

ii Real time monitoring

A four week monitoring program was completed during July and August 2023 using two continuous PM monitoring units (FDS PM monitoring system) to record concentrations of PM_{10} and $PM_{2.5}$.

Appendix E.2 details the real time air quality monitoring.

Meteorological measurements for the monitoring period were sourced from the nearby Bureau of Meteorology (BoM) Badgerys Creek AWS. The onsite PM monitoring data was also compared with monitoring data for the same period from the DPE Bringelly AQMS.

Siting of equipment was conducted in accordance with AS/NZS 3580.1.1:2007, as much as practicable, taking the constraints of site into consideration. The monitoring equipment was deployed at the north-east and south-west corners of the site, with a specific focus of the monitoring study to record upwind and downwind concentrations. Technical issues with the AQM02 (south-west corner) resulted in PM_{10} concentrations being derived from the $PM_{2.5}$:PM_{10} relationship from the AQM01 (north-east corner) and applied to the measured $PM_{2.5}$ concentrations from AQM02.

A summary of the monitoring results are as follows:

- No exceedances of the 24 hour PM_{10} criterion of 50 µg/m^3 were recorded or derived at either of the onsite monitoring locations.
- No exceedances of the 24 hour $PM_{2.5}$ criterion of 25 µg/m^3 were recorded at either of the onsite monitoring locations.
- The PM_{10} and $PM_{2.5}$ concentrations at the quarry were generally comparable with the concurrent measurements at the DPE Bringelly AQMS for the same period.
- When upwind and downwind concentrations were considered, the contribution from the site did not result in an exceedance of the criteria specified.

It is inferred that no exceedances of the annual total solid particulates (TSP) criterion of 90 µg/m^3 would occur based on the recorded PM_{10} concentrations.

3.6.3 Noise and vibration

The noise survey included attended noise monitoring which occurred during the day period at multiple receptors around the site. The duration of each measurement was 15 minutes. Where access to a property was not granted or measurement at assessment location was not practical due to localised construction activities, monitoring was completed at alternative representative locations and results were calculated back for the actual assessment location. This approach is consistent with the approved Luddenham Quarry Noise Management Plan (NMP) (EMM 2021) for the site and the NSW EPA 'Noise Policy for Industry' (NPfI). The attended monitoring was completed during the day period in accordance with Section M4.1 of the EPL

EMM was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at the site. Due to limited operations occurring on-site and resourcing constraints, only one noise survey was completed. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified EPL limits. Appendix F details the August 2023 noise monitoring.

Attended environmental noise monitoring was completed in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW requirements. Meteorological data was obtained from the Badgerys Creek automatic weather station (AWS) (station ID 067108) which allowed correlation of atmospheric parameters with measured site noise levels.

Attended environmental noise monitoring was completed during the day period(s) of 23 and 24 August 2023 at six monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the August 2023 survey. The monitoring completed was consistent with previous reporting periods with no exceedance of project criteria.

3.7 Complaints and incidents

No complaints have been received within the reporting period.

No environmental incidents have been recorded during the reporting period, including exceedance of the monitoring criteria.

3.8 Proposed mitigation measures

Over the next 12 months, activities on site will continue to be managed to meet all relevant statutory requirements, limits, and performance measures/criteria. Mitigations proposed as part of the sites ongoing compliance include the following:

- Ongoing management of the site in accordance with the mitigation measures listed with relevant management plans.
- Monitoring is to be completed in accordance with relevant management plans.
- An internal review audit be completed to assess site compliance against relevant conditions and management plan requirements.

3.9 Report and document availability

Copies of the Annual Review will be made available to Council and any interested person upon request.

As required by Schedule 6, Condition 15(a), copies of the following documentation are publicly available on CPG's website (https://luddenhamquarry.com.au/).

3.9.1 Compliance against Schedule 3, Condition 15 (a)

As conditioned by Schedule 3, Condition 15 (a), this section demonstrates the availability of reports on CPG's website

- The document/s listed in condition 2 of Schedule 3.

Table 3.6 Schedule 3, Condition 2 requirements

Condition	Description	On Website
a	In compliance with these conditions of consent.	-
b	In accordance with all written directions of the Planning Secretary.	None received
c	Generally in accordance with EIS titled Proposed Clay/Shale Extraction Operation – Lot 3 – 275 Adams Road Luddenham, dated May 2003, and prepared by Douglas Nicolaisen & Associates Pty Ltd.	Yes
d	Generally in accordance with correspondence from Douglas Nicolaisen & Associates Pty Ltd to the Department dated 16 March 2004 relating to operating hours, location of environmental bunds and reduction in the proposed extraction area.	Yes

Table 3.6 Schedule 3, Condition 2 requirements

Condition	Description	On Website
e	Generally in accordance with information accompanying modification application DA 315-7-2003-MOD 1 for the relocation of the access bridge across Oaky Creek, lodged 16 November 2005, and prepared by Stuart J Castle Pty Ltd.	Yes (MOD 5)
f	Generally in accordance with Modification Application DA 315-7-2003 MOD 2 and the accompanying SEE titled "Section 96(1A) Modification Application, 275 Adams Road Luddenham" produced by Planning Direction Pty Ltd and dated 3 November 2009 and "Acoustic Report – Clay/Shale Quarry at 275 Adams Road Luddenham" produced by Golders Associates Ltd and dated 15 December 2009.	Yes (MOD 5)
g	Generally in accordance with Modification Application DA 315-7-2003 MOD 3 and the accompanying Environmental Assessment titled Environmental Assessment Report for Epic Mining Pty Ltd: 275 Adams Road, Luddenham, NSW, prepared by Benbow Environmental Pty Ltd and dated November 2014 relating to temporary stockpiling, extraction sequencing and other activities.	Yes (MOD 3)
h	Generally in accordance with Modification Application DA 315-7-2003 MOD 5 and the accompanying Modification Report titled Luddenham Quarry Modification Report DA 315-7-2003 MOD 5 Prepared for Coombs Property Group & KLF Holdings, prepared by EMM Consulting and dated August 2020; Submissions Report dated December 2020 and RFI Responses dated March 2021; as amended by the revised project description prepared by EMM Consulting and dated 16 April 2021.	Yes (MOD 5)

- Current statutory approvals for the development.

Table 3.7 Statutory approvals

Item	Approval	On Website
1	Development Consent DA No. 315-7-2003	Yes
2	Environmental Protection Licence 21562	Yes
3	ML 1816	Yes

- Approved strategies, plans and programs required under the conditions of this consent.

Table 3.8 Strategies, plans and programs

Item	Strategies/plans/programs	On Website
1	Air Quality Management Plan	Yes
2	Discharge Characterisation and Water Pollution Impact Assessment	Yes
3	Environmental Management Strategy	Yes
4	Final Land Use Plan	Yes
5	Irrigation Management Plan *As advised by CPG, no irrigation is currently proposed*	No
6	Noise Management Plan	Yes

Table 3.8 Strategies, plans and programs

Item	Strategies/plans/programs	On Website
7	Road Transport Protocol	Yes
8	Site Rehabilitation Plan (inclusive of Biodiversity Management Plan)	Yes
9	Soil and Water Management Plan (inclusive Site Water Balance, Erosion and Sediment Control Plan, Surface Water Management Plan and Groundwater Management Plan)	Yes
10	Traffic Management Plan *Matters addressed in the Road Transport Protocol plan*	No

- A comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs.

Table 3.9 Summary of monitoring results

Item	Monitoring results	On Website
1	Summary of monitoring results *This Annual Review provides a summary of monitoring results and will be uploaded to the website.*	Yes

- A complaints register, which is to be updated monthly.

Table 3.10 Complaints register

Year	Complaints Register	On Website
2022	September 2021 to October 2022 (0 Complaints)	Yes

- The Annual Reviews of the development (for the last 5 years).

Table 3.11 Annual Reviews

Year	Annual Review	On Website
2022	2021–2022 Annual Review	Yes

- Any other matter required by the Planning Secretary.

Table 3.12 Other matters required by the Planning Secretary

Item	Other Matters	On Website
1	RFI Responses	Yes
2	Submission Report	Yes

- Any Independent Environmental Audit of the development, and the Applicant's response to the recommendations in any audit.

Table 3.13 Independent Environmental Audit

Audit	Description of audit and responses	On Website
1	Not undertaken yet as works restarted less than 3 years ago	No

3.9.2 Compliance against Schedule 3, Condition 15 (b)

All information is checked annually and is kept up-to-date to the satisfaction of the Planning Secretary.

4 Summary of results

Table 4.1 outlines a summary of the monitoring completed for the Annual Review period and results pertaining the relevant assessments.

Table 4.1 Summary of results

Annual review item	Monitoring completed	Exceedance/non-compliance (NC) identified	Comments
Development and rehabilitation	Site inspection		No rehabilitation was undertaken in the reporting period.
Surface water	Water sampling	Elevated levels of physical and chemical analytes were recorded within monitoring.	Elevated levels were noted at both upstream and downstream monitoring sites.
Groundwater	Water sampling	Exceedance of metals. Oil and grease was identified as above detection limits. NC (1): Quarterly sampling. Only one round of sampling was completed.	Increased levels of contaminates may have been a result of neighbouring construction and/or improper development of the recent constructed bores. NC (1): Two of the three monitoring bores were destroyed and were not able to be repaired until August.
Air quality	Dust deposition gauge	All monitoring completed was compliant against project criteria. NC (2): No monitoring was completed between January 2023 to June 2023.	No exceedances identified. NC (2): Monitoring was not completed as minimal works were occurring onsite.
	Realtime ($PM_{2.5}$ and PM_{10})	All monitoring completed was compliant against project criteria. NC (3): Continuous air monitoring campaign occur twice a year. Only one round of monitoring was completed.	No exceedances identified. NC (3): Monitoring was not completed as minimal works were occurring onsite.
Noise and vibration	Noise monitoring	All monitoring completed was compliant against project criteria. NC (4): Monitoring occurs on a bi-annual basis. Only one round of surveys were completed.	No exceedances identified. NC (4): Due to limited operations occurring on-site and resourcing constraints, only one noise survey was completed.
Complaints			CPG advised that no complaints were received within the reporting period.
Incidents	Field inspections		CPG advised that no incidents were identified during the reporting period.

Appendix A

New South Wales Government Revenue

EMM
creating opportunities

NSW Revenue

Client History

Royalty online services

Welcome Eden Skyring

Logout

Lease details

Lease name:	ML 1816 (1992)
Return type:	Non-coal Mineral Annually (01/07/2022 - 30/06/2023)
Mineral / Extraction:	CLAY SHALE
Royalty regime:	Quantum Royalty
Royalty rate:	$0.35 per tonne

Royalty

Production

Ore produced:	Tonnes		$AUD	
Concentrates produced:	Tonnes		$AUD	
Export sales:	Tonnes		$AUD	
Local sales & other disposals:	Tonnes	138,029	$AUD	448,594.25
Purchases:	Tonnes		$AUD	
Net disposals:	Tonnes	138,029	$AUD	448,594.25
Closing stock:	Tonnes		$AUD	
Opening stock:	Tonnes		$AUD	
Minerals recovered:	Tonnes	138,029	$AUD	448,594.25

Deductions

Gross invoice value of contained mineral:	$AUD	
Invoiced off-site concentrate treatment charges:	$AUD	
Minerals recovered:	$AUD	448,594.25
Direct on-site treatment expenses:	$AUD	
Realisation:	$AUD	
On-site administration:	$AUD	
Depreciation:	$AUD	
Total deductions:	$AUD	
Ex Mine value:	$AUD	448,594.25

Royalty due: $AUD 48,310.15

Cancel

Appendix B
Material transportation

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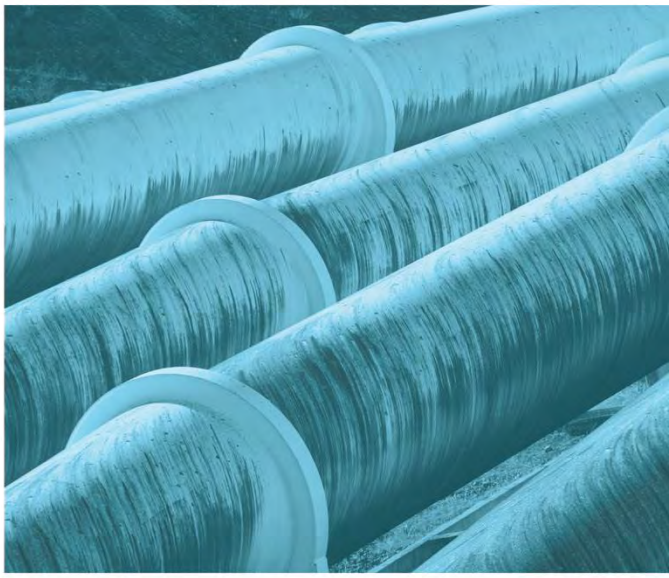
Luddenham Quarry

Road Transport Protocol

Prepared for Luddenham Operations Pty Ltd
August 2021

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Spring Hill QLD 4000
T 07 3648 1200

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Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Ground floor, 188 Normanby Road
Southbank VIC 3006
T 03 9993 1900

PERTH
Level 6, 191 St Georges Terrace
Perth WA 6000

CANBERRA
PO Box 9148
Deakin ACT 2600

Luddenham Quarry

Road Transport Protocol

Prepared for Luddenham Operations Pty Ltd

August 2021

EMM Sydney
Ground floor, 20 Chandos Street
St Leonards NSW 2065

T 02 9493 9500
E info@emmconsulting.com.au

www.emmconsulting.com.au

Luddenham Quarry

Road Transport Protocol

Report Number

J190749 RP45

Client

Luddenham Operations Pty Ltd

Date

4 August 2021

Version

V2

Prepared by

Eric Lei
Traffic Engineer
4/08/2021

Approved by

Abdullah Uddin
Associate Traffic Engineer
4/08/2021

Table of Contents

Attachments

Figures

1 Introduction

1.1 Project Overview

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by state significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd (Luddenham Operations) will reactivate and operate the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003 which was granted on 24 May 2021.

DA 315-7-2003 (as modified) permits the production and transportation of up to 300,000 tonnes per annum (tpa) of clay and shale product up to 31 December 2024.

The location of the Luddenham Quarry is shown in Figure 1.1.

1.2 Objectives

This Road and Transport Protocol (RTP) has been prepared to satisfy DA No. 315-7-2003 (as modified), Schedule 4, Condition 42. This RTP has been prepared with reference to the following documentation, where applicable:

- *Luddenham Quarry Modification 5 – Modification Report* (EMM Consulting 2020); and
- *Luddenham Quarry Modification 5 – Traffic Impact Assessment* (EMM Consulting 2020a).

This RTP outlines how traffic generated during construction and general operations of the quarry will be managed within the requirements of Transport for NSW (TfNSW) and Liverpool City Council (Council). This RTP outlines management protocols to manage potential traffic impacts associated with:

- the nature and extent of construction works proposed;
- the routes to be used by raw material haulage traffic, types and mass of traffic vehicles and periods of operation;
- the existing traffic use of the roads in the vicinity of the site; and
- over-size vehicle movements of heavy earth moving machinery to and from the quarry.

1.3 Consent conditions

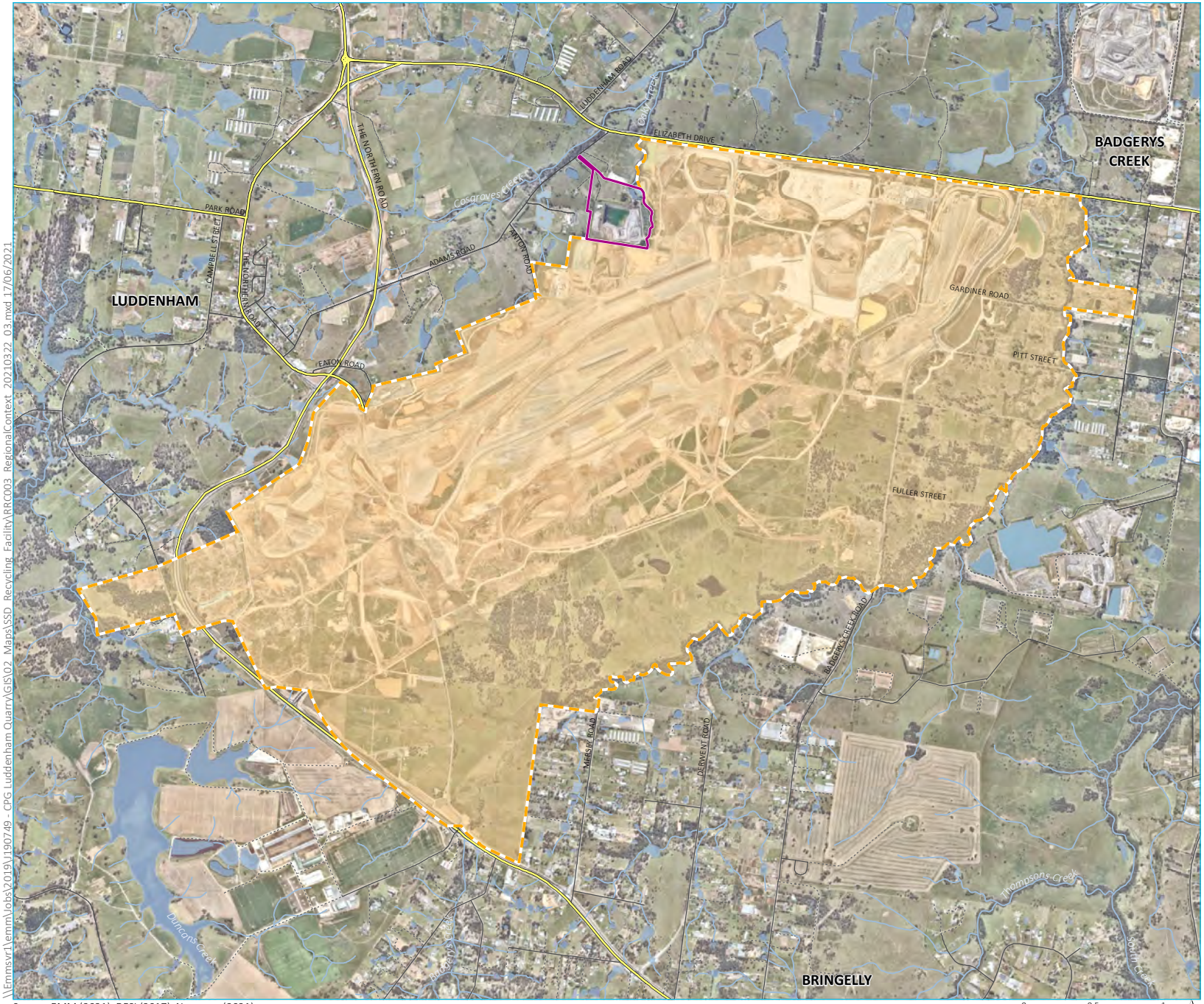
Schedule 4, Condition 42, of DA 315-7-2003 (as modified) requires the preparation of the RTP in accordance with the requirements outlined in Table 1.1.

Table 1.1 Schedule 4 Condition 42 Road Transport Protocol requirements

DA 315-7-2003 Schedule 4, Condition 42		Relevant section of this RTP
Condition 42	Prior to recommencing quarrying operations approved under Modification 5, the Applicant must develop a Road Transport Protocol, in consultation with TfNSW and Council, and to the satisfaction of the Planning Secretary. This protocol must:	Section 3
(a)	specify the haulage route(s) to be used, the maximum number of road movements and the haulage hours;	Section 4.2
(b)	include a Traffic Management Plan which addresses:	
	procedures to ensure that drivers adhere to the designated haulage route(s) as required under this Protocol;	Section 4.2 and 5.2
	measures to achieve a low-frequency, regular trucking schedule rather than a high-frequency, campaign trucking schedule;	Section 4.2.1
	contingency plans where, for example, any designated transport route is disrupted. This must also address procedures for notifying relevant agencies and affected communities by the implementation of any such contingency plan;	Sections 4.2.2
	procedures to ensure that all haulage vehicles associated with the quarry are clearly distinguishable as being related to the development;	Section 4.2.3
	procedures for monitoring of product transport, including keeping of accurate records of all laden truck movements to and from the site (including time of arrival and dispatch) and publishing a summary of these records in the Annual Review;	Section 4.2.4
	procedures for covering of all loads and ensuring that trucks do not track material onto public roads;	Sections 5.6 and 5.7.
	details for procedures for receiving and addressing complaints from the community concerning traffic issues associated with haulage from the quarry or return of unladen trucks to the quarry; and	Section 6
	measures to ensure the provisions of the traffic management plan are implemented, for example, education of drivers and any contractual agreements with operators of heavy vehicles which serve the quarry.	Section 5.
(c)	include a Code of Conduct for drivers which addresses:	
	travelling speeds;	Section 5.3.
	staggering of truck departures to ensure a regular trucking schedule throughout the day;	Section 5.2.
	instructions to drivers not to overtake each other on the haulage route(s), as far as practicable, and to maintain appropriate distances between vehicles;	Section 5.2.
	instructions to drivers to adhere to the designated haulage route(s);	Section 5.2.
	instructions to drivers to be especially safety conscious and to ensure that traffic regulations are obeyed strictly;	Section 5

Table 1.1 Schedule 4 Condition 42 Road Transport Protocol requirements

DA 315-7-2003 Schedule 4, Condition 42		Relevant section of this RTP
	driver training in the Code to ensure that all drivers are made aware and adhere to the Code; and	Section 5
	procedures for ensuring compliance with and enforcement of the Code.	Section 5



KEY

- Subject property
- Western Sydney International (Nancy-Bird Walton) Airport
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line

Source: EMM (2021); DFSI (2017); Nearmap (2021)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

\\Emmsvr1\emm\Jobs\2019\190749 - CPG Luddenham Quarry\GIS\02 Maps\SSD Recycling Facility\RRC003 RegionalContext 20210322 03.mxd 17/06/2021

Regional context

Luddenham Quarry
Road Transport Protocol
Figure 1.1

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2 Approved operations

2.1 Summary

Extractive operations are limited to 300,000 tonnes per annum (tpa), approved to 31 December 2024. The approved quarrying method involves extraction, crushing and stockpiling using a bulldozer, excavators, dump trucks and loading materials onto road trucks with a front-end loader.

The approved site access for the quarry is off Adams Road, approximately 250 metres (m) from the Elizabeth Drive/Adams Road intersection. An overview of the approved quarry layout is provided in Figure 2.1.

2.2 Hours of operation and workforce numbers

The approved hours of operation for the development are as follows:

- 7 00 am – 6 00 pm Monday to Friday (no haulage vehicles may enter or leave the site between 6 pm and 7 am Monday to Friday and on public holidays); and
- 7 00 am – 1 00 pm on Saturdays for maintenance activities only (no other work is to be undertaken on Saturday, Sunday and public holidays).]

The quarry site will support around 12 employees during normal operating conditions, with a maximum of 15 employees during peak operating times.

2.3 Haulage and haulage routes

The quarry is approved to generate a maximum of 100 daily truck movements.

Unless otherwise agreed by the Planning Secretary, the following restrictions apply to quarry related vehicles:

- quarry heavy vehicles are restricted to a maximum length of 19 m;
- all quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection; and
- quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access.

2.4 Road upgrades

Prior to recommencing quarrying operations approved under MOD 5, Luddenham Operations will:

- carry out pavement upgrades on the portion of Adams Road between Elizabeth Drive to approximately 40 m south of the site access road;
- prepare and implement a signage and line marking plan for the Elizabeth Drive/Adams Road intersection to restrict and manage truck access; and
- seal the internal site access road between Adams Road and the site access infrastructure area.

A section 138 approval under *the Roads Act 1938* will be obtained from Council prior to the start of pavement upgrade works on Adams Road.

KEY

- Study area
- Cadastral boundary

Proposed site modifications

- Approved extraction footprint
- Existing noise bunds
- Existing stockpiling area
- Extended stockpiling area
- Internal road
- Site entry infrastructure (incl. offices, amenities, weighbridge)
- Equipment laydown area

\\Emmsvr1\emm\Jobs\2019\190749 - CPG Luddenham Quarry\GIS\02 Maps\Modification Reporting\MR004 ProposedModification 20210422 05.mxd 17/06/2021

Source: EMM (2021); DFSI (2017); GA (2011); Nearmap (2020)

0 50 100 m

GDA 1994 MGA Zone 56

N

Approved site layout

Luddenham Quarry
Road Transport Protocol
Figure 2.1

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3 Consultation

This RTP has been prepared in consultation with TfNSW and Council. Outcomes of consultation with these agencies are summarised in the following subsections with consultation records contained in Attachment A.

Table 3.1 Consultation

Agency	Matters raised	Where addressed in RTP
TfNSW	The response from TfNSW raised no comments in relation to the RTP however noted that the signage and line marking plan required under Schedule 4 Condition 41(b) of the consent submitted to development.sco@transport.nsw.gov.au for review and approval. TfNSW also requested the signage and line marking plan be included in the RTP.	The signage and line marking plan is included in Attachment B of this RTP. The signage and line marking plan has also been forwarded to development.sco@transport.nsw.gov.au for review.
Council	Council requested the following information/comments be addressed/included in the RTP:	
	1. A haulage route map which shows travel routes from the origins to the subject site in a wide road network	An overview of heavy vehicle destinations and routes is provided in Figure 4.1.
	2. Parking provision and designated area for construction work	During the construction phase an equipment laydown area and light vehicle parking area will be established in the site entry infrastructure area as shown in Figure 1.2 (refer Section 4.1).
	3. Timeframe for the planned construction and operation activities, including the required Adams Road improvement works	The anticipated duration of the construction phase, including pavement upgrades on Adams Road will be around 4-8 weeks (refer Section 4.1).
	4. A notice with contact phone number and email details for community to make contacts regarding work activities, and installed at the site, during construction.	The construction traffic management plan prepared as part of the Section 138 application for the pavement upgrade works on Adams Road will contain the contact details for the community to make contact during pavement upgrades. This will be installed at the site entry during the construction phase.

Table 3.1 Consultation

Agency	Matters raised	Where addressed in RTP
	5. Access Arrangement - The report indicates that vehicle movements to the subject site would be restricted to left in/right out only at the Elizabeth Drive/Adams Road intersection. Elizabeth Drive is being used by significant construction vehicles, due to major construction works in the local area including the Western Sydney Airport and other major transport projects, such as The Northern Road upgrade, the M12 Motorway and Sydney Metro – WSA. With the expected increasing traffic movements along Elizabeth Drive close to its intersection with Adams Road, right turn movements out of Adams Road to Elizabeth Drive would experience delays which could result in right turn crashes at the intersection. Hence, consideration is to be given to restrict traffic movements at the intersection to left in/left out only, subject to Transport for NSW (TfNSW) approval.	Schedule 4 Condition 40 of the consent restricts all quarry-related traffic to left-in, right-out movements at the intersection of Elizabeth Drive and Adams Road, accordingly a left in/left out restriction of quarry vehicle traffic movements has not been considered further.
	6. Construction Traffic Management Plan - The CTMP is to include a requirement for Road Occupancy Permit and Road opening approval issued by Council or Road Occupancy License issued by the Transport Management Centre to be obtained before road works on the adjoining public roads. Works within the road reserve shall not commence until the construction traffic management plan has been endorsed.	This comment is noted and will be addressed in the CTMP prepared as part of the s138 application.

4 Traffic management plan

Traffic management for the quarry can generally be categorised into two stages as follows:

- Stage 1: construction including road upgrades and establishment of site entry infrastructure area prior to recommencement of quarrying operations as approved by MOD 5; and
- Stage 2: quarry operation including dispatch of quarry product.

A summary of the expected traffic impact in each stage is provided below, along with how that impact will be managed and minimised.

4.1 Stage One - Construction traffic management

The construction phase will involve sealing of the internal access roads, upgrades to Adams Road (as outlined in Section 2.4) and establishment of the site entry infrastructure area. Construction traffic will consist of earth moving plant and trucks, road pavement/asphalt trucks, heavy vehicles delivering site infrastructure (ie wheel wash and demountable site buildings) and light to medium commercial vehicles.

During the construction phase, a construction equipment laydown area and light vehicle parking would be provided in the site entry infrastructure area as shown in Figure 1.2. The anticipated duration of the construction phase, including pavement upgrades on Adams Road will be around 4-8 weeks.

4.1.1 Traffic route

The most significant traffic groups in this stage are site infrastructure deliveries, movement of road plant and road pavement/asphalt deliveries. These heavy vehicles will access Adams Road and the site via Elizabeth Drive east.

There will be no necessity for route restrictions as there will be no concentrated traffic activity from any one location during the construction phase and construction will occur during standard construction hours Monday to Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm.

4.1.2 Notification

Affected residents along Adams Road and Western Sydney Airport will be notified prior to the start of pavement upgrade works on Adams Road.

4.1.3 Road upgrades closure

Road closures may be required for the Adams Road pavement upgrade work, with appropriate Traffic Control Plans to be prepared by the road works contractor. Council approval will be sought prior to any road closure.

4.2 Stage Two - operational quarry traffic management

The operational quarry traffic stage encompasses the dispatch of clay and shale quarry products to local brick works. It also encompasses the delivery and removal as required of quarry related plant and equipment.

4.2.1 Haulage routes and schedule

Quarry trucks have fixed origins, destinations and transport routes with trucks predominately traveling between the quarry and the following locations:

- PGH Bricks Cecil Rd, Cecil Park;
- PGH Bricks Townson Road, Schofields; and
- Mulgoa Quarries 44 Tyrone Place Erskine Park.

All of the above locations are accessed via Elizabeth Road, east of the Elizabeth Drive/Adams Road intersection with all heavy vehicles travelling to and from the quarry via Elizabeth Drive east of the Elizabeth Drive/Adams Road intersection.

As outlined in Section 2.3, all quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection and quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access

All dispatch of quarry product will occur during the hours 7.00 am – 6.00 pm Monday to Friday. Haulage vehicles will not arrive at the quarry prior to 7.00 am.

Arrival of haulage vehicles and dispatch of quarry product is scheduled to ensure a low frequency regular trucking schedule with a maximum of 10 heavy vehicle movements scheduled per hour.

Plant and equipment will generally be transported to site from the quarry contractors' other operations. Oversize over mass (OSOM) permits will not be required as plant will be transported within curfew times and via approved heavy transport routes. An overview of designated haulage routes is shown in Figure 4.1.

4.2.2 Alternative routes

Consideration of alternative haulage routes, in the event of road closures, incidents or unforeseen events are addressed on an as occurs basis. Site truck drivers are instructed to use the arterial road network as much as possible and only use local roads where there is no alternative to reach to their destination.

If required, alternative haulage route notices are issued by Luddenham Operations to affected cartage-transport drivers.

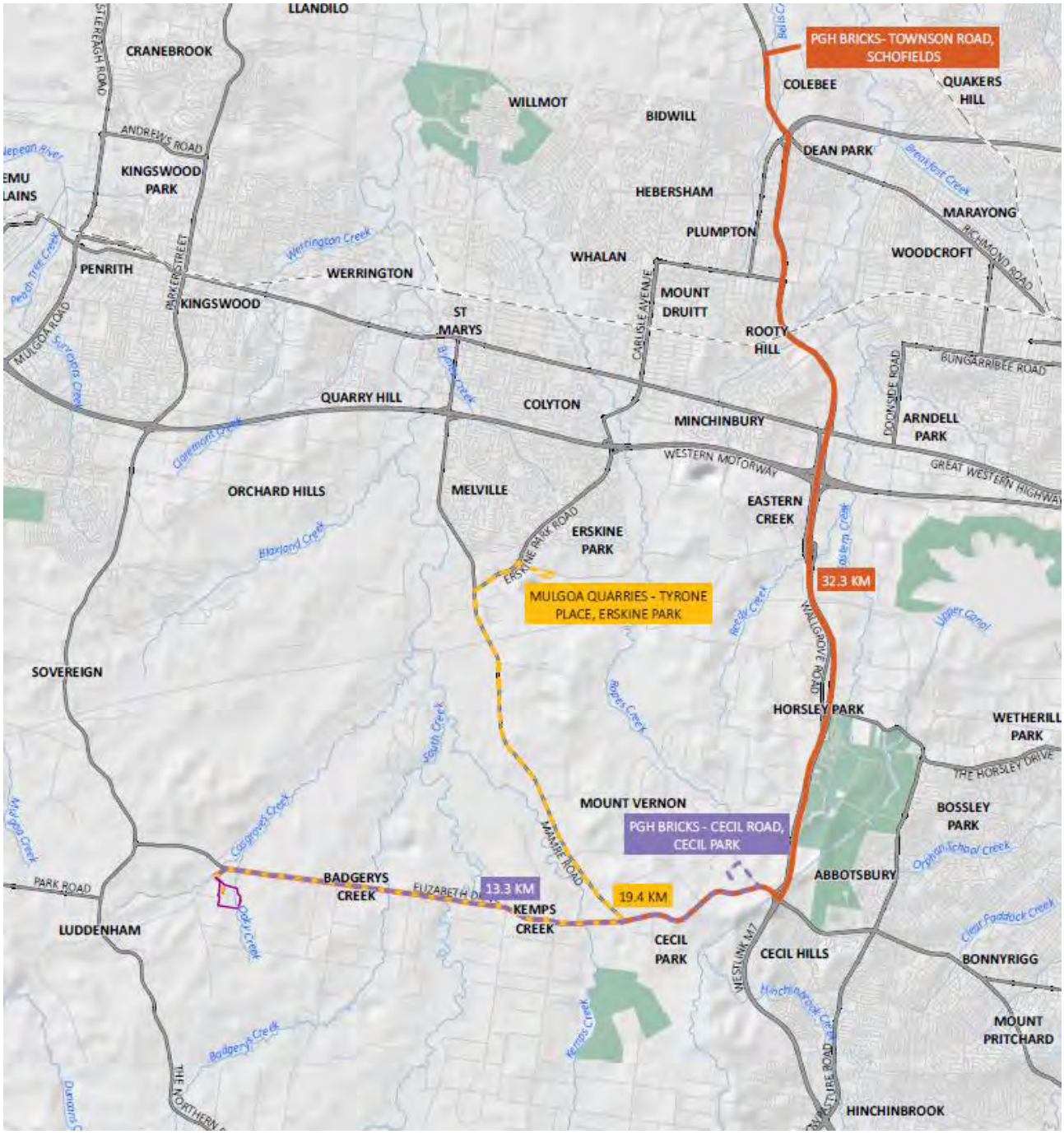
4.2.3 Quarry heavy vehicles

Quarry heavy vehicles hauling quarry product for Luddenham Operations will be limited to up to 19 m-in-length and are to display a sign in the windscreen to identify the heavy vehicle as being associated with Luddenham Operations.

4.2.4 Monitoring and reporting

Accurate records of all dispatch of quarry product are recorded including time of dispatch from the site and time of arrival at destination. Product is currently weighed on arrival at the brickworks and reported to Luddenham Operations. In addition, all haulage vehicles have in built scales to ensure they are carrying legal loads. A summary of truck movements and product dispatch is included in the annual review.

Figure 4.1 Heavy vehicle destinations and routes



5 Driver code of conduct

5.1 Purpose of the code

The Driver Code of Conduct (Code) outlines procedures to ensure that truck drivers adhere to the designated transport routes and that truck drivers implement safe driving practices.

Luddenham Operations ensure that all transport contractors are aware of the Code and that they drive responsibly and adhere to the code. All drivers are trained in the requirements of the Code and audits of the compliance with the Code are regularly conducted. All drivers reported or found to be acting in a manner contrary to the Code are subject to disciplinary action.

5.2 General requirements

Heavy vehicle drivers accessing the site must:

- abide by the conditions of consent;
- undertake a site induction carried out by an approved member of the quarry staff or suitably qualified person under the direction of Luddenham Operations. The site induction will outline:
    - the maximum daily traffic movements approved by the consent;
    - quarry related vehicles are restricted to left-in, right-out movements at the Elizabeth Drive/Adams Road intersection;
    - quarry related heavy vehicles are restricted from travelling on Adams Road south of the site access; and
    - scheduling of arrivals and departures to ensure a regular trucking schedule throughout the day (ie no move than 10 movements per hour).
- hold a valid driver's licence for the class of vehicle they are driving;
- operate the vehicle in a safe manner within and external to the site;
- adhere to designated transport routes;
- not overtake each other on the haulage route, as far as practicable, and maintain appropriate distances between vehicles;
- not park on street, verges, or footpaths in the vicinity of the site or when accessing the site; and
- comply with all directions of authorised site personnel when within the site.

5.3 Heavy vehicle speed

A speed limit of 20 km/h is applied within the site for all vehicles with the exception of the sealed internal access road which has a speed limit of 40 km/h.

Drivers are to observe the posted speed limits on all public roads with speed adjusted appropriately to suit the road environment and prevailing weather conditions to comply with Australian road rules. The vehicle speed must be appropriate to ensure the safe movements of the vehicle based on the vehicle configuration.

Heavy vehicle operators and drivers are subject to the Heavy Vehicle National Law and Regulations. TfNSW also has a heavy vehicle rating system which centralises all road offences so repeat driver and operator offences can be identified (https://roads-waterways.transport.nsw.gov.au/roads/demerits-offences/heavy-vehicle-offences.html)

5.4 Driver fatigue

Fatigue is one of the biggest causes of crashes for heavy vehicle drivers. The National Heavy Vehicle Accreditation Scheme allows heavy vehicle operators the choice of operating under three fatigue management schemes: Standard Hours of Operation; Basic Fatigue Management (BFM); and Advanced Fatigue Management (AFM). All heavy vehicle drivers operating at the site must be aware of their adopted fatigue management scheme and operate within its requirements.

Fatigue includes (but is not limited to) the following:

- feeling sleepy;
- feeling physically or mentally tired, weary or drowsy;
- feeling exhausted or lacking energy; and
- behaving in a way consistent with any of the above.

5.5 Heavy vehicle control

In order to minimise the impact of noise from truck transport, the following controls will apply to truck operators:

- compression brakes not to be used in the vicinity of residential areas;
- tailgates must be locked and secured to avoid noise or spillage;
- always observe the posted speed on site and the local road network;
- no tailgating is permitted – a 3 second gap is to be observed at all times;
- equipment to be used must be fit for the purpose; and
- drivers to obey the operating hours outlined in Section 2.2.

5.6 Load covering

Loose material on the road surface has the potential to cause road crashes and vehicle damage. All loaded vehicles leaving the quarry must be covered prior to leaving the site and remain covered as required under NSW law for the duration of the trip. The load cover may be removed upon arrival at the delivery site. All care is to be taken to ensure that all loose debris from the vehicle body and wheels is removed prior to leaving the site and again after unloading.

Drivers must ensure that the tailgate is locked before leaving the site. Luddenham Operations is to monitor for presence of loose material on the side of the vehicle route from facility operations and take appropriate action (removal or suppression of loose materials) regularly.

5.7 Cleanliness

All loaded vehicles are to be inspected prior to leaving the site for cleanliness. Any materials that could fall on the road should be removed prior to leaving the site. All outgoing vehicles will traverse through a wheel wash to avoid tracking of soil off site.

5.8 Breakdown and incidents

In the case of a breakdown the vehicle must be towed to the nearest breakdown point as soon as possible. All breakdowns must be reported to Luddenham Operations and the vehicle protected in accordance with the Heavy Vehicle Drivers handbook.

6 Complaints management

During operating hours, a telephone complaints line will be available for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by vehicle or mobile plant connected with the operation. The telephone number will be made available on the Luddenham Operations website.

A complaints register will be made publicly available on the Luddenham Operations website, updated monthly.

A record must be kept of any complaints made to any employee or contractor in relation to activities conducted at the site. The record of complaint must be kept for at least four years after the date of the complaint, and include the following details:

- date and time of the complaint;
- method by which the complaint was made;
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a not the that effect;
- nature of the complaint;
- action taken in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was undertaken in relation to the complaint, the reasons why no action was taken.

7 Incidents

Any incident that occurs within the site boundary or is associated with Luddenham Quarry's operations must be reported by the employee or contractor who has been associated with or witnessed the incident to the Site Supervisor. An incident is defined by development consent DA 315-7-2003 as a set of circumstances that:

- causes, or threatens to cause, material harm to the environment; and/or
- breaches or exceeds the limits or performance measures/criteria in the development consent.

DPIE is required to be notified as soon as practicable following an incident. Where an incident results in a non-compliance with development consent DA 315-7-2003, DPIE and any relevant agencies are required to be notified with the following information within seven days:

- the non-compliance;
- the reasons for the non-compliance (if known); and
- what actions have been taken, or will be taken, to address the non-compliance.

In accordance with the requirements of the Environment Protection Licence and *Protection of the Environment Operations Act 1997* (POEO Act), any employee or contractor must notify the NSW Environment Protection Authority (EPA) and any relevant agencies of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident. Notifications must be made by telephoning the Environmental Line service on 131 555. Written details of the notification to the EPA must be provided within seven days of the incident.

8 Reporting and access to information

8.1 Annual review

Luddenham Quarry prepares an annual review that reviews the performance of operations against the requirements of consent and the quarry's respective management plans and provides an overview of environmental management actions taken. The annual review typically includes the following elements specific to traffic management:

- any amendments to statutory approvals;
- total product haulage during the reporting period;
- summary of heavy vehicle movements;
- a summary of complaints or incidents relating haulage of quarry product or movement of quarry plant over the reporting period;
- any non-compliance recorded during the reporting period and the actions taken to ensure compliance;
- identification of any discrepancies between the predicted and actual impacts of operations and an analysis of the potential cause of any significant discrepancies; and
- a summary of management actions to be implemented over the next year to improve the environmental performance of the site.

8.2 Access to information

For the duration of the development Luddenham Operations will ensure the website keeps up-to-date information on the following:

- Environmental assessment reports;
- current statutory approvals for the development;
- approved strategies, plans and programs required under the conditions of the consent;
- a complaints register, which is to be updated monthly;
- the annual reviews of the development (from the recommencement of quarrying under MOD 5);
- any independent environmental audit of the development, and response to the recommendations in any audit; and
- any other matter required by the Secretary.

9 Review

This RTP, including traffic management plan and driver code of conduct, will be reviewed, and if necessary revised to the satisfaction of the Secretary within 3 months of a modification to DA 315-7-2004 or following the submission of an:

- annual review:
- incident report; or
- audit report

Revisions to this RTP will be distributed to the relevant internal and external stakeholders.

References

EMM Consulting. 2021. “Luddenham Advanced Resource Recovery Centre Addendum Traffic Impact Assessment.”

EMM Consulting. 2020. “Luddenham Quarry Modification Report DA 315-7-2003 MOD5.”

EMM Consulting. 2020. “Luddenham Quarry Scoping Report MOD5.”

EMM Consulting. 2020. “Luddenham Quarry Traffic Impact Assessment DA 315-7-2003 MOD5.”

NSW TfNSW Heavy Vehicle offences website visited 8 June 2021
https://roads-waterways.transport.nsw.gov.au/roads/demerits-offences/heavy-vehicle-offences.html

Attachment A

Consultation

Janet Krick

From: Charles Wiafe <WiafeC@liverpool.nsw.gov.au>
Sent: Sunday, 18 July 2021 10:59 PM
To: Janet Krick
Cc: Christopher Jattan; Stella Qu
Subject: RE: Luddenham Quarry - Road Transport Protocol

Follow Up Flag: FollowUp
Flag Status: Completed

Hi Janet,

Council has reviewed the Road Transport Protocol report (RTPR) prepared for Luddenham Quarry and requests that the following information/comments are to be addressed and included in the report:

1. A haulage route map which shows travel routes from the origins to the subject site in a wide road network;

2. Parking provision and designated area for construction work;

3. Timeframe for the planned construction and operation activities, including the required Adams Road improvement works;

4. A notice with contact phone number and email details for community to make contacts regarding work activities, and installed at the site, during construction.

5. Access Arrangement - The report indicates that vehicle movements to the subject site would be restricted to left in/right out only at the Elizabeth Drive/Adams Road intersection.

   Elizabeth Drive is being used by significant construction vehicles, due to major construction works in the local area including the Western Sydney Airport and other major transport projects, such as The Northern Road upgrade, the M12 Motorway and Sydney Metro – WSA.

   With the expected increasing traffic movements along Elizabeth Drive close to its intersection with Adams Road, right turn movements out of Adams Road to Elizabeth Drive would experience delays which could result in right turn crashes at the intersection.

   Hence, consideration is to be given to restrict traffic movements at the intersection to left in/left out only, subject to Transport for NSW (TfNSW) approval.

6. Construction Traffic Management Plan - The CTMP is to include a requirement for Road Occupancy Permit and Road opening approval issued by Council or Road Occupancy License issued by the Transport Management Centre to be obtained before road works on the adjoining public roads. Works within the road reserve shall not commence until the construction traffic management plan has been endorsed.

   The road occupancy application is to include a traffic control plan to minimise construction impacts. The Traffic Control Plan is to be prepared in accordance with AS1742.3 “Traffic Control Devices for Works on Roads” and the Roads and Maritime Services publication “Traffic Control at Worksites” and certified by an appropriately accredited Roads and TfNSW Traffic Controller and submitted to Council and the PCA for approval. Application forms for Road Occupancy Permit and Road opening approval are available on Council’s website or can be requested from Council’s Customer Services.

Should you require clarification, please contact us again.

Regards

Charles

Charles Wiafe
Service Manager Transport Management

LIVERPOOL CITY COUNCIL

02 8711 7452 | 0417 175 763 | WiafeC@liverpool.nsw.gov.au
Customer Service: 1300 36 2170 | 33 Moore Street Liverpool, NSW 2170, Australia
www.liverpool.nsw.gov.au

From: Janet Krick <jkrick@emmconsulting.com.au>
Sent: Wednesday, June 30, 2021 8:47 AM
To: Stella Qu <QuS@liverpool.nsw.gov.au>; Charles Wiafe <WiafeC@liverpool.nsw.gov.au>
Cc: Phil Towler <ptowler@emmconsulting.com.au>
Subject: Luddenham Quarry - Road Transport Protocol

Good morning Stella and Charles,

As you may be aware, Modification 5 (MOD 5) of DA 315-7-2003 to allow for the reactivation of quarrying at Luddenham Quarry was approved on 24 May 2021.

As part of the revised conditions of consent (CoC), Luddenham Operations Pty Ltd (Luddenham Operations), a joint venture between Coombes Property Group and KLF Recycling must prepare updated management plans prior to the recommencement of quarrying operations. The CoC require the preparation of a Road Transport Protocol in consultation for Transport for NSW (TfNSW) and Council.

Accordingly please find the draft Road Transport Protocol attached for your review and comment.

Please note that the protocol addresses operational traffic management for the quarry as per the consent requirements. A separate construction traffic management plan will be prepared and submitted to Council as part of the Section 138 approval to carry out pavement upgrades on Adams Road required prior to the recommencement of quarrying.

Any comments would be appreciated by 14 July 2021. Please do not hesitate to give me a call with any questions/comments you may have.

Many thanks in advance

Janet Krick
Associate Environmental Planner

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T 02 4907 4800
M 0456 664 212
D 02 4907 4811
Connect with us

NEWCASTLE | Level 3, 175 Scott Street, Newcastle NSW 2300

Please note my working days are Monday to Thursday

Janet Krick

From: Felix Liu <Felix.Liu@transport.nsw.gov.au>
Sent: Tuesday, 13 July 2021 10:02 AM
To: Janet Krick
Cc: Phil Towler; Abdullah Uddin
Subject: 20210713 - TfNSW response - Luddenham Quarry - Road Transport Protocol - SYD09/00807/14

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Janet,

Thank you for sending the Road Transport Protocol and the signage and linemarking plan to TfNSW for review.

TfNSW has reviewed the information and raises no further comments. However, it should be noted that the signage and linemarking plan should form part of the requested Road Transport Protocol / Operation Traffic Management Plan (OTMP) to be submitted to TfNSW for review and approval. The documents should be submitted to development.sco@transport.nsw.gov.au.

I hope this has been of assistance.

Kind regards

Felix Liu

Land Use Planner
Sydney Roads
Greater Sydney
Transport for NSW

Tel: 02 8849 2113
Level 5/27 Argyle Street Parramatta NSW 2150

From: Janet Krick [mailto:jkrick@emmconsulting.com.au]
Sent: Wednesday, 30 June 2021 8:43 AM
To: Felix Liu <Felix.Liu@transport.nsw.gov.au>
Cc: Phil Towler <ptowler@emmconsulting.com.au>
Subject: Luddenham Quarry - Road Transport Protocol

Good morning Felix,

As you may be aware, Modification 5 (MOD 5) of DA 315-7-2003 to allow for the reactivation of quarrying at Luddenham Quarry was approved on 24 May 2021.

As part of the revised conditions of consent (CoC), Luddenham Operations Pty Ltd (Luddenham Operations), a joint venture between Coombes Property Group and KLF Recycling must prepare updated management plans prior to the recommencement of quarrying operations. The CoC require the preparation of a Road Transport Protocol in consultation for Transport for NSW (TfNSW) and Council.

Accordingly please find the draft Road Transport Protocol attached for your review and comment.

Please note that the protocol addresses operational traffic management for the quarry as per the consent requirements. A separate construction traffic management plan will be prepared as part of the Section 138 approval to carry out pavement upgrades on Adams Road required prior to the recommencement of quarrying.

Any comments would be appreciated by 14 July 2021. Please do not hesitate to give me a call with any questions/comments you may have.

Many thanks in advance

Janet Krick
Associate Environmental Planner
EMM creating opportunities
T 02 4907 4800
M 0456 664 212
D 02 4907 4811
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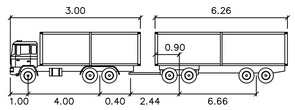
Please note my working days are Monday to Thursday

Attachment B

Signage and line marking plan



19meters Truck and Dog

meters

First Unit Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 20.7
First Unit Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

VEHICLE

LEGEND

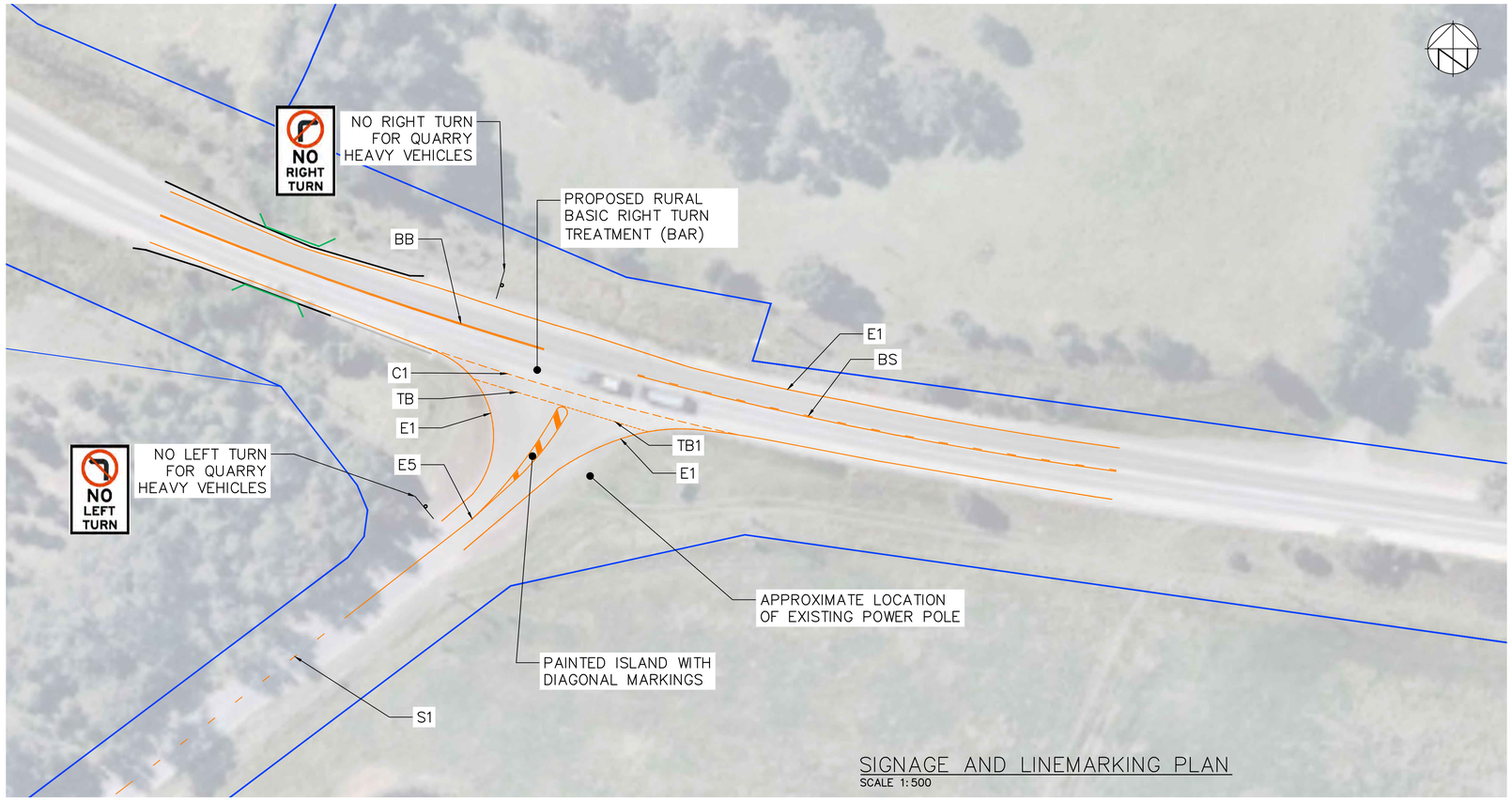
CIVIL WORKS

- EXISTING BOUNDARY BASED ON EXISTING ILP
- LINEMARKING LEFT EDGE LINE (E1)
- LINEMARKING DOUBLE BARRIER LINE (BB)
- LINEMARKING GIVE WAY LINE (TB)
- LINEMARKING GIVE WAY LINE (TB1)
- LINEMARKING BARRIER RESTRICTED OVERTAKING LINE (BS)
- LINEMARKING DIVIDING LINE (S1)
- LINEMARKING PAINTED MEDIAN (E5)
- LINEMARKING CONTINUITY LINE (C1)

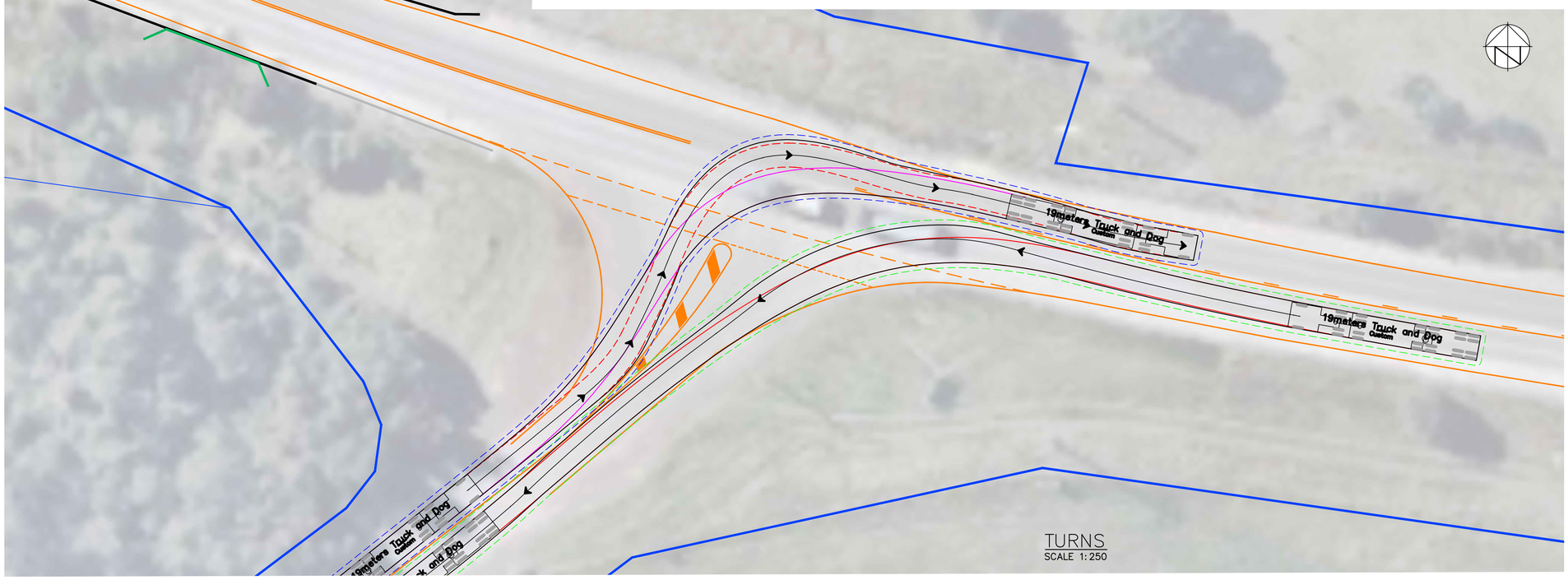
LEGEND

TURNING PATHS (19m TRUCK & DOG)

- BODY CLEARANCE 0.5M
- TRUCK DIRECTION
- FRONT TIRES
- REAR TIRES



SIGNAGE AND LINEMARKING PLAN
SCALE 1:500



TURNS
SCALE 1:250

A1 PLOT 250 0 2.5 5.0 7.5 10 500 A3 PLOT
5 2.5

A1 PLOT 500 0 5 10 15 20 1000 A3 PLOT
10 5

SK01

DESCRIPTION: ADAMS RD AND ELIZABETH DR INTERSECTION IMPROVEMENT: SIGNAGE AND LINEMARKING PLAN
DATE: 01.07.2021

PROJECT: 275 ADAMS ROAD, LUDDENHAM
PROJECT NUMBER: 7472

INDESCO
CANBERRA | SYDNEY | WOLLONGONG
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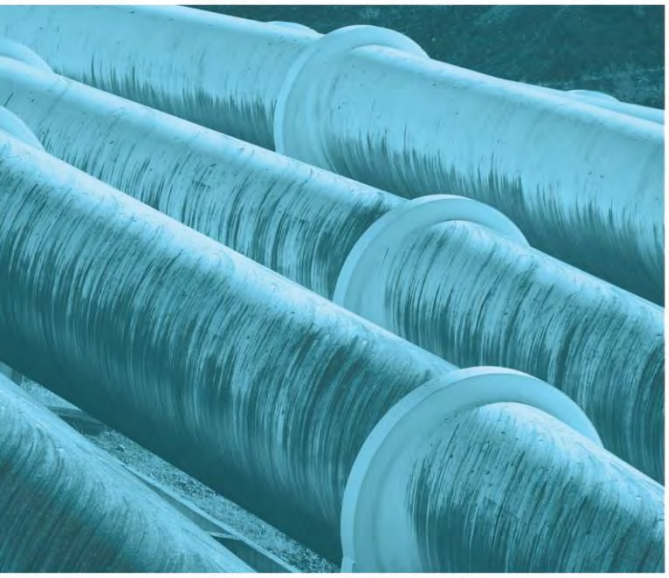

Appendix C
Development and rehabilitation

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C.1 Quarry overview (29 May 2022)

Downloaded from Nearmaps on 20 September 2023.

Images from September 2022 were not available on Nearmaps. The image shown was the closest to the September period that could be sourced through the service.

C.2 Quarry overview (10 May 2023)

Downloaded from Nearmaps on 20 September 2023.

Images from September 2023 were not available on Nearmaps. The image shown is the most recent available

Appendix D

Surface Water and Groundwater Annual Review

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Luddenham Quarry

Water review (September 2022 - August 2023)

Prepared for Luddenham Operations Pty Ltd

September 2023

Luddenham Quarry

Water review (September 2022 - August 2023)

Luddenham Operations Pty Ltd

J190749 RP#80

September 2023

Version	Date	Prepared by	Reviewed by	Comments
1	15/09/2023	Jonathon Schacht	Patrick Carolan	Draft
2	27/09/2023	Jonathon Schacht	Patrick Carolan	Final

Reviewed by

Patrick Carolan
Senior Water Resources Engineer
27 September 2023

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

TABLE OF CONTENTS

Appendices

Tables

Figures

1 Introduction

1.1 Overview

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by State significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd is operating the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003 which was granted on 24 May 2021.

1.2 Purpose of this report

This report outlines water balance modelling and water quality monitoring undertaken by EMM Consulting Pty Ltd (EMM) to support the Luddenham Quarry AR, for the annual review period of 1 September 2022 to 31 August 2023.

1.3 Report structure

The following sections set out:

- an overview of EMM's understanding of the site operations (Section 2)
- water balance results for the annual review period (Section 3)
- water quality results for the annual review period (Section 4)
- a summary of work undertaken and recommendations for environmental compliance (Section 5).

2 Background

2.1 Overview

This section describes EMM's understanding of the site operations, water management and water quality monitoring program.

2.2 Summary of site operations

During the annual review period, quarry activities were undertaken in 6–8-week campaigns. Activities included the removal of existing stockpiled materials and extraction of new material from the south-western quadrant of the quarry site. Outside of quarry campaigns, there were no other activities on site. Luddenham Operations has advised that during the annual review period:

- no transfers between the water management dam and the quarry pit were undertaken
- dust suppression was undertaken during quarrying campaigns, using a 40 kilolitre (kL) water truck with an average of one trip per day sourcing water from the water management dam
- no discharges were observed to occur from the water management dam to Oaky Creek.

2.3 Water quality monitoring program

A water quality monitoring program was developed for the Soil and Water Management Plan (SWMP) (EMM 2021) for the site. The program commenced in March 2022 and involves quarterly groundwater and annual surface water monitoring (refer Appendix A for monitoring locations). The following sections outline the program details.

2.3.1 Surface water monitoring locations

The surface water monitoring program consists of the following locations (refer Appendix A):

- Oaky Creek upstream of the site
- Oaky Creek downstream of the site
- water stored within the quarry pit
- water stored within the water management dam.

2.3.2 Groundwater monitoring locations

A groundwater monitoring bore network was installed before quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores were drilled and installed to a depth of approximately 30 metres (m) into the Bringelly Shale with the overlying unconsolidated material cased off. The monitoring bores were sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek.

During the 2021-2022 annual review, two sites (BSM1 and BSM2) were reported to be damaged and not producing representative results. It is noted that these sites have recently been replaced with new bores, with the first sampling event from these locations being taken on the 24 August 2023.

2.3.3 Analytes

The analytical suite for the surface and groundwater monitoring program are presented in Table 2.1. Physical and chemical stressors (except for total suspended solids) are monitored in the field with a calibrated hand-held water quality meter. All other parameters are analysed at a laboratory accredited by the National Association of Testing Authorities (NATA).

Table 2.1 Surface and groundwater quality analytes

Category	Parameters	Analysis method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, total dissolved solids	In the field with a calibrated hand-held water quality meter
	Total suspended solids	Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory

2.4 Water level monitoring

Water levels are monitored via manual measurements at each monitoring bore during sampling. A deviation of two metres from the long-term median groundwater level in the quarry monitoring bores is considered a trigger for further action. Two metres as the deviation value aligns with the minimal impact considerations of the aquifer interference activities stated in the NSW Aquifer Interference Policy (DPI 2012).

3 Water balance

3.1 Methodology and data

The site water balance model that was developed for the MOD5 approval (EMM 2020a) was updated to assess the water management system during the annual review period. The following sections outline the model updates.

3.1.1 GoldSim representation

The water balance model was developed in GoldSim version 14. The model was created by representing the water cycle as a series of elements, each containing pre-set rules and data, that were linked together to simulate the interaction of these elements over the annual review period from 1 September 2022 to 31 August 2023.

To undertake the modelling the following simplifications and assumptions were made:

- No pumped water transfers between the water management dam and the quarry pit or irrigation were applied to the model as advised by Luddenham Operations.
- A simulation timeframe was set as the same as the annual review period with the initial water level in the water management dam and quarry pit assumed to be 6.8 megalitres (ML) and 78 ML respectively, at the beginning of the simulation. This is consistent with site observations and results from the end of the previous annual review period.
- Dust suppression took place during intermittent periods of 6 weeks on, 8 weeks off, using a 40 kL water cart during the simulation timeframe as advised by Luddenham Operations.

3.1.2 Data

i Climatic data

Daily rainfall and evaporation data from Bureau of Meteorology's Badgerys Creek AWS weather station (station number 67108) was adopted for the water balance model simulation period.

ii Catchment runoff

Surface runoff was estimated using the Australian Water Balance Model (AWBM). The AWBM was developed by Boughton (2004) and is widely used across Australia to estimate runoff. The hydrological model calculates runoff and baseflow components from rainfall after allowing for relevant losses and storage. The AWBM was incorporated into the GoldSim water balance model for the site.

For each surface type present on site, the AWBM was parameterised to achieve long-term average volumetric runoff coefficients (Cv) based on typical values. The assumed catchment breakdown and Cv applied to each surface type are provided in Table 3.1.

Table 3.1 Catchment runoff parameters

Surface type	Management areas	Area (ha)	Cv
Impervious – high runoff potential	Roofs, weighbridge, sealed roads	0.8	0.9
Disturbed – moderate runoff potential	Unsealed roads, stockpiles	9.7	0.6
Pasture – low runoff potential	Grassed catchments, vegetated bunds	2.8	0.4

iii Groundwater inflows

The predicted quantity of groundwater to be intercepted by the quarry pit was assumed to be a constant 5 m^3/day, based on the original groundwater assessment undertaken for the quarry (Douglas Nicolaisen and Associates 2003).

3.2 Water balance results

The water management system for Luddenham Quarry was modelled from 1 September 2022 to 31 August 2023. The estimated values for each of the inputs and outputs of the water management system for the annual review period are provided in

Figure 3.1. A summary of the estimated annual inputs and outputs of the water management systems is presented in Table 3.2. Total results have been rounded to 0.1 megalitres per year (ML/year).

As shown in Table 3.2, there was an overall net decrease of water predicted to be stored within the quarry pit and water management dam over the annual review period, which is consistent with site observations made at the beginning and end of the period. There were no modelled discharges from the water management dam into Oaky Creek during the annual review period.

Table 3.2 Summary of site water balance

Water management element	Volume (ML/year)
INPUTS	
Groundwater inflows	1.8
Rainfall	15.4
Catchment runoff	8.1
Total Inputs	**25.3**
OUTPUTS	
Dust suppression	4.3
Evaporation	29.2
Total Outputs	**33.5**
CHANGE IN STORAGE	
Quarry pit	-3.5
Water management dam	-4.7
Total change in storage	-8.2
BALANCE	**0**

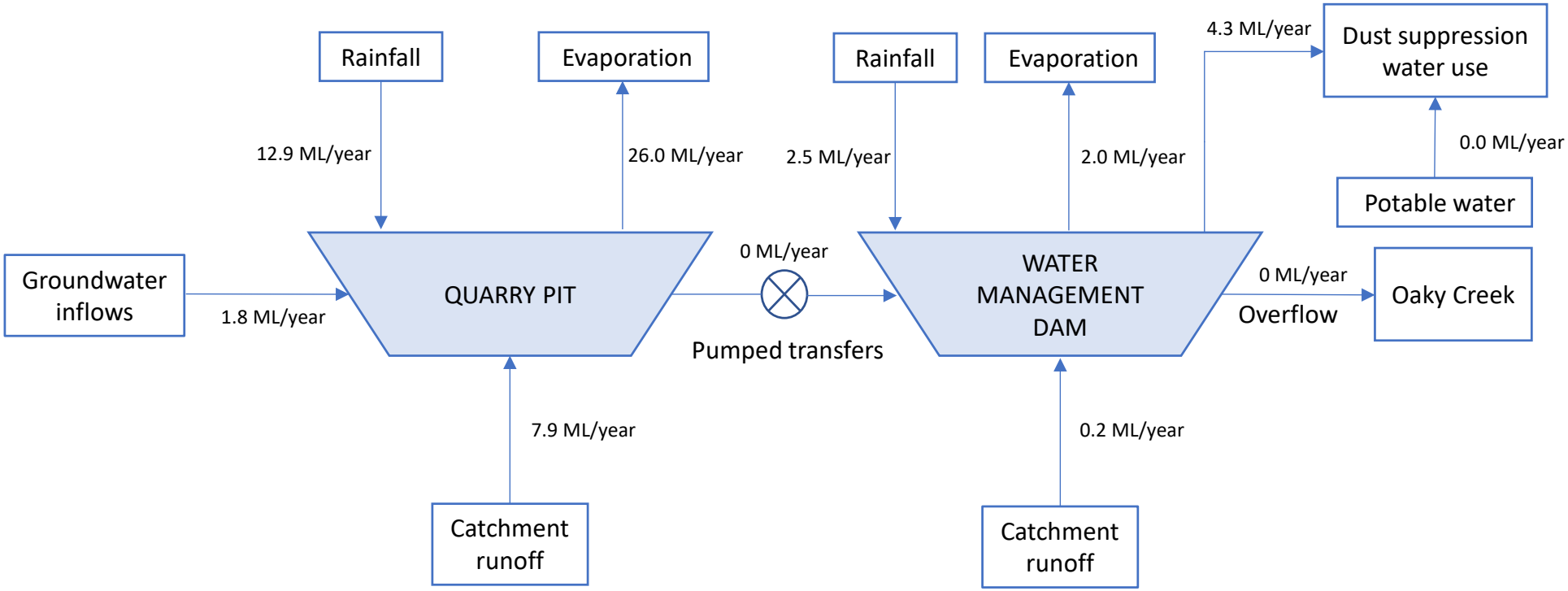

Figure 3.1 **Water balance schematic with results**

4 Water monitoring

4.1 Monitoring overview

The first three quarterly groundwater monitoring events were not undertaken for the annual review period due the damaged monitoring sites awaiting rehabilitation. One monitoring round from the SWMP monitoring program was undertaken for this annual review period:

- Surface water and groundwater monitoring – 24 August 2023. Four surface water sites were sampled along with all three groundwater monitoring sites following the rehabilitation of BSM1 and BSM2. Manual water level measurements were taken from each of the groundwater bores.

4.2 Rainfall context

The Bureau of Meteorology operates a rain gauge at Badgerys Creek (approximately 3 kilometres (km) from the site – Station number: 067108). The preceding one, three and five-day rainfall totals to 9:00 am on 31 August 2022 are presented in Table 4.1. It is noted that the monitoring was undertaken during dry conditions.

Table 4.1 Rainfall before 24 August 2023

Gauge location	One-day prior rainfall total (mm)	Three-day prior rainfall total (mm)	Five-day prior rainfall total (mm)
Badgerys Creek AWS	0.8	0.8	0.8

4.3 Completed monitoring

The following sections describe the completed monitoring and field observations. Key results are discussed in Section 4.6.

4.3.1 Groundwater

Field observations for completed groundwater monitoring is presented in Table 4.2.

Table 4.2 Field observations (groundwater monitoring)

Time of sample	Monitoring point	Site description	Field comments/context
Groundwater sampling locations			
24/08/2023 – 11:56 AM	BSM1	Upgradient bore to measure background contamination levels.	Bore hole restored with 0.77 m stick up to top of PVC. Turbid brown colour, no smell.
24/08/2023 – 10:27 AM	BSM2	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Bore hole restored with 0.54 m stick up to top of PVC. Turbid brown colour, no smell.
24/08/2023 – 10:15 AM	BSM3	Bore which is down hydraulicly gradient to the quarry pit and BSM1.	Mostly clear, some suspended solids, sulphur smell.

4.3.2 Surface water

Field observations for completed surface water monitoring is presented in Table 4.3.

Table 4.3 Field observations (surface water)

Time of sample	Monitoring point	Site description	Field comments/context
Surface water management ponds			
24/08/2023 - 12:33 PM	Quarry Pit	Large storage body in the central part of the site. Stored water is used for dust suppression and storage of sediment-laden water.	Relatively clear, light green, no odour.
24/08/2023 - 9:31 AM	Water management dam	Located toward the north-eastern edge of the site. Stored water is used for dust suppression and storage of sediment-laden water. Excess water from this dam discharges into Oaky Creek.	Oily sheen on surface with no smell, slightly brown colour.
24/08/2023 – 1:03 PM	Upstream	Oaky Creek, upstream of the site	Stagnant water, yellow clear colour, no odour.
24/08/2023 – 1:56 PM	Downstream	Oaky Creek, downstream of the site	Water flowing, mostly clear, no odour.

4.4 Laboratory analysis

Water samples were transported to a NATA-accredited laboratory (Australian Laboratory Services (ALS) in Sydney, NSW for analysis. All laboratory analytes that were not additionally measured in situ (i.e. pH, electrical conductivity (EC), dissolved oxygen and oxidation-reduction potential) were received by the laboratory within the maximum holding times.

4.5 Quality assurance/quality control

Samples were collected in laboratory-provided sample containers with appropriate preservation. Samples were collected and sent to the laboratory under appropriate chain of custody protocols.

The field QA/QC procedures used to establish accurate, reliable, and precise results included:

- calibration of equipment by the supplier before use
- keeping samples chilled
- submitting laboratory samples within holding times
- wearing fresh disposable nitrile gloves during sampling at each sampling location.

4.6 Monitoring results (annual review period)

Monitoring results for the annual review period are detailed in the following appendices:

- Groundwater levels are provided in Appendix B.
- Surface water monitoring results are provided in Appendix C.

- Groundwater quality results are provided in Appendix D.

Key observations of groundwater levels during the annual review period include the following:

- Groundwater levels are significantly higher than the baseline trends due to wetter than average climate conditions between 2020 and 2022.
- The groundwater level in BSM3 trends slightly down from the previous review period due to an easing of climate conditions.
- Levels recorded in the newly constructed bores (BSM1 and BSM2) are elevated above baseline trends and the previous review period.

A review of water quality results from the newly constructed bores (BSM1 and BSM2) showed water quality for some analytes that are not consistent with baseline data trends, notably:

- electrical conductivity in BSM1 was 963 micro siemens per centimetre (µS/cm) compared to a baseline median of 23,100 µS/cm
- total nitrogen in BSM2 was 237 milligrams per litre (mg/L). No baseline data exists for nitrogen; however, nitrogen levels have historically been less than 8.2 mg/L within bores on site during operation.

It is suspected that new bores BSM1 and BSM2 may have not been developed following the recent construction and likely contain trapped surface water or residual drilling fluid, producing unrepresentative results.

4.7 Review of trigger exceedances

4.7.1 Groundwater

Exceedances related to BSM2 and the comparison to upgradient bores BSM1 are not assessed in this report due to suspected unrepresentative results. The following exceedances relative to default guideline trigger values were noted:

- Iron exceeded the trigger value at BSM3 with a concentration of 1.29 mg/L. Iron is known to be present in groundwater near the site with the baseline data set median concentration noted as 8.5 mg/L.
- Zinc exceeded the trigger values at all three sites. A concentration of 0.027 mg/L was noted at BSM3 which is below the baseline median of 0.06 mg/L.
- Oil and grease were above detection limits at BSM1 and BSM3. The source of oil and grease at BSM3 is unknown. Since commencement of operations oil and grease within groundwater has been below detection. The presence of oil and grease within BSM3 may be linked to potential well contamination.

As no quarrying activities below groundwater level are currently being undertaken, the potential for impacts to groundwater quality is limited. Trigger value exceedances over default guideline values are consistent with baseline trends and are unlikely to be related to the project. The oil and grease detection at BSM3 is inconclusive and may be a result of well cross contamination. Recommendations for future monitoring are made in Section 5.

4.7.2 Surface water

The following receiving water exceedances were noted:

- Ammonia exceeded the trigger value at the downstream/impact site. However, poorer water quality was noted at the upstream/control site suggesting that the quarry is not the source of the exceedance.

- Nitrogen in both oxidised and total form exceeded the trigger values at the downstream/impact site. Exceedances were also noted at the upstream/control site, however poorer water quality was noted downstream. Concentrations of nitrogen recorded within Oaky Creek are the lower end of the recorded baseline range.

- Phosphorus exceeded the trigger value at the downstream/impact site. No exceedances were noted at the upstream/control site. Concentrations of phosphorus recorded within Oaky Creek are around the median of the recorded baseline range.

- Copper exceeded trigger values at the downstream/control site. An exceedance was also noted at the upstream/control site, however poorer water quality was noted downstream. Concentrations of copper recorded within Oaky Creek are the lower end of the recorded baseline range.

- Zinc exceeded the trigger value at the downstream/impact site. No exceedances were noted at the upstream/control site. Concentrations of nitrogen recorded within Oaky Creek are around the median of the recorded baseline range.

As no discharge has occurred from the site water management system and significant inflow from the neighbouring Western Sydney Airport occurs upstream of the impact monitoring site, is it is unlikely that the quarry is the source of downstream/impact site exceedances that are not consistent with the upstream/control site.

5 Summary and recommendations

Groundwater quality exceedances were noted for iron and zinc. However, concentrations were consistent with baseline data trends. Oil and grease was above detection at two groundwater sites, however, suspected to be related to well contamination. Some nutrients and toxicants copper and zinc were elevated within the receiving water samples, though consistent with baseline data trends.

Considering the baseline data trends and currently limited site activities, it is unlikely that exceedances are related to the quarry. The following recommendations are made for future monitoring rounds:

- Water quality results from newly constructed bores BSM1 and BSM2 are not consistent with other sites and the baseline data range (low EC reported at BSM1 and high nitrogen levels reported at BSM2). To ensure representative samples are collected during the next quarterly monitoring round, the following options are recommended:
    - All bores on site should be developed with a compressor truck to remove any potential contamination within the wells and increase well efficiency.
    - Should unrepresentative samples continue to be collected, low flow sampling with a bladder pump could be undertaken during subsequent rounds to limit the collection of well water in samples.

6 References

EMM 2020a, *Luddenham Quarry – Modification 5: Surface Water Assessment*, prepared by EMM Consulting Pty Limited for Coombes Property Group and KLF Holdings Pty Ltd.

EMM 2020b, Luddenham Quarry – Preliminary site investigation, prepared by EMM Consulting Pty Limited for Coombes Property Group and KLF Holdings Pty Ltd.

EMM 2021, *Luddenham Quarry – Soil and Water Management Plan*, prepared by EMM Consulting Pty Limited for Luddenham Operations Pty Ltd.

Appendix A
Water quality monitoring locations

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KEY

- Study area
- Cadastral boundary
- Watercourse
- Water quality monitoring location
- Groundwater monitoring bore

Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); Nearmap (2020)

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Water quality monitoring locations

Luddenham Quarry
Water Management Plan
Figure 4.1

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Appendix B
Groundwater levels

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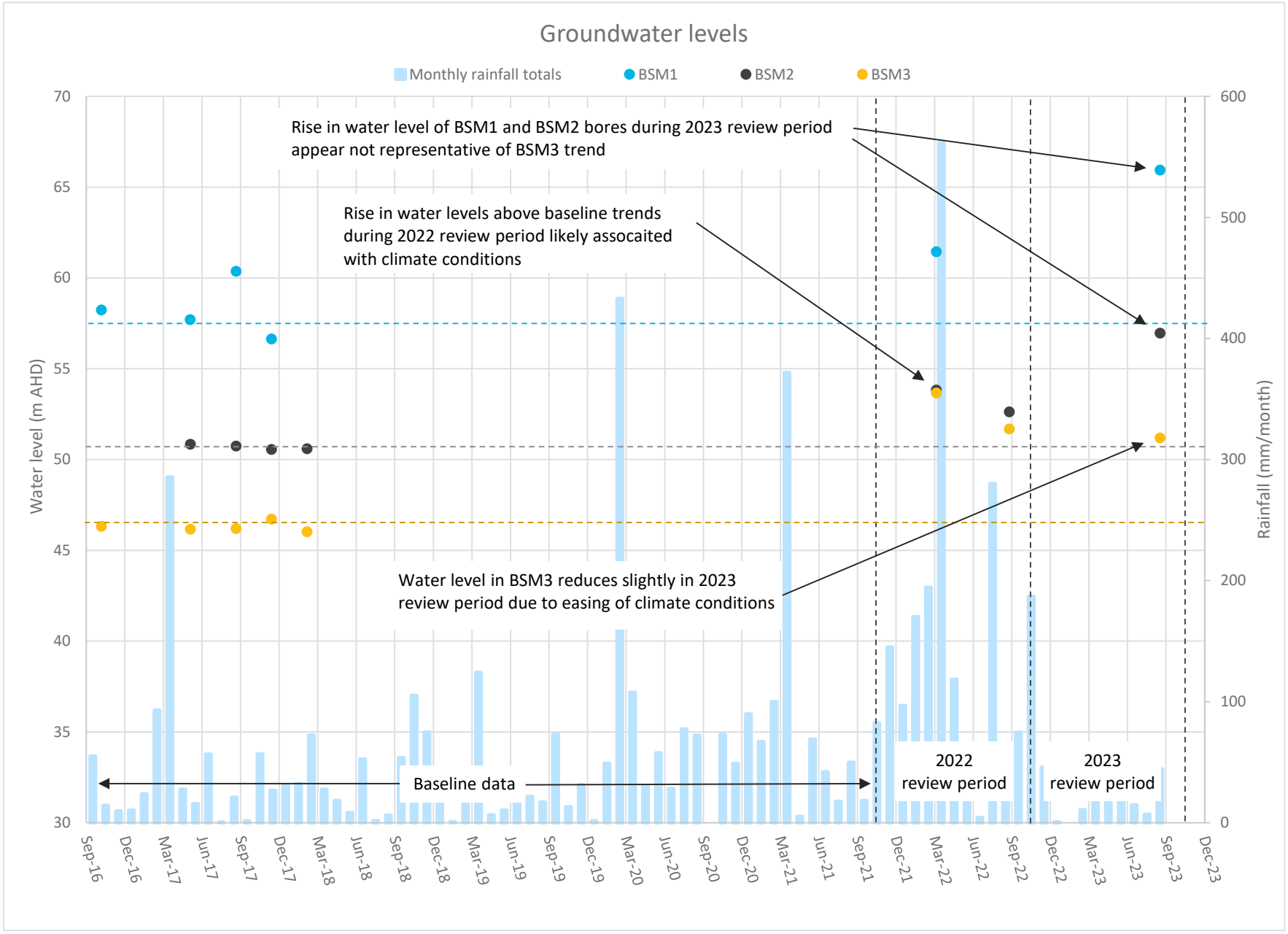
Groundwater levels
Monthly rainfall totals
BSM1
BSM2
BSM3
Water level (m AHD)
Rainfall (mm/month)
Rise in water level of BSM1 and BSM2 bores during 2023 review period appear not representative of BSM3 trend
Rise in water levels above baseline trends during 2022 review period likely assocaited with climate conditions
Water level in BSM3 reduces slightly in 2023 review period due to easing of climate conditions
Baseline data
2022 review period
2023 review period

Appendix C
Surface water quality results

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Table C.1 Surface Water quality results – August 2023

Group	Parameter	Units	LOR	Trigger value	Baseline data range	Oaky Creek upstream	Oaky Creek downstream	Quarry pit	Water management dam
Field	Temp	°C	-	–	–	15.2	15.2	16.1	14.6
	EC	µS/cm	-	125–2,200	773 – 5,990	2,650	1,964	4,393	767
	pH	–	-	6.5–8.5	7.8 – 8.6	7.8	7.4	8.9	79
	Dissolved oxygen (DO)	% sat	-	85%–110%	–	100.2	71.7	89.3	76.4
	DO	mg/L	-	–	8 – 10.5	9.98	7.16	8.7	7.75
	Redox potential	mV	-	–	–	76.3	79.7	60.1	70.1
	Total dissolved solids (TDS)	mg/L	-	–	398 – 3,720	1,723	1,277	2,854	498
Nutrients	Ammonia (as N)	mg/L	0.01	0.02	<0.01 – 0.1	0.07	0.04	0.01	0.03
	Nitrite + nitrate (as N)	mg/L	0.01	0.04	<0.01 – 6.51	0.21	0.53	0.53	<0.01
	Total Kjeldahl nitrogen	mg/L	0.1	–	0.2 – 1.4	0.3	0.6	0.9	0.6
	Nitrite (as N)	mg/L	0.01	–	<0.01 – 0.13	<0.01	<0.01	<0.01	0.04
	Nitrate (as N)	mg/L	0.01	–	<0.01 – 6.38	0.21	0.53	0.34	<0.01
	Nitrogen (total)	mg/L	0.1	0.5	0.2 – 7.9	0.8	1.4	0.6	0.6
	Phosphorus (total)	mg/L	0.01	0.05	<0.01 – 0.13	0.02	0.07	0.3	0.02
	Reactive phosphorus (as P)	mg/L	0.01	0.02	<0.01 – <0.01	<0.010	<0.010	<0.01	<0.01
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	<0.01 – 0.04	<0.01	<0.01	<0.01	0.01
	Arsenic	mg/L	0.001	0.013	<0.001 – 0.001	<0.001	<0.001	<0.001	<0.001
	Boron	mg/L	0.05	0.37	<0.05 – <0.05	<0.050	<0.050	<0.050	<0.050
	Cadmium	mg/L	0.0001	0.0002	<0.0001 – <0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	<0.001 – 0.0005	<0.001	<0.001	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	<0.001 - 0.019	0.002	0.003	<0.001	0.001
	Iron	mg/L	0.05	0.3	<0.05 – <0.05	<0.05	<0.05	<0.05	<0.05
	Lead	mg/L	0.001	0.0034	<0.001 – <0.001	<0.001	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	<0.001 – 0.059	0.087	0.35	<0.001	0.048
	Nickel	mg/L	0.001	0.011	<0.001 – 0.004	0.001	0.002	<0.001	0.002
	Zinc	mg/L	0.005	0.008	<0.005 – 0.026	0.007	0.011	<0.005	<0.005

Table C.1 Surface Water quality results – August 2023

Group	Parameter	Units	LOR	Trigger value	Baseline data range	Oaky Creek upstream	Oaky Creek downstream	Quarry pit	Water management dam
Other	Oil and grease	mg/L	5	Above detection	<5	<5	<5	<5	<5
	Total suspended solids (TSS)	mg/L	5	–	–	6	16	31	25
	Total hardness as $CaCO_3$	mg/L	1	–	–	495	296	523	71

Note: Results in red indicate an exceedance of the trigger value.

LOR = limit of reporting.

Appendix D
Groundwater quality results

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Table D.1 Groundwater quality results – August 2023

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Field	Temp	°C	-	–	20.5	18.6	19.4	19.0
	EC	µS/cm	-	Comparison with upgradient bore	23,100	963	12,470	12,517
	pH	–	-	6.5 – 8.5	6.7	7.8	6.5	6.6
	DO	% sat	-	–	–	42.7	32.5	21.4
	DO	mg/L	-	–	1.5	3.9	2.8	1.8
	Redox potential	mV	-	–	–	19.4	20.7	-150
	TDS	mg/L	-	–	–	626	8,795	8,116
Nutrients	Ammonia as N	mg/L	0.01	Comparison with upgradient bore	–	0.03	3.8	8.2
	Nitrite + nitrate as N	mg/L	0.01	Comparison with upgradient bore	–	0.59	220	0.09
	Total Kjeldahl nitrogen	mg/L	0.1	–	–	2.2	17.2	8.6
	Nitrite (as N)	mg/L	0.01	–	<0.005	<0.01	2.05	<0.01
	Nitrate (as N)	mg/L	0.01	–	0.01	0.59	218	0.09
	Nitrogen (total)	mg/L	0.1	Comparison with upgradient bore	–	2.8	237	8.7
	Phosphorus (total)	mg/L	0.01	Comparison with upgradient bore	0.05	0.14	0.67	0.1
	Reactive phosphorus (as P)	mg/1	0.01	Comparison with upgradient bore	0.4	0.02	<0.01	0.08
Metals (dissolved)	Aluminium	mg/L	0.01	0.055	–	0.04	<0.01	<0.01
	Arsenic	mg/L	0.001	0.013	<0.001	0.001	<0.001	<0.001
	Boron	mg/L	0.05	0.37	–	<0.05	<0.05	<0.05
	Cadmium	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium	mg/L	0.001	0.001	0.002	<0.001	<0.001	<0.001
	Copper	mg/L	0.001	0.0014	<0.001	0.001	<0.001	<0.001
	Iron	mg/L	0.05	0.3	8.5	<0.05	<0.05	1.29
	Lead	mg/L	0.001	0.0034	<0.001	<0.001	<0.001	<0.001
	Manganese	mg/L	0.001	1.9	–	0.003	1.12	0.131
	Nickel	mg/L	0.001	0.011	0.006	0.002	0.004	<0.001
	Zinc	mg/L	0.005	0.008	0.06	0.015	0.018	0.027

Table D.1 Groundwater quality results – August 2023

Group	Parameter	Units	LOR	Trigger value	Baseline median	BSM1	BSM2	BSM3
Other	Oil and grease	mg/L	5	Above detection	<5	13	<5	24
	Turbidity	NTU	0.1	Comparison with upgradient bore	–	64	73	33

Note: Results in red indicate an exceedance of the trigger value.

LOR = limit of reporting.

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03 Level 3
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Younge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Appendix E
Air Quality monitoring

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E.1 Deposited Dust Annual Review

Luddenham Annual Review

Dust Deposition Monitoring

Prepared for Luddenham Operations

September 2023

Luddenham Annual Review

Dust Deposition Monitoring

Luddenham Operations

J190749a RP#77

September 2023

Version	Date	Prepared by	Approved by	Comments
1	27 September 2023	Cale Kennedy	Phil Towler	Final

Approved by

Phil Towler
Associate Director
27 September 2023

Level 3 175 Scott Street
Newcastle NSW 2300

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Appendices

Tables

Figures

1 Introduction

EMM Consulting has been contracted by Luddenham Operations to undertake environmental air quality monitoring activities for operation of the Luddenham Quarry Project off Adams Road, Luddenham.

The air quality monitoring network consists of 3 dust deposition gauges installed, operated and analysed in accordance with AS 3580. 10. 1 2003. Static dust monitoring sites were chosen at locations adjacent to sensitive receivers in close proximity to the works in accordance with the approved Air Quality Management Plan (AQMP). This report has been prepared to support the September 2022 – August 2023 Annual Review (AR).

2 Methodology

Depositional Dust Gauges (DDG) have been installed in accordance with the requirements *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005) and AS 3580. 10. 1 2016.

In accordance with DEC (2007) '*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*', the project specific criterion for dust deposition is:

> Annual average dust deposition of no greater than 4g/m2/month (assessed as total insoluble solids), and no more than a 2g/m^2/month increase on background (assessed as insoluble solids).

Samples are analysed in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC 2006) guidelines by a NATA Accredited laboratory. Certificate of Analysis reports are included in Appendix A.

3 Results

Results for the period August 2022 – August 2023 are compiled in Table 3.1.

Table 3.1 AR DDG results

Site	Date on	Date off	No. days active	Insoluble solids ($g/m^2/month$)*	Comments
DG01	8/07/22	31/08/22	54	1.4	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG02	8/07/22	31/08/22	54	0.7	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG03	8/07/22	31/08/22	54	1.1	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG01	31/08/22	18/10/22	48	1.1	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG02	31/08/22	18/10/22	48	0.3	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG03	31/08/22	18/10/22	48	1.8	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG01	18/10/22	21/11/22	34	0.5	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG02	18/10/22	21/11/22	34	0.4	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG03	18/10/22	21/11/22	34	1.0	Sample exposure exceeds AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days
DG01	21/11/22	15/12/22	24	0.2*	Sample exposure is less than AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days due to Christmas break
DG02	21/11/22	15/12/22	24	2.3*	Sample exposure is less than AS 3580.10.1 - 2016 due to Christmas break
DG03	21/11/22	15/12/22	24	2.3*	Sample exposure is less than AS 3580.10.1 - 2016 due to Christmas break
DG01	15/12/22	19/01/23	35	1.1	Sample exposure is more than AS 3580.10.1 - 2016 due to Christmas break
DG02	15/12/22	19/01/23	35	2.1	Sample exposure is more than AS 3580.10.1 - 2016 due to Christmas break
DG03	15/12/22	19/01/23	35	1.3	Sample exposure is more than AS 3580.10.1 - 2016 due to Christmas break
DG01	22/06/23	20/07/23	28	0.4	Sample exposure complies with AS 3580.10.1 – 2016
DG02	22/06/23	20/07/23	28	0.3	Sample exposure complies with AS 3580.10.1 – 2016
DG03	22/06/23	20/07/23	28	0.7	Sample exposure complies with AS 3580.10.1 – 2016

Table 3.1 AR DDG results

Site	Date on	Date off	No. days active	Insoluble solids (g/m²/month)*	Comments
DG01	20/07/23	24/08/23	35	2.8	Sample exposure is more than AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days due to resourcing constraints
DG02	20/07/23	24/08/23	35	2.2	Sample exposure is more than AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days due to resourcing constraints
DG03	20/07/23	24/08/23	35	1.2	Sample exposure is more than AS 3580.10.1 - 2016 allowances of 30 days +/- 2 days due to resourcing constraints

* Note: Quarry not operational during monitoring. Results not attributable to Luddenham Quarry.

A copy of the laboratory Certificate of Analysis' are attached in Appendix A.

Figure 3.1 below show the annual dust deposition results.

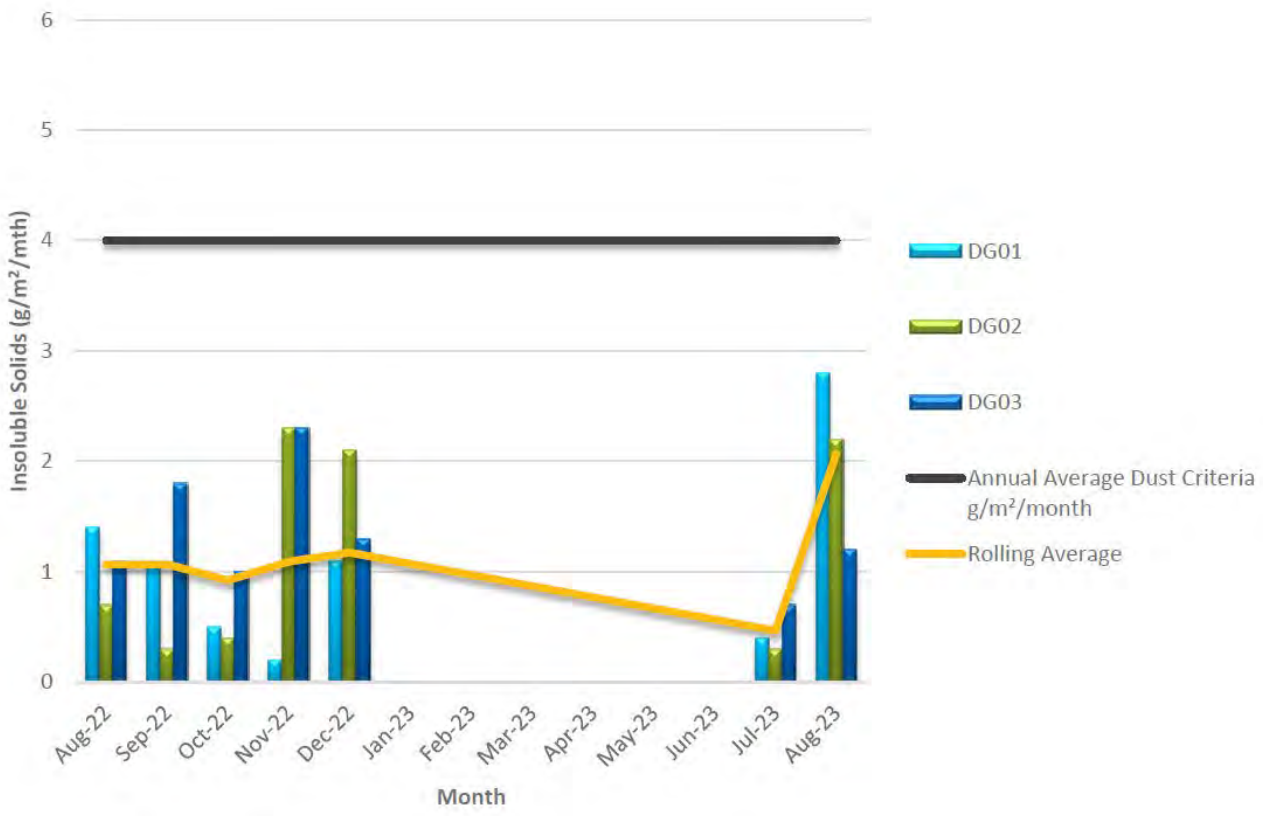

Figure 3.1 DDG Results (August 2022 – August 2023)

Note(s):

1. No monitoring was completed DDG monitoring was completed during the period, January 2023 – June 2023. Monitoring was not completed during this time as the quarry was in a state of care and maintenance and no operational activities were occurring.

4 Conclusion

Insoluble solids is the criterion which dust deposition is measured by the NSW EPA, and is considered to be the most representative measure of dust components such as soil and weathered rock disturbed during earthworks and construction activities. Other matter collected may include bird droppings, insects, organic matter such as pollen and seeds, coal and vegetative matter.

From the results reviewed over the AR period, the following comments and recommendations are made:

- All gauges analysed during the AR period recorded dust deposition results under 4.0 g/m^2/month.
- All gauges are compliant with the 4.0 g/m^2/month rolling annual average dust deposition criteria.
- All DDG results have shown consistent and ongoing compliance, well below the monthly and annual criteria. Therefore it is proposed that DDG monitoring will cease as of the date of this AR. Pending approval from the Department of Planning and Environment, the Air Quality Management Plan will be updated to reflect this request.
- To maintain ongoing compliance, it is recommended that site personnel exercise caution when working and operating machinery, ensure exposed surfaces are sealed or revegetated in accordance with approved measures and continued regular use of dust control measures such as the use of water carts and street sweepers when the site is active.

Appendix A
Certificates of Analysis

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A.1 Monitoring Period (8 July 2022 – 31 August 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2208640**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: Patrick Carolan	Contact	: Customer Services EM
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: 02 4907 4800	Telephone	: +61 3 8549 9600
Project	: J190749	Date Samples Received	: 02-Sep-2022 15:00
Order number	: ----	Date Analysis Commenced	: 06-Sep-2022
C-O-C number	: ----	Issue Date	: 13-Sep-2022 12:31
Sampler	: ADRIAN MA, JONATHON TAIT		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 54 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**DG01** **08/07/22 - 31/08/22**	**DG02** **08/07/22 - 31/08/22**	**DG03** **08/07/22 - 31/08/22**	**----**	**----**
			Sampling date / time	31-Aug-2022 00:00	31-Aug-2022 00:00	31-Aug-2022 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2208640-001**	**EN2208640-002**	**EN2208640-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**1.4**	**0.7**	**1.1**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**45**	**22**	**34**	**----**	**----**

A.2 Monitoring Period (31 August 2022 – 18 October 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2210085**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	: Customer Services EM
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 21-Oct-2022 08:50
Order number	: J190749	Date Analysis Commenced	: 24-Oct-2022
C-O-C number	: ----	Issue Date	: 01-Nov-2022 14:30
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
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ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 48 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1** **31/08/22 - 18/10/22**	**2** **31/08/22 - 18/10/22**	**3** **31/08/22 - 18/10/22**	**----**	**----**
			Sampling date / time	18-Oct-2022 00:00	18-Oct-2022 00:00	18-Oct-2022 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2210085-001**	**EN2210085-002**	**EN2210085-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**1.1**	**0.3**	**1.8**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**32**	**8**	**50**	**----**	**----**

A.3 Monitoring Period (18 October 2022 – 21 November 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2211289**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	: Customer Services EM
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 22-Nov-2022 12:24
Order number	: J190749	Date Analysis Commenced	: 23-Nov-2022
C-O-C number	: ----	Issue Date	: 01-Dec-2022 15:32
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Thomas Regan	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 34 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1**	**2**	**3**	**----**	**----**
			Sampling date / time	21-Nov-2022 00:00	21-Nov-2022 00:00	21-Nov-2022 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2211289-001**	**EN2211289-002**	**EN2211289-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.5**	**0.4**	**1.0**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**10**	**8**	**21**	**----**	**----**

A.4 Monitoring Period (21 November 2022 – 15 December 2022)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2212299**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	: Customer Services EM
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 19-Dec-2022 11:20
Order number	: J190749	Date Analysis Commenced	: 20-Dec-2022
C-O-C number	: ----	Issue Date	: 03-Jan-2023 11:46
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

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Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 24 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1**	**2**	**3**	**----**	**----**
			Sampling date / time	15-Dec-2022 00:00	15-Dec-2022 00:00	15-Dec-2022 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2212299-001**	**EN2212299-002**	**EN2212299-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.2**	**2.3**	**2.3**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**3**	**32**	**32**	**----**	**----**

A.5 Monitoring Period (15 December 2022 – 19 January 2023)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2300649**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	: Customer Services EM
Address	: Level 3, 175 Scott Street, Newcastle NSW 2300 Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 3 8549 9600
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 20-Jan-2023 16:47
Order number	: J190749	Date Analysis Commenced	: 23-Jan-2023
C-O-C number	: ----	Issue Date	: 01-Feb-2023 18:59
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

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Accredited for compliance with
ISO/IEC 17025 - Testing

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- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Zoran Grozdanovski	Laboratory Operator	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 35 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1** **15/12/22 - 19/01/23**	**2** **15/12/22 - 19/01/23**	**3** **15/12/22 - 19/01/23**	**----**	**----**
			Sampling date / time	19-Jan-2023 00:00	19-Jan-2023 00:00	19-Jan-2023 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2300649-001**	**EN2300649-002**	**EN2300649-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**1.1**	**2.1**	**1.3**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**23**	**44**	**27**	**----**	**----**

A.6 Monitoring Period (22 June 2023 – 20 July 2023)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2307435**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: Luddenham Dust Deposition Monitoring	Date Samples Received	: 25-Jul-2023 12:40
Order number	: J190749	Date Analysis Commenced	: 27-Jul-2023
C-O-C number	: ----	Issue Date	: 02-Aug-2023 15:19
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

Accreditation No. 825
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ISO/IEC 17025 - Testing

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- General Comments
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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Shane Merrell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

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Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
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~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1** **22/06/23 - 20/07/23**	**2** **22/06/23 - 20/07/23**	**3** **22/06/23 - 20/07/23**	**----**	**----**
			Sampling date / time	20-Jul-2023 00:00	20-Jul-2023 00:00	20-Jul-2023 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2307435-001**	**EN2307435-002**	**EN2307435-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.4**	**0.3**	**0.7**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**7**	**5**	**11**	**----**	**----**

A.7 Monitoring Period (20 July 2023 – 24 August 2023)

CERTIFICATE OF ANALYSIS

Work Order	: **EN2308599**	Page	: 1 of 2
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Newcastle
Contact	: MR DAVID BONE	Contact	:
Address	: 6/146 Hunter Street Newcastle 2300	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: J190749 Luddenham Dust Deposition Monitorning	Date Samples Received	: 29-Aug-2023 10:10
Order number	: J190749	Date Analysis Commenced	: 31-Aug-2023
C-O-C number	: ----	Issue Date	: 06-Sep-2023 16:17
Sampler	: DAVID BONE		
Site	: ----		
Quote number	: EN/112/21		
No. of samples received	: 3		
No. of samples analysed	: 3		

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ISO/IEC 17025 - Testing

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Signatories	*Position*	*Accreditation Category*
Shane Merrell	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

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Where moisture determination has been performed, results are reported on a dry weight basis.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 35 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.
- For dust analysis, the Limit of Reporting (LOR) referenced in the reports for deposited matter parameters represents the reporting increment rather than reporting limit.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			Sample ID	**1** **20/07/23 - 24/08/23**	**2** **20/07/23 - 24/08/23**	**3** **20/07/23 - 24/08/23**	**----**	**----**
			Sampling date / time	24-Jul-2023 00:00	24-Jul-2023 00:00	24-Jul-2023 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN2308599-001**	**EN2308599-002**	**EN2308599-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**2.8**	**2.2**	**1.2**	**----**	**----**
Total Insoluble Matter (mg)	----	2	mg	**58**	**45**	**24**	**----**	**----**

Australia

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

E.2 Realtime Monitoring Annual Review

Luddenham Quarry

Real-time air quality monitoring campaign - August 2023

Prepared for Luddenham Operations Pty Ltd

September 2023

Luddenham Quarry

Real-time air quality monitoring campaign - August 2023

Luddenham Operations Pty Ltd

J190749 RP79

September 2023

Version	Date	Prepared by	Reviewed by	Comments
V1	26 September 2023	Amie Gilbert	Scott Fishwick	

Approved by

Scott Fishwick
National Technical Lead – Air Quality
26 September 2023

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

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Attachments

Tables

Figures

Photographs

1 Introduction

Luddenham Quarry is located at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The existing shale/clay quarry is approved by state significant development (SSD) consent DA 315-7-2003, issued by the NSW Minister for Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The site is owned by CFT No 13 Pty Ltd, a member of the Coombes Property Group (CPG).

Luddenham Operations Pty Ltd will reactivate and operate the quarry in accordance with Modification 5 (MOD 5) of DA 315-7-2003, which was granted by the NSW Department of Planning and Environment (DPE then DPIE) on 24 May 2021.

This report provides a summary of the four-week real-time particulate matter (PM) monitoring campaign conducted at the site during July and August 2023 (the assessment period), to satisfy the requirements of the development consent (as modified).

1.1 Air quality management plan and monitoring program

Condition 4 (Schedule 4) of the development consent (as modified) requires the preparation of an air quality management plan (AQMP). The AQMP was completed in September 2021. As identified in Section 5 of the AQMP, the requirements for ambient air quality monitoring at the site are outlined in Condition 3 (Schedule 4) as follows:

> carry out regular air quality monitoring to determine whether the development is complying with the relevant conditions in this consent.

The specific AQMP requirements outlined in Condition 4 (Schedule 4) requires a monitoring program that:

> (i) is capable of evaluating the performance of the development against the air quality criteria;
>
> (ii) adequately supports the air quality management system; and
>
> (iii) includes a protocol for identifying any air quality-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.

1.2 Continuous particulate matter monitoring

Section 5.2.2 of the AQMP relates to continuous particulate matter (PM) monitoring and is reproduced in this section.

To evaluate compliance with the air quality criteria for TSP, PM_{10} and $PM_{2.5}$ (see Section 2), two continuous PM monitoring instructions will be deployed on a campaign basis[1].

The instruments will be solar powered and relocatable and will be positioned upwind and downwind of the main dust generation activities occurring during the monitoring campaign. The upwind and downwind monitoring will enable compliance assessment against the short-term air quality criteria, which are evaluated against the increment increase from the development alone, as follows:

- PM contribution from quarry = downwind concentration minus upwind concentration.

[1] If all three size fractions cannot be measured simultaneously by the selected instrument, preference will be given to PM_{10} and $PM_{2.5}$ and TSP will be derived from PM_{10} concentrations based on the assumption that PM_{10} is 40% of TSP.

Seasonal wind roses for the Bureau of Meteorology (BoM) Badgerys Creek automatic weather station (AWS) are presented in Figure A.1 (of the AQMP), which can be used to determine which locations are upwind and downwind for each monitoring campaign. Compliance assessment will use the meteorological monitoring data collected for the period of each monitoring campaign to determine upwind and downwind conditions on a daily basis.

The monitoring campaigns would run for a period of one month, repeated twice a year. After the first year, the need to continue the real-time particulate matter monitoring campaigns will be reviewed in conjunction with DPE.

Compliance assessment against the long-term air quality criteria will be based on monitoring data collected at both locations across each monitoring campaign. The monthly average concentrations will be used as a proxy for compliance assessment against the annual average concentrations. Any identified extraordinary events during each monitoring campaign will be excluded from the calculation of the monthly average.

2 Applicable criteria

Condition 1 of Schedule 4 lists the relevant air quality criteria for the development (replicated below in Table 2.1 and Table 2.2).

The long-term criteria in Table 2.1 are assessed against the total cumulative impact (the development contribution plus all other sources), whereas the short-term criteria in Table 2.2 apply to the incremental impact (development contribution alone).

Table 2.1 Long-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion	Basis
Total suspended particulate matter (TSP)	Annual	90 µg/m^3	Total impact (incremental increase from development plus all other sources) but excluding extraordinary events such as bushfires, prescribed burning, dust storms.
Particulate matter <10 µm (PM_{10})	Annual	25 µg/m^3	
Particulate matter <2.5 µm ($PM_{2.5}$)	Annual	8 µg/m^3	

Table 2.2 Short-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion	Basis
Particulate matter <10 µm (PM_{10})	24 hour	50 µg/m^3	Incremental impact (increase in concentrations from the development alone)
Particulate matter <2.5 µm ($PM_{2.5}$)	24 hour	25 µg/m^3	

As the monitoring campaign is four weeks in duration, the short-term 24-hour average criteria will be the focus of this monitoring report. Discussion regarding compliance with the annual average criteria will be derived from the period averaging concentrations recorded.

3 Monitoring network and methodology

3.1 Monitoring network

In accordance with Section 5.2.2 of the AQMP, the continuous PM monitoring network installed at the site for the four-week campaign consists of two continuous PM monitoring units.

In the absence of site-specific meteorological measurements, historical wind conditions recorded by the BoM Badgerys Creek AWS (located 2.3 km to the south-east of the site) for the assessment period were reviewed. The data analysis identified a dominance of winds from the north-east and south-west. Consequently, to record upwind and downwind PM concentrations at the site, the two continuous PM monitoring units were sited at the north-east and south-west corners of the site.

For the 2023 monitoring campaign period, concurrent meteorological monitoring data from the BoM Badgerys Creek AWS was collated. Further, to provide an understanding of potential regional-scale air quality events, concurrent measurements from the DPE Bringelly air quality monitoring station (AQMS), located 5.9 km to the south-east of the site, have been collated.

The monitoring resources adopted in this campaign are summarised in Table 3.1, and the monitoring locations are shown in Figure 3.1.

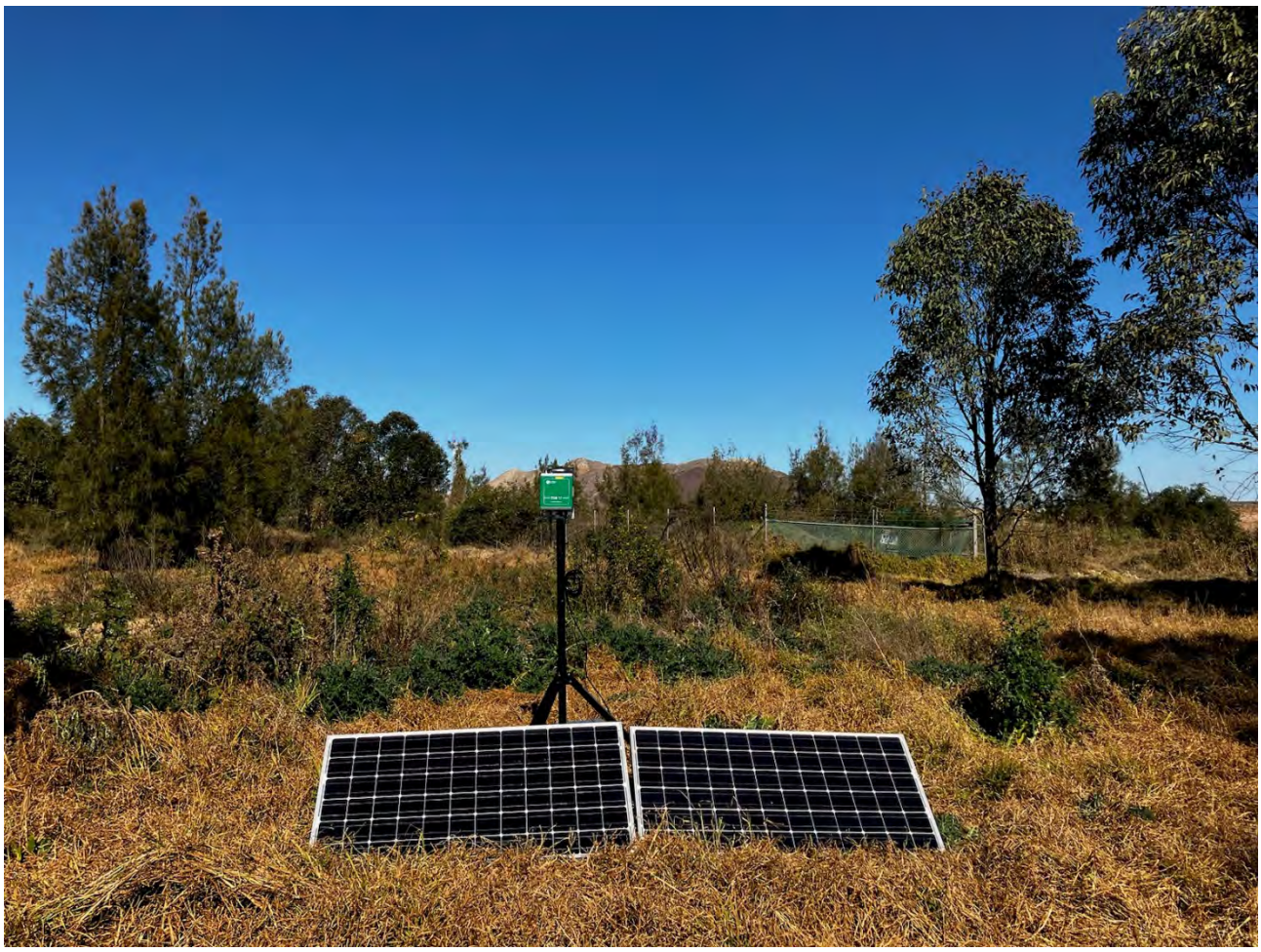
Table 3.1 Summary of monitoring network adopted in monitoring campaign at Luddenham quarry

	Location ID	Description	Coordinates (MGA 56)	
			Easting (m)	Northing (m)
Onsite air quality	AQM01	Site boundary in north-east corner	289187	6249479
	AQM02	Site boundary in south-west corner	288833	6249248
Reference air quality	DPE AQMS	Bringelly AQMS	293102	6244719
Meteorology	BoM AWS	Badgerys Creek AWS	289920	6246951

3.2 Monitoring methodology

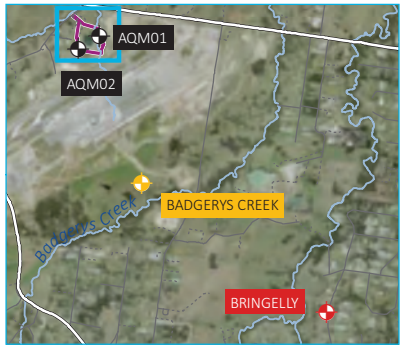
The BoM Badgerys Creek AWS continuously measures mean wind speed, mean wind direction, the standard deviation of wind direction (referred to as 'sigma-theta'), mean temperature, mean relative humidity, pressure and accumulated rainfall. The measurements are recorded as 1-hour averages from 1-minute data.

The onsite particulate matter monitoring was completed by Ektimo Pty Ltd, a NATA accredited monitoring specialist. Ektimo installed two FDS-17 continuous PM monitoring units at the site. The monitoring was conducted at ground level, with the inlet positioned at approximately 1.5 m. During the monitoring period the PM_{10} and $PM_{2.5}$ measurements were taken continuously and recorded as both 1-minute and 1-hour mean values in micrograms per cubic metre ($\mu g/m^3$). Daily average concentrations were also calculated. The PM monitoring installations are shown in Photograph 3.1 and Photograph 3.2



Photograph 3.1 AQM01 monitoring location

Photograph 3.2 AQM02 monitoring location



KEY

- Study area
- On site air quality monitor
- Major road
- Minor road
- Vehicular track
- Named watercourse
- Cadastral boundary

INSET KEY

- Study area
- Major road
- Named watercourse
- BoM AWS
- DPE AQMS
- On site air quality monitor

\\emmsvr1\EMM\Jobs\2019\J190749 - CPG Luddenham Quarry\GIS\02 Maps\Modification Reporting\Air Quality\AQ0010 QuarryMonitoring 20220923 01.mxd 27/09/2022

Source: EMM (2022); ABS (2021); DFSI (2020, 2021); ESRI (2022); GA (2011)

0 100 200 m

GDA 1994 MGA Zone 56

N

Luddenham quarry monitoring network

Luddenham Quarry
Air quality monitoring report
Figure 3.1

EMM
creating opportunities

4 Meteorological data

4.1 Overview of data for reporting period

This section of the report presents a summary and analysis of the meteorological data that were collected by the BoM Badgerys Creek AWS during the reporting period.

An overview of the continuous data from the BoM Badgerys Creek AWS is provided in Figure 4.1. The panel on the left shows the time series of 1-hour values for each parameter, with the grey bars indicating the presence of data and any red bars indicating missing data. Some summary statistics for the reporting period are also given, including the mean, median, 95th percentile, minimum, maximum and number of missing points. The panel on the right shows the frequency distribution of the values for each parameter.

The key descriptive statistics and time series plots for the meteorological parameters collected at the BoM Badgerys Creek AWS during the reporting period are provided in the following sections.

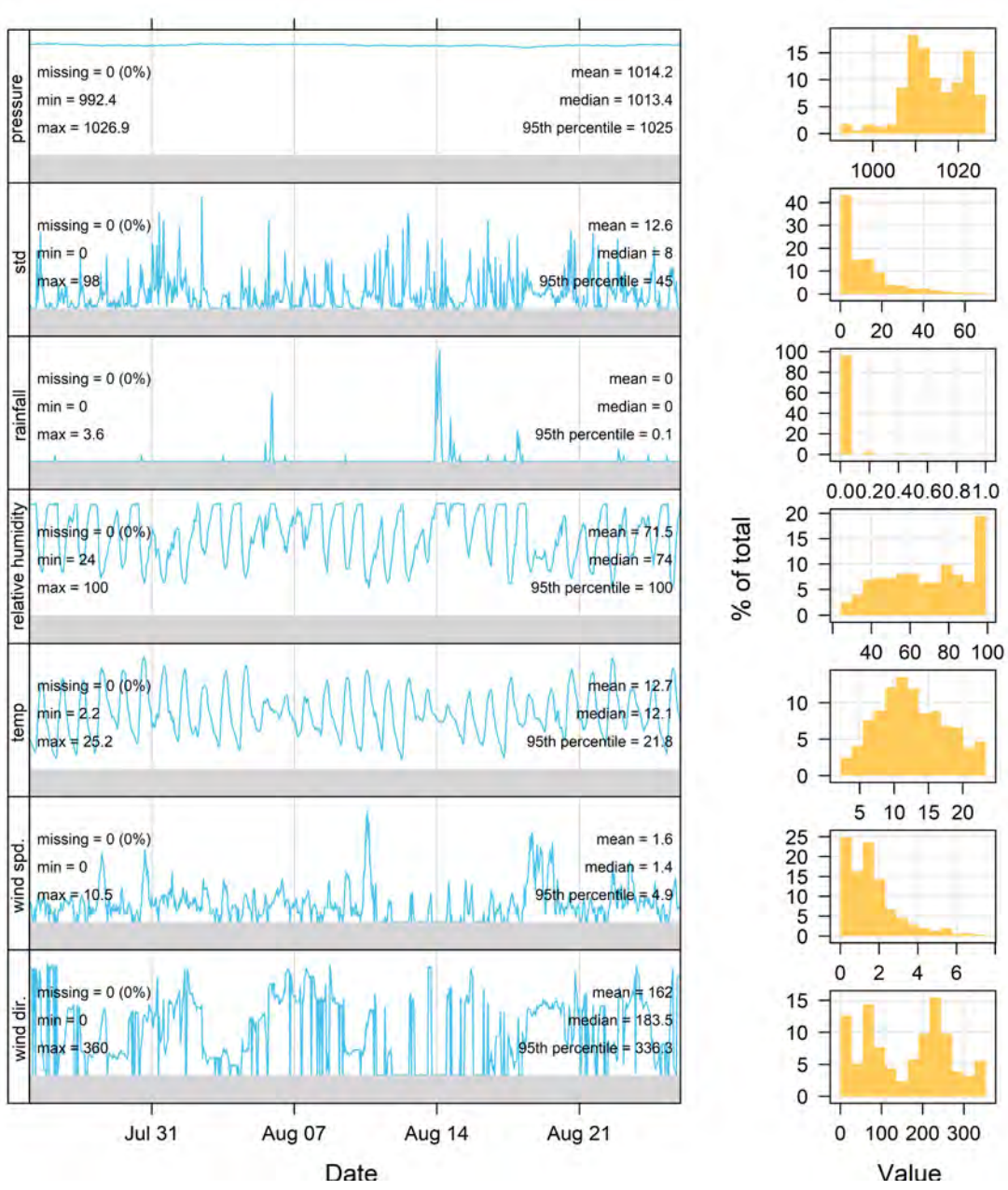


Figure 4.1 Meteorological data summary – BoM Badgerys Creek AWS

4.2 Meteorological data

Key descriptive statistics for the meteorological data collected at the BoM Badgerys Creek AWS during the reporting period are provided in Table 4.1. The statistics are calculated from the 1-hour values and are shown for the assessment period.

Table 4.1 Summary of meteorological data – assessment period 2023 – BoM Badgerys Creek AWS

Parameter	Minimum	Maximum	Median	Average	Standard deviation
Temperature (°C)	2.2	25.2	12.1	12.7	5.1
Wind speed (m/s)	0.0	10.5	1.4	1.7	1.6
Rainfall (mm)	0.0	3.4	0.0	0.04	0.3
Relative Humidity (%)	24.0	100.0	73.0	71.5	22.5

The wind rose for the 2023 monitoring campaign from the BoM Badgerys Creek AWS is presented in Figure 4.2. The wind rose shows that winds during the assessment period were predominately from the north-east and south-west, and therefore indicate that the two continuous PM monitoring units installed at the site are appropriately located to record upwind and downwind particulate matter concentrations.

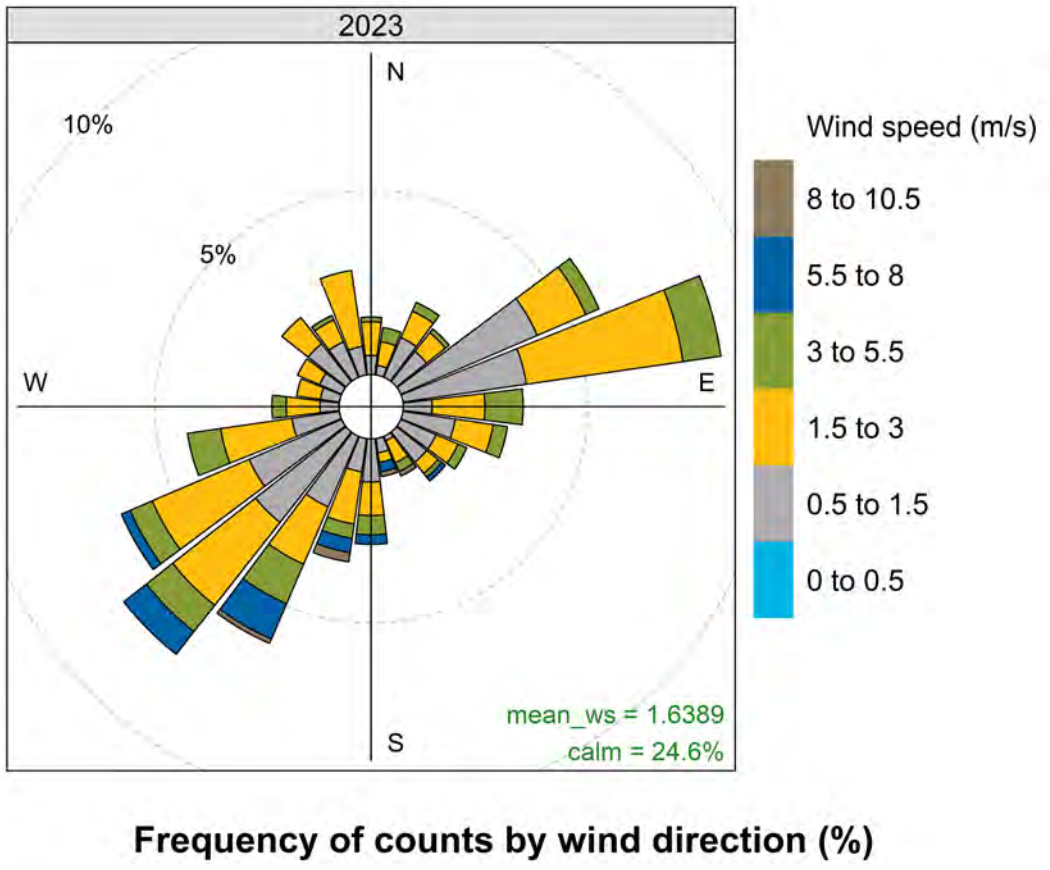


Figure 4.2 Wind rose for the assessment period – BoM Badgerys Creek AWS

5 Air quality data

5.1 Overview of data for reporting period

This section of the report presents a summary and analysis of the air quality (PM_{10} and $PM_{2.5}$) data that were collected from the onsite monitors during the reporting period. The data from the DPE Bringelly AQMS are included for comparison.

Analysis from these datasets found concentrations recorded by the AQM02 (south-west corner) presented anomalous measurements of PM_{10} concentrations, whereby the recorded PM_{10} and $PM_{2.5}$ concentrations were near identical. When compared to the corresponding data recorded at AQM01, the PM_{10} and $PM_{2.5}$ concentrations recorded at AQM02 were both very comparable to the AQM01 $PM_{2.5}$ concentrations.

Further, measurements from AQM01 and AQM02 were compared against concurrent PM_{10} and $PM_{2.5}$ concentrations recorded at the DPE Bringelly AQMS. $PM_{2.5}$ concentrations between the two onsite monitors and the DPE Bringelly AQMS showed good alignment between the sites. PM_{10} concentrations between the two onsite monitors and DPE Bringelly AQMS varied noticeably, with AQM02 measuring concentrations much lower than AQM01 and the DPE Bringelly AQMS.

It was concluded that the PM_{10} measurements from AQM02 were representative of $PM_{2.5}$ concentrations at that location, likely due to an instrumentation issue with the light scattering method in detecting different particle sizes. As a result, PM_{10} concentrations for AQM02 have been derived by adopting the hourly $PM_{2.5}$:PM_{10} relationship from AQM01 and applying it to the $PM_{2.5}$ concentrations recorded by the AQM02.

An overview of the continuous (hourly) data from the two PM_{10}/$PM_{2.5}$ monitors located at the site in provided in Figure 5.1. Measurements were collected starting from 12:00 pm on 25 July 2023 to 9:00 am on 25 August 2023.

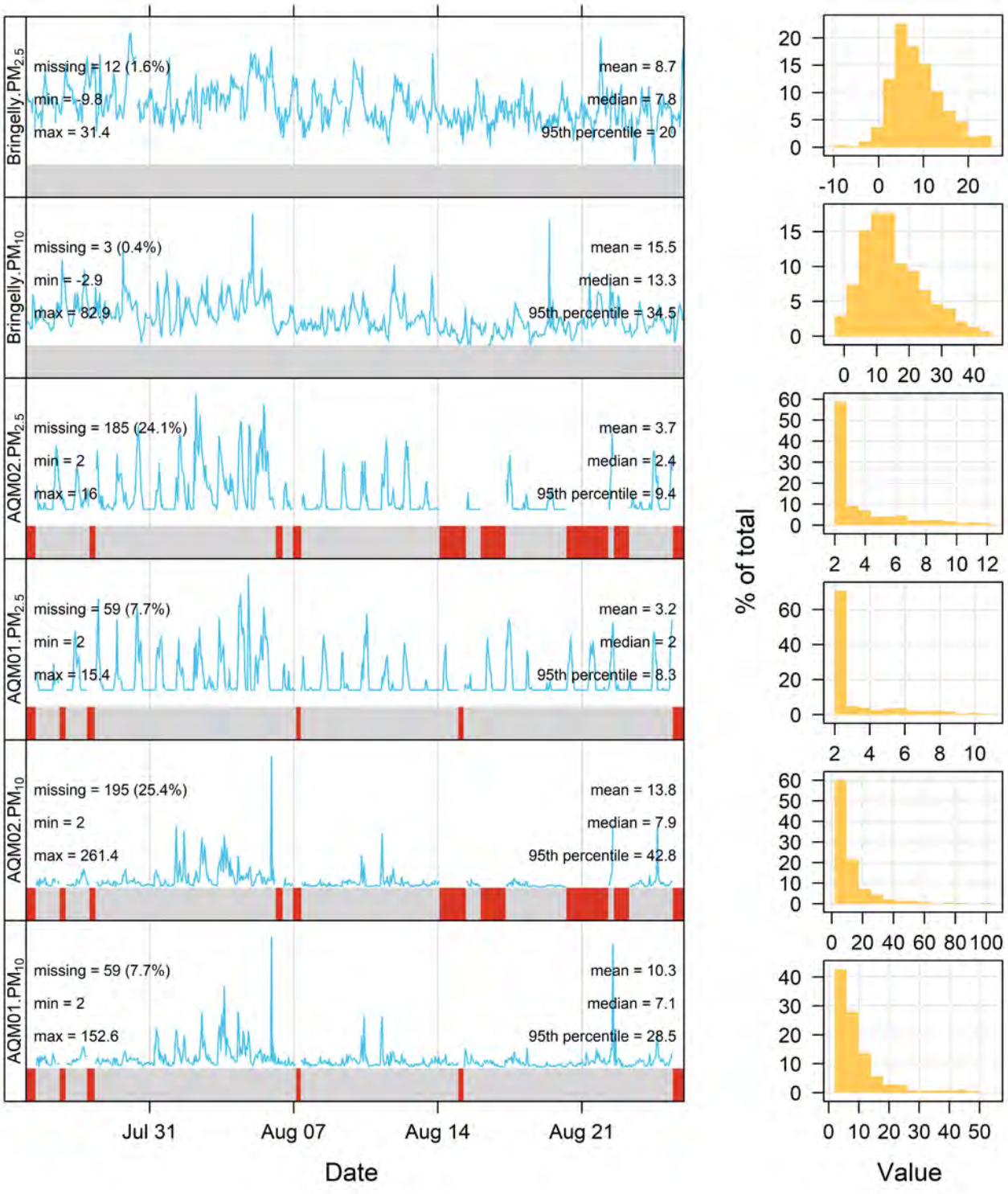


Figure 5.1 **Air quality monitoring data – DPE Bringelly and onsite monitors – assessment period**

5.2 PM_{10} concentrations

PM_{10} concentrations are reported here as 24-hour mean values (midnight to midnight). A statistical summary of the 24-hour PM_{10} concentrations recorded (AQM01) and derived (AQM02) at the site during the reporting period is provided in Table 5.1. The corresponding values from the DPE Bringelly AQMS are included for comparison.

The period mean PM_{10} concentrations for the onsite monitoring and the DPE Bringelly AQMS were generally similar, with concentrations at the site generally lower than at the DPE Bringelly AQMS.

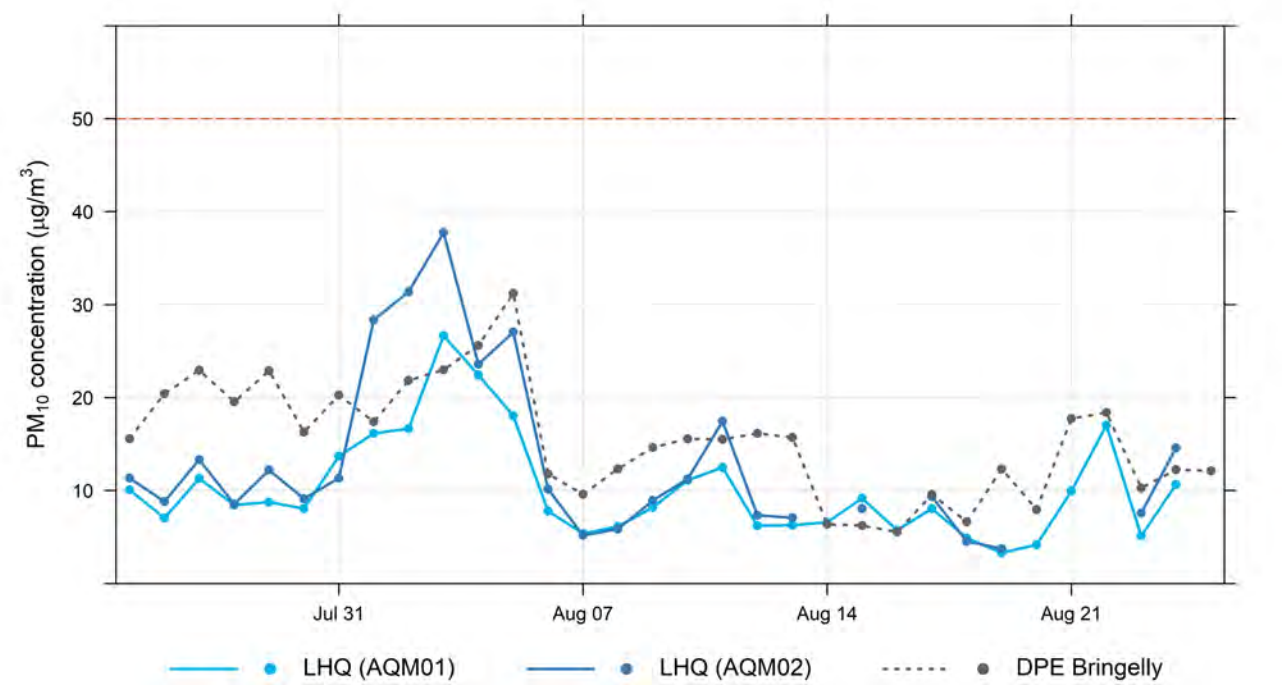
No exceedances of the 24-hour PM_{10} criterion of 50 µg/m^3 were recorded at any location during the campaign.

Table 5.1 Statistics for PM_{10} 24-hour average concentration

Monitoring location	Mean (µg/m3)	Median (µg/m3)	Maximum (µg/m3)	Standard deviation	Days above 50 µg/m^3
AQM01	10.4	8.2	26.7	5.8	0
AQM02*	15.3	11.8	37.8	10.1	0
DPE Bringelly AQMS	15.4	15.6	31.2	6.2	0

Note *: PM_{10} concentrations for AQM02 were derived from the hourly $PM_{2.5}$:PM_{10} relationship applied to AQM02 $PM_{2.5}$ concentrations.

The time series of 24-hour PM_{10} concentrations recorded at the site and DPE Bringelly AQMS are plotted in Figure 5.2. The concentrations at all three sites were generally similar across the presented monitoring period; concentrations at the AQM02 site are slightly higher than at the AQM01 site. It is noted that both AQM01 (north-east corner) and AQM02 (south-west corner) recorded a notable spike (26.7 µg/m^3 and 38.4 µg/m^3, respectively) on 3 August 2023 that was not recorded at the DPE Bringelly AQMS.



Note: red broken line marks 24-hour average PM_{10} criterion of 50 µg/m^3

Figure 5.2 Daily mean PM_{10} concentration

The measured/derived PM_{10} concentrations from the two onsite monitors at the site and recorded by the DPE Bringelly AQMS are also presented below using bivariate polar plots and polar annulus plots.

The bivariate plots (Figure 5.3 to Figure 5.5) show how PM_{10} concentrations vary by wind speed and wind direction over the reporting period. The plots provide a graphical impression of potential sources influencing PM_{10} concentrations at the monitoring locations.

The following points are noted from the bivariate polar plots (Figure 5.3 to Figure 5.5):

- The bivariate polar plots for AQM01 and AQM02 (Figure 5.3 and Figure 5.4, respectively) show a distinct signal to the north-east. the bivariate polar plot for AQM02 (Figure 5.4) shows a stronger signal to the north-east than AQM01 (Figure 5.3), which is likely to be associated with emissions from the site as well as neighbouring activities.

- The bivariate polar plot for AQM01 and AQM02 (Figure 5.3 and Figure 5.4, respectively) also shows a slight signal when winds are from the south-east, which is likely to be associated with emissions from construction activities at the Western Sydney Airport.

- The bivariate polar plot for the DPE Bringelly AQMS (Figure 5.5) shows a signal from the north to the east, which is likely to be associated with emissions from domestic heating and road traffic.

The polar annulus plots (Figure 5.6 to Figure 5.8) show the temporal variation in the PM_{10} concentration by wind direction during the whole reporting period. In this case, the temporal variation is by hour of the day (0 to 23).

- The polar annulus plots for AQM01 and AQM02 (Figure 5.6 and Figure 5.7, respectively) show that the highest concentrations occur between 8:00 am and 8:00 pm, and are likely to be associated with operations at the site or neighbouring construction activities.

- The polar annulus plots for the DPE Bringelly AQMS (Figure 5.8) shows that the highest concentrations occur between in the morning (approximately 8:00 am to 12:00 pm) and in the late afternoon to night (4:00 pm to 12.00 am), supporting the earlier conclusion that recorded concentrations are likely to be associated with emissions from domestic heating (night) and road traffic (morning).

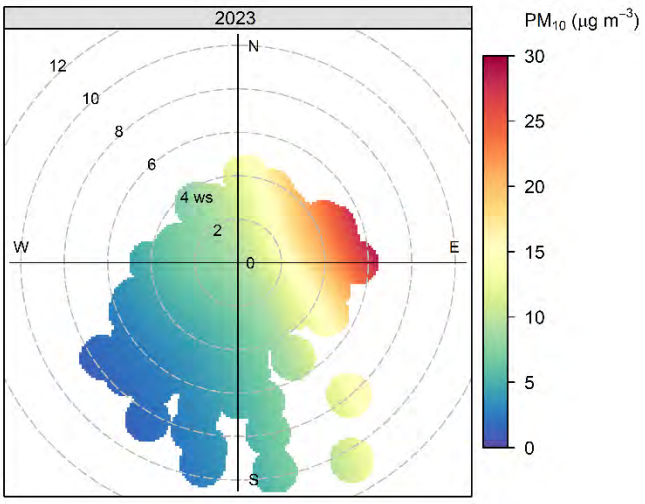


Figure 5.3 Assessment period bivariate polar plot for PM_{10} at AQM01

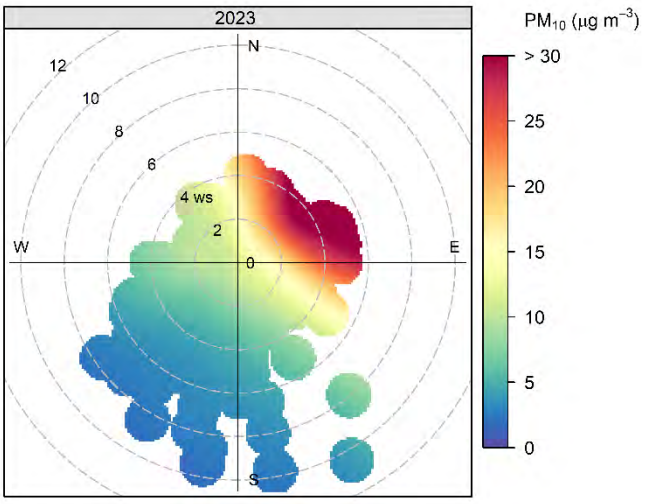


Figure 5.4 Assessment period bivariate polar plot for PM_{10} at AQM02

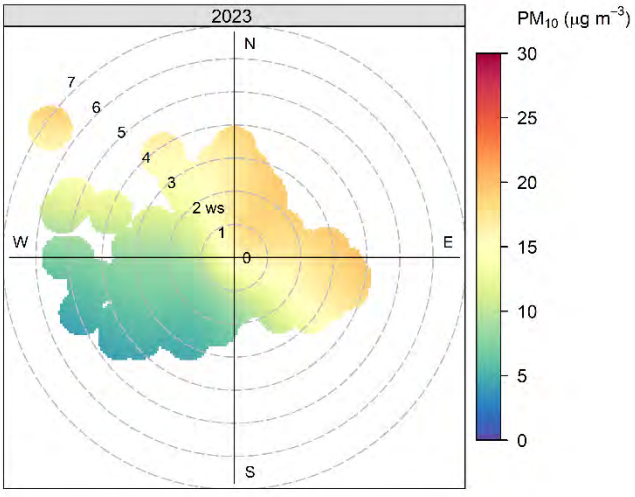


Figure 5.5 Assessment period bivariate polar plot for PM_{10} at DPE Bringelly

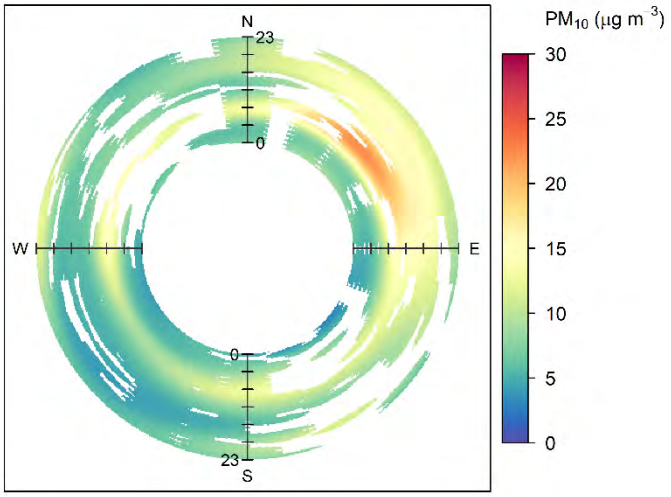


Figure 5.6 **Polar annulus plot for PM_{10} at AQM01**

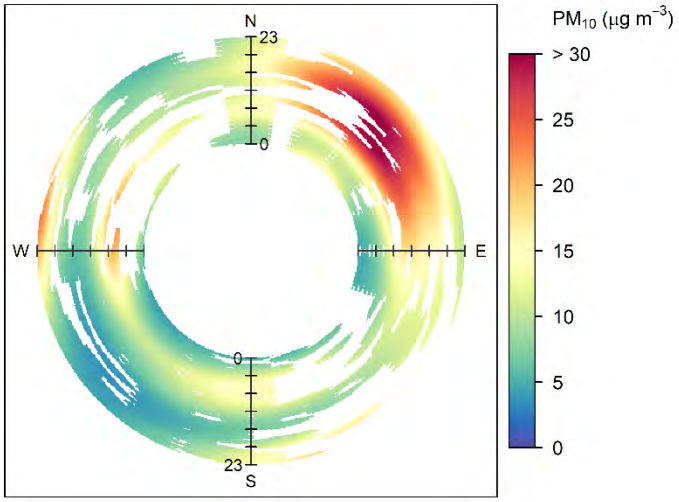


Figure 5.7 **Polar annulus plot for PM_{10} at AQM02**

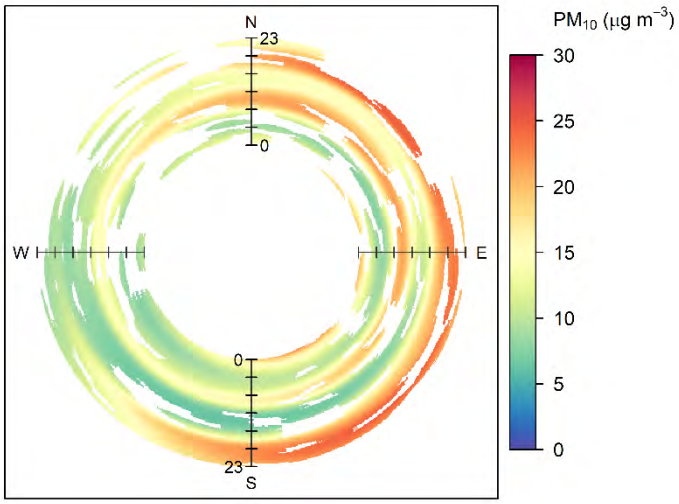


Figure 5.8 **Polar annulus plot for PM_{10} at DPE Bringelly**

5.3 $PM_{2.5}$ concentrations

The presentation of the $PM_{2.5}$ data follows the same format as that for PM_{10}.

A statistical summary of the 24-hour $PM_{2.5}$ concentrations at the site during the reporting period is provided in Table 5.2. The corresponding values from the DPE Bringelly AQMS are included for comparison.

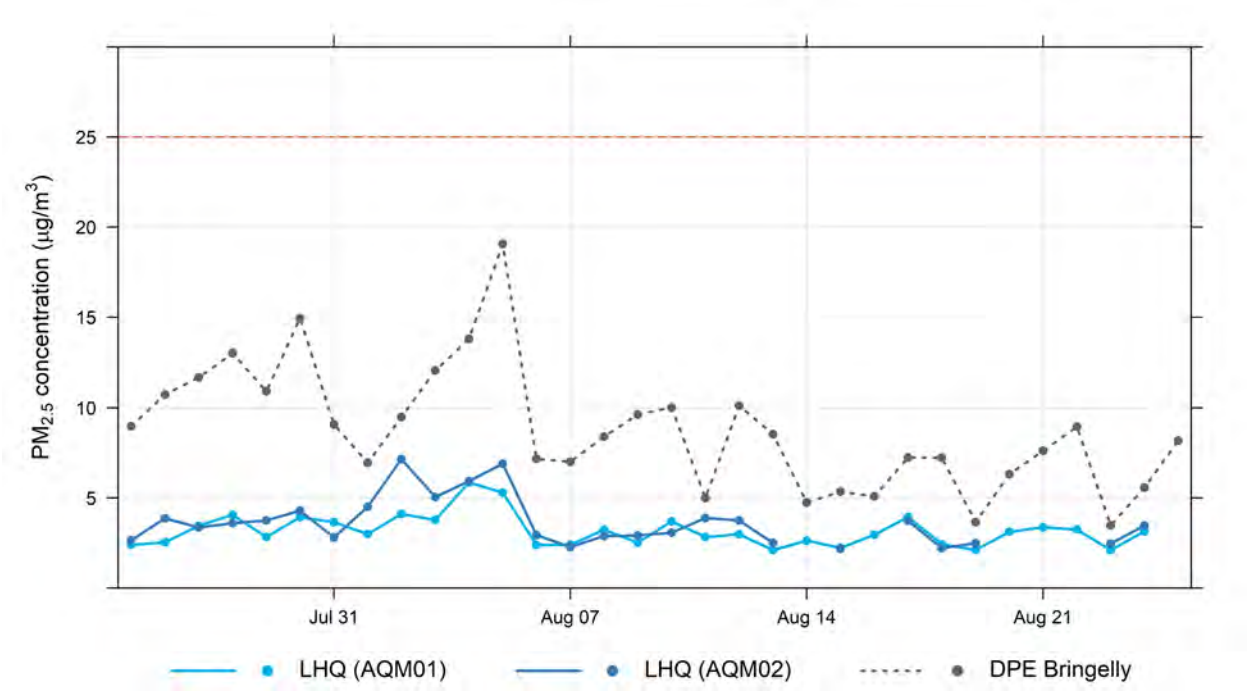
For the monitoring campaign period, the $PM_{2.5}$ concentrations at the quarry were generally lower than at the DPE Bringelly AQMS.

No exceedances of the 24-hour average $PM_{2.5}$ criterion (25µg/m^3) were recorded at any of the monitoring locations.

Table 5.2 Statistics for $PM_{2.5}$ 24-hour average concentrations

Monitoring location	Mean (µg/m^3)	Median (µg/m^3)	Maximum (µg/m^3)	Standard deviation	Days above 25 µg/m^3
AQM01	3.2	3.1	5.9	0.9	0
AQM02	3.9	3.8	7.2	1.4	0
DPE Bringelly AQMS	8.8	8.5	19.1	3.4	0

The time series of 24-hour $PM_{2.5}$ concentrations recorded at the site and Bringelly are presented in Figure 5.9. As with PM_{10}, the concentrations at the site were generally lower than at the DPE Bringelly AQMS; however, the three monitoring sites generally followed a similar trend.



Note: read broken line marks 24-hour average $PM_{2.5}$ criterion of 25 µg/m^3

Figure 5.9 Daily mean $PM_{2.5}$ concentration

The bivariate polar plots for $PM_{2.5}$ are shown in Figure 5.10 to Figure 5.12, and the polar annulus plots are shown in Figure 5.13 to Figure 5.15.

The following points are noted from the bivariate polar plots (Figure 5.10 to Figure 5.12):

- The bivariate polar plots for AQM01 and AQM02 (Figure 5.10 and Figure 5.11, respectively) show generally low concentrations in all directions; however, there are slightly higher concentrations recorded when winds are from the south-east and east.

- The bivariate polar plot for the DPE Bringelly AQMS (Figure 5.12) shows a signal at the station and to the north, which is likely to be associated with emissions from domestic heating and road traffic.

The polar annulus plots (Figure 5.13 and Figure 5.15) show the temporal variation in the $PM_{2.5}$ concentration by wind direction during the whole reporting period. In this case the temporal variation is by hour of the day (0 to 23).

- The polar annulus plots for AQM01 and AQM02 (Figure 5.13 and Figure 5.14, respectively) show that the highest concentrations occur between 8:00 am and 4:00 pm, and are likely to be associated with neighbouring construction activities.

- The polar annulus plots for the DPE Bringelly AQMS (Figure 5.15) shows that the highest concentrations occur between early evening to early the next morning (8:00 pm to 8:00 am) supporting the earlier conclusion that recorded concentrations are likely to be associated with emissions from domestic heating (night) and road traffic (early morning).

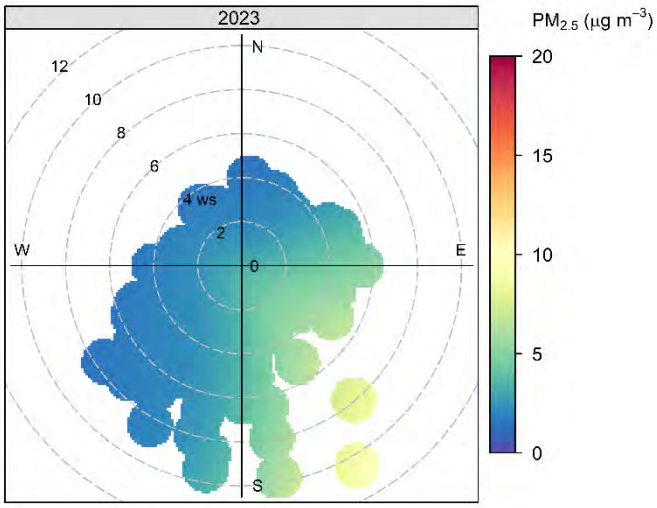


Figure 5.10 Assessment period bivariate polar plot for $PM_{2.5}$ at AQM01

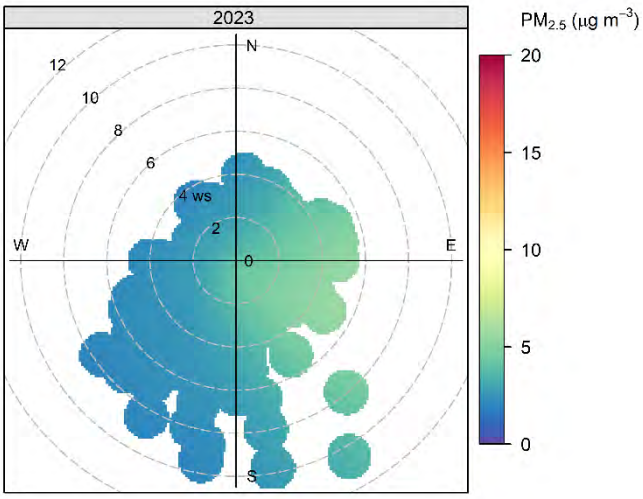


Figure 5.11 Assessment period bivariate polar plot for $PM_{2.5}$ at AQM02

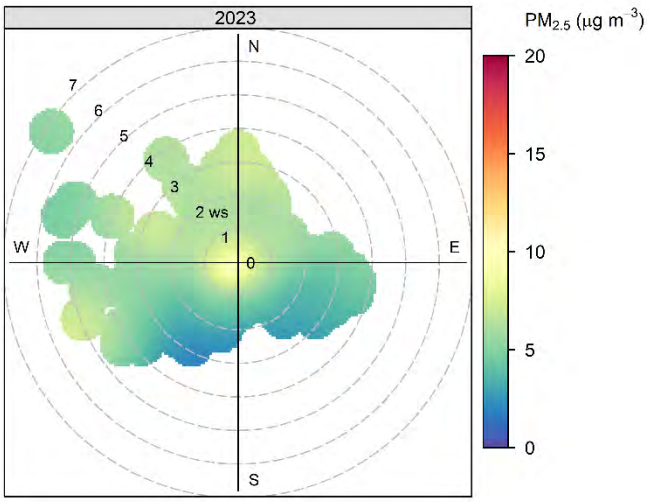


Figure 5.12 Assessment period bivariate polar plot for $PM_{2.5}$ at DPE Bringelly

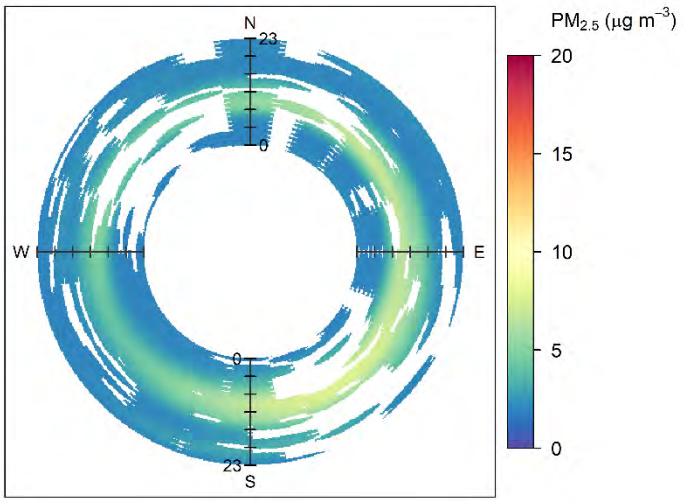


Figure 5.13 Polar annulus plot for $PM_{2.5}$ at AQM01

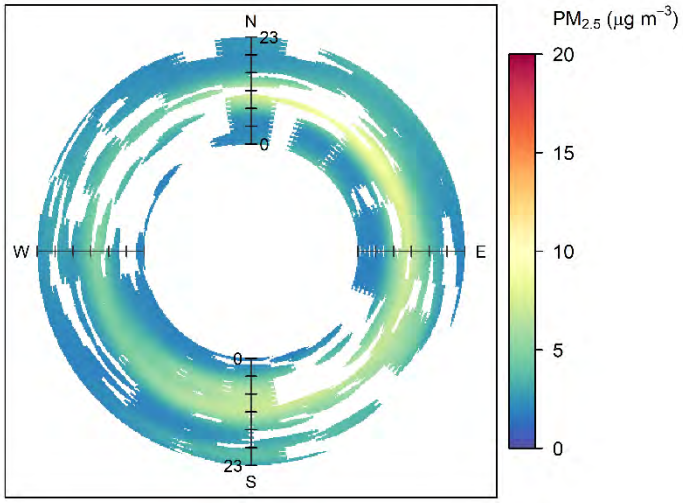


Figure 5.14 Polar annulus plot for $PM_{2.5}$ at AQM02

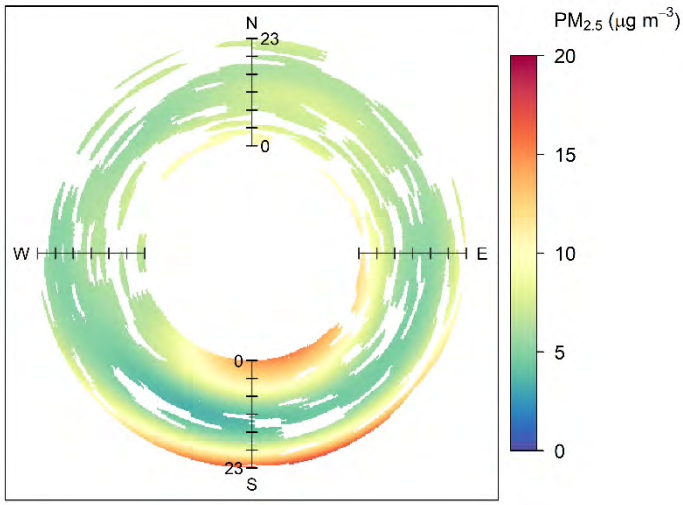


Figure 5.15 Polar annulus plot for $PM_{2.5}$ at DPE Bringelly

5.4 Upwind and downwind concentrations

As stated in Section 1.2, the upwind and downwind monitoring will enable compliance assessment against the short-term air quality criteria, which are evaluated against the increment increase from the development alone, as follows:

- PM contribution from quarry = downwind concentration minus up wind concentration.

To determine the potential contribution from the site to recorded concentrations, the periods of the July to August 2023 monitoring campaign where the wind direction aligned with the two onsite PM monitoring locations were interrogated. For the purpose of this analysis, upwind and downwind conditions were considered to occur when winds were between 15° and 65° (AQM01 is upwind, AQM02 is downwind of the site) and between 215° and 265° (AQM02 is upwind, AQM01 is downwind of the site).

The mean PM_{10} and $PM_{2.5}$ concentration and wind speeds when the site was upwind or downwind of each monitor are given in Table 5.3. The number of hours for each condition is also provided.

For AQM01, PM_{10} and $PM_{2.5}$ concentrations were higher during upwind conditions than downwind conditions. For AQM02 PM_{10} and $PM_{2.5}$ concentrations were higher during downwind conditions relative to upwind conditions.

Table 5.3 PM_{10} and $PM_{2.5}$ concentrations upwind and downwind of the quarry

Parameter		AQM upwind of quarry			AQM downwind of quarry		
		Mean (µg/m³)	Mean wind speed (m/s)	Hours upwind	Mean (µg/m³)	Mean wind speed (m/s)	Hours downwind
PM_{10}	AQM01	14.1	0.8	89	7.5	0.8	189
	AQM02	10.1	0.8	189	23.0	0.8	89
$PM_{2.5}$	AQM01	2.8	0.8	89	2.8	0.8	189
	AQM02	3.3	0.8	189	3.8	0.8	89

The potential contribution of recorded PM_{10} and $PM_{2.5}$ concentrations from onsite emission sources (e.g. quarrying, haulage of material, wind erosion) have been calculated by reviewing the differences in mean measurements at the two locations under upwind and downwind conditions (i.e. AQM01 upwind and AQM02 downwind). The average difference at each site is presented in Table 5.4. For the monitoring period, the average difference (or quarry contribution) is up to 8.9 µg/m³ for PM_{10}, and less than 1.1 µg/m³ for $PM_{2.5}$.

Table 5.4 PM contributions from the quarry

Parameters		Average contribution (µg/m³)
PM_{10}	AQM01	8.9
	AQM02	negligible
$PM_{2.5}$	AQM01	1.1
	AQM02	negligible

5.5 TSP concentrations

Measurements of TSP were not collected at the site during the July to August 2023 monitoring campaign. As stated in Section 1.2, TSP concentrations would be derived from PM_{10} concentrations based on the assumption that PM_{10} is 40% of TSP.

For the average PM_{10} concentrations recorded by the two onsite monitors, the derived average TSP concentrations are 26 µg/m^3 and 38.2 µg/m^3 for AQM01 and AQM02, respectively. Both concentrations are well below the applicable assessment criteria of 90 µg/m^3 (Table 2.1); however, it is noted that the TSP assessment criteria applies to annual average concentrations.

6 Conclusion

EMM has been commissioned to manage a short-term ambient air quality monitoring campaign at the site.

A four-week monitoring program was completed during July and August 2023 using two continuous PM monitoring units (FDS PM monitoring system) to record concentrations of PM_{10} and $PM_{2.5}$. Meteorological measurements for the monitoring period were sourced from the nearby BoM Badgerys Creek AWS. The onsite PM monitoring data was also compared with monitoring data for the same period from the DPE Bringelly AQMS.

The monitoring equipment was deployed at the north-east and south-west corners of the site, with a specific focus of the monitoring study to record upwind and downwind concentrations. Issues with the AQM02 (south-west corner) resulted in PM_{10} concentrations being derived from the $PM_{2.5}$:PM_{10} relationship from the AQM01 (north-east corner) and applied to the measured $PM_{2.5}$ concentrations from AQM02.

A summary of the monitoring results are as follows:

- No exceedances of the 24-hour PM_{10} criterion of 50 µg/m^3 were recorded or derived at either of the onsite monitoring locations.
- No exceedances of the 24-hour $PM_{2.5}$ criterion of 25 µg/m^3 were recorded at either of the onsite monitoring locations.
- The PM_{10} and $PM_{2.5}$ concentrations at the quarry were generally comparable with the concurrent measurements at the DPE Bringelly AQMS for the same period.
- When upwind and downwind concentrations were considered, the contribution from the site did not result in an exceedance of the criteria specified in Section 2.
- It is inferred that no exceedances of the annual TSP criterion of 90 µg/m^3 would occur based on the recorded PM_{10} concentrations.

Attachment A

Summary of 24-hour average concentrations recorded on site

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A.1 Daily average PM_{10} and $PM_{2.5}$ data

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration (µg/m^3)

Date	PM_{10} concentration (µg/m^3)		$PM_{2.5}$ concentration (µg/m^3)	
	AQM01	AQM02	AQM01	AQM02
25/07/2023	Less than 24-hours of data			
26/07/2023	Less than 24-hours of data			3.9
27/07/2023	11.3	13.3	3.5	3.4
28/07/2023	Less than 24-hours of data			
29/07/2023	8.8	12.2	2.8	3.8
30/07/2023	8.1	9.1	3.9	4.3
31/07/2023	13.7	11.4	3.7	2.8
1/08/2023	16.2	28.4	3.0	4.5
2/08/2023	16.6	31.4	4.1	7.2
3/08/2023	26.7	37.8	3.8	5.1
4/08/2023	22.4	23.6	5.9	5.9
5/08/2023	18.1	27.1	5.3	6.9
6/08/2023	7.8	Less than 24-hours of data	2.4	Less than 24-hours of data
7/08/2023	5.4	Less than 24-hours of data	2.4	Less than 24-hours of data
8/08/2023	6.1	5.9	3.2	2.9
9/08/2023	8.2	8.9	2.5	2.9
10/08/2023	11.1	11.3	3.7	3.1
11/08/2023	12.5	17.5	2.8	3.9
12/08/2023	6.2	7.3	3.0	3.8
13/08/2023	6.3	7.1	2.1	2.5
14/08/2023	6.6	Less than 24-hours of data	2.6	Less than 24-hours of data
15/08/2023	Less than 24-hours of data			
16/08/2023	5.7	Less than 24-hours of data	3.0	Less than 24-hours of data
17/08/2023	8.1	Less than 24-hours of data	4.0	Less than 24-hours of data
18/08/2023	4.9	4.5	2.4	2.2
19/08/2023	3.3	3.8	2.1	2.5
20/08/2023	4.2	Less than 24-hours of data	3.1	Less than 24-hours of data
21/08/2023	10.0	Less than 24-hours of data	3.4	Less than 24-hours of data
22/08/2023	17.0	Less than 24-hours of data	3.2	Less than 24-hours of data

Table A.1 Daily average PM_{10} and $PM_{2.5}$ concentration ($\mu g/m^3$)

Date	PM_{10} concentration ($\mu g/m^3$)		$PM_{2.5}$ concentration ($\mu g/m^3$)	
	AQM01	AQM02	AQM01	AQM02
23/08/2023	5.1	Less than 24-hours of data	2.1	Less than 24-hours of data
24/08/2023	10.7	14.6	3.2	3.5
25/08/2023	Less than 24-hours of data			

Australia

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Appendix F

Noise and Vibration Annual Review

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CPG Luddenham Quarry

Noise Compliance Report - August 2023

Prepared for Luddenham Operations Pty Ltd

September 2023

CPG Luddenham Quarry

Noise Compliance Report - August 2023

Luddenham Operations Pty Ltd

J190749a RP78

September 2023

Version	Date	Prepared by	Reviewed by	Comments
1	13 September 2023	Jared Blackburn	Carl Fokkema	Final

Approved by

Carl Fokkema
Associate - Acoustics
13 September 2023

Ground floor 20 Chandos Street
St Leonards NSW 2065
PO Box 21
St Leonards NSW 1590

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Appendices

Tables

Figures

1 Introduction

1.1 Background

EMM Consulting Pty Ltd (EMM) was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at Luddenham Quarry (the site) located at Luddenham, NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits.

Attended environmental noise monitoring described in this report was done during the day periods of 23 and 24 August 2023 at six monitoring locations.

1.2 Attended monitoring locations

Site monitoring locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences.

Table 1.1 Attended noise monitoring locations

Location descriptor	Description	Address	Coordinates (MGA56)	
			Easting	Northing
R1	Approximately 880 metres (m) northwest of the site	2161–2177 Elizabeth Drive, Luddenham	288807	6250432
R2	Approximately 680 m northwest of the site	2111–2141 Elizabeth Drive, Luddenham	289142	6250089
A1	Approximately 260 m north of site	Northern site boundary utilised to calculate for R3 – 285 Adams Road, Luddenham	288937	6249498
A2	Approximately 635 m southwest	5 Anton Road, Luddenham Southwestern utilised to represent for R4 - 5 Anton Road, Luddenham, R5 - 185 Adams Road, Luddenham and R7 – 161 Adams Road, Luddenham	288345	6249200
A3	Approximately 260 m west of the site	Western site boundary utilised to calculate for R6 - 225 Adams Road, Luddenham	288912	6249491
A4	Approximately 1020 m northwest of the site	196 – 214 Adams Road, Luddenham utilised to calculate for R8 - 2510-2550 Elizabeth Drive, Luddenham	288632	6249769

KEY

- Study area
- Cadastral boundary

Assessment location

- Active recreation
- Commercial
- Noise assessment locations
- Noise monitoring locations

\\emmsvr1\EMM\Jobs\2019\J190749 - CPG Luddenham Quarry\GIS\02 Maps\Modification Reporting\Noise Management Plan\NMP002 AssessmentLocations 20230901 01.mxd 8/09/2023

Source: EMM (2023); DFSI (2017); GA (2011); Nearmap (2020)

0 100 200 m

GDA 1994 MGA Zone 56

N

Noise Compliance Report
- August 2023

CPG Luddenham Quarry
Noise Compliance Report – August 2023
Figure 1.1

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1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1%of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Environment protection licence

Noise assessment criteria for the operations are provided in the site's EPL which is included as Appendix B. These are specified at locations which are representative of residences potentially impacted by quarry noise.

2.2 Noise limits

Noise impact limits based on EPL 21562 are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Location description	Day $L_{Aeq,15minute}$
R1	2161–2177 Elizabeth Drive, Luddenham	41
R2	2111–2141 Elizabeth Drive, Luddenham	43
R3	285 Adams Road, Luddenham	53
R4	5 Anton Road, Luddenham	46
R5	185 Adams Road, Luddenham	45
R6	225 Adams Road, Luddenham	52
R7	161 Adams Road, Luddenham	41
R8	2510–2550 Elizabeth Drive, Luddenham	41

2.3 Meteorological conditions

Condition L2.3 of the EPL states the meteorological conditions which the noise limits apply under:

L3.2 Noise-enhancing meteorological conditions:

a) The noise limits set out in condition L2.1 apply under the meteorological conditions listed in the table below.

b) For those meteorological conditions not referred to in condition L2.1(a) table, the noise limits that apply are the noise limits in conditions L2.1 table plus 5 dB.

Table 2.2 Applicable meteorological conditions

Assessment period	Meteorological conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3 metres per second (m/s) at 10 m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3 m/s at 10 m above ground level; or Stability category E and F with wind speeds up to and including 2 m/s at 10 m above ground level.

Condition L2.4 specifies the source of meteorological data to be used and method for determining stability categories:

L2.4 For the purpose of condition L2.3:

a) The meteorological conditions are to be determined from meteorological data obtained from the meteorological weather station identified as Bureau of Meteorology AWS at Badgerys Creek, NSW (Station no 067108).

b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):

i. Use of sigma-theta data (section D1.4).

It is noted that the site only operates during the day period.

2.4 Additional requirements

Monitoring and reporting have been done in accordance with the NSW EPA 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW requirements. Meteorological data was obtained from the Badgerys Creek automatic weather station (AWS) (station ID 067108) which allowed correlation of atmospheric parameters with measured site noise levels.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted during the day period at each location. The duration of each measurement was 15 minutes. Where access to a property was not granted or measurement at assessment location was not practical due to localised construction activities, monitoring was completed at alternative representative locations and results were calculated back for the actual assessment location. This approach is consistent with the approved NMP for the site and the NPfI. The attended monitoring was completed during the day period in accordance with section M4.1 of the EPL. The assessment locations are listed in Table 1.1 and shown on Figure 1.1. Atmospheric conditions were measured at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15minute}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq}.

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfI.

3.4 Instrumentation

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 Measurement equipment

Item	Serial number	Calibration due date	Relevant standard
Brüel & Kjær Type 2250 sound level meter	3008201	12 July 2025	IEC 61672-1:2002
Svan SV36 calibrator	106879	5 June 2024	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – August 2023 [1]

Location	Start date and time	L_{Amax}	L_{A1}	L_{A10}	L_{Aeq}	L_{A50}	L_{A90}	L_{Amin}
A1	23/08/2023 9:35	75	69	57	56	49	45	41
A1	23/08/2023 9:54	69	56	51	49	47	45	41
A3	23/08/2023 10:17	65	56	52	49	48	45	42
A3	23/08/2023 10:32	63	57	51	49	48	45	42
A4	23/08/2023 11:59	84	74	54	59	47	44	40
A4	23/08/2023 12:14	86	76	60	63	52	44	41
R1	23/08/2023 12:38	85	75	66	63	56	49	43
R1	23/08/2023 12:53	79	73	65	62	54	47	41
R2	23/08/2023 13:12	97	82	72	72	62	52	46
R2	23/08/2023 13:28	83	76	70	66	58	50	46
A2	23/08/2023 14:00	81	71	56	59	48	46	43
A2	23/08/2023 14:15	70	65	56	54	49	47	44
R1	24/08/2023 9:49	78	72	66	62	57	49	44
R1	24/08/2023 10:04	85	74	68	64	59	48	42
R2	24/08/2023 10:23	86	79	72	68	61	51	44
R2	24/08/2023 10:37	96	79	71	68	61	52	46
A2	24/08/2023 11:42	73	61	53	51	45	43	40
A2	24/08/2023 11:57	76	67	53	54	46	43	40
A4	24/08/2023 12:19	86	77	54	62	42	37	33
A4	24/08/2023 12:34	86	77	58	63	41	36	31
A1	24/08/2023 12:56	83	62	52	51	43	39	36
A1	24/08/2023 13:12	80	75	48	60	41	39	36
A3	24/08/2023 13:46	68	55	47	44	41	37	34
A3	24/08/2023 14:02	66	52	46	44	41	38	35

Notes: 1. Levels in this table are not necessarily the result of activity at site.

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 m

above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height.

Table 4.2 Measured atmospheric conditions – August 2023

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north [1]	Cloud cover 1/8s
A1	23/08/2023 9:35	17	2.2	217	-
A1	23/08/2023 9:54	18	1.5	215	-
A3	23/08/2023 10:17	18	1.2	226	-
A3	23/08/2023 10:32	18	1.9	230	-
A4	23/08/2023 11:59	19	2	183	7
A4	23/08/2023 12:14	19	1.8	180	7
R1	23/08/2023 12:38	18	1.5	163	8
R1	23/08/2023 12:53	19	1.8	160	8
R2	23/08/2023 13:12	21	1.3	180	8
R2	23/08/2023 13:28	21	1.2	179	8
A2	23/08/2023 14:00	21	1	205	8
A2	23/08/2023 14:15	20	2.7	216	8
R1	24/08/2023 9:49	14	1.1	219	8
R1	24/08/2023 10:04	15	1.3	234	8
R2	24/08/2023 10:23	20	0.5	211	8
R2	24/08/2023 10:37	16	1	197	8
A2	24/08/2023 11:42	16	-	-	8
A2	24/08/2023 11:57	17	-	-	8
A4	24/08/2023 12:19	17	-	-	7
A4	24/08/2023 12:34	18	-	-	7
A1	24/08/2023 12:56	18	0.2	240	6
A1	24/08/2023 13:12	19	-	-	3
A3	24/08/2023 13:46	19	-	-	3
A3	24/08/2023 14:02	19	-	217	3

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.2.2 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from Badgerys Creek automatic weather station (AWS) (station ID 067108). Noise limits are applicable under all weather conditions but are adjusted during very noise-enhancing weather conditions as defined by the NPfI.

Table 4.3 Site noise levels and limits – August 2023

Location	Start date and time	Wind		Stability class	Very enhancing[1]	Limits, dB		Site levels, dB		Exceedances, dB [1]	
		Speed m/s	Direction [3]			$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$ [2]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
R3 (A1)[4]	23/08/2023 9:35	3.0	252	A	N	53	N/A	45	55	Nil	N/A
R3 (A1) [4]	23/08/2023 9:54	3.0	242	B	N	53	N/A	44	56	Nil	N/A
R6 (A3) [4]	23/08/2023 10:17	3.0	233	B	N	52	N/A	42	45	Nil	N/A
R6 (A3) [4]	23/08/2023 10:32	3.0	233	B	N	52	N/A	42	45	Nil	N/A
R8 (A4) [4]	23/08/2023 11:59	2.7	226	B	N	41	N/A	29	29	Nil	N/A
R8 (A4) [4]	23/08/2023 12:14	2.7	226	B	N	41	N/A	29	29	Nil	N/A
R1	23/08/2023 12:38	3.1	197	B	Y	46[1]	N/A	IA (<39)	IA (<39)	Nil	N/A
R1	23/08/2023 12:53	4.3	176	B	Y	46[1]	N/A	IA (<37)	IA (<37)	Nil	N/A
R2	23/08/2023 13:12	4.3	176	C	Y	48[1]	N/A	IA (<42)	IA (<42)	Nil	N/A
R2	23/08/2023 13:28	2.7	180	B	N	43	N/A	IA (<40)	IA (<40)	Nil	N/A
R4 (A2)	23/08/2023 14:00	3.0	186	B	N	46	N/A	IA (<36)	IA (<36)	Nil	N/A

Table 4.3 Site noise levels and limits – August 2023

Location	Start date and time	Wind		Stability class	Very enhancing[1]	Limits, dB		Site levels, dB		Exceedances, dB [1]	
		Speed m/s	Direction [3]			$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$ [2]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
R4 (A2)	23/08/2023 14:15	3.7	170	C	Y	51[1]	N/A	IA (<37)	IA (<37)	Nil	N/A
R5 (A2)	23/08/2023 14:00	3.0	186	B	N	45	N/A	IA (<36)	IA (<36)	Nil	N/A
R5 (A2)	23/08/2023 14:15	3.7	170	C	Y	50[1]	N/A	IA (<37)	IA (<37)	Nil	N/A
R7 (A2) [4]	23/08/2023 14:00	3.0	186	B	N	41	N/A	IA (<36)	IA (<36)	Nil	N/A
R7 (A2) [4]	23/08/2023 14:15	3.7	170	C	Y	41	N/A	28	28	Nil	N/A
R1	24/08/2023 9:49	3.0	264	B	N	41	N/A	IA (<39)	IA (<39)	Nil	N/A
R1	24/08/2023 10:04	3.0	264	B	N	41	N/A	IA (<38)	IA (<38)	Nil	N/A
R2	24/08/2023 10:23	3.2	237	B	Y	48[1]	N/A	IA (<41)	IA (<41)	Nil	N/A
R2	24/08/2023 10:37	3.2	237	B	Y	48[1]	N/A	IA (<42)	IA (<42)	Nil	N/A
R4 (A2)	24/08/2023 11:42	2.5	321	A	N	46	N/A	IA (<33)	IA (<33)	Nil	N/A
R4 (A2)	24/08/2023 11:57	2.5	340	A	N	46	N/A	IA (<33)	IA (<33)	Nil	N/A

Table 4.3 Site noise levels and limits – August 2023

Location	Start date and time	Wind		Stability class	Very enhancing[1]	Limits, dB		Site levels, dB		Exceedances, dB [1]	
		Speed m/s	Direction [3]			$L_{Aeq,15minute}$	L_{Amax}	$L_{Aeq,15minute}$ [2]	L_{Amax}	$L_{Aeq,15minute}$	L_{Amax}
R5 (A2)	24/08/2023 11:42	2.5	321	A	N	45	N/A	IA (<33)	IA (<33)	Nil	N/A
R5 (A2)	24/08/2023 11:57	2.5	340	A	N	45	N/A	IA (<33)	IA (<33)	Nil	N/A
R7 (A2) [4]	24/08/2023 11:42	2.5	321	A	N	41	N/A	28	28	Nil	N/A
R7 (A2) [4]	24/08/2023 11:57	2.5	340	A	N	41	N/A	28	28	Nil	N/A
R8 (A4) [4]	24/08/2023 12:19	1.6	341	A	N	41	N/A	22	22	Nil	N/A
R8 (A4) [4]	24/08/2023 12:34	1.6	341	A	N	41	N/A	21	21	Nil	N/A
R3 (A1) [4]	24/08/2023 12:56	2.1	290	D	N	53	N/A	40	41	Nil	N/A
R3 (A1) [4]	24/08/2023 13:12	2.1	290	D	N	53	N/A	37	40	Nil	N/A
R6 (A3) [4]	24/08/2023 13:46	3.3	138	D	Y	57[1]	N/A	35	40	Nil	N/A
R6 (A3) [4]	24/08/2023 14:02	4.2	101	D	Y	57[1]	N/A	35	39	Nil	N/A

Notes: 1. Noise limits are adjusted by +5 dB during 'very noise-enhancing meteorological conditions' in accordance with the NPfI.

2. Site-only $L_{Aeq,15minute}$, includes modifying factor penalties if applicable.

3. Degrees magnetic north, "-" indicates calm conditions.

4. Access to this property was not granted or measurement at assessment location was not practical due to localised construction activities, hence attended noise monitoring was completed at an alternative representative locations (refer to Figure 1.1) and site contribution calculated back to the assessment location in accordance with the approved NMP for the site.

5 Summary

EMM was engaged by Luddenham Operations Pty Ltd to conduct a bi-annual noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified EPL limits.

Attended environmental noise monitoring described in this report was done during the day period(s) of 23 and 24 August 2023 at six monitoring locations.

Noise levels from site complied with relevant limits at all monitoring locations during the August 2023 survey.

Appendix A
Noise perception and examples

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A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

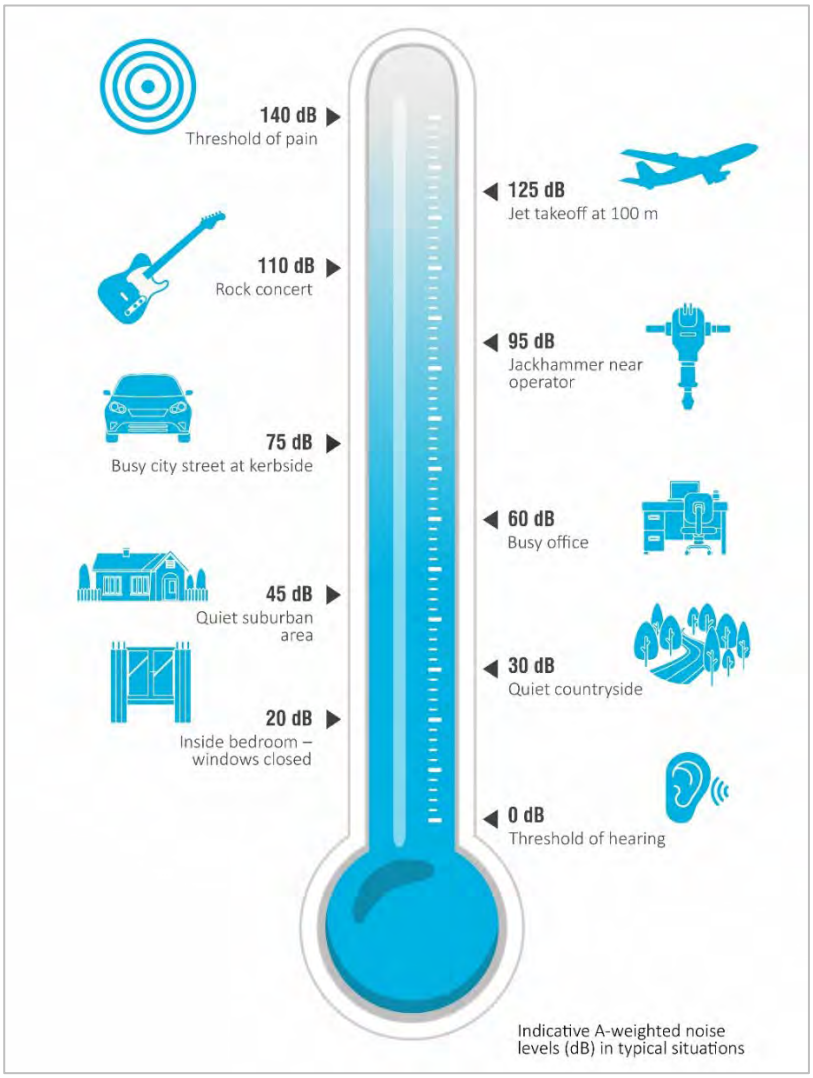

Figure A.1 Common noise levels

Appendix B
Regulator documents

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Day	LAeq (15 minute)	2 times a year	41

Note: EPA Identification No. 4 and 7 are entitled to negotiated agreement under the *Voluntary Land Acquisition and Mitigation Policy*. Where negotiated agreements are in place noise limits will not apply.

L2.2 For the purposes of Condition L2.1:

a) Day means the period from 7am to 6pm Monday to Saturday and the period from 8am to 6pm Sunday and public holidays.

L2.3 Noise-enhancing meteorological conditions

a) The noise limits set out in Condition L2.1 apply under the meteorological conditions in the table below.
b) For those meteorological conditions not referred to in the table below, the noise limits that apply are the noise limits in Condition L2.1 plus 5dB.

Assessment Period	Meteorological Conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level; or Stability category E and F with wind speeds up to and including 2m/s at 10m above ground level.

L2.4 For the purposes of Condition L2.3:

a) The meteorological conditions are to be determined from the meteorological weather station identified as BoM monitoring point at Badgerys Creek.
b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):

i. Use of sigma-theta data (section D1.4).

L2.5 To assess compliance:

a) with the LAeq(15 minutes) noise limits in Condition L2.1 and L2.3, the noise measurement equipment must be located:

(i) approximately on the property boundary, where any residence is situated 30 metres or less from the property boundary closest to premises; or where applicable,
(ii) in an area within 30 metres of a residence façade, but not closer than 3 metres where any residence on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable,
(iii) in an area within 50 metres of the boundary of a National Park or Nature Reserve,
(iv) at any other location identified in Condition L2.1.

POINT 2

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	43

POINT 3

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	53

POINT 4

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	46

POINT 5

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	45

POINT 6

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	52

POINT 7

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	LAeq (15 minute)	2 times a year	41

POINT 8

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)

Day	LAeq (15 minute)	2 times a year	41

Note: EPA Identification No. 4 and 7 are entitled to negotiated agreement under the *Voluntary Land Acquisition and Mitigation Policy*. Where negotiated agreements are in place noise limits will not apply.

L2.2 For the purposes of Condition L2.1:

a) Day means the period from 7am to 6pm Monday to Saturday and the period from 8am to 6pm Sunday and public holidays.

L2.3 Noise-enhancing meteorological conditions

a) The noise limits set out in Condition L2.1 apply under the meteorological conditions in the table below.
b) For those meteorological conditions not referred to in the table below, the noise limits that apply are the noise limits in Condition L2.1 plus 5dB.

Assessment Period	Meteorological Conditions
Day	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Evening	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level.
Night	Stability Categories A, B, C and D with wind speeds up to and including 3m/s at 10m above ground level; or Stability category E and F with wind speeds up to and including 2m/s at 10m above ground level.

L2.4 For the purposes of Condition L2.3:

a) The meteorological conditions are to be determined from the meteorological weather station identified as BoM monitoring point at Badgerys Creek.
b) Stability category shall be determined using the following method from Fact Sheet D of the Noise Policy for Industry (NSW EPA, 2017):

i. Use of sigma-theta data (section D1.4).

L2.5 To assess compliance:

a) with the LAeq(15 minutes) noise limits in Condition L2.1 and L2.3, the noise measurement equipment must be located:

(i) approximately on the property boundary, where any residence is situated 30 metres or less from the property boundary closest to premises; or where applicable,
(ii) in an area within 30 metres of a residence façade, but not closer than 3 metres where any residence on the property is situated more than 30 metres from the property boundary closest to the premises; or, where applicable,
(iii) in an area within 50 metres of the boundary of a National Park or Nature Reserve,
(iv) at any other location identified in Condition L2.1.

Appendix C
Calibration certificates

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Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23471

Client Details	EMM Consulting Ground Floor Suite 01, 20 Chandos Street
Equipment Tested/ Model Number :	Type 2250
Instrument Serial Number :	3008201
Microphone Serial Number :	2888134
Pre-amplifier Serial Number :	16037
Firmware Version :	N/A

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	23.1 °C	**Ambient Temperature :**	24.3 °C
Relative Humidity :	44 %	**Relative Humidity :**	44.1 %
Barometric Pressure :	101.6 kPa	**Barometric Pressure :**	101.3 kPa

Calibration Technician :	Max Moore	**Secondary Check:**	Rhys Gravelle
Calibration Date :	12 Jul 2023	**Report Issue Date :**	17 Jul 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.014 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Test Report

Calibration Number C23471

Client Details EMM Consulting
Ground Floor
Suite 01, 20 Chandos Street

Equipment Tested/ Model Number : Type 2250
Instrument Serial Number : 3008201
Microphone Serial Number : 2888134
Pre-amplifier Serial Number : 16037
Firmware Version : N/A

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	23.1 °C	**Ambient Temperature :**	24.3 °C
Relative Humidity :	44 %	**Relative Humidity :**	44.1 %
Barometric Pressure :	101.6 kPa	**Barometric Pressure :**	101.3 kPa

Calibration Technician : Max Moore
Calibration Date : 12 Jul 2023
Secondary Check: Rhys Gravelle
Report Issue Date : 17 Jul 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*Pass*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.014 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

1. OVERVIEW

This report presents the calibration test results of a Type 2250 Sound Level Meter, and associated equipment. Calibration is carried out in accordance with *IEC 61672-3.2013, Electroacoustics - Sound Level Meters - Part 3: Periodic Tests*.

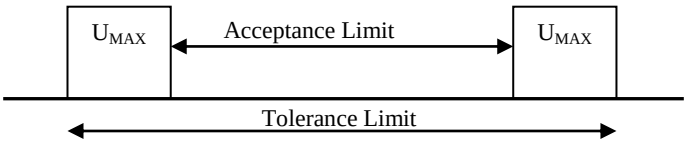
Relevant clauses from this standard have been used for periodic testing in conjunction with Acoustic Research Labs internal test methods described in Section 1 of the calibration work instruction manual.

Where required, reference is made to manual version 34 as provided by the manufacturer.

1.1 UNCERTAINTIES

For each test performed, the associated measurement uncertainties are derived at the 95% confidence level and are given with a coverage factor of 2.

The uncertainty applies at the time of measurement only, and takes no account of any drift or other effects that may apply afterwards. When estimating uncertainty at any later time, other relevant information should also be considered, including, where possible, the history of the performance of the instrument and the manufacturer's specifications.



Where deviations from the design goals are provided to determine conformance to performance specifications, each measurement is reported with:

- The measured deviation from the design goal
- Associated acceptance limits for the test
- Maximum allowable uncertainty of measurement for the test
- Actual expanded uncertainty for each measurement

1.2 DOCUMENT CONVENTIONS

Test results which highlight non-conformances relative to the standard, and the sound level meter type specified by the manufacturer have been marked with an **F** in the respective tests.

Any tests that are not required, due to sound level meter configuration, are marked N/A.

2. GENERAL

2.1 ENVIRONMENTAL CONDITIONS DURING TEST

No corrections have been applied to any results obtained to compensate for the environmental conditions.

2.2 CALIBRATION TESTS

Where applicable the following tests were performed in accordance with the requirements of *IEC 61672-3.2013*. These clauses are used to define the periodic testing of Sound Level Meters.

Clause 10	Indication at the Calibration Check Frequency
Clause 11	Self Generated Noise
Clause 12	Acoustical Signal Tests of Frequency Weighting
Clause 13	Electrical Signal Tests of Frequency Weightings
Clause 14	Frequency and Time Weightings at 1kHz
Clause 15	Long Term Stability
Clause 16	Level Linearity on the Reference Level Range
Clause 17	Level Linearity including the level range control
Clause 18	Toneburst Response
Clause 19	Peak C Sound Level
Clause 20	Overload Indication
Clause 21	High Level Stability

2.3 TEST EQUIPMENT USED

All test equipment used during periodic testing are calibrated every 12months by an accredited laboratory, traceable to SI units.

The performance of all equipment during these calibrations and the effects of instrument stability are used to determine the measurement uncertainty of each reported result.

2.3.1 Multi-function Acoustic Calibrator

A Bruel & Kjaer 4226 Multi-function calibrator (S/N - 2985012) was used for frequency response testing of the entire instrument (including microphone). This instrument was used as a reference calibrator and for frequency response verification.

2.3.2 Microphone Electrical Equivalent Circuit

Calibration of most instrument parameters is carried out using electrical signals fed to the unit via a two-port electrical equivalent circuit of the microphone.

A 14pF capacitance dummy microphone was used during testing.

2.3.3 Adjustable Attenuator

A means for varying the attenuation of electrical signals via the dummy microphone was provided by a JFW Industries dual rotary attenuator (S/N - 792819 2132). The attenuator is switchable in 1dB steps between 0dB and 60dB.

2.3.4 Arbitrary Function Generator

A Keysight 33511B (S/N – MY58001621) was used to generate the required electrical signals.

2.3.5 Environmental Monitoring

A MHB-382SD (S/N – AG.44204) was used for measuring environmental conditions during device calibration. It is capable of providing temperature, relative humidity and pressure measurements.

3. CALIBRATION TEST RESULTS

3.1 INDICATION AT THE CALIBRATION CHECK FREQUENCY

The indication of the sound level meter at the calibration check frequency was checked by application of an acoustic signal at the reference sound pressure level and frequency.

Stated reference conditions as found in manual are

Reference Level : 94.0 dB

Reference Frequency : 1000.0 Hz

Indications before and after adjustments were recorded and are shown in Table 1 (all measurements in dB) -

Table 1 - Check Frequency Calibration Results

Frequency Weighting	Initial Response	B&K 4226 Corrected	FreeField Corrected	Final Corrected Response
A	93.80	94.10	94.02	94.02
C	93.80	94.10	94.02	94.02
Z	93.80	94.10	94.02	94.02

Free field adjustment data as provided by the manufacturer. Windscreen correction factors applied.

3.2 SELF GENERATED NOISE

3.2.1 Microphone Installed

Self generated noise was measured with the microphone installed on the sound level meter, in the configuration submitted for periodic testing. The sound level meter was set to the most-sensitive level range and with frequency weighting A selected.

Ten (10) time weighted observations were made over a period of 60 seconds.

Random Readings dB(A)

17.50	17.70	17.50	17.50	17.50
17.60	17.50	17.60	17.60	17.60

Acoustic Noise Floor : 17.6 dB(A)

3.2.2 Electrical Input Signal Device

With the microphone replaced by the electrical input signal device and terminated as specified, the sound level meter was set to the most-sensitive level range and with frequency weightings Z, C and A selected as provided.

Ten (10) time weighted observations were made over a period of 60 seconds.

Random Readings dB(A)

12.50	12.40	12.50	12.50	17.80
19.70	20.70	21.90	22.60	22.90

Random Readings dB(C)

11.00	11.10	11.10	15.00	11.00
11.00	11.00	11.00	11.00	11.10

Random Readings dB(Z)

15.4	15.2	15.2	15.1	15.2
15.1	15.2	15.1	15.3	15.2

	dB(A)	dB(C)	dB(Z)
Electric Noise Floor :	17.6	11.4	15.2

3.3 ACOUSTICAL SIGNAL TESTS OF A FREQUENCY WEIGHTING

The sound level meter was set to measure frequency weighting C with a FAST response. The test was carried out using a multi-function acoustic calibrator set to pressure mode.

Three (3) readings were made at each test frequency. The average of the readings was then corrected to the multi-function acoustic calibrator.

Table 2 - Frequency Weighting C Response

Freq Hz	Reading 1	Reading 2	Reading 3	Uncertainty (dB)
125	94.1	94.1	94.1	0.13
1 000	94.1	94.1	94.1	0.13
8 000	87.7	87.7	87.7	0.14

Actual Freq Hz	B&K 4226 Corrections	Corrected Response dB(C)		Uncertainty (dB)
		Actual	re 1kHz	
125.90	-0.06	94.04	0.02	0.13
1005.10	-0.08	94.02	0.00	0.13
7915.10	0.00	87.70	-6.32	0.14

Adjustments were then applied to correct for free field and sound level meter body effects with data supplied by the manufacturer as per Table 3. Windscreen correction factors applied.

Table 3 - Correction Data

Actual Freq (Hz)	Pressure to Freefield (dB)	Uncertainty (dB)	Body Effects (dB)	Uncertainty (dB)	WS Effects (dB)	Uncertainty (dB)
125.90	0.00	0.25	0.00	0.25	0.00	0.20
1005.10	0.80	0.25	-0.07	0.25	-0.18	0.20
7915.10	3.41	0.35	-0.08	0.35	0.41	0.30

Finally, the corrected responses are normalised to the response at 1kHz and compared to the tolerance limits stated in Table 2 of IEC 61672.1-2013.

Table 4 - Acoustic C Response

Actual Freq (Hz)	Corrected Response dB(C)		Expected Response dB(C)		Deviation (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
	Actual	re 1kHz	re 1kHz	Tolerance Limit				
125.90	94.04	-0.53	-0.2	±1.0	-0.33	P	0.43	0.60
1005.10	94.57	0.00	0.0	±0.7	0.00	P	0.43	0.60
7915.10	91.44	-3.13	-3.0	+1.5 / -2.5	-0.13	P	0.60	0.70

3.4 ELECTRICAL SIGNAL TESTS OF FREQUENCY WEIGHTINGS

Frequency weighting responses for Z, C and A were determined relative to the response at 1kHz using steady sinusoidal electrical input signals.

On the reference level range, and for each frequency weighting under test, the level of a 1kHz input signal was adjusted to yield 95dB. At test frequencies other than 1kHz, the input signal level was adjusted to compensate for the design goal attenuations as specified in Table 2 of IEC 61672.1-2013.

Table 5 - Measured Electrical Frequency Response

Freq (Hz)	A Weighting (dB)	C Weighting (dB)	Z Weighting (dB)	Uncertainty (dB)
63	95.1	95.0	95.1	0.13
125	95.0	95.1	95.0	0.11
250	95.0	95.0	95.0	0.10
500	95.0	95.1	95.0	0.10
1 000	95.0	95.0	95.0	0.10
2 000	95.0	95.1	95.0	0.10
4 000	95.0	95.0	95.0	0.10
8 000	95.0	95.0	95.0	0.10
15 850	94.1	94.1	94.2	0.13

Adjustments were then applied to correct for a uniform free field response and sound level meter body effects with data supplied by the manufacturer as per Table 6. Windscreen correction factors applied.

Table 6 - Correction Data

Freq (Hz)	Ufreq (dB)	Uncertainty (dB)	Body Effects (dB)	Uncertainty (dB)	WS Effects (dB)	Uncertainty (dB)
63	0.00	0.25	0.00	0.25	0.00	0.20
125	0.00	0.25	0.00	0.25	0.00	0.20
250	0.00	0.25	0.07	0.25	-0.01	0.20
500	0.00	0.25	0.22	0.25	-0.07	0.20
1 000	0.10	0.25	-0.07	0.25	-0.18	0.20
2 000	0.01	0.25	-0.09	0.25	-0.67	0.20
4 000	0.02	0.25	-0.09	0.25	-0.05	0.20
8 000	0.00	0.35	-0.08	0.35	0.41	0.30
15 850	-0.87	0.45	0.11	0.35	1.33	0.30

Finally, the corrected responses were referenced to the response at 1kHz and compared to the tolerance limits stated in Table 2 of IEC 61672.1-2013.

Table 7 - A Weighted Electrical Response

Freq (Hz)	Response (dB)		Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
	Corrected	re 1kHz				
63	95.10	0.25	±1.0	P	0.43	0.60
125	95.00	0.15	±1.0	P	0.42	0.60
250	95.06	0.21	±1.0	P	0.42	0.60
500	95.15	0.30	±1.0	P	0.42	0.60
1 000	94.85	0.00	±0.7	P	0.42	0.60
2 000	94.25	-0.60	±1.0	P	0.42	0.60
4 000	94.88	0.03	±1.0	P	0.42	0.60
8 000	95.33	0.48	+1.5 / -2.5	P	0.59	0.70
15 850	94.67	-0.18	+2.5 / −16	P	0.66	1.00

Table 8 - C Weighted Electrical Response

Freq (Hz)	Response (dB)		Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
	Corrected	re 1kHz				
63	95.00	0.15	±1.0	P	0.43	0.60
125	95.10	0.25	±1.0	P	0.42	0.60
250	95.06	0.21	±1.0	P	0.42	0.60
500	95.25	0.40	±1.0	P	0.42	0.60
1 000	94.85	0.00	±0.7	P	0.42	0.60
2 000	94.35	-0.50	±1.0	P	0.42	0.60
4 000	94.88	0.03	±1.0	P	0.42	0.60
8 000	95.33	0.48	+1.5 / -2.5	P	0.59	0.70
15 850	94.67	-0.18	+2.5 / −16	P	0.66	1.00

Table 9 - Z Weighted Electrical Response

Freq (Hz)	Response (dB)		Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
	Corrected	re 1kHz				
63	95.10	0.25	±1.0	P	0.43	0.60
125	95.00	0.15	±1.0	P	0.42	0.60
250	95.06	0.21	±1.0	P	0.42	0.60
500	95.15	0.30	±1.0	P	0.42	0.60
1 000	94.85	0.00	±0.7	P	0.42	0.60
2 000	94.25	-0.60	±1.0	P	0.42	0.60
4 000	94.88	0.03	±1.0	P	0.42	0.60
8 000	95.33	0.48	+1.5 / -2.5	P	0.59	0.70
15 850	94.77	-0.08	+2.5 / −16	P	0.66	1.00

3.5 FREQUENCY AND TIME WEIGHTINGS AT 1KHZ

A steady sinusoidal electrical input signal of 1kHz at the reference sound pressure level was applied to the reference level range.

The deviations of the indicated level of C and Z frequency weightings were recorded, along with the deviations of the indication of A weighted time averaged, and SLOW weighted response.

Table 10 - Frequency and Time Weighting Results

Frequency Weighting	Time Weighting	Response (dB)	Deviation (dB)	P/F	Tolerance Limit (dB)	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
A	Fast	94.0	0.0	P	±0.2	0.10	0.20
	Leq	94.0	0.0	P	±0.2	0.10	0.20
	Slow	94.0	0.0	P	±0.2	0.10	0.20
C	Fast	94.0	0.0	P	±0.2	0.10	0.20
Z	Fast	94.0	0.0	P	±0.2	0.10	0.20

3.6 LONG-TERM STABILITY

Long-term stability was tested by comparing a steady sinusoidal electrical signal applied at the start, and at the end of testing. The applied signal level was set to the reference level and frequency and was maintained constant. The difference between the indicated levels was recorded.

Table 11 - Frequency and Time Weighting Results

Signal Level (mV)	Initial Response (dB)	Final Response (dB)	Deviation (dB)	P/F	Tolerance Limit (dB)	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
71.8	94	94.0	0.0	P	±0.1	0.10	0.10

3.7 LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE

Level linearity was tested with a steady sinusoidal electrical signal at a frequency of 8kHz, with the meter set to display frequency weighted A, FAST response.

The starting point for level linearity testing was set to 94.0dB as stated in the instruction manual.

Level linearity was measured in 5dB steps of increasing input signal level from the starting point up to within 5dB of the stated upper limit, then at 1dB steps up to (but not including) the first indication of overload.

Table 12 - Level Linearity - Increasing

Ideal (dB)	Response (dB)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
94.0	94.0	0.0	±0.8	P	0.1	0.3
99.0	99.0	0.0	±0.8	P	0.1	0.3
104.0	104.0	0.0	±0.8	P	0.1	0.3
109.0	109.0	0.0	±0.8	P	0.1	0.3
114.0	114.0	0.0	±0.8	P	0.1	0.3
119.0	119.0	0.0	±0.8	P	0.1	0.3
124.0	124.0	0.0	±0.8	P	0.1	0.3
129.0	129.0	0.0	±0.8	P	0.1	0.3
134.0	134.0	0.0	±0.8	P	0.1	0.3
135.0	135.0	0.0	±0.8	P	0.1	0.3
136.0	136.0	0.0	±0.8	P	0.1	0.3
137.0	137.0	0.0	±0.8	P	0.1	0.3
138.0	138.0	0.0	±0.8	P	0.1	0.3
139.0	139.0	0.0	±0.8	P	0.1	0.3
140.0	140.0	0.0	±0.8	P	0.1	0.3

Overload indication at 140.9dB.

Level linearity test was the continued in 5dB steps of decreasing input signal level from the starting point up to within 5dB of the stated lower limit, then at 1dB steps up to (but not including) the first indication of under range.

Table 13 - Level Linearity - Decreasing

Ideal (dB)	Response (dB)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
94.0	94.0	0.0	±0.8	P	0.1	0.3
89.0	89.0	0.0	±0.8	P	0.1	0.3
84.0	84.0	0.0	±0.8	P	0.1	0.3
79.0	79.0	0.0	±0.8	P	0.1	0.3
74.0	74.0	0.0	±0.8	P	0.1	0.3
69.0	69.0	0.0	±0.8	P	0.1	0.3
64.0	64.0	0.0	±0.8	P	0.1	0.3
59.0	59.0	0.0	±0.8	P	0.1	0.3
54.0	54.0	0.0	±0.8	P	0.1	0.3
49.0	49.0	0.0	±0.8	P	0.1	0.3
44.0	44.1	0.1	±0.8	P	0.1	0.3
39.0	39.1	0.1	±0.8	P	0.1	0.3
35.6	35.6	0.0	±0.8	P	0.1	0.3
34.6	34.7	0.1	±0.8	P	0.1	0.3
33.6	33.7	0.1	±0.8	P	0.1	0.3
32.6	32.7	0.1	±0.8	P	0.1	0.3
31.6	31.9	0.3	±0.8	P	0.1	0.3
30.6	30.9	0.3	±0.8	P	0.1	0.3
29.6	29.9	0.3	±0.8	P	0.1	0.3
28.6	28.0	-0.6	±0.8	P	0.1	0.3
27.6	28.1	0.5	±0.8	P	0.1	0.3
26.6	26.6	0.0	±0.8	P	0.1	0.3
25.6	25.8	0.2	±0.8	P	0.1	0.3

No under range indicated.

3.8 TONEBURST RESPONSE

The response of the sound level meter to short-duration signals was tested on the reference range with 4kHz tone bursts.

The tone bursts were generated from a steady sinusoidal signal at a level of 137.0dB.

Table 14 - FAST Weighted Response

Burst Length	Response dB(A)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
200ms	136.0	0.0	±0.5	P	0.1	0.3
2ms	118.9	-0.1	+1.0 / -1.5	P	0.1	0.3
0.25ms	109.8	-0.2	+1.0 / -3	P	0.1	0.3

Table 15 - SLOW Weighted Response

Burst Length	Response dB(A)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
200ms	129.5	-0.1	±0.5	P	0.1	0.3
2ms	109.9	-0.1	+1.0 / -3	P	0.1	0.3

Table 16 - Sound Exposure Level Response

Burst Length	Response dB(A)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
200ms	129.9	-0.1	±0.5	P	0.1	0.3
2ms	109.9	-0.1	+1.0 / -1.5	P	0.1	0.3
0.25ms	100.8	-0.2	+1.0 / -3	P	0.1	0.3

3.9 PEAK C RESPONSE

Indication of Peak C sound level was tested on the least sensitive level range. Test signals used were -

- A single complete cycle of an 8kHz sinusoid, starting and stopping at zero crossings
- Positive and negative half cycles of a 500Hz sinusoid, starting and stopping at zero crossings.

The level of the steady 8kHz sinusoid was adjusted to display 132.0dB(C).

Table 17 - Single Cycle Response

Response Peak C	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Overload Peak C	Maximum Permitted Uncertainty (dB)
133.6	-1.8	±2.0	P	0.22	N	0.35

Table 18 - Half Cycle Response

Signal Orientation	Response Peak C (dB)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
Positive	134.0	-0.4	±1.0	P	0.1	0.35
Negative	134.2	-0.2	±1.0	P	0.1	0.35

No overload was noted during Peak C testing.

3.10 OVERLOAD INDICATION

The overload indication was tested on the least sensitive level range, with the sound level meter set to display frequency weighted A, time averaged values.

Positive and negative half cycle sinusoidal electrical signals at 4kHz were used. The test began at an indicated time averaged level of139.0dB(A).

Using the positive half cycle signal, the signal level was increased in steps of 0.5dB up to, but not including, the first indication of overload. The level of the input signal was then increased in steps of 0.1dB until the first indication of overload. These steps were repeated using the negative half cycle signal.

Table 19 - Overload Indication

Signal Orientation	Overload Response (dB)	Difference (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
Positive		N/A	±1.5	N/A	0.10	0.25
Negative						

Overload indication could not be verified due to insufficient output of the waveform generator.

Overload latch indication could not be verified due to insufficient output of the waveform generator.

3.11 HIGH LEVEL STABILITY

High level stability was tested by measuring the response of the meter to high signal levels. The result was evaluated as the difference between the A-Weighted indicated levels in response to a steady 1kHz signal applied over 5 minutes.

Table 20 - FAST Weighted Response

Time Weighting	Initial Response (dB)	Final Response (dB)	Deviation (dB)	Tolerance Limit (dB)	P/F	Uncertainty (dB)	Maximum Permitted Uncertainty (dB)
Fast	139.0	139.0	0.0	±0.1	P	0.10	0.10
Slow	N/A	N/A	N/A	±0.1	N/A	0.10	0.10
Leq	139.0	139.0	0.0	±0.1	P	0.10	0.10

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Calibrator

IEC 60942:2017

Calibration Certificate

Calibration Number C23274

Client Details EMM Consulting
Ground Floor Suite 01 20 Chandos Street PO Box 21
St Leonards NSW 2065

Equipment Tested/ Model Number : SVANTEK SV 36
Instrument Serial Number : 106879

Atmospheric Conditions
Ambient Temperature : 24.5°C
Relative Humidity : 48.4%
Barometric Pressure : 101.79kPa

Calibration Technician : Shaheen Boaz
Calibration Date : 05 Jun 2023
Secondary Check: Megan Williams
Report Issue Date : 6 Jun 2023
Approved Signatory : Juan Aguero

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

	Nominal Level	Nominal Frequency	Measured Level	Measured Frequency
	94	1000	94.07	999.99
	114	1000	114.05	999.99

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10dB*	*Temperature*	*±0.1°C*
Frequency	*±0.07%*	*Relative Humidity*	*±1.9%*
Distortion	*±0.20%*	*Barometric Pressure*	*±0.014kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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Sound Calibrator
IEC 60942:2017
Calibration Test Report

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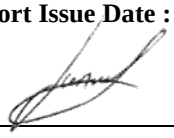
Approved Signatory :  Juan Aguero

Characteristic Tested	Result
Generated Sound Pressure Level	*Pass*
Frequency Generated	*Pass*
Total Distortion	*Pass*

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed..

Uncertainties of Measurement -

Specific Tests		Environmental Conditions	
Generated SPL	*±0.10dB*	*Temperature*	*±0.1°C*
Frequency	*±0.07%*	*Relative Humidity*	*±1.9%*
Distortion	*±0.20%*	*Barometric Pressure*	*±0.014kPa*

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

1. OVERVIEW

This report presents the calibration test results of a SVANTEK SV 36 Acoustic Calibrator, and associated equipment. Calibration is carried out in accordance with *IEC 60942-2017, Electroacoustics - Sound Calibrators*.

Relevant clauses from this standard have been used for periodic testing in conjunction with Acoustic Research Labs internal test methods described in Section 2 of the calibration work instruction manual.

1.1 UNCERTAINTIES

For each test performed, the associated measurement uncertainties are derived at the 95% confidence level and are given with a coverage factor of 2.

The uncertainty applies at the time of measurement only, and takes no account of any drift or other effects that may apply afterwards. When estimating uncertainty at any later time, other relevant information should also be considered, including, where possible, the history of the performance of the instrument and the manufacturer's specifications.

1.2 DOCUMENT CONVENTIONS

Test results which highlight non-conformances relative to the standard, and the sound level meter type specified by the manufacturer have been marked with an **F** in the respective tests.

Any tests that are not required, due to sound level meter configuration, are marked N/A.

2. GENERAL

2.1 ENVIRONMENTAL CONDITIONS DURING TEST

No corrections have been applied to any results obtained to compensate for the environmental conditions.

All tolerance limits stated apply to measurements made at and around reference environmental conditions within the following ranges:

80 kPa to 105 kPa

20°C to 26°C

25% to 90% relative humidity

2.2 CALIBRATION TESTS

Where applicable the following tests were performed in accordance with the requirements of *IEC 60942-2017* Annex B.

2.3 TEST EQUIPMENT USED

All test equipment used during periodic testing are calibrated every 12months by an accredited laboratory, traceable to SI units.

The performance of all equipment during these calibrations and the effects of instrument stability are used to determine the measurement uncertainty of each reported result.

2.3.1 Multi-function Acoustic Calibrator

A Bruel & Kjaer 4226 Multi-function calibrator (S/N - 2985012) was used as the reference for the sound pressure level and the signal frequency.

2.3.2 Sound Level Meter

ARL Ngara Class 1 (S/N - 878035). This device was used for converting acoustic signals into voltages which may be measured by the multimeter.

2.3.3 Audio Analyser

Abonet Audio Analyzer AVR-3710 (S/N - V859B9018). This device was used for measuring the AC voltage output of the reference Ngara unit. The AC level is proportional to the sound pressure level and frequency applied to the reference microphone.

2.3.4 Environmental Monitoring

A MHB-382SD (S/N – AG.44204) was used for measuring environmental conditions during device calibration. It is capable of providing temperature, relative humidity and pressure measurements.

3. CALIBRATION TEST RESULTS

3.1 SOUND PRESSURE LEVEL

3.1.1 Generated Sound Pressure Level

The sound pressure level generated by the sound calibrator was measured three times as an average over 20 s of operation. During each measurement the sound calibrator was decoupled and rotated from the microphone to ensure any variations in operation were captured.

Table 1 – Generated Sound Pressure Level Results

Nominal Level (dB)	Measured Level (dB)	Deviation (dB)	Tolerance (dB)	P/F	U95 (dB)	
94	94.07	0.07	±0.25	P	0.10	Measured Output
114	114.05	0.05	±0.25	P	0.10	Measured Output

3.2 FREQUENCY OUTPUT

The frequency generated by the sound calibrator was measured as an average over 20s of operation. The deviation from expected values is calculated as the absolute value of the difference in per cent between the frequency of the sound generated by the sound calibrator and the corresponding specified frequency.

Table 2 – Frequency Output Results

Nominal Level (dB)	Nominal Frequency (Hz)	Measured Frequency (Hz)	Deviation (Hz)	Tolerance (Hz)	P/F	U95 (%)	
94	1000	999.99	-0.01	±7.00	P	0.07	Measured Output
114	1000	999.99	-0.01	±7.00	P	0.07	Measured Output

3.3 TOTAL DISTORTION

The total distortion, measured over the frequency range from 22,5 Hz to 20 kHz, was measured as an average over 20s of operation.

Table 3 – Total Distortion Results

Nominal Level (dB)	Distortion (%)	Tolerance (%)	P/F	U95 (%)	
94	0.30	±2.50	P	0.20	Measured Output
114	0.75	±2.50	P	0.20	Measured Output

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
60 W 6th Ave
Vancouver BC V5Y 1K1
T 604 999 8297

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au

Australia

SYDNEY
Ground floor, 20 Chandos Street
St Leonards NSW 2065
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NEWCASTLE
Level 3, 175 Scott Street
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ADELAIDE
Level 4, 74 Pirie Street
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MELBOURNE
188 Normanby Road
Southbank VIC 3006

PERTH
Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO
2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER
60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1

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emmconsulting.com.au