15.0 Air quality

15.1 Introduction

This chapter provides a summary of the air quality values present within the Project Site and study area. This includes analysis of the operational activities for the Project and study area from an air quality perspective, selection of appropriate ambient air quality goals, review of existing air quality monitoring data, analysis of local meteorology and climatic conditions, prediction and assessment of operational emissions and identification of mitigation measures.

A detailed technical report is attached in **Appendix G-1** (Air quality). The supporting Air quality technical report in **Appendix G-1** has been prepared based on an earlier project definition. The project definition presented in this chapter supersedes that definition and does not require any additional changes to the study.

Greenhouse gases are not considered in this chapter and are discussed separately in **Chapter 16** (Greenhouse gas).

Environmental objectives and outcomes

The Project seeks to protect environmental values relating to air quality established under the Environmental Protection Regulation 2019 (Qld) (EP Regulation). With respect to air quality within and surrounding the Project Site, these specifically relate to those environmental values set out under the Environmental Protection (Air) Policy 2019 (EPP Air). The protection of air quality supports conditions conductive to healthy and biodiverse ecosystems.

Ensham manages impacts to air quality in accordance with Environmental Authority (EA) EPML00732813 and this has ensured compliance with current EA conditions as demonstrated by no air quality related complaints in the last six years. The Project will continue to monitor air quality in accordance with the requirements of EA, extending the monitoring program to include the Project Site. As the Project is an extension of the current underground operation at Ensham Mine, air quality impacts are not considered to be significant. Therefore, air quality is not considered a critical matter in the environmental impact statement (EIS).

15.1.1 Scope of assessment

The scope of this study is to:

- analyse the operational activities for the Project from an air quality perspective
- select appropriate ambient air quality goals for the Project
- review and discuss existing air quality monitoring data sourced from the existing Ensham Mine air quality monitoring network and the Queensland Department of Environment and Science (DES)
- analyse local meteorology and climatic conditions using data collected at the Ensham Mine and by the Bureau of Meteorology (BoM), with reference to the dispersion of air pollutants
- predict and assess the potential impacts of operational emissions associated with existing Ensham Mine activities and the Project, on air quality within the study area
- propose mitigation measures and strategies, where required.

The study area for the purposes of this air quality assessment includes the Project's airshed environment and sensitive receptor locations.

15.2 Legislation and policy

15.2.1 Environmental Protection Act 1994 and Environment Protection Regulation 2019

The *Environmental Protection Act 1994* (Qld) (EP Act) regulates environmentally relevant activities (ERA) under the EP Regulation which are permitted under an Environmental Authority (EA). There are several Environmental Protection Policies (EPPs) published under the EP Act that govern the requirement for management of environmental issues such as noise, air, and water. These policies determine objectives to be achieved in various environments with reference to sensitive receptors. The EPP Air was considered as part of this assessment.

15.2.2 Environmental Protection (Air) Policy 2019

The EPP Air seeks to enhance or protect the atmospheric environment in Queensland by providing air quality objectives. The air quality objectives set out in the EPP Air are intended to be progressively achieved over the long term.

The EPP Air recommends several strategies to control emissions for different types of activities to protect and enhance environmental values such as air quality is conducive to protecting the health and biodiversity of ecosystems, human health and wellbeing, aesthetics of the environment, including the appearance of buildings, structures and other property, and agricultural use of the environment.

Air quality objectives discussed in **Section 15.2.5** have been used to identify if an environmental value of the air environment is enhanced or protected in an area or place.

15.2.3 National Environment Protection (Ambient Air Quality) Measure

National Environment Protection Measures (NEPM) outline agreed national objectives for protecting or managing particular aspects of the environment. The air quality of an environment is protected by the Air Quality NEPM as amended (2021). The Air Quality NEPM provides guidance relating to air in the external environment and does not include air inside buildings or structures.

The Air Quality NEPM outlines monitoring, assessment and reporting procedures for PM_{10} (particulate matter less than 10 micrometres), $PM_{2.5}$ (particulate matter less than 2.5 micrometres), nitrogen dioxide, carbon monoxide, ozone, sulphur dioxide pollutants.

The Air Quality NEPM standards are intended to be applied to air quality experienced by the general population in a region and not to air quality in areas in the region affected by localised air emissions, such as individual industrial sources or projects.

The goal of the Air Quality NEPM is to achieve the recommended standards with the allowable exceedances, as assessed in accordance with the associated monitoring protocol. The standards were set at a level intended to adequately protect human health and wellbeing. The standards in the Air Quality NEPM relevant to the Project correspond to the EPP Air objectives protecting the health and wellbeing environmental values. The Air Quality NEPM standards relevant to the Project are consequently addressed in the air quality objectives in the EPP Air.

15.2.4 Nuisance dust guideline

The deposition of larger dust particles can commonly cause nuisance in residential areas. Although no dust deposition objectives are prescribed in the EPP Air, DES commonly sets a guidance deposition rate of 120 milligrams per square metre per day (mg/m²/day) averaged over one month, which is based on research into community complaints for coal related projects. Although not a legislative requirement, it is noted within DES (2017a) that it is frequently used in Queensland. As such, a dust deposition goal of 120 mg/m²/month has been applied in this assessment.

15.2.5 Air quality objectives

The referenced air quality criteria and guideline values shown below in **Table 15-1** have been adopted as the air quality objectives for the Project. The dust deposition monthly average guideline is not legislative but was adopted for the purposes of the Project air quality assessment (**Section 15.2.2**).

Table 15-1 Adopted air quality objectives

Pollutant	Air quality objective (µg/m³)	Averaging period	Environmental value	Source
Total suspended particulate (TSP)	90	Annual	Health and well being	EPP Air
PM_{10}	50	24 hours	Health and well being	EPP Air
	25	Annual	Health and well being	EPP Air
$PM_{2.5}$	25	24 hours	Health and well being	EPP Air
	8	Annual	Health and well being	EPP Air
Dust deposition[1]	120 mg/m²/day	Monthly	Nuisance	DES Recommended

[1] Not legislative but adopted for the Project air quality assessment, see Section 15.2.4

15.3 Methodology

The assessment methodology for air quality follows industry standard dispersion modelling and assessment techniques to predict air pollutant concentrations in the study area. The methodology used to complete the dispersion modelling assessment. including identification of sensitive receptors, compilation of the emissions inventory, dispersion model information and selected model settings. is summarised in the following sections. A detailed description of the air quality methodology is provided in **Appendix G-1** (Air quality).

15.3.1 Sensitive receptors

Sensitive air quality receptors surrounding the Project were identified via a desktop search of aerial images as per the DES Guideline Application requirements for activities with impacts to air (DES, 2017a). As per the DES guideline, a sensitive receptor can include:

- a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises
- a motel, hotel or hostel
- a kindergarten, school, university or other educational institution

- a medical centre or hospital
- a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 2004* or a World Heritage Area
- a public park or garden
- a place used as a workplace including an office for business or commercial purposes.

The Project is located in a rural setting, a significant distance away from major population centres. As a result, the only sensitive receptor types that apply to the proposal are neighbouring rural dwellings. The locations of the identified nearby sensitive receptors are presented in **Section 15.4.1.**

15.3.2 Modelling methodology

This assessment made use of the CSIRO model 'The Air Pollution Model' (TAPM), the CALMET meteorological processor and the CALPUFF dispersion model. The CALPUFF modelling system consists of three main components and a set of pre-processing and post-processing programs. The main components of the modelling system are CALMET (a diagnostic three-dimensional meteorological model), CALPUFF (an air quality dispersion model), and CALPOST (a post-processing package).

15.3.2.1 Modelled meteorological data

The meteorological data used in the dispersion model are of fundamental importance, as these data drive the predictions of the transport and dispersion of the air pollutants in the atmosphere. The most critical parameters are:

- wind direction, which determines the initial direction of transport of pollutants from their sources
- wind speed, which dilutes the plume in the direction of transport and determines the travel time from source to receiver
- atmospheric turbulence, which indicates the dispersive ability of the atmosphere.

Both measured and prognostic meteorological data were used in this assessment. Pseudo upper air stations were generated from TAPM model runs for locations within the meteorological CALMET domain. The use of pseudo upper air stations allowed the CALMET modelling to be driven primarily by surface observations, which were considered to be representative of the study area. Meteorological data were sourced for the stations listed in **Table 15-2** for the year 2016. An analysis of the CALMET generated meteorological data and its suitability for this assessment is presented in the following sections.

Table 15-2 Meteorological stations used in the modelling

Station	Coordinates (Geocentric datum of Australia (GDA) zone 56)	Variables	Source
Emerald Airport	619,971 metres (m); 7,392,953 m	Wind direction; wind speed; temperature; rainfall; pressure; relative humidity	BoM
Blackwater Airport	684,415 m; 7,388,726 m	Wind direction; wind speed; temperature; rainfall; pressure; relative humidity	BoM
UA1	640,017 m; 7,411,383 m	Upper air	TAPM
UA2	664,017 m; 7,403,383 m	Upper air	TAPM
UA3	641,017 m; 7,402,383 m	Upper air	TAPM

Station	Coordinates (Geocentric datum of Australia (GDA) zone 56)	Variables	Source
UA4	657,017 m; 7,396,383 m	Upper air	TAPM

15.3.2.2 Modelling scenarios

Three modelling scenarios were selected based mainly on projected annual throughputs, with higher throughputs generally worse from a dust-generating perspective. Proximity to sensitive receptors was also considered, however, most of the receptors are distant (minimum 3.1 kilometres (km) to the south) from the existing Ensham Mine and, therefore, this was not as important a consideration as the throughputs. The three selected scenarios are summarised as follows:

- Scenario 1: Based on 2024 throughputs – this scenario was chosen to represent the worst-case dust emissions for Ensham Mine and the Project, with significant run of mine (ROM) throughput (both underground (the Project and existing) and open-cut) and a large volume of rehabilitation works projected for the year. While 2024 presents the highest overall emissions, only a part of the emissions are due to the Project.
- Scenario 2: Based on 2028 throughputs – this scenario was selected as the potential worst-case dust emissions for the rehabilitation works. The year 2028 is projected to have the second highest total throughput volume, after 2021. However, in 2021 the rehabilitation works will be split over Y Pit and F Pit at the northern end of the mine. The nearest receptor to the Y Pit or F Pit works is approximately 6 km to the west. In 2028, rehabilitation works will be confined to B Pit and dust-generating activities will be more concentrated than in 2021. The closest receptor to the B Pit rehabilitation works is approximately 5 km to the south east. Underground (the Project and existing) operations will be ongoing in 2031 and were included in the scenario. Open-cut operations will cease by 2024 and were not included in this scenario. Only part of the overall emissions for this scenario are due to the Project.
- Scenario 3: Based on 2031 throughputs – this scenario represents the highest Project ROM throughput of 4.23 million tonnes per annum. Existing underground and open-cut operations are expected to have ceased well before 2031 and were not included in this scenario. Rehabilitation works are projected to be ongoing in 2031 and were included in this scenario. All mining (non-rehabilitation) emissions are due to the Project for this scenario.

The general layout of each of the scenarios, in terms of where each activity is occurring, are presented in **Figure 15-1**, **Figure 15-2** and **Figure 15-3**.

As the Project entails an extension of existing underground mining operations and the installation of 4 flares in zones 2 and 3, there is no material construction phase. Therefore, commissioning (construction) emissions have not been included as a scenario. Minor surface related infrastructure will be added alongside the existing mining infrastructure to be utilised for the Project. Construction emissions will not be significant and are considered to have low risk of impacts to air quality at sensitive receptors, therefore they have not been considered further.

Major air emissions associated with decommissioning of the Project would be related to rehabilitation works, which have been included in all three modelled scenarios. Additional decommissioning phase emissions (beyond rehabilitation works) would be greatly reduced compared with the scenarios modelled here and therefore have not been included in this assessment. Any outcomes from this assessment can be considered conservative for the decommissioning phase.

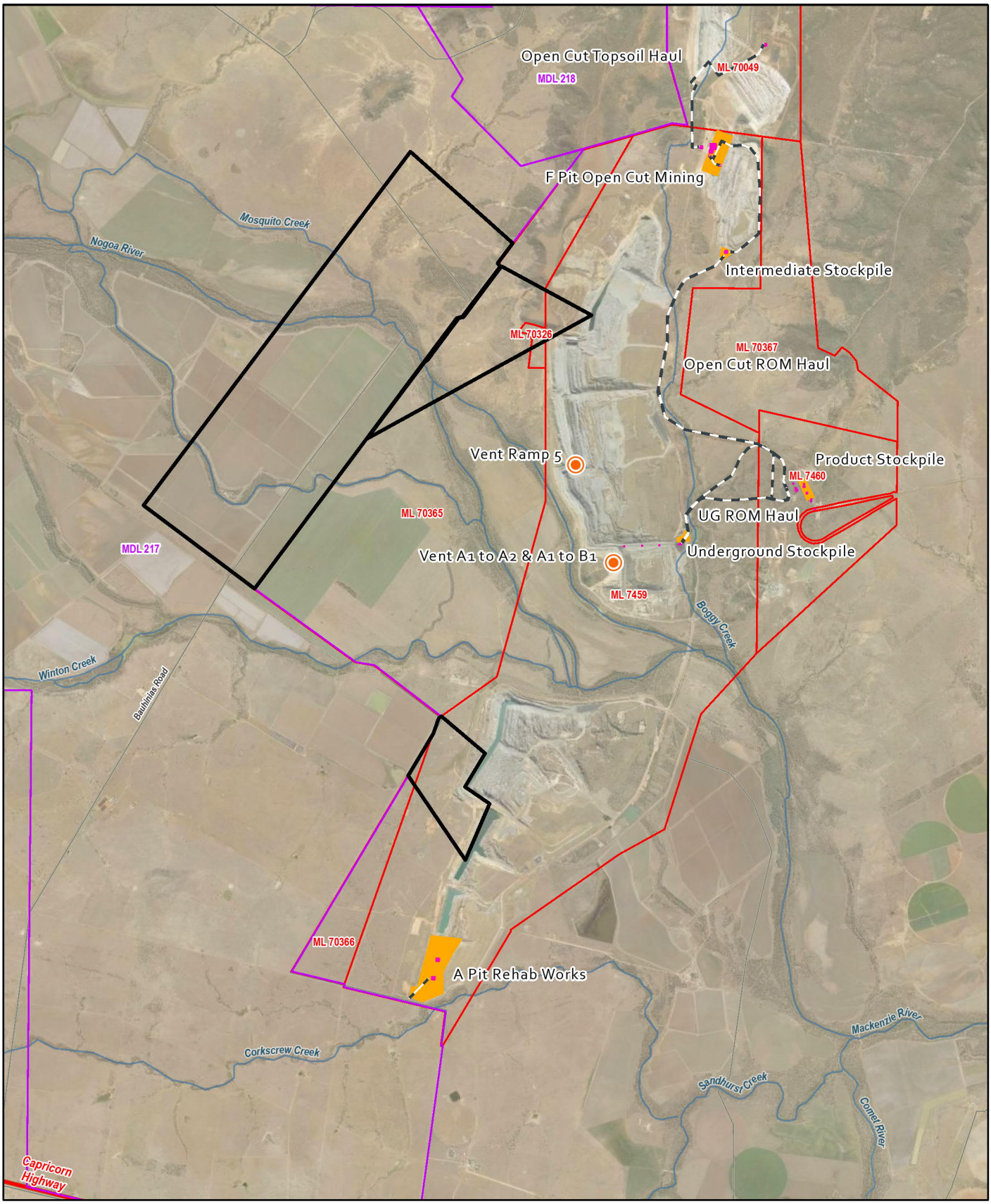


Figure 15-1
Source layout for Scenario 1 - 2024 operations

Legend

- Project Area
- Watercourse
- Main road
- Other road
- Vent shafts
- Haul roads
- Volume sources
- Wind erosion sources

Ensham mine leases

- Mineral development licence
- Mining leases

Ensham RESOURCES

0 2 3 km

ENSHAM LIFE OF MINE EXTENSION PROJECT

Projection: GDA 1994 MGA Zone 55 Scale: 1:100,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017.
AECOM 2020

AECOM GIS Printed Date: 10/08/2020, P:\60\X60603371\900_CAD_GIS\920_GIS\02_MXDs\60603371_Ensham_EIS\60603371_Chapter15_AirQuality\60603371_Chapter15_AirQuality.aprx, FIGURE G073_F15-1_SC1Sources2024Operations, V2

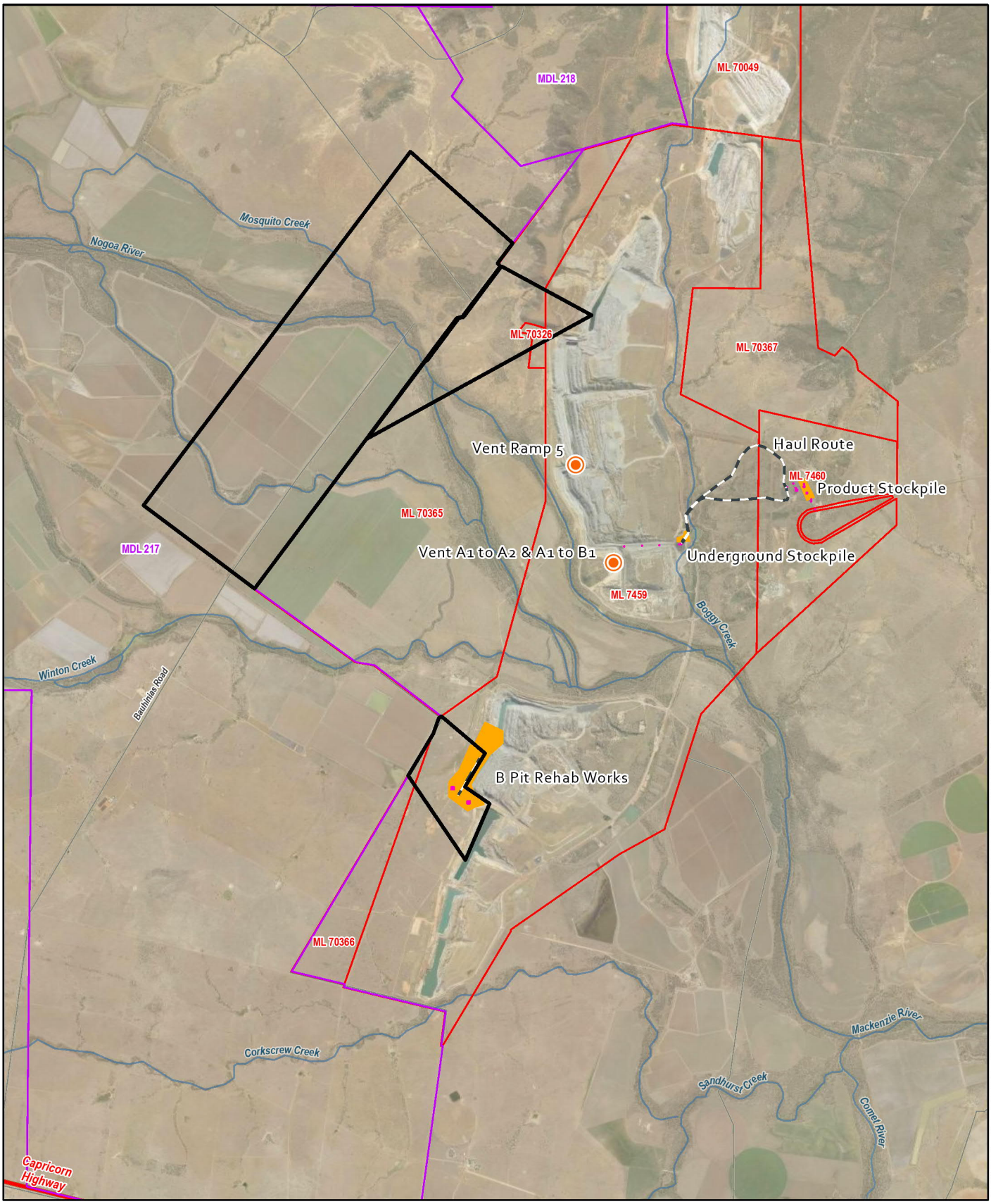


Figure 15-2
Source layout for Scenario 2 - 2028 operations

Ensham RESOURCES

0 2 3 km

ENSHAM LIFE OF MINE EXTENSION PROJECT

Legend

- Project Area
- Watercourse
- Main road
- Other road
- Vent shafts
- Haul roads
- Volume sources
- Wind erosion sources

Ensham mine leases

- Mineral development licence
- Mining leases

Projection: GDA 1994 MGA Zone 55 Scale: 1:100,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017.
AECOM 2020

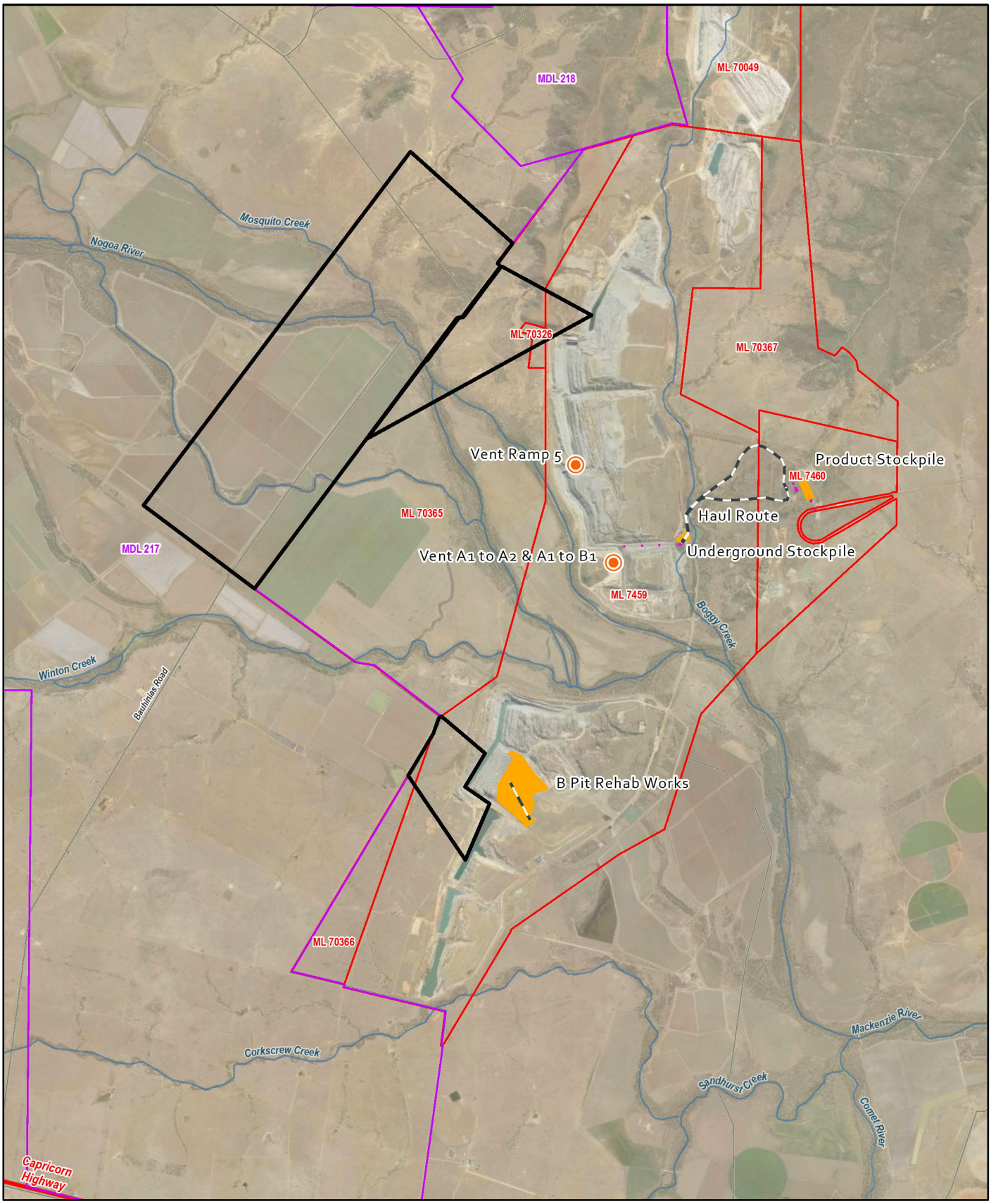


Figure 15-3
Source layout for Scenario 3 - 2031 operations

Ensham RESOURCES

0 2 3 km

ENSHAM LIFE OF MINE EXTENSION PROJECT

Legend

- Project Area
- Watercourse
- Main road
- Other road
- Vent shafts
- Haul roads
- Volume sources
- Wind erosion sources

Ensham mine leases

- Mineral development licence
- Mining leases

Projection: GDA 1994 MGA Zone 55 Scale: 1:100,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017.
AECOM 2020

AECOM GIS Printed Date: 10/08/2020, PX60\X60603371\900_CAD_GIS\920_GIS\02_MXDs\60603371_Ensham_EIS\60603371_Chapter15_AirQuality\60603371_Chapter15_AirQuality.aprx, FIGURE G075_F15-3_SC3Sources2031Operations, V2

15.4 Existing environment

15.4.1 Project Site and sensitive receptors

The land surrounding the Project Site is predominantly farming land. A number of sensitive receptors are in the vicinity of the Project Site and are listed in **Table 15-3** and presented on **Figure 15-4**. The environmental values (see **Table 15-1**) that the surrounding residential receptors are sensitive to, include health and well-being, and nuisance.

Table 15-3 Sensitive receptor list

Sensitive receptor ID	Sensitive receptor type	Easting*	Northing*	Distance to current operations (km)	Distance to Portal at Pit C or CHPP (km)
R01	Residential	646,751	7,416,272	6.6	12.5
R02	Residential	640,694	7,416,564	12.6	16.0
R03	Residential	645,242	7,412,996	8.0	10.4
R04	Residential	648,044	7,409,592	4.0	6.0
R05	Residential	640,814	7,407,418	10.5	10.9
R06	Residential	642,131	7,406,949	9.0	9.6
R07	Residential	645,014	7,404,294	6.3	6.4
R08	Residential	643,634	7,401,051	8.6	8.6
R09	Residential	643,560	7,400,532	6.3	8.9
R10	Residential	642,715	7,399,714	6.7	10.0
R11	Residential	642,093	7,399,167	7.2	10.8
R12	Residential	642,508	7,398,896	6.9	10.6
R13	Residential	642,904	7,398,609	6.5	10.4
R14	Residential	649,504	7,391,905	3.1	12.9
R15	Residential	649,608	7,391,803	3.1	13.0
R16	Residential	649,651	7,391,713	3.1	13.1
R17	Residential	649,747	7,391,646	3.1	13.1
R18	Residential	653,684	7,395,265	3.6	9.3
R19	Residential	646,178	7,390,287	3.6	15.3
R20	Residential	645,655	7,384,271	5.1	21.2
R21	Residential	649,827	7,390,342	11.0	14.4
R22	Residential	652,172	7,389,210	4.6	15.5
R23	Residential	652,855	7,390,087	6.4	14.5
R24	Residential	656,494	7,385,277	12.1	19.0

Sensitive receptor ID	Sensitive receptor type	Easting*	Northing*	Distance to current operations (km)	Distance to Portal at Pit C or CHPP (km)
R25	Residential	658,995	7,389,189	11.5	15.4
R26	Residential	651,609	7,386,540	8.7	18.1
R27	Residential	663,890	7,386,652	17.0	19.4
R28	Residential	665,401	7,404,324	10.3	9.5
R29	Residential	656,542	7,427,270	9.8	23.0
R30	Residential	643,311	7,425,691	13.6	22.5
R31	Residential	642,014	7,425,763	14.4	23.1
R32	Residential	636,852	7,408,774	14.3	15.1
R33	Residential	638,897	7,405,714	12.2	12.6

* As per MGA GDA94 Zone 55 reference system

15.4.2 Local climate and meteorology

Historic climate and meteorological observations were reviewed to validate the generated meteorology for the study area that has been used in the dispersion modelling assessment.

Long-term annual wind roses for morning and afternoon conditions at the Emerald Post Office and Blackwater Water Treatment Plant BoM stations were available for review. The 9 am and 3 pm annual wind roses for these stations are presented in **Figure 15-5**.

Morning winds at the Emerald Post Office location are predominantly from the south-east, east, and north-east and are low to moderate strength when not calm. Calm conditions occur for approximately 9 per cent of the time for the 9 am wind observations. Winds at 3 pm in Emerald Post Office are similar to morning winds, with winds from the east of a similar strength. Calm conditions account for only 6 per cent of afternoon wind observations.

Wind conditions at the Blackwater Water Treatment Plant station location are slightly stronger than those observed at Emerald Post Office. Morning winds are most frequently from the east, and often of moderate strength. Calm conditions are more prevalent in the mornings at the Blackwater station, with 19 per cent calms measured in the mornings. No afternoon wind roses were available for the Blackwater Water Treatment Plant station.

15.4.3 Background air quality

Air quality monitoring data available from the DES monitoring station at Blackwater were reviewed to establish the existing air quality environment. Blackwater is about 41 km to the south east of Ensham Mine.

Data from the Blackwater station recorded from April 2019 to March 2020 were adopted for use in the assessment attached in **Appendix G-1**. Data from Ensham Mine's St Aubins monitoring location was adopted as a background dust deposition rate. These data are summarised in **Table 15-4**.

Since the assessment presented in **Appendix G-1** was prepared, more recent data available from the Blackwater air quality monitoring station have been reviewed to confirm existing background particulate concentrations in the region. This analysis is presented as an addendum to **Appendix G-1**. The conclusion

of the latest review was that the background data used in the air quality assessment is likely to be a conservative overestimate of typical background particulate levels in the region, especially in relation to PM_{10}.

Table 15-4 Adopted background particulate levels

Pollutant	Averaging time and statistic	Adopted background concentration (µg/m³, unless stated)	Air objective (µg/m³, unless stated)	Monitoring location and time period
TSP	Annual average	58.8	**90**	Scaled from Blackwater PM_{10} value using an assumed ratio of 0.4
PM_{10}	24 hours, 70th percentile	25.1	**50**	Blackwater April 2019 to March 2020
	Annual average	23.5	**25**	
$PM_{2.5}$	24 hours, 70th percentile	7.5	**25**	
	Annual average	7.0	**8**	
Deposited dust	30 days, 70th percentile	80.3 mg/m²/day	**120 mg/m²/day**	Ensham (St Aubins) 2018

15.4.3.1 Assimilative capacity of the air environment

The assimilative capacity of the receiving air environment can be quantified through the difference between the adopted background concentrations and the air objectives defined in Table 15-1. Based on the data presented in **Table 15-4**, the assimilative capacities of the environment for each pollutant of concern are as follows:

- Deposited dust: 80.3 mg/m²/day 30-day average, representing 66.9% of the 120 mg/m²/day criterion
- Annual average TSP: adopted background level is 65% of the 90 µg/m³ criterion
- 24-hour average PM_{10}: adopted background level is 50% of the 50 µg/m³ criterion
- Annual average PM_{10}: adopted background level is 94% of the 25 µg/m³ criterion
- 24-hour average $PM_{2.5}$: adopted background level is 30% of the 25 µg/m³ criterion
- Annual average $PM_{2.5}$: adopted background level is 88% of the 8 µg/m³ criterion.

The above comparison indicates that some assimilative capacity for Project air emissions remains for all pollutants; although only about 6% of the criterion is estimated to remain for annual average PM_{10} based on the adopted background value. It is noted however, that as discussed above, the background monitoring data review presented as an addendum in **Appendix G-1** concluded that the background PM_{10} levels assumed in the air quality assessment are likely to overestimate the typical levels in Blackwater, and hence the levels that may typically occur in the vicinity of Ensham Mine. Based on Blackwater monitoring data from the 2020 calendar year, for example, the annual average background PM_{10} value (16.2 µg/m³) represents only 65% of the relevant criterion.

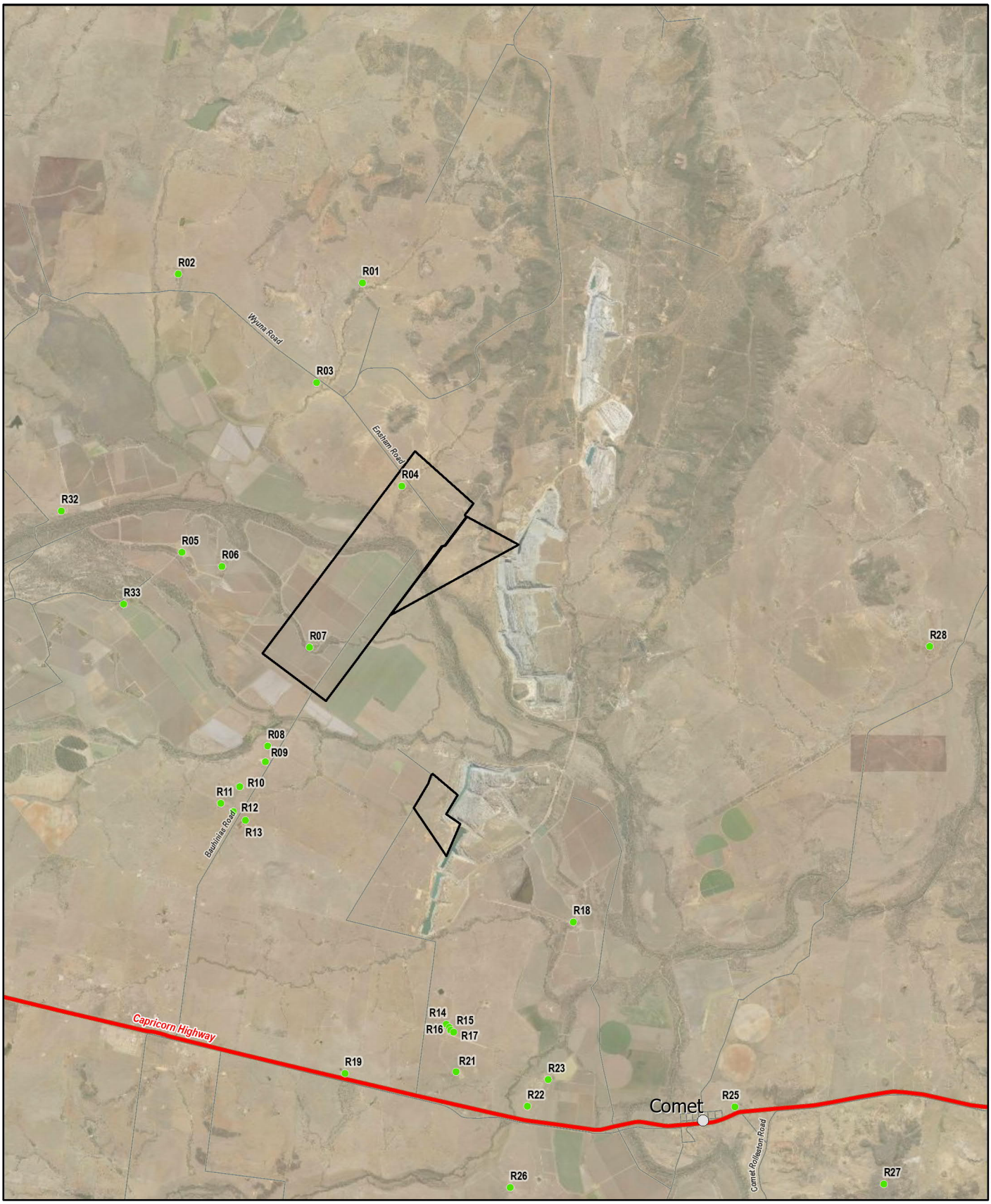


Figure 15-4
Identified sensitive receptors

Legend

- Project Area
- Main road
- Other road
- Towns
- Receptors

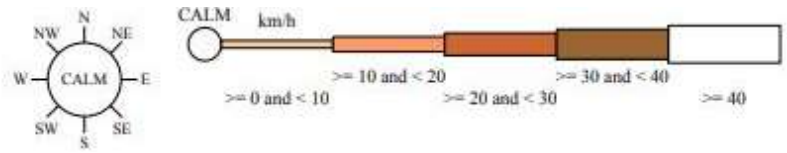
Ensham RESOURCES

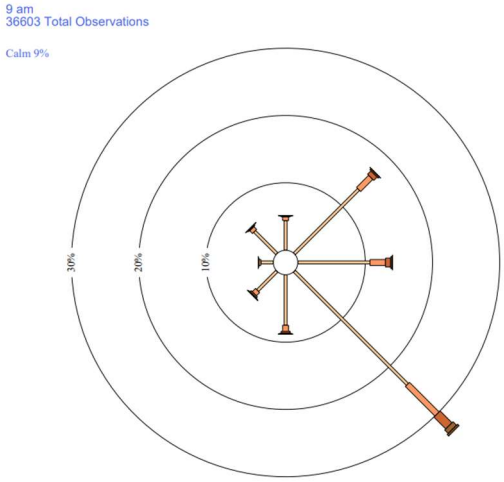
0 3 5 km

ENSHAM LIFE OF MINE EXTENSION PROJECT

Projection: GDA 1994 MGA Zone 55 Scale: 1:175,000
Source: State of Queensland, 2019. Imagery: State of Queensland, 2017.
AECOM 2020

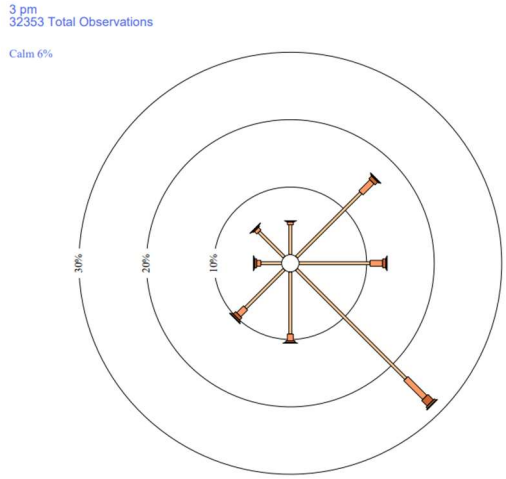
AECOM GIS Printed Date: 10/08/2020, PX60GX60603719\900_CAD_GIS\920_GIS\02_MXDs\60603371_Ensham_EIS\60603371_Chapter15_AirQuality\60603371_Chapter15_AirQuality.aprx, FIGURE G072_F15-4_SensitiveReceptors, V2





Annual 9am wind rose at Emerald Post Office[1.]

Annual 9am wind rose at Blackwater Treatment Plant[2.]



No 3pm wind rose available for Blackwater Treatment Plant

Annual 3pm wind rose at Emerald Post Office[1.]

Figure notes:
1. Annual wind rose of wind direction versus wind speed based on observations from 1896 to 1992
2. Annual wind rose of wind direction versus wind speed based on observations from 1995 to 2008

Figure 15-5 Wind roses for BoM monitoring stations Blackwater and Emerald

15.4.4 Terrain and land use

Terrain features and land use can influence meteorological conditions on both a local and regional scale. The terrain in the area is generally flat, with the area to the west of Ensham Mine a flood plain for the Nogoa River, a tributary of the Fitzroy River. The areas to the east and south are also mostly flat with elevations above sea level approximately 160 m. Ensham Mine itself sits within a small valley that runs north south, with peaks either side at between 230 and 300 m. This valley extends past the northern boundary of the open-cut pits at Ensham Mine.

Land use surrounding the mine consists of agricultural uses to the east and south of Ensham Mine, in the areas of the Nogoa River floodplain. Scattered residential rural land is to the north, west, and south. Primarily the surrounding land is categorised as agriculture and dry land farming. The townships of Comet, Emerald, and Blackwater are located to the south, west, and east, and are between 10 and 40 km from Ensham Mine.

15.4.5 Existing emission sources

A National Pollutant Inventory search conducted for the study area shows three main facilities that are required to report emissions annually, which include the following:

- Kestrel Mine, Emerald (24 km north-east of the Project)
- Blackwater Mine, Blackwater (35 km south-east of the Project)
- Curragh Mine, Blackwater (40 km east of the Project).

Although each of the identified existing emissions sources are likely to be significant emissions sources for the region, the separation distances between them and Ensham Mine is such that their emissions are not expected to directly affect the study area. Given the prevailing wind conditions for the area, emissions from the Kestrel Mine, are unlikely to impact the study area. Emissions from Curragh Mine and Blackwater Mine are likely to be captured in the Blackwater DES monitoring data, which has been adopted for the assessment, resulting in a conservative assessment of potential cumulative impacts.

15.4.6 Emissions sources that may commence during life of mine

Two mining leases to the north-east are classified as permits under application, ML 700028 (Wilton Coal Project) and ML 700043 (Fairhill Coal Project). Although both projects are currently under application, there is potential for them to commence during the life of mine for the Project.

The Wilton Coal Project, located approximately 3 km east of the northern extent of the Ensham Mine, has a proposed maximum coal production of 1.65 Mtpa and proposed operating life of six years. An air quality impact assessment was prepared for the Wilton Coal Project by Simpson Engineering Group, dated 5 October 2018. The Wilton Coal Project air quality impact assessment considered the cumulative impact of its proposed open cut operations and the existing air environment. The existing environment considered in the Wilton Coal Project air quality impact assessment included monitoring that had contributions from the existing Ensham mine operations.

The Wilton Coal Project air quality impact assessment identified that predicted cumulative air quality impacts from Wilton Coal Project were expected to result in minor exceedances of the EPP Air at the sensitive receptors closest to the Wilton Coal Project. To manage the potential for exceedances the Wilton Coal Project made a commitment to implement a reactive management strategy comprising continuous real-time monitoring of PM_{10} and meteorology. The objective of the monitoring program is to manage and prevent exceedances of dust at the border of the Wilton Coal Project mining lease, and not contribute to a cumulative exceedance from the existing operations of Ensham Mine. It is therefore expected that any potential cumulative impacts from the

combined emissions sources of the Wilton Coal Project and the Project have been already considered in the Wilton Coal Project air quality impact assessment and will be managed by the Wilton Coal Project air quality monitoring and program.

The Fairhill Coal Project is approximately 20 km to the north-west of Ensham Mine. An air quality impact assessment was completed for Fairhill Coal Project by Simpson Engineering Group, dated 3 June 2019. The Fairhill Coal Project air quality impact assessment provided predicted air impacts to its nearest 10 sensitive receptors. None of the sensitive receptors with predicted air impacts are shared with Ensham Mine. Therefore, due to the lack of predicted impacts at shared sensitive receptors and the 20km separation distance between the Fairhill Coal Project and Ensham Mine, there is a low likelihood of cumulative air quality impacts.

In addition to the above point, the approved open cut mine at Ensham is scheduled to close by 2024. Closure of the open cut mining operation will have a positive impact on currently approved emission levels.

15.5 Potential impacts

15.5.1 Modelled Emissions

Emission rates for sources of air pollution identified for each scenario were estimated using a combination of published emission rates and site-specific data. A summary of the emission rates modelled for each scenario (in grams per second (g/s)) are presented in **Table 15-5**, **Table 15-6** and **Table 15-7**.

As discussed in **Section 15.3.2.2**, the Project entails an extension of existing underground mining operations hence there is no construction or commissioning phase, and to account for the decommissioning phase, the concurrent rehabilitation works have been included in the operational scenario emissions listed in the following tables.

Table 15-5 Scenario 1 (operations) modelled emission rates

Activity/source	Emission rate (g/s) – scenario 1 (Ensham Mine)			Emission rate (g/s) – scenario 1 (Project only)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Underground Mining Sources						
Vent A1 to A2 & A1 to B1	0.290	0.290	0.290	-	-	-
Vent Ramp 5	0.080	0.080	0.080	-	-	-
Conveyor transfer points on portal to UG stockpile conveyor	0.081	0.038	0.006	0.046	0.022	0.003
Loading UG stockpile from conveyors	1.058	0.449	0.067	0.597	0.254	0.038
Load trucks with FEL at UG stockpile	2.556	1.234	0.185	1.442	0.696	0.104
Haul from UG stockpile to CHP	3.766	1.074	0.107	2.124	0.606	0.061
Wind erosion on UG stockpile	4.158	2.079	0.312	-	-	-
Open Cut Sources						
Dragline on overburden	3.870	1.487	0.223	-	-	-
Excavator loading trucks with ROM	0.328	0.301	0.045	-	-	-
Dozer with dragline	0.225	0.081	0.012	-	-	-

Activity/source	Emission rate (g/s) – scenario 1 (Ensham Mine)			Emission rate (g/s) – scenario 1 (Project only)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Haul ROM to intermediate stockpiles with dump trucks	1.554	0.443	0.044	-	-	-
Dump ROM onto intermediate stockpiles	0.226	0.095	0.014	-	-	-
Load road trains from intermediate stockpiles	0.656	0.316	0.047	-	-	-
Haul ROM with road trains	1.965	0.560	0.056	-	-	-
Drilling	0.112	0.059	0.009	-	-	-
Blasting	0.324	0.169	0.025	-	-	-
Scraper on topsoil	0.156	0.039	0.006	-	-	-
Haul topsoil	1.036	0.418	0.042	-	-	-
Dump topsoil on stockpiles	0.065	0.023	0.003	-	-	-
Grader on all haul roads	0.396	0.177	0.027	-	-	-
Wind erosion on intermediate stockpile	4.274	2.137	0.321			
Wind erosion on open cut pit areas	20.191	10.095	1.514	-	-	-
Processing Plant Sources						
Dump coal from trucks into ROM crusher hopper	1.107	0.465	0.070	0.497	0.209	0.031
Transfer points on conveyors (total)	0.204	0.096	0.014	0.091	0.043	0.006
Crushing (tertiary crushing controlled)	0.066	0.030	0.006	0.030	0.013	0.002
Screening	0.122	0.041	0.003	0.055	0.018	0.001
Loading product stockpile with stackers	0.443	0.188	0.028	0.199	0.085	0.013
Dozers on product stockpile	-	-	-	20.527	7.933	1.190
Loading trains	0.044	0.019	0.003	0.020	0.008	0.001
Wind erosion on product stockpile	7.883	3.942	0.591	-	-	-
Rehabilitation sources						
Dozers on rehab (2 dozers)	0.899	0.171	0.026	-	-	-
Grader on rehab	0.137	0.061	0.009	-	-	-
Load trucks with rehab overburden via excavator	0.020	0.010	0.001	-	-	-
Haul rehab overburden with dump trucks	0.782	0.223	0.022	-	-	-
Dump rehab overburden from trucks	0.371	0.133	0.020	-	-	-
Load trucks with topsoil	0.013	0.006	0.001	-	-	-
Haul topsoil with dump trucks	0.601	0.171	0.017	-	-	-
Dump topsoil from trucks	0.237	0.085	0.013	-	-	-
Wind erosion on rehab area	47.397	23.698	3.555	-	-	-

Table 15-6 Scenario 2 (operations) modelled emission rates

Activity/source	Emission rate (g/s) – Scenario 2 (Ensham Mine)			Emission rate (g/s) – Scenario 2 (Project only)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Underground Mining Sources						
Vent A1 to A2 & A1 to B1	0.29	0.29	0.29	-	-	-
Vent Ramp 5	0.08	0.08	0.08	-	-	-
Conveyor transfer points on portal to UG stockpile conveyor	0.068	0.032	0.005	0.038	0.018	0.003
Loading UG stockpile from conveyors	0.893	0.380	0.057	0.491	0.208	0.031
Load trucks with FEL at UG stockpile	2.158	1.042	0.156	1.185	0.572	0.086
Haul from UG stockpile to CHP	3.180	0.907	0.091	1.747	0.498	0.050
Wind erosion on UG stockpile	4.158	2.079	0.312	-	-	-
Processing Plant Sources						
Dump coal from trucks into ROM crusher hopper	0.744	0.313	0.047	0.409	0.172	0.026
Transfer points on conveyors (total)	0.137	0.065	0.010	0.075	0.036	0.005
Crushing (tertiary crushing controlled)	0.045	0.020	0.004	0.025	0.011	0.002
Screening	0.082	0.028	0.002	0.045	0.015	0.001
Loading product stockpile with stackers	0.298	0.127	0.019	0.164	0.069	0.010
Dozers on product stockpile	-	-	-	20.527	7.933	1.190
Loading trains	0.030	0.013	0.002	0.016	0.007	0.001
Wind erosion on product stockpile	7.883	3.942	0.591	-	-	-
Rehabilitation sources						
Dozers on rehab (9 dozers)	4.044	0.768	0.115	-	-	-
Grader on rehab	0.137	0.061	0.009	-	-	-
Load trucks with rehab overburden via excavator	0.089	0.042	0.004	-	-	-
Haul rehab overburden with dump trucks	3.516	1.002	0.100	-	-	-
Dump rehab overburden from trucks	1.632	0.585	0.088	-	-	-
Load trucks with topsoil	0.003	0.001	0.0001	-	-	-
Haul topsoil with dump trucks	0.078	0.022	0.002	-	-	-
Dump topsoil from trucks	0.063	0.023	0.003	-	-	-
Wind erosion on rehab area	57.630	28.815	4.322	-	-	-

Table 15-7 Scenario 3 (operations) modelled emission rates

Activity/source	Emission rate (g/s) – Scenario 3 (Project only)		
	TSP	PM_{10}	$PM_{2.5}$
Underground Mining Sources			
Vent A1 to A2 & A1 to B1	0.29	0.29	0.29
Vent Ramp 5	0.08	0.08	0.08
Conveyor transfer points on portal to UG stockpile conveyor	0.123	0.058	0.009
Loading UG stockpile from conveyors	1.605	0.682	0.102
Load trucks with FEL at UG stockpile	3.880	1.873	0.281
Haul from UG stockpile to CHP	5.717	1.630	0.163
Wind erosion on UG stockpile	4.158	2.079	0.312
Processing Plant Sources			
Dump coal from trucks into ROM crusher hopper	1.338	0.562	0.084
Transfer points on conveyors (total)	0.246	0.116	0.017
Crushing (tertiary crushing controlled)	0.080	0.036	0.007
Screening	0.147	0.049	0.003
Loading product stockpile with stackers	0.535	0.227	0.034
Dozers on product stockpile	20.527	7.933	1.190
Loading trains	0.054	0.023	0.003
Wind erosion on product stockpile	7.883	3.942	0.591
Rehabilitation sources			
Dozers on rehab (5 dozers)	2.247	0.427	0.064
Grader on rehab	0.137	0.061	0.009
Load trucks with rehab overburden via excavator	0.054	0.030	0.003
Haul rehab overburden with dump trucks	2.117	0.773	0.077
Dump rehab overburden from trucks	0.983	0.409	0.061
Load trucks with topsoil	0.009	0.004	0.0004
Haul topsoil with dump trucks	0.596	0.170	0.017
Dump topsoil from trucks	0.160	0.057	0.009
Wind erosion on rehab area	57.345	28.673	4.301

15.5.2 Impact assessment

Results of the three modelling scenarios for the pollutants of concern are summarised in **Table 15-8**, which presents the highest concentrations predicted at the worst-affected receptors (in terms of both Project-only impacts and cumulative impacts in cases where this is not the same receptor). The results are presented as "Project" (Project emissions only), "Ensham" (emissions due to the approved operations at Ensham Mine) and "Cumulative" (total of Project, approved Ensham Mine operations and background concentrations listed in **Table 15-4**).

The predicted cumulative ground level concentrations have been compared against the relevant air quality criteria for the identified pollutant of concern.

The results are summarised as follows:

- Scenario 1:
  - Predicted Project (Project emission only) pollutant concentrations were well below (at most 14 per cent) the relevant air quality criteria
  - Predicted cumulative (total of Project, existing Ensham Mine operations and background concentrations) pollutant concentrations were highest at Receptor R4 for all pollutants except for 24-hour PM_{10} which was highest at receptor R7. All predicted cumulative concentrations were below the relevant air quality criteria.
- Scenario 2:
  - Predicted Project (Project emission only) pollutant concentrations were well below (at most 14 per cent) the relevant air quality criteria
  - Predicted cumulative (total of Project, existing Ensham Mine operations and background concentrations) pollutant concentrations were highest at Receptor R13 for all pollutants except for 24-hour $PM_{2.5}$ which was highest at receptor R10. All predicted cumulative concentrations were below the relevant air quality criteria.
- Scenario 3:
  - Predicted Project (Project emission only) pollutant concentrations were well below (at most 19 per cent) the relevant air quality criteria
  - Predicted cumulative (total of Project, existing Ensham Mine operations and background concentrations) pollutant concentrations were highest at Receptor R13 for all pollutants except for 24-hour PM_{10} which was highest at receptor R7 and 24-hour $PM_{2.5}$ which was highest at R10. All predicted cumulative concentrations were below the relevant air quality criteria.

Overall, predicted pollutants concentrations for all three scenarios showed that the Project will contribute only minor amounts to pollutant concentrations at sensitive receptors and that cumulative pollutant concentrations would remain below relevant air quality criteria.

While the cumulative annual average PM_{10} are only fractionally below the relevant air quality objective, as discussed previously the background monitoring data review presented in the addendum in **Appendix G-1** concluded that the background PM_{10} levels assumed in the air quality assessment are likely to be highly conservative. For example, if Blackwater monitoring data from the 2020 calendar year was used, the cumulative annual average PM_{10} concentrations shown in **Table 15-8** would be reduced by just over 7 µg/m^3.

The modelling results also indicate that over the life of the Project, i.e. from Scenario 1 (2024) through Scenario 2 (2028) to Scenario 3 (2032), the cumulative off-site particulate levels are not predicted to increase significantly as a result of the Project, and instead are predicted to reduce slightly in most cases.

Based on the above, the assimilative capacity of the environment appears sufficient such that Project emissions are unlikely to contribute to exceedances of the relevant air quality criteria.

Table 15-8 Highest predicted pollutant concentrations at sensitive receptors

Pollutant and averaging period	Scenario	Concentration at worst-affected receptor (µg/m³)			Air quality objective (µg/m³)	Receptor
		Project	Ensham	Cumulative		
TSP – Annual average	1	1.4	1.5	**61.7**	**90**	R8 & R9
	2	1.4	1.6	**61.7**		R9
		1.2	1.8	**61.9**		R13
	3	2.6	-	**61.4**		R9 & R12
PM_{10}– Annual average	1	0.5	0.9	**24.9**	**25**	R7
		0.4	1.0	**24.9**		R4
	2	0.5	0.7	**24.7**		R13
	3	1.1	-	**24.6**		R13
PM_{10}– 24 hour average	1	7.2	4.1	**36.4**	**50**	R7
	2	7.0	1.8	**33.9**		R7
		3.4	5.7	**34.2**		R13
	3	9.3	-	**33.4**		R7
$PM_{2.5}$– Annual average	1	0.08	0.15	**7.3**	**8**	R7
	2	0.08	0.11	**7.2**		R9
		0.07	0.13	**7.2**		R13
	3	0.18	-	**7.2**		R13
$PM_{2.5}$– 24 hour average	1	1.1	0.6	**9.2**	**25**	R7
	2	1.0	0.3	**8.8**		R7
		0.8	0.6	**9.0**		R10
	3	1.5	-	**9.0**		R8, R9, R10
Pollutant and averaging period	**Scenario**	**Concentration at worst-affected receptor (µg/m³)**			**Air quality objective (mg/m²/day)**	**Receptor**
		Project	**Ensham**	**Cumulative**		
Deposited dust – 30 days	1	0.03	0.09	**80.4**	**120**	R7
	2	0.03	0.03	**80.3**		R7
	3	0.06	-	**80.3**		R13

15.6 Mitigation measures

Consistent with current practice at Ensham Mine, dust controls are proposed to be used throughout the duration of the Project. No additional Project-specific dust control measures are required as the modelling showed that existing mitigation strategies will provide a level of control that allows the Project to comply with air quality criteria. Current air quality controls that would continue for the Project include:

- Maintain a high degree of dust control efficiency on primary haul roads via watering, with the application of additional water to hauls roads during very dry and dusty periods. Assumed Level 2 Watering (greater than two litres per square metre per hour) with a 75 per cent control efficiency
- Dragline drop heights maintained to approximately 9 m or less

- Overburden dumping from truck and shovel occurs within pit
- Dozer utilisation rates at 90 per cent or less
- Ongoing rehabilitation as per residual void rehabilitation plan
- Continue monthly dust deposition monitoring at the current three monitoring locations
- Modify operations during adverse meteorological conditions if necessary— e.g. reduce and/or cease operations during dry windy conditions
- At rail load out:
  - apply veneer suppressant to the surface of loaded coal wagons
  - maintain coal loading techniques where applicable to reduce overfilling hence spillage during transport
  - load profiling to create a consistent surface of coal in each wagon, to be implemented at the load out.

The assessment showed no exceedances of relevant air quality criteria during the life of the Project. Current mitigation strategies listed above are sufficient and would continue for the duration of the Project. These mitigation strategies should ensure a high likelihood that the air quality criteria are met for the duration of the Project.

15.7 Summary and conclusions

An air quality assessment was conducted to assess the potential for offsite impacts due to dust emissions from mining activities associated with the Project. Three operational scenarios were defined, and scenario specific emission rates quantified for relevant dust generating activities. Relevant mitigation commitments were identified and applied to the emission rates.

The assessment predicts that the Project will not cause the exceedance of any of the air quality objectives at any of the identified sensitive receptors, even using very conservative background concentrations to estimate the potential cumulative impacts. The predicted cumulative concentrations of all the pollutants of interest were below the EA criteria in all of the modelled scenarios.

Overall, the outcomes of the three modelled scenarios showed that the Project is not predicted to exceed air quality objectives. The assimilative capacity of the receiving environment is generally sufficient such that Project emissions would not result in an unacceptable degradation of air quality at neighbouring sensitive receptors for the environmental values to which they are sensitive. Existing emission sources and emissions sources that may commence during the life of mine have been considered and were determined to have a low likelihood of cumulative impact at shared sensitive receptors.

Current air quality management at Ensham Mine is proving to be effective in generating compliance with relevant EA conditions as shown by no air quality related complaints in the last six years. The current management and EA conditions would apply to the Project and it is therefore anticipated that ongoing air quality compliance would be achieved with the inclusion of the Project.

15.8 References

DES, 2017a, *Application requirements for activities with impacts to air,* Department of Environment and Science.