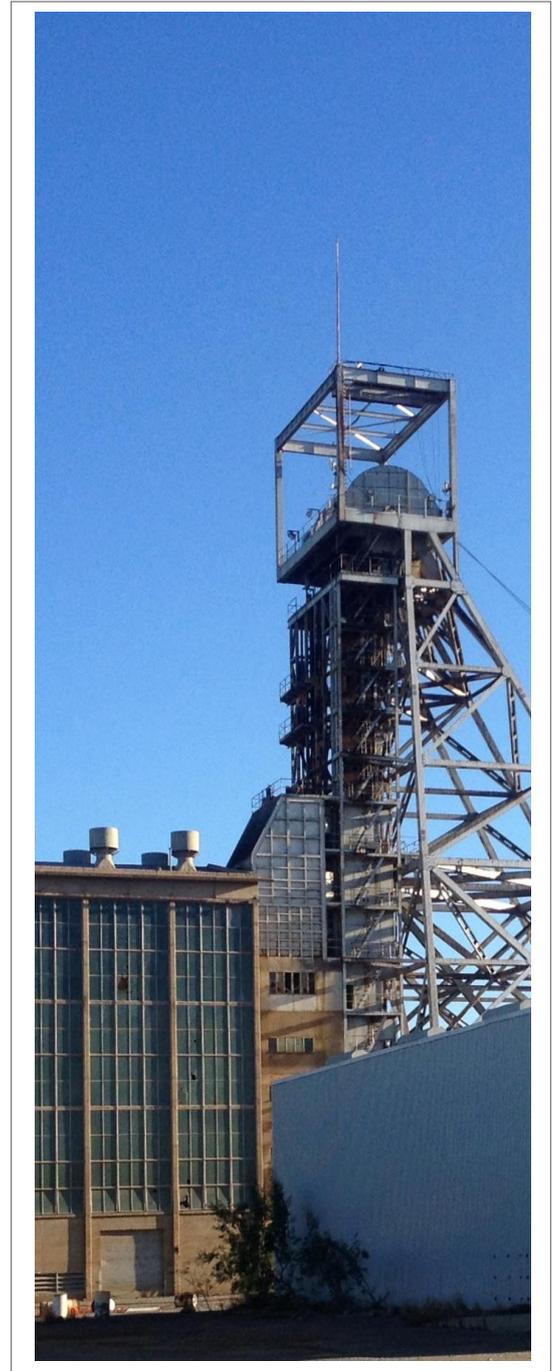


Air Quality Management Plan

(Revision 1.2, April 2020)

Broken Hill North Mine



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TITLE BLOCK

Name of Mine:	Broken Hill North Mine
Development Application Number	SSD 7538
Applicant	Perilya Broken Hill Limited
Development Consent Date	Approved - 22 December 2017, Last Modified - 31 July 2019 (Mod 2)
Development Consent Condition Number & Title	Condition 5 of Schedule 3 Air Quality Management Plan

VERSION CONTROL

SUMMARY OF DOCUMENT REVISIONS				
Rev. No.	Date Revised	Section Revised	Revision Description	Revision Authority
A	3/10/2018	ALL	Issued for INTERNAL Review	J Cox, B Bussell and M. Bland
B	3/10/2018	ALL	Issued for AGENCY Review	G. Hender
C	18/11/18	Various	Issued for SECRETARY'S Approval	G. Hender
D	07/12/18	Various	Issued for SECRETARY'S Approval (following receipt of DPE comments)	G. Hender
E	14/12/18	9	Issued for SECRETARY'S Approval (following receipt of DPE 2 nd comments)	G. Hender
F	21/12/18	9, 10	Issued for SECRETARY'S Approval (following receipt of DPE 3 rd comments)	G. Hender
G	10/11/19	8, 9, 10, 11, 12	Issued for SECRETARY'S Approval (following completion of AQMP Audit (Schedule 3, Condition. 12) and Independent Audit (Schedule 4, Condition 12)	G. Hender
H	22/01/20	11	Issued for SECRETARY'S Approval following receipt of EPA feedback dated 22/01/20	G. Hender
I	20/2/20	Various	Modified following DPIE review dated 21 February 2020	G. Hender
I.2	3/4/20	1, 8, 9,10, 11, 12	Modified following DPIE review dated 1 April 2020	G. Hender

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CONTENTS

1	Introduction and Scope.....	9
2	Project Description.....	9
3	Consultation	13
4	Environmental Management System.....	13
5	Legal and Other Requirements	14
5.1	Legislation	14
5.2	Conditions of Consent.....	14
5.3	Environment Protection License.....	17
5.4	Mining Leases	18
5.5	Guidelines, Policies and Standards	18
6	Environmental Risk	20
6.1	Risks Associated with Particulate Matter	20
6.2	Risks Associated with Lead	20
6.3	Risk Assessment.....	21
6.3.1	Human Health Risk Assessment	21
6.3.2	Particulate Matter	21
7	Existing Environment	25
7.1	Deposited Dust	25
7.2	Total Suspended Particulates	25
7.3	PM ₁₀ and PM _{2.5}	25
7.4	Lead in Soils.....	25
8	Air Quality Criteria.....	31
8.1	Compliance Criteria	31
8.2	Assumed Air Quality Modelling Criteria	31
9	Management and Mitigation Measures	32
10	Air Quality Monitoring Program	32
10.1	Purpose and Overview.....	32
10.2	Monitoring Parameters and Frequency.....	37
10.3	Monitoring Locations and Equipment	38
10.4	Meteorological Monitoring.....	40
10.4.1	Predictive Meteorology.....	40
10.4.2	Real-time Meteorological Monitoring.....	40
10.5	Real-time PM ₁₀ Monitoring	41
10.6	Total Suspended Particulates	41
10.7	Deposited Dust	41

10.8	Stack Monitoring.....	42
10.9	Paved Road Silt Loading.....	42
10.10	Free Area Emission Control Factor	43
10.11	Daily and Ad-Hoc Visual Inspections.....	43
10.12	Portable PM ₁₀ Monitoring	43
10.13	Odour Management	43
10.14	Cumulative Air Quality Monitoring and Impacts	44
10.15	Monitoring Equipment Inspection and Calibration	44
11	Trigger Action Response Plan.....	45
12	Data Management and Reporting	50
12.1	Sample Collection, Data Receipt, Analysis and Storage	50
12.2	Data Validation and Quality Control.....	50
12.3	Reporting	52
13	Incident and Non-compliance Reporting	52
13.1	Incident and Non-compliance Management.....	52
13.2	Emergency Management Process	53
13.3	Complaints Management Process	53
14	Training and Awareness.....	53
15	Roles and Responsibilities.....	54
16	Review and Revision Process	54
17	References.....	55

APPENDICES

Appendix 1	Air Quality Monitoring Locations.....	57
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FIGURES

Figure 1	Approved Mine Site Layout	11
Figure 2	Approved Limit of Mining	12
Figure 3	DEPOSITED DUST LEVELS – 2010 to 2019	26
Figure 4	TSP CONCENTRATIONS – 2010 to 2019	27
Figure 5	PM ₁₀ CONCENTRATIONS – RASP MINE	28
Figure 6	Blood Lead Level Assessment Districts.....	30
Figure 7	North Mine Air Quality Monitoring Locations	39
Figure 8	EXAMPLE OF DUSTX FORECAST TOOL	40

TABLES

Table 1	Conditions of Consent associated with the Air Quality Management Plan.....	15
Table 2	EPL 2683 Licence Conditions associated with the Air Quality Management Plan.....	17
Table 3	Mining lease conditions associated with the air quality management plan	18
Table 4	Summary of ranking groups.....	22
Table 5	TSP emissions - Ranking of Activities	23
Table 6	PM ₁₀ Emissions - Ranking of Activities.....	23
Table 7	Pb emissions - Ranking of Activities.....	23
Table 8	Ranking of Off-site Impacts.....	24
Table 9	Broken Hill Soil Lead Concentrations.....	29
Table 10	Air Quality Compliance Criteria	31
Table 11	Assumed Air Quality Modelling Criteria	32
Table 12	Management and Mitigation Measures - Air Quality.....	33
Table 13	Monitoring Parameters	37
Table 14	Monitoring Locations and Equipment	38
Table 15	Inspection and Calibration Schedule for Air Quality Monitoring Equipment.....	44
Table 16	Trigger Action Response Plans.....	46
Table 17	Roles and Responsibilities.....	54

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1 Introduction and Scope

This *Air Quality Management Plan* (AQMP) is one of several management plans required by the Development Consent Conditions of SSD 7538. These other plans are listed in Section 4. The overarching document in this list is the *Environmental Management Strategy* for the Broken Hill North Mine which contextualises each of the subordinate management plans and includes generic systems-based details that are common to all plans.

The current document describes the management of air quality associated with the operational phase of the Broken Hill North Mine (the North Mine). This document specifically addresses the requirements of Condition 5 of Schedule 3 of SSD7538.

Responsibility for preparation of the original version of this document was as follows.

- RW Corkery & Co Pty Limited (RWC) – prepared the initial draft of this document based on the *Construction Air Quality Management Plan*, ensuring consistency between this document and the commitments made throughout the development application process. RWC also provided administrative assistance in the finalisation of this report.
- ERM (formerly Pacific Environment) – Ms Judith Cox of ERM was endorsed as a suitably qualified and experienced person by the Secretary on 25 January 2018. Ms Cox reviewed the modelling results to determine the most significant sources of particulate matter (and lead) emissions from the Mine Site. That information was then used by Ms Cox to inform the risk assessment and proposed management measures. In the absence of specific guidance for lead mining, and due to the similarities in activities that generate dust, management measures have been developed with reference to the *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining* (Donnelly et al, 2011). Finally, Ms Cox also reviewed and amended as required all remaining sections.
- Perilya Broken Hill Limited (PBHL) – was intimately involved in all stages of the preparation of this document and reviewed and approved the document for release.

Subsequent revisions have been prepared by PBHL or RWC, with input from Ms Cox as required.

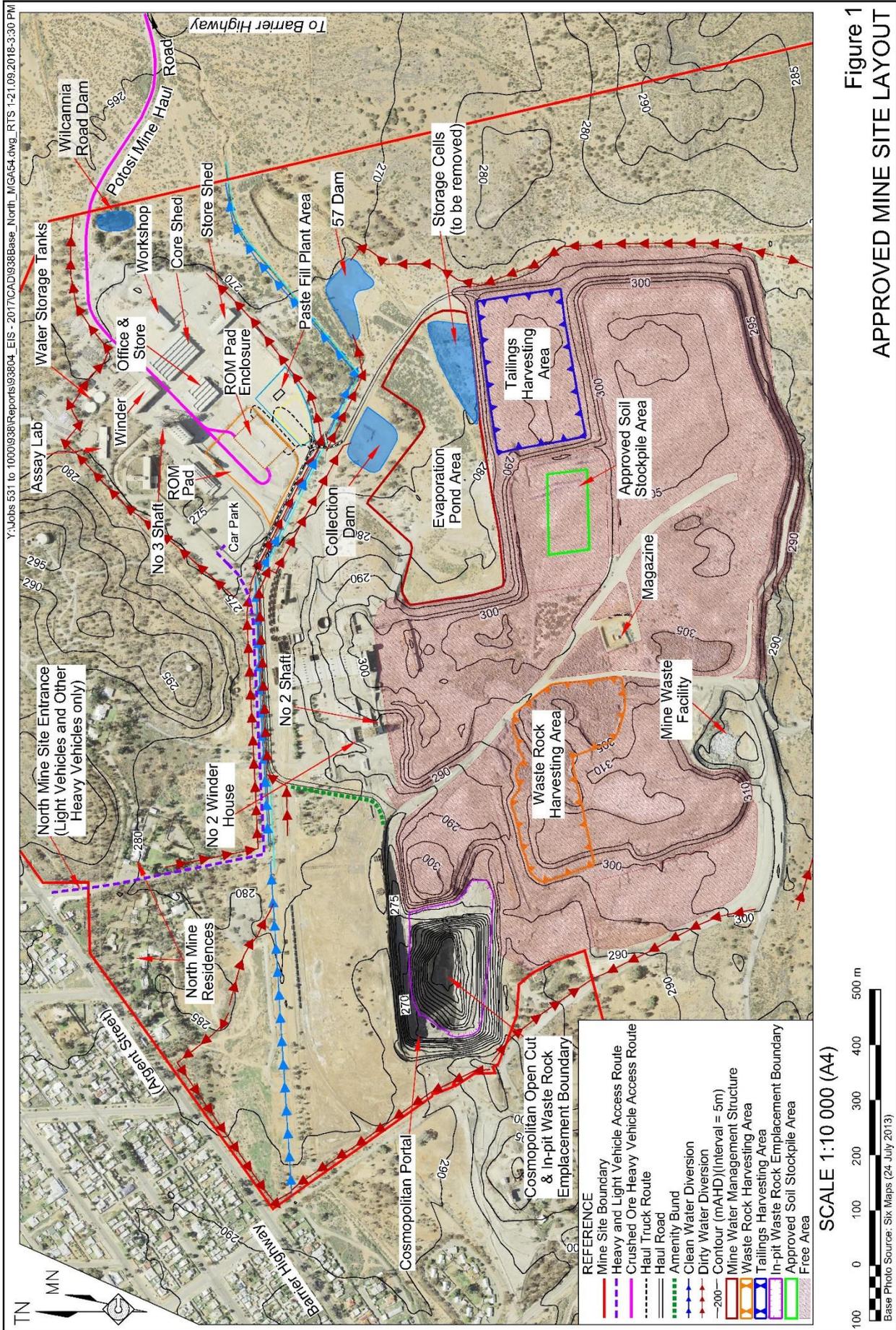
2 Project Description

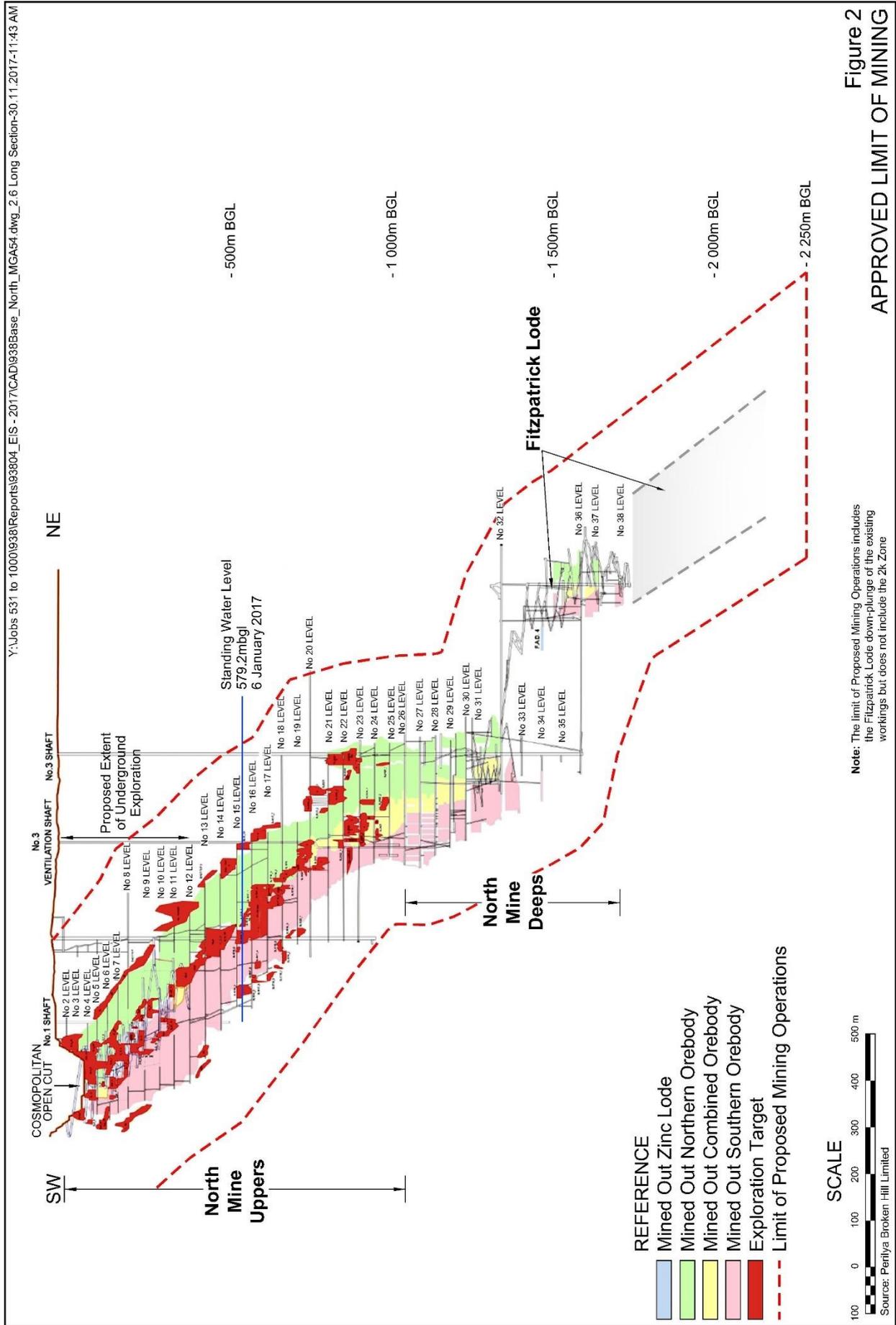
The North Mine first started operations in 1883. Perilya Broken Hill Limited (PBHL) acquired assets of Pasminco Ltd in Broken Hill, including the North and South Mines, in 2002. Operations recommenced at the North Mine in 2003, with ore crushed from the North Mine and transported to PBHL Southern Operations (Southern Ops) for processing. The North Mine was placed under care and maintenance in August 2008. Underground exploration and maintenance re-commenced in April 2017.

Development Consent SSD7538 for the recommencement of mining operations was granted under Section 89E of the *Environmental Planning and Assessment Act 1979* on the 22 December 2017 and subsequently modified on 9 September 2018.

The approved activities include the following (**Figures 1 and 2**).

- Remediate the existing Cosmopolitan access ramp, portal and decline to the 12 Level (the limit of the existing decline) to facilitate safe and efficient access to the underground workings.
- Restore and upgrade existing electrical, ventilation, air and water services, including on surface and within the decline, No. 2 and No. 3 Shafts, No. 3 Vent Rise.
- Extend the existing decline from the 12 Level to link with the existing decline between the 32 Level and the 38 Level.
- Undertake exploration drilling from underground to further define remnant ore and identify additional ore lenses and lodes.
- Develop access drives to permit access by modern mining equipment.
- Extract remnant ore and ore below the base of previous mining operations, including within the Fitzpatrick Area.
- Transport extracted ore to the surface ROM Pad using underground haul trucks, including establishment of a haulage route utilising existing roads and a proposed haul road cutting.
- Transport extracted waste rock for placement either within completed stopes underground or within the in-pit waste rock emplacement in the Cosmopolitan Open Cut.
- Extract waste rock from the existing surface waste rock emplacement for transportation back underground as required.
- Extract tailings from a former Tailings Storage Facility for mixing with water and cement in a pastefill plant for use backfilling completed stopes.
- Re-establish surface infrastructure required to support the mining operation, including a ROM pad, office and store, workshop and fuel store, change house and car park, services (power, water, air and communications), surface magazine and ancillary infrastructure.
- Crush stockpiled ore within the ROM Pad enclosure using a mobile crusher.
- Load and transport the crushed ore to the Southern Operations using A-double road trains via the approved transport route, namely the Potosi Mine Haul Road, Barrier Highway, Iodide Street, Crystal Street and Gypsum Street.
- Process the transported ore within the Southern Operations Concentrator under the continuing use rights held for that operation.
- Dewater the existing workings and transfer that water to on site evaporation ponds or the Southern Operations.





3 Consultation

Revision F of this document was approved by the Secretary and a description of consultation associated with that and earlier revisions has been removed from this document.

Revision G of this document was provided to the Environment Protection Authority and NSW Health for comment. The following feedback was received.

The following consultation related to the preparation of Revision G of this Management Plan was undertaken.

- Environment Protection Authority – 22 January 2020

The Environment Protection Authority indicated that it had no objection to the removal of TARP AQ5 related to the monitoring of deposited dust levels provided that PBHL undertake regular reviews of deposited dust levels against meteorological data and other air quality data being collected. These procedures are embodied in Section 12. As a result, TARP 5 has been removed.

The Environment Protection Authority, however, requested that TARP AQ2 related to the use of meteorological monitoring be retained. This TARP has been reinstated into this document.

- NSW Health – 14 February 2020

NSW Health indicated that it had no additional comments in relation to Revision G of this document.

Revision H of this Management Plan was submitted to the Department of Planning, Industry and Environment for Secretary's approval on 22 January 2020. The following feedback was received.

- Department of Planning, Industry and Environment – 21 February 2020

Department of Planning, Industry and Environment provided a range of comments in relation to Revision H of this Document, primarily related to matters of clarity and consistency. These matters have been addressed in this document (Revision I).

4 Environmental Management System

The Environmental Management System for the North Mine comprises the following principal documents.

- Environmental Management Strategy (EMS).

The EMS defines the broader environmental management system requirements that are common to all relevant environmental aspects for the construction phase of the North Mine,

- Air Quality Management Plan.
- Noise Management Plan.
- Blast Management Plan.
- Transportation Management Plan.
- Water Management Plan.

- Historic Heritage Management Plan.
- Aboriginal Cultural Heritage Chance Finds Protocol.
- *Rehabilitation Management Plan* (to be prepared at a later date).

A range of Standard Operating Procedures (SOPs) are in place to manage implementation of the above Management Strategy and Management Plans. These SOPs provide operational personnel with a detailed description of how each of the identified measures is to be implemented. These SOPs are live documents and are introduced, amended, removed and replaced as required. The SOPs relevant to management of Air Quality within the Mine Site as of the date of finalisation of the current version of this document are as follows.

- H02FO3SOP3335 - Procedure for Environmental Monitoring

5 Legal and Other Requirements

A range of approvals, licenses and consents exist for the North Mine, each of which include conditional requirements. The following subsections present the statutory commitments relevant to this *Air Quality Management Plan*.

5.1 Legislation

The following sections of the *Protection of the Environment Operations Act 1997* (POEO Act) are relevant to this Plan.

- Section 124 makes it an offence to operate any plant (other than domestic plant) at the premises in such a manner as to cause air pollution from the premises if the air pollution is caused by the occupier's failure to maintain the plant in an efficient condition, or to operate the plant in a proper and efficient manner.
- Section 126 makes it an offence to fail to deal with "materials" in a proper and efficient manner that results in air pollution.
- Section 129 states that the occupier of a premise must not cause or permit, the emission of any offensive odour.
- Section 148 imposes a duty on employers and employees to notify the EPA (or local council) where a pollution incident causes or threatens material harm to the environment.

5.2 Conditions of Consent

Development Consent SSD7538 was granted on 22 December 2017. Conditional requirements identified in SSD7538 that are relevant to this *Air Quality Management Plan* are reproduced in **Table 1** with a reference provided to the section(s) of this document where each conditional requirement is addressed.

Table 1 Conditions of Consent associated with the Air Quality Management Plan (Cont'd)

Page 2 of 2

Cond No	Conditions of Consent	Document Reference
3(5)	Prior to commencing construction, unless the Secretary agrees otherwise, the Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Secretary. This plan must:	
	(a) be prepared in consultation with the EPA and NSW Health;	Sect 3
	(b) be prepared by a suitably-qualified expert whose appointment has been endorsed by the Secretary;	Sect 1
	(c) describe the measures that would be implemented to ensure compliance with the relevant air quality criteria and operating conditions of this consent;	Sects 9 to 11
	(d) describe the air quality management system in detail;	Entire document
	(e) include an air quality monitoring program that: <ul style="list-style-type: none"> • adequately supports the air quality management system; • uses monitors to evaluate the performance of the development against the air quality criteria in the consent and relevant NSW criteria; • includes a combination of fixed and real-time air quality monitoring instruments to guide the implementation of air quality mitigation measures to ensure compliance with the relevant conditions of this consent; • includes a program to monitor all stack and vent shaft emissions; • validates nickel and mercury emissions through post commissioning monitoring, and proposes additional mitigation measures if elevated mercury or nickel occur; • evaluates and reports annually on: <ul style="list-style-type: none"> – the effectiveness of the air quality management system; and – compliance with the air quality criteria and operating conditions in this consent; • defines what constitutes an air quality incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents; and • outlines procedures to manage responses to any complaints or issues raised by the owners of affected residences. 	Sect 10
3(6)	The Applicant must implement the approved Air Quality Management Plan for the development.	Noted
3(12)	Within 1 month of commencing mining operations, and every 2 years thereafter, unless the Secretary agrees otherwise, the Applicant must undertake an audit of the air quality and health management measures required under this consent. This audit must:	
	(a) be conducted by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Secretary;	Noted
	(b) assess the proposed and/or implemented management measures with respect to dust and lead management in accordance with conditions 3, 4, 5 and 8 of schedule 3 of this consent, and best practice; and	
	(c) recommend actions to improve these measures if required.	
3(13)	Within 3 months of undertaking this audit, unless otherwise agreed with the Secretary, the Applicant must submit a copy of the audit report to the Secretary, together with a response to any recommendations contained in the audit report. The Applicant must implement the audit recommendations, to the satisfaction of the Secretary.	Noted
3(14)	Prior to commencing construction, and for the life of the development, the Applicant must ensure that there is an on-site meteorological station that:	
	(a) complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline; and	Sect 10.4.2
	(b) is capable of continuous real-time measurement of temperature inversions in accordance with the NSW Industrial Noise Policy, unless a suitable alternative is approved by the Secretary following consultation with the EPA.	
3(26)	The Applicant must:	
	(a) ensure that:	Sect 9
	(point 3) all trucks leaving the site pass through an effective wheel cleaning facility	
	(point 4) trucks used for ore haulage pass through an effective truck washing facility at least once a week	

5.3 Environment Protection License

A variation to Environment Protection License (EPL) 2683 was issued 6 July 2018. The licence currently applies to both the North Mine and Potosi Mine sites. Conditional requirements identified in EPL 2683 that are relevant to this *Air Quality Management Plan* are reproduced in **Table 2** with a reference provided to the section(s) of this document where each conditional requirement is addressed.

Table 2 EPL 2683 Licence Conditions associated with the Air Quality Management Plan

Cond No	Conditions of Consent	Document Reference																									
O3.1	The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.	Sect 9																									
O3.2	Trucks entering and leaving the premises that are carrying loads must be covered at all times, except during loading and unloading.	Sect 9																									
M2.1	For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:	Sect 10																									
M2.2	Point 16, 17, 19, 20, 22, 23, 24, 25	Sect 10																									
	<table border="1"> <thead> <tr> <th>Pollutant</th> <th>Units of measure</th> <th>Frequency</th> <th>Sampling Method</th> </tr> </thead> <tbody> <tr> <td>Particulates - Deposited Matter</td> <td>grams per square metre per month</td> <td>Monthly</td> <td>AM-19</td> </tr> <tr> <td>Total lead</td> <td>grams per square metre per month</td> <td>Monthly</td> <td>AM-19</td> </tr> </tbody> </table>	Pollutant	Units of measure	Frequency	Sampling Method	Particulates - Deposited Matter	grams per square metre per month	Monthly	AM-19	Total lead	grams per square metre per month	Monthly	AM-19														
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M3.1	Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with: <ul style="list-style-type: none"> a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place. 	Sect 10																									
M4.1	At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively. <p>Point 28</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Sampling method</th> <th>Units of measure</th> <th>Averaging period</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>Rainfall</td> <td>AM-4</td> <td>millimetres per hour</td> <td>1 hour</td> <td>Continuous</td> </tr> <tr> <td>Wind Direction at 10 metres</td> <td>AM-2 & AM-4</td> <td>Degrees</td> <td>30 minutes</td> <td>Continuous</td> </tr> <tr> <td>Wind Speed at 10 metres</td> <td>AM-2 & AM-4</td> <td>metres per second</td> <td>30 minutes</td> <td>Continuous</td> </tr> <tr> <td>Temperature at 10 metres</td> <td>AM-4</td> <td>degrees Celsius</td> <td>1 hour</td> <td>Continuous</td> </tr> </tbody> </table>	Parameter	Sampling method	Units of measure	Averaging period	Frequency	Rainfall	AM-4	millimetres per hour	1 hour	Continuous	Wind Direction at 10 metres	AM-2 & AM-4	Degrees	30 minutes	Continuous	Wind Speed at 10 metres	AM-2 & AM-4	metres per second	30 minutes	Continuous	Temperature at 10 metres	AM-4	degrees Celsius	1 hour	Continuous	Sect 10
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Temperature at 10 metres	AM-4	degrees Celsius	1 hour	Continuous																							

5.4 Mining Leases

Consolidated Mining Leases (CMLs) 4 and 5 have been renewed until 23 June 2024 and 17 June 2021. Conditional requirements identified in CML4 and 5 that are relevant to this AQMP are reproduced in **Table 3** with a reference provided to the section(s) of this document where each conditional requirement is addressed.

Table 3 Mining lease conditions associated with the air quality management plan

Cond No	Conditions of Consent	Document Reference
2	The proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.	Sects 9 to 11
18	Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.	Sects 9 to 11

5.5 Guidelines, Policies and Standards

Air quality management at the North Mine will be undertaken with reference to the Environment Protection Authority approved methods:

General

- Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Environment Protection Authority, 2016).
- AS/NZS 3580.14:2014 : Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications
- NSW EPA Requirements for publishing pollution monitoring data. October 2013
- NSW EPA Air Quality Guidance Notes for Construction Sites

Ambient Air Monitoring

- AM-2 Guide for measurement of horizontal wind for air quality applications - AS 2923-1987 Ambient Air - Guide for Measurement of Horizontal Wind for Air Quality Applications
- AM-4 Meteorological monitoring guidance for regulatory modelling applications - USEPA (2000) EPA 454/R-99-005 - *Meteorological Monitoring Guidance for Regulatory Modelling Applications*
- AS/NZS 3580.9.3:2015 : Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - Total suspended particulate matter (TSP) - High volume sampler gravimetric method
- AS/NZS 3580.1.1:2016 : Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment

Deposited Dust Monitoring

- AM-19 Particulates – deposited matter – gravimetric method - AS/NZS 580.10.1:2016 - Methods for sampling and analysis of ambient air - Determination of particulate matter - Deposited matter - Gravimetric method²
- Method APHA 3030 – *Preliminary Treatment of Samples* (Preparation of samples)
- Method APHA 3111B – *Direct Air-Acetylene Flame Method* (Measurement of lead)

Total Suspended Particulates

- AS/NZS 3580.9.3:2015 - Methods for sampling and analysis of ambient air Method 9.3: Determination of suspended particulate matter—Total suspended particulate matter (TSP)— High volume sampler gravimetric method
- AS/NZS 3580.9.15:2014 : Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - Particulate metals high or low volume sampler gravimetric collection - Inductively coupled plasma (ICP) spectrometric method³

PM₁₀

- AS/NZS 3580.9.11:2016 : Methods for sampling and analysis of ambient air - Determination of suspended particulate matter - PM₁₀ beta attenuation monitors⁴

Stack Monitoring

- TM-1 Selection of sampling positions - AS 4323.1-1995 Stationary source emissions Selection of sampling positions
- TM-2 Velocity or volumetric flow rate or temperature or pressure of stack gases
- TM-12 Type 1 substances (elements antimony (Sb), arsenic (As), cadmium (Cd), lead (Pb) or mercury (Hg) or any compound containing one or more of those elements)
- TM-13 Type 2 substances (elements beryllium (Be), chromium (Cr), cobalt (Co), manganese (Mn), nickel (Ni), selenium (Se), tin (Sn) or vanadium (V) or any compound containing one or more of those elements)
- TM-14 Cadmium (Cd) or mercury (Hg) or any compound containing one or more of those elements
- TM-15 Solid particles (Total) - AS 4323.2-1995 - Stationary source emissions Method 2: Determination of total particulate matter—Isokinetic manual sampling— Gravimetric method
- TM-22 Moisture content in stack gases - USEPA (2000) Method 4 - *Determination of Moisture Content in Stack Gases*.
- TM-24 Carbon dioxide (CO₂) in stack gases - USEPA (1990) Method 3A - Oxygen and Carbon Dioxide Concentrations – Instrumental
- TM-25 Oxygen (O₂) in stack gases USEPA (1990) Method 3A - Oxygen and Carbon Dioxide Concentrations – Instrumental

² It is noted that the Schedule 3, Condition 2, Table 2, note c, refers to the now superseded AS/NZS 3580.10.1:2003.

³ It is noted that EPL2683 references the now superseded *Australian Standard 2800-1985: Ambient Air - Determination of Particulate Lead - High Volume Sampler Gravimetric Collection - Flame Atomic Absorption Spectrometric Method*

⁴ It is noted that Condition M2.2 of EPL2683 refers to the now superseded AS/NZS 3580.9.11 - 2008

6 Environmental Risk

6.1 Risks Associated with Particulate Matter

The Air Quality Assessment prepared to support the application for Development Consent (Pacific Environment, 2017) states that particulate matter has the capacity to affect health and to cause nuisance effects. Particulate matter may be classified as follows.

- TSP – refers to all suspended particles in the air. In practice, the upper size range is typically 30µm to 50µm.
- PM₁₀ – refers to all particles with equivalent aerodynamic diameters of less than 10µm. PM₁₀ are a sub-component of TSP.
- PM_{2.5} – refers to all particles with equivalent aerodynamic diameters of less than 2.5µm diameter. PM_{2.5} are a sub-component of PM₁₀.

The human respiratory system has in-built defensive systems that prevent particles larger than approximately 10µm from reaching the more sensitive parts of the respiratory system. Finer particles may enter the respiratory system and cause health impacts, with PM_{2.5} likely to have a more substantial impact on health than PM₁₀.

The particulate matter compliance criteria identified in Section 8.1 have been determined by the Environment Protection Authority based on the protection of human health.

6.2 Risks Associated with Lead

The *Human Health Risk Assessment* prepared by ToxConsult (2017) states that lead in dust is the principal chemical of concern. This is principally a result of Broken Hill's long history of lead mining and past mining and smelting practices that have resulted in widespread surface soil contamination.

Historically there has been high prevalence of elevated blood lead levels in children in Broken Hill. However, this has progressively decreased from the early 1990's through to 2011, after which concentrations have remained fairly constant.

The EIS prepared to support the application for Development Consent (RWC, 2017) identifies that lead may be absorbed by humans through the following, in order of significance.

- Ingesting dust, soil, water or food that is contaminated with lead.
- Breathing air that contains very fine particles of lead.
- Absorption via the skin.

Lead is toxic to multiple organ systems, and effects may range from enzyme inhibition and anaemia to disorders of the nervous, immune and reproductive systems, impaired kidney and cardiovascular functions, and even death at after very high exposure to lead (blood lead levels above 70µg/dL).

The effects of lead at high levels of exposure include the following.

- Impaired neurodevelopment in children or neurological performance in adults.
- Impact on the blood-making organs and associated anaemia.
- Kidney damage and associated renal impact/failure.
- Cardiovascular effects, including increased blood pressure.

The effects of lead at low exposure (blood lead levels between 5µg/dL and 10µg/dL) include the following.

- A higher occurrence of behavioural problems (poor attention, impulsivity and hyperactivity) in children.
- Delay in physical sexual maturity or onset of puberty.

The effects of lead at very low exposure (blood lead levels less than 5µg/dL) may potentially include reduced average academic achievement and IQ in children.

In light of the above, the National Health and Medical Research Council determined that blood lead levels greater than 5µg/dL should be investigated and reduced.

6.3 Risk Assessment

6.3.1 Human Health Risk Assessment

A *Human Health Risk Assessment* was prepared by ToxConsult (ToxConsult, 2017) to support the application for Development Consent. That assessment determined that the risk associated with emissions of lead from the Mine Site would be negligible. That assessment was based upon particulate emissions determined by the *Air Quality Assessment* (Pacific Environment, 2017). The results and conclusions of the Human Health Risk Assessment, therefore, are predicated on the assumption that the particulate matter concentrations and lead deposition levels determined by Pacific Environment (2017) are complied with.

6.3.2 Particulate Matter

6.3.2.1 Introduction

In order to determine those activities with the greatest potential to result in particulate matter concentrations and lead deposition rates that exceed those identified by Pacific Environment (2017) a risk ranking for particular sources was completed to guide the development of this Plan.

The ranking of emissions and sensitive-receptor concentrations and lead deposition rates focused on the ore activities, tailings activities and wind erosion from the free areas⁵. The emissions from these activities represented over 90% of the total calculated emissions in the air quality assessment (AQA) (Pacific Environment, 2017).

⁵ Areas that will not be disturbed by PBHL but are still a source of emissions due to wind erosion (see **Figure 1**).

Additional commitments made during the review process, and approved changes under MOD1 were incorporated into the emission inventories developed for the revised AQA. A separate letter report, referred to hereafter as ERM (2018), describes the revised AQA.

Vendor information related to the baghouse stacks and building design were also incorporated.

Table 4 presents how each activity was allocated for the ranking assessment.

Table 4 Summary of ranking groups

Emission Inventory Activity	Ranking Group
Upcast Vent Shaft	Vent shaft
Crusher Baghouse	Baghouse stacks
ORE - Hauling ore from Portal to ROM Pad	Paved roads
ORE - Unloading ore at ROM Pad	Unloading at ROM pad
ORE - FEL Loading ore to crusher	Transfer to/from Crushed Ore Circuit
ORE - Unloading crushed ore to stockpile	Transfer to/from Crushed Ore Circuit
ORE - FEL Loading crushed ore to road trucks	Transfer to/from Crushed Ore Circuit
ORE - Hauling crushed ore out of site (unsealed)	Unpaved roads
TAILINGS - FEL Loading tailings to haul trucks	Tailings Transfer
TAILINGS - Hauling tailings from Tailings Storage Facility to Pastefill Storage Facility (unsealed)	Unpaved roads
TAILINGS - Emplacing tailings at Pastefill Plant Stockpile	Tailings Transfer
TAILINGS - FEL Loading tailings to hopper at Pastefill Plant Stockpile	Tailings Transfer
WE - Rest of site	Wind Erosion Free Areas
Source: ERM (2018) – Table 1	

6.3.2.2 Ranking by Emissions

Tables 5 to 7 present the emissions estimates for TSP, PM₁₀ and lead (Pb) in the TSP fraction, along with their ranking in terms of the magnitude of emissions. Emission estimates and source rankings are also provided with controls applied.

The highest ranking emission source in terms of uncontrolled emissions is unpaved roads when considered TSP emissions and lead in TSP emissions, and wind erosion from the free areas when considering PM₁₀ emissions.

Total emissions of TSP, PM₁₀ and lead (in TSP) can be reduced by between approximately 65% (TSP and PM₁₀) and 75% (lead in TSP), providing that the proposed management and mitigation measures are implemented (see Section 9).

The top four emission sources (including controls) that represent approximately 97% of the total emissions are as follows.

1. Upcast Vent Shaft.
2. Unpaved roads.
3. Paved Roads.
4. Baghouse stacks.

Table 5 TSP emissions - Ranking of Activities

Emission Source Group	TSP Emissions Uncontrolled (kg/y)	Rank TSP Emissions Uncontrolled	TSP Emissions Controlled (kg/y)	Rank TSP Emissions Controlled
Baghouse stacks	1,186	6	1,186	4
Free areas wind erosion	59,743	2	418	6
Paved roads	6,058	4	3,029	3
Tailings transfer	880	7	440	5
Transfer to/from crushed ore circuit	1,760	5	35	7
Unloading at ROM pad	587	8	12	8
Unpaved roads	64,854	1	6,485	2
Upcast vent	44,466	3	44,466	1

Source: ERM (2018) – Table 6

Table 6 PM₁₀ Emissions - Ranking of Activities

Emission Source Group	PM ₁₀ Emissions Uncontrolled (kg/y)	Rank PM ₁₀ Emissions Uncontrolled	PM ₁₀ Emissions Controlled (kg/y)	Rank PM ₁₀ Emissions Controlled
Baghouse stacks	1,186	4	1,186	3
Free areas wind erosion	29,872	1	209	5
Paved roads	1,163	5	581	4
Tailings transfer	416	7	208	6
Transfer to/from crushed ore circuit	832	6	17	7
Unloading at ROM pad	277	8	6	8
Unpaved roads	16,541	3	1,654	2
Upcast vent	22,233	2	22,233	1

Source: ERM (2018) – Table 7

Table 7 Pb emissions - Ranking of Activities

Emission Source Group	Pb Emissions Uncontrolled (kg/y)	Rank Pb Emissions Uncontrolled	Pb Emissions Controlled (kg/y)	Rank Pb Emissions Controlled
Baghouse stacks	101	3	101	1
Free areas wind erosion	66	4	0	8
Paved roads	50	5	25	4
Tailings transfer	7	8	4	5
Transfer to/from crushed ore circuit	150	2	3	6
Unloading at ROM pad	50	6	1	7
Unpaved roads	331	1	33	3
Upcast vent	35	7	35	2

Source: ERM (2018) – Table 8

6.3.2.3 Ranking by Impact

Source contribution to air pollution levels at receptors does not always translate to being due to the highest source emissions as it is a function of:

- the location of a receptor in relation to an emission source (including intervening terrain); and
- local meteorology

The dispersion modelling completed for the revised AQA was updated with the changes discussed in Section 6.3.2.1, with the aggregated annual average impacts at the most impacted Project-related receptor and the top nine non-Project related receptors used to determine the ranking presented in **Table 8**.

Table 8 Ranking of Off-site Impacts

Activity Group	Off-site Annual Impact Ranking*			
	PM ₁₀	Dust Deposition	Pb Concentration	Pb Deposition
Baghouse stacks	4	4	2	1
Free areas wind erosion	5	5	8	8
Paved roads	2	2	1	2
Tailings transfer	6	6	6	6
Transfer to/from crushed ore circuit	7	7	5	5
Unloading at ROM pad**	8	8	7	7
Unpaved roads	3	3	4	4
Upcast vent	1	1	3	3
*based on aggregated annual impact of most-impacted Project-Related receptor and top nine impacted non-project related receptor				
** this activity will take place in the ROM Pad enclosure				
Source: ERM (2018) – Table 9				

As with the controlled emissions, the unpaved roads, paved roads, the upcast vent rise and the baghouse stacks are shown to have the most impact at the off-site receptors.

6.3.2.4 Dust Management Prioritisation

Based on the analysis of the air emissions inventory and the dispersion modelling, the following risk ranking has been developed. This risk ranking, from most significant (No. 1) to least significant (No. 7) has been used to inform the management and mitigation measures identified in Section 9.

- 1 Paved roads
- 2 Upcast vent
- 3 Baghouse stacks
- 4 Unpaved roads
- 5 Tailings transfer
- 6 Transfer to/from crushed ore circuit
- 7 Free areas wind erosion

7 Existing Environment

7.1 Deposited Dust

The annual average dust deposition level for four dust deposition sites identified on EPL 2683 (see Section 10.3 and **Figure 7**) for the period 2010 to 2019 varies from 0.8g/m²/month and 6.1g/m²/month. **Figure 3** presents monthly data for this period.

The annual average deposited lead levels for all recorded data during this period varies from 0.0018g/m²/month to 0.0108g/m²/month. There are no relevant guidelines for Pb levels in deposited dust.

7.2 Total Suspended Particulates

Total suspended particulate (TSP) concentrations have historically been measured within the Mine Site at EPA26 (see Section 10.3 and **Figure 7**). Annual average TSP concentrations between 2010 and 2018 were between 20µg/m³ and 72µg/m³, less than the annual guideline value of 90µg/m³ (**Figure 4**). The annual average TSP concentration for 2019 was 96µg/m³. This result is attributable to the extraordinary dust storm events that affected NSW as a whole between September and December 2019.

The annual average Pb concentration in TSP at EPA26 for all recorded data between 2010 and 2018 were between 0.04µg/m³ and 0.21µg/m³ (**Figure 4**). The annual average Pb concentration for 2019 was 0.19µg/m³.

7.3 PM₁₀ and PM_{2.5}

Monitoring of PM₁₀ and PM_{2.5} using real-time Beta-attenuation monitors commenced at EPA29 and EPA31 on 1 July 2018 and 22 August 2018 respectively (see Section 10.3 and **Figure 7**). Data is collected in 15-minute increments and is averaged to arrive at 24-hour average concentrations for PM₁₀ and PM_{2.5} (**Figure 5**). In summary, 24-hour PM₁₀ and PM_{2.5} concentrations typically are less than 50µg/m³ and 25µg/m³ respectively, with exceedances of these concentrations typically during the warmer months when regional dust events are common.

7.4 Lead in Soils

The following information has been largely sourced from ToxConsult (2017), presented as Appendix 2 of the *Response to Submissions* prepared to support the application for development consent. Readers looking for a more detailed review of residual lead in the environment surrounding the Mine Site are referred to that document.

ToxConsult (2017) determined that within Broken Hill, ingestion of soil and dust was determined to be the most likely exposure pathway for lead to enter the human body, particularly for the most at-risk age group of young children. In particular, hand-to-mouth transfer within this age group is widely acknowledged as a significant contributor to ingestion of lead. As a result, existing soil lead levels are important in determining risks associated with blood lead levels in surrounding residents.

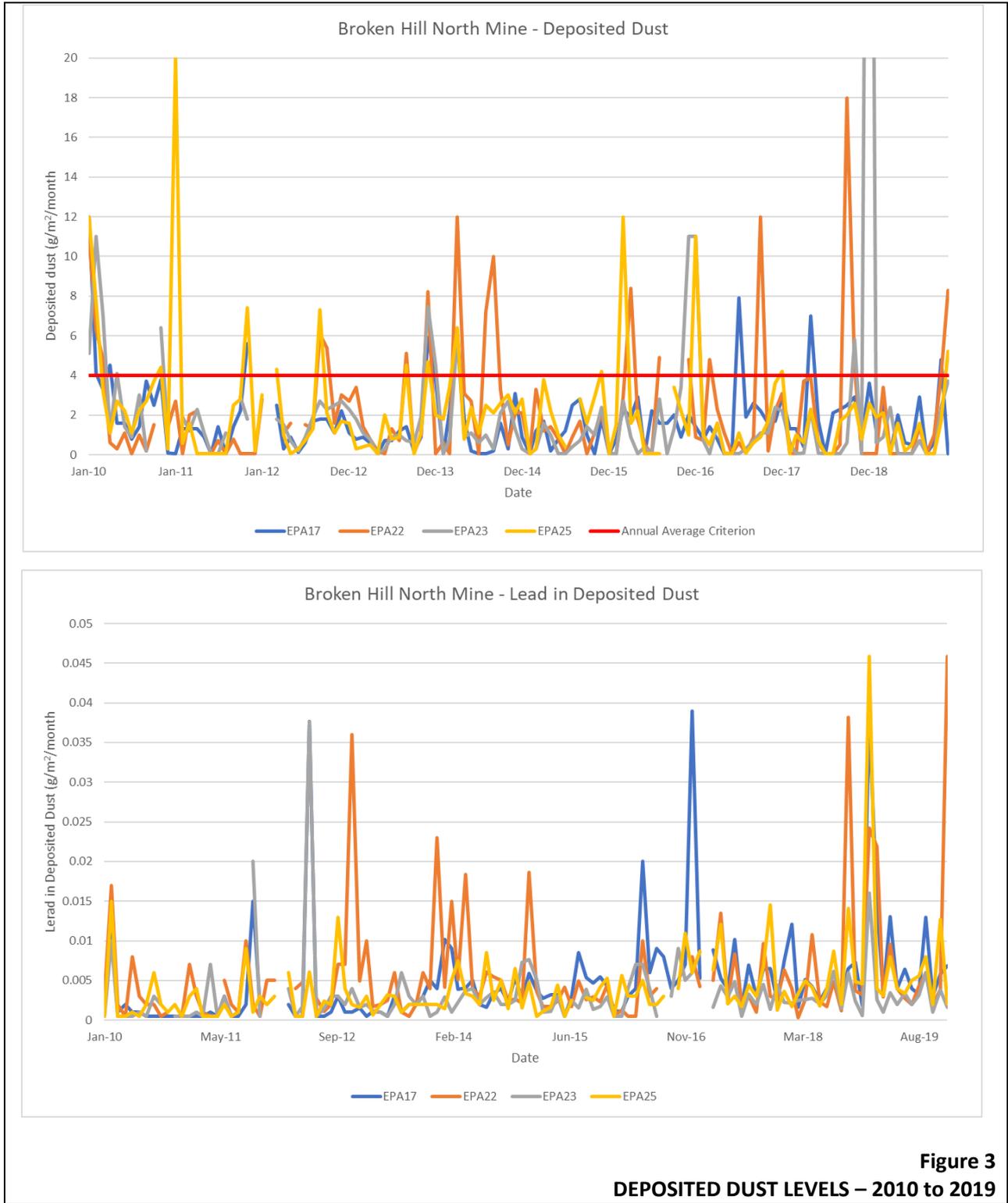


Figure 3
DEPOSITED DUST LEVELS – 2010 to 2019

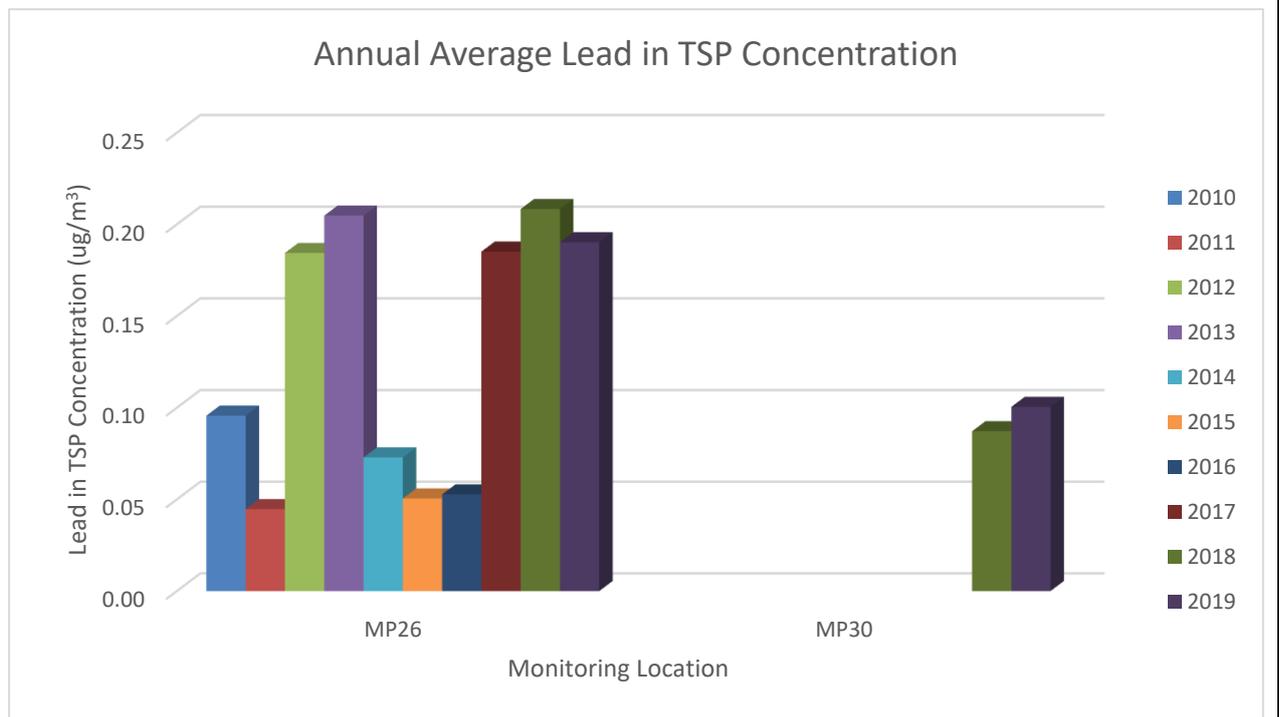
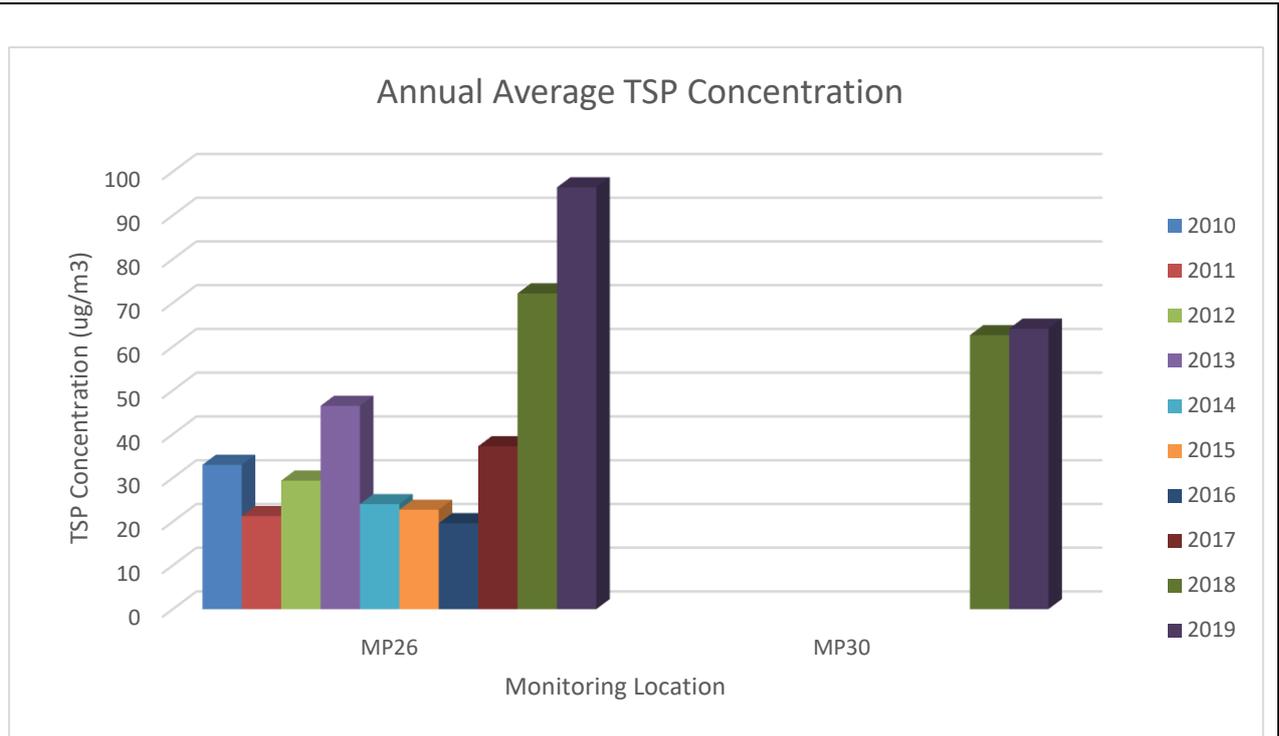


Figure 4
TSP CONCENTRATIONS – 2010 to 2019

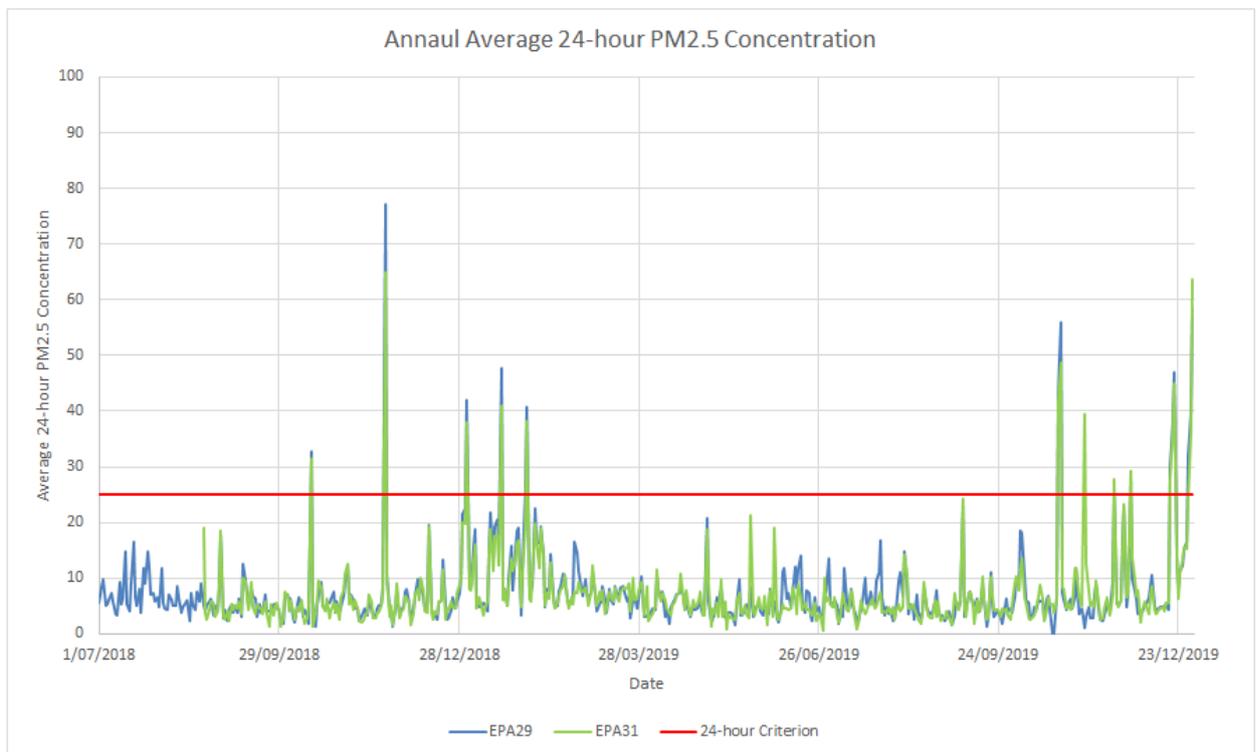
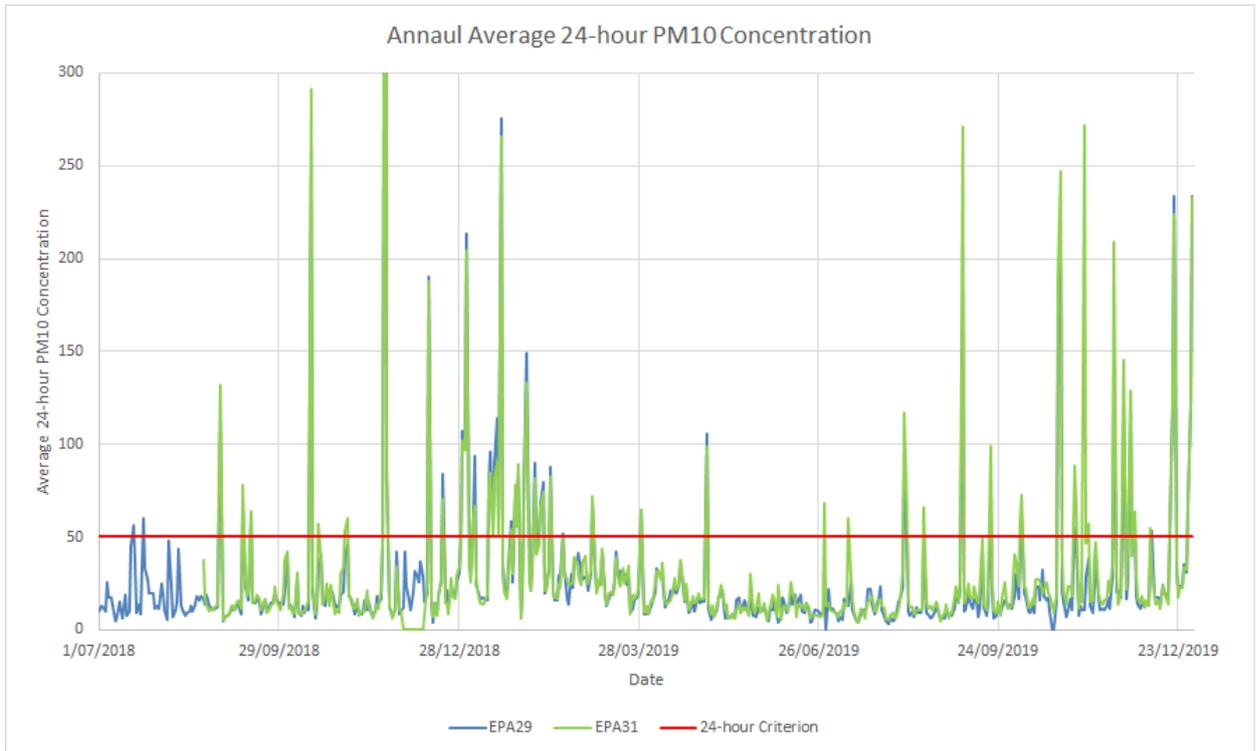


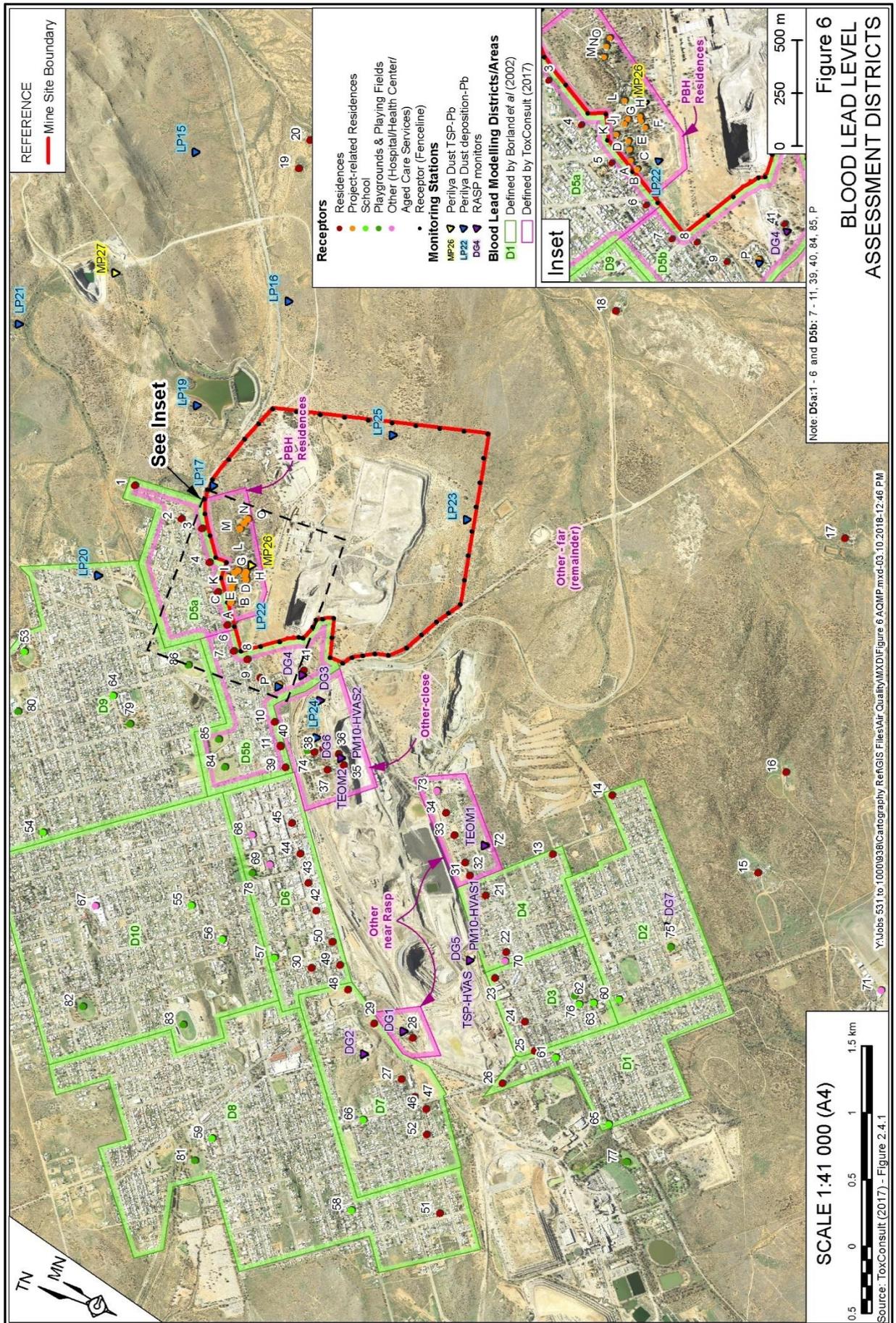
Figure 5
PM₁₀ CONCENTRATIONS – RASP MINE

Elevated lead levels in soils are a natural feature of Broken Hill with the Line of Lode exposed at the surface at the time it was discovered in 1883. However, since that date, continuous mining operations, including historic smelting and poor (by current standards) tailings and waste rock management practices, and historical use of leaded petrol and paint have resulted in substantial additions of lead to soils.

ToxConsult (2017) established 15 assessment districts/areas, including those identified by the NSW Department of Rural Health (Boreland et al, 2002) (**Figure 6**). **Table 9** presents the soil lead levels associated with each of the surrounding districts. In summary, Districts 6 and 7 have the highest soil lead concentrations of 1 125µg/g. The non-North Mine related district most likely to be affected by mining activities within the Mine Site is District 5A, with a soil lead concentration of 275µg/g.

Table 9 Broken Hill Soil Lead Concentrations

District/Area	Existing Mean Soil Lead Concentration (µg/g)	Number of Samples	Soil Lead Concentration Range (µg/g)
D1	733	8	101 – 1 810
D3	733		
D4	733		
Other - near Rasp	733		
D2	275	30	41.3 - 922
D5a	275		
D5b	275		
D8	275		
D9	275		
D10	275		
Other – close	275		
PBHL Residences	275		
D6	1,125	9	71 - 4 644
D7	1,125		
Other – far	100	-	-
Source: ToxConsult (2017) – After Tables 3.4.1 and 3.4.2			



8 Air Quality Criteria

8.1 Compliance Criteria

Table 10 identifies the air quality criteria specified in Conditions 2 and 3 of Schedule 3 of the Development Consent for any residence on privately owned land. In addition, whilst not incorporated in to the Development Consent Conditions for SSD 7538, PBHL has introduced further self-imposed criteria into this plan with respect to the smaller PM_{2.5} air-borne particulate fraction. These criteria are consistent with National Environment Protection (Ambient Air Quality) Measure – standards and goals. The criteria are 24-hour PM_{2.5} < 25 µg/m³ and annual average of 8 µg/m³.

Figure 6 also identifies the locations of surrounding sensitive receptors.

Table 10 Air Quality Compliance Criteria

Pollutant/Aspect	Averaging period	Criterion
Condition 2, Schedule 3 of SSD7538		
Particulate matter < 10 µm (PM ₁₀)	Annual	^a < 25 µg/m ³
	24 hour	^a < 50 µg/m ³
Particulate matter < 2.5 µm (PM _{2.5})	Annual	< 8 µg/m ³
	24 hour	< 25 µg/m ³
Total suspended particulate (TSP) matter	Annual	^a < 90 µg/m ³
^c Deposited dust	Annual	^b < 2 g/m ² /month ^a < 4 g/m ² /month
Lead	Annual	^a < 0.5 µg/m ³
Condition 3, Schedule 3 of SSD7538		
Free Area Emission Control Factor	Not Applicable	99.3%
Maximum ventilation flow	Instantaneous	235 m ³ /s
Notes: ^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources). ^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own). ^c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method ⁶ . ^d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed with the Secretary.		

8.2 Assumed Air Quality Modelling Criteria

Table 11 presents the air quality criteria assumed during modelling for the air quality assessment prepared by Pacific Environment (2017) and presented as Appendix 1 of the *Response to Submissions*. The criteria marked with an * have been embodied in the conditions to SSD7538 and exceedance of these criteria would constitute a non-compliance with the development consent. Exceedance of the remaining criteria would not constitute non-compliance, however, it may indicate that the North Mine's air quality-related impacts are greater than that assumed during preparation of the application for development consent and further investigation may be required.

⁶ It is noted that the Schedule 3, Condition 2, Table 2, note c, refers to the now superseded AS/NZS 3580.10.1:2003. The current standard, AS/NZ 358010.1:2016 will be used to determine insoluble solids.

Table 11 Assumed Air Quality Modelling Criteria

Aspect	Criteria	
	Particulate matter	Metal composition
Surface Areas		
Free Areas (see Figure 1).	99.3% control*	0.11% Pb
Sealed Roads	<2g/m ² ^	0.83% Pb
Ventilation Shaft		
Flow Rate	235m ³ /s	N/A
TSP	1.41g/s	0.0011 g/s
PM ₁₀	0.71g/s	N/A
PM _{2.5}	0.47g/s	N/A
ROM Pad Shed Baghouse Vents		
Flow Rate	19.7m ³ /s	N/A
TSP	0.004g/s	8.5% Pb
PM ₁₀	0.004g/s	N/A
PM _{2.5}	0.001g/s	N/A
^ - Using the methodology described in Section 10.9.		

9 Management and Mitigation Measures

Table 12 indicates management and mitigation measures that will continue to be implemented by PBHL to ameliorate potential air quality-related impacts from the North Mine. It is noted that the management measures are identified in the priority order presented in Section 6.3.2.4.

These measures were determined throughout the approvals process and, in the absence of specific guidance for lead mining, they have been developed with reference to the NSW EPA document *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and / or Minimise Emissions of Particulate Matter from Coal Mining* (Donnelly et al, 2011) (hereafter referred to as the Best Practice Report)

10 Air Quality Monitoring Program

10.1 Purpose and Overview

The purpose of this Air Quality Monitoring Program is to:

- provide for predictive and real-time air quality data to facilitate adaptive management of mining operations within the Mine Site to minimise particulate and lead emissions (Sections 10.4 and 10.5);
- monitor airborne particulates to demonstrate compliance with air quality criteria (Sections 10.5 to 10.8); and
- ensure that emissions are consistent with those assumed modelling parameters during the application for Development Consent for the North Mine (Section Sections 10.9 and 10.10).

Table 12 Management and Mitigation Measures - Air Quality

Page 1 of 4

ID	Mitigation Measure	Timing	Source	Responsibility	Evidence for Compliance
General Operations					
G1	Educate all staff in relation to acceptable/unacceptable visual dust emissions through site inductions and re-inductions and require that all unacceptable dust emissions are reported through the incident management system	Continuous throughout the life of the North Mine	Development Consent (Condition 3(4))	North Mine Manager or delegate	Induction records Incident Management System
G2	Undertake daily informal on-site and off-site inspections for visible dust, address any identified emissions immediately and ensure that all unacceptable dust emissions are reported through the incident management system.	Continuous throughout the life of the North Mine	Response to Submissions (Section 3.5.2.3)	North Mine Manager or delegate	Incident Management System
G3	Limit disturbance to the minimum area necessary for mining and associated activities.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Physical survey markers dated photographs, signage, toolbox meeting notes, Standard Operating Procedures
G4	Limit, where practicable, surface operations during periods of adverse meteorological conditions, including high winds.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Mine record book
G5	Maintain operational exposed areas in a moist condition by using a water cart to water down areas likely to generate wind-blown and traffic-generated dust.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Water truck log book, pump records
G6	Reshape, rip and rehabilitate all completed areas as soon as practicable after the completion of mining operations.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	dated photographs, Annual Reports
G7	Ensure that trucks transporting crushed ore or tailings cover their loads at all times, including using rigid framed covers for ore transport trucks	Continuous throughout the life of the North Mine	Development Consent (Condition 3(3))	North Mine Manager or delegate	Induction records Driver Code of Conduct Toolbox meeting notes Incident reports Loader operator records
G8	Install wheel washing stations at all exit points from operational sections of the Mine Site and ensure that these are used by all vehicles exiting the operational sections of the Mine Site	Complete and continuous throughout the life of the North Mine	Development Consent (Condition 3(3) and 3(26))	North Mine Manager or delegate	Dated photographs
G9	Adhere to all vehicle speed limits.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Induction records, Driver Code of Conduct, Signage, Incident reports

Table 12 Management and Mitigation Measures - Air Quality (Cont'd)

Page 2 of 4

ID	Mitigation Measure	Timing	Source	Responsibility	Evidence for Compliance
General Operations (Cont'd)					
G10	Transport of ore from the mine portal to the run-of-mine pad: 7 am to 6 pm and 7 pm to 6 am, 7 days a week only.	Continuous throughout the life of the North Mine	Air quality assessment	North Mine Manager or delegate	Daily mine reports, toolbox meeting notes, tag board records
G11	Undertake tailings and waste rock harvesting, and transport of ore from the run-of-mine pad to South Mine: 8 am to 6 pm, 7 days a week only.	Continuous throughout the life of the North Mine	Air quality assessment	North Mine Manager or delegate	Daily mine reports, toolbox meeting notes, tag board records
G12	Cover stockpiled tailings within the Pastefill Plant Stockpile Area with tarpaulins or similar.	Continuous throughout the life of the North Mine	Response to Submissions (Section 3.5.2.3)	North Mine Manager or delegate	Dated photographs
G13	Ensure that all North Mine workers are instructed during their induction on the requirement to limit dust emissions and the requirement to report emissions to their supervisor who will then be responsible for either implementing the Trigger Action Response Plans (TARPs) presented in Section 11 or reporting the emissions to their supervisor.	Continuous throughout the life of the North Mine	No	North Mine Manager or delegate	Induction records Incident reports
G14	Minimise the drop height during Paste Fill hopper and truck loading operations at the surface outside of the ROM Pad enclosure	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Induction records
G15	Operate the largest practical truck size to reduce the number of vehicle movements necessary.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Induction records
Unpaved Roads					
UR1	Sheet regularly used unsealed roads with low silt and low lead materials such as coarse crushed waste rock	Continuous throughout the life of the North Mine	No	North Mine Manager or delegate	Mine record book
UR2	Apply water and/ or chemical suppressants (in accordance to the manufacturers specifications) to unpaved roads within trafficked areas to minimise the generation of dust.	Continuous throughout the life of the North Mine	Response to Submissions (Section 3.5.2.3)	North Mine Manager or delegate	Water truck log book, pump records
UR3	Install a water spray system alongside the haul road from the tailings harvesting area to the pastefill plant, and operate this system when the road is used by trucks transporting tailings	Complete and during transportation of tailings	Development Consent (Condition 3(3))	North Mine Manager or delegate	Dated photographs
UR4	Clearly define all unpaved road traffic area with marker posts or speed limit signage to control their location and dust generation.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Dated photographs

Table 12 Management and Mitigation Measures - Air Quality (Cont'd)

Page 3 of 4

ID	Mitigation Measure	Timing	Source	Responsibility	Evidence for Compliance
Unpaved Roads (Cont'd)					
UR5	Close, rip and rehabilitate all obsolete roads.	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Dated photographs
Paved Roads					
PR1	Seal the haul road between the entrance to the mine portal and the ROM pad, and ensure that the width of the sealed road permits trucks to pass, or includes sealed passing lanes	Complete	Development Consent (Condition 3(3))	North Mine Manager or delegate	Dated photographs
PR2	Maintain paved roads with a maximum silt loading of 2g/m ² through the use of a sweeper truck and regular washing of the road.	Continuous throughout the life of the North Mine	Response to Submissions (Section 3.5.2.3)	North Mine Manager or delegate	Monitoring reports Sweeper and water cart logs
Upcast Vent Rise					
V1	Install a variable speed drive fan within the No. 3 vent rise with a maximum ventilation flow rate of 235 m ³ /s, and ensure that the fan is operated at the minimum rate required to ensure safe operation	Complete and continuous throughout the life of the North Mine	Development Consent (Condition 3(3))	North Mine Manager or delegate	Commissioning reports, calibration reports, stack monitoring reports
ROM Pad Enclosure and Baghouse Stacks					
R1	Enclose the crusher and ROM pad (including all stockpile areas) within a building equipped with a negative pressure dust extraction and collection system, and ensure that ore crushing, stockpiling and the unloading/loading of trucks only occurs within the enclosed building	Complete and continuous throughout the life of the North Mine	Development Consent (Condition 3(3))	North Mine Manager or delegate	Dated photographs, construction certificate, commissioning reports
R2	Ensure that the baghouse filtration and exhaust system is maintained to the manufacturers specifications and that the emission criteria identified in Section 8.2 are achieved	Continuous throughout the life of the North Mine	No	North Mine Manager or delegate	Maintenance records Monitoring records
Tailings Transfer					
	See "General Operations" above, particularly G1 to G7, G9 and G11 to G15.				
Transfer to/from Crushed Ore Circuit					
	See "General Operations" above, particularly G1 to G11. G13 and G15.				

Table 12 Management and Mitigation Measures - Air Quality (Cont'd)

Page 4 of 4

ID	Mitigation Measure	Timing	Source	Responsibility	Evidence for Compliance
Wind Erosion from Free Areas					
W1	In 'free areas' (see Figure 1) where testing (see Section 10.10) indicates that the natural surface does not achieve an emission control factor of 99.3% or better, apply a chemical, indicatively a lignosulfonate, based dust suppressant in accordance with the manufacturer's instructions to achieve the required 99.3% emission control factor.	Continuous throughout the life of the North Mine	Development Consent (Condition 3(3))	North Mine Manager or delegate	Dated photographs monitoring results
W2	Where practicable, profile all disturbed surfaces to reduce velocity of overland winds, including following the completion of each tailings or waste rock harvesting program	Continuous throughout the life of the North Mine	EIS (Section 4.2.6)	North Mine Manager or delegate	Dated photographs and monthly/annual reports
Air Quality Monitoring					
MO1	Operate a meteorological station capable of real-time monitoring at location EPA28 consistent with the requirements of Condition 3(14) of SSD 7538 and Condition P1.2 of EPL 2683 and ensure that <ul style="list-style-type: none"> the station is monitored in real-time by the Mine Control Centre; and 	Continuous throughout the life of the North Mine	SSD 7538 - Condition 3(14) EPL 2683 – Condition P1.2	Environment Superintendent	Photographs Initial and annual calibration certificates Mine Control Centre records Data validation records identified in Section 12.2
MO2	Operate a system to proactively predict dust lift off (similar to the KITE Dustx system) as described in Section 10.4.1 and implement the procedures identified in TARP AQ1	Continuous throughout the life of the North Mine	SSD 7538 - Condition 3(4)(e)	Environment Superintendent	Web portal
MO3	Operate a real-time PM ₁₀ monitoring system as described in Section 10.5 and implement the procedures identified in TARP AQ3	Continuous throughout the life of the North Mine		Environment Superintendent	Web portal Initial and annual calibration certificates
MO4	Operate a HVAS monitoring system as described in Section 10.6 and implement the procedures identified in TARP AQ4	Every 6 days		Environment Superintendent	Monitoring records Initial and annual calibration certificates
MO5	Operate a deposited dust monitoring system as described in Section 10.7	Every 30±2 days		Environment Superintendent	Monitoring records Initial and annual calibration certificates
MO6	Operate a stack monitoring system as described in Section 10.8 and implement the procedures identified in TARP AQ6	Annually		Environment Superintendent	Monitoring reports

The Air Quality Monitoring Plan comprises eight components, namely:

- real-time meteorological monitoring program capable of detecting adverse meteorological conditions;
- real-time PM₁₀ monitoring program capable of facilitating adaptive management of particulate emissions within the Mine Site;
- TSP monitoring program;
- deposited dust monitoring program;
- stack monitoring program;
- paved road silt loading monitoring program;
- free areas control level monitoring program; and
- targeted monitoring programs to determine efficacy of mitigation measures

10.2 Monitoring Parameters and Frequency

Table 13 presents the parameters to be monitored and frequency of monitoring to be completed. Sections 10.4 to 10.11 present a detailed description of each monitoring component.

Table 13 Monitoring Parameters

Page 1 of 2

Parameter	Units	Frequency
Meteorological Monitoring		
Temperature (2m and 10m)	Degrees Celsius	Continuous and real-time
Wind direction (10m)	Degrees	Continuous and real-time
Wind speed (10m)	Metres per second	Continuous and real-time
Relative Humidity	Percent	Continuous and real-time
Suspended Particulates		
PM ₁₀	µg/m ³	Continuous and real-time
PM _{2.5}	µg/m ³	Continuous and real-time
TSP	µg/m ³	Every 6 days
Total lead in TSP	µg/m ³	Every 6 days
Deposited Dust Monitoring		
Insoluble solids	g/m ² /month	30±2 days
Total lead in deposited dust	g/m ² /month	30±2 days
Stack Monitoring (Vent Rise and Baghouse Stacks)		
Flow Rate	m ³ /s	Within 3 months of commissioning, then before 31 December each year thereafter. Subject to frequency review after three sampling events.
TSP	g/s	
PM ₁₀	g/s	
PM _{2.5}	g/s	
Type 1 substances ¹ , including Hg	g/s	
Type 2 substances ² , including Ni	g/s	

Table 13 Monitoring Parameters (Cont'd)

Page 2 of 2

Parameter	Units	Frequency
Paved Roads		
Silt loading on paved roads	g/m ²	Quarterly
Free Areas		
Emission Control Factor	%	Annually
Visual Inspections		
Visible dust leaving work area	Not Applicable	Continuous
Note 1: Type 1 substances include antimony, arsenic, cadmium, lead and mercury or any compound containing one or more of those elements.		
Note 2: Type 2 substances include beryllium, chromium, cobalt, manganese, nickel, selenium, tin and vanadium or any compound containing one or more of those elements		

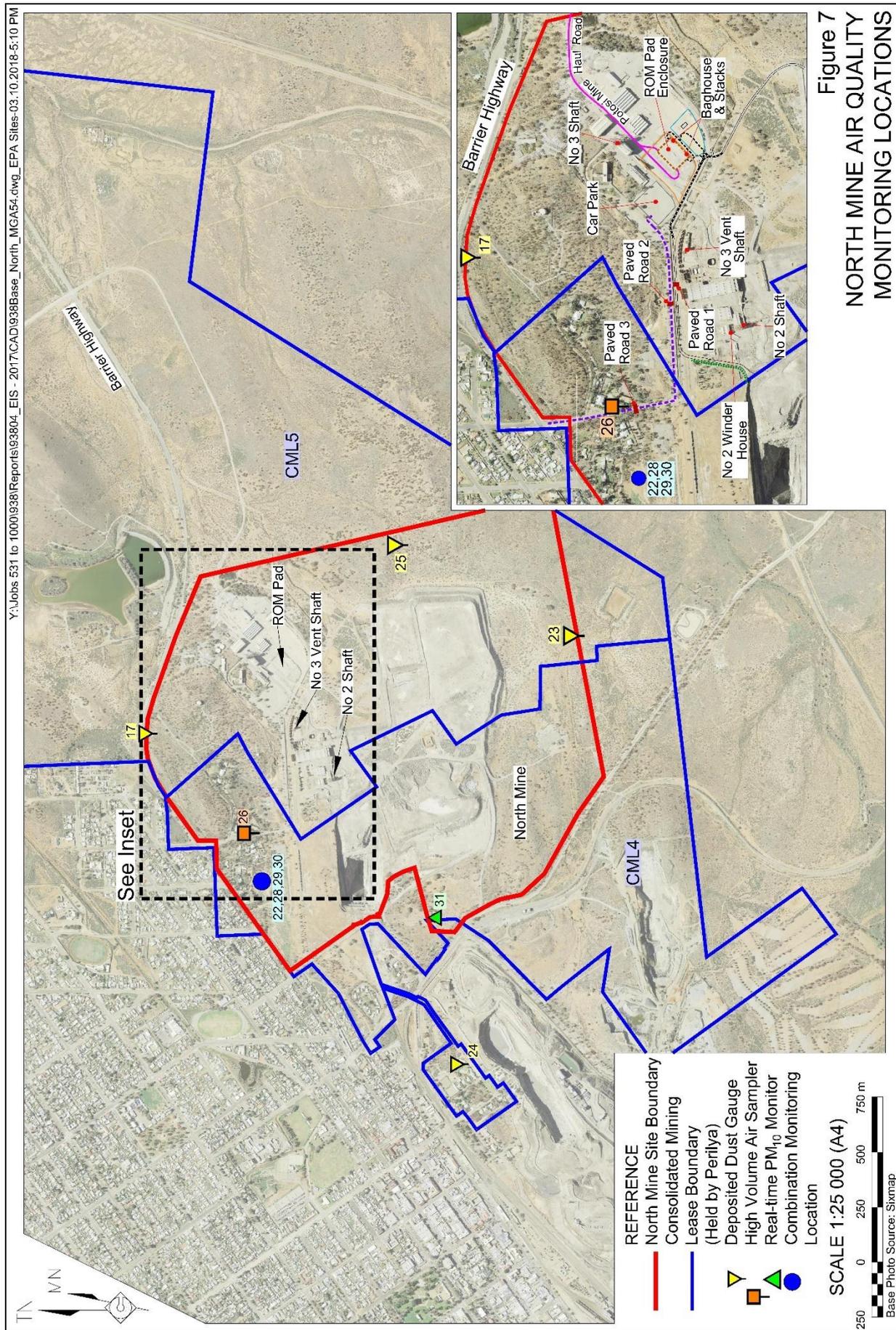
10.3 Monitoring Locations and Equipment

Figure 7 and **Table 14** present the location and class of equipment to be used to monitor air quality within and surrounding the Mine Site. **Appendix 1** presents detailed information in relation to selected monitoring locations.

In addition, additional monitoring of silt loads on sealed roads and control levels within “free areas” will be undertaken.

Table 14 Monitoring Locations and Equipment

Site No.1	Latitude	Longitude	Location Description	Equipment
EPA17	-31.944788	141.489754	Caravan Park/northern boundary of Mine Site	Deposited Dust Gauge
EPA22	-31.949649	141.482309	Close to North Mine Residences	Deposited Dust Gauge
EPA23	-31.962027	141.494565	Southern boundary of Mine Site	Deposited Dust Gauge
EPA24	-31.957483	141.473927	West of Mine Site near Proprietary Square	Deposited Dust Gauge
EPA25	-31.954831	141.498854	Eastern boundary of Mine Site	Deposited Dust Gauge
EPA26	-31.949386	141.485069	Close to North Mine Residences	HVAS (TSP)
EPA28	-31.949746	141.482331	Close to North Mine residences	Meteorological station
EPA29	-31.949746	141.482331	Close to North Mine residences	Fixed real-time BAM (PM ₁₀ , PM _{2.5} and wind)
EPA30	-31.949746	141.482331	Close to North Mine residences	HVAS (TSP)
EPA31	-31.956970	141.480952	Western boundary of Mine Site	Fixed real-time BAM (PM ₁₀ , PM _{2.5} and wind)
EPA32	Not Applicable		Portable PM ₁₀ monitor	Portable nephelometer (PM ₁₀)
No. 2 Shaft ³	-31.952306	141.487512	No. 2 Shaft	Shaft
No. 3 Vent Shaft ⁴	-31.950897	141.490043	No. 3 Vent Shaft	Shaft
ROM Pad	-31.950749	141.493163	ROM Pad	Exhaust shaft
Baghouse	-31.950408	141.493536		
Paved Road 1	-31.950574	141.4896	Paved Haul Road	Dust pan, broom, sieves, scales
Paved Road 2	-31.950365	141.489257	Paved Site Entrance Road	Dust pan, broom, sieves, scales
Paved Road 3	-31.949727	141.484986	Paved Site Entrance Road	Dust pan, broom, sieves, scales
Free Areas	See Figure 1		Free Areas	Confined Air Burst Chamber
Note 1: EPI2683 also identifies monitoring locations EPA15, EPA16, EPA18, EPA19, EPA20, EPA21 and EPA27. These locations are associated with the Potosi Mine and are not addressed in this document				
Note 2: EPA22, EPA28, EPA29 and EPA30 are collocated				
Note 3: No. 2 Shaft to be monitored until the No. 3 Vent Shaft is recommissioned as a ventilation shaft after which No. 2 Shaft will become an inflow shaft and no further monitoring will be undertaken				
Note 4: No. 3 Vent Shaft to be monitored only once commissioned as a ventilation shaft				



10.4 Meteorological Monitoring

10.4.1 Predictive Meteorology

PBHL uses KITE Dustx system maintained by Katestone Environmental (<http://kite.katestone.com.au/>). This system provides a 7-day forecast of conditions associated with dust generation. In addition, it provides updates at hourly resolution to the forecast weather conditions. **Figure 8** presents an example of the output of this system.

The daily forecast will continue to be provided to the North Mine Manager, the North Mine Operations Superintendent and the Environmental Superintendent or their delegate. Where relevant, identification of resultant risks will continue to be disseminated at surface works pre-start meetings. The data dashboard will be made available to all senior North Mine personnel. TARPs associated with “dust lift off” predictions are presented in Section 11.

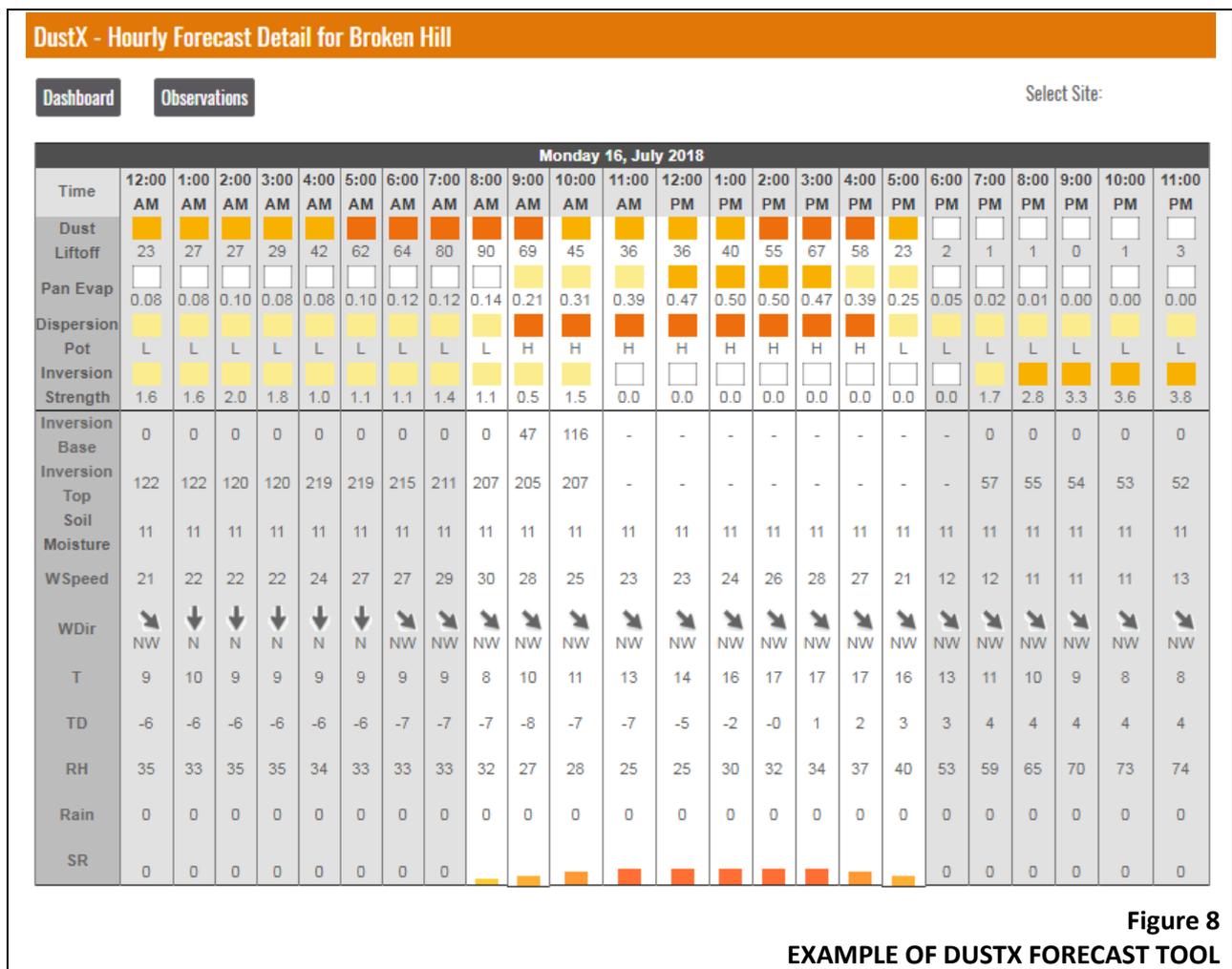


Figure 8
EXAMPLE OF DUSTX FORECAST TOOL

10.4.2 Real-time Meteorological Monitoring

A real-time meteorological station is installed at EPL28 (**Figure 7**). The station records the following.

- Temperature (°C) at 2m and 10m.
- Wind speed (m/s) at 10m

- Wind direction (degrees) at 10m.
- Relative humidity (%).

The meteorological station is linked to the Mine Control Centre. The meteorological station will also provide North Mine specific meteorological observations that will be used to retrospectively investigate potential non-compliances or complaints.

Finally, to permit staff without immediate access to wind speed and direction data from the meteorological station, a wind sock has been installed atop the No. 3 Shaft and / or No. 2 Shaft headframes to provide instant visual information with respect to wind speed and direction and the risk to surrounding sensitive receptors.

10.5 Real-time PM10 Monitoring

Real-time PM₁₀ BAM monitoring (with wind speed and wind direction sensors) will continue to be undertaken at EPA29 and EPA31 (**Figure 7**). Data from each of these monitors is available via a portal managed by the equipment supplier and alerts consistent with the relevant TARPs presented in Section 11 are provided to the North Mine Manager or their delegate as required.

10.6 Total Suspended Particulates

TSP monitoring will continue to be undertaken at EPA26 and EPA30 using high volume air samplers (HVAS) (**Figure 7**). These units draw a known volume of air through a filter every 6 days. The filter collects suspended particulates and, once collected and dispatched to a NATA accredited laboratory, the concentration of all suspended particulates in the air during the 24-hour period can be back calculated. The HVAS units are not real-time monitoring units and data is only available retrospectively.

The Environmental Superintendent or their delegate will collect and replace the filters after each 6-day cycle and dispatch them to the relevant NATA accredited laboratory. Returned data will continue to be reviewed, analysed and reported as described in Section 12.

10.7 Deposited Dust

Deposited dust monitoring will continue to be undertaken at EPA17, EPA22, EPA23, EPA24 and EPA25 using deposited dust gauges. These gauges comprise a glass funnel of known diameter in a glass bottle. All dust that is deposited within the funnel over a one month (30 days plus/minus 2 days) is washed into the bottle and the bottle is dispatched to a NATA accredited laboratory. The sample is rinsed (to remove soluble matter) and heated (to remove combustible/organic matter) and the remaining ash is weighed. The rate of dust deposition can then be back calculated. The dust gauges are not real-time monitoring units and data is only available retrospectively.

The Environmental Superintendent or their delegate will collect and replace the sample bottles after each 30-day cycle and dispatch them to the relevant NATA accredited laboratory. Returned data will be reviewed, analysed and reported as described in Section 12.

10.8 Stack Monitoring

Stack monitoring will be undertaken at two locations as follows (**Figure 7**).

- Exhaust ventilation from the underground workings.

During the air quality assessment for the development application, a number of assumptions were made in relation to both the concentration and composition of the particulate matter entrained within the exhaust air. These assumptions were made based on monitoring results from the Southern Operations ventilation rises. Of the three samples collected, one sample had elevated mercury (Hg) and nickel (Ni) concentrations. As neither Hg nor Ni form a component of the ore within the Line of Lode, the significance of these results could not be determined. As a result, PBHL committed to undertake monitoring of exhaust air from the ventilation rises to ensure consistency with the assumed air quality modelling criteria identified in Section 8.2.

Initially, the No. 2 Shaft will form the exhaust ventilation rise for the underground workings until decline development reaches the 16 Level at which time the workings will be connected into the No. 3 Vent Shaft. At that point, the No. 2 Shaft will become an inflow shaft. As a result, monitoring of exhaust air will initially be undertaken on the No. 2 Shaft, before relocating to the No. 3 Vent Shaft once commissioned.

Monitoring will be undertaken initially at the No. 2 Shaft within 3 months of the commencement of mining operations then annually thereafter until commissioning of the No. 3 Vent Rise. Once the No. 3 Vent Shaft has been commissioned, monitoring would be undertaken within 3 months then annually thereafter.

- ROM Pad Baghouse stacks.

PBHL committed to installing the ROM Pad within an enclosed structure equipped with a dust collection and filtration system. The effectiveness of the dust collection system may be measured by monitoring the concentration of particulates within the exhaust air. As a result, stack monitoring of the baghouse exhaust air will be undertaken concurrently with the mine ventilation monitoring to ensure consistency with the assumed air quality monitoring criteria identified in Section 8.2.

Stack monitoring will be undertaken by a suitably certified and experienced organisation and all analysis will be completed by NATA accredited laboratories.

10.9 Paved Road Silt Loading

PBHL has committed to achieving silt loading of $2\text{g}/\text{m}^2$ or less on all sealed roads within the Mine Site, compliance with this commitment to be demonstrated through a sampling program at least quarterly. In summary, the sampling involves marking a sampling area of known size across the full width of the sealed road, collecting loose material from that area and determining the mass of the silt fraction of the collected material. Where the $2\text{g}/\text{m}^2$ criterion is not achieved the TARPs presented in Section 11 will be implemented.

Risk assessments associated with this sampling methodology have identified that an alternative methodology should be developed to demonstrate compliance with this criterion. PBHL is trialling the use of a portable PM_{10} monitor to generate a correlation curve between silt loadings and PM_{10} concentrations.

Once this trial has been completed and the results accepted by Department of Planning, Industry and Environment and the Environment Protection Authority, this Management Plan will be amended to reflect the revised methodology

10.10 Free Area Emission Control Factor

Free areas are non-operational areas identified on **Figure 1**. A testing program is required to determine the level of fugitive dust control achieved and to identify any areas that are not meeting the 99.3% control criteria identified in Section 8.1.

All free areas will continue to be surveyed annually using the Confined Air Burst Chamber (CABC) method. This is semi-quantitative technique developed by MRI Global in the United States (is used to characterise the relative dust emission potential of various surface types subject to wind erosion. The method provides an estimation of the percentage control efficiency. Where the required criterion is not achieved the TARPs presented in Section 11 will be implemented.

10.11 Daily and Ad-Hoc Visual Inspections

The North Mine Manger or their delegate will undertake daily visual inspections of the Mine Site. In the event that dust emissions are observed, the TARPs presented in Section 11 will be implemented.

10.12 Portable PM₁₀ Monitoring

A portable PM₁₀ monitoring unit using optical particle counter technology (Aeroqual Dust Profiler) will be maintained on site and used to test the effectiveness of control measures identified in this management plan and investigate air quality-related issues, including complaints and potential non-compliances

The portable monitor will be calibrated against the Federal Reference Monitors (BAM and HVAS) to determine an appropriate calibration factor for PM₁₀ and TSP particle fractions.

10.13 Odour Management

Condition 4(a) of Schedule 3 of SSD7538 requires that no offensive odours are emitted from the Mine Site. There are no identified sources of odour or fumes to be generated during mining operations. In the event that mine personnel notice odour-related issued within the Mine Site, the TARPs presented in Section 11 will be implemented.

In an emergency, stench gas may be released into the underground workings to alert mine workers. Nearby community may smell the emergency release, however, as this is an essential emergency management measure, no control measures or monitoring is proposed.

10.14 Cumulative Air Quality Monitoring and Impacts

A range of non-North Mine dust sources exist surrounding the Mine Site. In summary, these include dust emissions from:

- surrounding bare areas;
- sealed and unsealed roads; and
- other mining, extractive and industrial sources.

On receipt of an alert indicating elevated PM₁₀ concentrations, the North Mine Manager or their delegate will determine if PBHL is the likely source of the emissions. If an external source is obvious communications to the operator of that source may result. These measures are embodied in TARP AQ3.

10.15 Monitoring Equipment Inspection and Calibration

Monitoring equipment inspection will include the following. Where errors are noted the TARPs presented in Section 11 will be implemented.

- Error status of real-time monitoring equipment will be automatically monitored by the Environment Department.
- HVAS units are inspected every 6th day, with vacuum run time and flow rates recorded.
- Deposited dust gauges will be inspected every 30 ± 2 days and any changes to the local environment recorded and, where relevant, rectified.
- All monitoring locations will be inspected annually prior to 31 December to ensure ongoing compliance with the location requirements of the relevant Australian Standard and any issues (overgrowing trees, changed surrounding land use, etc.) will be rectified.

All monitoring equipment will be calibrated and maintained in accordance with the manufacturer's instructions and the requirements of the relevant approved test method. **Table 15** presents the calibration schedule for the Air Quality Monitoring equipment within the North Mine.

Table 15 Inspection and Calibration Schedule for Air Quality Monitoring Equipment

Page 1 of 2

All Equipment	Frequency	Organisation
Visual inspection of the apparatus and surroundings	Each monitoring event. Work orders to be generated if maintenance is required	PBHL
Check Status of electrical equipment tags	Each monitoring event. Work orders to be generated if maintenance is required	
Meteorological Station		
Visual inspection (Wind sensor, tipping rain gauge, etc)	Monthly	PBHL
Sensor calibration	2 yearly	Supplier
Beta Attenuation Monitor		
Check function of air conditioner and temperature stability	Monthly	PBHL
Replace filter tape	As required	PBHL
Precision Check	3 monthly	Supplier

Table 15 (Cont'd) Inspection and Calibration Schedule for Air Quality Monitoring Equipment

Page 2 of 2

All Equipment	Frequency	Organisation
Flow leak Check		
Volumetric flow rate check		
Particle mass calibration		
Sample tube cleaning		
Cam greasing	6 monthly	
Perform backup of the database	Annually	
Volumetric flow rate calibration		
Pressure transducer check and calibration		
Pump rebuild	As required	
High Volume Air Sampler		
3-point calibration (60/70/80 m3/hr)	2 monthly	PBHL
Inspect TSP heads for dust accumulation and insects	Each monitoring event	
Dust Deposition Gauge		
Check sample bottles for contaminants	Each monitoring event	PBHL
Check stand for structural integrity		
Check for location compliance with Australian Standard	Annually	

11 Trigger Action Response Plan

Table 16 presents the Trigger Action Response Plans for air quality-related matters.

Table 16 Trigger Action Response Plans

TARP No	Issue	Trigger Level	Alert Level	Action	Response
AQ1	KITE Dustx system identifies "dust lift off" potential in next 24 hours	No category allocation	Green	No action required	Nil
		Moderate potential (score Category 3)	Yellow	Review proposed activities in next 24 hours.	Consider rescheduling planned dust emitting activities
		High potential (Category 2)	Amber	Review proposed activities in next 24 hours.	Reschedule planned dust emitting activities. Consider implementing proactive dust suppression, including application of dust suppressants, prior to commencement of adverse weather condition.
		Extreme potential (Category 1)	Red	Review proposed activities in next 24 hours.	Immediately reschedule planned dust emitting activities. Immediately implement proactive dust suppression, including application of dust suppressants, prior to commencement of adverse weather condition.
AQ2	Real time meteorological monitoring indicates wind from east to southwest (100° - 230°)	Gentle Winds (<3 m/s)	Green	No action required	Nil
		Moderate winds (3 m/s to 5 m/s)	Yellow	North Mine Manager or delegate undertakes a desktop review of potential dust generating works	If dust emitting activities are occurring consider adjusting, implementing additional controls, relocating or ceasing some dust emitting activities
		High winds (5 m/s to 8 m/s)	Amber	North Mine Manager or delegate undertakes a further desktop review of aboveground works and assess dust generation sources	If dust emitting activities are occurring adjust, implement additional controls, relocate or cease dust emitting activities
		Very high winds (>8 m/s to 10 m/s)	Red	North Mine Manager or delegate undertakes an immediate physical inspection of aboveground works and assess visible dust generation	If dust emitting activities are occurring cease those immediately Consider application of additional dust controls such as use of water cart or sprays to prevent fugitive emissions

Table 16 Trigger Action Response Plans (Cont'd)

TARP No	Issue	Trigger Level	Alert Level	Action	Response
AQ3	Real-time PM ₁₀ monitors indicate exceedance of trigger level and wind from east to southwest (100° - 230°)	PM ₁₀ <50 µg/m ³	Green	No action required	Nil
		PM ₁₀ >50 µg/m ³ for 45 minutes	Yellow	North Mine Manager or delegate undertakes a desktop review of potential dust generating works, prevailing wind conditions and PM ₁₀ data from both BAM monitors and determines in PBHL activities are likely cause of elevated PM ₁₀ concentrations	If PBHL activities are likely source of elevated PM ₁₀ concentration: <ul style="list-style-type: none"> implement additional dust controls (water truck, sprinklers, etc); and consider adjusting, relocating or ceasing some dust emitting activities. If an external source is obvious communications to the operator of that source may result.
		PM ₁₀ >50 µg/m ³ for 90 minutes	Amber	North Mine Manager or delegate undertakes a physical inspection of potential dust generating works, prevailing wind conditions and PM ₁₀ data from both BAM monitors and determines in PBHL activities are likely cause of elevated PM ₁₀ concentrations	If PBHL activities are likely source of elevated PM ₁₀ concentration adjust, implement additional controls, relocate or cease dust emitting activities If an external source is obvious communications to the operator of that source may result.
		PM ₁₀ >50 µg/m ³ for 180 minutes	Red	North Mine Manager or delegate undertakes an immediate physical inspection of potential dust generating works, prevailing wind conditions and PM ₁₀ data from both BAM monitors	If dust emitting activities are occurring cease those immediately Consider application of additional dust controls such as use of water cart or sprays to prevent fugitive emissions. If an external source is obvious communications to the operator of that source may result.
AQ4	HVAS sampling results received	Results within criteria identified in Section 8.1	Green	No action required	File results and report as described in Section 12.3
		Results exceed 24-hour TSP criterion identified in Section 8.1	Red	Immediately implement procedures identified in Section 13	Report and investigate potential non-compliance in accordance with the procedures identified in Section 13

Table 16 Trigger Action Response Plans (Cont'd)

Page 3 of 4

TARP No	Issue	Trigger Level	Alert Level	Action	Response
AQ5	TARP removed from Revision G				
AQ6	Stack monitoring results received	Results within criteria identified in Section 8.1 and 8.2	Green	No action required	File results and report as described in Section 12.3
		Results exceed criteria identified in Section 8.2 (modelling assumptions)	Amber	Investigate reason for exceedance of criteria(ion)	Implement measures to ensure consistency with criteria(ion) OR Implement modelling to determine the significance (if any) of the exceedance and measures to ensure consistency with criteria(ion) if required
		Results exceed criteria identified in Section 8.1 (flow rate)	Red	Immediately implement procedures identified in Section 13	Report and investigate potential non-compliance in accordance with the procedures identified in Section 13
AQ7	Free Area Emission Control results received	All free areas achieve 99.3% control	Green	No action required	File results and report as described in Section 12.3
		Some free areas do not achieve 99.3% control	Amber	Apply Lignosulfonate dust suppression at the rates identified by the manufacturer and retest until all free areas achieve 99.3% control. If required, reapply Lignosulfonate dust suppression until required control level achieved	File results and report as described in Section 12.3
AQ8	Sealed road silt loading test results received	All results >2g/m ²	Green	No action required	File results and report as described in Section 12.3
		Some results <2g/m ²	Amber	Immediately sweep, wash or vacuum all sealed roads within the Mine Site and retest until all sealed roads achieve a silt loading of <2g/m ²	Modify road maintenance practices File results and report as described in Section 12.3

Table 16 Trigger Action Response Plans (Cont'd)

Page 4 of 4

TARP No	Issue	Trigger Level	Alert Level	Action	Response
AQ9	Visible dust observed by any person on the Mine Site	Visible Dust carrying no further than 25m from work area or below wheel height of mobile plant	Green	No action required	Nil
		Visible Dust generated carrying between 25m and 50 from work area or above wheel height of mobile plant	Yellow	Site personnel notify North Mine Manager or their delegate North Mine Manager or their delegate undertakes a desktop assessment	Consider adjusting, implementing additional controls, relocating or ceasing some dust emitting activities
		Visible Dust generated and carrying more than 50m from work area or above body height of mobile plant	Amber	Site personnel notify North Mine Manager or their delegate North Mine Manager or their delegate inspects work area	Adjust, implement additional controls, relocate or cease dust emitting activities
		Visible Dust carrying over Mine Site boundary	Red	Site personnel notify North Mine Manager or their delegate North Mine Manager or their delegate immediately inspects work area	Immediately cease all dust emitting activities Consider application of additional dust controls such as use of water cart or sprays to prevent fugitive emissions
AQ10	Odour with potential to impact on offsite land identified	No odour identified	Green	No action required	Nil
		Odour with potential to impact on offsite land identified	Amber	Site personnel notify North Mine Manager or their delegate North Mine Manager or their delegate immediately inspects work area	Immediately cease odour emitting activities

Note: TARP number 5 was removed from Revision G following the AQMP Independent Audit Action Plan.

12 Data Management and Reporting

12.1 Sample Collection, Data Receipt, Analysis and Storage

The following data will be retained in relation to all samples collected in accordance with the requirements of the Environment Protection Licence.

- the date(s) on which the sample was taken;
- the time(s) at which the sample was collected;
- the location at which the sample was taken; and
- the name of the person who collected the sample.

Records of inspections and calibration events will be kept for 4 years.

Analyses will be performed by NATA certified laboratories for the specific tests required.

All laboratory monitoring data will be reviewed as soon as reasonably practicable after receipt and any non-compliance with the criteria identified in Section 8.1 will be reported in accordance with the procedures in Section 13.1.

Following data validation, performed by the Environment Superintendent or delegate the data is incorporated into a database and is subsequently available for reporting. All monitoring data is backed up in accordance with PBHL's information technology procedures. Records would be maintained for a minimum of four years.

12.2 Data Validation and Quality Control

The North Mine Air Quality monitoring program will generate three classes of data, namely:

- automatically generated data from the meteorological station and real-time BAM monitors; and
- laboratory data from the deposited dust gauges, HVAS monitors and stack monitoring programs; and
- PBHL generated data, including free area emission control data and sealed road silt load data.

Each class of data will be validated separately as follows.

- Automatically generated data (meteorological station and real-time monitors).
 - **Data availability** - Environmental personnel will inspect the data logs daily to identify loss of data. The target for all monitoring unit availability is also that used by NSW AAQ NEPM network data with an availability of 75%.
 - **Data quality (BAM)** – These units are calibrated quarterly, flow checked monthly and subjected to data validation every month. Validation records are incorporated in to the BAM monthly reports.

-
- **Data quality (meteorological station)** – temperature, wind speed and direction and humidity data generated by the on-site meteorological station will be compared with data recorded by the Bureau of Meteorology-operated Broken Hill Airport meteorological station on an as needed basis. It is noted that significant variation may occur as a result of topographical changes.
 - **Data quality (portable monitor)** – 24-hour average data from the portable monitor will be validated against TSP data collected by the on-site HVAS monitors and PM₁₀ data generated by the BAM units to generate a calibration curve. Use of this monitor for determination of efficacy of mitigation measures will use the k-factor generated from the calibration curves to approximate USEPA FRM methods.
 - Laboratory-generated data
 - **Data quality** – only NATA-accredited laboratories would be used for the analysis of environmental monitoring samples from the North Mine. PBHL will require all contracted laboratories to certify that their procedures comply with the relevant standards and approved methods.
 - **Data validation** - The Environmental Officer or their delegate will receive the data from the laboratory and input the data in to either the DDG or HVAS spreadsheets (Refer S:\HSE\Environment\Monitoring\0_ALL AIR QUALITY\DustDeposition\Data\2019) and S:\HSE\Environment\Monitoring\0_ALL AIR QUALITY\HVAS\Data\2019). During this process conditional formatting identifies those data that exceed the relevant criteria. In the event that the data is not within expected ranges, an investigation will be commenced to determine the validity of the returned data and any cause or effect from North Mine operations.
 - PBHL-generated data
 - **Data quality** – The Environmental Superintendent or their delegate will review the data generated by the free area emission test work and the silt loading on sealed roads, including all sampling locations and any duplicates to ensure that acceptable variance (typically $\pm 0.5\%$ emission control or $\pm 5 \mu\text{g}/\text{m}^3$ silt loading) is achieved. If acceptable variance is not achieved, the Environmental Superintendent or their delegate will investigate the cause of the variance and implement remedial action, including potentially re doing the sampling program.
 - **Data validation** – The Environmental Officer or their delegate will receive the data from PBHL implemented monitoring programs and compare it with previous results. In the event that the data is within expected ranges, it will be loaded into the relevant database. In the event that the data is not within expected ranges, an investigation will be commenced to determine the validity of the returned data. Depending on the outcome of that investigation, the data will either be loaded into the relevant database or rejected, with the reason for the rejection noted on the relevant file. Where required, remedial action will be implemented to correct the reason for the rejection of the data, and the sampling program will be repeated.
-

12.3 Reporting

The results of any monitoring required will contain the following information within the monitoring report.

- Name and address of reporting organisation or individual
- Date of issue of the report
- The test method used and details of any deviation from that method
- Period of monitoring (start and end dates and percentage of time the instruments were on-line)
- The location of monitoring points (normal address and Australian Map Grid reference, height above nominal ground level, and a description of the terrain features).
- The air pollutants measured, the monitoring instruments used, and a description of the air sampling system
- Maximum hourly average concentration, daily average concentration, and appropriate longer-term averages
- Appropriate statistical information to describe the variability and range of the concentrations
- Any factors that may have affected the monitoring results
- The precision of the results (using AS 2706 as a guide)
- Details of the most recent calibration of each instrument used to take measurements.

The Environmental Superintendent or their delegate would prepare the following statutory and publicly available reports, including an analysis of the monitoring results.

- Monthly reports (PBHL website).
- Quarterly reports (NSW EPA).
- Community Consultative Committee Reports (CCC meeting schedule)
- Annual Return (NSW EPA).
- Annual Environmental Management Report for each calendar year (NSW DRG).
- NGERs annual report for greenhouse gas emissions attributable to the North Mine
- National Pollutant Inventory annual report attributable to the North Mine

13 Incident and Non-compliance Reporting

13.1 Incident and Non-compliance Management

An incident is defined as:

- An event that causes, or threatens to cause, material environmental harm
- Breaches or exceeds the limit or performance measure or criteria associated with the Conditions of Consent or Environmental Protection License.

A non-compliance is defined as any event which is not in conformance with threshold levels as determined within the conditions of consent or an exceedance of any criteria under other approval or legislation, including EPL 2683.

Sections 8.1 and 8.2 of the *Environmental Management Strategy* describe the procedures to be implemented in the event of an incident or non-compliance. In summary, PBHL will:

- Implement measures to control and/or manage the incident or non-compliance;
- Immediately report the incident or non-compliance to the Environment Protection Authority, Resources Regulator and Department of Planning and Environment; and
- Prepare a written report within 7 days and provide a copy of that report to the above agencies.

13.2 Emergency Management Process

The PBHL *Emergency Response and Crisis Management Procedure* is the prevailing document that governs emergency response actions. That document incorporates the *Pollution Incident Response Management Plan* required under EPL2683. In summary, in an emergency situation, one or more crisis management teams are convened and those teams coordinate emergency response, including interactions with external agencies, including emergency services.

13.3 Complaints Management Process

Section 7.1 of the *Environmental Management Strategy* describes the procedures to be implemented in the event of a complaint. In summary, complaints may be received directly via telephone, email or web form from PBHL's website, or indirectly via relevant government agencies. Upon receipt, the name and contact details of the complainant and the nature of the complaint are recorded. PBHL will then investigate the complaint and implement system improvements if required. The results of the investigation are communicated back to the complainant.

14 Training and Awareness

The environmental risk management process and the broader environmental risks for PBHL are communicated to all site personnel via the PBHL general induction. In particular, all North Mine workers will be instructed during their induction on the requirement to limit dust emissions and the requirement to report emissions to their supervisor who will then be responsible for either implementing the TARPs presented in Section 11 or reporting the emissions to their supervisor.

Job hazard analysis and 'take-time take-charge' are site-wide risk assessment tools used to identify health, safety and environment related risks and are used by operators and supervisors.

15 Roles and Responsibilities

Table 17 presents the roles and responsibilities for implementation of this Plan.

Table 17 Roles and Responsibilities

Role	Responsibility
General Manager	Ensure adequate resources are available to enable implementation of the Plan.
North Mine Manager	Accountable for the overall environmental performance of the North Mine, including the outcomes of this Plan.
Health, Environment, Safety and Training Manager	Ensure adequate resources are available to enable implementation of the Plan.
Environmental Superintendent	Accountable for the implementation of this Plan, including all management and mitigation measures, monitoring and reporting.
Environmental Advisor	Accountable for the day-to-day implementation of this Plan, including ensuring standard operating procedures re complied with and all monitoring data is collected and stored appropriately.
All other employees and contractors	Responsible for following directions and instructions from site management and supervisors.

16 Review and Revision Process

In accordance with the requirements of Condition 6 of Schedule 4, this Plan will be reviewed within 3 months of:

- a) the submission of an annual review
- b) the submission of an incident report
- c) the submission of an audit
- d) any modification to the conditions of this consent, (unless the conditions require otherwise);

PBHL will review and, if necessary revise, the strategies, plans, and programs, including associated Standard Operating Procedures, required under the consent.

Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document will be submitted to the Secretary for approval, unless otherwise agreed with the Secretary.

17 References

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Appendix 1

Air Quality Monitoring Locations

EPA ID Number: 26		
Site Name	North Mine HVAS	
Instrument Type	High Volume Air Sampler with TSP sampling head	
Geographic Coordinates	Latitude	Longitude
	-31.949386	141.485069
Parameters Monitored	TSP, Lead, Nickel & Mercury on filter paper	
Units of Measure	µg/m ³	
Averaging Period	24-hour Annual	
Sampling Frequency	24-hours 1-day-in-6	
Sampling Method	AS/NZ 3580.9.3:2015	
Location Classification	On site	
Commissioning Date	July 2008	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	HVAS Monitor located close to North Mine Residences	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term analysis TSP concentrations close to North Mine residences. Evaluation of lead, nickel & mercury content of TSP fraction	



EPA ID Number: 28		
Site Name	Argent Street Monitoring Station	
Instrument Type	Meteorological station	
Geographic Coordinates	Latitude	Longitude
	-31.949746	141.482331
Parameters Monitored	Wind direction (10m AGL); Wind speed (10m AGL); Sigma Theta (10m AGL) Temperature (2m & 10m AGL); Relative humidity (2m AGL); Barometric pressure (2m AGL); Rainfall (mm)	
Units of Measure	Wind direction (degrees) Wind speed (metres per second) Temperature (degrees Celsius) Relative humidity (%) Barometric pressure (kPa)	
Averaging Period	15-minutes	
Sampling Frequency	Continuous	
Sampling Method	AS/NZ 3580.14:2014	
Location Classification	On-site	
Commissioning Date	June 2018	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	On-site meteorological station located on-site, between Jabez Street and Tin Street, south of Argent Street. Co-located with ID 28 (PM10 BAM) and ID 30 (TSP HVAS)	
Monitoring Objective	Compliance. Condition of Consent 3(14). EP Licence. Site-representative meteorological monitoring.	



EPA ID Number: 29		
Site Name	Argent Street Monitoring Station	
Instrument Type	Beta attenuation method (BAM) PM ₁₀	
Geographic Coordinates	Latitude	Longitude
	-31.949746	141.482331
Parameters Monitored	PM ₁₀ Wind speed & Wind Direction (2m)	
Units of Measure	µg/m ³	
Averaging Period	24-hour Annual	
Sampling Frequency	Continuous	
Sampling Method	AS/NZ 3580.9.11:2016	
Location Classification	On-site	
Commissioning Date	July 2018	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	On site real-time PM ₁₀	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Operational dust management. Upwind/Downwind contribution evaluation.	



EPA ID Number: 30		
Site Name	Argent Street Monitoring Station	
Instrument Type	High Volume Air Sampler with TSP sampling head	
Geographic Coordinates	Latitude	Longitude
	-31.949746	141.482331
Parameters Monitored	TSP, Lead, Nickel & Mercury on filter paper	
Units of Measure	µg/m ³	
Averaging Period	24-hour Annual	
Sampling Frequency	24-hours 1-day-in-6	
Sampling Method	AS/NZ 3580.9.3:2015	
Location Classification	On-site	
Commissioning Date	August 2018	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	HVAS Monitor located near sensitive receptors	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term analysis TSP concentrations close to off-site residences. Evaluation of lead, nickel & mercury content of TSP fraction	



EPA ID Number: 31		
Site Name	Menindee Street Monitoring Station	
Instrument Type	Beta attenuation method (BAM) PM ₁₀	
Geographic Coordinates	Latitude	Longitude
	-31.956970	141.480952
Parameters Monitored	PM ₁₀ Wind speed & Wind Direction (2m)	
Units of Measure	µg/m ³	
Averaging Period	24-hour Annual	
Sampling Frequency	Continuous	
Sampling Method	AS/NZ 3580.9.11:2016	
Location Classification	On site	
Commissioning Date	August 2018	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	On site real-time PM ₁₀	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Operational dust management. Upwind/Downwind contribution evaluation.	



EPA ID Number: 17		
Site Name	Caravan Park	
Instrument Type	Dust Deposition Gauge	
Geographic Coordinates	Latitude	Longitude
	-31.944788	141.489754
Parameters Monitored	Insoluble solids, Lead, Nickel & Mercury	
Units of Measure	g/m ² /month	
Averaging Period	Monthly Annual	
Sampling Frequency	Monthly	
Sampling Method	TSP: AS/NZ 3580.10.1:2016 %Pb, % Ni, % Hg	
Location Classification	Background	
Commissioning Date	January 2002	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	Off-site Dust deposition gauge	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term trend analysis.	



EPA ID Number: 22		
Site Name	Argent Street North Mine	
Instrument Type	Dust Deposition Gauge	
Geographic Coordinates	Latitude	Longitude
	-31.949649	141.482309
Parameters Monitored	Insoluble solids, Lead, Nickel & Mercury	
Units of Measure	g/m ² /month	
Averaging Period	Monthly Annual	
Sampling Frequency	Monthly	
Sampling Method	TSP: AS/NZ 3580.10.1:2016 %Pb, % Ni, % Hg	
Location Classification	On-site	
Commissioning Date	January 2002	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	On-site Dust deposition gauge	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term trend analysis.	



EPA ID Number: 23		
Site Name	Common Dam	
Instrument Type	Dust Deposition Gauge	
Geographic Coordinates	Latitude	Longitude
	-31.962027	141.494565
Parameters Monitored	Insoluble solids, Lead, Nickel & Mercury	
Units of Measure	g/m ² /month	
Averaging Period	Monthly Annual	
Sampling Frequency	Monthly	
Sampling Method	TSP: AS/NZ 3580.10.1:2016 %Pb, % Ni, % Hg	
Location Classification	On-site	
Commissioning Date	January 2002	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	On-site Dust deposition gauge	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term trend analysis.	



EPA ID Number: 24		
Site Name	Proprietary Square	
Instrument Type	Dust Deposition Gauge	
Geographic Coordinates	Latitude	Longitude
	-31.957483	141.473927
Parameters Monitored	Insoluble solids, Lead, Nickel & Mercury	
Units of Measure	g/m ² /month	
Averaging Period	Monthly Annual	
Sampling Frequency	Monthly	
Sampling Method	TSP: AS/NZ 3580.10.1:2016 %Pb, % Ni, % Hg	
Location Classification	Background	
Commissioning Date	January 2002	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	Off-site Dust deposition gauge	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term trend analysis.	



EPA ID Number: 25		
Site Name	Rasp Ridge	
Instrument Type	Dust Deposition Gauge	
Geographic Coordinates	Latitude	Longitude
	-31.954831	141.498854
Parameters Monitored	Insoluble solids, Lead, Nickel & Mercury	
Units of Measure	g/m ² /month	
Averaging Period	Monthly Annual	
Sampling Frequency	Monthly	
Sampling Method	TSP: AS/NZ 3580.10.1:2016 %Pb, % Ni, % Hg	
Location Classification	Background	
Commissioning Date	January 2002	
Reporting Frequency	Monthly	
Auditing Frequency	Annual	
Station Description	Off-site Dust deposition gauge	
Monitoring Objective	Compliance. Condition of Consent 3(2) and 3(5)(e). EP Licence. Long-term trend analysis.	

