# Appendix G

## *Air Quality and Greenhouse Gas Assessment*

# Boggabri Coal Mine Modification 8

## Air Quality and Greenhouse Gas Assessment

Final | Revision 2

21 July 2021

Hansen Bailey on behalf of Boggabri Coal Operations Pty Ltd

Hansen Bailey Reference 1974

# Boggabri Coal Mine Modification 8

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## Acronyms and definitions

| Abbreviation | Definition |
|---|---|
| BoM | Bureau of Meteorology |
| BCOPL | Boggabri Coal Operations Pty Ltd |
| CALMET | Meteorological model for the CALPUFF air dispersion model |
| CALPUFF | Computer-based air dispersion model |
| CO | Carbon monoxide |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DEC | Department of Environment and Conservation |
| DPIE | Department of Planning, Industry and Environment |
| EPA | NSW Environment Protection Authority |
| ERF | Emissions Reduction Fund |
| EPL | Environment Protection Licence |
| GHG | Greenhouse gas |
| HVAS | High volume air sampler |
| Jacobs | Jacobs Group (Australia) Pty Limited |
| MCCPL | Maules Creek Coal Pty Ltd |
| MIA | Mine Infrastructure Area |
| Mtpa | Million tonnes per annum |
| NGER | National Greenhouse Gas and Energy Reporting |
| NEPM | National Environment Protection Measure |
| NEPC | National Environment Protection Council of Australia |
| NO | Nitric oxide |
| $NO_2$ | Nitrogen dioxide |
| $NO_x$ | Oxides of nitrogen |
| NPI | National Pollutant Inventory |
| OEH | Office of Environment and Heritage, now part of the Department of Planning, Industry and Environment as Environment, Energy and Science |
| $PM_{2.5}$ | Particulate matter with equivalent aerodynamic diameters less than 2.5 microns |
| $PM_{10}$ | Particulate matter with equivalent aerodynamic diameters less than 10 microns |
| POEO Act | *Protection of the Environment Operations (POEO) Act 1997* |
| ROM | Run-of-mine |
| $SO_2$ | Sulphur dioxide |
| SSD | State Significant Development (Boggabri's Project approval declared SSD 09_0182 in June 2019) |
| TAPM | The Air Pollution Model – a meteorological and air dispersion model developed by CSIRO |
| TCPL | Tarrawonga Coal Pty Ltd |
| TEOM | Tapered Element Oscillating Microbalance |
| TSP | Total suspended particulate matter |

# Executive Summary


Boggabri Coal Operations Pty Ltd (BCOPL), a subsidiary of Idemitsu Australia Resources (IAR), is seeking approval to modify its approved mining operations at the Boggabri Coal Mine (BCM), hereafter referred to MOD 8. Approval is sought via an application made under Section 4.55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This report provides an assessment of the potential air quality and greenhouse gas (GHG) impacts of MOD 8.

The assessment involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling to predict the impact of MOD 8 on local air quality. GHG emissions have been estimated in accordance with recognised Australian Government procedures to address the environmental assessment requirements.

The key air quality issues for the proposed changes associated with MOD 8 were identified as mining dust, post-blast fume and diesel exhaust. These issues were the focus of the assessment.

A detailed review of the existing environment was carried out including an analysis of historically measured concentrations of key quality indicators from representative monitoring stations. This included analysis of six years of site specific monitoring data. The following conclusions were made in relation to the existing environment:

- Meteorological conditions in 2017 were representative of the long term, local conditions around the BCM.
- There was a deterioration in air quality conditions from 2017 to 2019, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Northwest Slopes and Plains.
- BCOPL has complied with the air quality criteria specified in the existing State Significant Development (SSD) Approval for the past six years.

The key outcomes of the modelling and subsequent assessment are:

- The potential extent of impacts due to the BCM (including the changes sought by MOD 8) would be largely within the currently approved extent of impacts.
- Dust concentrations and deposition levels due to mining are unlikely to exceed relevant Environment Protection Authority (EPA) and Voluntary Land Acquisition and Mitigation Policy (VLAMP) assessment criteria at the nearest private sensitive receptors and are expected to continue complying with the existing air quality criteria in the SSD Approval.
- The only potential for BCM (including the changes sought by MOD 8) to cause an exceedance of EPA criteria (specifically 24-hour average $PM_{10}$) is when the background levels from other sources are already approaching the criteria. Under these conditions, modelling indicated that the contribution from BCM (including the changes sought by MOD 8) would be very small (3 µg/m$^3$ at one property) and that this risk can be managed through the ongoing implementation of the air quality management measures currently in place at BCM.
- No changes are proposed to BCOPL's existing air quality monitoring network.
- Post blast fume emissions are not expected to result in any adverse air quality impacts.
- Emissions from diesel exhausts associated with off-road vehicles and mining equipment are not expected to result in any adverse air quality impacts.
- The estimated annual average Scope 1 and 2 emissions from BCM (including the changes sought by MOD 8) represent approximately 0.13% of Australia's 2019 emissions. Coal produced by the BCM is predominantly exported to countries which are either signatories to the Paris Agreement and / or have announced or adopted domestic laws or policies to achieve their emissions targets. Whilst emissions from the end use of the coal have been calculated as Scope 3 emissions for the purposes of the MOD 8 assessment, BCOPL's customers account for these same emissions as Scope 1 emissions and are required to comply with their respective countries' emissions targets.

- The mitigation measures, strategies and initiatives of Idemitsu and BCOPL show that the business is actively engaged in minimising existing and future GHG emissions associated with their coal operations.

Based on this assessment, it has been concluded that MOD 8 is unlikely to affect air quality beyond the range of historically measured fluctuations of key air quality indicators around Boggabri. This conclusion has been informed by modelling which showed that BCM (including changes sought by MOD 8) would not result in changes to air quality that would cause exceedances of air quality criteria at the nearest private sensitive receptors.

## Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to quantify the potential air quality impacts of the Boggabri Coal Mine Modification 8 in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

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# 1. Introduction

## 1.1 Background

Boggabri Coal Operations Pty Ltd (BCOPL), a subsidiary of Idemitsu Australia Resources (IAR), is seeking approval for a modification to operations at the Boggabri Coal Mine (BCM). Specifically, BCOPL is seeking a modification to the existing State Significant Development (SSD) Approval 09_0182 to increase the depth of approved mining operations within the currently approved Mine Disturbance Boundary and to facilitate the construction of a fauna movement crossing of the existing haul road at the BCM (MOD 8). Approval is sought via an application to be made under Section 4.55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This report provides an assessment of the potential air quality and greenhouse gas (GHG) impacts of the BCM incorporating changes sought by MOD 8.

## 1.2 Modification Description

The BCM is an open-cut coal mine located approximately 15 kilometres (km) northeast of the township of Boggabri in north western NSW. The mine has been operating since 2006. Truck and excavator operations are used to mine coal which is crushed and screened or washed in the Coal Handling Preparation Plant (CHPP) to produce thermal, semi-soft coking and Pulverised Coal Injected (PCI) products. Product coal is loaded onto trains via an on-site train loading facility and transported by rail to the Port of Newcastle for sale to the export market. BCOPL has managed the BCM operations on behalf of IAR and its joint venture partners since 2006.

BCM operates pursuant to SSD Approval 09_0182 (as modified) which allows for the extraction of up to 8.6 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until the end of December 2033. These operations are referred to as the Approved Development.

In summary, the Proposed Modification includes:

- Increasing the approved maximum depth of mining down to the Templemore Coal Seam to recover an additional 61.6 Million tonnes (Mt) of ROM coal within the currently approved Mine Disturbance Boundary. It is expected that the additional ROM coal will be suitable for producing a lower ash, higher energy thermal, semi-soft coking and PCI quality products for sale to the export market. This will result in the extension of the mine life by six (6) years.
- Construction of a specifically designed fauna movement crossing over the existing haul road between the overburden emplacement area and the western side of the regional biodiversity corridor. The establishment of the fauna movement crossing is proposed to improve the movement of fauna from the Leard State Forest through the Southern Rehabilitation Area.

A detailed description of MOD 8 is provided in the Modification Report with details of all activities that are relevant to the air quality and GHG assessment outlined in Section 5.

Figure 1 shows the location of the BCM, surrounding features and nearest properties. It also illustrates the key features related to MOD 8, including the approved Mine Disturbance Boundary and location where mining operations will increase beyond the Merriown seam, and the MOD 8 Disturbance Footprint where some minor additional disturbance will be required to facilitate the construction of the fauna movement crossing.

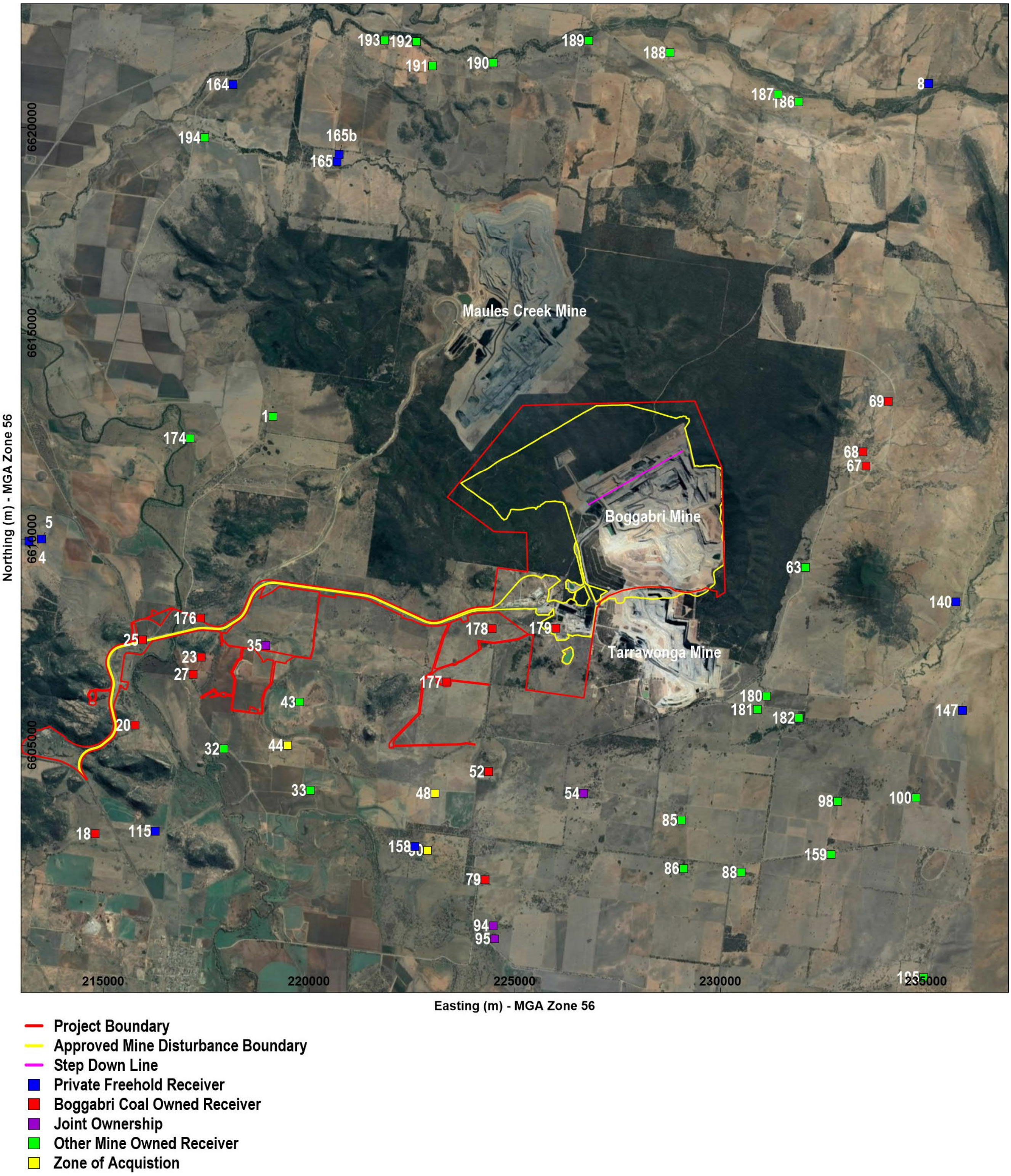



Figure 1 Location of the BCM and surrounds

## 1.3 Performance Outcome

The desired performance outcome for MOD 8 relating to air quality and GHG is to minimise air quality and GHG impacts to reduce risks to human health and the environment to the greatest extent practicable through the design and operation of mining operations at BCM.

## 1.4 Report Structure

The report is structured as follows:

- Section 1 – Introduces MOD 8 with a summary of the background, description and performance outcomes.
- Section 2 – Identifies the key air quality and GHG issues to be addressed.
- Section 3 – Outlines the key legislative and policy assessment requirements for air quality and greenhouse gas.
- Section 4 – Discusses key features of the existing environment including surrounding land uses, sensitive receptors, and local meteorological and air quality conditions.
- Section 5 – Provides an overview of the methods used to assess the potential for air quality and greenhouse gas impacts.
- Section 6 – Provides an assessment of the potential construction and operational air quality impacts including potential cumulative impacts.
- Section 7 – Provides an assessment of the potential GHG emissions.
- Section 8 – Outlines the measures to mitigate or otherwise effectively manage and monitor potential impacts.
- Section 9 – Provides the conclusions of the assessment.

# 2. Key Issues

Air quality issues can arise when emissions from an industry or activity lead to a deterioration in the ambient air quality. Potential air quality issues have been identified from a review of MOD 8 and associated activities. This identification process has considered the types of emissions to air and proximity of these emission sources to sensitive receptors.

Emissions to air from MOD 8 could occur from a variety of activities including material handling, material transport, processing, and wind erosion from exposed areas. These emissions will primarily occur during the operational phase, as limited construction works will be required.

The most commonly associated emission to air from open cut coal mining is dust, also referred to as particulate matter. Key classifications of particulate matter include:

- Total suspended particulates (TSP).
- Particulate matter with equivalent aerodynamic diameter of 10 microns or less ($PM_{10}$).
- Particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$).
- Deposited dust.

Plant and equipment engine exhausts also have the potential to generate emissions that include carbon monoxide (CO), oxides of nitrogen ($NO_x$) and particulate matter, and to a lesser extent sulphur dioxide ($SO_2$). Post-blast fume has the potential to generate nitric oxide (NO) emissions which, in turn, can oxidise to the more harmful nitrogen dioxide ($NO_2$).

The area around the BCM contains various emission sources that contribute to local air quality and the potential cumulative impacts are an important issue to address.

The key issues which were identified for MOD 8 for consideration in this assessment included:

- Mining dust i.e. particulate matter in the form of TSP, $PM_{10}$, $PM_{2.5}$ and deposited dust;
- Post-blast fume ($NO_2$);
- Diesel exhaust ($PM_{10}$, $PM_{2.5}$ and $NO_2$); and
- Greenhouse gas emissions e.g. carbon dioxide equivalent gases ($CO_2$-e).

# 3. Policy Setting

## 3.1 Air Quality Criteria

Air quality is typically quantified by the concentrations of substances in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of one or more substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the substances most relevant to MOD 8 have been identified, from Section 2, as particulate matter and $NO_2$.

The Environment Protection Authority (EPA) has developed assessment criteria for a range of air quality indicators including particulate matter and $NO_2$. These criteria are outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2016), hereafter referred to as the Approved Methods. Most of the EPA criteria referred to in this report have been drawn from national standards for air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 1998).

MOD 8 has been assessed in terms of its ability to comply with the relevant air quality criteria set by the EPA as part of the Approved Methods. These criteria are outlined in Table 1 and apply to existing and potentially sensitive receptors, where the Approved Methods defines a sensitive receptor as including *"a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area"*.

Table 1 EPA air quality assessment criteria

| Air quality indicator | Averaging time | Criterion* |
|---|---|---|
| Particulate matter ($PM_{10}$) | 24-hour | 50 µg/m$^3$ |
| | Annual | 25 µg/m$^3$ |
| Particulate matter ($PM_{2.5}$) | 24-hour | 25 µg/m$^3$ |
| | Annual | 8 µg/m$^3$ |
| Particulate matter (TSP) | Annual | 90 µg/m$^3$ |
| Deposited dust | Annual (maximum increase) | 2 g/m$^2$/month |
| | Annual (maximum total) | 4 g/m$^2$/month |
| Nitrogen dioxide ($NO_2$) | 1-hour | 246 µg/m$^3$ |
| | Annual | 62 µg/m$^3$ |

**Source: Table 7.1 of the Approved Methods.*

The EPA air quality assessment criteria relate to the total concentration of pollutants in the air (that is, cumulative) and not just the contribution from project-specific sources. Therefore, some consideration of background levels needs to be made when using these criteria to assess the potential impacts. In situations where background levels are elevated the proponent must "*demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity and that best management practices will be implemented to minimise emissions of air pollutants as far as is practical*" (EPA, 2016). Section 4 provides further discussion on background levels.

In December 2015, the Australian Government announced a National Clean Air Agreement (Agreement). This Agreement aims to reduce air pollution and improve air quality via the following main actions:

- The introduction of emission standards for new non-road spark ignition engines and equipment.
- Measures to reduce air pollution from wood heaters.
- Strengthened ambient air quality reporting standards for particle pollution.

The strengthening of ambient air quality reporting standards for particle pollution is relevant to MOD 8. Specifically, and at the time, the following was agreed:

> *"Taking into account the latest scientific evidence of health impacts, Ministers agreed to strengthen national ambient air quality reporting standards for airborne fine particles. Ministers agreed to adopt reporting standards for annual average and 24-hour $PM_{2.5}$ particles of 8 µg/m$^3$ and 25 µg/m$^3$ respectively, aiming to move to 7 µg/m$^3$ and 20 µg/m$^3$ respectively by 2025. Ministers also agreed to establish an annual average standard for $PM_{10}$ particles of 25 µg/m$^3$. Victoria and the Australian Capital Territory will set, and South Australia will consider setting, a more stringent annual average $PM_{10}$ standard of 20 µg/m$^3$ in the state, while ensuring nationally consistent monitoring and reporting against the agreed National Environment Protection Measure standards. The decision was also taken to review $PM_{10}$ standards in 2018. The review will be co-led by the NSW and Victorian governments, in discussion with other jurisdictions."*

On 25 February 2016, an amendment to the NEPM entered into force and introduced the new national air quality standards for $PM_{10}$ and $PM_{2.5}$, as noted above. The EPA subsequently revised its $PM_{10}$ and $PM_{2.5}$ assessment criteria as part of an update to the Approved Methods. These revised criteria are reflected in Table 1 and took effect from 20 January 2017 onwards. There is currently no State legislation regarding the aim to move to more stringent $PM_{2.5}$ criteria by 2025. Accordingly, MOD 8 is assessed against the current criteria detailed in the Approved Methods as these criteria would be applied by the consent authority in accordance with the non-discretionary development standards for mining specified in Clause 12AB of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) (2018 amendment).

The NSW Voluntary Land Acquisition and Mitigation Policy (NSW Government, 2018) (VLAMP) includes the NSW Government's policy for voluntary mitigation and land acquisition to address dust (particulate matter) impacts from state significant mining, petroleum and extractive industry developments. The VLAMP brings the air quality criteria in line with the NEPM standards and EPA criteria.

From the VLAMP, voluntary mitigation rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in Table 2 at any residence or workplace.

Table 2 VLAMP mitigation criteria for particulate matter

| Air quality indicator | Averaging time | Mitigation criterion | Impact type |
|---|---|---|---|
| Particulate matter ($PM_{10}$) | 24-hour | 50 µg/m$^3$ ** | Human health |
| | Annual | 25 µg/m$^3$ * | Human health |
| Particulate matter ($PM_{2.5}$) | 24-hour | 25 µg/m$^3$ ** | Human health |
| | Annual | 8 µg/m$^3$ * | Human health |
| Particulate matter (TSP) | Annual | 90 µg/m$^3$ * | Amenity |
| Deposited dust | Annual (maximum increase) | 2 g/m$^2$/month ** | Amenity |
| | Annual (maximum total) | 4 g/m$^2$/month * | Amenity |

** Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).*
*** Incremental impact (i.e. increase in concentrations due to the development alone), with zero allowable exceedances of the criteria over the life of the development.*

Voluntary acquisition rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in Table 3 at any residence or workplace on privately owned land, or on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.

Table 3 VLAMP acquisition criteria for particulate matter

| Air quality indicator | Averaging time | Acquisition criterion | Impact type |
|---|---|---|---|
| Particulate matter ($PM_{10}$) | 24-hour | 50 µg/m$^3$ ** | Human health |
| | Annual | 25 µg/m$^3$ * | Human health |
| Particulate matter ($PM_{2.5}$) | 24-hour | 25 µg/m$^3$ ** | Human health |
| | Annual | 8 µg/m$^3$ * | Human health |
| Particulate matter (TSP) | Annual | 90 µg/m$^3$ * | Amenity |
| Deposited dust | Annual (maximum increase) | 2 g/m$^2$/month ** | Amenity |
| | Annual (maximum total) | 4 g/m$^2$/month * | Amenity |

** Cumulative impact (i.e. increase in concentrations due to the development plus background concentrations due to all other sources).*
*** Incremental impact (i.e. increase in concentrations due to the development alone), with up to five allowable exceedances of the criteria over the life of the development.*

The particulate matter levels for comparison with the criteria in Table 2 and Table 3 must be calculated in accordance with the Approved Methods.

## 3.2 Greenhouse Gas

### 3.2.1 Overview

GHG is a collective term for a range of gases that are known to trap radiation in the upper atmosphere, where they have the potential to contribute to the greenhouse effect (global warming). GHGs include:

- Carbon dioxide ($CO_2$); by far the most abundant GHG, primarily released during fuel combustion.
- Methane ($CH_4$); generated from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills).
- Nitrous oxide ($N_2O$); generated from industrial activity, fertiliser use and production.
- Hydrofluorocarbons (HFCs); commonly used as refrigerant gases in cooling systems.
- Perfluorocarbons (PFCs); used in a range of applications including solvents, medical treatments and insulators.
- Sulphur hexafluoride ($SF_6$); used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

It is common practice to aggregate the emissions of these gases to the equivalent emission of carbon dioxide. This provides a simple figure for comparison of emissions against targets. Aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential (GWP). The resulting number is expressed as carbon dioxide equivalents (or $CO_2$-e).

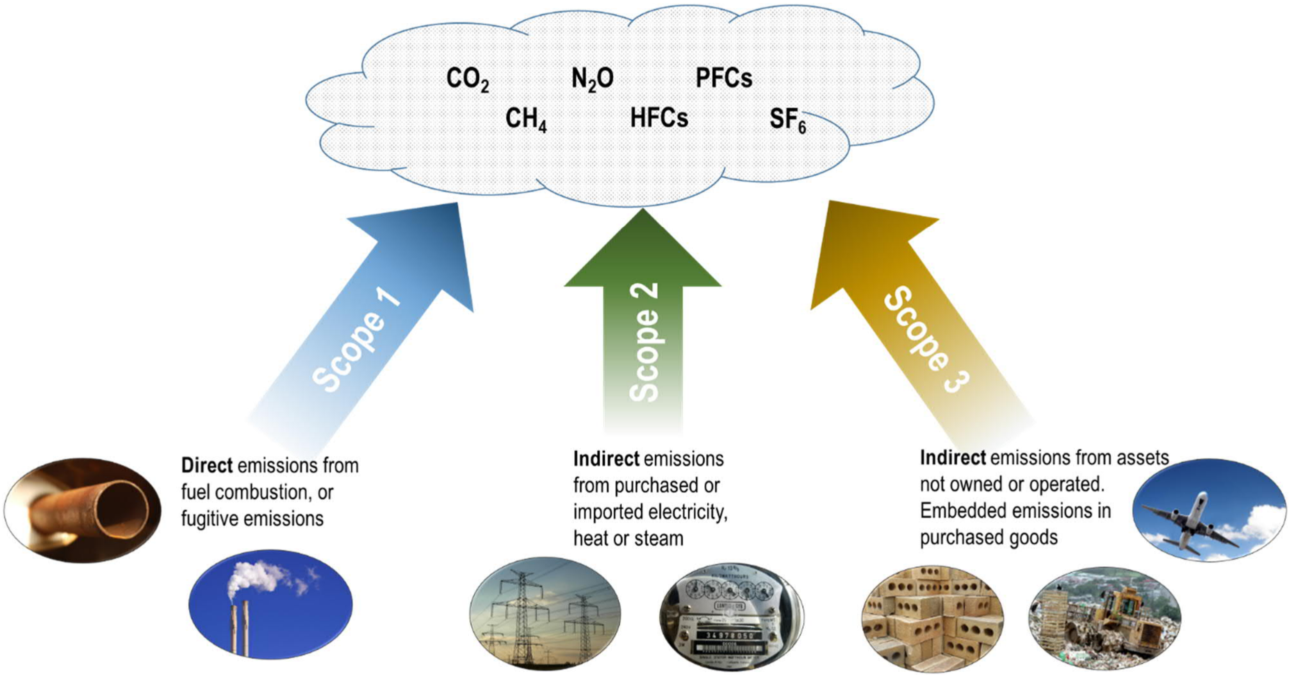
GHG emissions that form an inventory can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol (GHG Protocol)[1] and can be summarised as follows (refer to Figure 2):

- Scope 1 – Direct emissions from sources that are owned or operated by the organisation (examples include combustion of diesel in company owned vehicles or used in on-site generators).
- Scope 2 – Indirect emissions associated with the import of energy from another source (examples include importation of electricity or heat).

[1] The Greenhouse Gas Protocol is a collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides guidance on the calculation and reporting of carbon footprints.

- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (examples include business travel (by air or rail) and product usage).

The purpose of differentiating between the scopes of emissions is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.




*Adapted from – World Business Council for Sustainable Development – Greenhouse Gas Protocol*

Figure 2 Sources of greenhouse gases

### 3.2.2 Federal Greenhouse Gas Policy

#### Paris Climate Conference COP21

During the 21st yearly session of the Conference of Parties (COP) held in Paris in 2015, an agreement was reached 'to achieve a balance between anthropogenic (human induced) emissions by sources and removals by sinks of greenhouse in the second half of this century'. Following COP21, international agreements were made to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius (based on temperature pre-industrial levels).
- From 2018, countries are to submit revised emission reduction targets every five years, with the first being effective from 2020, and goals set to 2050.
- Define a pathway to improve transparency and disclosure of emissions.
- Make provisions for financing the commitments beyond 2020.

In response to this challenge, Australia has committed to reduce emissions to 26-28% on 2005 levels by 2030.

#### National Greenhouse and Energy Reporting Act 2007

The Federal Government uses the National Greenhouse Gas and Energy Reporting (NGER) legislation for the measurement, reporting and verification of GHG emissions in Australia. This legislation is used for a range of purposes, including international GHG reporting. Corporations which meet the thresholds for reporting under NGER must register and report their GHG emissions.

Under the *National Greenhouse and Energy Reporting Act 2007* (NGER Act), constitutional corporations in Australia which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator on an annual basis. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* identifies a number of methodologies to account for GHGs from specific sources relevant to the proposal. This includes emissions of GHGs from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction), and from consumption of electricity from the grid. BCOPL currently reports its emissions from BCM's activities under the NGER Act.

#### Emissions Reduction Fund (ERF)

Previous legislation passed by the Australian Government to reduce carbon emissions was the *Clean Energy Act 2011*. This legislation established an Emissions Trading Scheme (ETS), also referred to as a carbon price. Under this ETS, approximately 370 companies were required to purchase a permit for every tonne of carbon equivalent they emit.

The *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* repealed the *Clean Energy Act 2011*. This abolished the carbon pricing mechanism from 1 July 2014, and replaced it with the Australian Government's Direct Action Plan, which aims to focus on sourcing low cost emission reductions. The Direct Action Plan includes an Emissions Reduction Fund (ERF); legislation to implement the ERF came into effect on 13 December 2014, and is now the centrepiece of the Australian Government's policy suite to reduce emissions.

Emissions reduction and sequestration methodologies are available under the ERF which could provide the opportunity to earn carbon credits as a result of emissions reduction activities.

### 3.2.3 State Greenhouse Gas Policy

#### NSW Climate Change Policy Statement

In response to national GHG reduction commitments, the NSW government has developed the NSW Climate Change Policy Statement which sets the objective of achieving net-zero emissions by 2050. The policy does not impose any specific requirements on developments undertaken by private companies but intends to achieve net-zero emissions through a combination of policy development, leading by example and advocacy.

### 3.2.4 Existing Approvals

As required under SSD 09_0182, BCOPL is required to implement all reasonable and feasible measures to minimise GHG emissions from the BCM. BCOPL has a number of processes by which the GHG emissions from the mining operations are mitigated, including those identified in the Air Quality and Greenhouse Gas Management Plan (Idemitsu, 2018) (or the latest approved version). This plan sets out a range of measures for the management and mitigation of GHGs and opportunities for energy savings. Section 8 provides further details on these measures.

# 4. Existing Environment

This section provides a description of the environmental characteristics in the area, including a review of recent and historical meteorological and ambient air quality conditions. One of the objectives for this review was to develop an understanding of any existing air quality issues and to identify the main factors that have influenced air quality conditions.

## 4.1 Local Setting

The BCM is located in a predominantly rural-residential area in the Northwest Slopes and Plains of NSW, approximately 15 km northeast of Boggabri, and within the Narrabri Shire Council (NSC) Local Government Area (LGA). The closest regional centres are Gunnedah, approximately 40 km to the south, and Narrabri, approximately 50 km to the northwest. The Willow Tree Range forms part of the Leard State Forest and borders the BCM to the north, east and west.

The land surrounding the BCM is predominantly used for agriculture including cattle grazing, cotton and wheat farming. The area also includes the two other existing open-cut coal mines. Maules Creek Mine is located approximately 5 km to the northwest and Tarrawonga Mine borders the BCM to the south. There are also a number of isolated rural residences associated with the surrounding farms (Figure 1).

The surrounding terrain is gently undulating with steeper slopes emerging near ridgelines, encompassing the BCM Project Boundary. Figure 3 shows a pseudo three-dimensional representation of the local terrain. This topographical environment will influence local wind conditions, discussed in Section 4.2.

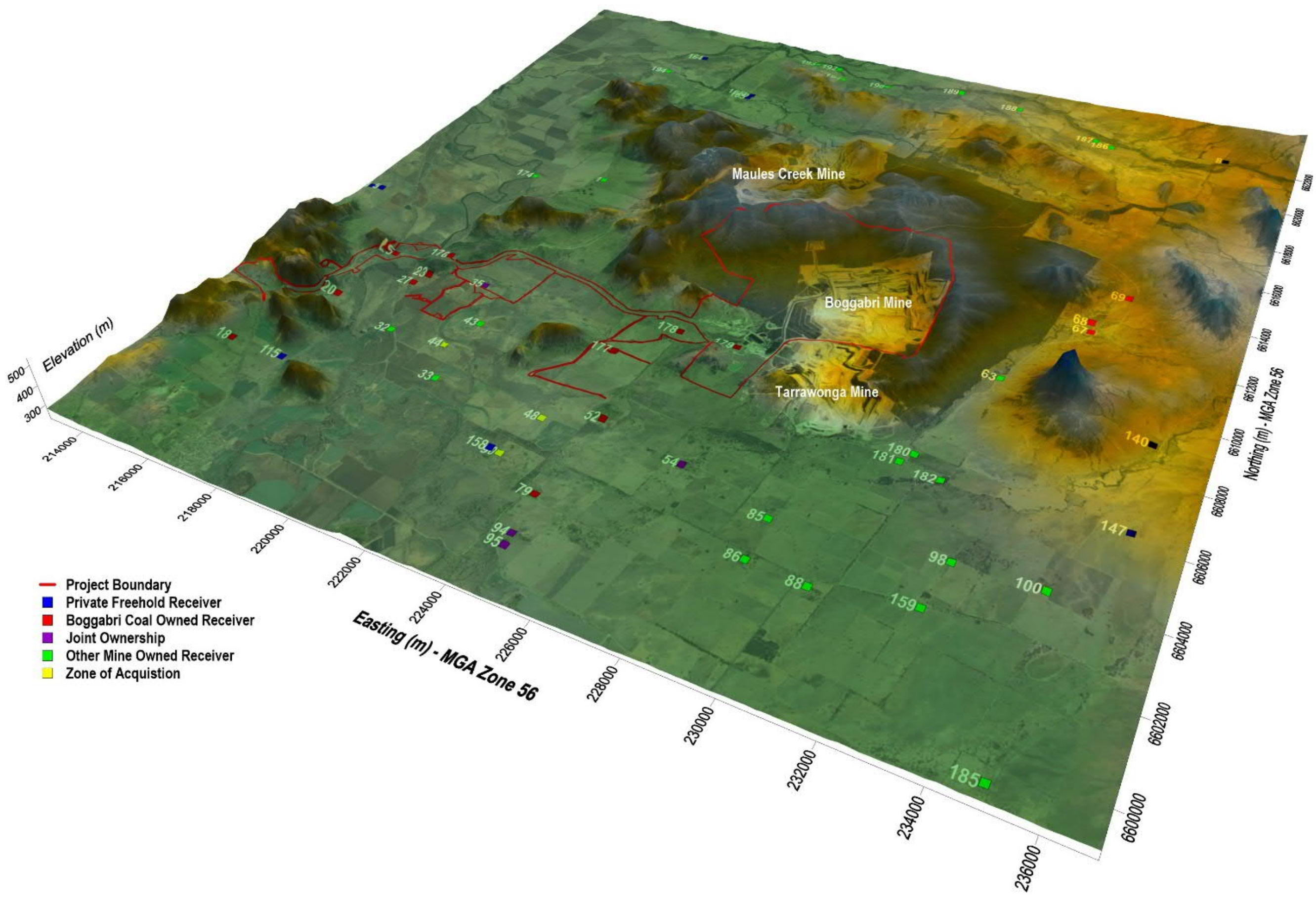



Figure 3 Pseudo three-dimensional representation of the local terrain

## 4.2 Meteorology

Meteorological conditions are important for determining the transport of emissions, and the potential influences on air quality. In addition, meteorological data are often used with concurrent air quality data to determine potential contributions from sources of interest. This section provides an analysis of the meteorological conditions around the BCM and identifies the datasets that are representative of the long term, local conditions.

BCOPL operates four meteorological stations around the BCM with one station, referred to as "W1", specifically operated to meet the monitoring requirements of SSD Approval 09_0182. Meteorological monitoring is also carried out by the operators of the Maules Creek Mine and Tarrawonga Mine. Figure 4 shows the location of all identified meteorological stations proximate to the BCM.

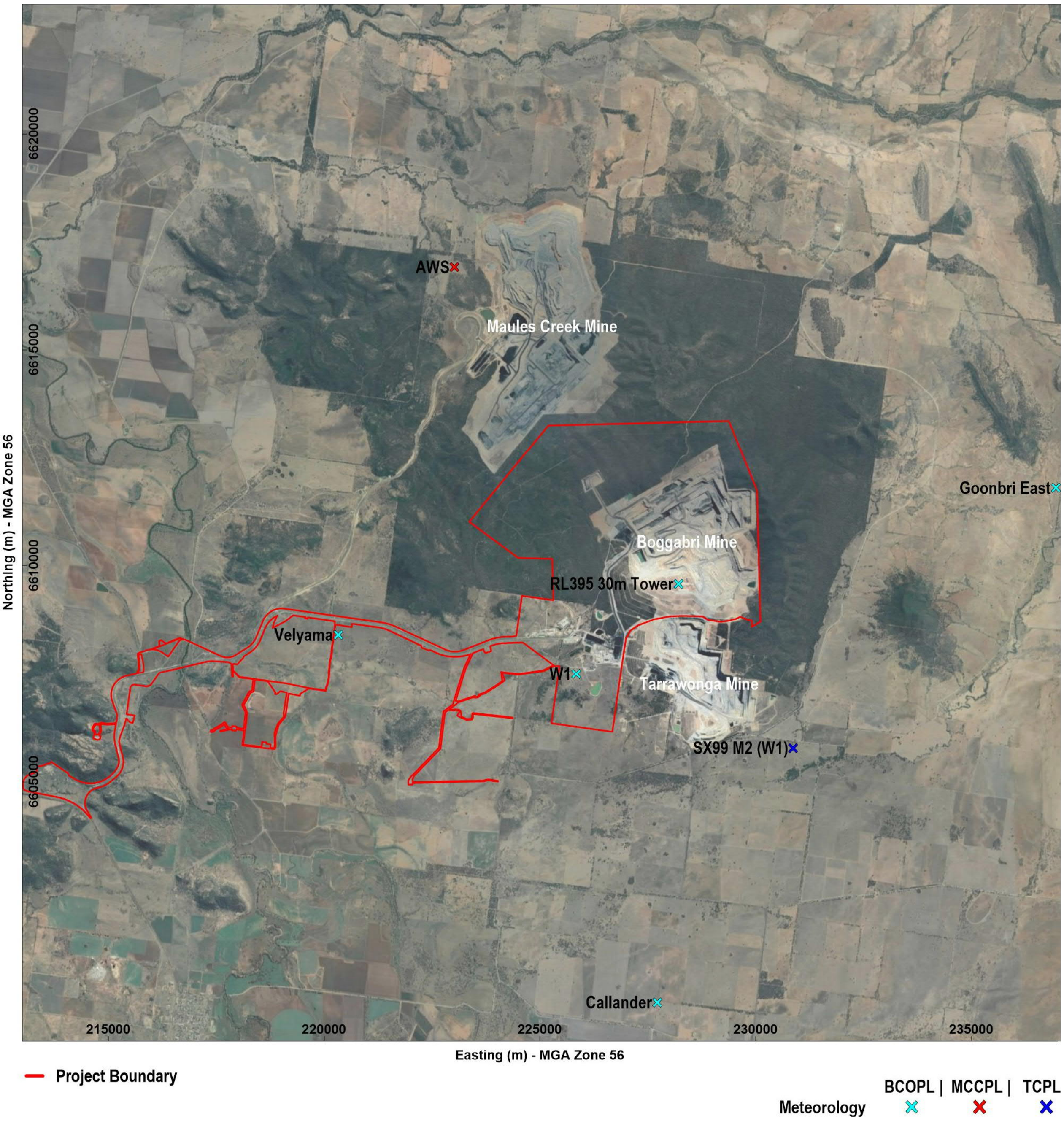



Figure 4 Location of meteorological stations

The EPA prescribes the minimum requirements for meteorological data that are to be used for air quality assessments. These requirements are outlined in the Approved Methods and include minimum data capture rates, siting and operation, and data preparation. Two types of meteorological stations are described by the EPA:

- “Site specific”.
- “Site representative”.

Data from site-specific meteorological stations are preferred for air quality assessments under the Approved Methods. However, site representative data are also acceptable provided that the data adequately describe the expected meteorological conditions at the site of interest. From the EPA descriptions (EPA, 2016), there will be multiple meteorological stations collecting data that can be classified as representative of conditions around the BCM.

Six years of data from the primary BCOPL meteorological station, W1, have been analysed in order to characterise the local conditions and to identify representative datasets. This station can be regarded as “site-specific”. The analysis involved comparing statistics from the data collected at W1 for each calendar year to determine a year-long dataset that most closely reflects the longer term, local conditions. Wind data have primarily been used for this purpose although rainfall data have also been considered.

Wind-roses have been prepared from the data collected at W1 in the most recent six-year period (2015 to 2020 inclusive). The wind-roses (Figure 5) show the frequency of wind speeds and wind directions based on hourly records. The circular format of the wind rose shows the direction from which the wind blew and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colours of each spoke provide details on the speed of the wind from each direction.

The most common winds in the area are from the north-northwest and south-southeast. This pattern of winds is evident in all of the six recent years of data, to various degrees. There are seasonal variations in the wind patterns. The figures in Appendix A show that autumn is generally when the north-northwest winds become less common. Figure 5 shows some fluctuations in the prevailing winds, from north to northwest and from south to southeast, but the data generally indicate that wind patterns do not vary significantly from year to year, and potentially the data from any of the years presented could be considered as representative of the longer term conditions.

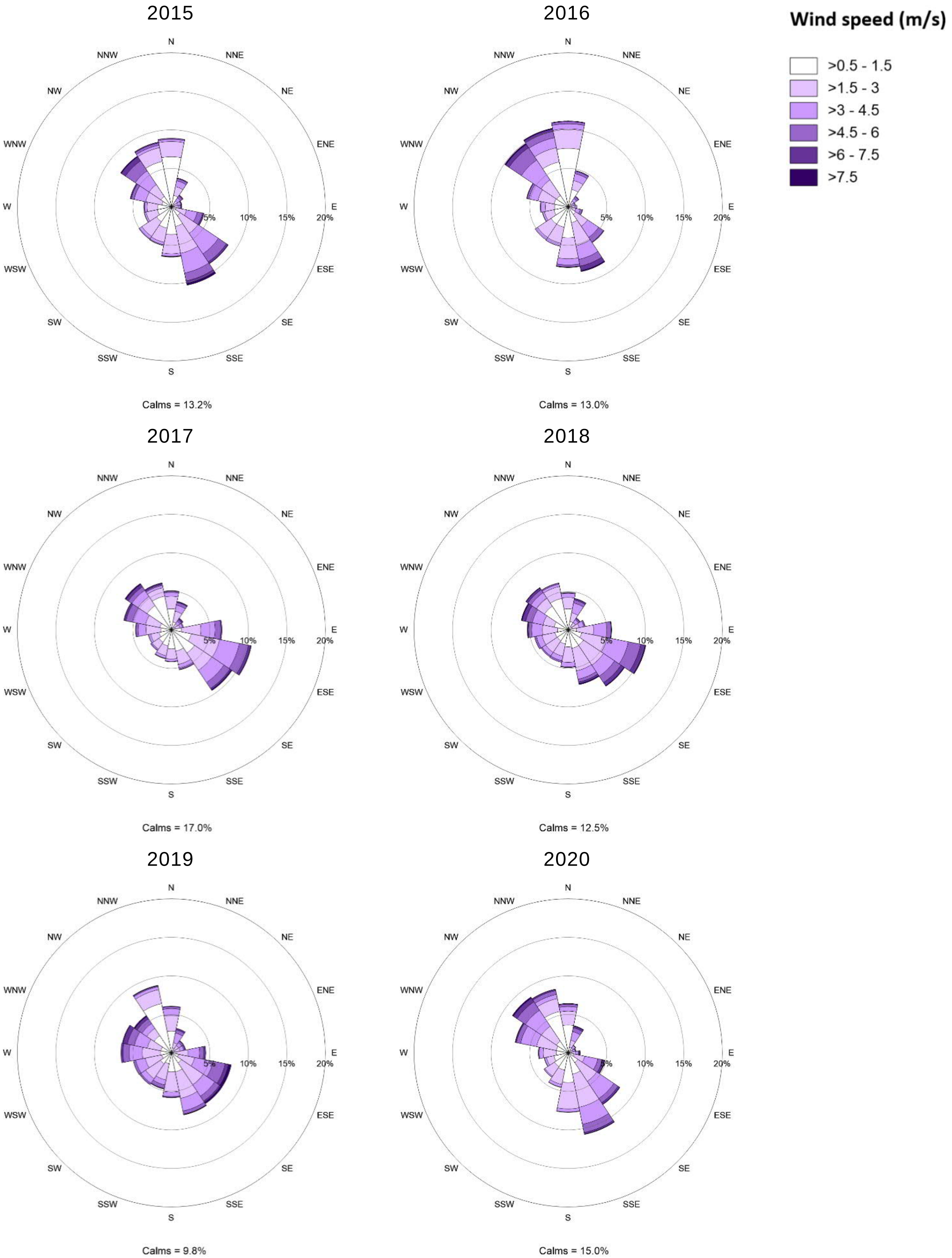



Figure 5 Annual wind-roses for data collected at the BCM meteorological station (W1)

Figure 6 shows the hourly wind speed data from W1. These data show that wind speeds are generally lower in winter and higher in summer with maximum wind speeds reaching around 10 metres per second. Rainfall data from the Bureau of Meteorology's station at Boggabri Post Office (SN 55007) have also been presented. The rainfall data show the effect of the drought from 2017 to 2019, with annual rainfall at least 20 per cent lower than the long term average of 590 mm, based on 136 years of data collected between 1884 to 2020.

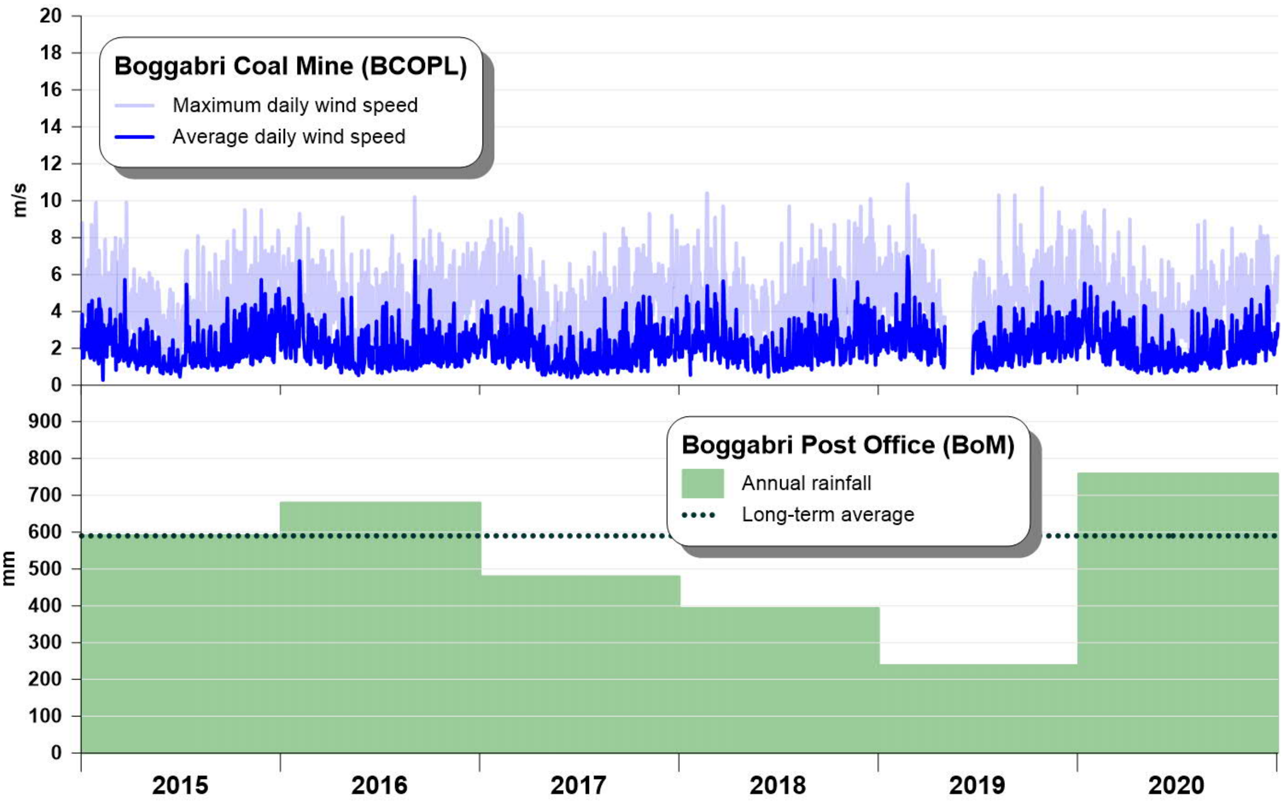



Figure 6 Wind speed and rainfall data collected between 2015 and 2020

Table 4 provides annual wind statistics for the 2015 to 2020 calendar years. With the exception of rainfall, these statistics support the earlier observation that conditions do not vary significantly from year to year.

Table 4 Statistics from meteorological data collected between 2015 and 2019

| Location | Statistic | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|
| BCM (W1) | Percentage complete (%) | 93 | 95 | 98 | 93 | 85 | 96 |
| BCM (W1) | Mean wind speed (m/s) | 2.1 | 2.0 | 2.0 | 2.2 | 2.4 | 2.1 |
| BCM (W1) | Percentage of calms (<= 0.5 m/s) | 13.2 | 13.0 | 17.0 | 12.5 | 9.8 | 15.0 |
| BCM (W1) | Percentage of wind speeds >6 m/s | 2.5 | 2.4 | 2.4 | 3.2 | 3.7 | 2.6 |
| BCM (W1) | Rainfall (mm) | 522 | 575 | 506 | 385 | 209 | 878 |
| Boggabri Post Office | Rainfall (mm) | 591 | 680 | 480 | 394 | 239 | 759 |

Data from the 2017 calendar year have been identified as being representative of the long term, local conditions around the BCM and suitable for informing the air quality impacts of MOD 8. This determination was based on:

- High data capture rate, meeting the EPA's requirement for a minimum 90% complete dataset.
- Similar wind patterns to other years.
- Rainfall slightly below the long-term average and the preference was for a drier than average year resulting in a more conservative approach in terms of air quality (dust) conditions.

Section 4.3 also shows that air quality conditions in 2017 were similar to other years and not adversely influenced by bushfire activity or extreme conditions. Methods used for incorporating the 2017 data into modelling for MOD 8 are discussed in detail in Section 5. Annual and seasonal wind-roses from data collected at W1 in 2017 are provided in Appendix A.

## 4.3 Air Quality

There is an extensive air quality monitoring network surrounding the BCM and neighbouring mines. Each mining company is required to operate an air quality monitoring network as part of their planning approval conditions. The DPIE also conducts monitoring at Gunnedah and Narrabri as part of their NSW Air Quality Monitoring Network. This section examines the historical air quality conditions around the BCM and establishes the appropriate background levels to be considered for assessment of MOD 8.

It should be noted that air quality monitoring data represent the contributions from all sources that have at some stage been upwind of each monitor. In the case of particulate matter (as $PM_{10}$) for example, a measurement may contain contributions from many sources such as from mining activities, construction works, bushfires and ‘burning off’, agricultural activities, industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds, and so on.

### 4.3.1 Extraordinary Events

Air quality in many parts of NSW, including the Northwest Slopes and Plains, was adversely influenced by drought conditions between 2017 to 2019 and lower than average rainfall. A deterioration in air quality conditions in recent years was not unique to the Northwest Slopes and Plains and extraordinary events, beyond normal conditions, have been identified as part of annual reviews of monitoring data.

In its “Annual Air Quality Statement 2018”, DPIE (formerly OEH) concluded that particle levels increased across NSW due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH, 2019). The DPIE subsequently concluded, from their “Annual Air Quality Statement 2019”, that air quality in NSW was greatly affected by the continuing intense drought conditions and unprecedented extensive bushfires during 2019. In addition, the continued “intense drought has led to an increase in widespread dust events throughout the year” (DPIE, 2020).

The influence of drought conditions on air quality is evident in the DPIE’s monitoring data. Figure 7 shows the rolling annual average $PM_{10}$ concentrations from data collected at various rural and urban air quality monitoring sites since 2011. These data clearly show an increase in $PM_{10}$ concentrations at all rural and urban locations from 2017 onwards, reflecting the onset of drought conditions, and increased bushfire activity in 2019. The rolling annual average $PM_{10}$ concentrations decreased rapidly in 2020 as rainfall increased.

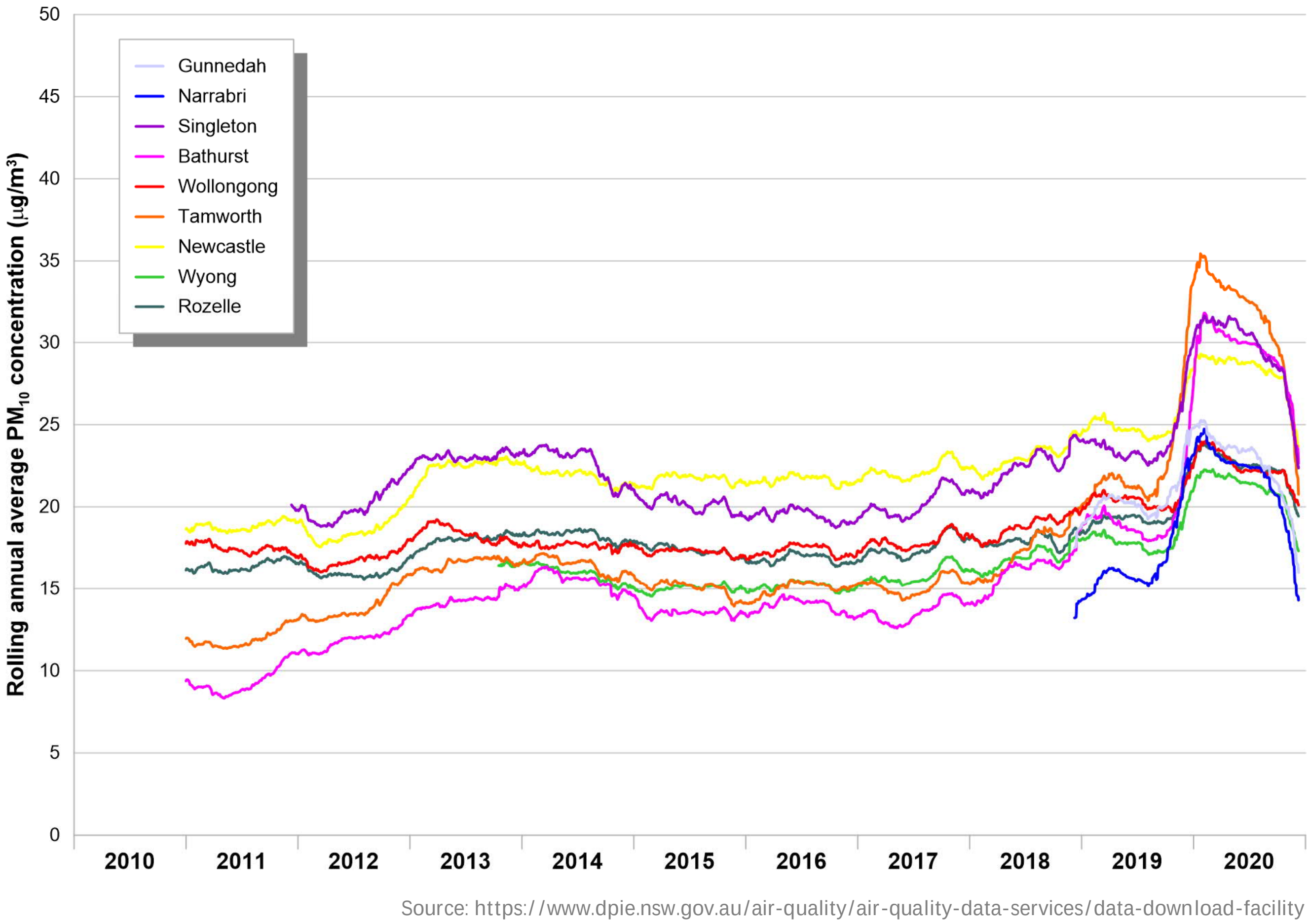



Figure 7 Rolling annual average $PM_{10}$ concentrations at various NSW air quality monitoring sites

The use of years with elevated air quality levels, largely driven by extraordinary events or extreme climatic conditions (or both) are avoided in modelling studies primarily because they do not address the definition of representative. In addition, extraordinary events cannot be reliably simulated in air dispersion models as it is not possible to identify all possible factors that led to these events, for example, the factors that influence the time, location and intensity of bushfires. This context has been considered in the analysis below.

### 4.3.2 Particulate Matter (as $PM_{10}$)

Air quality criteria for $PM_{10}$ are set to protect against adverse health impacts. BCOPL has a network of $PM_{10}$ monitors around the BCM to assist with operations management and to determine ongoing compliance with SSD 09_0182. Figure 8 shows the $PM_{10}$ monitoring locations for BCM and neighbouring Maules Creek and Tarrawonga Mines. A mix of technologies is used to measure $PM_{10}$ including high volume air sampler (HVAS) and Tapered Element Oscillating Microbalance (TEOM).

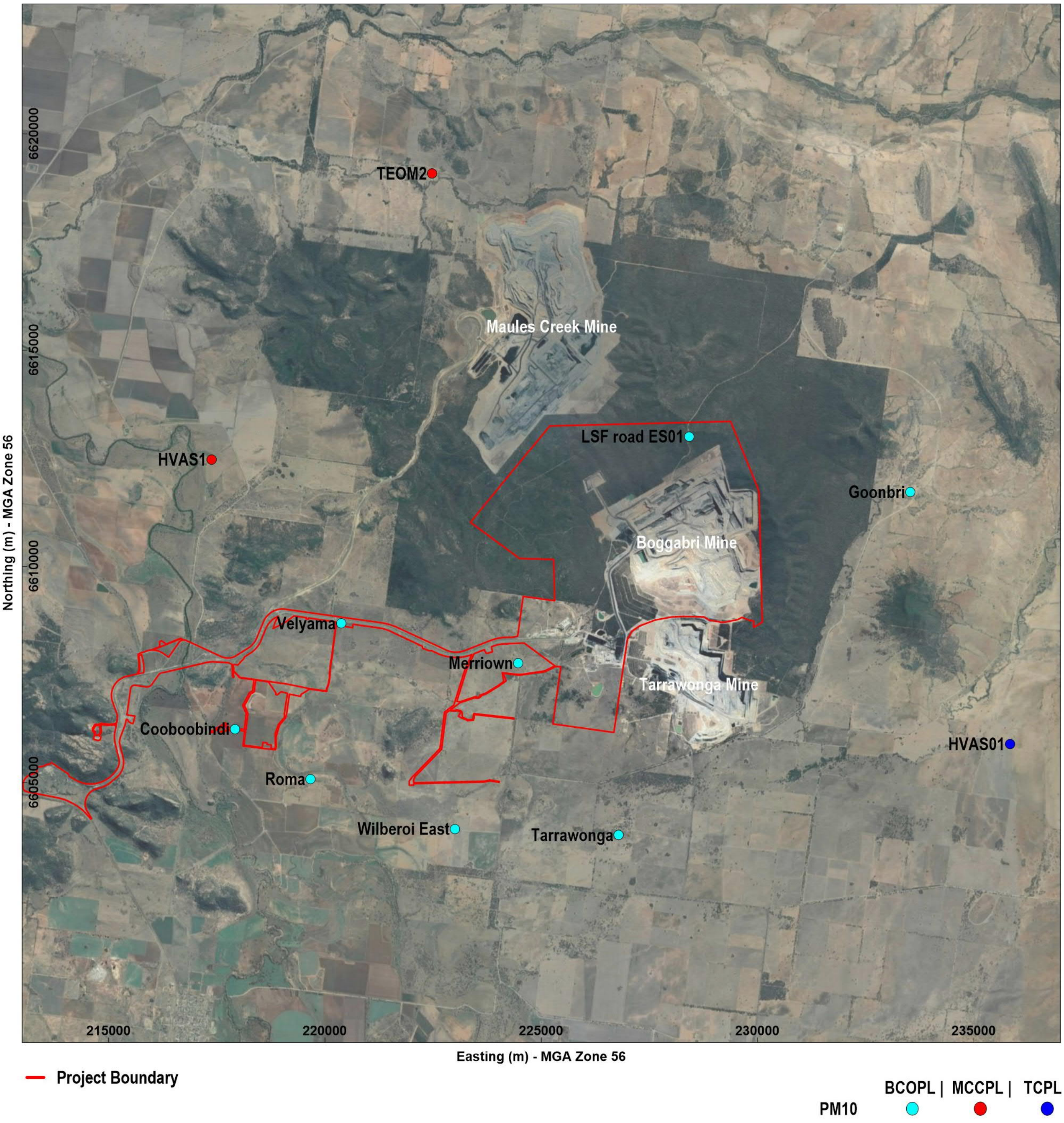



Figure 8 Location of $PM_{10}$ monitors

Figure 9 shows the measured 24-hour average $PM_{10}$ concentrations from each BCM monitoring site for data collected between 2015 and 2020. Table 5 provides a summary of all data.

Table 5 Summary of measured $PM_{10}$ concentrations

| Year | Roma / Cooboobindi (HVAS) [1] | Merriown (HVAS) [2] | Goonbri (TEOM) [2] | Wilberoi East (TEOM) [1] | Tarrawonga (TEOM) [2] | Velyama (TEOM) [2] | EPA criterion |
|---|---|---|---|---|---|---|---|
| Maximum 24-hour average in µg/m³ | | | | | | | |
| 2015 | 38* | 41* | * | * | 69 | * | 50 |
| 2016 | 104 | 31 | * | * | 65 | * | 50 |
| 2017 | 59 | 48 | * | * | 54 | * | 50 |
| 2018 | 229 | 204 | * | 187 | 234 | * | 50 |
| 2019 | 95 | 167 | 242 | 210 | 707* | 222* | 50 |
| 2020 | 57* | 56 | 218 | 118 | 129 | 117 | 50 |
| Number of days above 50 µg/m³ | | | | | | | |
| 2015 | 0* | 0* | * | * | 5 | * | - |
| 2016 | 1 | 0 | * | * | 3 | * | - |
| 2017 | 1 | 0 | * | * | 3 | * | - |
| 2018 | 4 | 3 | * | 15 | 30 | * | - |
| 2019 | 5 | 14 | 69 | 66 | 71* | 44* | - |
| 2020 | 1 | 2 | 17 | 6 | 13 | 7 | - |
| Annual average in µg/m³ | | | | | | | |
| 2015 | 11* | 10* | * | * | 17 | * | 30 |
| 2016 | 12 | 11 | * | * | 18 | * | 30 |
| 2017 | 12 | 12 | * | * | 19 | * | 25 |
| 2018 | 27 | 28 | * | 26 | 29 | * | 25 |
| 2019 | 23 | 36 | 43 | 37 | 56* | 32* | 25 |
| 2020 | 17* | 17 | 21 | 15 | 20 | 15 | 25 |

*Notes: Grey shading illustrates a measurement above the EPA criterion. SSD 09_0182 criteria are 50 µg/m³ (24-hour) and 30 µg/m³ (annual).*

*NA = not available at the time of assessment.*

** Less than 75% data capture*

*[1] Used for compliance monitoring*

*[2] Used for proactive management*

The data can be summarised as follows:

- $PM_{10}$ concentrations increased from 2017 to 2019 coinciding with drought conditions and lower than average rainfall. These conditions led to increases in the number of days when the 24-hour average $PM_{10}$ concentration exceeded 50 µg/m³ and increases in the annual average $PM_{10}$ concentrations. The increases in $PM_{10}$ concentrations were observed across many locations in NSW and were not unique to the Northwest Slopes and Plains. Concentrations decreased in 2020, coinciding with increased rainfall.
- There are seasonal variations with higher $PM_{10}$ concentrations generally occurring in the warmer months.

The $PM_{10}$ monitoring data are reviewed by BCOPL as part of annual reporting and with consideration of extraordinary events, as outlined in Section 4.3.1. These reviews have shown that BCOPL has complied with the $PM_{10}$ criteria specified in SSD 09_0182 in all years between 2015 and 2020.

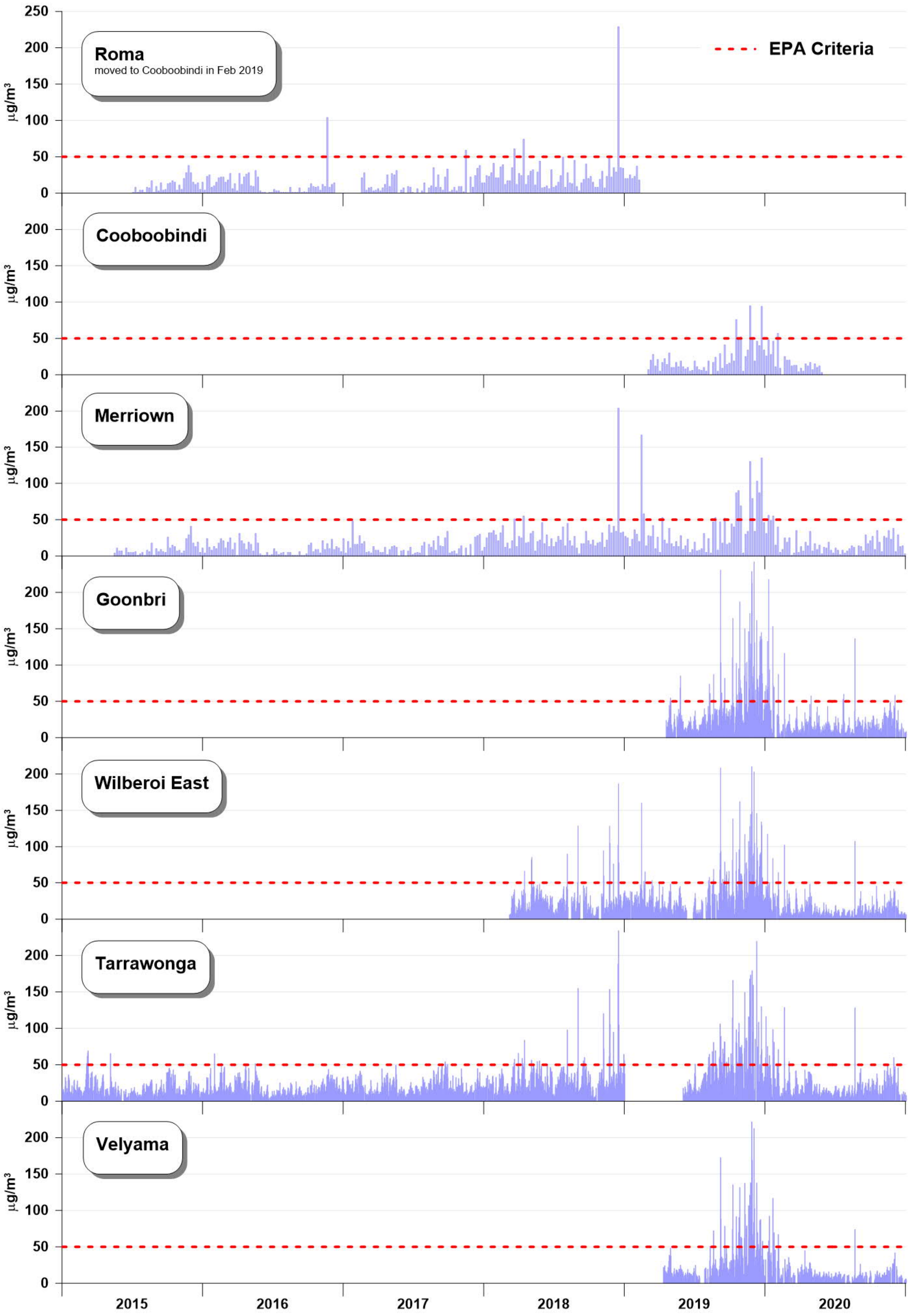



Figure 9 Measured 24-hour average $PM_{10}$ concentrations

#### 4.3.3 Particulate Matter (as $PM_{2.5}$)

Air quality criteria for $PM_{2.5}$ are set to protect against adverse health impacts. The closest monitoring stations to the BCM that measure $PM_{2.5}$ are located at Gunnedah (40 km to the south) and Narrabri (50 km to the northwest). Both of these stations are operated by the DPIE.

Figure 10 shows the measured 24-hour average $PM_{2.5}$ concentrations from the Gunnedah and Narrabri monitoring sites for data collected between 2015 and 2020. The EPA's current air quality assessment criterion for $PM_{2.5}$ (25 µg/m$^3$) has also been shown, but it should be noted that this assessment criterion came into effect from 20 January 2017 onwards. $PM_{2.5}$ concentrations did not exceed the EPA criterion at Gunnedah until mid-2018 coinciding with the increasing effects of the drought. Levels at Gunnedah were generally higher than those measured at Narrabri.

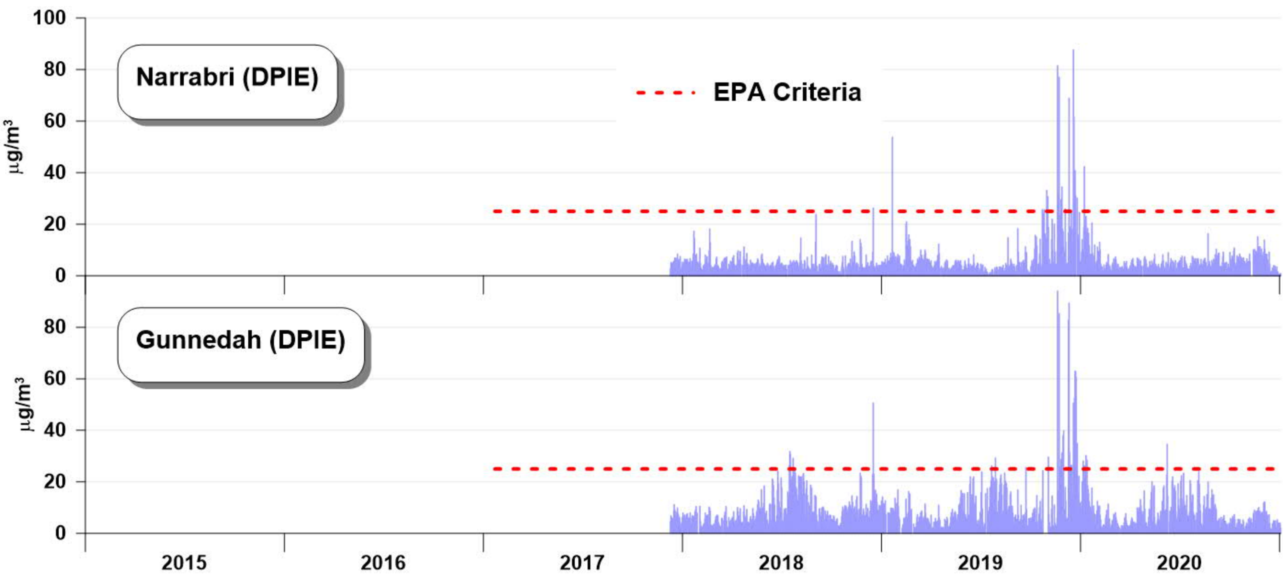



Figure 10 Measured 24-hour average $PM_{2.5}$ concentrations

Table 6 summarises the measured $PM_{2.5}$ concentrations for data collected between 2015 and 2020. Both stations have recorded multiple days above the 25 µg/m$^3$ criterion since the monitoring commenced. Annual average concentrations at Gunnedah were not dissimilar to concentrations measured at both Singleton and Newcastle (within 20 per cent), with the 8 µg/m$^3$ criterion being exceeded in 2018 and 2019. As noted above, the data showed that $PM_{2.5}$ concentrations were generally lower at Narrabri than at Gunnedah. This may be partially due to the lower population of Narrabri, meaning less anthropogenic emission sources such as wood smoke.

Table 6 Summary of measured $PM_{2.5}$ concentrations

| Year | Gunnedah | Narrabri | Singleton | Newcastle | EPA criterion |
|---|---|---|---|---|---|
| Maximum 24-hour average in µg/m³ | | | | | |
| 2015 | - | - | 25 | 30 | - |
| 2016 | - | - | 28 | 66 | - |
| 2017 | - | - | 30 | 18 | 25 |
| 2018 | 51 | 26 | 19 | 20 | 25 |
| 2019 | 94 | 88 | 69 | 96 | 25 |
| 2020 | 35 | 42 | 46 | 79 | 25 |
| Number of days above 25 µg/m³ | | | | | |
| 2015 | - | - | 0 | 1 | - |
| 2016 | - | - | 2 | 1 | - |
| 2017 | - | - | 1 | 0 | - |
| 2018 | 5 | 1 | 0 | 0 | - |
| 2019 | 24 | 20 | 20 | 25 | - |
| 2020 | 6 | 1 | 5 | 5 | - |
| Annual average in µg/m³ | | | | | |
| 2015 | - | - | 7.6 | 7.9 | - |
| 2016 | - | - | 7.9 | 7.8 | - |
| 2017 | - | - | 8.2 | 7.4 | 8 |
| 2018 | 9.0 | 4.9 | 8.1 | 7.8 | 8 |
| 2019 | 11.2 | 7.8 | 10.9 | 10.9 | 8 |
| 2020 | 7.7 | 5.5 | 8.4 | 8.1 | 8 |

*Notes: Grey shading illustrates a measurement above the EPA criterion. SSD 09_0182 does not specify criteria for $PM_{2.5}$.*

It is also useful to compare the DPIE data with information from other locations. Annual average $PM_{2.5}$ concentrations in Singleton and Newcastle were similar to those measured at Gunnedah. At Cape Grim, a site in rural Tasmania that is used as a global "baseline" reference for unpolluted air entering Australia, the mean $PM_{2.5}$ concentration was 5.6 µg/m³ for data collected between 1998 and 2008 (ANSTO, 2008). Cape Grim's particulate matter mass is predominantly from sea salt.

$PM_{2.5}$ concentrations are strongly influenced by combustion-related sources such as bushfires, motor vehicles and wood smoke from domestic heating. The *Upper Hunter Fine Particle Characterisation Study* (OEH, 2013) investigated the factors which contributed to elevated $PM_{2.5}$ concentrations in the Hunter Valley. This study identified a clear seasonal trend with higher $PM_{2.5}$ concentrations occurring in the cooler months, and predominantly due to wood smoke from domestic heating. Specifically, in Singleton, wood smoke accounted for approximately 14% of the total $PM_{2.5}$, peaking at around 38% in winter.

A particle characterisation study has not been done for the Northwest Slopes and Plains. Wood smoke would also be a factor in $PM_{2.5}$ levels around Boggabri but given the lower population of Boggabri relative to Singleton it would not be unreasonable to infer that wood smoke would form a lower percentage of the total $PM_{2.5}$ than at Singleton.

#### 4.3.4 Particulate Matter (as TSP)

TSP is not monitored in the vicinity of the BCM. The NSW Minerals Council (2000) estimated that, for rural environments in NSW, the average $PM_{10}$ concentrations are typically 40% of the TSP concentrations. More recent studies (see for example Jacobs, 2018) have examined $PM_{10}$ and TSP data have also shown that average $PM_{10}$ concentrations are close to 40% of the TSP concentrations in rural environments of NSW. For this assessment it has therefore been assumed that $PM_{10}$ concentrations would be 40% of the TSP concentrations, an assumption that yields an estimated annual average TSP concentration of 47 µg/m$^3$ based on the highest measured annual average $PM_{10}$ concentration of 19 µg/m$^3$ in 2017.

Table 7 shows the estimated annual average TSP concentrations from each $PM_{10}$ monitoring site for data collected between 2015 and 2020. Annual average TSP concentrations were clearly higher in 2018 and 2019 than in the preceding five years. Again, this outcome was influenced by the drought conditions and lower than average rainfall. The increases in TSP concentrations were not unique to the Northwest Slopes and Plains.

Table 7 Summary of estimated TSP concentrations

| Year | Roma / Cooboobindi (HVAS) [1] | Merriown (HVAS) [2] | Goonbri (TEOM) [2] | Wilberoi East (TEOM) [1] | Tarrawonga (TEOM) [2] | Velyama (TEOM) [2] | EPA criterion |
|---|---|---|---|---|---|---|---|
| Annual average in µg/m$^3$ | | | | | | | |
| 2015 | 28* | 25* | * | * | 42 | * | 90 |
| 2016 | 30 | 27 | * | * | 44 | * | 90 |
| 2017 | 31 | 30 | * | * | 47 | * | 95 |
| 2018 | 68 | 69 | * | 64 | 73 | * | 90 |
| 2019 | 58 | 91 | 109 | 92 | 140* | 81* | 90 |
| 2020 | 44* | 43 | NA | 39 | NA | NA | 90 |

*Notes: Grey shading illustrates a measurement above the EPA criterion. SSD 09_0182 criterion is 90 µg/m$^3$ (annual). NA = not available at the time of assessment.*

** Less than 75% data capture*

*[1] Used for compliance monitoring*

*[2] Used for proactive management*

#### 4.3.5 Deposited Dust

Air quality criteria for deposited dust are set to protect against nuisance amenity impacts. Monitoring of deposited dust relates to the collection of particles that settle from the ambient air. Insoluble and soluble matter are separated by filtration and the mass of dried insoluble solids is determined gravimetrically. The exposure period is 30 ±2 days and one result (of insoluble solids) is obtained every month.

Monitoring of deposition dust is carried out by BCOPL at three locations (Figure 11) and the measurements are used to determine ongoing compliance with SSD 09_0182. Table 5 shows the annual average deposited dust levels from each BCM monitoring site for data collected between 2015 and 2020. Deposited dust levels have not exceeded the 4 g/m$^2$/month criterion in the past six years.

Table 8 Summary of measured deposited dust

| Year | Greenhills D4 | Goonbri D5 | Onavale D6 | EPA criterion |
|---|---|---|---|---|
| Annual average in g/m$^2$/month | | | | |
| 2015 | 0.8 | 0.7 | 1.4 | 4 |
| 2016 | 1.5 | 2.0 | 1.9 | 4 |
| 2017 | 2.6 | 1.6 | 1.5 | 4 |

| Year | Greenhills D4 | Goonbri D5 | Onavale D6 | EPA criterion |
|---|---|---|---|---|
| 2018 | 3.0 | 1.8 | 2.2 | 4 |
| 2019 | 2.3 | 1.7 | 2.9 | 4 |
| 2020 | 2.1 | 1.2 | 1.3 | 4 |

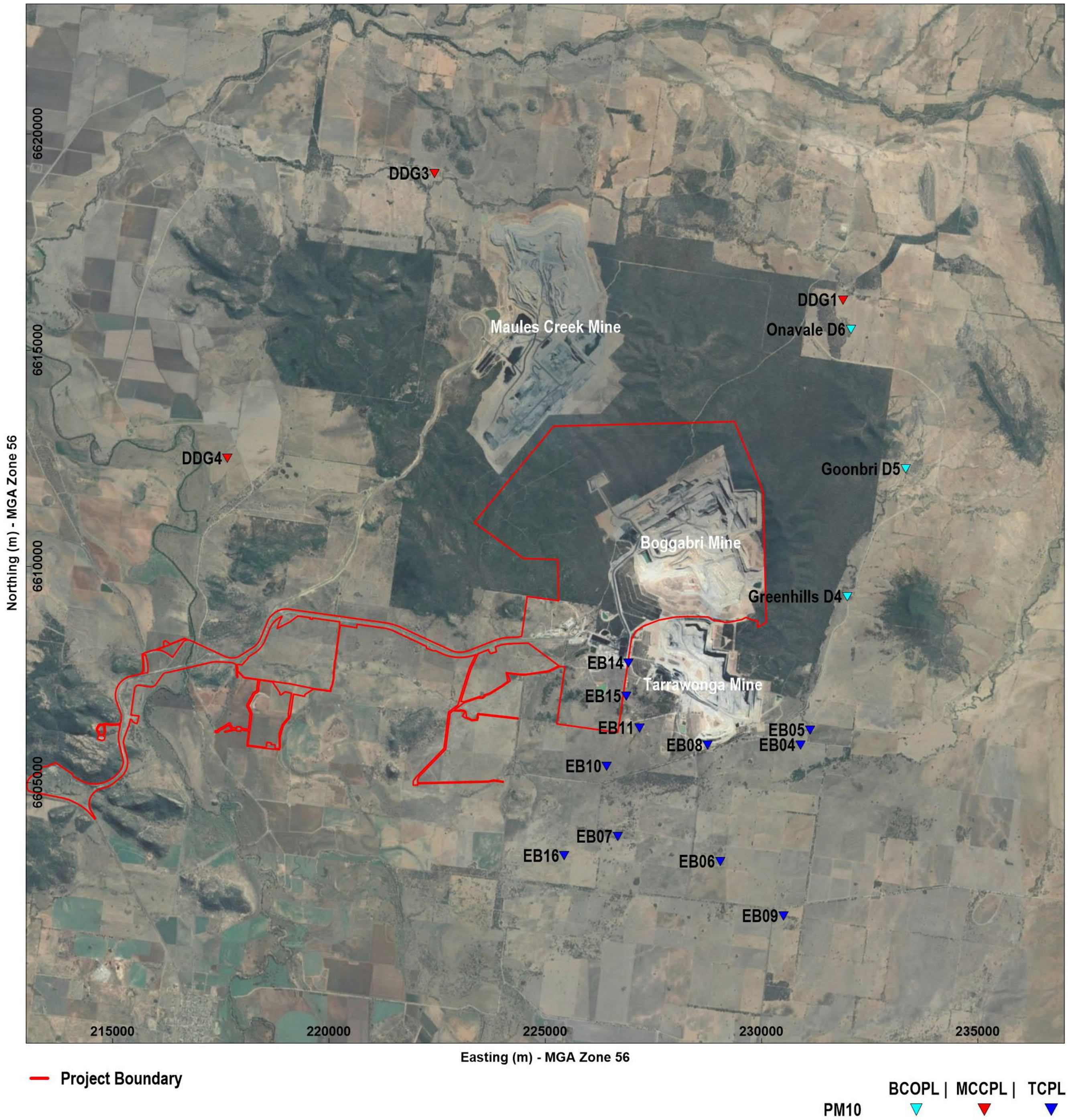



Figure 11 Location of dust deposition monitors

### 4.3.6 Nitrogen Dioxide ($NO_2$)

Table 9 provides a summary of the measured $NO_2$ concentrations from Gunnedah, the closest known air quality monitoring site which records this air quality indicator. As expected for this rural location these data show that the maximum $NO_2$ concentrations have not exceeded the EPA's 1-hour average criterion of 246 µg/m$^3$. Annual averages have not exceeded the EPA's annual average criterion of 62 µg/m$^3$.

Table 9 Summary of measured $NO_2$ concentrations

| Year | Gunnedah | EPA criterion |
|---|---|---|
| Maximum 1-hour average in µg/m$^3$ | | |
| 2015 | - | 246 |
| 2016 | - | 246 |
| 2017 | - | 246 |
| 2018 | 70 | 246 |
| 2019 | 74 | 246 |
| 2020 | 57 | 246 |
| Annual average in µg/m$^3$ | | |
| 2015 | - | 62 |
| 2016 | - | 62 |
| 2017 | - | 62 |
| 2018 | 10 | 62 |
| 2019 | 10 | 62 |
| 2020 | 6 | 62 |

### 4.3.7 Complaints

BCOPL maintains a register of all complaints that may be associated with activities at the BCM. Six (6) air quality related complaints have been received by BCOPL in the past six years with Table 10 providing the details. These records indicate a reduction in the number of complaints relating to dust since 2015. Investigations were carried out for each complaint.

Table 10 Summary of air quality related complaints

| Year | Details of complaints |
|---|---|
| 2015 | 2 complaints received in relation to amount of dust. Action from BCM – after site investigation, operations at time of first complaint were in line with operating procedures. On second complaint, report provided to EPA and no further actions required. 1 complaint received in relation to amount of dust. Action from BCM – incident report prepared. No further actions required. |
| 2016 | 1 complaint relating to dust blowing towards house. Action from BCM – changes made to night time operation to reduce noise and due with ongoing monitoring of weather conditions. |
| 2017 | 1 complaint. General complaint received in relation to large cloud of dust generated from BCM. Action from BCM – provided EPA report. |
| 2018 | 1 complaint. NSW EPA received a community complaint in relation to ambient dust levels around Boggabri Coal Mine, Tarrawonga Coal Mine and Maules Creek Coal Mine. Action from BCM – provided EPA report. |
| 2019 | Nil |
| 2020 | Nil |

## 4.4 Greenhouse Gas

GHG emissions from the BCM are calculated and reported in accordance with the NGER Act. Table 11 shows the reported GHG emissions for recent years. GHG emissions from the BCM have fluctuated by up to 12 per cent over these three reporting years.

Table 11 Reported GHG emissions

| Reporting year | Scope 1 emissions (Mt $CO_2$-e) | Scope 2 emissions (Mt $CO_2$-e) |
|---|---|---|
| 2016/2017 | 0.184 | 0.019 |
| 2017/2018 | 0.177 | 0.018 |
| 2018/2019 | 0.203 | 0.019 |
| 2019/2020 | 0.174 | 0.017 |

## 4.5 Summary of Existing Environment

The review of the existing environment led to the following observations:

- Meteorological conditions in 2017 were representative of the long term, local conditions around the BCM.
- There was a deterioration in air quality conditions from 2017 to 2019, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Northwest Slopes and Plains.
- BCOPL has complied with the air quality criteria specified in SSD 09_0182 in all of the past six years.

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be added to project contributions for the assessment of potential cumulative impacts. For this objective, it was important to identify the monitoring stations that are sufficiently close to the area of interest but not adversely influenced by those sources which are proposed for modification, such as mining operations. Table 12 shows the assumed background levels that apply at sensitive receptors, taking into account this objective. These levels (or approach) have been added to project contributions to determine the potential cumulative impacts.

Table 12 Assumed background levels that apply at sensitive receptors

| Air quality indicator | Averaging time | Assumed background level that applies at sensitive receptors | Notes |
|---|---|---|---|
| Particulate matter ($PM_{10}$) | 24-hour | Variable by day | Measured 24-hour average $PM_{10}$ concentrations in the representative year (2017) from Tarrawonga monitoring site, less the modelled contributions from BCM, Maules Creek Mine and Tarrawonga Mine. The resultant data been inferred as 'background' levels and added to the model predictions for MOD 8 for the assessment of potential cumulative impacts, in accordance with EPA guidelines.<br>The Tarrawonga monitoring site has the most comprehensive records. |
| | Annual | 14 µg/m³ | Measured annual average $PM_{10}$ concentrations in the representative year (2017) from Tarrawonga monitoring site, less the modelled contributions from BCM, Maules Creek Mine and Tarrawonga Mine.<br>The Tarrawonga monitoring site has the most comprehensive records. |
| Particulate matter ($PM_{2.5}$) | 24-hour | Variable by day | Estimated 24-hour average $PM_{2.5}$ concentrations in the representative year (2017) and derived from the background $PM_{10}$ concentrations on the assumption that 44% of the $PM_{10}$ is $PM_{2.5}$. The DPIE data for Gunnedah and Narrabri from 2018 and 2019 showed that $PM_{2.5}$ was on average 44% of the $PM_{10}$. This is a conservative estimate given that 2019 was heavily influenced by bushfires. |

| Air quality indicator | Averaging time | Assumed background level that applies at sensitive receptors | Notes |
|---|---|---|---|
| | | | The data been added to the project contributions for the assessment of potential cumulative impacts, in accordance with EPA guidelines. |
| | Annual | 6.3 µg/m$^3$ | Estimated annual average $PM_{2.5}$ concentrations in the representative year (2017) and derived from the $PM_{10}$ concentrations on the assumption that 44% of the $PM_{10}$ is $PM_{2.5}$. |
| Particulate matter (TSP) | Annual | 47 µg/m$^3$ | Annual average TSP concentration in the representative year (2017) from Tarrawonga, calculated by assuming $PM_{10}$ is 40% of the TSP. |
| Deposited dust | Annual | 2.6 g/m$^2$/month | Annual average deposited dust level (total) in the representative year (2017) from Greenhills. |
| Nitrogen dioxide ($NO_2$) | 1-hour | 74 µg/m$^3$ | Maximum 1-hour average $NO_2$ concentration from data collected between 2018 and 2019 from Gunnedah. |
| | Annual | 10 µg/m$^3$ | Annual average $NO_2$ concentration from data collected between 2018 and 2019 from Gunnedah. |

# 5. Assessment Methodology

This assessment has followed the procedures outlined in the Approved Methods (EPA, 2016). The Approved Methods include guidelines for the preparation of meteorological data, reporting requirements and air quality assessment criteria to assess the significance of expected impacts.

Specific methodologies for each of the identified key issues (from Section 2) are described below. A conservative approach has been taken in regards to determining background levels, estimating emissions, and application of mitigation measures.

## 5.1 Mining Dust

Operational dust has been quantified by modelling. The choice of model has considered the expected transport distances for the emissions, as well as the potential for temporally and spatially varying flow fields due to influences of the locally complex terrain, non-uniform land use, and stagnation conditions characterised by calm or very low wind speeds with variable wind directions. The CALPUFF model has been selected. This model is specifically listed in the Approved Methods as a more advanced dispersion model than AUSPLUME v 6.0 and has been used to predict ground-level particulate matter concentrations and deposition levels due to MOD 8 activities and other sources. Concentrations and deposition levels have been simulated for every hour of the representative year and results at sensitive receptors have then been compared to the relevant air quality assessment criteria.

Figure 12 shows an overview of the model and key inputs. Appendix C provides details of all model settings.

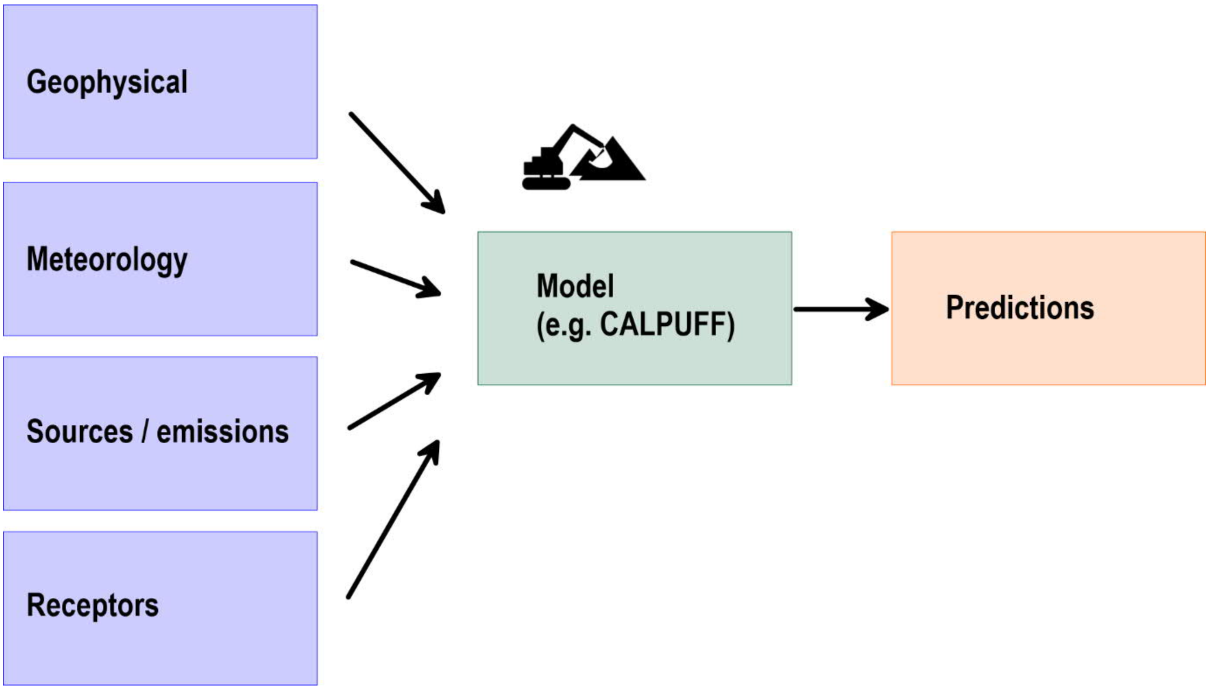



Figure 12 Overview of model inputs

Dust (particulate matter) is the most significant emission to air from the operations and estimates of these emissions are required by the dispersion model. Total dust emissions have been estimated for selected operational scenarios using the material handling schedule, equipment listing and mine plans relating to MOD 8 combined with emission factors from:

- *Emission Estimation Technique Manual for Mining* (NPI, 2012).
- AP 42 (US EPA 1985 and updates).

The BCM production schedule and equipment usage forecasts have been used to identify a range of future operational years to be assessed. Figure 13 shows the estimated ROM coal and overburden movements over the life of MOD 8. There are no specific guidelines or procedures which define an adequate level of information to demonstrate that selected scenarios are representative of worst-case impacts. The worst-case for one location may be different to the worst-case for another location so it is important to consider scenarios of mining at various locations and intensities as well as potential for cumulative effects with other existing or approved operations.

Three future operational scenarios have been selected; 2024, 2029 and 2032. The scenarios for 2024 and 2029 represent the periods of anticipated maximum numbers of mining equipment and maximum haul distances from the mining areas to overburden emplacement areas. The scenario for 2032 addresses the maximum material handling quantity over the life of the mine. All three scenarios therefore cover maximum material handling quantities, maximum haul distances, varying proximities to local communities, and combined interactions with other approved mining operations.

A scenario for a historical, representative year (2017) was also developed to quantify recent contributions of the three mining operations to air quality and to establish background levels.

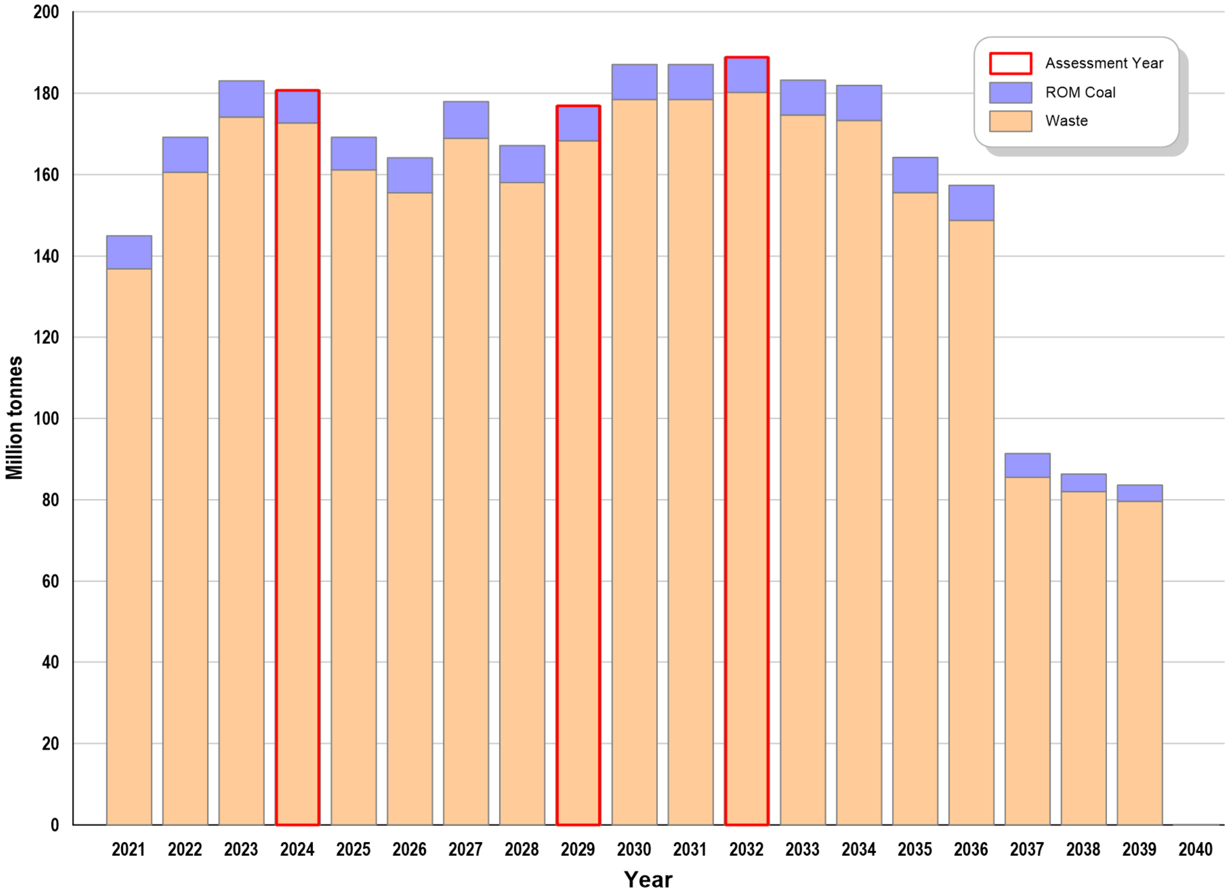



Figure 13 Estimated ROM coal and overburden movements over the life of MOD 8

The modelling has considered contributions from the BCM as well as from the surrounding mining operations. Table 13 shows the assumed ROM coal production data from each operation in the model domain.

The data for 2017 were derived from the Annual Reviews produced by each mining operation and available on their respective websites. The Annual Reviews also included overburden handling quantities and plans showing the active mining locations which are important for determining site dust emissions.

The data for future mining scenarios were sourced from publicly available materials including relevant assessment documents (i.e. Environmental Assessments, EIS etc.) for the existing and approved operations. These data have been included in the model for future mining scenarios to reflect the current approved life and maximum approved production limit in accordance with the planning approvals in place at the time of completing this assessment. Estimated production quantities for the BCM were provided by BCOPL.

Table 13 Assumed ROM coal production from each mining operation in the model domain

| Operation | ROM coal production (Mtpa) | | | |
|---|---|---|---|---|
| | 2017 | 2024 | 2029 | 2032 |
| Boggabri Coal Mine (SSD 09_0182) as approved | 8.0 | - | - | - |
| Boggabri Coal Mine Modification 8 | - | 8.0 | 8.6 | 8.6 |
| Maules Creek Mine (PA 10_0138) | 10.5 | 13 | 13 | 13 |
| Tarrawonga Mine (PA 11_0047) | 1.9 | 3* | 3* | - |

** Tarrawonga Life-of-Mine modification seeks to increase production to 3.5 Mtpa. This modification was approved on 9 February 2021. A sensitivity test has been done to check if outcomes would change as a result of potential cumulative effects. Results are provided in Appendix E.*

Table 14, Table 15 and Table 16 summarise the estimated annual TSP, $PM_{10}$ and $PM_{2.5}$ emissions, respectively, due to the BCM as well as all other operating, or assumed to be operating, mines in the model domain. It should be noted that the main intent of the inventories was to capture the most significant emission sources that may affect off-site air quality. Not every source will be captured. However, the contribution of emissions from sources not identified will be captured in the air quality monitoring data and these data have been added to the predicted mining contributions. Full details on the emission calculations, including assumptions, emission controls and allocation of emissions to modelled locations are provided in Appendix D.

Table 14 Estimated TSP emissions

| Operation | Annual TSP emissions (kg/y) | | | |
|---|---|---|---|---|
| | 2017 | 2024 | 2029 | 2032 |
| Boggabri Coal Mine (SSD 09_0182) as approved | 4,749,815 | - | - | - |
| Boggabri Coal Mine Modification 8 | - | 6,799,109 | 5,930,105 | 5,076,701 |
| Maules Creek Mine (PA 10_0138) | 4,934,897 | 5,688,863 | 5,688,863 | 5,688,863 |
| Tarrawonga Mine (PA 11_0047) | 1,497,140 | 1,778,163 | 1,778,163 | - |

Table 15 Estimated $PM_{10}$ emissions

| Operation | Annual $PM_{10}$ emissions (kg/y) | | | |
|---|---|---|---|---|
| | 2017 | 2024 | 2029 | 2032 |
| Boggabri Coal Mine (SSD 09_0182) as approved | 1,588,516 | - | - | - |
| Boggabri Coal Mine Modification 8 | - | 2,197,956 | 1,894,024 | 1,637,248 |
| Maules Creek Mine (PA 10_0138) | 1,661,388 | 1,887,563 | 1,887,563 | 1,887,563 |
| Tarrawonga Mine (PA 11_0047) | 515,381 | 602,894 | 602,894 | - |

Table 16 Estimated $PM_{2.5}$ emissions

| Operation | Annual $PM_{2.5}$ emissions (kg/y) | | | |
|---|---|---|---|---|
| | 2017 | 2024 | 2029 | 2032 |
| Boggabri Coal Mine (SSD 09_0182) as approved | 225,482 | - | - | - |
| Boggabri Coal Mine Modification 8 | - | 304,472 | 270,728 | 240,930 |
| Maules Creek Mine (PA 10_0138) | 228,406 | 253,214 | 253,214 | 253,214 |
| Tarrawonga Mine (PA 11_0047) | 83,344 | 93,440 | 93,440 | - |

As noted above, emission estimates for 2017 were based on the production and material handling quantities contained in the respective Annual Reviews. Estimates for future years were based on the maximum approved production rates as per the relevant planning approvals. The model predictions will likely over-state actual impacts as, based on historical data, the mines are not likely to operate at their maximum approved production rate in each year.

Emissions from other mining operations (Maules Creek and Tarrawonga) were important for quantifying the potential cumulative impacts. Two approaches were considered for estimating emissions from other mining operations. These approaches included:

- Deriving emission estimates from previously published EIS data; or
- Recalculating emissions from other mines in the model domain specifically for this assessment.

The approach of recalculating emissions from other mining operations in the model domain has been chosen for this assessment. This approach has been favoured because it maintains consistency in the emission calculation methods for all mining operations. It also has the following advantages over recent EIS data:

- TSP, $PM_{10}$ and $PM_{2.5}$ can be separated for each activity for each mining operations. To date, most EIS air quality assessments have only calculated TSP emissions, with $PM_{10}$ and $PM_{2.5}$ emissions derived from regional ratios such as those published by the SPCC (1986).
- The proportions of wind sensitive, wind insensitive and wind erosion activities can be more accurately defined. Historical assessments have often applied fixed ratios of these three activity types, usually based on information from the Mt Arthur Mine EIS (URS, 2000).
- Pit retention can be modelled and the adjusted emissions can be made specific to each activity and the hourly wind speed.
- Triggered control factors can be modelled. For example, the effect of rainfall for suppressing dust from exposed areas can be simulated for relevant hours in the year.

There are also disadvantages to the approach of recalculating emissions from other mines. The main disadvantages are potential inconsistencies between the emission estimates and other published EIS emissions data, and the inability to precisely match source locations to future mine plans. However, it will be seen in Section 6, that the emission estimation approach combined with model setup assumptions has produced results which do not underestimate average concentrations at the key sensitive receptor locations.

There will be operational controls in place at the BCM which will also have a direct effect on emissions to air. Specifically, BCOPL is committed to the continued implementation of operational controls during adverse weather conditions in order to minimise impacts, as per Section 5.4 of the Air Quality and Greenhouse Gas Management Plan (Idemitsu, 2018) and Schedule 3 Condition 30 (d) of SSD 09_0182. The operational controls will result in reduced levels of activity at the BCM relative to the capacity considered as part of the current air quality modelling. In practice these operational controls, which will vary on a daily basis, will lead to lower emissions to air than for unconstrained activities. Consequently the estimated emissions in Table 14, Table 15 and Table 16 should represent conservative estimates, as these further detailed operational controls are not included, and it follows that the predicted impacts of MOD 8 will also be conservative. That is, the predicted impacts are likely to over-state actual impacts to some extent.

Mining operations were represented by a series of volume sources located according to the location of activities for each modelled scenario. Emissions from the dust generating activities at each operation were assigned to one or more source location (refer to Appendix D for details of the allocations).

Dust emissions for all modelled mine-related sources have been considered to fit in one of three categories, as follows:

- Wind insensitive sources, where emissions are relatively insensitive to wind speed (for example, dozers).
- Wind sensitive sources, where emissions vary with the hourly wind speed, raised to the power of 1.3, a generic relationship published by the US EPA (1987). This relationship has been applied to sources such as loading and unloading of waste to/from trucks and results in increased emissions with increased wind speed.
- Wind sensitive sources, where emissions also vary with the hourly wind speed, but raised to the power of 3, a generic relationship published by Skidmore (1998). This relationship has been applied to sources including wind erosion from stockpiles, overburden dumps or active pits, and results in increased emissions with increased wind speed.

Emissions from each volume source were developed on an hourly time step, taking into account the level of activity at that location and, in some cases, the hourly wind speed. This approach ensured that light winds corresponded with lower dust generation and higher winds, with higher dust generation.

Blasting activities and associated emissions were assumed to take place only during daylight hours (9 am to 5 pm for the purposes of the modelling) while all other activities have been modelled for 24 hours per day.

Pit retention (that is, retention of dust particles within the open pits) has been included in the model simulations. The pit retention calculation determines the fraction of dust emitted in the pit that may escape the pit. The "escaped fraction" is a function of the gravitational settling velocity of the particles and the wind speed and is shown by the following relationship (US EPA, 1995).

Equation 1:

$$\varepsilon = \frac{1}{\left(1 + \frac{v_g}{(\alpha U_r)}\right)}$$

where:

$\varepsilon$ = escaped fraction for the particle size category

$V_g$ = gravitational settling velocity (m/s)

$U_r$ = approach wind speed at 10 m (m/s)

$\alpha$ = proportionality constant in the relationship between flux from the pit and the product of $U_r$ and concentration in the pit (0.029)

To model the effect of pit retention, the emissions from mining sources within the open pits have been reduced, as per the calculation above. This approach means that much of the coarser dust would remain trapped in the pits. Typically, five per cent of the $PM_{10}$ emissions are trapped in the pit using this calculation but application of Equation 1 means that emissions can be more dependent on the changing wind speed.

Finally, the model predictions at identified sensitive receptors were then compared with the EPA air quality criteria, previously discussed in Section 3.1. Contour plots have also been created to show the spatial distribution of model predictions. Section 6.2 provides the assessment of operational dust.

## 5.2 Post Blast Fume

Blasting activities have the potential to result in fume and particulate matter emissions. Particulate matter emissions from blasting are produced from the modelling discussed in Section 5.1. Post-blast fume has also been quantified by modelling.

Post-blast fume can be produced in non-ideal explosive conditions of the ammonium nitrate/fuel oil (ANFO) and is visible as an orange / brown plume. The fumes comprise of $NO_x$ including nitric oxide (NO) and $NO_2$. In general, at the point of emission, NO will comprise the greatest proportion of the total $NO_x$ emission. Typically, this is 90% by volume of the $NO_x$. The remaining 10% will comprise mostly $NO_2$. Ultimately however, much of the NO emitted into the atmosphere is oxidised to $NO_2$. The rate at which this oxidisation takes place depends on prevailing atmospheric conditions including temperature, humidity and the presence of other substances in the atmosphere such as ozone. It can vary from a few minutes to many hours. The rate of conversion is important because from the point of emission to the point of maximum ground-level concentration there will be an interval of time during which some oxidation will take place. If the dispersion is sufficient to have diluted the plume to the point where the concentration is very low, then the level of oxidation is unimportant. However, if the oxidation is rapid and the dispersion is slow then high concentrations of $NO_2$ can occur.

The $NO_x$ monitoring data from Gunnedah (March 2018 to November 2020) show that percentage of $NO_2$ in the $NO_x$ is inversely proportional to the total $NO_x$ concentration, and when $NO_x$ concentrations are high, the percentage of $NO_2$ in the $NO_x$ is typically of the order of 20%. This is demonstrated by Figure 14 which shows that, for high $NO_x$ concentrations, the $NO_2$ to $NO_x$ ratio reduces to 20%.

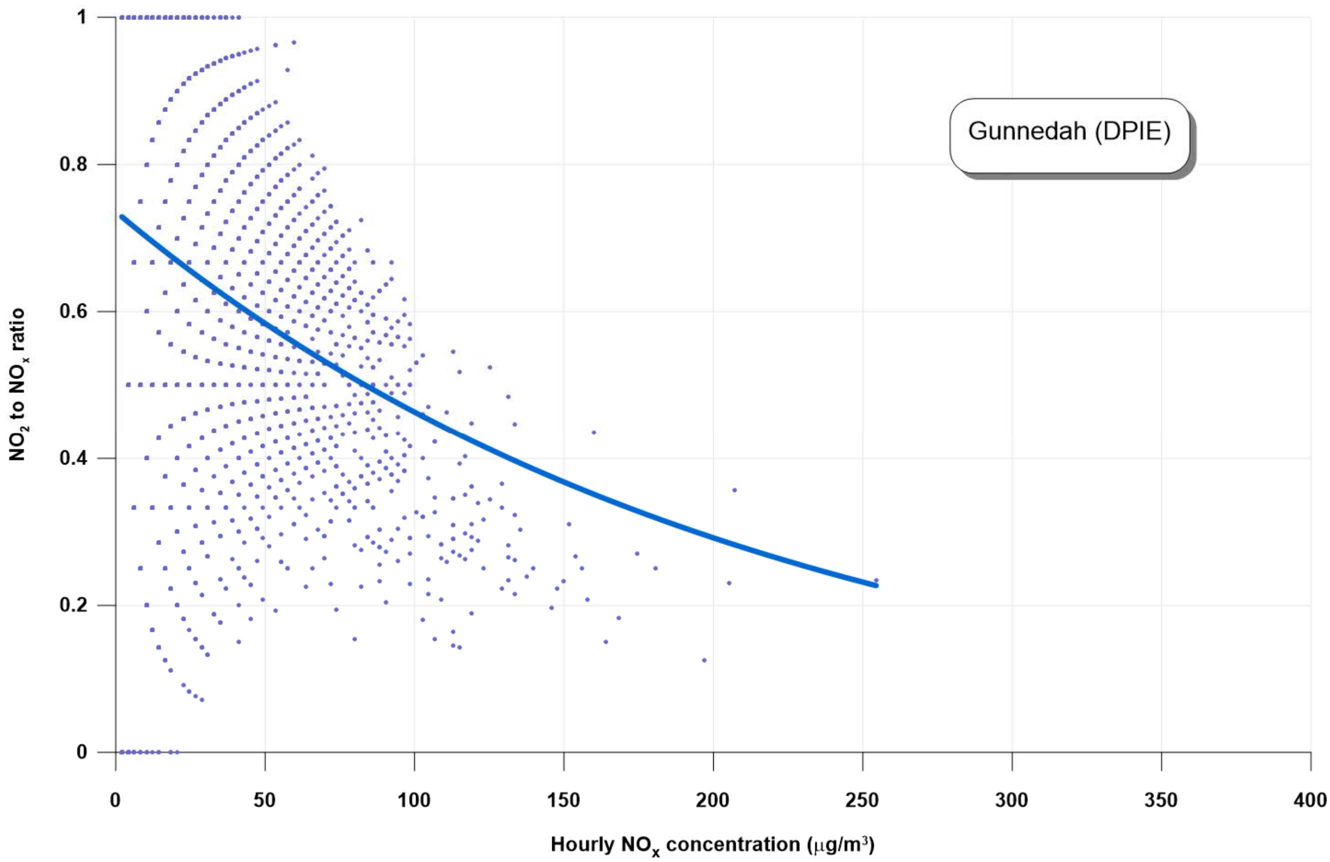



Figure 14 Measured $NO_2$ to $NO_x$ ratios from hourly average data collected at Gunnedah (2018 to 2020)

The methodology for the operation post-blast fume modelling is outlined below:

- Blasts modelled as a single volume source in a location indicative of the centre of BCM.

- Release heights of 20 m, effective plume heights of 40 m, initial horizontal spread (sigma y) of 25 m and initial vertical spread (sigma z) of 10 m. These are conservative estimates based on the data presented by Attalla *et al*. (2008). No plume rise due to buoyancy was modelled, which is again a conservative assumption.
- Emissions assumed to occur every hour between 9 am and 5 pm.
- Blasting could be on any day of the week, a conservative assumption as, in accordance with SSD 09_0182, blasting cannot occur on Sundays or public holidays unless written approval is obtained from the Secretary.
- $NO_x$ emissions based on data presented in the Queensland *Guidance Note for the management of oxides in open cut blasting* (DEEDI, 2011). It was conservatively assumed that the initial $NO_2$ concentration in the plume would be 17 ppm (34.9 mg/$m^3$) based on the Rating 3 Fume Category in the Queensland Guidance Note.
- The initial $NO_2$ concentration in the plume was converted to a total $NO_x$ emission rate based on a detailed measurement program of $NO_x$ in blast plumes in the Hunter Valley made by Attalla *et al*. (2008) which found that the NO:$NO_2$ ratio was typically 27:1, giving a $NO_x$:$NO_2$ ratio of approximately 18.6 g $NO_x$/g $NO_2$.
- Calculated emission of 866 g/s of $NO_x$ per blast and an emission release time of 5 minutes.
- 20% of the $NO_x$ is $NO_2$ at the points of maximum 1-hour average concentrations and at sensitive receptors.

Model results for post-blast fume have been compared to the applicable EPA air quality criterion for $NO_2$; that is 246 µg/$m^3$ as a 1-hour average and taking background levels into account. Section 6.3 provides the assessment of operational post blast fume.

## 5.3 Diesel Exhaust

Emissions from diesel exhausts associated with off-road vehicles and equipment at mine sites are often deemed a lower air quality impact risk than dust emissions from the material handling activities. This is because of the relatively few emission sources involved, for example when compared to a busy motorway, and the large distances between the sources and sensitive receptors. Nevertheless, a review of the potential impacts has been carried out, including modelling to quantify the potential impacts.

The most significant emissions from diesel exhausts are products of combustion including CO, $NO_x$, $PM_{10}$ and $PM_{2.5}$. It is the $NO_x$, or more specifically $NO_2$, and $PM_{10}$ (including $PM_{2.5}$) which have been assessed. DPIE monitoring data have shown that CO concentrations have not exceeded relevant air quality criteria at rural or urban monitoring stations in NSW, indicating that this substance represents a much lower air quality risk.

The modelling for mining dust (Section 5.1) has considered emission factors that represent the contribution from both wheel generated particulates and the exhaust particulates. These emission factors, including with control factors, are based on measured emissions which included diesel particulates in the form of both $PM_{10}$ and $PM_{2.5}$. The emission factors are also likely to include more diesel exhaust particulate than from a modern truck as the factors were developed on the basis of emissions from trucks measured in the 1980s (that is, older trucks). Todoroski Air Sciences has also reported (TAS, 2016) that several studies, reported to the EPA, confirmed that a control factor of 85% can be maintained, representing all components of the truck haulage emission. This information highlights that the potential impacts of diesel exhaust emissions (as $PM_{10}$ and $PM_{2.5}$) are represented in the model results for operational dust (Section 6.2).

Table 17 provides the explicit estimates of $PM_{10}$ and $PM_{2.5}$ emissions due only to diesel plant and equipment exhausts. Emission factors for “Industrial off-road vehicles and equipment” from the EPA’s 2008 Air Emissions Inventory (EPA, 2012) were used for the calculations and it has been assumed that there will be no reduction to emissions in the future; a conservative approach. These factors relate to diesel exhaust and evaporative emissions.

Table 17 Estimated $PM_{10}$ and $PM_{2.5}$ emissions from diesel engines

| Parameter | 2024 | 2029 | 2032 |
|---|---|---|---|
| Estimated fuel usage (kL) (source: BCOPL) | 78,900 | 99,845 | 99,701 |
| $PM_{10}$ calculations | | | |
| Diesel exhaust emission factor (kg/kL) | 2.84 | 2.84 | 2.84 |
| Diesel exhaust emissions - all equipment (kg/y) | 224,076 | 283,560 | 283,151 |
| $PM_{2.5}$ calculations | | | |
| Diesel exhaust emission factor (kg/kL) | 2.75 | 2.75 | 2.75 |
| Diesel exhaust emissions - all equipment (kg/y) | 217,354 | 275,053 | 274,656 |

Emissions of $NO_x$ from diesel exhausts have been estimated using fuel consumption data, provided by BCOPL, and an emission factor from the EPA's Air Emissions Inventory for 2008 (EPA, 2012). Table 18 shows the calculations. Again, it has been assumed that there will be no reduction to emissions in the future; a conservative approach.

Table 18 Estimated $NO_x$ emissions from diesel engines

| Parameter | 2024 | 2029 | 2032 |
|---|---|---|---|
| Estimated fuel usage (kL) (source: BCOPL) | 78,900 | 99,845 | 99,701 |
| $NO_x$ calculations | | | |
| Diesel exhaust emission factor (kg/kL) | 40.77 | 40.77 | 40.77 |
| Diesel exhaust emissions - all equipment (kg/y) | 3,216,753 | 4,070,681 | 4,064,810 |

The $NO_x$ emission estimates for 2029 from Table 18 have been explicitly modelled to provide an indication of the off-site $NO_2$ concentrations due to diesel exhaust emissions. Section 6.4 provides the assessment of operational diesel exhaust.

## 5.4 Greenhouse Gas

The GHG inventory in this document has been calculated in accordance with the principles of the GHG Protocol and the "Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia" (DEE, 2017). The initial actions for a GHG inventory is to determine the sources of GHG emissions, assess their likely significance and set a boundary for the assessment. Creating an inventory of the likely GHG emissions associated with the project has the benefit of determining the scale of the emissions and providing a baseline from which to develop and deliver GHG reduction options.

The results of this assessment are presented in terms of the previously mentioned 'Scopes' to help understand the direct and indirect impacts of the project. The GHG Protocol (and similar reporting schemes) dictates that reporting Scope 1 and 2 sources is mandatory, whilst reporting Scope 3 sources is optional. Reporting *significant* Scope 3 sources is recommended. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities include the extraction and production of purchased materials, transportation of purchased fuels, and use of sold products (i.e. burning of coal) and services. The inventory for this assessment includes all significant sources of GHGs (Scopes 1, 2 and 3) associated with MOD 8.

GHG emissions associated with operation of BCM are well understood, given that the mine is currently operating. Future projections of production, fuel usage and electricity usage (from BCOPL) were used to determine the additional greenhouse gas emissions from MOD 8. Table 19 shows the key emission sources that have been considered in this assessment.

Table 19 GHG emission sources

| Activity | Description | Scope(s) |
|---|---|---|
| Diesel usage | Combustion of diesel fuel from mobile and stationary plant and equipment. | 1, 3 |
| Fugitive | Fugitive emissions from the extraction of coal. | 1 |
| Blasting | Detonation of explosives used for blasting. | 1 |
| Electricity | Electricity usage. | 2, 3 |
| Transport (rail) | Transport of product coal by rail to port. | 3 |
| Transport (shipping) | Transport of product coal by ship to market. | 3 |
| Energy production | Combustion of thermal coal in power generators by end users. | 3 |
| Coking coal use | Combustion of semi-soft coking coal by end users for steel production. | 3 |

Table 20 outlines the greenhouse gas emission estimation methodologies for each activity.

Table 20 GHG emission estimation methodologies

| Activity | Emission estimation methodology |
|---|---|
| Diesel usage | Emission factors from NGA Factors (DEE, 2020). |
| Fugitive | Emission factors from NGA Factors (DEE, 2020). |
| Blasting | Emission factors from NGA Factors (DCC, 2008). |
| Electricity | Emission factors from NGA Factors (DEE, 2020). |
| Transport (rail) | Emission factors from the Department for Environment, Food and Rural Affairs (DEFRA) (2019), based on "Freighting goods / freight train". 150 km assumed distance from mine to port. |
| Transport (shipping) | Emission factors from DEFRA (2019), based on "Freighting goods / cargo ship, bulk carrier". 8,000 km assumed distance from port to market. |
| Energy production | Emission factors from NGA Factors (DEE, 2020). |
| Coking coal use | Emission factors from NGA Factors (DEE, 2020). |

Section 7 provides the assessment of GHG emissions.

# 6. Air Quality Assessment

This section provides an assessment of the identified key air quality issues from Section 2.

## 6.1 Construction

Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using modelling. To do so would require knowledge of weather conditions for the period in which work will be taking place in each location on the site. The potential significance and impacts of construction dust has therefore been determined from a qualitative review, taking into consideration the intensity, scale, location and duration of the proposed works.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the construction works. However, there will be limited construction works required for increasing the depth of mining. Construction of the specifically designed fauna movement crossing over the existing haul road would occur in parallel with ongoing mining operations and, of relevance to air quality, would include:

- Development of access tracks and lay down areas.
- Transport of raw materials to site.
- Construction and installation of the fauna movement crossing.

These works would generally occur 7.00 am to 6.00 pm seven days per week with the numbers and types of equipment varying depending on the activity being undertaken. The total amount of dust generated would depend on the quantities of material handled, silt and moisture content of the soil, the types of operations being carried out, exposed areas, frequency of water spraying and speed of machinery. The detailed approach to construction will depend on decisions that will be made by the contractor(s) and changes to the construction methods and sequences that are expected to take place during the construction phase.

Material handling quantities in the construction phase are expected to be much lower than the material handling quantities in the operations phase. Consequently, the air quality impacts during construction will be lower than during operations. However, as for the operations phase, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. Dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme, unfavourable weather conditions, such as dry, high wind speed conditions. Monitoring would also continue to be carried out during the construction phase to assess compliance with EPA criteria. Section 8 provides more specific information on monitoring and management.

## 6.2 Mining Dust

This section provides an assessment of MOD 8 in terms of mining dust, based on the methodology described in Section 5.1. Model results have been assessed for each of the key particulate matter classifications.

### 6.2.1 Particulate Matter (as $PM_{10}$)

Figure 15 shows the predicted maximum 24-hour average $PM_{10}$ concentrations due to BCM (including the changes sought by MOD 8) for each assessment scenario. The EPA does not prescribe a project only criteria for 24-hour average $PM_{10}$, but the VLAMP refers to 50 $\mu g/m^3$ for the purposes of determining land acquisition and mitigation. The modelling shows that the 50 $\mu g/m^3$ criterion would not be exceeded at any private sensitive receptor. In addition the predicted extent of the 50 $\mu g/m^3$ for the BCM (including the changes sought by MOD 8) is largely within the approved maximum extent, based on historical modelling for the operation, with the exception of a potential increase on Crown Land to the north-northeast.

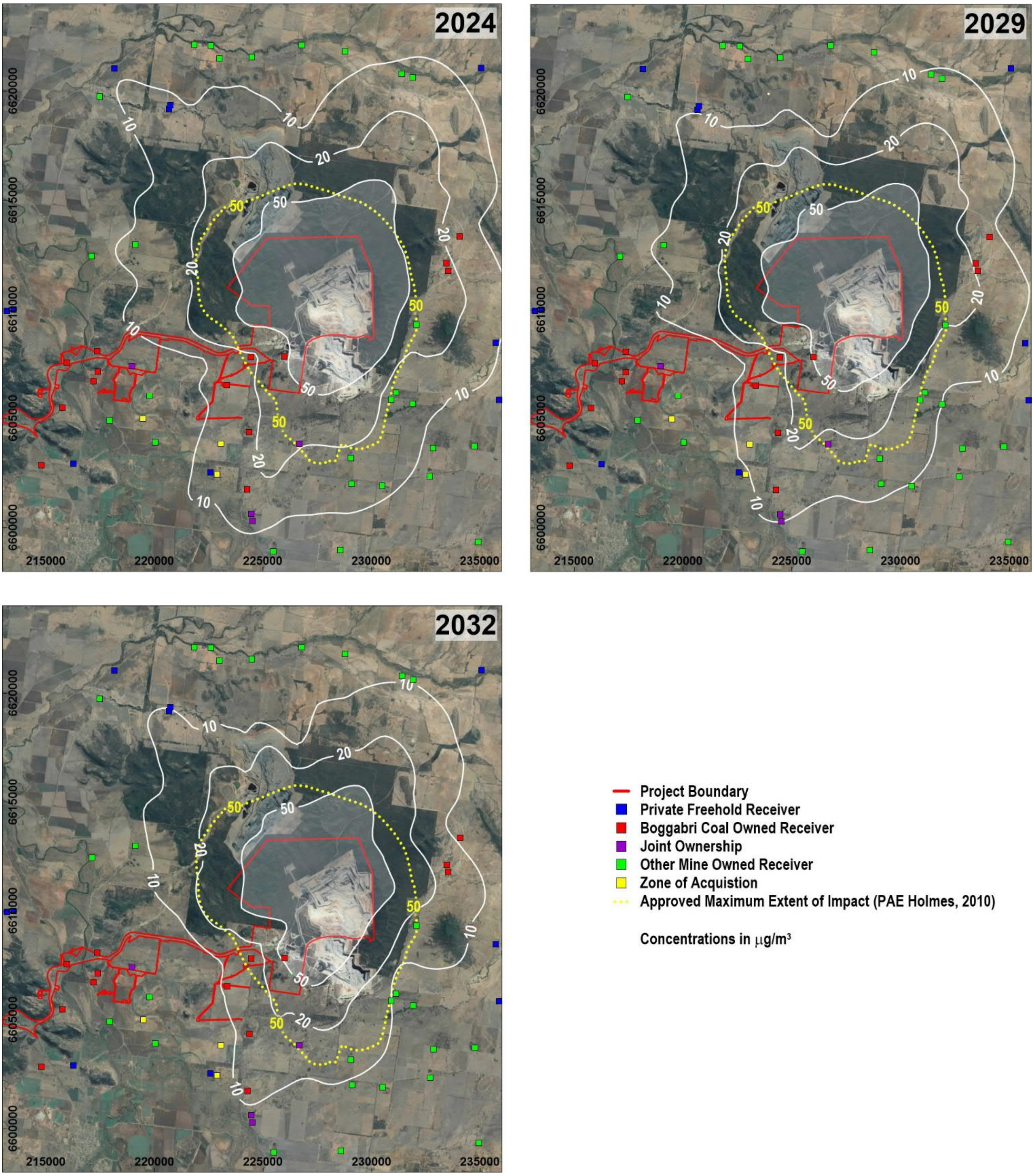



Figure 15 Predicted maximum 24-hour average $PM_{10}$ due to BCM

Compliance with the EPA's 24-hour average $PM_{10}$ criterion of 50 µg/m$^3$ has also been assessed. This criterion relates to the total concentration in the air (that is, cumulative) and not just the contribution from the BCM (including the changes sought by MOD 8).

As noted in Section 4.3, most locations around Boggabri, and in fact NSW, have historically recorded one or more days each year when the 24-hour average $PM_{10}$ concentration exceeded 50 µg/m$^3$. The model has therefore been configured to show the predicted number of days each year above 50 µg/m$^3$ and an assessment of whether MOD 8 would cause additional exceedances has been made.

Figure 16 shows the predicted number of days above 50 µg/m$^3$ due to BCM (including the changes sought by MOD 8), other mining operations and other sources of $PM_{10}$. These results show that, for a representative year, three private sensitive receptors (140, 147 and 165) are expected to experience in the order of one day when $PM_{10}$ concentrations exceed 50 µg/m$^3$. This result is within the range of historically measured days when $PM_{10}$ concentrations have exceeded 50 µg/m$^3$, with the exception of extraordinary years e.g. due to dust storms and bushfires. The nearest private sensitive receptor (158) is not expected to experience $PM_{10}$ concentrations above 50 µg/m$^3$.


Figure 16 Predicted number of days above 50 µg/m$^3$ $PM_{10}$ due to BCM and other sources

Additional investigation of the potential for MOD 8 to cause an exceedance has been carried out. This involved examining contemporaneous background and mining contributions for each day in the modelling year, referred to as a “Level 2” assessment by the Approved Methods.

Figure 17 to Figure 19 show the time series’ of 24-hour average $PM_{10}$ concentrations for properties 140, 158 and 165 respectively. These are the three closest private sensitive receptors to BCM. The results show that concentrations would be well below 50 µg/m$^3$ for most days of the year at each location. The only potential for BCM (including the changes sought by MOD 8) to cause an exceedance of 50 µg/m$^3$, at property 140, would be when the background levels were approaching 50 µg/m$^3$. In this scenario, the modelling indicates a very small (3 µg/m$^3$) contribution from BCM. This risk can be managed through existing BCM air quality management measures, as described in Section 8 below.

Appendix E provides tabulated results that confirm the outcomes above. These outcomes do not change with the approval of Tarrawonga Modification 7.

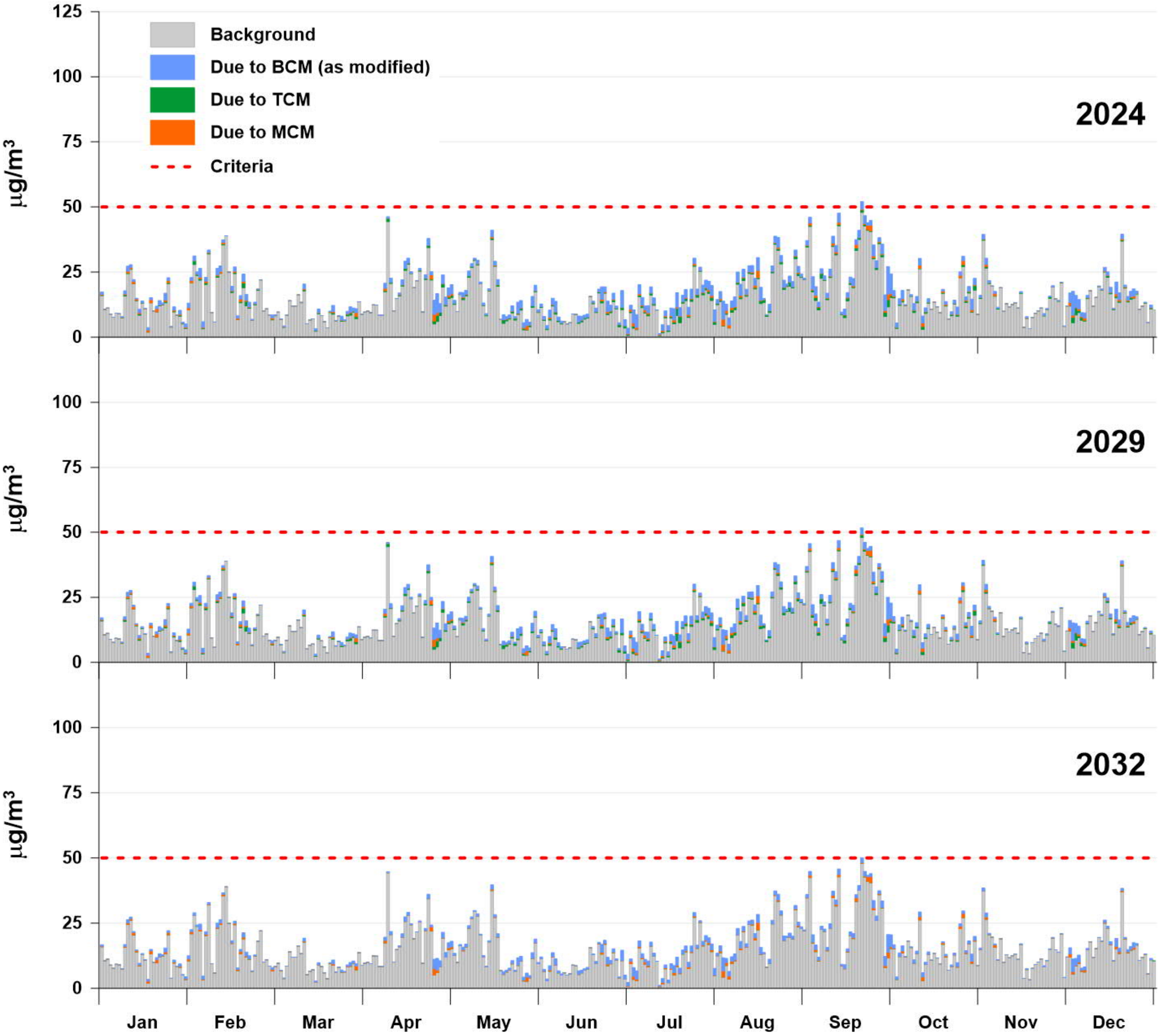



Figure 17 Time series of 24-hour average $PM_{10}$ at receiver 140

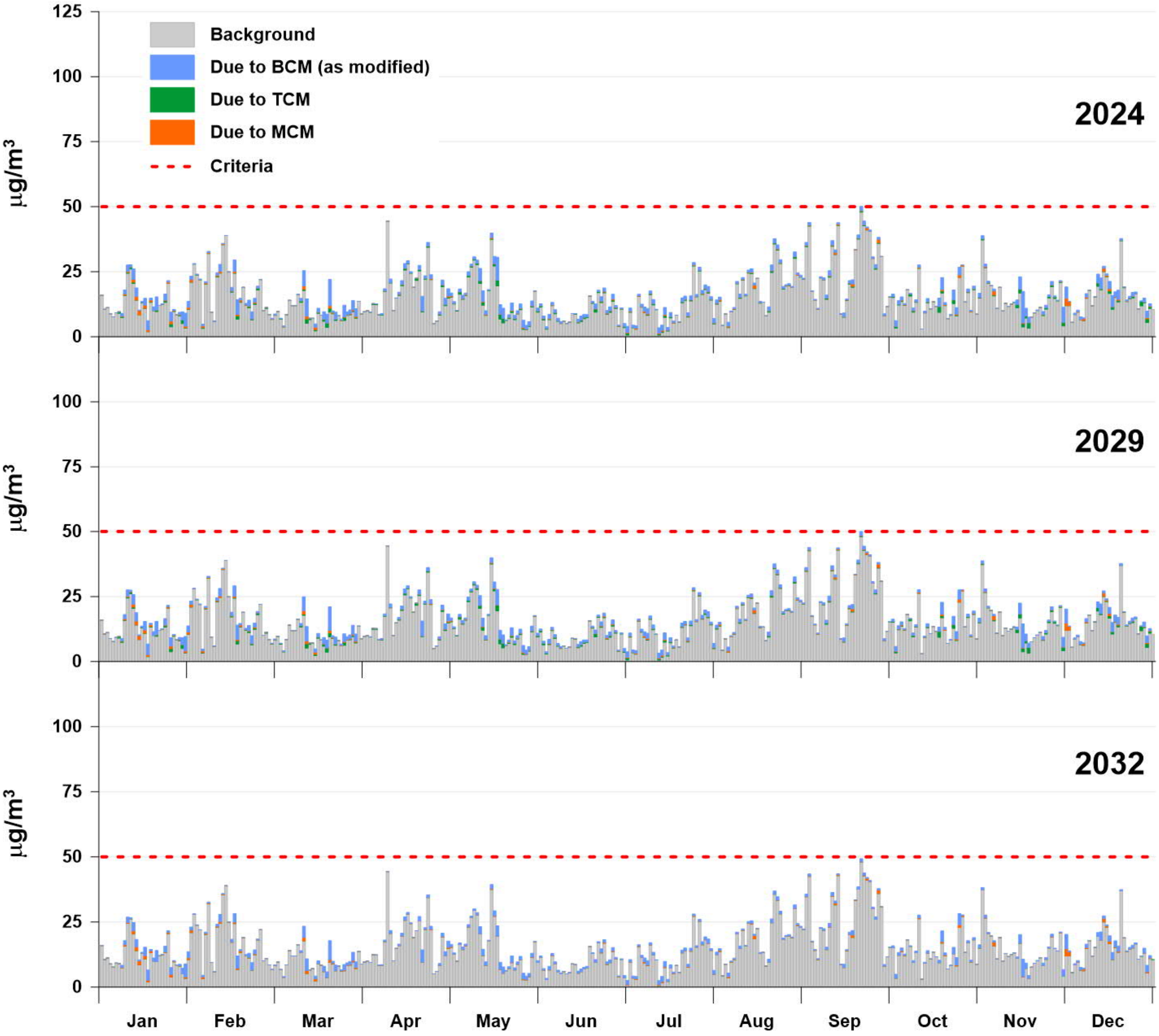



Figure 18 Time series of 24-hour average $PM_{10}$ at receiver 158

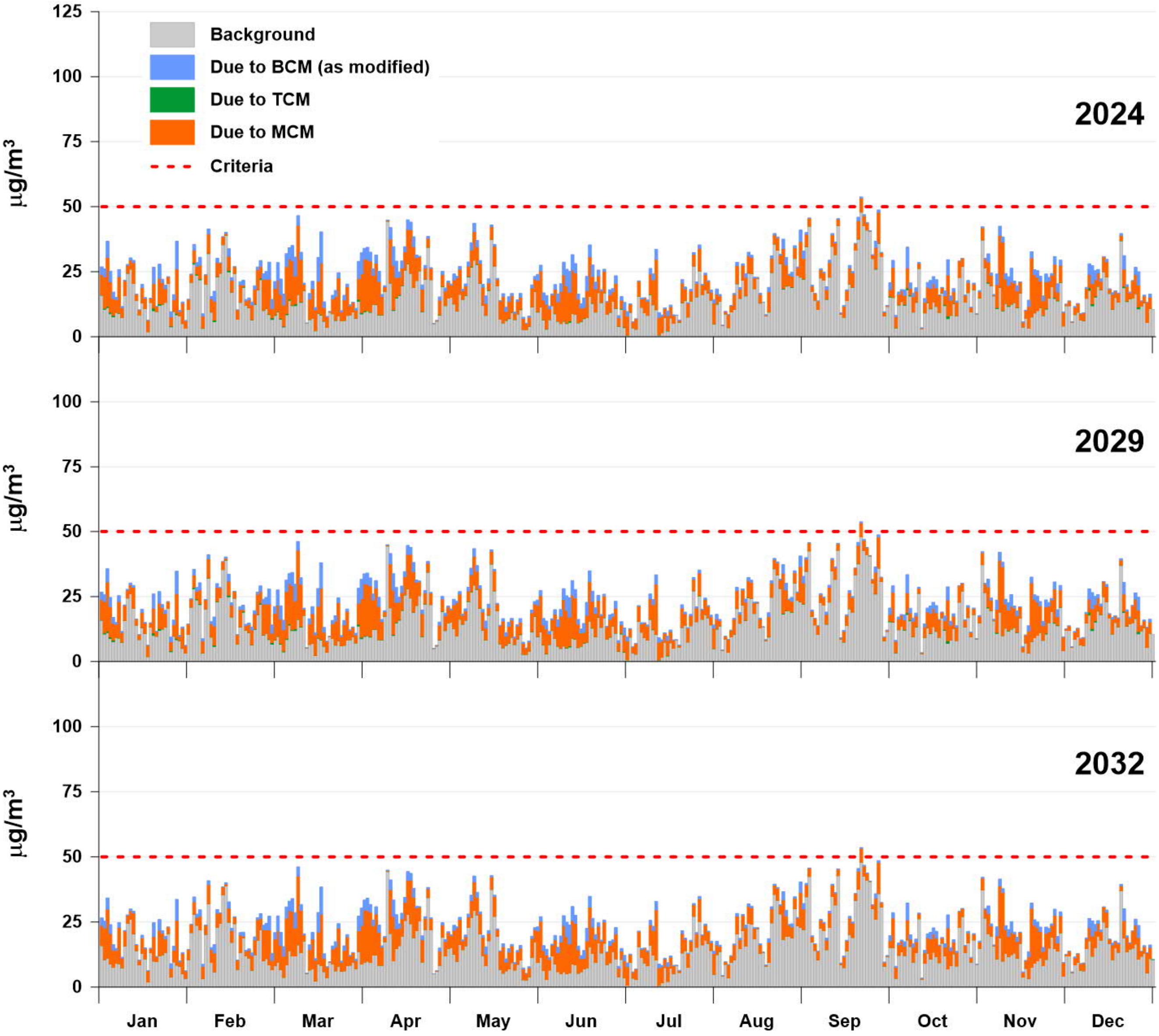



Figure 19 Time series of 24-hour average $PM_{10}$ at receiver 165

Figure 20 shows the predicted annual average $PM_{10}$ concentrations due to BCM (including the changes sought by MOD 8). There are no applicable “project only” criteria but it can be seen from these results that the contribution of the BCM (including the changes sought by MOD 8) to annual average $PM_{10}$ concentrations is within the originally approved contribution, except for a potential minor increase to the northeast of the Project Boundary, on Crown Land.

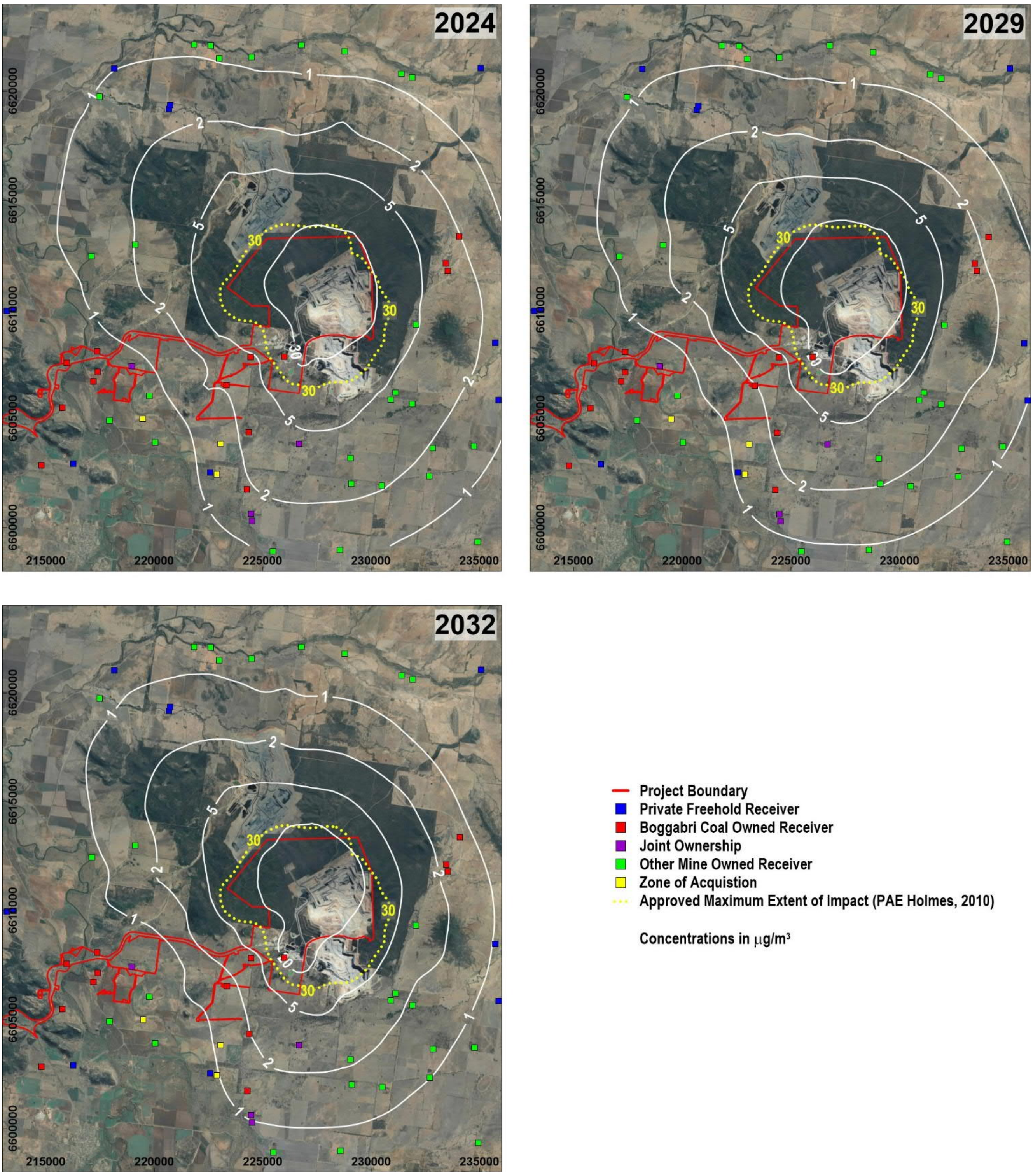



Figure 20 Predicted annual average $PM_{10}$ due to BCM

Figure 21 shows the predicted annual average $PM_{10}$ concentrations due to BCM (including the changes sought by MOD 8), other mining operations and other sources of $PM_{10}$. These results indicate compliance with the EPA's assessment criterion for annual average $PM_{10}$ (25 µg/m$^3$) at all private sensitive receptors.

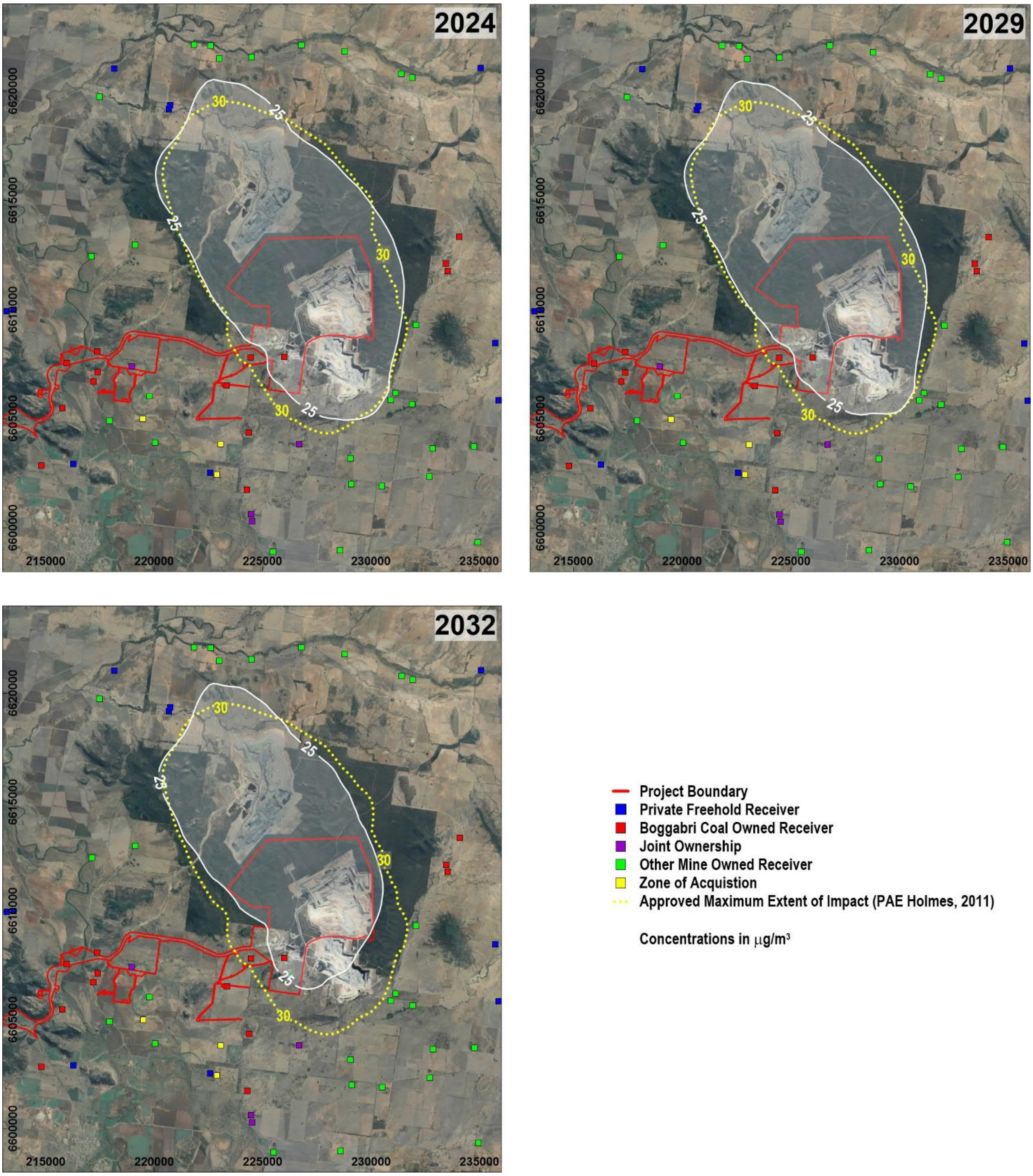



Figure 21 Predicted annual average $PM_{10}$ due to BCM and other sources

### 6.2.2 Particulate Matter (as $PM_{2.5}$)

Figure 22 shows the predicted maximum 24-hour average $PM_{2.5}$ concentrations due to BCM (including the changes sought by MOD 8) for each assessment scenario. The EPA does not prescribe a project only criteria for 24-hour average $PM_{2.5}$, but the VLAMP refers to 25 $\mu g/m^3$ for the purposes of determining land acquisition and mitigation. The modelling shows that the 25 $\mu g/m^3$ criterion would not be exceeded at any private sensitive receptor.

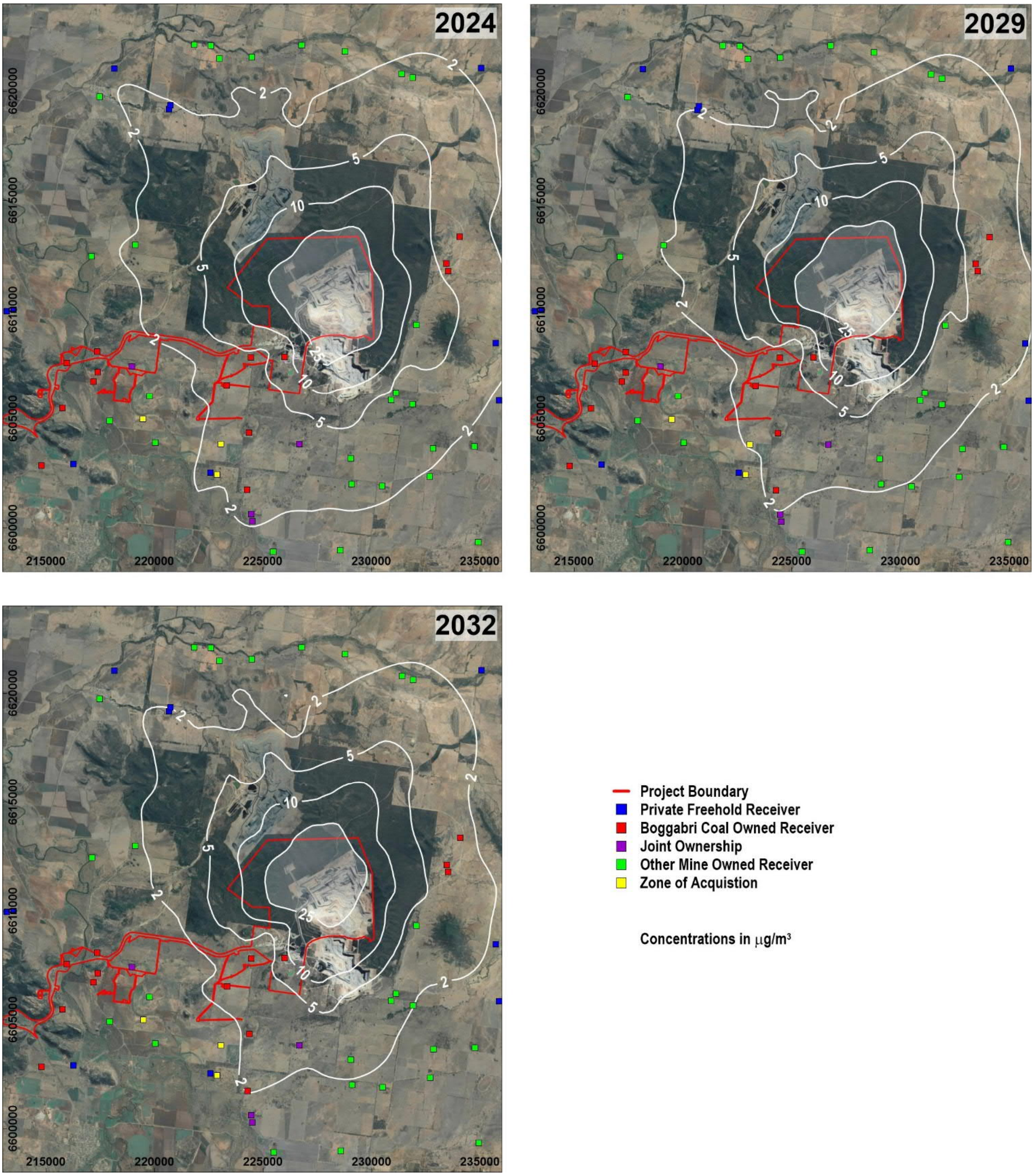



Figure 22 Predicted maximum 24-hour average $PM_{2.5}$ due to BCM

Compliance with the EPA's 24-hour average $PM_{2.5}$ criterion of 25 µg/m$^3$ has also been assessed. This criterion relates to the total concentration in the air (that is, cumulative) and not just the contribution from the BCM (including the changes sought by MOD 8). Figure 16 shows the predicted number of days above 25 µg/m$^3$ due to BCM (including the changes sought by MOD 8), other mining operations and other sources of $PM_{10}$. These results show that, for a representative year, the nearest private sensitive receptors are not expected to experience $PM_{2.5}$ concentrations above 25 µg/m$^3$. However, based on historical monitoring data (Section 4.3) it is possible that $PM_{2.5}$ concentrations will exceed 25 µg/m$^3$ from time-to-time due to other factors such as dust storms, bushfires and influences of drought.

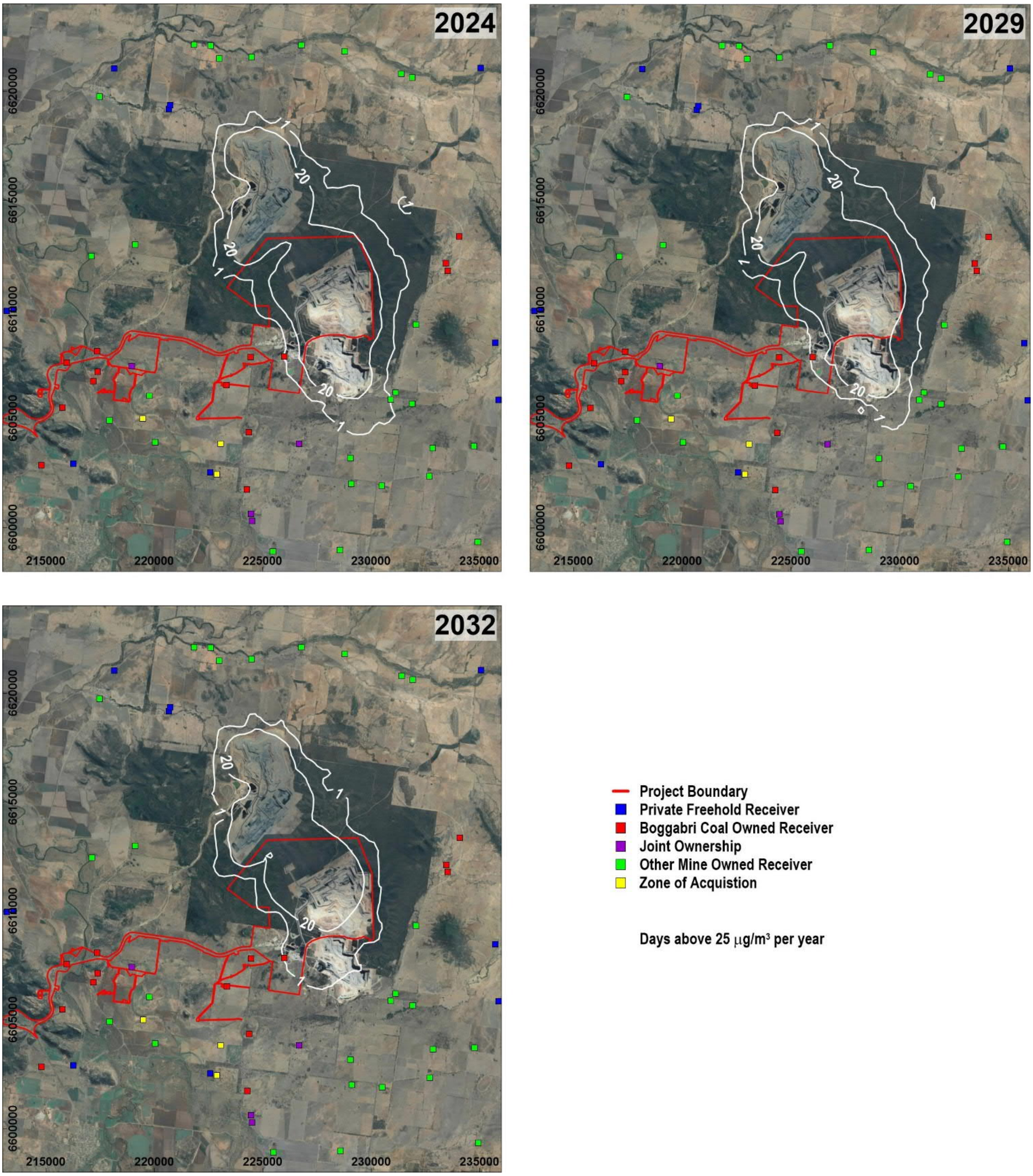



Figure 23 Predicted number of days above 25 µg/m$^3$ $PM_{2.5}$ due to BCM and other sources

Figure 20 shows the predicted annual average $PM_{2.5}$ concentrations due to BCM (including the changes sought by MOD 8). There are no applicable “project only” criteria but it is useful to note that the BCM is predicted to contribute no more than 1 µg/m$^3$ at the nearest private sensitive receptors including properties 140, 147, 158 and 165 (including 165b).


Figure 24 Predicted annual average $PM_{2.5}$ due to BCM

Figure 21 shows the predicted annual average $PM_{2.5}$ concentrations due to BCM (including the changes sought by MOD 8), other mining operations and other sources of $PM_{2.5}$. These results show that the EPA's assessment criterion for annual average $PM_{2.5}$ (8 $\mu g/m^3$) will not be exceeded at private sensitive receptors including properties 140, 147, 158 and 165.

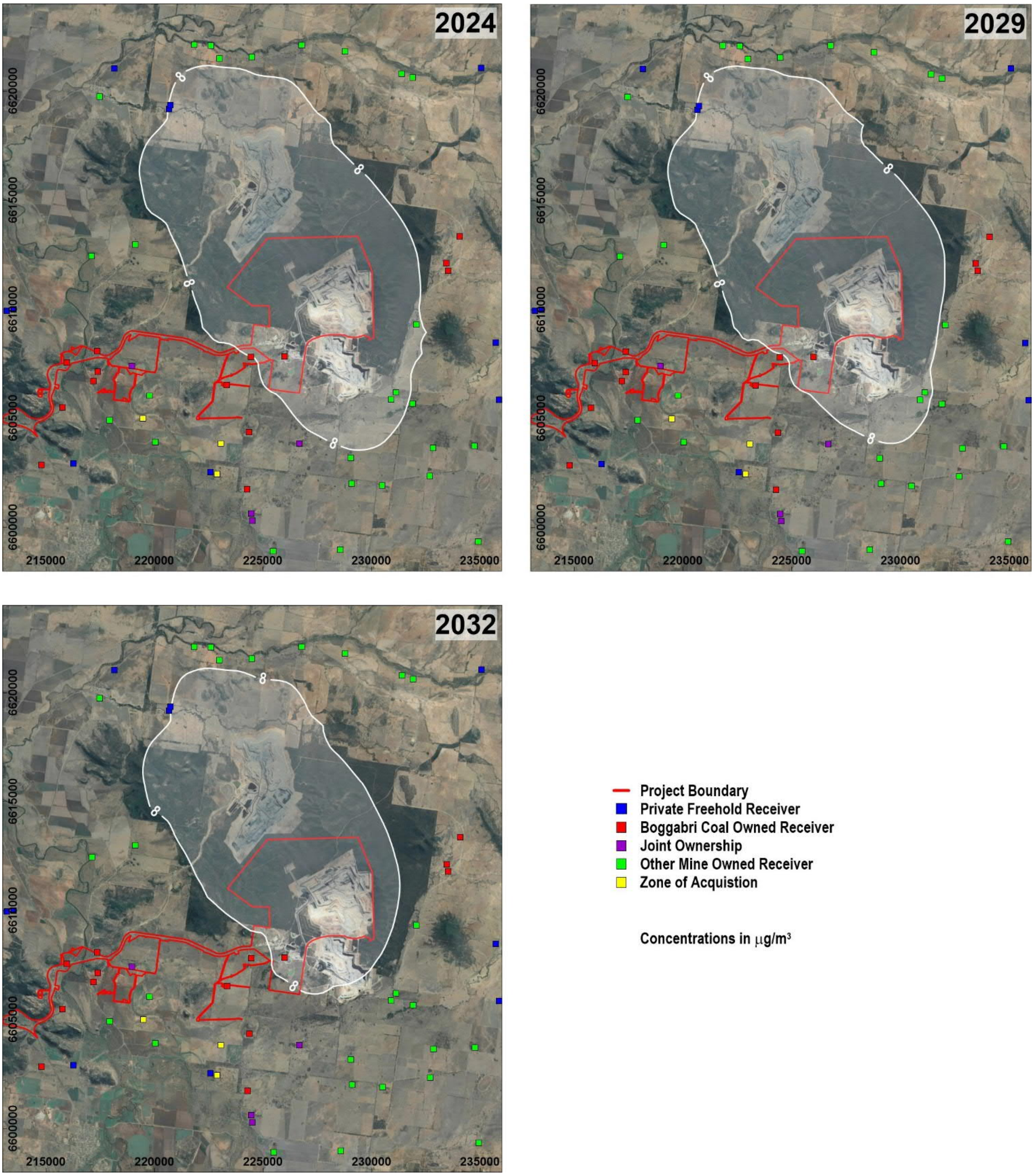



Figure 25 Predicted annual average $PM_{2.5}$ due to BCM and other sources

### 6.2.3 Particulate Matter (as TSP)

Figure 26 shows the predicted annual average TSP concentrations due to BCM (including the changes sought by MOD 8). There are no applicable "project only" criteria but it is useful to note that the BCM is predicted to contribute no more than 1 µg/m$^3$ at the nearest private sensitive receptors.

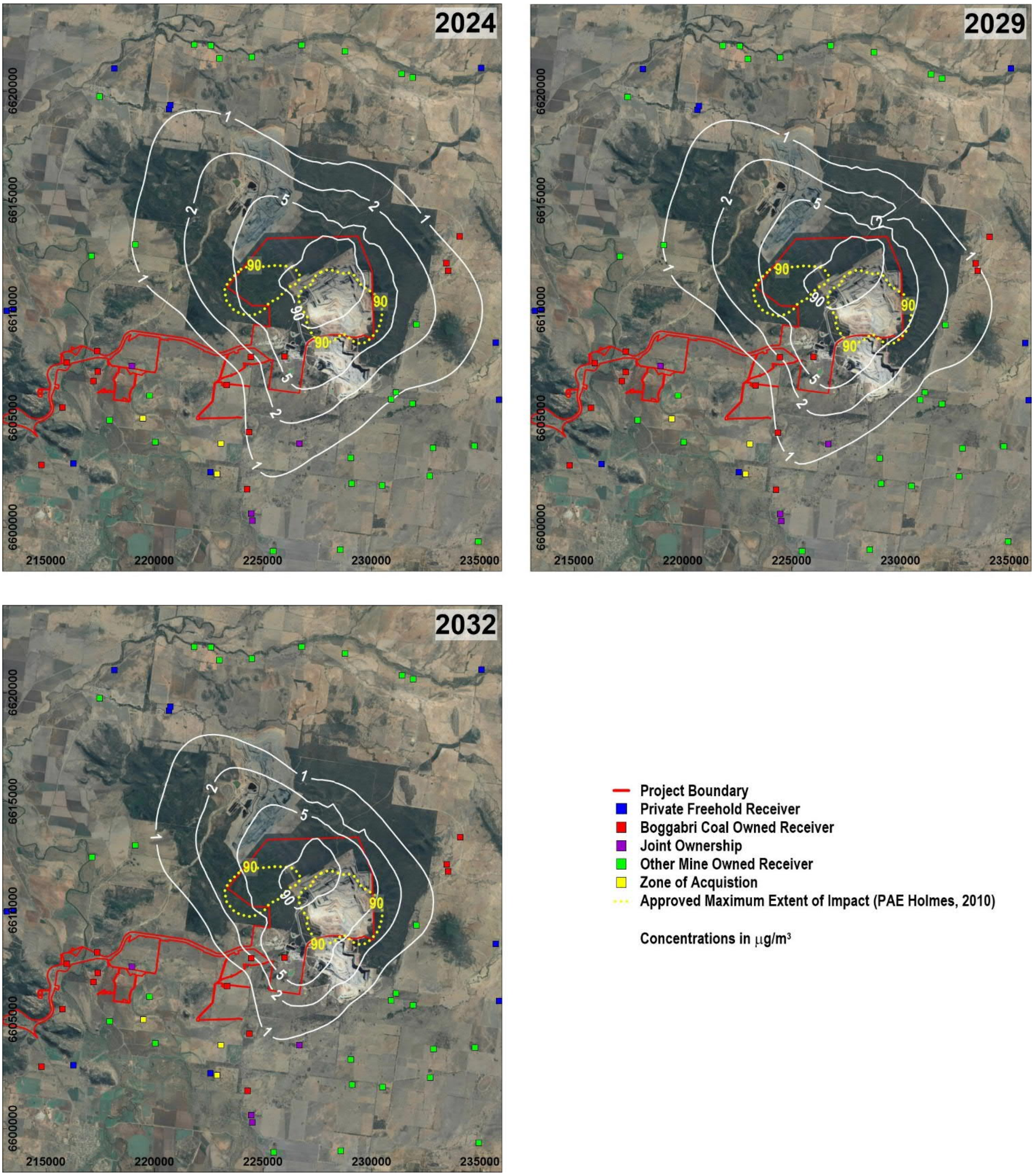



Figure 26 Predicted annual average TSP due to BCM

Figure 27 shows the predicted annual average TSP concentrations due to BCM (including the changes sought by MOD 8), other mining operations and other sources of $PM_{2.5}$. These results show that the EPA's assessment criterion for annual average TSP (90 µg/m$^3$) will not be exceeded at private sensitive receptors.

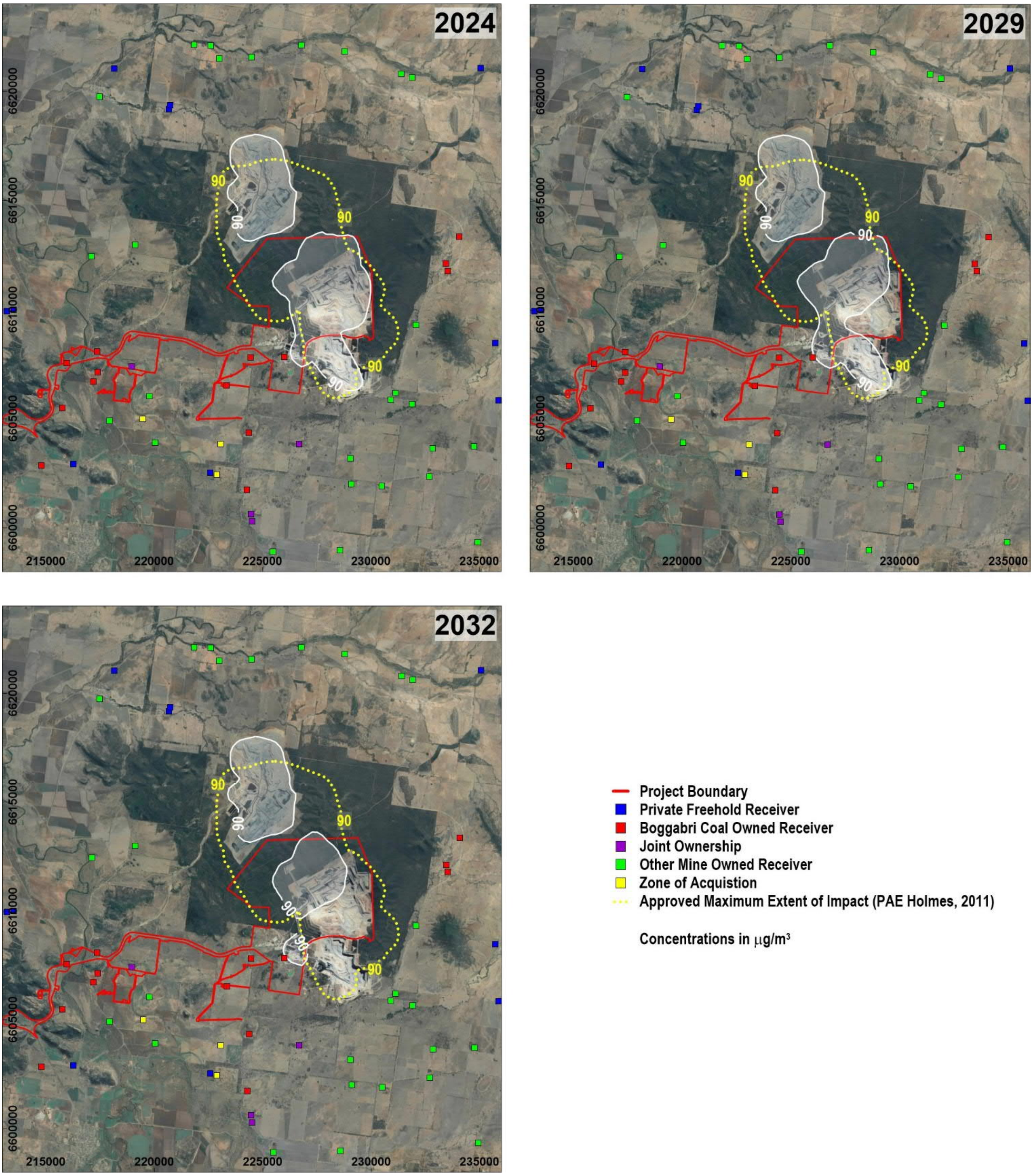



Figure 27 Predicted annual average TSP due to BCM and other sources

### 6.2.4 Deposited Dust

Figure 28 shows the predicted annual average deposited dust levels due to BCM (including the changes sought by MOD 8). These results show that the EPA's assessment criterion for incremental deposited dust due to the BCM on its own (2 g/m$^2$/month) will not be exceeded at private sensitive receptors.


Figure 28 Predicted annual average deposited dust due to BCM

Figure 29 shows the predicted annual average deposited dust levels due to BCM (including the changes sought by MOD 8), other mining operations and other sources of dust. These results show that the EPA's assessment criterion for total deposited dust due to the BCM plus background concentrations due to all other sources (4 g/m$^2$/month) will not be exceeded at private sensitive receptors.

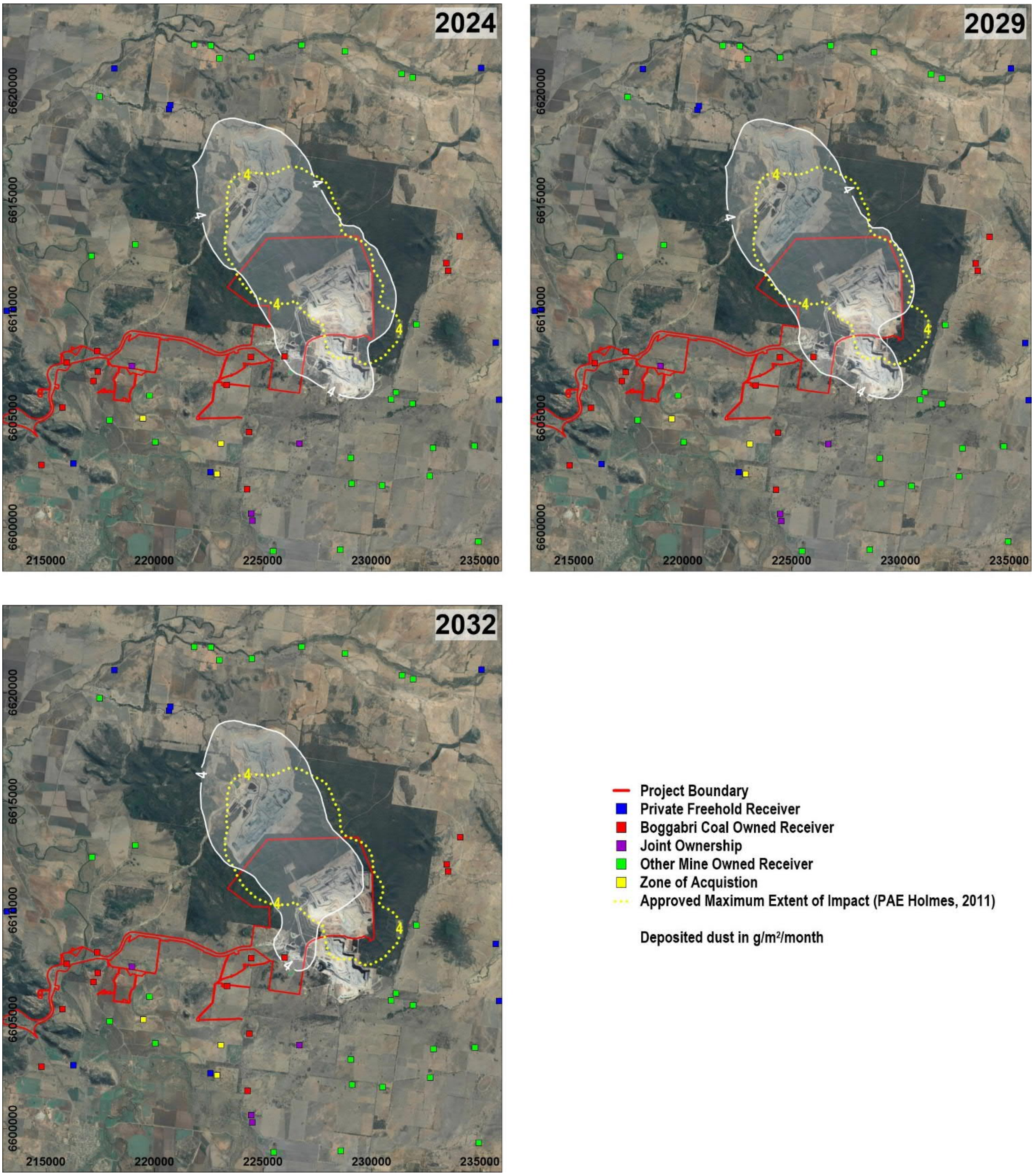



Figure 29 Predicted annual average deposited dust due to BCM and other sources

## 6.3 Post Blast Fume

Figure 30 shows the predicted maximum 1-hour average $NO_2$ concentrations due to post-blast fume, based on the methodology outlined in Section 5.2. These results show that, under worst-case meteorological conditions with a rated 3 fume, blasting every day between 9 am and 5 pm and maximum background $NO_2$ concentrations from Gunnedah, the maximum 1-hour average $NO_2$ concentrations will not exceed EPA's criterion of 246 µg/m$^3$ at any off-site sensitive receptor.

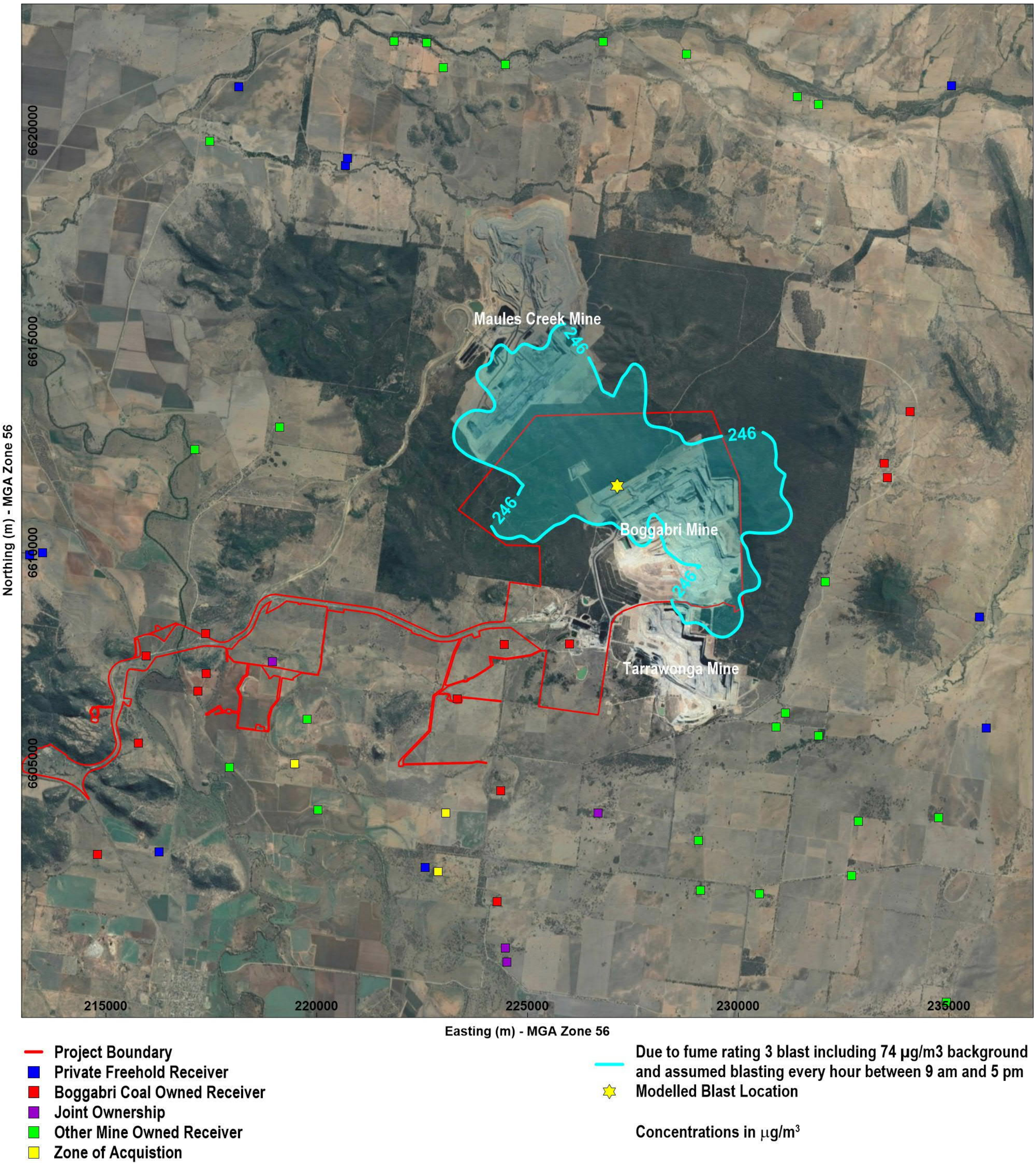



Figure 30 Predicted maximum 1-hour average $NO_2$ due to blasting (including background levels)

While worst-case assumptions have been made with respect to time-of-day, fume rating and background levels, the modelling has been based on a blast positioned broadly in the middle of the approved Mine Disturbance Boundary. It is acknowledged that moving the assumed blast location, for example further to the south, would lead to a corresponding shift in the contours, potentially changing the predicted extent of impacts. However, this potential will be managed through the design process for each individual blast which will be designed to comply with relevant criteria. The potential for post-blast fume impacts will be identified prior to all blasts, taking into account the specific parameters of each blast, to avoid worst-case conditions and to minimise fume emissions from blasting, in accordance with contemporary conditions of approval.

Based on the dispersion modelling, with predominantly worst-case assumptions, and proposed implementation of site-specific pre-blast procedures it has therefore been concluded that MOD 8 will not lead to adverse air quality impacts with respect to post blast fume. In addition, it is important to note that no changes are proposed to the number of blasts per day, permissible blasting hours, blasting practices or blast management procedures as part of MOD 8. Therefore, the extent of potential blast fume impact will be within the extent of potential blast fume impact approved for BCM and will continue to be managed in accordance with existing approved management plans and processes.

BCOPL has developed blasting procedures to provide for effective fume management. A site-specific blast management plan is implemented during operations, including key fume management actions, such as defining the potential risk zone based upon weather patterns and obtaining permission to fire, based on an assessment of current weather conditions. In addition to general fume management practices, BCOPL continues to work closely with its explosive suppliers to minimise the potential for post-blast fume. BCOPL also works with neighbouring operations to coordinate and avoid cumulative impacts from blasting.

## 6.4 Diesel Exhaust

Figure 31 shows the predicted maximum 1-hour average $NO_2$ concentrations due to diesel exhaust emissions at BCM, based on the conservative methodology outlined in Section 5.2. The results assume that 20% of the $NO_x$ is $NO_2$ at the locations of maximum ground-level concentrations and a maximum background concentration of 74 $\mu g/m^3$. Compliance with the EPA's 246 $\mu g/m^3$ criterion is predicted at all private sensitive receptors.

Figure 32 shows the predicted annual average $NO_2$ concentrations. These predictions assume that 70% of the $NO_x$ is $NO_2$ based on the annual average $NO_x$ to $NO_2$ percentage in the data collected from Gunnedah from 2018 to 2020, and 10 $\mu g/m^3$ background levels. Compliance with the EPA's 62 $\mu g/m^3$ criterion is predicted at all private sensitive receptors.

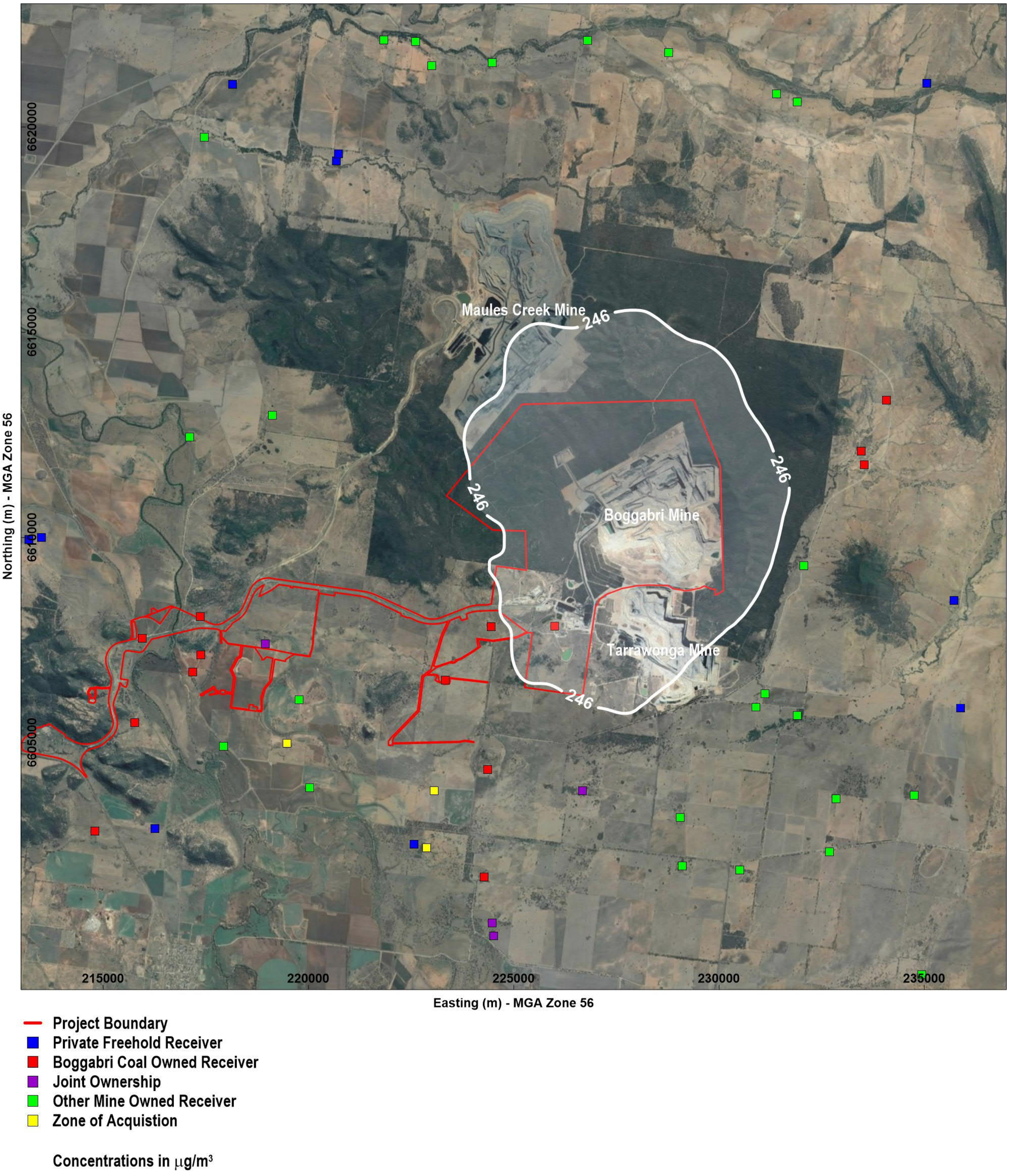



Figure 31 Predicted maximum 1-hour average $NO_2$ due to diesel exhausts (including background levels)

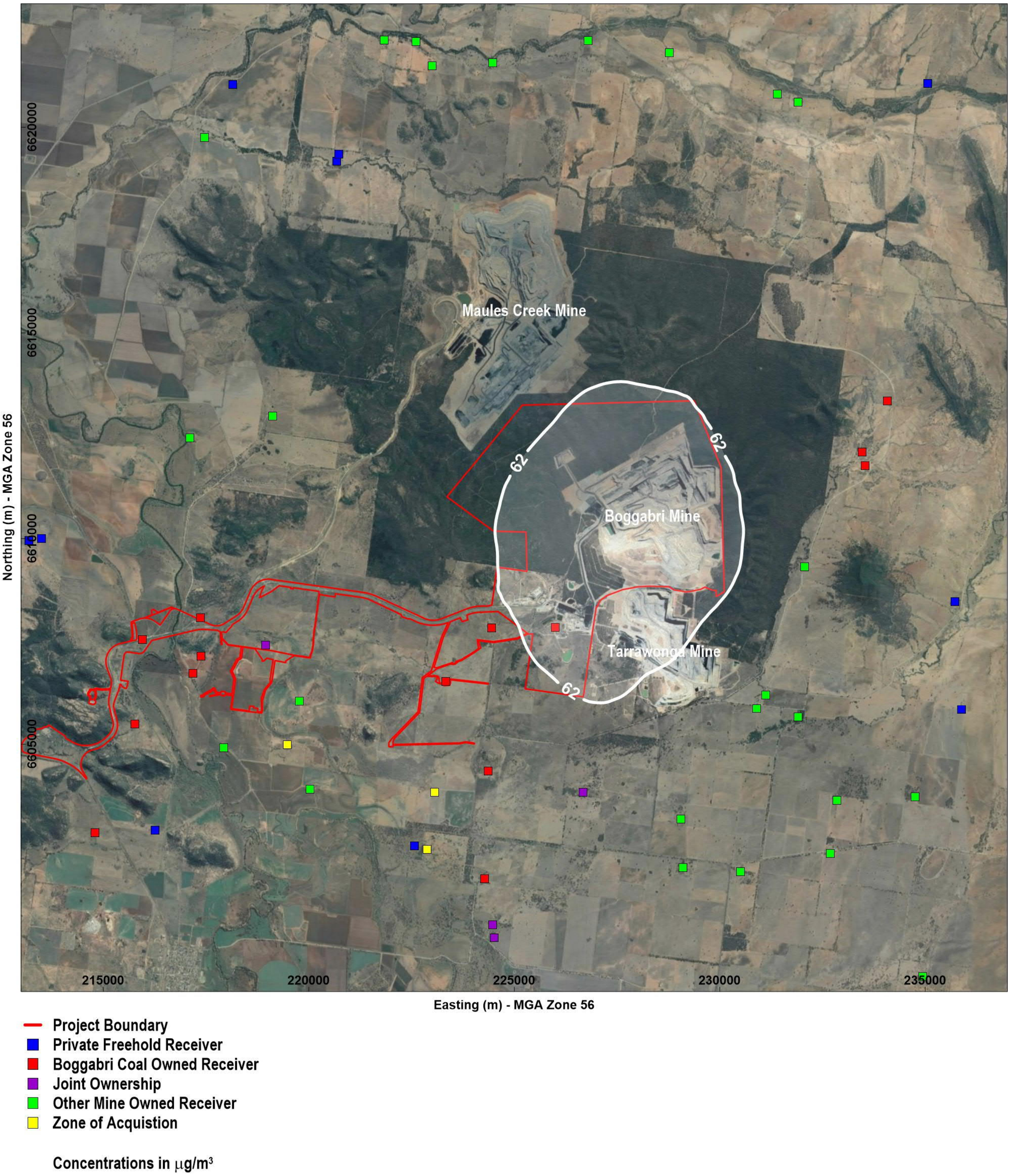



Figure 32 Predicted annual average $NO_2$ due to diesel exhausts (including background levels)

# 7. Greenhouse Gas Assessment

## 7.1 Emissions

Table 21 shows the estimated emissions of GHGs due to all identified GHG-generating activities at BCM (including changes sought by MOD 8) for each mining year. Over the lifetime of the project, from 2022 to 2042, the Scope 1 and 2 emissions are estimated to average 0.69 Mt $CO_2$-e per year. Appendix F provides more detailed breakdowns of the estimated emissions for each activity by mining year.

Table 21 Summary of estimated GHG emissions

| Mining year | ROM coal (Mt) | Emissions (Mt $CO_2$-e) | | |
|---|---|---|---|---|
| | | Scope 1 | Scope 2 | Scope 3 |
| 2022 | 8.60 | 0.74 | 0.07 | 20.28 |
| 2023 | 8.90 | 0.81 | 0.06 | 21.42 |
| 2024 | 8.00 | 0.80 | 0.06 | 19.35 |
| 2025 | 8.00 | 0.80 | 0.06 | 19.15 |
| 2026 | 8.60 | 0.82 | 0.06 | 20.59 |
| 2027 | 9.00 | 0.83 | 0.06 | 22.07 |
| 2028 | 9.10 | 0.79 | 0.06 | 21.81 |
| 2029 | 8.60 | 0.80 | 0.06 | 21.16 |
| 2030 | 8.60 | 0.80 | 0.06 | 20.26 |
| 2031 | 8.60 | 0.81 | 0.06 | 20.96 |
| 2032 | 8.60 | 0.76 | 0.06 | 20.61 |
| 2033 | 8.54 | 0.76 | 0.06 | 20.21 |
| 2034 | 8.60 | 0.77 | 0.06 | 20.17 |
| 2035 | 8.60 | 0.75 | 0.06 | 20.37 |
| 2036 | 8.60 | 0.74 | 0.06 | 20.57 |
| 2037 | 5.83 | 0.48 | 0.04 | 14.29 |
| 2038 | 4.30 | 0.38 | 0.04 | 11.61 |
| 2039 | 4.00 | 0.36 | 0.04 | 9.76 |
| 2040 | - | 0.09 | - | 0.00 |
| 2041 | - | 0.09 | - | 0.00 |
| 2042 | - | 0.09 | - | 0.00 |
| Average (2022-2042) | 7.95 | 0.63 | 0.06 | 16.41 |
| Total (2022-2042) | 143.06 | 13.27 | 1.05 | 344.68 |

Figure 33 shows the estimated emissions by scope and by activity. These estimates show that fugitive emissions from coal extraction would be the most significant direct (Scope 1) emissions.

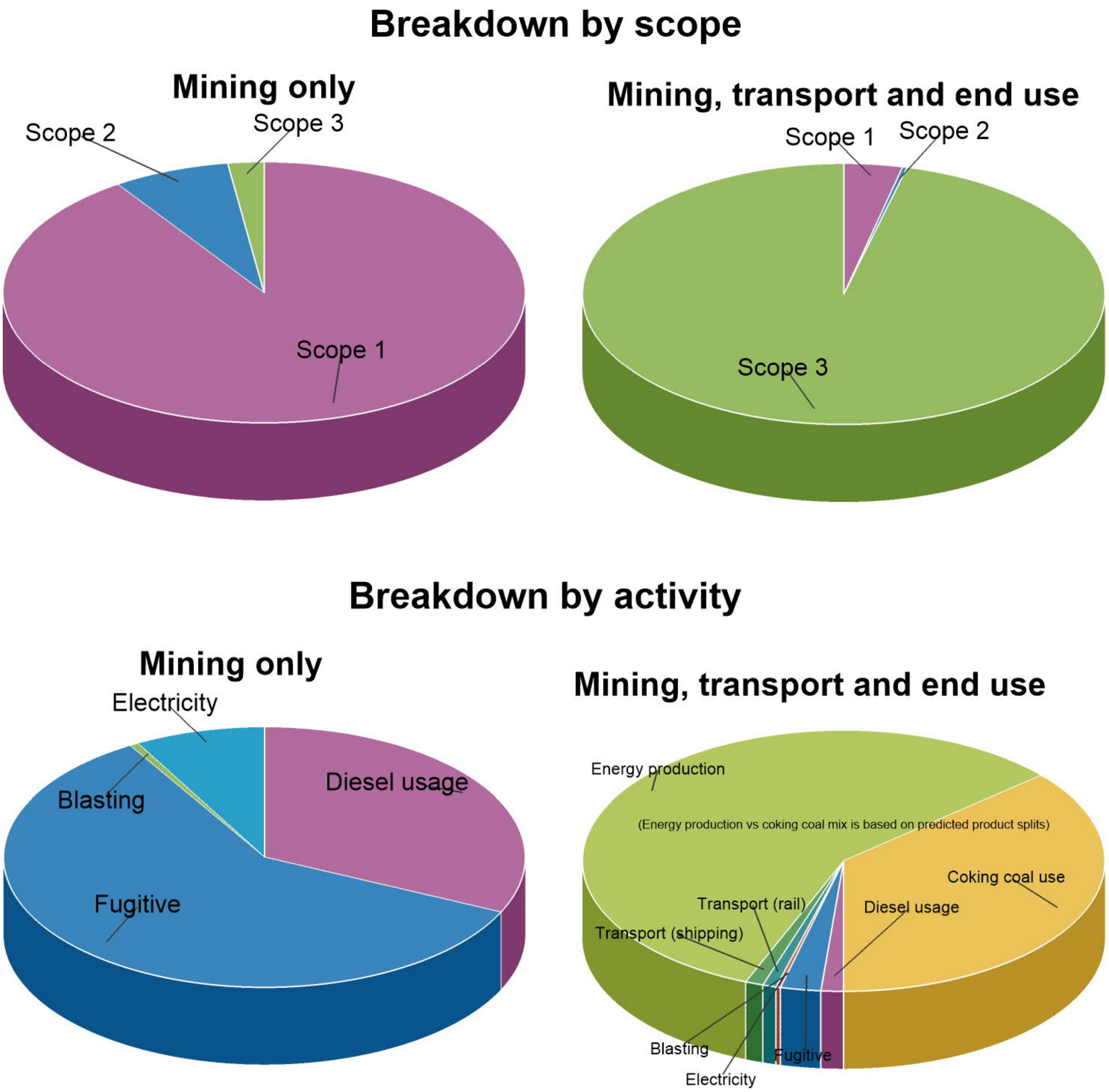



Figure 33 Summary of greenhouse gas emissions by scope and activity

Figure 34 provides a comparison between the estimated greenhouse gas emissions of the approved and modified operations. For this comparison the emissions from the approved operations were calculated using BCOPL's most recent approved ROM coal and product coal estimates, and pro-rated by the emission intensity of the modified operations. The comparison shows that maximum Scope 1, Scope 2 and Scope 3 emissions will be similar between the two scenarios (i.e. the maximum emission of the modified operations are within six per cent of the maximum emissions of the approved operations) however the emissions associated with the BCM including MOD 8 would occur for additional years.

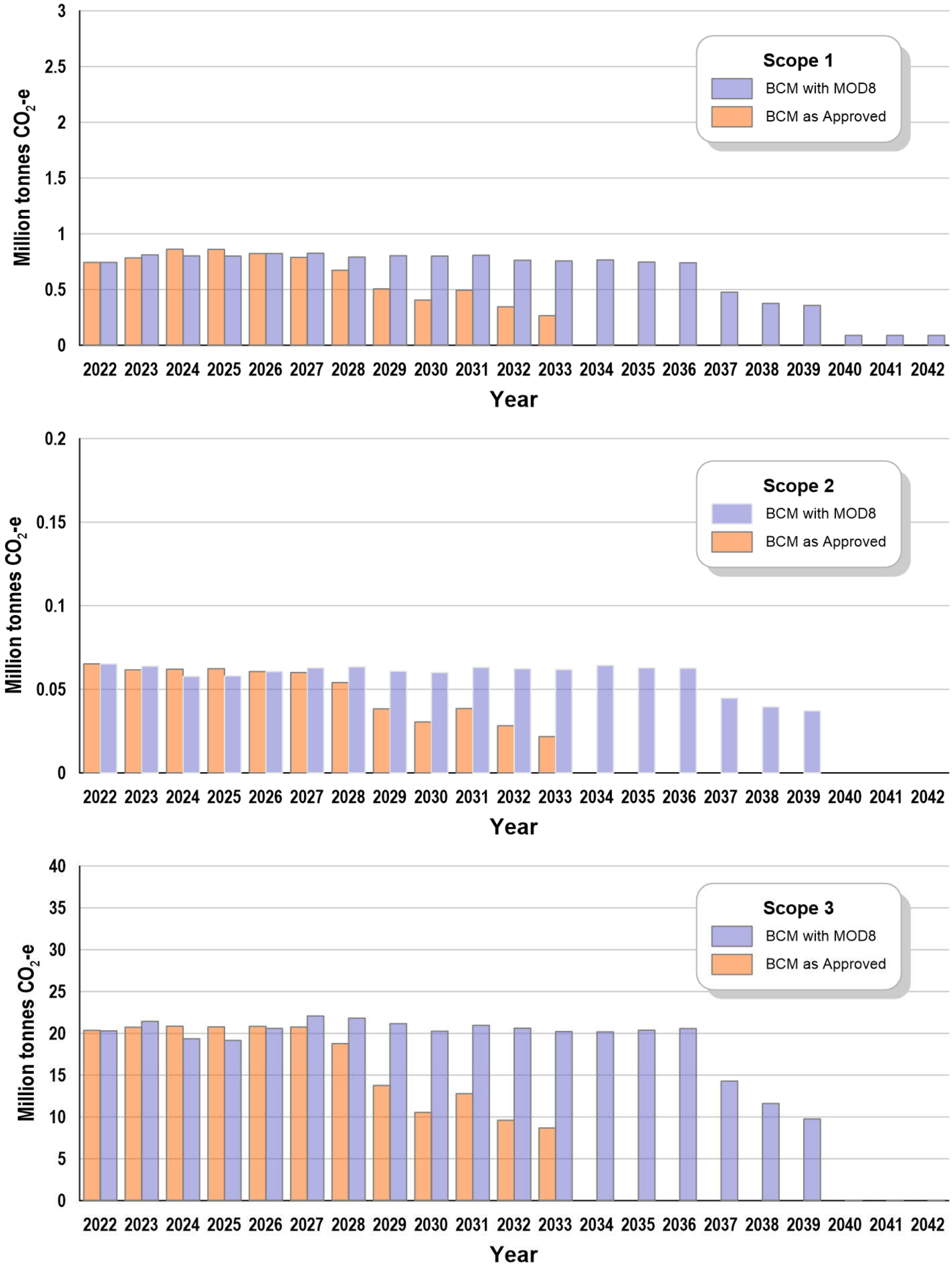



Figure 34 Comparison of greenhouse gas emissions for approved and modified developments

## 7.2 Impact and Context

The DEE provides a National Greenhouse Gas Inventory, where statistics on emissions per annum are stored, and detailed analysis of sources can be determined. To develop the context for this assessment, the impacts of the emissions projected in this assessment have been compared with the latest emissions officially recorded on the National Greenhouse Gas Inventory. The latest available data through the Inventory is from 2019 (DISER, 2021).

Table 22 presents these national and state figures in context with the projected emissions from the project. The estimated annual average Scope 1 and 2 emissions from the BCM (including the changes sought by MOD 8) (0.69 Mt $CO_2$-e) represent approximately 0.13% of Australia's 2019 emissions.

Table 22 GHG emissions in the State and National context

| Parameter | Value |
|---|---|
| National statistics | |
| Total reported Australia GHG emissions in 2019 (Mt $CO_2$-e) | 529.3 |
| Total reported NSW GHG emissions in 2019 (Mt $CO_2$-e) | 136.6 |
| Modification statistics | |
| Average projected GHG emissions per year (Mt $CO_2$-e) | 0.69 |
| Proportion of 2019 total Australia emissions | 0.13% |
| Proportion of 2019 total NSW emissions | 0.51% |

In addition to the direct emission sources associated with MOD 8, the following indirect emission sources are identified:

- Rail and sea transport of the product coal to customers.
- Combustion of the thermal coal by customers for energy production.
- Combustion of the semi-soft coking coal for steel making.

The indirect sources listed above have been classified as Scope 3 for MOD 8 as the emissions, while a result of the activities of the BCM, are from sources not owned or operated by BCOPL. As noted in Section 3.2 the purpose of differentiating between the scopes of emissions is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.

Coal produced by the BCM is predominantly exported to Japan, South Korea, Netherlands, and Malaysia. These countries are either signatories to the Paris Agreement and / or have announced or adopted domestic laws or policies to achieve their emissions targets. Consequently, the emissions associated with product coal combustion will be reported as Scope 1 emissions at the point of consumption and are therefore appropriate to be classified as Scope 3 for MOD 8.

# 8. Monitoring and Management

BCOPL operates the BCM in accordance with the approved Air Quality and Greenhouse Gas Management Plan (Idemitsu, 2018) and the Boggabri-Maules Creek-Tarrawonga (BTM) Air Quality Management Strategy (BTM, 2017). Table 23 outlines the existing dust management measures that are in place at the existing approved BCM, based on the operational details provided by BCOPL, and the assumed emission control factors that were applied for the modelling. These measures would continue to be adopted as part of MOD 8. In addition, BCOPL currently implements, and would continue to implement, a Trigger Action Response Plan (TARP). This plan identifies specific meteorological conditions that, upon measurement, require action for managing dust.

Table 23 Emission management measures

| Activity | Emission management measures | Assumed emission control (%) (NPI, 2012, Katestone, 2011) |
|---|---|---|
| Topsoil stripping | Watering | 50 |
| Hauling topsoil | Watering of unsealed haul routes / roads | 75 |
| Drilling | Water injection and / or curtains | 70 |
| Hauling overburden / coal | Watering of unsealed haul routes / roads | 85 |
| Handling coal at ROM pad / CHPP | Water sprays / enclosure | 70 |
| Dozers of coal stockpiles | Watering | 50 |
| Conveyors | Covered | 70 |
| Wind erosion from ROM stockpiles | Water sprays | 50 |
| Wind erosion from product stockpiles | Water sprays | 50 |

The modelling showed that the potential extent of impacts due to the BCM (including the changes sought by MOD 8) would be largely within the approved extent of impacts and that dust concentrations and deposition levels would not exceed relevant EPA assessment criteria at the nearest private sensitive receptors. Some potential minor increases in the BCM contribution to air quality have been predicted by modelling on Crown Land to the north of the Project Boundary. Therefore, no additional dust emission mitigation beyond that already undertaken by the BCM pursuant to their existing management plan, the TARP and BTM complex strategy would be warranted.

As noted in Section 4, the current BCM air quality monitoring network consists of three dust deposition gauges, three HVASs, four TEOMs and five meteorological stations. As the modelling showed that MOD 8 would not lead to exceedances of criteria at private sensitive receptors, the current monitoring regime is appropriate and no changes to the network are proposed.

Mitigation of GHG emissions is inherent in the development of the mine plan. For example, reducing fuel usage by mobile plant and equipment is an objective of mine planning and good practice. Hence, savings of GHG emissions are attributable to appropriate mine planning. The mitigation measures to reduce the level of future GHG emissions from BCM include:

- Planning and designing of operations to minimise fuel usage and to maximise energy efficiency.
- Regular maintenance of plant and equipment to minimise fuel consumption and associated emissions.
- Consideration of alternative fuels (e.g. hydrogen, liquified natural gas, biodiesel, solar systems) where economically and practically feasible.
- Continuing to select plant and equipment that are energy efficient.
- Training staff on continuous improvement strategies to minimise fuel usage and maximise energy efficiency.

BCOPL has established and is actively regenerating land as part of the BCM biodiversity offset strategy. BCOPL is also committed to, and has advanced, the establishment of woodland communities on its mine rehabilitation areas. These measures are aimed towards delivering a major proportion of a regional biodiversity corridor being established between the Pilliga State Forest to the west and the Nandewar Ranges to the east. While not quantified for this assessment, BCOPL's work on its biodiversity offset strategy and mine rehabilitation areas is effectively creating a carbon sink (i.e. increasing the quantity of carbon being absorbed from the atmosphere). Accordingly, the reported emissions for MOD 8 as presented in Section 7 are considered to be conservative estimates of the BCM's influence to the carbon climate.

In addition to the site specific mitigation measures listed above, Idemitsu recognises the importance of identifying and implementing sustainable energy efficiency programs designed to deliver sustainable resource management for all its operations. The Idemitsu corporate Energy Management Policy that promotes these values include the following strategies:

- Improving the management of energy and greenhouse gas emissions across Idemitsu operations.
- Complying with all relevant legislation, policies and energy efficiency improvement strategies and obligations.
- Seeking and implementing energy savings technology and practices where cost effective.
- Accelerating energy efficient technology uptake through involvement in relevant research initiatives, and ongoing research conducted through the Idemitsu Coal and Environment Research Laboratory. Idemitsu operates the only private research institute that specialises in fuel efficient coal in Japan.
- Integrating energy management strategies into business decision making.
- Communicating the Energy Management Policy and provide training opportunities for Idemitsu employees.

The mitigation measures, strategies and initiatives demonstrate that Idemitsu and BCOPL are actively engaged in minimising GHG emissions associated with their coal operations.

# 9. Conclusions

This report has provided an assessment of the potential air quality impacts of Boggabri Coal Mine Modification 8 including quantification of GHG emissions. In summary, the assessment has involved identifying the key air quality issues, characterising the existing environment, quantifying emissions to air and modelling to predict the impact of MOD 8 on local air quality. GHG emissions have also been estimated in accordance with recognised methodologies.

The key air quality issues were identified as mining dust, post-blast fume and diesel exhaust. These issues were the focus of the assessment.

A detailed review of the existing environment was carried out including an analysis of historically measured concentrations of key quality indicators from representative monitoring stations. This included analysis of six years of site specific monitoring data. The following conclusions were made in relation to the existing environment:

- Meteorological conditions in 2017 were representative of the long term, local conditions around the BCM.
- There was a deterioration in air quality conditions from 2017 to 2019, heavily influenced by drought, dust storms and bushfires. These conditions were not unique to the Northwest Slopes and Plains.
- BCMs operations have complied with the air quality criteria specified in SSD 09_0182 in all of the past six years.

The key outcomes of the modelling and subsequent assessment are:

- The potential extent of impacts due to the BCM (including the changes sought by MOD 8) would be largely within the approved extent of impacts.
- Dust concentrations and deposition levels due to mining are unlikely to exceed relevant EPA and VLAMP assessment criteria at the nearest private sensitive receptors. The only potential for BCM (including the changes sought by MOD 8) to cause an exceedance of EPA criteria (specifically 24-hour average $PM_{10}$) is when the background levels are already approaching the criteria. Under these conditions, the modelling indicated that the contribution from BCM would be very small (3 $\mu g/m^3$ at one property) and that this risk can be managed through appropriate air quality management measures.
- Post blast fume emissions are not expected to result in any adverse air quality impacts (as $NO_2$), based on modelling which showed compliance with air quality criteria.
- Emissions from diesel exhausts associated with off-road vehicles and equipment are not expected to result in any adverse air quality impacts.
- The estimated annual average Scope 1 and 2 emissions from BCM (including the changes sought by MOD 8) represent approximately 0.13% of Australia's 2019 emissions. Coal produced by the BCM is predominantly exported to countries which are either signatories to the Paris Agreement and / or have announced or adopted domestic laws or policies to achieve their emissions targets. Whilst emissions from the end use of the coal have been calculated as Scope 3 emissions for the purposes of the MOD 8 assessment, BCOPL's customers account for these same emissions as Scope 1 emissions and are required to comply with their respective countries' emissions targets.
- The mitigation measures, strategies and initiatives of Idemitsu and BCOPL show that the business is actively engaged in minimising existing and future GHG emissions associated with their coal operations.

Based on this assessment, it has been concluded that MOD 8 is unlikely to affect air quality beyond the range of historically measured fluctuations of key air quality indicators around Boggabri. This conclusion has been informed by modelling which showed that BCM (including the changes sought by MOD 8) would not result in changes to air quality that would cause exceedances of air quality criteria at the nearest private sensitive receptors. In addition, the conclusions do not change following the recent (February 2021) approval of a proposed modification to the adjacent Tarrawonga mine.

These outcomes are consistent with the desired performance outcome for MOD 8 which, for air quality, is to minimise air quality impacts to reduce risks to human health and the environment to the greatest extent practicable through the design and operation of the BCM.

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# Appendix A. Annual and seasonal wind-roses

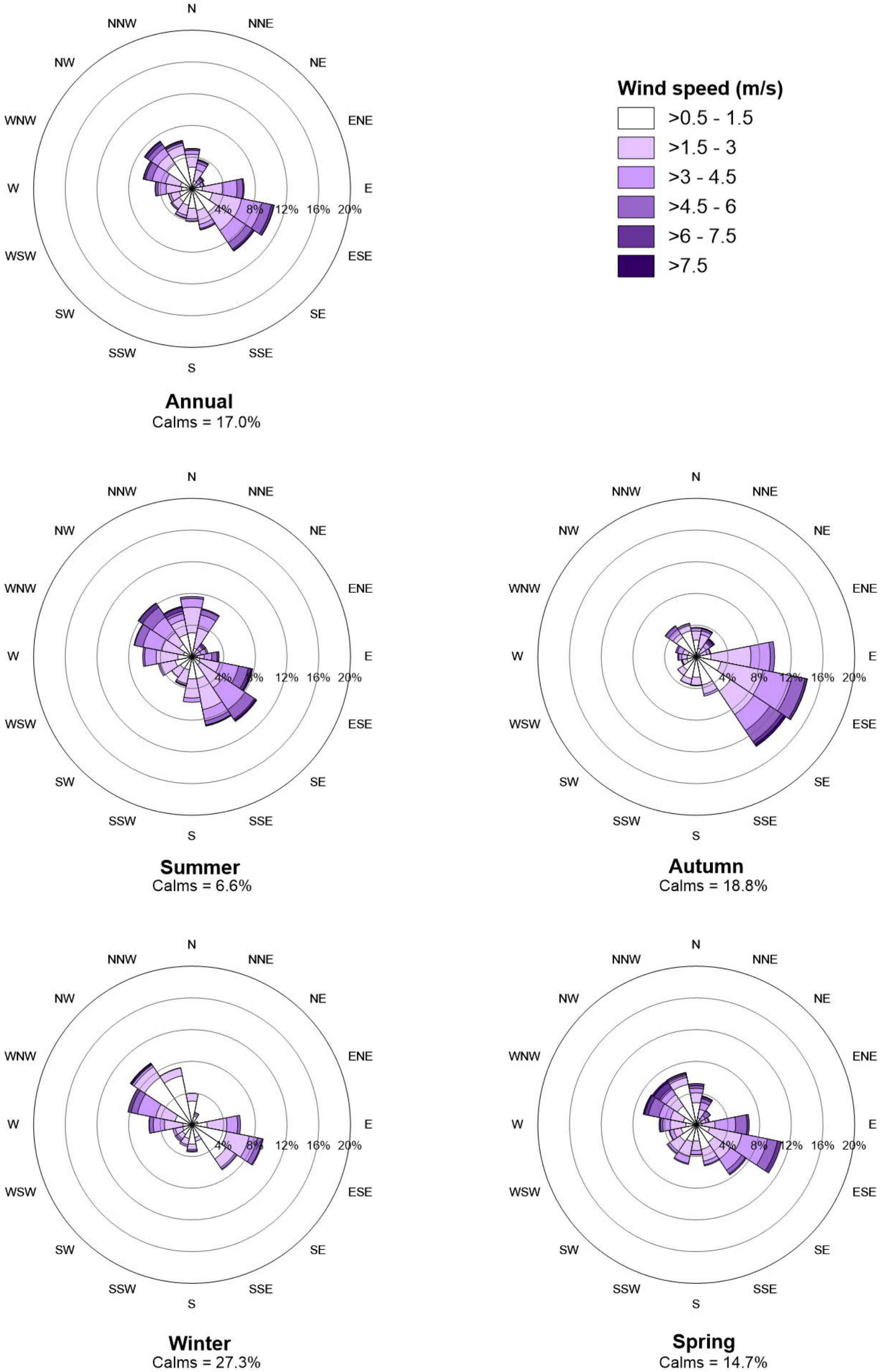


Figure A1 Annual and seasonal wind-roses for data collected at the BCM meteorological station (W1) in 2017

# Appendix B. Air quality data analysis

Figure B1 shows the measured $PM_{10}$ concentrations by time of year based on all available data from each monitoring site. The highest concentrations are generally in the warmer months, from October to January.

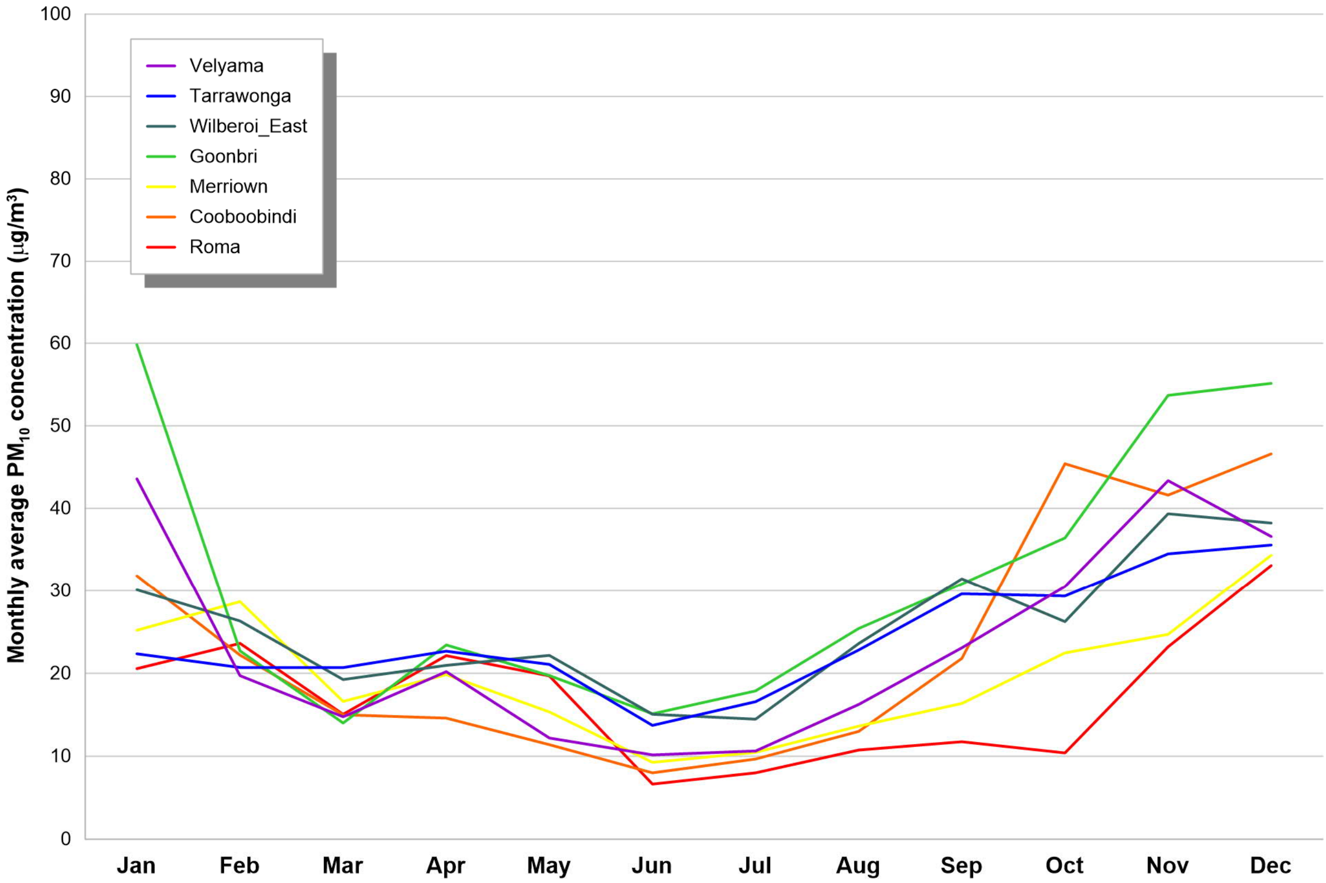


Figure B1 Measured $PM_{10}$ concentrations by time of year

# Appendix C. Model settings and setup

Geophysical

Figure C1 shows the model grid, land-use and terrain information, as used by CALMET. It is noted that the extent of some land-uses will change over time, such as mining areas, however the model sensitivity has been tested and changes from grassland to barren land (i.e. mining areas) were found to have very little influence on the dispersion modelling results.

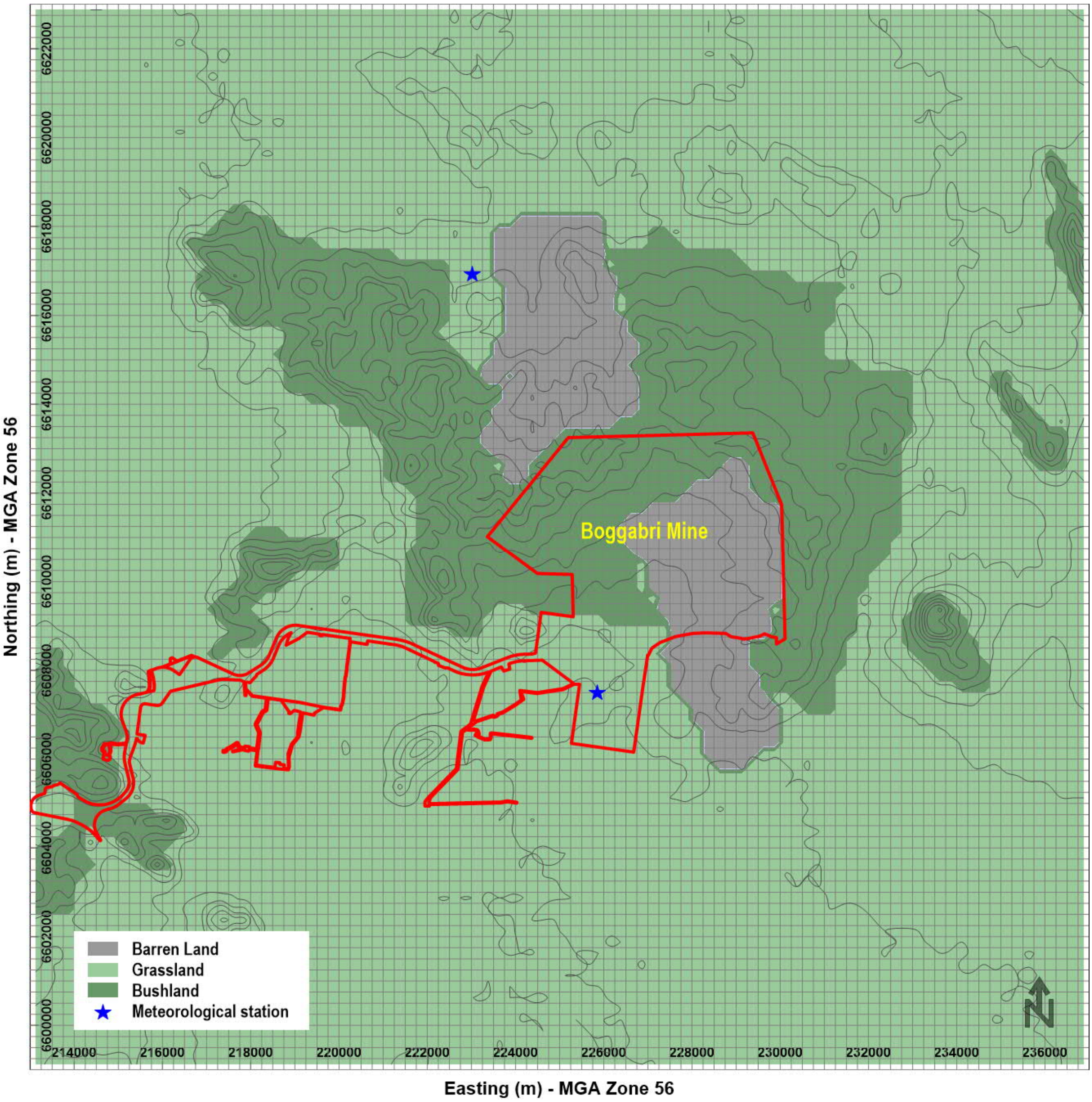


Figure C1 Model domain, grid, land use and terrain information

Figure C2 shows a snapshot of winds at 10 metres above ground-level as simulated by the CALMET model under stable conditions. This plot shows the effect of the topography on local winds, for this particular hour, and highlights the non-uniform wind patterns in the area, further supporting the use of a non-steady-state model such as CALPUFF.

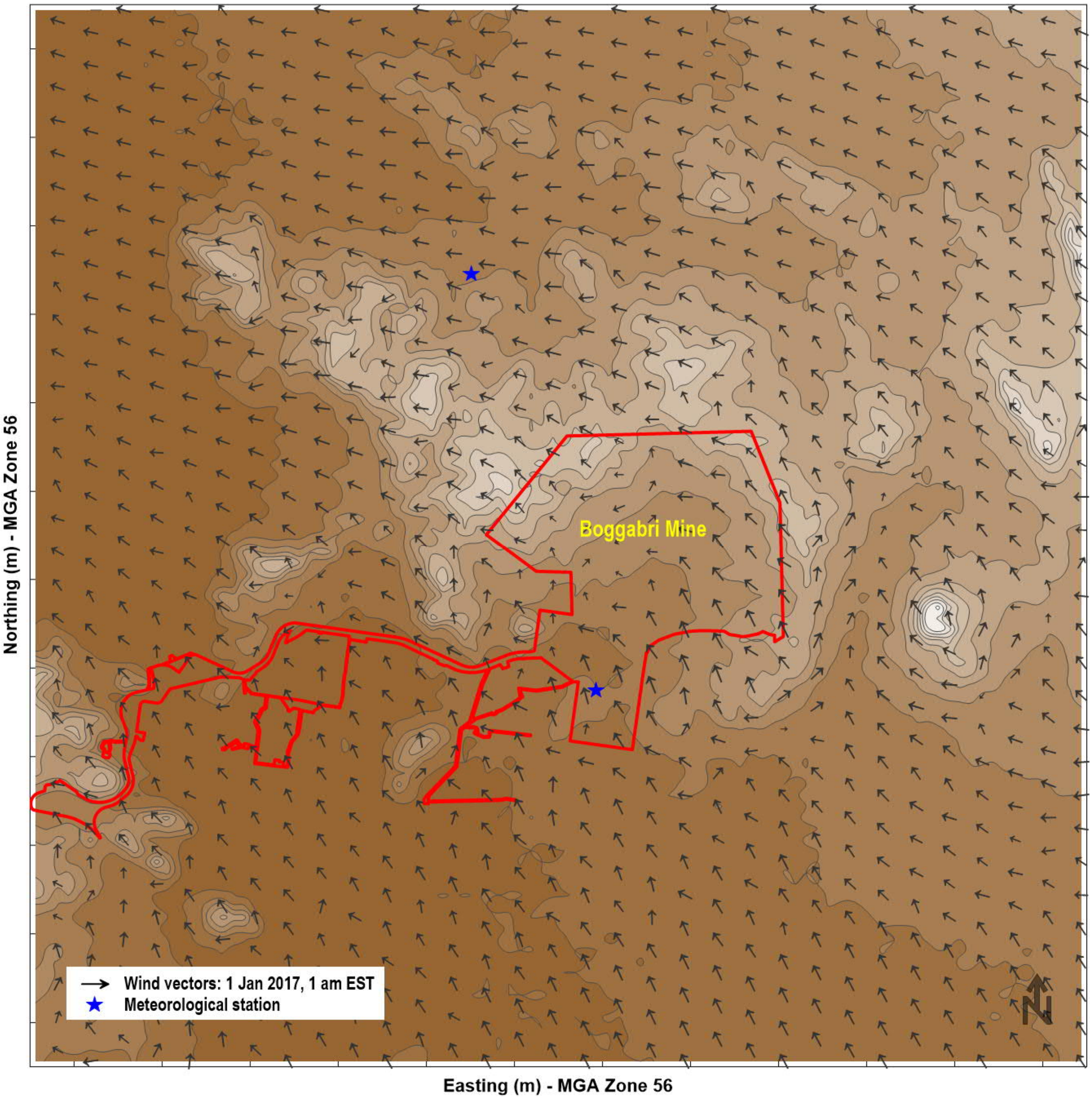


Figure C2 Example of CALMET simulated ground-level wind flows

## Meteorology

The CALPUFF model, through the CALMET meteorological pre-processor, simulates complex meteorological patterns that exist in a particular region. The necessary upper air data for CALMET were generated by the CSIRO's prognostic model, TAPM, and the required surface observation data were sourced from local weather stations. CALMET was used to produce a year-long, three-dimensional output of meteorological conditions for input to the CALPUFF air dispersion model. The meteorological modelling followed the guidance of TRC (2011) and adopted the "observations" mode.

Table C1 Model settings and inputs for TAPM

| Parameter | Value(s) |
|---|---|
| Model version | 4.0.5 |
| Number of grids (spacing) | 4 (30 km, 10 km, 3 km, 1 km) |
| Number of grids point | 35 x 35 x 25 |
| Year(s) of analysis | 2017 |
| Centre of analysis | 30º36' S, 150º10' E |
| Terrain data source | 30 m Shuttle Research Topography Mission (SRTM) |
| Land use data source | Default |
| Meteorological data assimilation | BCM meteorological station. Radius of influence = 15 km. Number of vertical levels for assimilation = 4 |

Table C2 Model settings and inputs for CALMET

| Parameter | Value(s) |
|---|---|
| Model version | 6.334 |
| Terrain data source(s) | 30 m SRTM and Project DEM. Higher resolution topographical data were not necessary in order to develop wind fields that reflect the influence of terrain and effects that are important for dispersion of emissions from the project to the sensitive receptor areas. |
| Land use data source(s) | Digitised from aerial imagery |
| Meteorological grid domain | 24 km x 24 km |
| Meteorological grid resolution | 0.25 km |
| Meteorological grid dimensions | 96 x 96 x 9 grid points |
| Meteorological grid origin | 213000 mE, 6599000 mN. MGA Zone 56 |
| Surface meteorological stations | W1: wind speed, wind direction<br>Maules Creek mine: wind speed, wind direction<br>TAPM (at location of W1): temperature, humidity, ceiling height, cloud cover and air pressure |
| Upper air meteorological stations | Upper air data file for the location of the W1 meteorological station, derived by TAPM. Biased towards surface observations (-1, -0.8, -0.6, -0.4, -0.2, 0, 0, 0, 0) |
| Simulation length | 8760 hours (1 Jan 2017 to 31 Dec 2017) |
| R1, R2 | 0.5, 1 |
| RMAX1, RMAX2 | 5, 20 |
| TERRAD | 5 |

Table C3 Model settings and inputs for CALPUFF

| Parameter | Value(s) |
|---|---|
| Model version | 6.42 |
| Computational grid domain | 96 x 96 |
| Chemical transformation | None |
| Dry deposition | Yes |
| Wind speed profile | ISC rural |
| Puff element | Puff |
| Dispersion option | Turbulence from micrometeorology |
| Time step | 3600 seconds (1 hour) |
| Terrain adjustment | Partial plume path |

| Parameter | Value(s) |
|---|---|
| Number of volume sources | See below. Height = 5 m, SY = 20 m, SZ = 10 m. |
| Number of discrete receptors | 676. See below. |

Sources

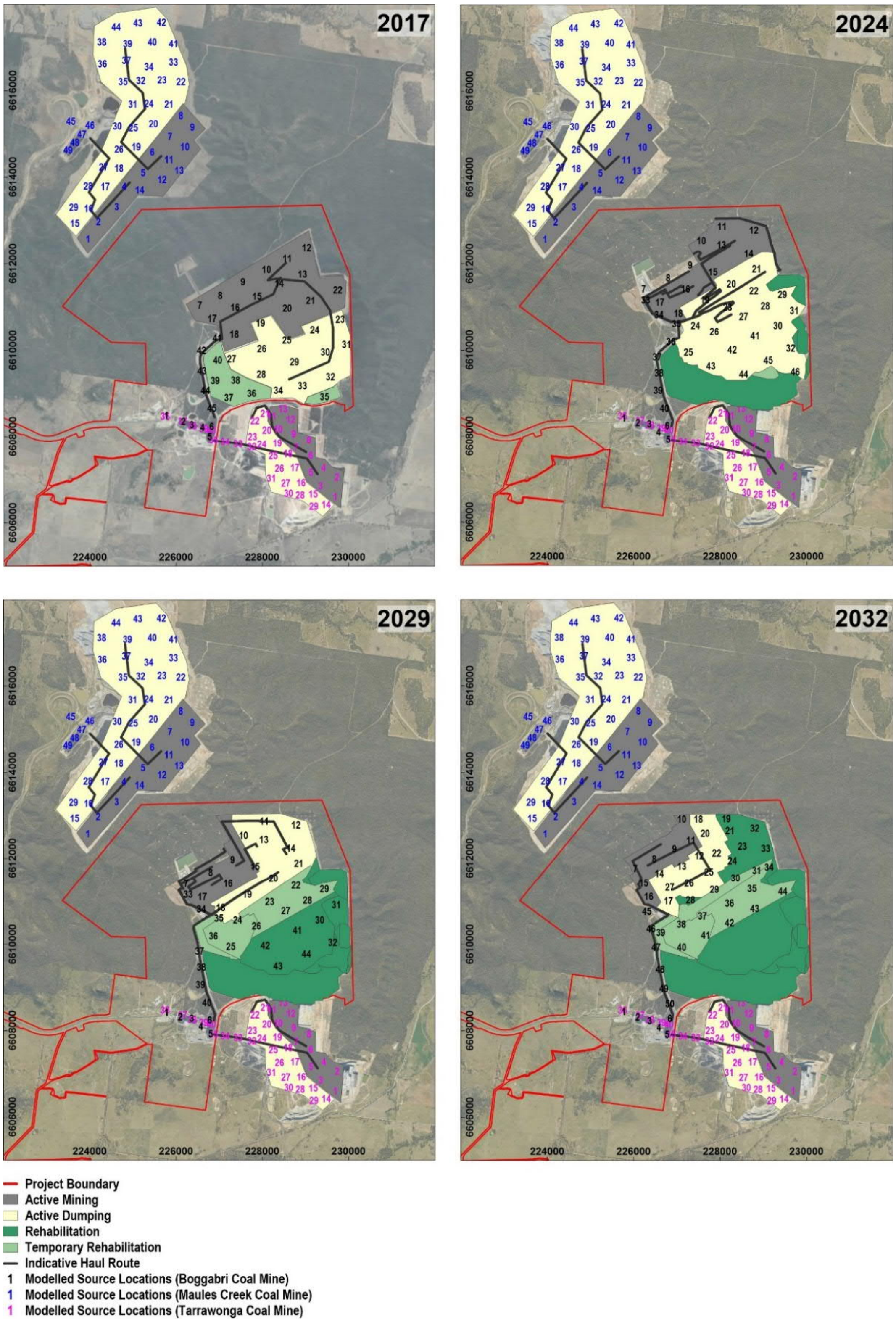


Figure C3 Modelled source locations

Receptors

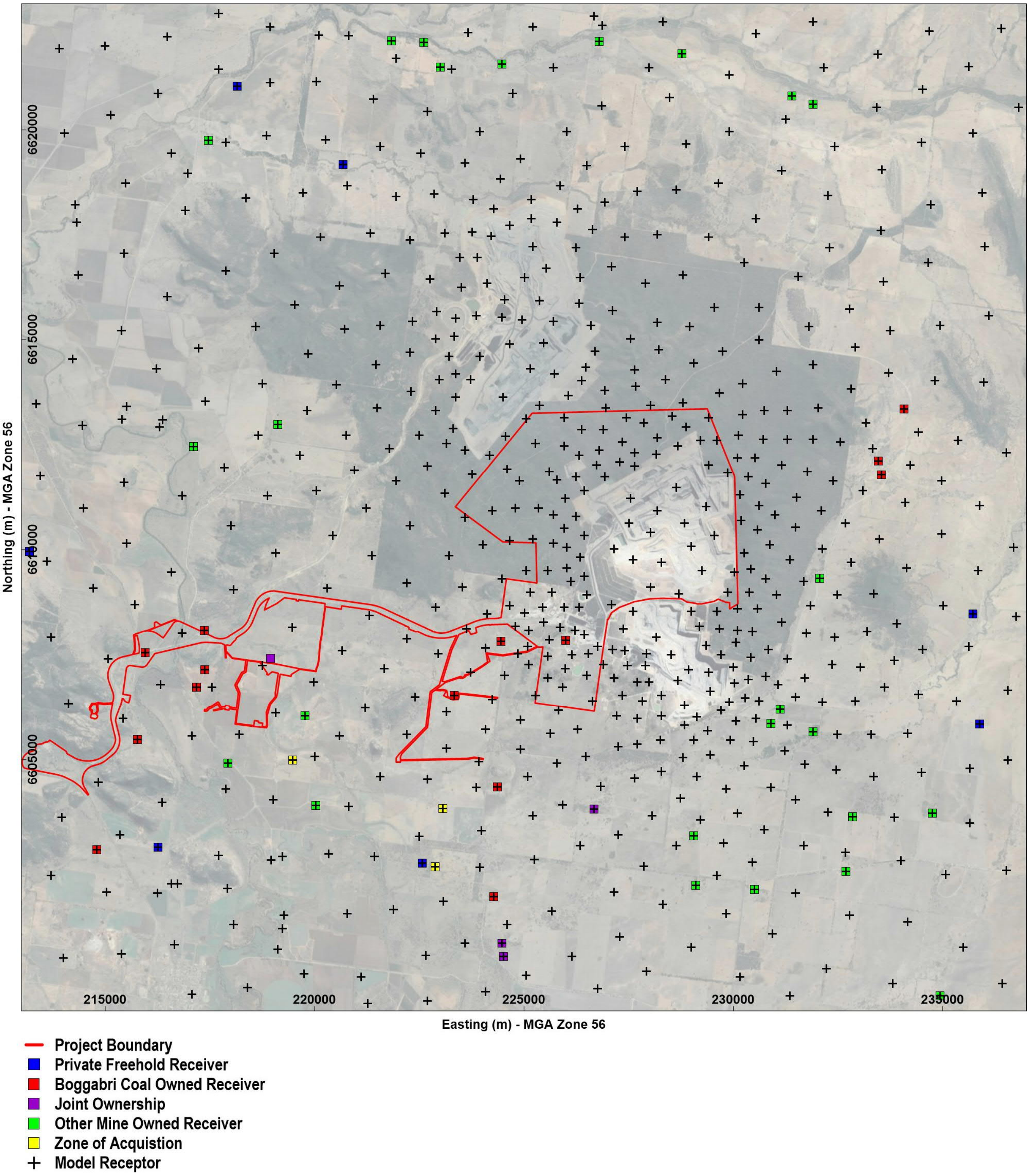


Figure C4 Model receptor locations

# Appendix D. Emission calculations

## Emission factors

| Activity | Emission factor | | | Units | Source |
|---|---|---|---|---|---|
| | TSP | $PM_{10}$ | $PM_{2.5}$ | | |
| Stripping topsoil | $E_{TSP} = 0.029$ | $E_{PM10} = 0.0073 \times E_{TSP}$ | $E_{PM2.5} = 0.05 \times E_{TSP}$ | kg/t | US EPA / NPI |
| Drilling | $E_{TSP} = 0.59$ | $E_{PM10} = 0.52 \times E_{TSP}$ | $E_{PM2.5} = 0.03 \times E_{TSP}$ | kg/hole | US EPA / NPI |
| Blasting | $E_{TSP} = 0.00022 \times A^{1.5}$ | $E_{PM10} = 0.52 \times E_{TSP}$ | $E_{PM2.5} = 0.03 \times E_{TSP}$ | kg/blast | US EPA / NPI |
| Loading material / dumping overburden | $E_{TSP} = 0.74 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | $E_{PM10} = 0.35 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | $E_{PM2.5} = 0.053 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | kg/t | US EPA / NPI |
| Hauling on unsealed roads | $E_{TSP} = 4$ | $E_{PM10} = 0.3 \times E_{TSP}$ | $E_{PM2.5} = 0.03 \times E_{TSP}$ | kg/VKT | SPCC |
| Dozers shaping overburden | $E_{TSP} = 2.6 \times (S^{1.2}/M^{1.3})$ | $E_{PM10} = 0.3375 \times (S^{1.5}/M^{1.4})$ | $E_{PM2.5} = 0.105 \times E_{TSP}$ | kg/hour | US EPA / NPI |
| Dozers working on coal | $E_{TSP} = 35.6 \times (S^{1.2}/M^{1.3})$ | $E_{PM10} = 6.33 \times (S^{1.5}/M^{1.4})$ | $E_{PM2.5} = 0.022 \times E_{TSP}$ | kg/hour | US EPA / NPI |
| Loading coal | $E_{TSP} = 0.58 / M^{1.2}$ | $E_{PM10} = 0.0447 / M^{0.9}$ | $E_{PM2.5} = 0.019 \times E_{TSP}$ | kg/t | US EPA / NPI |
| Unloading coal | $E_{TSP} = 0.01$ | $E_{PM10} = 0.0042$ | $E_{PM2.5} = 0.019 \times E_{TSP}$ | kg/t | NPI |
| Miscellaneous transfer | $E_{TSP} = 0.74 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | $E_{PM10} = 0.35 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | $E_{PM2.5} = 0.053 \times 0.0016 \times ((U/2.2)^{1.3}/(M/2)^{1.4})$ | kg/t | US EPA / NPI |
| Loading product coal to trains | $E_{TSP} = 0.0004$ | $E_{PM10} = 0.00017$ | $E_{PM2.5} = 0.05 \times E_{TSP}$ | kg/t | NPI |
| Wind erosion from exposed areas | $E_{TSP} = 0.1$ | $E_{PM10} = 0.5 \times E_{TSP}$ | $E_{PM2.5} = 0.075 \times E_{TSP}$ | kg/ha/h | US EPA |
| Grading roads | $E_{TSP} = 0.0034 \times s^{2.5}$ | $E_{PM10} = 0.00336 \times s^{2}$ | $E_{PM2.5} = 0.0001054 \times s^{2.5}$ | kg/VKT | US EPA / NPI |

A = blast area ($m^2$)
U = wind speed (m/s)
M = moisture content (%)
S = silt content (%)
s = speed (km/h)

**Emission inventory**
**2024**

| Emission calculations | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boggabri 2024 | | | | | | | | | | | | | | | | | | | | |
| | Annual emissions (kg/y) | | | | | | TSP | | PM10 | | PM2.5 | | Variables | | | | | | | |
| Activity | TSP | PM10 | PM2.5 | Control (%) | Intensity | Units | Factor | Units | Factor | Units | Factor | Units | Area (m2) | (ws/2.2)^1.3 | Moisture (%) | kg/VKT | t/truck | km/trip | Silt (%) | Speed (km/h) |
| Topsoil - stripping | 4635 | 1167 | 232 | 50 | 319667 | t/y | 0.029 | kg/t | 0.0073 | kg/t | 0.001 | kg/t | - | - | - | - | - | - | - | - |
| Topsoil - loading to trucks | 370 | 175 | 26 | 0 | 319667 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Topsoil - hauling to stockpiles | 3322 | 982 | 100 | 75 | 319667 | t/y | 0.04157 | kg/t | 0.01228 | kg/t | 0.001 | kg/t | - | - | - | 4 | 140 | 1.5 | - | - |
| Topsoil - unloading | 370 | 175 | 26 | 0 | 319667 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Drilling overburden | 11759 | 6115 | 353 | 70 | 66436 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting overburden | 86253 | 44851 | 2588 | 0 | 104 | blasts/y | 829.4 | kg/blast | 431.3 | kg/blast | 24.9 | kg/blast | 24222 | - | - | - | - | - | - | - |
| Excavators loading overburden to trucks | 199865 | 94531 | 14315 | 0 | 172696121 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Hauling overburden from pit to dump | 3685335 | 1089047 | 110560 | 85 | 172696121 | t/y | 0.14227 | kg/t | 0.04204 | kg/t | 0.004 | kg/t | - | - | - | 4 | 300 | 11 | - | - |
| Unloading overburden to dump | 200798 | 94972 | 14382 | 0 | 173502333 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Dozers shaping overburden | 636930 | 155058 | 66878 | 0 | 38059 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Dozers working on overburden for rehabilitation | 122754 | 29884 | 12889 | 0 | 7335 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Drilling coal | 0 | 0 | 0 | 70 | 0 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting coal | 0 | 0 | 0 | 0 | 0 | blasts/y | 829.4 | kg/blast | 431.3 | kg/blast | 24.9 | kg/blast | 24222 | - | - | - | - | - | - | - |
| Dozers working on coal | 449490 | 143286 | 9889 | 0 | 30701 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Loading ROM coal to trucks | 292764 | 45019 | 5563 | 0 | 8000000 | t/y | 0.03660 | kg/t | 0.00563 | kg/t | 0.001 | kg/t | - | - | 10 | - | - | - | - | - |
| Hauling ROM coal from pit to hopper / ROM pad | 221475 | 65448 | 6644 | 85 | 8000000 | t/y | 0.18456 | kg/t | 0.05454 | kg/t | 0.006 | kg/t | - | - | - | 4 | 185 | 8.8 | - | - |
| Unloading ROM coal to ROM hopper / pad | 24000 | 10080 | 456 | 70 | 8000000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| ROM coal rehandle to hopper | 24000 | 10080 | 456 | 0 | 2400000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| Transferring ROM coal by conveyor to CHPP | 292 | 138 | 21 | 70 | 8000000 | t/y | 0.00012 | kg/t | 0.00006 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Handling coal at CHPP | 1459 | 690 | 21 | 70 | 8000000 | t/y | 0.00061 | kg/t | 0.00029 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Dozers on ROM coal stockpiles | 39494 | 12590 | 869 | 50 | 5395 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Dozers on product coal stockpiles | 1288 | 371 | 28 | 50 | 340 | h/y | 7.6 | kg/h | 2.2 | kg/h | 0.167 | kg/h | - | - | 12 | - | - | - | 5 | - |
| Conveyer to product stockpiles | 207 | 98 | 15 | 70 | 7334997 | t/y | 0.00009 | kg/t | 0.00004 | kg/t | 0.0000 | kg/t | - | 0.98 | 12 | - | - | - | - | - |
| Loading product coal to trains | 2934 | 1247 | 147 | 0 | 7334997 | t/y | 0.00040 | kg/t | 0.00017 | kg/t | 0.0000 | kg/t | - | - | - | - | - | - | - | - |
| Wind erosion from active pits | 235239 | 117619 | 17643 | 0 | 269 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from active dumps | 525004 | 262502 | 39375 | 0 | 599 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from inactive or partially rehabed dumps | 6665 | 3333 | 500 | 30 | 11 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from ROM coal stockpiles | 2190 | 1095 | 164 | 50 | 5 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from product coal stockpile | 1752 | 876 | 131 | 50 | 4 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Grading roads | 18464 | 6528 | 202 | 50 | 60000 | km/y | 0.61547 | kg/VKT | 0.2176 | kg/VKT | 0.007 | kg/VKT | - | - | - | - | - | - | - | 8 |
| | | | | | | | | | | | | | | | | | | | | |
| | 6799109 | 2197956 | 304472 | | | | | | | | | | | | | | | | | |

Notes: production data supplied by BCOPL

**Emission inventory**
**2029**

| **Emission calculations** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boggabri 2029** | | | | | | | | | | | | | | | | | | | | |
| | Annual emissions (kg/y) | | | | | | TSP | | PM10 | | PM2.5 | | Variables | | | | | | | |
| Activity | TSP | PM10 | PM2.5 | Control (%) | Intensity | Units | Factor | Units | Factor | Units | Factor | Units | Area (m2) | (ws/2.2)^1.3 | Moisture (%) | kg/VKT | t/truck | km/trip | Silt (%) | Speed (km/h) |
| Topsoil - stripping | 5421 | 1365 | 271 | 50 | 373861 | t/y | 0.029 | kg/t | 0.0073 | kg/t | 0.001 | kg/t | - | - | - | - | - | - | - | - |
| Topsoil - loading to trucks | 433 | 205 | 31 | 0 | 373861 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Topsoil - hauling to stockpiles | 3885 | 1148 | 117 | 75 | 373861 | t/y | 0.04157 | kg/t | 0.01228 | kg/t | 0.001 | kg/t | - | - | - | 4 | 140 | 1.5 | - | - |
| Topsoil - unloading | 433 | 205 | 31 | 0 | 373861 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Drilling overburden | 13050 | 6786 | 391 | 70 | 73727 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting overburden | 98781 | 51366 | 2963 | 0 | 104 | blasts/y | 949.8 | kg/blast | 493.9 | kg/blast | 28.5 | kg/blast | 26514 | - | - | - | - | - | - | - |
| Excavators loading overburden to trucks | 194767 | 92119 | 13949 | 0 | 168290443 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Hauling overburden from pit to dump | 2807758 | 829716 | 84233 | 85 | 168290443 | t/y | 0.11123 | kg/t | 0.03287 | kg/t | 0.003 | kg/t | - | - | - | 4 | 300 | 8.6 | - | - |
| Unloading overburden to dump | 195637 | 92531 | 14012 | 0 | 169042562 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Dozers shaping overburden | 666384 | 162229 | 69970 | 0 | 39819 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Dozers working on overburden for rehabilitation | 135054 | 32878 | 14181 | 0 | 8070 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Drilling coal | 0 | 0 | 0 | 70 | 0 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting coal | 0 | 0 | 0 | 0 | 0 | blasts/y | 949.8 | kg/blast | 493.9 | kg/blast | 28.5 | kg/blast | 26514 | - | - | - | - | - | - | - |
| Dozers working on coal | 470280 | 149913 | 10346 | 0 | 32121 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Loading ROM coal to trucks | 314722 | 48396 | 5980 | 0 | 8600000 | t/y | 0.03660 | kg/t | 0.00563 | kg/t | 0.001 | kg/t | - | - | 10 | - | - | - | - | - |
| Hauling ROM coal from pit to hopper / ROM pad | 313840 | 92742 | 9415 | 85 | 8600000 | t/y | 0.24329 | kg/t | 0.07189 | kg/t | 0.007 | kg/t | - | - | - | 4 | 185 | 11.6 | - | - |
| Unloading ROM coal to ROM hopper / pad | 25800 | 10836 | 490 | 70 | 8600000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| ROM coal rehandle to hopper | 25800 | 10836 | 490 | 0 | 2580000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| Transferring ROM coal by conveyor to CHPP | 314 | 148 | 22 | 70 | 8600000 | t/y | 0.00012 | kg/t | 0.00006 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Handling coal at CHPP | 1569 | 742 | 22 | 70 | 8600000 | t/y | 0.00061 | kg/t | 0.00029 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Dozers on ROM coal stockpiles | 41324 | 13173 | 909 | 50 | 5645 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Dozers on product coal stockpiles | 36748 | 10590 | 808 | 50 | 9703 | h/y | 7.6 | kg/h | 2.2 | kg/h | 0.167 | kg/h | - | - | 12 | - | - | - | 5 | - |
| Conveyor to product stockpiles | 228 | 108 | 16 | 70 | 8069765 | t/y | 0.00009 | kg/t | 0.00004 | kg/t | 0.0000 | kg/t | - | 0.98 | 12 | - | - | - | - | - |
| Loading product coal to trains | 3228 | 1372 | 161 | 0 | 8069765 | t/y | 0.00040 | kg/t | 0.00017 | kg/t | 0.0000 | kg/t | - | - | - | - | - | - | - | - |
| Wind erosion from active pits | 143636 | 71818 | 10773 | 0 | 164 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from active dumps | 262016 | 131008 | 19651 | 0 | 299 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from inactive or partially rehabed dumps | 146593 | 73297 | 10994 | 30 | 239 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from ROM coal stockpiles | 2190 | 1095 | 164 | 50 | 5 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from product coal stockpile | 1752 | 876 | 131 | 50 | 4 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Grading roads | 18464 | 6528 | 202 | 50 | 60000 | km/y | 0.61547 | kg/VKT | 0.2176 | kg/VKT | 0.007 | kg/VKT | - | - | - | - | - | - | - | 8 |
| | | | | | | | | | | | | | | | | | | | | |
| | 5930105 | 1894024 | 270728 | | | | | | | | | | | | | | | | | |

Notes: production data supplied by BCOPL

**Emission inventory**
**2032**

| **Emission calculations** | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boggabri 2032** | | | | | | | | | | | | | | | | | | | | |
| | Annual emissions (kg/y) | | | | | | TSP | | PM10 | | PM2.5 | | Variables | | | | | | | |
| Activity | TSP | PM10 | PM2.5 | Control (%) | Intensity | Units | Factor | Units | Factor | Units | Factor | Units | Area (m2) | (ws/2.2)^1.3 | Moisture (%) | kg/VKT | t/truck | km/trip | Silt (%) | Speed (km/h) |
| Topsoil - stripping | 6244 | 1572 | 312 | 50 | 430596 | t/y | 0.029 | kg/t | 0.0073 | kg/t | 0.001 | kg/t | - | - | - | - | - | - | - | - |
| Topsoil - loading to trucks | 498 | 236 | 36 | 0 | 430596 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Topsoil - hauling to stockpiles | 4475 | 1322 | 134 | 75 | 430596 | t/y | 0.04157 | kg/t | 0.01228 | kg/t | 0.001 | kg/t | - | - | - | 4 | 140 | 1.5 | - | - |
| Topsoil - unloading | 498 | 236 | 36 | 0 | 430596 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Drilling overburden | 13320 | 6926 | 400 | 70 | 75255 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting overburden | 100820 | 52427 | 3025 | 0 | 104 | blasts/y | 969.4 | kg/blast | 504.1 | kg/blast | 29.1 | kg/blast | 26878 | - | - | - | - | - | - | - |
| Excavators loading overburden to trucks | 208562 | 98644 | 14938 | 0 | 180210164 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Hauling overburden from pit to dump | 2027725 | 599209 | 60832 | 85 | 180210164 | t/y | 0.07501 | kg/t | 0.02217 | kg/t | 0.002 | kg/t | - | - | - | 4 | 300 | 5.8 | - | - |
| Unloading overburden to dump | 209505 | 99090 | 15005 | 0 | 181025552 | t/y | 0.00116 | kg/t | 0.00055 | kg/t | 0.0001 | kg/t | - | 0.98 | 2 | - | - | - | - | - |
| Dozers shaping overburden | 630688 | 153538 | 66222 | 0 | 37686 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Dozers working on overburden for rehabilitation | 132996 | 32377 | 13965 | 0 | 7947 | h/y | 16.7 | kg/h | 4.07415 | kg/h | 1.757 | kg/h | - | - | 2 | - | - | - | 10 | - |
| Drilling coal | 0 | 0 | 0 | 70 | 0 | holes/y | 0.59 | kg/hole | 0.31 | kg/hole | 0.018 | kg/hole | - | - | - | - | - | - | - | - |
| Blasting coal | 0 | 0 | 0 | 0 | 0 | blasts/y | 969.4 | kg/blast | 504.1 | kg/blast | 29.1 | kg/blast | 26878 | - | - | - | - | - | - | - |
| Dozers working on coal | 445098 | 141886 | 9792 | 0 | 30401 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Loading ROM coal to trucks | 314722 | 48396 | 5980 | 0 | 8600000 | t/y | 0.03660 | kg/t | 0.00563 | kg/t | 0.001 | kg/t | - | - | 10 | - | - | - | - | - |
| Hauling ROM coal from pit to hopper / ROM pad | 286784 | 84747 | 8604 | 85 | 8600000 | t/y | 0.22231 | kg/t | 0.0657 | kg/t | 0.007 | kg/t | - | - | - | 4 | 185 | 10.6 | - | - |
| Unloading ROM coal to ROM hopper / pad | 25800 | 10836 | 490 | 70 | 8600000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| ROM coal rehandle to hopper | 25800 | 10836 | 490 | 0 | 2580000 | t/y | 0.01 | kg/t | 0.0042 | kg/t | 0.000 | kg/t | - | - | - | - | - | - | - | - |
| Transferring ROM coal by conveyor to CHPP | 314 | 148 | 22 | 70 | 8600000 | t/y | 0.00012 | kg/t | 0.00006 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Handling coal at CHPP | 1569 | 742 | 22 | 70 | 8600000 | t/y | 0.00061 | kg/t | 0.00029 | kg/t | 0.0000 | kg/t | - | 0.98 | 10 | - | - | - | - | - |
| Dozers on ROM coal stockpiles | 39106 | 12466 | 860 | 50 | 5342 | h/y | 14.6 | kg/h | 4.7 | kg/h | 0.322 | kg/h | - | - | 10 | - | - | - | 7 | - |
| Dozers on product coal stockpiles | 78022 | 22483 | 1716 | 50 | 20601 | h/y | 7.6 | kg/h | 2.2 | kg/h | 0.167 | kg/h | - | - | 12 | - | - | - | 5 | - |
| Conveyer to product stockpiles | 225 | 106 | 16 | 70 | 7947098 | t/y | 0.00009 | kg/t | 0.00004 | kg/t | 0.0000 | kg/t | - | 0.98 | 12 | - | - | - | - | - |
| Loading product coal to trains | 3179 | 1351 | 159 | 0 | 7947098 | t/y | 0.00040 | kg/t | 0.00017 | kg/t | 0.0000 | kg/t | - | - | - | - | - | - | - | - |
| Wind erosion from active pits | 130662 | 65331 | 9800 | 0 | 149 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from active dumps | 187416 | 93708 | 14056 | 0 | 214 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from inactive or partially rehabed dumps | 180269 | 90134 | 13520 | 30 | 294 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from ROM coal stockpiles | 2190 | 1095 | 164 | 50 | 5 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Wind erosion from product coal stockpile | 1752 | 876 | 131 | 50 | 4 | ha | 876.0 | kg/ha/y | 438.0 | kg/ha/y | 65.7 | kg/ha/y | - | - | - | - | - | - | - | - |
| Grading roads | 18464 | 6528 | 202 | 50 | 60000 | km/y | 0.61547 | kg/VKT | 0.2176 | kg/VKT | 0.007 | kg/VKT | - | - | - | - | - | - | - | 8 |
| | | | | | | | | | | | | | | | | | | | | |
| | 5076701 | 1637248 | 240930 | | | | | | | | | | | | | | | | | |

Notes: production data supplied by BCOPL

# Source allocations 2024

```
 --------------------------------      01-Dec-2020 16:36
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil - stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 4635 kg/y TSP  1167 kg/y PM10  232 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - loading to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 370 kg/y TSP  175 kg/y PM10  26 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - hauling to stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3322 kg/y TSP  982 kg/y PM10  100 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - unloading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 370 kg/y TSP  175 kg/y PM10  26 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 11759 kg/y TSP  6115 kg/y PM10  353 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 86253 kg/y TSP  44851 kg/y PM10  2588 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 199865 kg/y TSP  94531 kg/y PM10  14315 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3685335 kg/y TSP  1089047 kg/y PM10  110560 kg/y
PM2.5
 FROM SOURCES  : 21
7 8 9 10 11 12 13 14 15 16 17 19 20 21 22 23 24 25 26 27 28
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 200798 kg/y TSP  94972 kg/y PM10  14382 kg/y PM2.5
 FROM SOURCES  : 10
19 20 21 22 23 24 25 26 27 28
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 636930 kg/y TSP  155058 kg/y PM10  66878 kg/y
PM2.5
 FROM SOURCES  : 21
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 41 42 43 44 45 46
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 122754 kg/y TSP  29884 kg/y PM10  12889 kg/y PM2.5
 FROM SOURCES  : 12
26 27 29 30 31 32 41 42 43 44 45 46
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 449490 kg/y TSP  143286 kg/y PM10  9889 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 292764 kg/y TSP  45019 kg/y PM10  5563 kg/y PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 221475 kg/y TSP  65448 kg/y PM10  6644 kg/y PM2.5
 FROM SOURCES  : 21
5 6 7 8 9 10 11 12 13 14 15 16 17 33 34 35 36 37 38 39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM hopper / pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 24000 kg/y TSP  10080 kg/y PM10  456 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 24000 kg/y TSP  10080 kg/y PM10  456 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 292 kg/y TSP  138 kg/y PM10  21 kg/y PM2.5
 FROM SOURCES  : 3
4 5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1459 kg/y TSP  690 kg/y PM10  21 kg/y PM2.5
 FROM SOURCES  : 1
4
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 39494 kg/y TSP  12590 kg/y PM10  869 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1288 kg/y TSP  371 kg/y PM10  28 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 207 kg/y TSP  98 kg/y PM10  15 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 2934 kg/y TSP  1247 kg/y PM10  147 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 235239 kg/y TSP  117619 kg/y PM10  17643 kg/y
PM2.5
 FROM SOURCES  : 11
7 8 9 10 11 12 13 14 15 16 17
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 525004 kg/y TSP  262502 kg/y PM10  39375 kg/y
PM2.5
 FROM SOURCES  : 21
```

```
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 41 42 43 44 45 46
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from inactive or partially rehabed
dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 6665 kg/y TSP  3333 kg/y PM10  500 kg/y PM2.5
 FROM SOURCES  : 12
26 27 29 30 31 32 41 42 43 44 45 46
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2190 kg/y TSP  1095 kg/y PM10  164 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1752 kg/y TSP  876 kg/y PM10  131 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 18464 kg/y TSP  6528 kg/y PM10  202 kg/y PM2.5
 FROM SOURCES  : 40
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
15 16 17
```

## Source allocations
## 2029

```
 --------------------------------      01-Dec-2020 16:46
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil - stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 5421 kg/y TSP  1365 kg/y PM10  271 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - loading to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 433 kg/y TSP  205 kg/y PM10  31 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - hauling to stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 3885 kg/y TSP  1148 kg/y PM10  117 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - unloading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 433 kg/y TSP  205 kg/y PM10  31 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 13050 kg/y TSP  6786 kg/y PM10  391 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 98781 kg/y TSP  51366 kg/y PM10  2963 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 194767 kg/y TSP  92119 kg/y PM10  13949 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2807758 kg/y TSP  829716 kg/y PM10  84233 kg/y
PM2.5
 FROM SOURCES  : 17
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 195637 kg/y TSP  92531 kg/y PM10  14012 kg/y PM2.5
 FROM SOURCES  : 9
10 11 12 13 14 18 19 20 21
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 666384 kg/y TSP  162229 kg/y PM10  69970 kg/y
PM2.5
 FROM SOURCES  : 9
10 11 12 13 14 18 19 20 21
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 135054 kg/y TSP  32878 kg/y PM10  14181 kg/y PM2.5
 FROM SOURCES  : 17
22 23 24 25 26 27 28 29 30 31 32 35 36 41 42 43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 470280 kg/y TSP  149913 kg/y PM10  10346 kg/y
PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 314722 kg/y TSP  48396 kg/y PM10  5980 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 313840 kg/y TSP  92742 kg/y PM10  9415 kg/y PM2.5
 FROM SOURCES  : 14
5 6 7 8 9 15 16 17 33 34 37 38 39 40
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM hopper / pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 25800 kg/y TSP  10836 kg/y PM10  490 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 25800 kg/y TSP  10836 kg/y PM10  490 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 314 kg/y TSP  148 kg/y PM10  22 kg/y PM2.5
 FROM SOURCES  : 3
4 5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1569 kg/y TSP  742 kg/y PM10  22 kg/y PM2.5
 FROM SOURCES  : 1
4
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 41324 kg/y TSP  13173 kg/y PM10  909 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 36748 kg/y TSP  10590 kg/y PM10  808 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 228 kg/y TSP  108 kg/y PM10  16 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3228 kg/y TSP  1372 kg/y PM10  161 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 143636 kg/y TSP  71818 kg/y PM10  10773 kg/y PM2.5
 FROM SOURCES  : 8
7 8 9 15 16 17 33 34
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 262016 kg/y TSP  131008 kg/y PM10  19651 kg/y
PM2.5
 FROM SOURCES  : 9
```

```
10 11 12 13 14 18 19 20 21
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from inactive or partially rehabed
dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 146593 kg/y TSP  73297 kg/y PM10  10994 kg/y PM2.5
 FROM SOURCES  : 17
22 23 24 25 26 27 28 29 30 31 32 35 36 41 42 43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2190 kg/y TSP  1095 kg/y PM10  164 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1752 kg/y TSP  876 kg/y PM10  131 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 18464 kg/y TSP  6528 kg/y PM10  202 kg/y PM2.5
 FROM SOURCES  : 38
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
15 16 17
```

# Source allocations
# 2032

```
 --------------------------------      01-Dec-2020 16:57
  DUST EMISSION CALCULATIONS XL1
 --------------------------------

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Topsoil - stripping
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 6244 kg/y TSP  1572 kg/y PM10  312 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - loading to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 498 kg/y TSP  236 kg/y PM10  36 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - hauling to stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 4475 kg/y TSP  1322 kg/y PM10  134 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Topsoil - unloading
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 498 kg/y TSP  236 kg/y PM10  36 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 13320 kg/y TSP  6926 kg/y PM10  400 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 100820 kg/y TSP  52427 kg/y PM10  3025 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Excavators loading overburden to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 208562 kg/y TSP  98644 kg/y PM10  14938 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling overburden from pit to dump
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 2027725 kg/y TSP  599209 kg/y PM10  60832 kg/y
PM2.5
 FROM SOURCES  : 17
7 8 9 10 11 12 13 14 15 16 17 18 20 22 25 26 27
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading overburden to dump
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 209505 kg/y TSP  99090 kg/y PM10  15005 kg/y PM2.5
 FROM SOURCES  : 10
12 13 14 17 18 20 22 25 26 27
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers shaping overburden
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 630688 kg/y TSP  153538 kg/y PM10  66222 kg/y
PM2.5
 FROM SOURCES  : 10
12 13 14 17 18 20 22 25 26 27
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers working on overburden for rehabilitation
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 132996 kg/y TSP  32377 kg/y PM10  13965 kg/y PM2.5
 FROM SOURCES  : 21
19 21 23 24 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Drilling coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Blasting coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 0 kg/y TSP  0 kg/y PM10  0 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0

 ACTIVITY NAME : Dozers working on coal
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 445098 kg/y TSP  141886 kg/y PM10  9792 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading ROM coal to trucks
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 314722 kg/y TSP  48396 kg/y PM10  5980 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Hauling ROM coal from pit to hopper / ROM pad
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 286784 kg/y TSP  84747 kg/y PM10  8604 kg/y PM2.5
 FROM SOURCES  : 15
5 6 7 8 9 10 11 15 16 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Unloading ROM coal to ROM hopper / pad
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 25800 kg/y TSP  10836 kg/y PM10  490 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : ROM coal rehandle to hopper
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 25800 kg/y TSP  10836 kg/y PM10  490 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Transferring ROM coal by conveyor to CHPP
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 314 kg/y TSP  148 kg/y PM10  22 kg/y PM2.5
 FROM SOURCES  : 3
4 5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Handling coal at CHPP
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1569 kg/y TSP  742 kg/y PM10  22 kg/y PM2.5
 FROM SOURCES  : 1
4
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on ROM coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 39106 kg/y TSP  12466 kg/y PM10  860 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Dozers on product coal stockpiles
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 78022 kg/y TSP  22483 kg/y PM10  1716 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Conveyer to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 225 kg/y TSP  106 kg/y PM10  16 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Loading product coal to trains
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 3179 kg/y TSP  1351 kg/y PM10  159 kg/y PM2.5
 FROM SOURCES  : 1
1
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active pits
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 130662 kg/y TSP  65331 kg/y PM10  9800 kg/y PM2.5
 FROM SOURCES  : 5
7 8 9 10 11
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from active dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 187416 kg/y TSP  93708 kg/y PM10  14056 kg/y PM2.5
 FROM SOURCES  : 10
12 13 14 17 18 20 22 25 26 27
 HOURS OF DAY  :
```

```
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from inactive or partially rehabed
dumps
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 180269 kg/y TSP  90134 kg/y PM10  13520 kg/y PM2.5
 FROM SOURCES  : 21
19 21 23 24 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from ROM coal stockpiles
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 2190 kg/y TSP  1095 kg/y PM10  164 kg/y PM2.5
 FROM SOURCES  : 2
5 6
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Wind erosion from product coal stockpile
 ACTIVITY TYPE : Wind erosion
 DUST EMISSION : 1752 kg/y TSP  876 kg/y PM10  131 kg/y PM2.5
 FROM SOURCES  : 2
2 3
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 ACTIVITY NAME : Grading roads
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 18464 kg/y TSP  6528 kg/y PM10  202 kg/y PM2.5
 FROM SOURCES  : 44
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 HOURS OF DAY  :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

 Pit retention sources:
7 8 9 10 11
```

# Appendix E. Tabulated model results

## Tabulated Model Results

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| **Predicted maximum 24-hour average PM10 concentrations (ug/m3)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 11.8 | 11.3 | 9.0 | 51 | 51 | 51 | 51 | 51 | 50 |
| 4 | Private | 2.5 | 2.1 | 2.0 | 49 | 49 | 49 | 49 | 49 | 50 |
| 18 | Boggabri Coal | 2.9 | 2.3 | 1.7 | 49 | 49 | 48 | 49 | 49 | 50 |
| 20 | Boggabri Coal | 4.0 | 3.3 | 2.7 | 49 | 49 | 49 | 49 | 49 | 50 |
| 23 | Boggabri Coal | 6.5 | 5.5 | 4.4 | 49 | 49 | 49 | 49 | 49 | 50 |
| 25 | Boggabri Coal | 5.7 | 5.0 | 4.1 | 49 | 49 | 49 | 49 | 49 | 50 |
| 27 | Boggabri Coal | 5.6 | 4.7 | 3.8 | 49 | 49 | 49 | 49 | 49 | 50 |
| 32 | Whitehaven Coal Mining | 4.2 | 3.6 | 2.8 | 49 | 49 | 49 | 49 | 49 | 50 |
| 33 | Whitehaven Coal Mining | 5.0 | 5.3 | 5.0 | 50 | 49 | 49 | 50 | 49 | 50 |
| 35 | Mining Joint Ownership | 6.6 | 5.6 | 4.5 | 50 | 49 | 49 | 50 | 49 | 50 |
| 43 | Whitehaven Coal Mining | 5.6 | 4.8 | 3.9 | 50 | 50 | 49 | 50 | 50 | 50 |
| 44 | Private | 4.8 | 4.0 | 3.2 | 50 | 49 | 49 | 50 | 49 | 50 |
| 48 | Private | 13.3 | 10.8 | 8.5 | 51 | 51 | 50 | 51 | 51 | 50 |
| 52 | Boggabri Coal | 17.5 | 14.5 | 12.9 | 53 | 52 | 51 | 53 | 52 | 50 |
| 54 | Mining Joint Ownership | 20.7 | 17.3 | 14.1 | 56 | 56 | 53 | 56 | 56 | 50 |
| 63 | Whitehaven Coal Mining | 28.2 | 19.9 | 15.4 | 60 | 58 | 54 | 60 | 58 | 50 |
| 67 | Boggabri Coal | 22.3 | 18.9 | 15.3 | 56 | 55 | 53 | 56 | 55 | 50 |
| 68 | Boggabri Coal | 22.3 | 18.9 | 14.9 | 56 | 55 | 53 | 56 | 55 | 50 |
| 69 | Boggabri Coal | 14.4 | 12.0 | 9.3 | 54 | 53 | 52 | 55 | 53 | 50 |
| 79 | Boggabri Coal | 16.4 | 14.1 | 11.4 | 51 | 50 | 50 | 51 | 51 | 50 |
| 85 | Whitehaven Coal Mining | 18.2 | 15.2 | 12.5 | 66 | 61 | 53 | 67 | 63 | 50 |
| 86 | Whitehaven Coal Mining | 14.8 | 11.8 | 9.3 | 61 | 58 | 52 | 62 | 59 | 50 |
| 88 | Whitehaven Coal Mining | 11.7 | 9.8 | 7.9 | 56 | 56 | 51 | 57 | 56 | 50 |
| 90 | Private | 12.1 | 9.5 | 7.5 | 50 | 50 | 49 | 50 | 50 | 50 |
| 94 | Mining Joint Ownership | 14.6 | 11.7 | 9.2 | 50 | 50 | 49 | 50 | 50 | 50 |
| 95 | Mining Joint Ownership | 12.7 | 10.1 | 7.9 | 50 | 50 | 49 | 50 | 50 | 50 |
| 98 | Whitehaven Coal Mining | 8.5 | 6.7 | 5.3 | 58 | 56 | 51 | 59 | 57 | 50 |
| 100 | Whitehaven Coal Mining | 7.2 | 5.2 | 4.2 | 52 | 52 | 50 | 53 | 52 | 50 |
| 115 | Private | 3.2 | 2.7 | 2.0 | 49 | 49 | 49 | 49 | 49 | 50 |
| 140 | Private | 10.6 | 8.4 | 6.8 | 52 | 52 | 50 | 52 | 52 | 50 |
| 147 | Private | 7.3 | 5.9 | 4.6 | 51 | 51 | 50 | 52 | 51 | 50 |
| 158 | Private | 12.1 | 9.2 | 7.3 | 50 | 50 | 49 | 50 | 50 | 50 |
| 159 | Whitehaven Coal Mining | 8.1 | 6.5 | 5.2 | 55 | 54 | 51 | 56 | 55 | 50 |
| 182 | Whitehaven Coal Mining | 12.9 | 10.1 | 7.2 | 60 | 58 | 53 | 61 | 58 | 50 |
| 181 | Whitehaven Coal Mining | 17.1 | 13.0 | 10.1 | 72 | 69 | 54 | 74 | 71 | 50 |
| 180 | Whitehaven Coal Mining | 16.9 | 12.7 | 9.3 | 65 | 62 | 54 | 66 | 63 | 50 |
| 179 | Boggabri Coal | 37.7 | 51.6 | 58.7 | 79 | 92 | 93 | 79 | 93 | 50 |
| 178 | Boggabri Coal | 18.4 | 18.7 | 16.4 | 57 | 56 | 54 | 57 | 56 | 50 |
| 177 | Boggabri Coal | 12.5 | 12.9 | 10.5 | 53 | 52 | 51 | 53 | 52 | 50 |
| 176 | Boggabri Coal | 6.9 | 6.0 | 4.9 | 49 | 49 | 49 | 49 | 49 | 50 |
| 185 | Whitehaven Coal Mining | 2.8 | 2.3 | 1.8 | 50 | 50 | 49 | 50 | 50 | 50 |
| 186 | Whitehaven Coal Mining | 12.8 | 11.3 | 9.6 | 55 | 54 | 52 | 55 | 54 | 50 |
| 187 | Whitehaven Coal Mining | 11.9 | 10.7 | 9.4 | 56 | 55 | 53 | 56 | 55 | 50 |
| 192 | Whitehaven Coal Mining | 4.4 | 4.2 | 4.0 | 52 | 52 | 52 | 52 | 52 | 50 |
| 190 | Whitehaven Coal Mining | 5.9 | 5.1 | 4.5 | 53 | 53 | 53 | 53 | 53 | 50 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 165 | Private (including 165B) | 12.1 | 9.7 | 10.4 | 54 | 54 | 54 | 54 | 54 | 50 |
| 191 | Whitehaven Coal Mining | 5.6 | 5.3 | 5.0 | 53 | 53 | 52 | 53 | 53 | 50 |
| 193 | Whitehaven Coal Mining | 5.8 | 4.8 | 4.7 | 52 | 52 | 52 | 52 | 52 | 50 |
| 164 | Private | 9.5 | 7.8 | 8.0 | 50 | 50 | 50 | 50 | 50 | 50 |
| 194 | Whitehaven Coal Mining | 8.4 | 7.1 | 6.6 | 50 | 50 | 50 | 50 | 50 | 50 |
| 188 | Whitehaven Coal Mining | 7.0 | 6.5 | 5.9 | 57 | 56 | 54 | 57 | 56 | 50 |
| 189 | Whitehaven Coal Mining | 3.7 | 3.5 | 3.6 | 60 | 60 | 60 | 60 | 60 | 50 |
| 174 | Whitehaven Coal Mining | 8.4 | 7.3 | 5.4 | 50 | 50 | 49 | 50 | 50 | 50 |
| **Predicted annual average PM10 concentrations (ug/m3)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 2.0 | 1.9 | 1.5 | 18.3 | 18.1 | 17.4 | 18.4 | 18.2 | 25 |
| 4 | Private | 0.4 | 0.3 | 0.3 | 15.2 | 15.2 | 14.9 | 15.2 | 15.2 | 25 |
| 18 | Boggabri Coal | 0.3 | 0.2 | 0.2 | 15.0 | 14.9 | 14.8 | 15.0 | 14.9 | 25 |
| 20 | Boggabri Coal | 0.4 | 0.3 | 0.3 | 15.2 | 15.2 | 14.9 | 15.2 | 15.2 | 25 |
| 23 | Boggabri Coal | 0.6 | 0.6 | 0.5 | 15.7 | 15.7 | 15.2 | 15.8 | 15.7 | 25 |
| 25 | Boggabri Coal | 0.5 | 0.4 | 0.4 | 15.5 | 15.4 | 15.1 | 15.5 | 15.5 | 25 |
| 27 | Boggabri Coal | 0.6 | 0.5 | 0.4 | 15.6 | 15.5 | 15.1 | 15.6 | 15.5 | 25 |
| 32 | Whitehaven Coal Mining | 0.5 | 0.5 | 0.4 | 15.4 | 15.3 | 15.0 | 15.4 | 15.4 | 25 |
| 33 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 15.5 | 15.5 | 15.1 | 15.6 | 15.5 | 25 |
| 35 | Mining Joint Ownership | 0.8 | 0.7 | 0.6 | 16.0 | 15.9 | 15.3 | 16.1 | 16.0 | 25 |
| 43 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.6 | 15.9 | 15.8 | 15.3 | 16.0 | 15.8 | 25 |
| 44 | Private | 0.7 | 0.6 | 0.5 | 15.6 | 15.5 | 15.1 | 15.7 | 15.6 | 25 |
| 48 | Private | 1.4 | 1.3 | 1.1 | 16.5 | 16.4 | 15.7 | 16.5 | 16.4 | 25 |
| 52 | Boggabri Coal | 2.5 | 2.4 | 2.0 | 17.8 | 17.7 | 16.6 | 18.0 | 17.8 | 25 |
| 54 | Mining Joint Ownership | 4.1 | 3.5 | 2.8 | 20.3 | 19.7 | 17.5 | 20.6 | 20.0 | 25 |
| 63 | Whitehaven Coal Mining | 5.2 | 3.9 | 2.8 | 21.3 | 20.0 | 17.8 | 21.6 | 20.2 | 25 |
| 67 | Boggabri Coal | 2.8 | 2.3 | 1.7 | 18.4 | 17.9 | 16.8 | 18.5 | 18.0 | 25 |
| 68 | Boggabri Coal | 2.9 | 2.4 | 1.7 | 18.5 | 18.0 | 16.9 | 18.6 | 18.1 | 25 |
| 69 | Boggabri Coal | 2.0 | 1.7 | 1.2 | 17.5 | 17.2 | 16.4 | 17.6 | 17.2 | 25 |
| 79 | Boggabri Coal | 1.8 | 1.6 | 1.3 | 16.9 | 16.7 | 15.9 | 17.0 | 16.8 | 25 |
| 85 | Whitehaven Coal Mining | 3.3 | 2.7 | 2.2 | 20.3 | 19.8 | 16.8 | 20.8 | 20.3 | 25 |
| 86 | Whitehaven Coal Mining | 2.4 | 2.1 | 1.6 | 18.6 | 18.2 | 16.2 | 18.9 | 18.5 | 25 |
| 88 | Whitehaven Coal Mining | 2.1 | 1.7 | 1.4 | 18.2 | 17.9 | 15.9 | 18.5 | 18.2 | 25 |
| 90 | Private | 1.3 | 1.2 | 1.0 | 16.2 | 16.1 | 15.6 | 16.3 | 16.1 | 25 |
| 94 | Mining Joint Ownership | 1.6 | 1.4 | 1.1 | 16.6 | 16.4 | 15.6 | 16.7 | 16.5 | 25 |
| 95 | Mining Joint Ownership | 1.4 | 1.2 | 1.0 | 16.4 | 16.2 | 15.5 | 16.5 | 16.3 | 25 |
| 98 | Whitehaven Coal Mining | 1.9 | 1.5 | 1.2 | 17.9 | 17.5 | 15.8 | 18.1 | 17.8 | 25 |
| 100 | Whitehaven Coal Mining | 1.3 | 1.1 | 0.8 | 16.7 | 16.4 | 15.4 | 16.8 | 16.6 | 25 |
| 115 | Private | 0.3 | 0.3 | 0.2 | 15.0 | 15.0 | 14.8 | 15.1 | 15.0 | 25 |
| 140 | Private | 1.6 | 1.3 | 1.0 | 16.7 | 16.4 | 15.7 | 16.8 | 16.5 | 25 |
| 147 | Private | 1.2 | 1.0 | 0.8 | 16.4 | 16.2 | 15.4 | 16.5 | 16.3 | 25 |
| 158 | Private | 1.2 | 1.1 | 0.9 | 16.1 | 16.0 | 15.5 | 16.1 | 16.0 | 25 |
| 159 | Whitehaven Coal Mining | 1.6 | 1.3 | 1.0 | 17.3 | 17.0 | 15.6 | 17.5 | 17.3 | 25 |
| 182 | Whitehaven Coal Mining | 3.1 | 2.5 | 1.9 | 20.4 | 19.8 | 16.5 | 20.9 | 20.3 | 25 |
| 181 | Whitehaven Coal Mining | 4.1 | 3.2 | 2.4 | 23.9 | 23.0 | 17.1 | 24.9 | 24.0 | 25 |
| 180 | Whitehaven Coal Mining | 4.1 | 3.2 | 2.4 | 23.4 | 22.5 | 17.1 | 24.3 | 23.4 | 25 |
| 179 | Boggabri Coal | 13.7 | 20.3 | 24.3 | 35.9 | 42.5 | 39.1 | 36.6 | 43.2 | 25 |
| 178 | Boggabri Coal | 4.6 | 4.6 | 4.1 | 21.9 | 21.8 | 18.9 | 22.3 | 22.3 | 25 |
| 177 | Boggabri Coal | 2.1 | 2.0 | 1.7 | 17.8 | 17.6 | 16.4 | 18.0 | 17.8 | 25 |
| 176 | Boggabri Coal | 0.7 | 0.6 | 0.5 | 15.9 | 15.8 | 15.3 | 16.0 | 15.9 | 25 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 185 | Whitehaven Coal Mining | 0.6 | 0.5 | 0.4 | 15.4 | 15.3 | 14.9 | 15.5 | 15.4 | 25 |
| 186 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.5 | 16.2 | 16.1 | 15.8 | 16.2 | 16.1 | 25 |
| 187 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.5 | 16.3 | 16.2 | 15.9 | 16.3 | 16.2 | 25 |
| 192 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.6 | 18.5 | 18.4 | 18.3 | 18.5 | 18.4 | 25 |
| 190 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.6 | 18.8 | 18.7 | 18.5 | 18.8 | 18.7 | 25 |
| 165 | Private (including 165B) | 1.6 | 1.4 | 1.3 | 22.5 | 22.4 | 22.1 | 22.6 | 22.4 | 25 |
| 191 | Whitehaven Coal Mining | 0.9 | 0.8 | 0.7 | 19.3 | 19.2 | 19.1 | 19.4 | 19.3 | 25 |
| 193 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.6 | 18.6 | 18.5 | 18.4 | 18.6 | 18.5 | 25 |
| 164 | Private | 1.0 | 0.9 | 0.8 | 18.6 | 18.5 | 18.3 | 18.6 | 18.5 | 25 |
| 194 | Whitehaven Coal Mining | 1.1 | 0.9 | 0.9 | 18.1 | 18.0 | 17.8 | 18.1 | 18.0 | 25 |
| 188 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 16.7 | 16.6 | 16.4 | 16.7 | 16.6 | 25 |
| 189 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 17.3 | 17.2 | 17.1 | 17.3 | 17.3 | 25 |
| 174 | Whitehaven Coal Mining | 1.3 | 1.1 | 0.9 | 16.9 | 16.8 | 16.2 | 17.0 | 16.8 | 25 |
| **Predicted maximum 24-hour average PM2.5 concentrations (ug/m3)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 2.2 | 2.0 | 1.9 | 22.0 | 22.0 | 21.9 | 22.0 | 22.0 | 25 |
| 4 | Private | 0.5 | 0.4 | 0.4 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 25 |
| 18 | Boggabri Coal | 0.6 | 0.5 | 0.4 | 21.3 | 21.3 | 21.3 | 21.3 | 21.3 | 25 |
| 20 | Boggabri Coal | 0.8 | 0.6 | 0.5 | 21.4 | 21.4 | 21.3 | 21.4 | 21.4 | 25 |
| 23 | Boggabri Coal | 1.2 | 1.0 | 0.9 | 21.5 | 21.5 | 21.4 | 21.5 | 21.5 | 25 |
| 25 | Boggabri Coal | 1.1 | 0.9 | 0.8 | 21.4 | 21.4 | 21.4 | 21.4 | 21.4 | 25 |
| 27 | Boggabri Coal | 1.0 | 0.9 | 0.7 | 21.5 | 21.5 | 21.4 | 21.5 | 21.5 | 25 |
| 32 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.6 | 21.5 | 21.5 | 21.4 | 21.5 | 21.5 | 25 |
| 33 | Whitehaven Coal Mining | 1.0 | 1.1 | 1.1 | 21.6 | 21.5 | 21.4 | 21.6 | 21.6 | 25 |
| 35 | Mining Joint Ownership | 1.2 | 1.0 | 0.9 | 21.6 | 21.6 | 21.5 | 21.6 | 21.6 | 25 |
| 43 | Whitehaven Coal Mining | 1.1 | 0.9 | 0.8 | 21.6 | 21.6 | 21.5 | 21.6 | 21.6 | 25 |
| 44 | Private | 0.9 | 0.7 | 0.7 | 21.6 | 21.5 | 21.4 | 21.6 | 21.6 | 25 |
| 48 | Private | 2.4 | 2.0 | 1.6 | 21.9 | 21.9 | 21.6 | 21.9 | 21.9 | 25 |
| 52 | Boggabri Coal | 2.9 | 2.5 | 2.4 | 22.4 | 22.3 | 21.9 | 22.4 | 22.3 | 25 |
| 54 | Mining Joint Ownership | 3.6 | 2.9 | 2.6 | 23.3 | 23.1 | 22.4 | 23.3 | 23.2 | 25 |
| 63 | Whitehaven Coal Mining | 6.8 | 4.6 | 3.8 | 24.2 | 23.7 | 22.7 | 24.3 | 23.7 | 25 |
| 67 | Boggabri Coal | 4.3 | 4.0 | 3.3 | 22.8 | 22.7 | 22.3 | 22.8 | 22.8 | 25 |
| 68 | Boggabri Coal | 4.4 | 4.1 | 3.3 | 22.8 | 22.8 | 22.4 | 22.8 | 22.8 | 25 |
| 69 | Boggabri Coal | 3.1 | 3.1 | 2.5 | 22.2 | 22.3 | 22.0 | 22.2 | 22.3 | 25 |
| 79 | Boggabri Coal | 2.7 | 2.4 | 2.0 | 21.9 | 21.8 | 21.6 | 21.9 | 21.9 | 25 |
| 85 | Whitehaven Coal Mining | 3.6 | 2.8 | 2.5 | 24.2 | 23.9 | 22.5 | 24.4 | 24.1 | 25 |
| 86 | Whitehaven Coal Mining | 2.9 | 2.2 | 1.9 | 23.3 | 23.1 | 22.1 | 23.4 | 23.2 | 25 |
| 88 | Whitehaven Coal Mining | 2.4 | 1.9 | 1.7 | 23.5 | 23.2 | 22.1 | 23.6 | 23.4 | 25 |
| 90 | Private | 2.2 | 1.6 | 1.4 | 21.8 | 21.7 | 21.5 | 21.8 | 21.7 | 25 |
| 94 | Mining Joint Ownership | 2.5 | 2.0 | 1.6 | 21.8 | 21.8 | 21.5 | 21.8 | 21.8 | 25 |
| 95 | Mining Joint Ownership | 2.2 | 1.7 | 1.4 | 21.7 | 21.7 | 21.5 | 21.8 | 21.7 | 25 |
| 98 | Whitehaven Coal Mining | 2.3 | 1.7 | 1.4 | 23.3 | 23.0 | 22.1 | 23.4 | 23.1 | 25 |
| 100 | Whitehaven Coal Mining | 1.7 | 1.3 | 1.1 | 22.4 | 22.3 | 21.7 | 22.5 | 22.3 | 25 |
| 115 | Private | 0.7 | 0.5 | 0.4 | 21.4 | 21.3 | 21.3 | 21.4 | 21.3 | 25 |
| 140 | Private | 2.6 | 2.1 | 1.8 | 22.1 | 22.1 | 21.7 | 22.2 | 22.1 | 25 |
| 147 | Private | 1.8 | 1.3 | 1.1 | 22.1 | 22.0 | 21.6 | 22.1 | 22.1 | 25 |
| 158 | Private | 2.2 | 1.7 | 1.4 | 21.7 | 21.7 | 21.5 | 21.8 | 21.7 | 25 |
| 159 | Whitehaven Coal Mining | 1.9 | 1.4 | 1.2 | 23.0 | 22.8 | 21.9 | 23.1 | 22.9 | 25 |
| 182 | Whitehaven Coal Mining | 3.7 | 2.6 | 2.0 | 24.3 | 23.8 | 22.5 | 24.4 | 23.9 | 25 |
| 181 | Whitehaven Coal Mining | 4.6 | 3.1 | 2.5 | 25.6 | 25.0 | 22.9 | 25.9 | 25.2 | 25 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 180 | Whitehaven Coal Mining | 4.7 | 3.2 | 2.5 | 25.5 | 24.8 | 22.9 | 25.6 | 25.0 | 25 |
| 179 | Boggabri Coal | 6.4 | 7.4 | 8.2 | 26.9 | 27.8 | 27.1 | 27.0 | 27.8 | 25 |
| 178 | Boggabri Coal | 4.2 | 3.7 | 3.0 | 23.4 | 23.2 | 22.7 | 23.5 | 23.3 | 25 |
| 177 | Boggabri Coal | 2.4 | 2.6 | 2.2 | 22.4 | 22.3 | 22.0 | 22.4 | 22.3 | 25 |
| 176 | Boggabri Coal | 1.3 | 1.1 | 1.0 | 21.5 | 21.5 | 21.4 | 21.5 | 21.5 | 25 |
| 185 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 21.8 | 21.7 | 21.4 | 21.8 | 21.8 | 25 |
| 186 | Whitehaven Coal Mining | 2.7 | 2.6 | 2.4 | 21.8 | 21.6 | 21.4 | 21.8 | 21.7 | 25 |
| 187 | Whitehaven Coal Mining | 2.5 | 2.5 | 2.3 | 22.0 | 21.8 | 21.4 | 22.0 | 21.9 | 25 |
| 192 | Whitehaven Coal Mining | 0.9 | 0.8 | 0.8 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 25 |
| 190 | Whitehaven Coal Mining | 1.1 | 1.1 | 1.0 | 22.2 | 22.2 | 22.2 | 22.2 | 22.2 | 25 |
| 165 | Private (including 165B) | 2.2 | 2.0 | 2.1 | 22.9 | 22.9 | 22.9 | 22.9 | 22.9 | 25 |
| 191 | Whitehaven Coal Mining | 1.1 | 1.0 | 1.0 | 22.5 | 22.5 | 22.5 | 22.5 | 22.5 | 25 |
| 193 | Whitehaven Coal Mining | 1.1 | 1.0 | 0.9 | 22.3 | 22.3 | 22.3 | 22.3 | 22.3 | 25 |
| 164 | Private | 1.8 | 1.6 | 1.7 | 21.8 | 21.9 | 21.8 | 21.9 | 21.9 | 25 |
| 194 | Whitehaven Coal Mining | 1.7 | 1.4 | 1.4 | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | 25 |
| 188 | Whitehaven Coal Mining | 1.3 | 1.3 | 1.2 | 22.2 | 22.2 | 21.8 | 22.3 | 22.2 | 25 |
| 189 | Whitehaven Coal Mining | 0.8 | 0.8 | 0.8 | 22.6 | 22.7 | 22.6 | 22.7 | 22.7 | 25 |
| 174 | Whitehaven Coal Mining | 1.6 | 1.4 | 1.2 | 21.6 | 21.6 | 21.6 | 21.6 | 21.6 | 25 |
| **Predicted annual average PM2.5 concentrations (ug/m3)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 0.4 | 0.4 | 0.4 | 7.2 | 7.1 | 7.0 | 7.2 | 7.2 | 8 |
| 4 | Private | 0.1 | 0.1 | 0.1 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 8 |
| 18 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 6.5 | 6.5 | 6.4 | 6.5 | 6.5 | 8 |
| 20 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 6.5 | 6.5 | 6.5 | 6.5 | 6.5 | 8 |
| 23 | Boggabri Coal | 0.2 | 0.1 | 0.1 | 6.7 | 6.6 | 6.5 | 6.7 | 6.7 | 8 |
| 25 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.6 | 6.6 | 8 |
| 27 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.6 | 6.6 | 8 |
| 32 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.6 | 6.6 | 8 |
| 33 | Whitehaven Coal Mining | 0.2 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.6 | 6.6 | 8 |
| 35 | Mining Joint Ownership | 0.2 | 0.2 | 0.1 | 6.7 | 6.7 | 6.6 | 6.7 | 6.7 | 8 |
| 43 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 6.7 | 6.7 | 6.6 | 6.7 | 6.7 | 8 |
| 44 | Private | 0.2 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.7 | 6.6 | 8 |
| 48 | Private | 0.3 | 0.3 | 0.3 | 6.8 | 6.8 | 6.7 | 6.9 | 6.8 | 8 |
| 52 | Boggabri Coal | 0.6 | 0.5 | 0.4 | 7.1 | 7.1 | 6.8 | 7.2 | 7.1 | 8 |
| 54 | Mining Joint Ownership | 0.9 | 0.7 | 0.6 | 7.7 | 7.5 | 7.0 | 7.7 | 7.6 | 8 |
| 63 | Whitehaven Coal Mining | 1.3 | 1.0 | 0.8 | 8.1 | 7.8 | 7.2 | 8.1 | 7.8 | 8 |
| 67 | Boggabri Coal | 0.7 | 0.6 | 0.5 | 7.3 | 7.2 | 7.0 | 7.3 | 7.3 | 8 |
| 68 | Boggabri Coal | 0.7 | 0.6 | 0.5 | 7.3 | 7.3 | 7.0 | 7.4 | 7.3 | 8 |
| 69 | Boggabri Coal | 0.5 | 0.5 | 0.4 | 7.1 | 7.1 | 6.9 | 7.1 | 7.1 | 8 |
| 79 | Boggabri Coal | 0.4 | 0.3 | 0.3 | 6.9 | 6.9 | 6.7 | 6.9 | 6.9 | 8 |
| 85 | Whitehaven Coal Mining | 0.8 | 0.6 | 0.5 | 7.8 | 7.7 | 6.9 | 7.9 | 7.8 | 8 |
| 86 | Whitehaven Coal Mining | 0.6 | 0.5 | 0.4 | 7.4 | 7.3 | 6.8 | 7.5 | 7.3 | 8 |
| 88 | Whitehaven Coal Mining | 0.5 | 0.4 | 0.3 | 7.3 | 7.2 | 6.7 | 7.4 | 7.3 | 8 |
| 90 | Private | 0.3 | 0.3 | 0.2 | 6.8 | 6.7 | 6.6 | 6.8 | 6.7 | 8 |
| 94 | Mining Joint Ownership | 0.3 | 0.3 | 0.2 | 6.9 | 6.8 | 6.6 | 6.9 | 6.8 | 8 |
| 95 | Mining Joint Ownership | 0.3 | 0.3 | 0.2 | 6.8 | 6.8 | 6.6 | 6.8 | 6.8 | 8 |
| 98 | Whitehaven Coal Mining | 0.5 | 0.4 | 0.3 | 7.2 | 7.1 | 6.7 | 7.3 | 7.2 | 8 |
| 100 | Whitehaven Coal Mining | 0.3 | 0.3 | 0.2 | 6.9 | 6.9 | 6.6 | 7.0 | 6.9 | 8 |
| 115 | Private | 0.1 | 0.1 | 0.1 | 6.5 | 6.5 | 6.4 | 6.5 | 6.5 | 8 |
| 140 | Private | 0.4 | 0.3 | 0.3 | 6.9 | 6.9 | 6.7 | 7.0 | 6.9 | 8 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 147 | Private | 0.3 | 0.3 | 0.2 | 6.9 | 6.8 | 6.6 | 6.9 | 6.8 | 8 |
| 158 | Private | 0.3 | 0.2 | 0.2 | 6.7 | 6.7 | 6.6 | 6.8 | 6.7 | 8 |
| 159 | Whitehaven Coal Mining | 0.4 | 0.3 | 0.3 | 7.1 | 7.0 | 6.6 | 7.1 | 7.1 | 8 |
| 182 | Whitehaven Coal Mining | 0.8 | 0.6 | 0.5 | 7.9 | 7.7 | 6.9 | 8.0 | 7.8 | 8 |
| 181 | Whitehaven Coal Mining | 1.0 | 0.8 | 0.6 | 8.7 | 8.5 | 7.0 | 8.9 | 8.6 | 8 |
| 180 | Whitehaven Coal Mining | 1.0 | 0.8 | 0.6 | 8.6 | 8.4 | 7.0 | 8.8 | 8.5 | 8 |
| 179 | Boggabri Coal | 2.4 | 2.8 | 3.1 | 10.1 | 10.5 | 9.5 | 10.2 | 10.7 | 8 |
| 178 | Boggabri Coal | 1.0 | 0.9 | 0.8 | 8.0 | 7.9 | 7.3 | 8.1 | 8.0 | 8 |
| 177 | Boggabri Coal | 0.5 | 0.4 | 0.4 | 7.2 | 7.1 | 6.8 | 7.2 | 7.1 | 8 |
| 176 | Boggabri Coal | 0.2 | 0.1 | 0.1 | 6.7 | 6.7 | 6.5 | 6.7 | 6.7 | 8 |
| 185 | Whitehaven Coal Mining | 0.2 | 0.1 | 0.1 | 6.6 | 6.6 | 6.5 | 6.6 | 6.6 | 8 |
| 186 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 6.8 | 6.8 | 6.7 | 6.8 | 6.8 | 8 |
| 187 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 6.8 | 6.8 | 6.7 | 6.8 | 6.8 | 8 |
| 192 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 8 |
| 190 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 7.4 | 7.4 | 7.4 | 7.4 | 7.4 | 8 |
| 165 | Private (including 165B) | 0.3 | 0.3 | 0.3 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8 |
| 191 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 8 |
| 193 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 7.3 | 7.3 | 7.3 | 7.3 | 7.3 | 8 |
| 164 | Private | 0.2 | 0.2 | 0.2 | 7.2 | 7.2 | 7.2 | 7.2 | 7.2 | 8 |
| 194 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 7.1 | 7.1 | 7.1 | 7.1 | 7.1 | 8 |
| 188 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.1 | 6.9 | 6.9 | 6.8 | 6.9 | 6.9 | 8 |
| 189 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.1 | 7.1 | 7.1 | 7.0 | 7.1 | 7.1 | 8 |
| 174 | Whitehaven Coal Mining | 0.3 | 0.2 | 0.2 | 6.9 | 6.9 | 6.8 | 6.9 | 6.9 | 8 |
| **Predicted annual average TSP concentrations (ug/m3)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 1.0 | 1.0 | 0.8 | 48.8 | 48.8 | 48.4 | 48.8 | 48.8 | 90 |
| 4 | Private | 0.2 | 0.1 | 0.1 | 47.3 | 47.3 | 47.2 | 47.3 | 47.3 | 90 |
| 18 | Boggabri Coal | 0.1 | 0.1 | 0.0 | 47.2 | 47.1 | 47.1 | 47.2 | 47.2 | 90 |
| 20 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 47.3 | 47.3 | 47.2 | 47.3 | 47.3 | 90 |
| 23 | Boggabri Coal | 0.2 | 0.2 | 0.1 | 47.5 | 47.5 | 47.3 | 47.5 | 47.5 | 90 |
| 25 | Boggabri Coal | 0.2 | 0.2 | 0.1 | 47.4 | 47.4 | 47.2 | 47.4 | 47.4 | 90 |
| 27 | Boggabri Coal | 0.2 | 0.2 | 0.1 | 47.4 | 47.4 | 47.2 | 47.4 | 47.4 | 90 |
| 32 | Whitehaven Coal Mining | 0.2 | 0.1 | 0.1 | 47.3 | 47.3 | 47.2 | 47.3 | 47.3 | 90 |
| 33 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.2 | 47.4 | 47.3 | 47.2 | 47.4 | 47.4 | 90 |
| 35 | Mining Joint Ownership | 0.3 | 0.2 | 0.2 | 47.6 | 47.6 | 47.3 | 47.7 | 47.6 | 90 |
| 43 | Whitehaven Coal Mining | 0.3 | 0.2 | 0.2 | 47.5 | 47.5 | 47.3 | 47.5 | 47.5 | 90 |
| 44 | Private | 0.2 | 0.2 | 0.1 | 47.4 | 47.4 | 47.2 | 47.4 | 47.4 | 90 |
| 48 | Private | 0.6 | 0.6 | 0.4 | 47.8 | 47.8 | 47.5 | 47.8 | 47.8 | 90 |
| 52 | Boggabri Coal | 1.1 | 1.0 | 0.8 | 48.4 | 48.4 | 47.8 | 48.4 | 48.4 | 90 |
| 54 | Mining Joint Ownership | 1.4 | 1.2 | 0.8 | 49.2 | 49.0 | 47.9 | 49.3 | 49.1 | 90 |
| 63 | Whitehaven Coal Mining | 2.6 | 1.8 | 1.2 | 50.2 | 49.3 | 48.4 | 50.2 | 49.4 | 90 |
| 67 | Boggabri Coal | 1.3 | 1.1 | 0.7 | 48.8 | 48.5 | 48.1 | 48.8 | 48.5 | 90 |
| 68 | Boggabri Coal | 1.3 | 1.0 | 0.6 | 48.8 | 48.5 | 48.0 | 48.8 | 48.5 | 90 |
| 69 | Boggabri Coal | 0.8 | 0.6 | 0.4 | 48.2 | 48.1 | 47.8 | 48.2 | 48.1 | 90 |
| 79 | Boggabri Coal | 0.8 | 0.7 | 0.5 | 48.0 | 47.9 | 47.5 | 48.1 | 48.0 | 90 |
| 85 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 48.9 | 48.8 | 47.5 | 49.0 | 48.9 | 90 |
| 86 | Whitehaven Coal Mining | 0.5 | 0.5 | 0.3 | 48.2 | 48.1 | 47.4 | 48.3 | 48.2 | 90 |
| 88 | Whitehaven Coal Mining | 0.4 | 0.4 | 0.3 | 48.0 | 47.9 | 47.3 | 48.0 | 48.0 | 90 |
| 90 | Private | 0.5 | 0.5 | 0.4 | 47.7 | 47.7 | 47.4 | 47.7 | 47.7 | 90 |
| 94 | Mining Joint Ownership | 0.6 | 0.5 | 0.4 | 47.9 | 47.8 | 47.4 | 47.9 | 47.8 | 90 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 95 | Mining Joint Ownership | 0.5 | 0.5 | 0.3 | 47.8 | 47.7 | 47.4 | 47.8 | 47.7 | 90 |
| 98 | Whitehaven Coal Mining | 0.4 | 0.4 | 0.3 | 48.0 | 48.0 | 47.3 | 48.1 | 48.0 | 90 |
| 100 | Whitehaven Coal Mining | 0.4 | 0.3 | 0.2 | 47.8 | 47.7 | 47.3 | 47.8 | 47.8 | 90 |
| 115 | Private | 0.1 | 0.1 | 0.1 | 47.2 | 47.2 | 47.1 | 47.2 | 47.2 | 90 |
| 140 | Private | 0.8 | 0.6 | 0.4 | 48.0 | 47.8 | 47.5 | 48.0 | 47.9 | 90 |
| 147 | Private | 0.5 | 0.4 | 0.3 | 47.8 | 47.7 | 47.4 | 47.9 | 47.8 | 90 |
| 158 | Private | 0.5 | 0.5 | 0.3 | 47.6 | 47.6 | 47.4 | 47.7 | 47.6 | 90 |
| 159 | Whitehaven Coal Mining | 0.3 | 0.3 | 0.2 | 47.8 | 47.7 | 47.3 | 47.8 | 47.8 | 90 |
| 182 | Whitehaven Coal Mining | 0.8 | 0.7 | 0.5 | 49.3 | 49.1 | 47.6 | 49.5 | 49.3 | 90 |
| 181 | Whitehaven Coal Mining | 1.0 | 0.9 | 0.6 | 51.2 | 51.0 | 47.7 | 51.6 | 51.4 | 90 |
| 180 | Whitehaven Coal Mining | 1.1 | 0.9 | 0.6 | 50.9 | 50.7 | 47.7 | 51.3 | 51.1 | 90 |
| 179 | Boggabri Coal | 9.4 | 21.3 | 31.0 | 64.6 | 76.5 | 78.1 | 65.2 | 77.0 | 90 |
| 178 | Boggabri Coal | 1.8 | 2.1 | 1.9 | 50.6 | 50.9 | 49.0 | 50.9 | 51.1 | 90 |
| 177 | Boggabri Coal | 0.7 | 0.7 | 0.6 | 48.3 | 48.3 | 47.6 | 48.3 | 48.3 | 90 |
| 176 | Boggabri Coal | 0.3 | 0.2 | 0.2 | 47.6 | 47.6 | 47.3 | 47.6 | 47.6 | 90 |
| 185 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 47.2 | 47.2 | 47.1 | 47.2 | 47.2 | 90 |
| 186 | Whitehaven Coal Mining | 0.3 | 0.2 | 0.1 | 47.6 | 47.5 | 47.4 | 47.6 | 47.5 | 90 |
| 187 | Whitehaven Coal Mining | 0.3 | 0.2 | 0.1 | 47.6 | 47.5 | 47.4 | 47.6 | 47.5 | 90 |
| 192 | Whitehaven Coal Mining | 0.3 | 0.3 | 0.2 | 48.7 | 48.7 | 48.6 | 48.7 | 48.7 | 90 |
| 190 | Whitehaven Coal Mining | 0.3 | 0.3 | 0.2 | 48.5 | 48.5 | 48.4 | 48.5 | 48.5 | 90 |
| 165 | Private (including 165B) | 0.9 | 0.8 | 0.7 | 52.0 | 51.9 | 51.7 | 52.0 | 51.9 | 90 |
| 191 | Whitehaven Coal Mining | 0.4 | 0.3 | 0.3 | 49.1 | 49.1 | 49.0 | 49.1 | 49.1 | 90 |
| 193 | Whitehaven Coal Mining | 0.4 | 0.3 | 0.3 | 48.9 | 48.9 | 48.8 | 48.9 | 48.9 | 90 |
| 164 | Private | 0.5 | 0.5 | 0.4 | 49.4 | 49.3 | 49.2 | 49.4 | 49.3 | 90 |
| 194 | Whitehaven Coal Mining | 0.6 | 0.5 | 0.4 | 48.9 | 48.9 | 48.7 | 48.9 | 48.9 | 90 |
| 188 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.1 | 47.7 | 47.7 | 47.6 | 47.7 | 47.7 | 90 |
| 189 | Whitehaven Coal Mining | 0.2 | 0.2 | 0.1 | 47.9 | 47.9 | 47.9 | 47.9 | 47.9 | 90 |
| 174 | Whitehaven Coal Mining | 0.7 | 0.6 | 0.5 | 48.2 | 48.1 | 47.8 | 48.2 | 48.1 | 90 |
| **Predicted annual average deposited dust (g/m2/month)** | | | | | | | | | | |
| 1 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 4 |
| 4 | Private | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 18 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 20 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 23 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 25 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 4 |
| 27 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 4 |
| 32 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 33 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 35 | Mining Joint Ownership | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 43 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 44 | Private | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 48 | Private | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |
| 52 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 4 |
| 54 | Mining Joint Ownership | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 4 |
| 63 | Whitehaven Coal Mining | 0.5 | 0.4 | 0.2 | 0.6 | 0.5 | 0.3 | 0.6 | 0.5 | 4 |
| 67 | Boggabri Coal | 0.2 | 0.2 | 0.1 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 4 |
| 68 | Boggabri Coal | 0.2 | 0.2 | 0.1 | 0.3 | 0.2 | 0.2 | 0.3 | 0.2 | 4 |
| 69 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 4 |
| 79 | Boggabri Coal | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |

| ID | Status | Due to BCM (as modified) | | | Cumulative | | | Cumulative (with Tarrawonga MOD7) | | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2024 | 2029 | 2032 | 2024 | 2029 | 2032 | 2024 | 2029 | |
| 85 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.0 | 0.2 | 0.2 | 0.0 | 0.2 | 0.2 | 4 |
| 86 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 88 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 90 | Private | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 94 | Mining Joint Ownership | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 95 | Mining Joint Ownership | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 98 | Whitehaven Coal Mining | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 100 | Whitehaven Coal Mining | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 115 | Private | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 140 | Private | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 4 |
| 147 | Private | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |
| 158 | Private | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 159 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 182 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.3 | 0.3 | 0.1 | 0.3 | 0.3 | 4 |
| 181 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.5 | 0.5 | 0.1 | 0.6 | 0.5 | 4 |
| 180 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.5 | 0.5 | 0.1 | 0.6 | 0.5 | 4 |
| 179 | Boggabri Coal | 0.8 | 1.6 | 2.3 | 1.6 | 2.4 | 2.3 | 1.6 | 2.4 | 4 |
| 178 | Boggabri Coal | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.2 | 0.4 | 0.5 | 4 |
| 177 | Boggabri Coal | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 4 |
| 176 | Boggabri Coal | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 185 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4 |
| 186 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 187 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 4 |
| 192 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 4 |
| 190 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |
| 165 | Private (including 165B) | 0.1 | 0.1 | 0.1 | 0.6 | 0.5 | 0.5 | 0.6 | 0.5 | 4 |
| 191 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 4 |
| 193 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 4 |
| 164 | Private | 0.1 | 0.1 | 0.0 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 | 4 |
| 194 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 4 |
| 188 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |
| 189 | Whitehaven Coal Mining | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |
| 174 | Whitehaven Coal Mining | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 4 |

# Appendix F. Greenhouse gas emissions by activity

**Diesel usage**

| | | | Emission factor (kg $CO_2$-e/kL) | | | Emissions (t $CO_2$-e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | ROM coal (t) | Usage (kL) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 8,600,000 | 78,900 | 2721.3 | 0 | 138.96 | 214,711 | - | 10,964 | 225,675 |
| 2023 | 8,900,000 | 96,963 | 2721.3 | 0 | 138.96 | 263,865 | - | 13,474 | 277,339 |
| 2024 | 8,000,000 | 113,798 | 2721.3 | 0 | 138.96 | 309,678 | - | 15,813 | 325,492 |
| 2025 | 8,000,000 | 113,125 | 2721.3 | 0 | 138.96 | 307,847 | - | 15,720 | 323,567 |
| 2026 | 8,600,000 | 107,852 | 2721.3 | 0 | 138.96 | 293,498 | - | 14,987 | 308,485 |
| 2027 | 9,000,000 | 99,845 | 2721.3 | 0 | 138.96 | 271,708 | - | 13,874 | 285,583 |
| 2028 | 9,100,000 | 85,115 | 2721.3 | 0 | 138.96 | 231,623 | - | 11,828 | 243,451 |
| 2029 | 8,600,000 | 100,958 | 2721.3 | 0 | 138.96 | 274,737 | - | 14,029 | 288,766 |
| 2030 | 8,600,000 | 99,701 | 2721.3 | 0 | 138.96 | 271,316 | - | 13,854 | 285,171 |
| 2031 | 8,600,000 | 102,707 | 2721.3 | 0 | 138.96 | 279,497 | - | 14,272 | 293,769 |
| 2032 | 8,600,000 | 86,118 | 2721.3 | 0 | 138.96 | 234,353 | - | 11,967 | 246,320 |
| 2033 | 8,535,828 | 85,190 | 2721.3 | 0 | 138.96 | 231,828 | - | 11,838 | 243,666 |
| 2034 | 8,600,000 | 87,163 | 2721.3 | 0 | 138.96 | 237,197 | - | 12,112 | 249,309 |
| 2035 | 8,600,000 | 79,707 | 2721.3 | 0 | 138.96 | 216,907 | - | 11,076 | 227,983 |
| 2036 | 8,600,000 | 77,842 | 2721.3 | 0 | 138.96 | 211,831 | - | 10,817 | 222,648 |
| 2037 | 5,832,456 | 43,242 | 2721.3 | 0 | 138.96 | 117,674 | - | 6,009 | 123,683 |
| 2038 | 4,300,000 | 41,108 | 2721.3 | 0 | 138.96 | 111,867 | - | 5,712 | 117,580 |
| 2039 | 3,995,727 | 41,413 | 2721.3 | 0 | 138.96 | 112,697 | - | 5,755 | 118,452 |
| 2040 | - | 32,869 | 2721.3 | 0 | 138.96 | 89,446 | - | 4,567 | 94,014 |
| 2041 | - | 32,869 | 2721.3 | 0 | 138.96 | 89,446 | - | 4,567 | 94,014 |
| 2042 | - | 32,869 | 2721.3 | 0 | 138.96 | 89,446 | - | 4,567 | 94,014 |
| | | | | | | | | Average | 223,285 |
| | | | | | | | | Total | 4,688,979 |

**Fugitive emissions**

| | | | Emission factor (t $CO_2$-e/t ROM) | | | Emissions (t $CO_2$-e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | ROM coal (t) | - | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2023 | 8,900,000 | - | 0.061 | 0 | 0 | 542,900 | - | - | 542,900 |
| 2024 | 8,000,000 | - | 0.061 | 0 | 0 | 488,000 | - | - | 488,000 |
| 2025 | 8,000,000 | - | 0.061 | 0 | 0 | 488,000 | - | - | 488,000 |
| 2026 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2027 | 9,000,000 | - | 0.061 | 0 | 0 | 549,000 | - | - | 549,000 |
| 2028 | 9,100,000 | - | 0.061 | 0 | 0 | 555,100 | - | - | 555,100 |
| 2029 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2030 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2031 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2032 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2033 | 8,535,828 | - | 0.061 | 0 | 0 | 520,686 | - | - | 520,686 |
| 2034 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2035 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2036 | 8,600,000 | - | 0.061 | 0 | 0 | 524,600 | - | - | 524,600 |
| 2037 | 5,832,456 | - | 0.061 | 0 | 0 | 355,780 | - | - | 355,780 |
| 2038 | 4,300,000 | - | 0.061 | 0 | 0 | 262,300 | - | - | 262,300 |
| 2039 | 3,995,727 | - | 0.061 | 0 | 0 | 243,739 | - | - | 243,739 |
| 2040 | - | - | 0.061 | 0 | 0 | - | - | - | |
| 2041 | - | - | 0.061 | 0 | 0 | - | - | - | |
| 2042 | - | - | 0.061 | 0 | 0 | - | - | - | |
| | | | | | | | | Average | 484,828 |
| | | | | | | | | Total | 8,726,905 |

**Blasting emissions**

| | | | Emission factor (t CO2-e/t Explosives) | | | Emissions (t CO2-e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | ROM coal (t) | Explosives (t) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2023 | 8,900,000 | 28,480 | 0.17 | 0 | 0 | 4,842 | - | - | 4,842 |
| 2024 | 8,000,000 | 25,600 | 0.17 | 0 | 0 | 4,352 | - | - | 4,352 |
| 2025 | 8,000,000 | 25,600 | 0.17 | 0 | 0 | 4,352 | - | - | 4,352 |
| 2026 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2027 | 9,000,000 | 28,800 | 0.17 | 0 | 0 | 4,896 | - | - | 4,896 |
| 2028 | 9,100,000 | 29,120 | 0.17 | 0 | 0 | 4,950 | - | - | 4,950 |
| 2029 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2030 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2031 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2032 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2033 | 8,535,828 | 27,315 | 0.17 | 0 | 0 | 4,643 | - | - | 4,643 |
| 2034 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2035 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2036 | 8,600,000 | 27,520 | 0.17 | 0 | 0 | 4,678 | - | - | 4,678 |
| 2037 | 5,832,456 | 18,664 | 0.17 | 0 | 0 | 3,173 | - | - | 3,173 |
| 2038 | 4,300,000 | 13,760 | 0.17 | 0 | 0 | 2,339 | - | - | 2,339 |
| 2039 | 3,995,727 | 12,786 | 0.17 | 0 | 0 | 2,174 | - | - | 2,174 |
| 2040 | - | - | 0.17 | 0 | 0 | - | - | - | |
| 2041 | - | - | 0.17 | 0 | 0 | - | - | - | |
| 2042 | - | - | 0.17 | 0 | 0 | - | - | - | |
| | | | | | | | | Average | 4,324 |
| | | | | | | | | Total | 77,827 |

**Electricity usage**

| | | | Emission factor (kg CO2-e/kWh) | | | Emissions (t CO2-e/year) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | ROM coal (t) | Usage (kWh) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 8,600,000 | 80,458,750 | 0 | 0.81 | 0.09 | - | 65,172 | 7,241 | 72,413 |
| 2023 | 8,900,000 | 78,780,910 | 0 | 0.81 | 0.09 | - | 63,813 | 7,090 | 70,903 |
| 2024 | 8,000,000 | 71,219,350 | 0 | 0.81 | 0.09 | - | 57,688 | 6,410 | 64,097 |
| 2025 | 8,000,000 | 71,577,120 | 0 | 0.81 | 0.09 | - | 57,977 | 6,442 | 64,419 |
| 2026 | 8,600,000 | 74,830,420 | 0 | 0.81 | 0.09 | - | 60,613 | 6,735 | 67,347 |
| 2027 | 9,000,000 | 77,546,820 | 0 | 0.81 | 0.09 | - | 62,813 | 6,979 | 69,792 |
| 2028 | 9,100,000 | 78,292,070 | 0 | 0.81 | 0.09 | - | 63,417 | 7,046 | 70,463 |
| 2029 | 8,600,000 | 75,111,640 | 0 | 0.81 | 0.09 | - | 60,840 | 6,760 | 67,600 |
| 2030 | 8,600,000 | 74,077,150 | 0 | 0.81 | 0.09 | - | 60,002 | 6,667 | 66,669 |
| 2031 | 8,600,000 | 77,868,710 | 0 | 0.81 | 0.09 | - | 63,074 | 7,008 | 70,082 |
| 2032 | 8,600,000 | 76,921,560 | 0 | 0.81 | 0.09 | - | 62,306 | 6,923 | 69,229 |
| 2033 | 8,535,828 | 76,315,690 | 0 | 0.81 | 0.09 | - | 61,816 | 6,868 | 68,684 |
| 2034 | 8,600,000 | 79,439,720 | 0 | 0.81 | 0.09 | - | 64,346 | 7,150 | 71,496 |
| 2035 | 8,600,000 | 77,548,310 | 0 | 0.81 | 0.09 | - | 62,814 | 6,979 | 69,793 |
| 2036 | 8,600,000 | 77,256,830 | 0 | 0.81 | 0.09 | - | 62,578 | 6,953 | 69,531 |
| 2037 | 5,832,456 | 55,170,190 | 0 | 0.81 | 0.09 | - | 44,688 | 4,965 | 49,653 |
| 2038 | 4,300,000 | 48,723,440 | 0 | 0.81 | 0.09 | - | 39,466 | 4,385 | 43,851 |
| 2039 | 3,995,727 | 45,764,640 | 0 | 0.81 | 0.09 | - | 37,069 | 4,119 | 41,188 |
| 2040 | - | - | 0 | 0.81 | 0.09 | - | - | - | |
| 2041 | - | - | 0 | 0.81 | 0.09 | - | - | - | |
| 2042 | - | - | 0 | 0.81 | 0.09 | - | - | - | |
| | | | | | | | | Average | 64,845 |
| | | | | | | | | Total | 1,167,213 |

| Transport (Rail) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Factor | kg CO2-e/t.km | 0.03333 | DEFRA 2019 - Freighting goods - Freight train | | | | | | |
| Distance | km | 720 | Assumed distance to port (return) | | | | | | |
| | | | Emission factor (kg CO2-e/t) | | | Emissions (t CO2-e/year) | | | |
| Year | Product coal (t) | - | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 7,671,013 | - | 0 | 0 | 24.00 | - | - | 184,086 | 184,086 |
| 2023 | 8,057,277 | - | 0 | 0 | 24.00 | - | - | 193,355 | 193,355 |
| 2024 | 7,334,997 | - | 0 | 0 | 24.00 | - | - | 176,022 | 176,022 |
| 2025 | 7,286,685 | - | 0 | 0 | 24.00 | - | - | 174,863 | 174,863 |
| 2026 | 7,907,905 | - | 0 | 0 | 24.00 | - | - | 189,771 | 189,771 |
| 2027 | 8,503,659 | - | 0 | 0 | 24.00 | - | - | 204,067 | 204,067 |
| 2028 | 8,482,325 | - | 0 | 0 | 24.00 | - | - | 203,555 | 203,555 |
| 2029 | 8,069,765 | - | 0 | 0 | 24.00 | - | - | 193,655 | 193,655 |
| 2030 | 7,784,392 | - | 0 | 0 | 24.00 | - | - | 186,807 | 186,807 |
| 2031 | 8,100,348 | - | 0 | 0 | 24.00 | - | - | 194,389 | 194,389 |
| 2032 | 7,947,098 | - | 0 | 0 | 24.00 | - | - | 190,711 | 190,711 |
| 2033 | 7,903,283 | - | 0 | 0 | 24.00 | - | - | 189,660 | 189,660 |
| 2034 | 7,951,451 | - | 0 | 0 | 24.00 | - | - | 190,816 | 190,816 |
| 2035 | 7,988,806 | - | 0 | 0 | 24.00 | - | - | 191,712 | 191,712 |
| 2036 | 7,830,013 | - | 0 | 0 | 24.00 | - | - | 187,902 | 187,902 |
| 2037 | 5,422,690 | - | 0 | 0 | 24.00 | - | - | 130,132 | 130,132 |
| 2038 | 4,258,549 | - | 0 | 0 | 24.00 | - | - | 102,195 | 102,195 |
| 2039 | 3,682,703 | - | 0 | 0 | 24.00 | - | - | 88,376 | 88,376 |
| 2040 | - | - | 0 | 0 | 24.00 | - | - | - | |
| 2041 | - | - | 0 | 0 | 24.00 | - | - | - | |
| 2042 | - | - | 0 | 0 | 24.00 | - | - | - | |
| | | | | | | | | Average | 176,226 |
| | | | | | | | | Total | 3,172,074 |

| Transport (Shipping) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Factor | kg CO2-e/t.km | 0.00354 | DEFRA 2019 - Freighting goods - Cargo ship, bulk carrier, average | | | | | | |
| Distance | km | 8000 | Assumed distance to market | | | | | | |
| | | | Emission factor (kg CO2-e/t) | | | Emissions (t CO2-e/year) | | | |
| Year | Product coal (t) | - | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total |
| 2022 | 7,671,013 | - | 0 | 0 | 28.31 | - | - | 217,182 | 217,182 |
| 2023 | 8,057,277 | - | 0 | 0 | 28.31 | - | - | 228,118 | 228,118 |
| 2024 | 7,334,997 | - | 0 | 0 | 28.31 | - | - | 207,668 | 207,668 |
| 2025 | 7,286,685 | - | 0 | 0 | 28.31 | - | - | 206,301 | 206,301 |
| 2026 | 7,907,905 | - | 0 | 0 | 28.31 | - | - | 223,889 | 223,889 |
| 2027 | 8,503,659 | - | 0 | 0 | 28.31 | - | - | 240,756 | 240,756 |
| 2028 | 8,482,325 | - | 0 | 0 | 28.31 | - | - | 240,152 | 240,152 |
| 2029 | 8,069,765 | - | 0 | 0 | 28.31 | - | - | 228,471 | 228,471 |
| 2030 | 7,784,392 | - | 0 | 0 | 28.31 | - | - | 220,392 | 220,392 |
| 2031 | 8,100,348 | - | 0 | 0 | 28.31 | - | - | 229,337 | 229,337 |
| 2032 | 7,947,098 | - | 0 | 0 | 28.31 | - | - | 224,998 | 224,998 |
| 2033 | 7,903,283 | - | 0 | 0 | 28.31 | - | - | 223,758 | 223,758 |
| 2034 | 7,951,451 | - | 0 | 0 | 28.31 | - | - | 225,121 | 225,121 |
| 2035 | 7,988,806 | - | 0 | 0 | 28.31 | - | - | 226,179 | 226,179 |
| 2036 | 7,830,013 | - | 0 | 0 | 28.31 | - | - | 221,683 | 221,683 |
| 2037 | 5,422,690 | - | 0 | 0 | 28.31 | - | - | 153,527 | 153,527 |
| 2038 | 4,258,549 | - | 0 | 0 | 28.31 | - | - | 120,568 | 120,568 |
| 2039 | 3,682,703 | - | 0 | 0 | 28.31 | - | - | 104,265 | 104,265 |
| 2040 | - | - | 0 | 0 | 28.31 | - | - | - | |
| 2041 | - | - | 0 | 0 | 28.31 | - | - | - | |
| 2042 | - | - | 0 | 0 | 28.31 | - | - | - | |
| | | | | | | | | Average | 207,909 |
| | | | | | | | | Total | 3,742,364 |

| Energy Production | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emission factor (kg CO2-e/t) | | | Emissions (t CO2-e/year) | | | | |
| Year | Product coal (t) | Thermal coal (t) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total | Thermal % |
| 2022 | 7,671,013 | 4,052,479 | 0 | 0 | 2436.48 | - | - | 9,873,783 | 9,873,783 | 53% |
| 2023 | 8,057,277 | 3,891,685 | 0 | 0 | 2436.48 | - | - | 9,482,012 | 9,482,012 | 48% |
| 2024 | 7,334,997 | 4,020,546 | 0 | 0 | 2436.48 | - | - | 9,795,981 | 9,795,981 | 55% |
| 2025 | 7,286,685 | 4,219,134 | 0 | 0 | 2436.48 | - | - | 10,279,835 | 10,279,835 | 58% |
| 2026 | 7,907,905 | 5,157,981 | 0 | 0 | 2436.48 | - | - | 12,567,318 | 12,567,318 | 65% |
| 2027 | 8,503,659 | 5,776,410 | 0 | 0 | 2436.48 | - | - | 14,074,107 | 14,074,107 | 68% |
| 2028 | 8,482,325 | 6,391,998 | 0 | 0 | 2436.48 | - | - | 15,573,976 | 15,573,976 | 75% |
| 2029 | 8,069,765 | 4,815,860 | 0 | 0 | 2436.48 | - | - | 11,733,746 | 11,733,746 | 60% |
| 2030 | 7,784,392 | 5,107,569 | 0 | 0 | 2436.48 | - | - | 12,444,491 | 12,444,491 | 66% |
| 2031 | 8,100,348 | 5,695,432 | 0 | 0 | 2436.48 | - | - | 13,876,807 | 13,876,807 | 70% |
| 2032 | 7,947,098 | 5,429,067 | 0 | 0 | 2436.48 | - | - | 13,227,813 | 13,227,813 | 68% |
| 2033 | 7,903,283 | 6,308,446 | 0 | 0 | 2436.48 | - | - | 15,370,402 | 15,370,402 | 80% |
| 2034 | 7,951,451 | 6,836,107 | 0 | 0 | 2436.48 | - | - | 16,656,038 | 16,656,038 | 86% |
| 2035 | 7,988,806 | 6,549,229 | 0 | 0 | 2436.48 | - | - | 15,957,066 | 15,957,066 | 82% |
| 2036 | 7,830,013 | 4,538,587 | 0 | 0 | 2436.48 | - | - | 11,058,177 | 11,058,177 | 58% |
| 2037 | 5,422,690 | 3,015,721 | 0 | 0 | 2436.48 | - | - | 7,347,743 | 7,347,743 | 56% |
| 2038 | 4,258,549 | 1,169,679 | 0 | 0 | 2436.48 | - | - | 2,849,899 | 2,849,899 | 27% |
| 2039 | 3,682,703 | 1,875,358 | 0 | 0 | 2436.48 | - | - | 4,569,272 | 4,569,272 | 51% |
| 2040 | - | - | 0 | 0 | 2436.48 | - | - | - | | |
| 2041 | - | - | 0 | 0 | 2436.48 | - | - | - | | |
| 2042 | - | - | 0 | 0 | 2436.48 | - | - | - | | |
| | | | | | | | | Average | 11,485,470 | |
| | | | | | | | | Total | 206,738,466 | |

| Coking coal use | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Emission factor (kg CO2-e/t) | | | Emissions (t CO2-e/year) | | | | |
| Year | Product coal (t) | Coking coal (t) | Scope 1 | Scope 2 | Scope 3 | Scope 1 | Scope 2 | Scope 3 | Total | Coking coal % |
| 2022 | 7,671,013 | 3,618,534 | 0 | 0 | 2760.9 | - | - | 9,990,412 | 9,990,412 | 47% |
| 2023 | 8,057,277 | 4,165,592 | 0 | 0 | 2760.9 | - | - | 11,500,784 | 11,500,784 | 52% |
| 2024 | 7,334,997 | 3,314,451 | 0 | 0 | 2760.9 | - | - | 9,150,866 | 9,150,866 | 45% |
| 2025 | 7,286,685 | 3,067,551 | 0 | 0 | 2760.9 | - | - | 8,469,202 | 8,469,202 | 42% |
| 2026 | 7,907,905 | 2,749,924 | 0 | 0 | 2760.9 | - | - | 7,592,264 | 7,592,264 | 35% |
| 2027 | 8,503,659 | 2,727,249 | 0 | 0 | 2760.9 | - | - | 7,529,662 | 7,529,662 | 32% |
| 2028 | 8,482,325 | 2,090,327 | 0 | 0 | 2760.9 | - | - | 5,771,183 | 5,771,183 | 25% |
| 2029 | 8,069,765 | 3,253,905 | 0 | 0 | 2760.9 | - | - | 8,983,707 | 8,983,707 | 40% |
| 2030 | 7,784,392 | 2,676,823 | 0 | 0 | 2760.9 | - | - | 7,390,439 | 7,390,439 | 34% |
| 2031 | 8,100,348 | 2,404,916 | 0 | 0 | 2760.9 | - | - | 6,639,732 | 6,639,732 | 30% |
| 2032 | 7,947,098 | 2,518,031 | 0 | 0 | 2760.9 | - | - | 6,952,032 | 6,952,032 | 32% |
| 2033 | 7,903,283 | 1,594,837 | 0 | 0 | 2760.9 | - | - | 4,403,186 | 4,403,186 | 20% |
| 2034 | 7,951,451 | 1,115,344 | 0 | 0 | 2760.9 | - | - | 3,079,353 | 3,079,353 | 14% |
| 2035 | 7,988,806 | 1,439,577 | 0 | 0 | 2760.9 | - | - | 3,974,528 | 3,974,528 | 18% |
| 2036 | 7,830,013 | 3,291,426 | 0 | 0 | 2760.9 | - | - | 9,087,298 | 9,087,298 | 42% |
| 2037 | 5,422,690 | 2,406,969 | 0 | 0 | 2760.9 | - | - | 6,645,402 | 6,645,402 | 44% |
| 2038 | 4,258,549 | 3,088,870 | 0 | 0 | 2760.9 | - | - | 8,528,062 | 8,528,062 | 73% |
| 2039 | 3,682,703 | 1,807,345 | 0 | 0 | 2760.9 | - | - | 4,989,899 | 4,989,899 | 49% |
| 2040 | - | - | 0 | 0 | 2760.9 | - | - | - | - | |
| 2041 | - | - | 0 | 0 | 2760.9 | - | - | - | - | |
| 2042 | - | - | 0 | 0 | 2760.9 | - | - | - | - | |
| | | | | | | | | Average | 7,259,889 | |
| | | | | | | | | Total | 130,678,011 | |