Jellinbah Group

LAKE VERMONT MEADOWBROOK PROJECT ENVIRONMENTAL IMPACT STATEMENT

CHAPTER 13 AIR QUALITY

aarc ENVIRONMENTAL SOLUTIONS

Table of Contents

List of Figures

List of Tables

13 Air Quality

13.1 Environmental objectives and performance outcomes

This chapter has been prepared to assist the DES in carrying out their environmental objective assessment in respect of the following environmental objective prescribed in the Project ToR:

The activity will be operated in a way that protects the environmental values of air.

The Project seeks to achieve the environmental objective by operating in a way that achieves all of the following:

- fugitive emissions of contaminants from storage, handling and processing of materials and transporting materials within the site are prevented or minimised;
- contingency measures will prevent or minimise adverse effects on the environment from unplanned emissions and shutdown and start up emissions of contaminants to air; and.
- releases of contaminants to the atmosphere for dispersion will be managed to prevent or minimise adverse effects on environmental values.

The environmental objective will be met through implementation of updated mitigation and management activities to address air quality. These will be detailed in section 13.5.

An air quality and greenhouse gas (GHG) assessment has been conducted for the Project by Katestone Environmental Pty Ltd (2022) and is presented as Appendix L, Air and GHG Assessment (Section 3). The Air and GHG Assessment has been prepared in consideration of the:

- *Environmental Protection Act 1994* (Qld);
- EP Regulation 2019 (Qld);
- Environmental Protection (Air) Policy 2019;
- EIS Guideline–Air (DES 2020i); and
- Guideline: Application requirements for activities with impacts to air (DES 2021f).

13.1.1 Air quality assessment terminology

The Environmental Protection (Air) Policy 2019 (Qld) (EPP Air) and the 'EIS Guideline–Air (DES 2020i)' provide definitions of key terms relating to air quality and GHG assessments. An overview of the terms essential to the technical interpretation of this chapter is provided below, including the indicators used to measure, model and assess the impacts of air.

TSP	total suspended particles means particles in the air environment with an equivalent aerodynamic diameter of less than 100 microns.
PM_{10}	means particles in the air environment with an equivalent aerodynamic diameter of not more than 10 microns.
$PM_{2.5}$	means particles in the air environment with an equivalent aerodynamic diameter of not more than 2.5 microns.
$\mu g/m^3$	means micrograms per cubic metre at zero degrees Celsius and an atmospheric pressure of 1.
Scope 1	emissions from sources that are owned or directly controlled by the organisation. Scope 1 emissions for coal projects will include fugitive coal seam methane vented or released during

mining, as well as emissions directly resulting from the project's activities, such as transportation of product and consumables.

Scope 2 — emissions from the consumption of purchased electricity, steam or other sources of energy (e.g. chilled water) generated upstream from the organisation. Scope 2 emissions for any type of project will include energy (e.g. electricity) used by the project but generated by other entities.

Scope 3 — emissions that are a consequence of the operations of an organisation but are not directly owned or controlled by the organisation. Scope 3 emissions will include indirect sources such as employee commuting, business travel, third-party distribution and logistics and the production of purchased goods.

CO_2-e — carbon dioxide equivalent is a measure used to compare the emissions of a particular greenhouse gas to carbon dioxide based on its global warming potential over a specified timeframe. For example, the global warming potential for methane compared to carbon dioxide over 100 years is 21, so the carbon dioxide equivalent of one tonne of methane is 21 tCO_2-e.

13.1.2 Air quality criteria

Schedule 1 of the EPP (Air) sets out air quality objectives for Queensland. The relevant air quality objectives for the Project are summarised in Table 13.1.

Table 13.1: Project objectives

Pollutant	**Environmental value (**Appendix L**)**	**Averaging period**	**Air quality objectives**	**Source**
TSP	Health and wellbeing	Annual	90 ($\mu g/m^3$)	EPP (Air)
PM_{10}	Health and wellbeing	24-hour	50 ($\mu g/m^3$)	EPP (Air)
		Annual	25 ($\mu g/m^3$)	EPP (Air)
$PM_{2.5}$	Health and wellbeing	24-hour	25 ($\mu g/m^3$)	EPP (Air)
		Annual	8 ($\mu g/m^3$)	EPP (Air)
Dust Deposition	Amenity	1-month	120 ($\mu g/m^3$)	DES (2017b)

13.1.2.1 Suspended dust particulates

During the life of the Project, mining activities will have the potential to generate particulate matter (e.g. dust) emissions through mining operations, transportation and processing. Generated particulate matter can occur in the form of the following:

- total suspended particulate (TSP) matter;
- particulate matter with an equivalent aerodynamic diameter of 10 µm or less (PM_{10}) (a subset of TSP); and
- particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) (a subset of TSP and PM_{10}).

13.1.2.2 Dust deposition

There are no air quality objectives prescribed in the EPP (Air) for deposited dust. However, the DES guideline, 'Application requirements for activities with impacts to air' (DES 2021f) indicates that when monitored in accordance with 'AS 3580.10.1—Methods for sampling and analysis of ambient air—Determination of

Particulates—Deposited Matter—Gravimetric method of 2016' (Standards Australia 2016), a dust deposition limit of 120 mg/m^2/day averaged over one month is commonly used in Queensland.

Dust deposition is mostly associated with dust nuisance or amenity impacts in residential areas. Elevated dust deposition rates can reduce public amenity by soiling of clothes, buildings and other surfaces in the area (Appendix L, Air Quality and GHG Assessment, Section 3.1).

13.1.2.3 Other pollutants

The main air pollutant from mining activities is particulates (dust). Emissions of other air pollutants will also arise from mining operations associated with diesel-powered equipment and blasting and include carbon monoxide (CO), oxides of nitrogen (NO_x) and other pollutants, such as sulphur dioxide (SO_2). However, in mining operations that apply standard control measures the emission of other pollutants will be transient in nature and likely to have negligible impact outside of the active working areas of the Project site. Other pollutants will have substantially less air quality impact than particulates and therefore the impacts of particulates were assessed as the critical air pollutant and for determining compliance conditions, cognisant that compliance for particulates is expected to also achieve compliance with air quality standards for other pollutants (Appendix L, Air Quality and GHG Assessment, Section 3.1).

13.1.2.4 Spontaneous combustion

Coal and coal waste materials can potentially present risk of spontaneous combustion and cause resultant impacts to air quality. The risks of spontaneous combustion will be managed within waste management and hazards and safety management frameworks, which will also achieve outcomes for the benefit of prevention of air quality impacts. The Project will operate a ROM coal stockpile within the MIA and transport coal to the existing Lake Vermont Mine for processing and handling. The ROM coal stockpile will be managed through the on-site communication systems and according to hazards and safety procedures which will include measures to monitor for and minimise risk of spontaneous combustion. Once transported to the existing Lake Vermont Mine, coal will be processed and handled through existing Lake Vermont Mine systems with protocols designed for safe handling including the prevention of spontaneous combustion. The management of coal waste material, which includes measures to reduce risk attributes of undesirable outcomes including spontaneous combustion, are described in Chapter 15, Waste Management and Chapter 6, Rehabilitation. The key elements of an emergency response to spontaneous combustion are described in Chapter 16, Hazards and Safety.

These management measures are considered sufficient to adequately manage potential impacts to air quality from spontaneous combustion.

13.1.2.5 Odour

The Lake Vermont Mine has not recorded odour impacts in the past. A spontaneous combustion event could contribute to odour emissions, however management measures for risk of spontaneous combustion are considered sufficient to avoid combustion events resulting in odour impacts (section 13.1.2.4).

Odour impacts from ventilation of underground air was assessed within the Air Quality and GHG Assessment, Appendix L, Section 3.1. The Project will ventilate air from the underground workings and ventilated air can have potential for odour impacts however the odour impact assessment concluded that underground air ventilation from the Project is unlikely to cause elevated odour levels and no management measures are considered necessary for odours.

13.2 Existing air environment

Environmental values to be enhanced or protected under EPP (Air) are those that are conducive to protecting:

- the health and biodiversity of ecosystems;
- human health and wellbeing;

- the aesthetics of the environment, including the appearance of buildings, structures and other property; and
- agricultural use of the environment.

Impacts on these values have been considered within the assessment of impacts to air, resultant of the proposed Project.

13.2.1 Local topography and climate

The Project is approximately 25 km north-east of Dysart, in a rural area surrounded by grazing and cropping land use. Several coal mines operate in the vicinity of the Project, including the Saraji Mine directly to the west and Peak Downs Coal Mine to the north-west.

The local topography of the Project site is relatively flat and approximately 155 mAHD above sea level. Elevation gradually decreases to the east, while to the west (beyond the Saraji Mine), hills reach peak elevations of 470 mAHD (Figure 13.1).

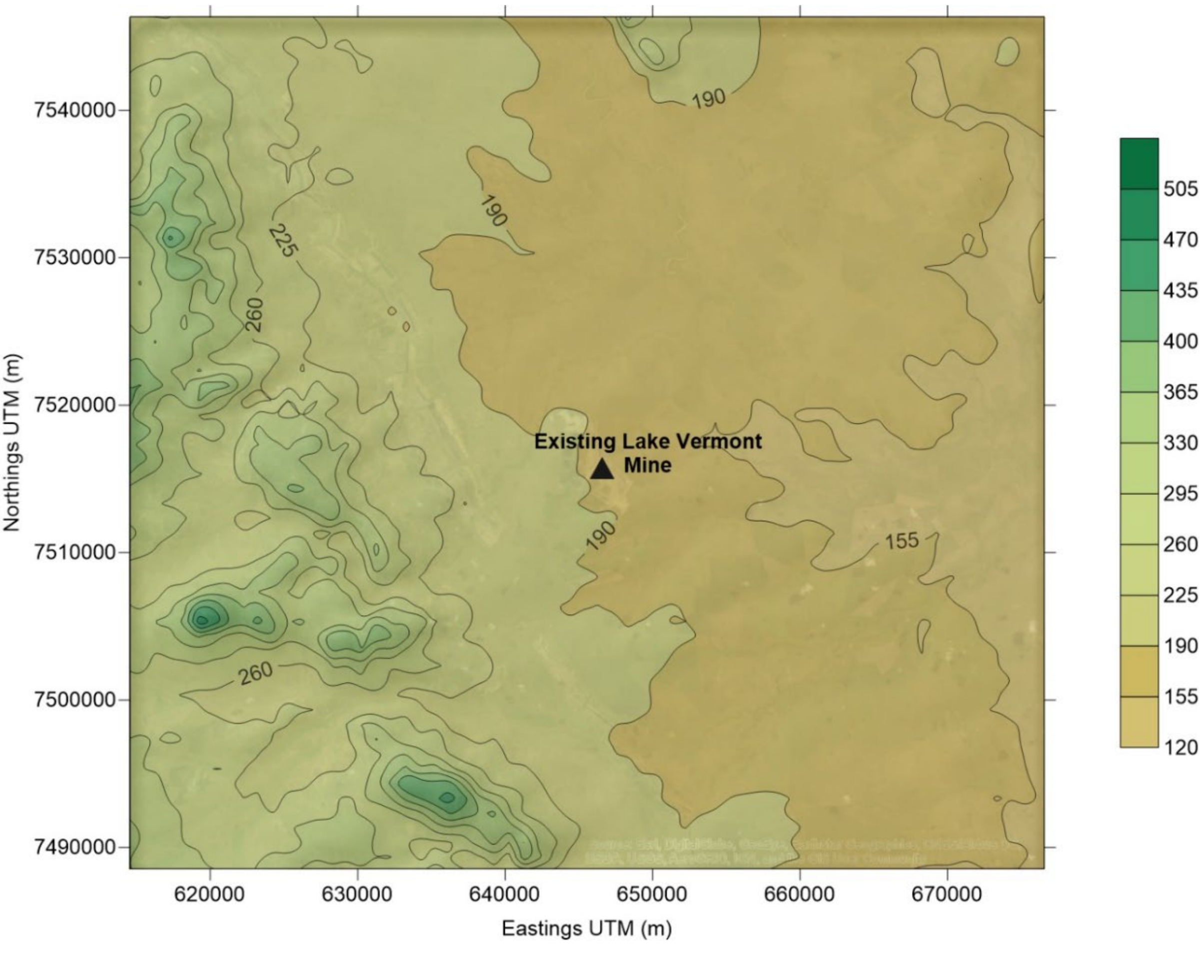

Figure 13.1: Surrounding terrain in the Project area

Climate and local topography can influence dispersion of air pollutants in the surrounding environment. Parameters that are important for the generation and dispersion of air pollutants, such as dust, include:

- wind speed and wind direction;
- atmospheric stability; and
- mixing height.

Climate for the Project region is further described in Chapter 4, Climate.

13.2.2 Atmospheric conditions

13.2.2.1 Wind speed and direction

Wind is a critical influencer of dust emissions in terms of wind speed and wind direction. The closest BoM weather station with continuous monitoring of wind is Moranbah Airport (Figure 13.2). Annual observational data from the Moranbah BoM weather station has been compared to meteorological data from the TAPM/CALMET model at a location indicative of the Project. Predicted wind characteristics are representative of conditions in the region, as outlined in the validation comparison (Appendix L, Air Quality and GHG Assessment, Section 3.3).

Modelled analysis of annual, seasonal, and diurnal wind speed and wind direction has been completed in Appendix L (Air Quality and GHG Assessment, Section 3.3). Seasonal wind roses show that during spring and summer, winds are predominantly from the east and shift towards predominant south-east to south winds during autumn and winter. Wind speed is consistent seasonally with little variation remaining between 2 m/s and 3 m/s. Diurnal wind roses show that late evening and night-time winds (6 pm to 6 am) are predominantly light to moderate and from the north-east to south-east, reducing in strength during the early hours of the morning. Winds during the day (6 am to 6 pm) are predominantly from the east to south-east and between 2 m/s and 7 m/s, with the strongest winds occurring during the afternoon (Appendix L, Air Quality and GHG Assessment, Section 3.3).

Overall, wind direction is predominately from the south-east and occurs minimally from the north-west and south-west. Analysis of the wind speed and wind direction at the site shows that winds are predominantly light to moderate, between 1 m/s and 7 m/s. Annual predicted mean wind speed is 2.81 m/s (Figure 13.3).

13.2.2.2 Atmospheric stability

Atmospheric stability refers to the vertical movement of the atmosphere and is an important factor in the dispersion and transport of a plume within a boundary layer (Appendix L, Air Quality and GHG Assessment, Section 3.3). Day-time conditions range from neutral to unstable as a result of solar heating of the ground inducing turbulent mixing in the atmosphere. Six classes of atmospheric stability are commonly identified using the Pasquil-Gifford scheme:

1) Class A: Extremely unstable conditions, typically on a sunny day (clear skies and warmer temperatures);
2) Class B: Unstable conditions, clear skies, day-time temperatures;
3) Class C: Slightly unstable conditions, moderate winds, slightly overcast and day-time temperatures;
4) Class D: Neutral conditions, cloudy overcast, moderate winds during either day-time or night-time;
5) Class E: Slightly stable conditions, cloudy overcast at night-time; and
6) Class F: Stable conditions, typically occurring during light wind conditions at night.

Stability class is calculated for the Project site (Appendix L, Air Quality and GHG Assessment, Section 3.3), as shown in Table 13.2, which indicates the distribution of stability classes. Figure 13.4 shows the distribution of stability classes predicted at the site by hour of the day.

Table 13.2: Frequency distribution of surface atmospheric stability conditions

Pasquil-Gifford Stability Class	Frequency %
A	1.4
B	6.5
C	12.5
D	41.2
E	9.8
F	28.6

13.2.2.3 Mixing height

Appendix L (Air Quality and GHG Assessment, Section 3.3) describes mixing height as the height of the mixed atmosphere above the ground (mixed layer), which varies diurnally. Air pollutants released at or near the ground will become dispersed within the mixed layer. During stable atmospheric conditions, the mixing height is often quite low and particulate dispersion is limited to within this layer. During the day, solar radiation heats the ground and causes the air above it to warm, resulting in convection and an increase in the mixing height. The growth of the mixing height is dependent on how well the warmer air from the ground can mix with the cooler upper-level air and, therefore, depends on meteorological factors, such as the intensity of solar radiation and wind speed. During strong winds, the air will be well mixed, resulting in an elevated mixing height (Appendix L, Air Quality and GHG Assessment, Section 3.3).

Mixing height information for the Project is presented in Figure 13.5. The data shows that the mixing height develops at around 6 am and increases to a peak around 2 pm to 3 pm before descending rapidly between 4 pm and 5 pm (Appendix L, Air Quality and GHG Assessment, Section 3.3).

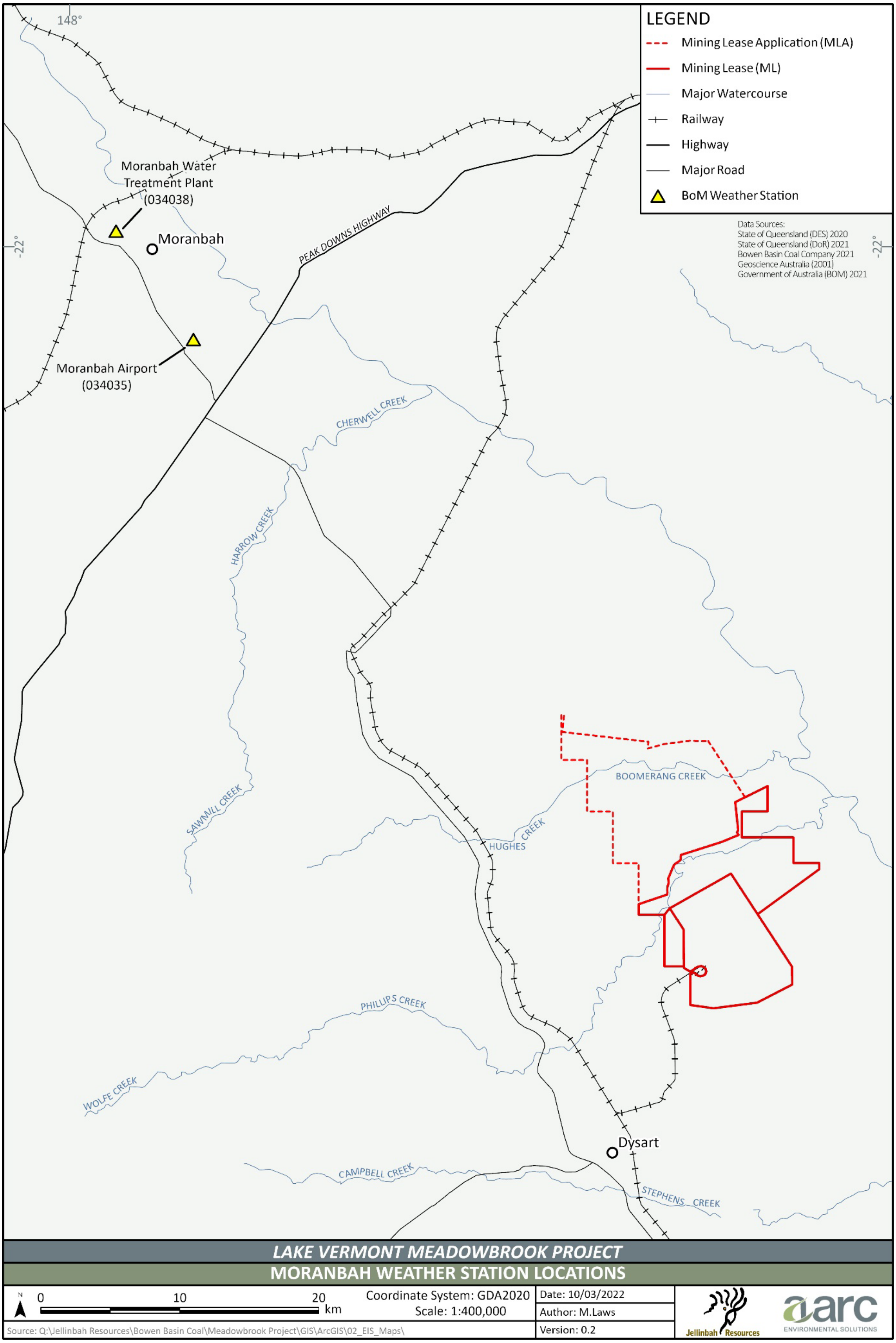

Figure 13.2: Moranbah weather stations

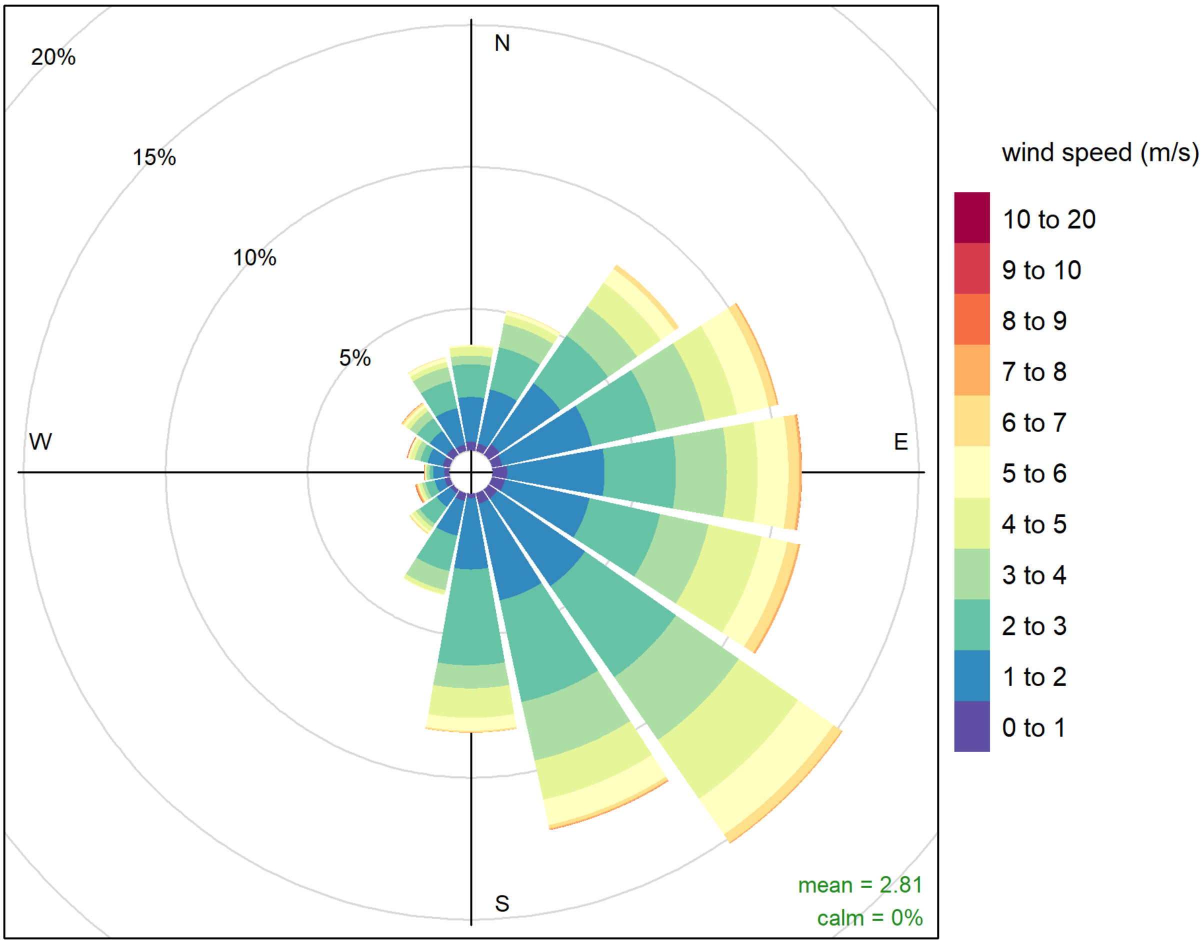

Figure 13.3: Annual distribution of the TAPM/CALMET generated winds for the Project site

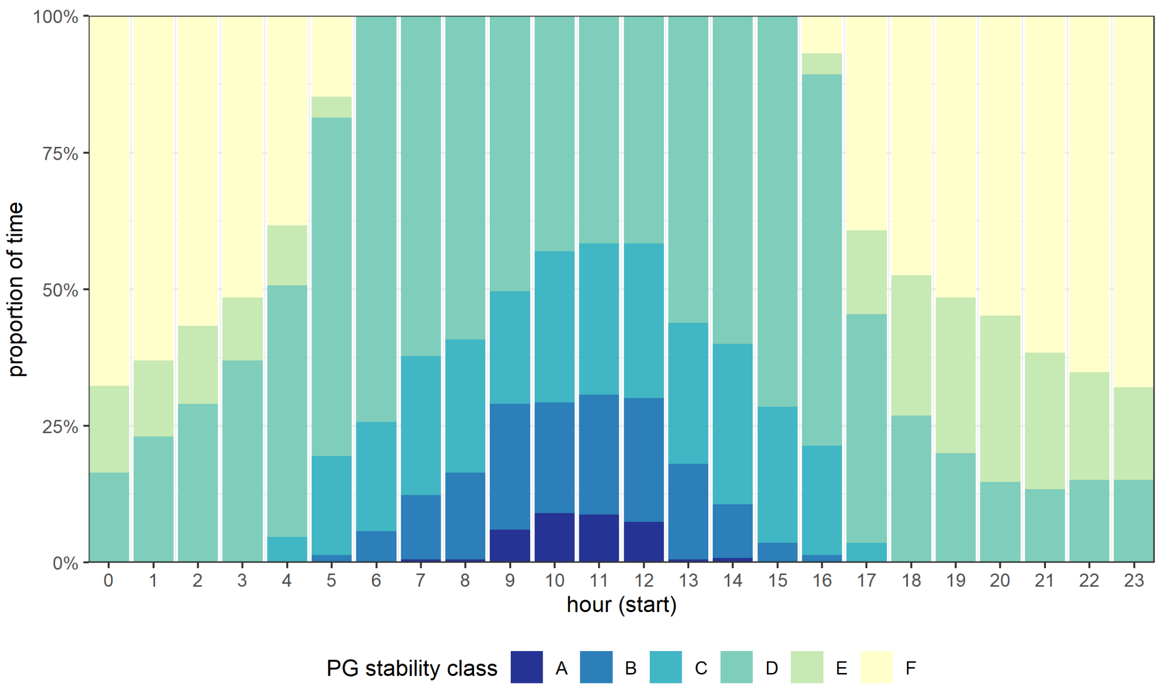

Figure 13.4: Proportion of stability class by hour of day

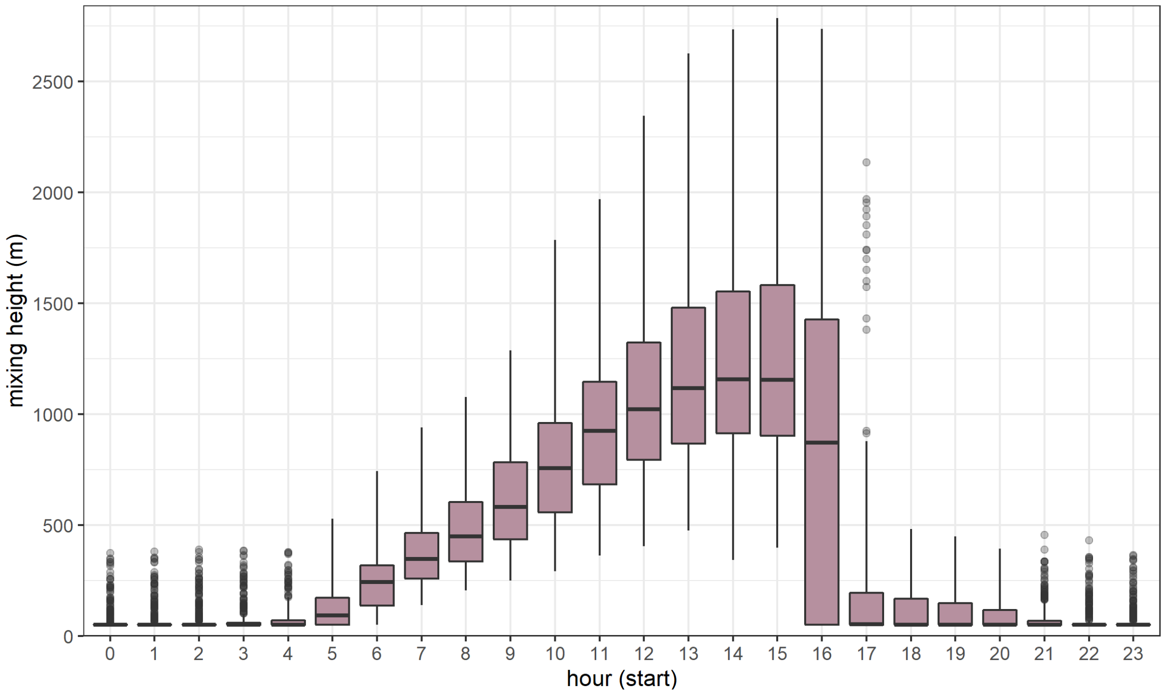

Figure 13.5: Box and whisker plot of mixing height data at the Project by hour of day

13.2.3 Sensitive receptors

Potential sensitive Receptors (SRs) identified in the vicinity of the Project are provided in Table 13.3, with locations shown in Figure 13.6. The SRs comprise rural dwellings and a commercial (mining) operation.

Of the potential SRs identified for the Project (as shown in Table 13.3) the potential receptors R5 (Meadowbrook Homestead), R6 (Lake Vermont Homestead), and the proposed Saraji East construction village (all owned by BMA) are subject to special conditions which limit their applicability for consideration as sensitive receptors. The Project Proponent has entered into a 'Co-existence Agreement' with BMA that, among other things, provides for the following:

- BMA and Bowen Basin Coal agree as to how the Saraji East Project and the Project may co-exist and how each party may assist, or at least not hinder, the development of the other party's project.
- BMA acknowledges and agrees that the Saraji East Project is adjacent to the Project and Bowen Basin Coal will be engaging in mining operations and/or associated activities in relation to the Project.
- BMA further expressly acknowledges and agrees that BMA shall make no objection or claim for compensation in relation to any nuisance to BMA's Saraji East Project (including, without limiting the generality of the foregoing, any accommodation, villages or camps for BMA's workers) caused by Bowen Basin Coal's mining operations and/or associated activities in relation to the Project (including, without limiting the generality of the foregoing, any noise, vibration, dust or light).
- BMA and Bowen Basin Coal acknowledge and agree that they will each use their reasonable endeavours and negotiate in good faith to resolve any disputes which may arise between the parties in relation to the Saraji East Project and the Project.
- The co-existence agreement has no completion date and will endure for the life of the Projects.

As a result of the above, BMA has confirmed its position that no specific regulator assessment and/or conditioning is required in relation to the LVM Project Environmental Authority application and any LVM Project interaction with the potential future Saraji East Project BMA village.

Table 13.3: Sensitive receptors

Receptor ID	Receptor type	Description	Easting (m)	Northing (m)	Distance and direction from the Project[1]
R1	Residential	Pownalls	653025.00	7512686.00	18.11 km north-west
R2	Residential	Seloh Nolem 1	652696.00	7532404.00	15.2 km south-west
R3	Residential	Old Kyewong	646743.00	7509949.00	16.49 km north-west
R4	Residential	Mockingbird Downs	652135.00	7513934.00	16.62 km west
R5	Residential	Meadowbrook Homestead[2]	638086.00	7520400.00	4.62 km north-east
R6	Residential	Lake Vermont Homestead[2]	640116.00	7516958.00	7.85 km north-east
R7	Residential	Willunga	666958.00	7529954.00	27.89 km west
R8	Residential	Leichardt	656328.00	7515670.00	19.09 km west
R9	Residential	Seloh Nolem 2	652770.00	7533482.00	15.83 km south-west
R10	Residential	Old Bombandy	657506.00	7516682.00	29.11 km west
R11	Residential	Vermont Park	647231.00	7537824.00	15.14 km south
R12	Residential	Saraji Homestead 1	629573.71	7519126.55	11.47 km east
R13	Residential	Saraji Homestead 3	630689.29	7522987.44	9.04 km east
R14	Commercial	BMA Saraji	631499.99	7520239.06	9.25 km east
R15	Residential	Iffley	647326.04	7539855.65	16.96 km south
R16	Residential	Tay Glen	635321.52	7509100.99	16.25 km north-east
R17	Residential	Semple Residence	649876.37	7506696.69	20.83 km north-west
R18	Residential	Saraji Homestead 2	630424.00	7523432.00	9.23 km east
n/a	Commercial	Proposed Saraji East Construction Village	636968.00	7526588.00	3.15 km east

[1] Distance and directions provided are from the centre point of the Project MIA.
[2] Meadowbrook and Lake Vermont homesteads are owned by BMA, with Meadowbrook unoccupied.

Meadowbrook Homestead is currently uninhabited, and BMA has confirmed it will not be used as a residence in the future. The Lake Vermont homestead is currently occupied by a tenant of BMA, with appropriate agreements in place with the residents to acknowledge adjacent mining impacts.

13.2.4 Regional air quality

The existing Lake Vermont Mine and the existing Saraji Mine represent the main sources of anthropogenic dust in the local region. Several other surrounding coal mines have also been identified as potential contributors to ambient dust concentrations. PM_{10} and $PM_{2.5}$ dust emissions from surrounding coal mines that have been reported to the National Pollutant Inventory (NPI) database for 2019/20 are included in Table 13.4 (Appendix L, Air Quality and GHG Assessment, Section 3.3).

Existing ambient air quality has been derived from publicly available data. Long-term, continuous monitoring data for dust deposition, PM_{10} and $PM_{2.5}$ is available from two DES monitoring stations in the township of Moranbah (approximately 58 km north-west of the Project site). These monitoring stations include Moranbah East in Utah Drive and Moranbah West in Cunningham Way. Due to the Moranbah West Station only commencing in July 2020, data available from this station has not been utilised for the assessments for PM_{10} and $PM_{2.5}$.

The Moranbah East weather station was the closest accessible monitoring station to the Project with long term (10 year) monitoring data. The Moranbah East station is situated within 10 km of the Isaac Plains coal mine, and within 18 km of the Peak Downs Coal Mine. Due to the location of the monitoring station and proximity to other similar mining projects, it was considered a suitable reference monitoring point. This monitoring station is near several established mines (Figure 13.7) and therefore the data provides a conservative reference baseline considering the location Project area is comparatively unimpacted by potential cumulative dust impacts.

Moranbah East PM_{10} data shows (particularly in the years 2012, 2018, and 2019) many concentrations greater than 50 µg/m (being the EPP Air objective, as shown in Table 13.1). Monthly monitoring reports issued by DES indicate this is resultant of several influences, including nearby housing construction, bushfires and dust storms. The highest 70th percentile value over the range of years monitored has been adopted for ambient background concentrations for cumulative air quality assessments on the basis that it is an appropriate criterion against which the results of the air quality monitoring could be compared. It was used to reduce the incidence of extreme isolated events on otherwise typical days that may contribute to biased or inaccurate results.

The Moranbah East Station also recorded $PM_{2.5}$ concentrations greater than the 24-hour and annual averaging objectives (Table 13.1) in 2019 and 2020, again influenced by nearby housing construction, bushfires and dust storms (Appendix L, Air Quality and GHG Assessment, Section 3.3).

Ambient background concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition are summarised in Table 13.5:. Background levels of PM_{10} and $PM_{2.5}$ are calculated based on publicly available information from Moranbah East Station (Appendix L, Air Quality and GHG Assessment, Section 3.3). Dust deposition is calculated using 18 months of validated data from Moranbah East Station. The maximum rolling annual average is calculated at 79.4 mg/m^2/day against a relevant objective of 120 $µg/m^3$ (Table 13.1).

Monitoring for TSP is not conducted at the DES Moranbah sites. TSP was, therefore, calculated from DES Moranbah PM_{10} data, using TSP/ PM_{10} ratios found in the NPI EET Manual (DCCEEW 2012), using emission factors for fugitive dust that range from 25% to 52%. An annual TSP concentration was calculated at 44.2 $µg/m^3$, against the relevant objective of 90 $µg/m^3$ (Table 13.5).

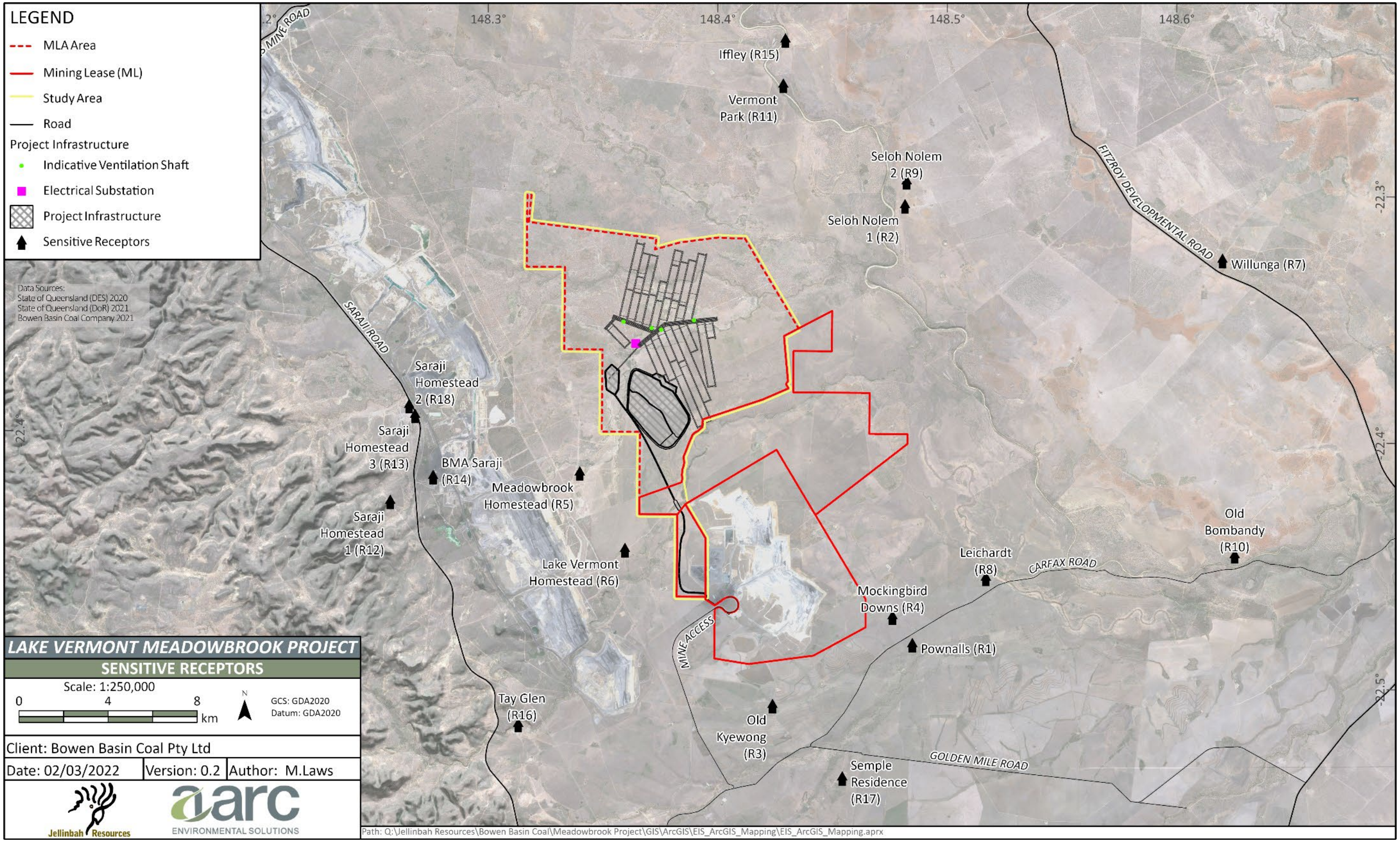

Figure 13.6: Sensitive receptors

Table 13.4: Dust emissions reported to NPI for 2019/2020

Mine sites	Approximate location from the Project boundary	PM_{10} (tonnes/year)	$PM_{2.5}$ (tonnes/year)
Lake Vermont Mine	6 km south	9,921	663
Saraji Mine	13 km west	8,218	167
South Walker Creek Mine	20 km north-west	3,458	57
Peak Downs Mine	27 km north-west	14,600	191
Poitrel Coal Mine	42 km north	2,340	76
Daunia Mine	42 km north	1,934	69
Caval Ridge Mine	44 km north-west	7,588	109
Millennium Coal Mine	45 km north-west	1,834	9
Carborough Downs Coal Mine	45 km north-west	1,552	6
Moorvale Mine	52.3 km north	4,693	72
Isaac Plains Coal Mine	63.6 km north-west	2,982	48
Coppabella Coal Mine	65.3 km north-east	7,351	3
Grosvenor	68.2 km north-west	955	23

Table 13.5: Ambient background concentrations

Air quality indicator	Period	Concentration
TSP	Annual	44.2 µg/m^3
PM_{10}	24-hour, 70th percentile	27.2 µg/m^3
	Annual	22.1 µg/m^3
$PM_{2.5}$	24-hour, 70th percentile	6.6 µg/m^3
	Annual	6.4 µg/m^3
Dust deposition	Annual average	79.4 mg/m^2/day

13.3 Potential impacts

13.3.1 Air quality modelling methodology

To assess air quality impacts resultant of the proposed Project, potential dust emissions from individual mining activities have been explicitly modelled.

Dust emission rates have been estimated using the base equation:

$$ER = A \times EF \times (1 - CF)$$

where:

ER = emission rate

A = activity/operations data

EF = emission factor

CF = reduction in emissions due to the implementation of control measures.

Emissions of TSP, PM_{10} and $PM_{2.5}$ from mining activities have been estimated using recognised and accepted methods of dust emissions estimation. These include approximation of emission rates from NPI emissions estimation technique handbooks and the United States Environmental Protection Agency (US EPA) AP-42 emission handbooks (USEPA, 1998, USEPA, 2006a, USEPA, 2006b, USEPA, 2006c, USEPA, 2011) (Appendix L, Air Quality and GHG Assessment, Section 3.4).

The emissions estimation techniques applied for this assessment has been based on standard methods applied throughout Australia and the United States. These methods are consistent with those adopted for other air quality assessments conducted for other coal mines in Australia. The size distribution of dust particles is derived from the emission rates estimated for TSP, PM_{10} and $PM_{2.5}$ (Appendix L, Air Quality and GHG Assessment, Section 3.4).

13.3.1.1 Modelling scenarios

Potential air quality impacts have been assessed for the mining operations during Project Year 7 (indicatively 2032) and Project Year 22 (indicatively 2047). Project Year 7 is representative of a high production year for the proposed underground mine, while Project Year 22 represents a period of overlap between the proposed underground mine and the proposed open-cut pit mining operations. These years have been selected as indicative of worst-case impacts on air quality.

Project activities that will generate emissions to air have been considered across a number of Project phases. These phases include construction, operations and closure of the proposed Project. Upset conditions (being periods of excessive dust emissions) have also been considered in modelling undertaken for the Project (Appendix L, Air Quality and GHG Assessment, Section 3.5).

In respect of dust emissions, it is acknowledged that Bowen Basin Coal has mitigation measures in place at the existing Lake Vermont Mine that will remain in place for the Project. Mitigation measures are discussed further in section 13.4. It is conservatively estimated that Bowen Basin Coal apply dust mitigation measures a minimum of 24 days per year. As such, this level of mitigation has been built into modelling scenarios.

Construction

Dust emissions (point source and diffuse source emissions) from construction activities are predicted to be minimal compared to the existing Lake Vermont Mine operations. The bulk of the construction activity will be associated with the development of the proposed mine infrastructure area and the development of the proposed infrastructure corridor. Best practices with regard to emission controls are already in place at the existing Lake Vermont Mine, with these proposed to be continued during construction activities to further reduce dust emissions (Appendix L, Air Quality and GHG Assessment, Section 3.5).

Operations

Project activities that are associated with emissions of particulate matter include the following point source emissions:

- transfers and handling of material; and
- emissions from stockpiles.

Diffuse emission sources will include:

- extraction of material;
- haulage; and
- wind erosion of exposed areas.

Emissions of oxides of nitrogen, sulphur dioxide and carbon monoxide would occur due to blasting activities and vehicle movements on-site which are diffuse sources of emission. However, these emissions are transient (contained within the haul road infrastructure corridor and open-cut pits) and low in magnitude; thus, their impact is likely to be negligible. Flaring of gas, a point source emission, as part of gas drainage of the underground coal seam, will occur where practicable. However, this is not expected to contribute adversely to the air quality of the area (Appendix L, Air Quality and GHG Assessment, Section 3.5).

For the majority of activities, the emission rate of particulate matter is dependent on wind speed, with little or no emissions occurring for some activities (e.g. stockpiles) below a wind speed threshold (Appendix L, Air Quality and GHG Assessment, Section 3.5).

Closure and rehabilitation

As the Project nears the end of its life, BBC will engage relevant stakeholders to undertake a decommissioning and rehabilitation process. Infrastructure assets will be either retained, sold, recycled, relocated or disposed of as either general or regulated waste. Progressive rehabilitation will be undertaken at the existing Lake Vermont Mine as soon as practicable and will be underway during this Project.

The Progressive Rehabilitation and Closure Plan will detail the milestones and schedule for the Project decommissioning, but it is expected that decommissioning of the proposed Project will proceed in a similar way to the process implemented at the existing Lake Vermont Mine. Emissions from rehabilitated areas are expected to be less than operational emissions.

13.3.1.2 Cumulative air quality assessment

The Project is close to several existing and proposed mining projects, as shown in Figure 13.7.

Due to its proximity to the Project, dust emissions from the existing Lake Vermont Mine have been included in the dispersion modelling of the proposed underground and open-cut mines. It would also be expected that ambient concentrations of dust would be elevated due to the other existing and proposed mining operations in the vicinity of the Project. Hence, representative background levels of TSP, PM_{10}, $PM_{2.5}$ and dust deposition have been acquired from monitoring in the area and have been added to the results of the dispersion modelling to determine the complete potential impact of the Project (Appendix L, Air Quality and GHG Assessment, Section 3.4). The inclusion of these background particulate levels in the modelling are considered to represent conditions inclusive of all existing and proposed Projects contributing to air quality, including proposed operations adjacent to the Project.

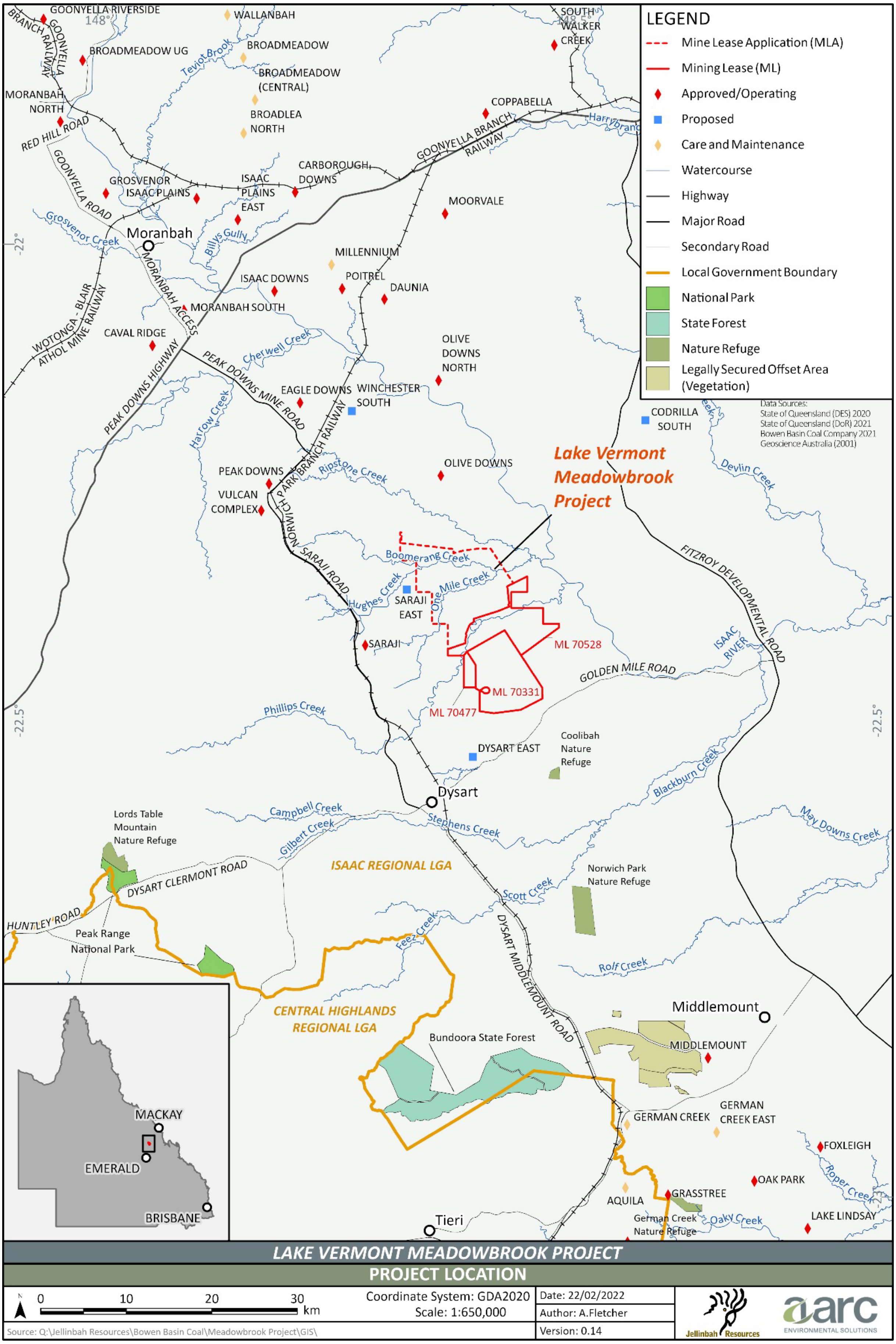

Figure 13.7: Project location in respect of existing and proposed mining projects

13.3.2 Air quality emissions results

A summary of emissions has been developed for the two modelled Project years (Year 7 and Year 22). Results have been determined for each modelled year.

13.3.2.1 Project Year 7

Predicted ground-level concentrations of TSP and dust deposition rates for Project Year 7 are presented in Table 13.6. Predicted ground-level concentrations of $PM_{2.5}$ and PM_{10} are presented in Table 13.7. The results of the cumulative assessment are presented as contour plots in Figure 13.8 to Figure 13.14. Results are sourced from Appendix L (Air Quality and GHG Assessment, Section 3.6) and have been presented as:

- Proposed emissions—the Project underground mine operations in isolation;
- Combined emissions—the Project underground mine operations and Lake Vermont Mine operations in isolation; and
- Cumulative emissions—the combined emissions with the ambient backgrounds representative of impacts from existing and proposed operations included.

Results from Year 7 modelling illustrate that:

- Predicted annual average concentrations of TSP comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted maximum monthly dust deposition rates comply with the EA limit at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted 24-hour average concentrations of $PM_{2.5}$ comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted annual average concentrations of $PM_{2.5}$ comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted 24-hour average concentrations of PM_{10} comply with the EA limit at all sensitive receptors in Project in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations. Additional dust mitigation measures have been applied that reflect current proactive management practices (Appendix L, Air Quality and GHG Assessment, Section 3.6).
- Predicted annual average concentrations of PM_{10} comply with the Air EPP objective at all assessed Project sensitive receptors in isolation, using standard mitigation measures for the Project and the existing operations.

Table 13.6: Predicted annual average TSP and dust deposition rates for Project Year 7

Receptors		TSP (µg/m3)			Dust deposition (mg/m2/day)		
		Annual			Max monthly		
		Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG
R1	Pownalls	0.1	0.7	44.9	0.2	3.0	82.4
R2	Seloh Nolem 1	0.1	0.5	44.7	0.1	0.6	80.0
R3	Old Kyewong	0.2	3.0	47.2	0.5	5.2	84.6
R4	Mockingbird Downs	0.1	1.5	45.7	0.2	7.6	87.0
R7	Willunga	0.01	0.1	44.3	0.04	0.5	79.9
R8	Leichardt	0.03	0.3	44.5	0.1	2.0	81.4
R9	Seloh Nolem 2	0.1	0.4	44.6	0.1	0.6	80.0
R10	Old Bombandy	0.02	0.2	44.4	0.1	1.8	81.2
R11	Vermont Park	0.1	0.8	45.0	0.1	0.9	80.3
R12	Saraji Homestead 1	0.4	1.0	45.2	0.8	3.9	83.3
R13	Saraji Homestead 3	0.5	1.3	45.5	1.2	4.7	84.1
R14	BMA Saraji	0.6	1.5	45.7	1.3	5.1	84.5
R15	Iffley	0.1	0.6	44.8	0.1	0.7	80.1
R16	Tay Glen	0.4	1.4	45.6	1.2	6.1	85.5
R17	Semple Residence	0.1	1.0	45.2	0.3	1.2	80.6
R18	Saraji Homestead 2	0.5	1.2	45.4	1.1	4.3	83.7
Objective		**90 µg/m^3 (EPP, Air)**			**120 µg/m^3 (DES 2017b)**		

Table 13.7: Predicted 24 hour and annual average $PM_{2.5}$ and PM_{10} for Project Year 7

Receptors		**$PM_{2.5}$ (µg/m³)**						**PM_{10} (µg/m³)**								
		24-hour			**Annual**			**24-hour Maximum [a]**			**24-hour 6th Highest [a]**			**Annual**		
		Proposed	Combined	Combined +BG	Proposed	Combined	Combined +BG	Proposed	Combined	Combined +BG	Proposed	Combined	Combined +BG	Proposed	Combined	Combined+BG
R1	Pownalls	0.9	4.1	10.7	0.02	0.1	6.5	2.1	15.3	42.5	0.6	6.1	33.3	0.04	0.5	22.6
R2	Seloh Nolem 1	0.7	2.0	8.6	0.03	0.1	6.5	1.6	8.6	35.8	1.3	6.6	33.8	0.1	0.4	22.5
R3	Old Kyewong	1.6	4.9	11.5	0.1	0.6	7.0	3.5	17.8	45.0	2.2	13.3	40.5	0.2	2.5	24.6
R4	Mockingbird Downs	1.5	5.3	11.9	0.03	0.2	6.6	3.5	18.7	45.9	1.1	14.1	41.3	0.1	1.1	23.2
R7	Willunga	0.2	0.6	7.2	0.004	0.02	6.4	0.5	2.8	30.0	0.2	1.4	28.6	0.01	0.1	22.2
R8	Leichardt	1.0	3.1	9.7	0.01	0.05	6.4	2.4	9.3	36.5	0.3	3.6	30.8	0.02	0.2	22.3
R9	Seloh Nolem 2	0.7	1.8	8.4	0.03	0.1	6.5	1.7	8.6	35.8	1.1	6.6	33.8	0.1	0.4	22.5
R10	Old Bombandy	0.7	2.2	8.8	0.01	0.04	6.4	1.45	7.7	34.9	0.4	3.2	30.4	0.02	0.2	22.3
R11	Vermont Park	1.1	2.5	9.1	0.04	0.2	6.6	3.0	10.4	37.6	1.7	8.0	35.2	0.1	0.7	22.8
R12	Saraji Homestead 1	1.0	2.1	8.7	0.1	0.3	6.7	2.0	4.5	31.7	1.6	3.7	30.9	0.3	0.8	22.9
R13	Saraji Homestead 3	1.4	2.4	9.0	0.2	0.4	6.8	2.9	5.8	33.0	2.2	5.2	32.4	0.5	1.1	23.2
R14	BMA Saraji	1.4	2.5	9.1	0.2	0.4	6.8	3.0	7.0	34.2	2.5	5.5	32.7	0.5	1.3	23.4
R15	Iffley	0.9	2.3	8.9	0.04	0.1	6.5	2.4	9.5	36.7	1.4	5.8	33.0	0.1	0.5	22.6
R16	Tay Glen	1.6	3.4	10.0	0.1	0.4	6.8	3.6	9.0	36.2	2.0	5.7	32.9	0.3	1.2	23.3
R17	Semple Residence	1.1	5.1	11.7	0.03	0.2	6.6	2.6	13.9	41.1	1.4	9.5	36.7	0.1	0.9	23.0
R18	Saraji Homestead 2	1.4	2.4	9.0	0.20	0.4	6.8	2.8	5.8	33.0	2.1	5.1	32.3	0.4	1.0	23.1
Objective		**25 µg/m³**			**8 µg/m³**			**50 µg/m³**						**25 µg/m³**		

[a] An additional 50% control factor has been applied to existing overburden haul roads for 24 days of the year to reflect proactive dust controls

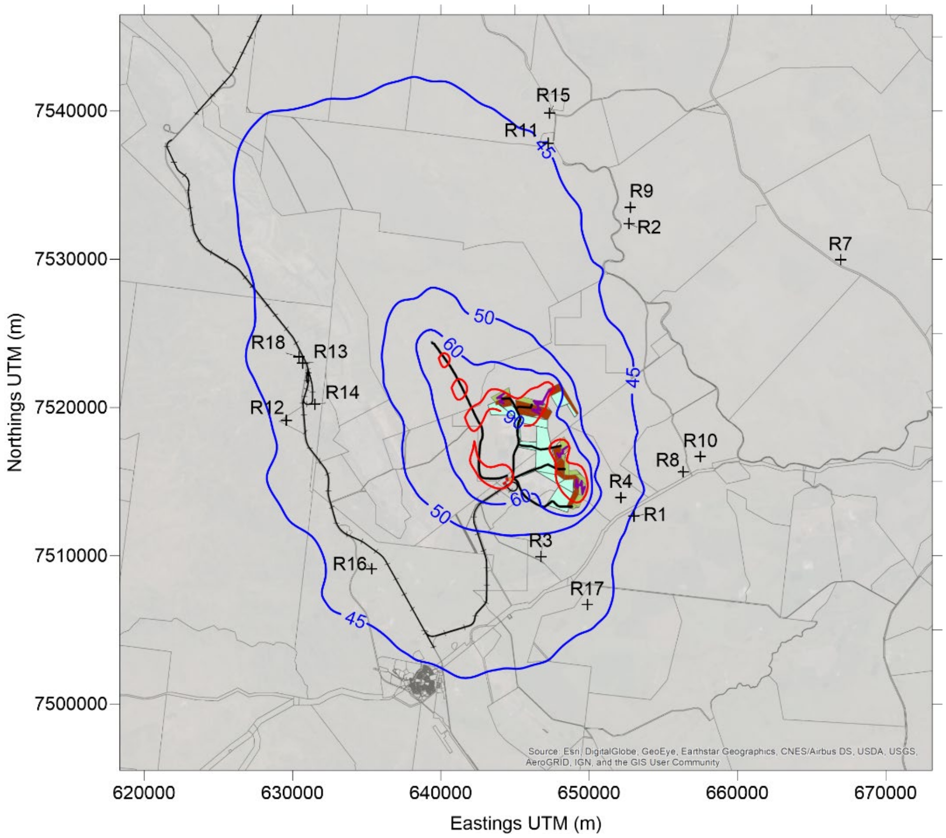

Figure 13.8: Predicted annual average TSP (µg/m³) cumulative emissions Year 7

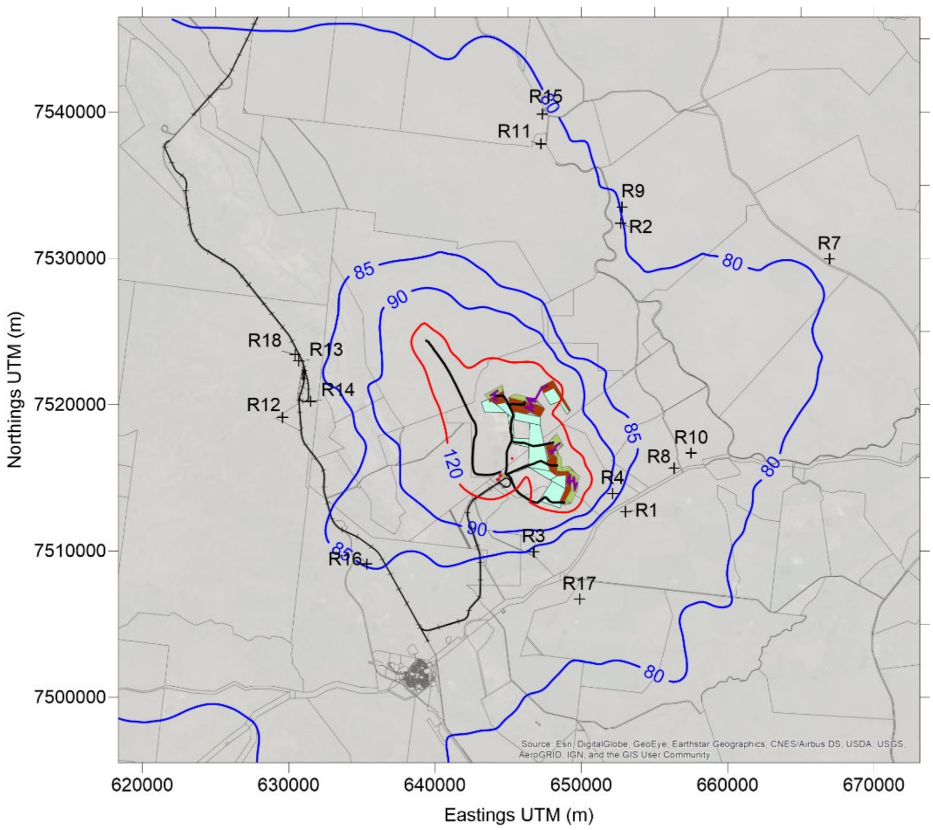

Figure 13.9: Predicted maximum monthly dust deposition (mg/m²/day) cumulative emissions Year 7

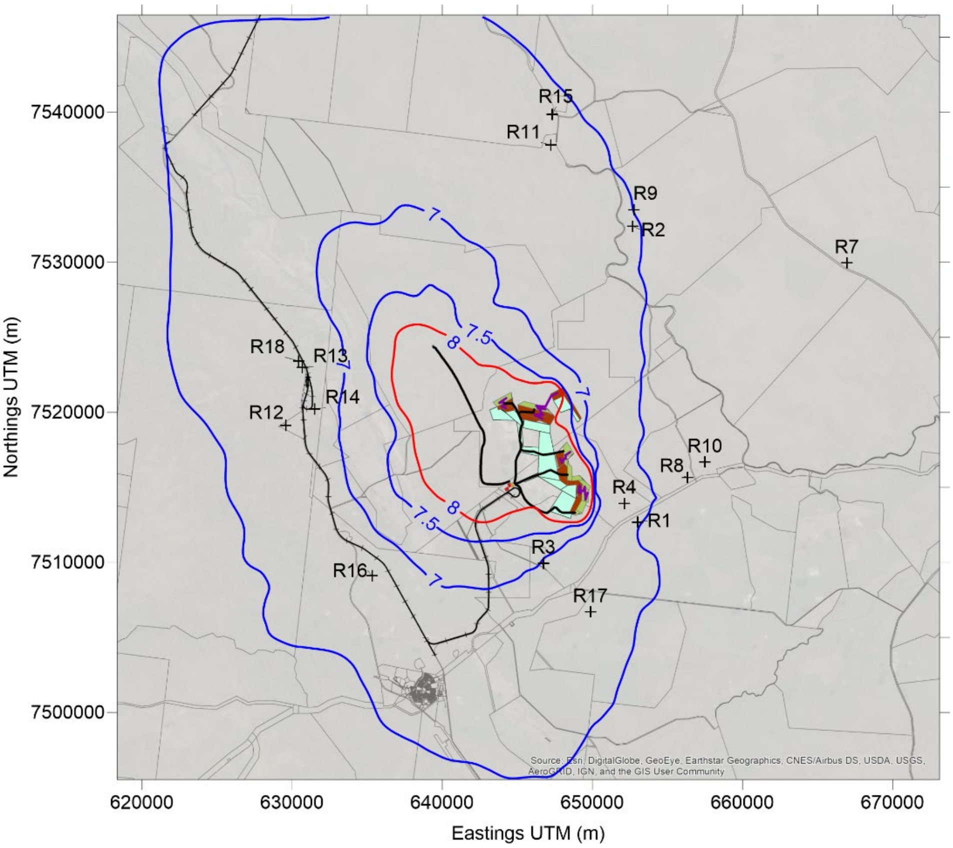

Figure 13.10: Predicted annual average $PM_{2.5}$ ($\mu g/m^3$) cumulative emissions Year 7

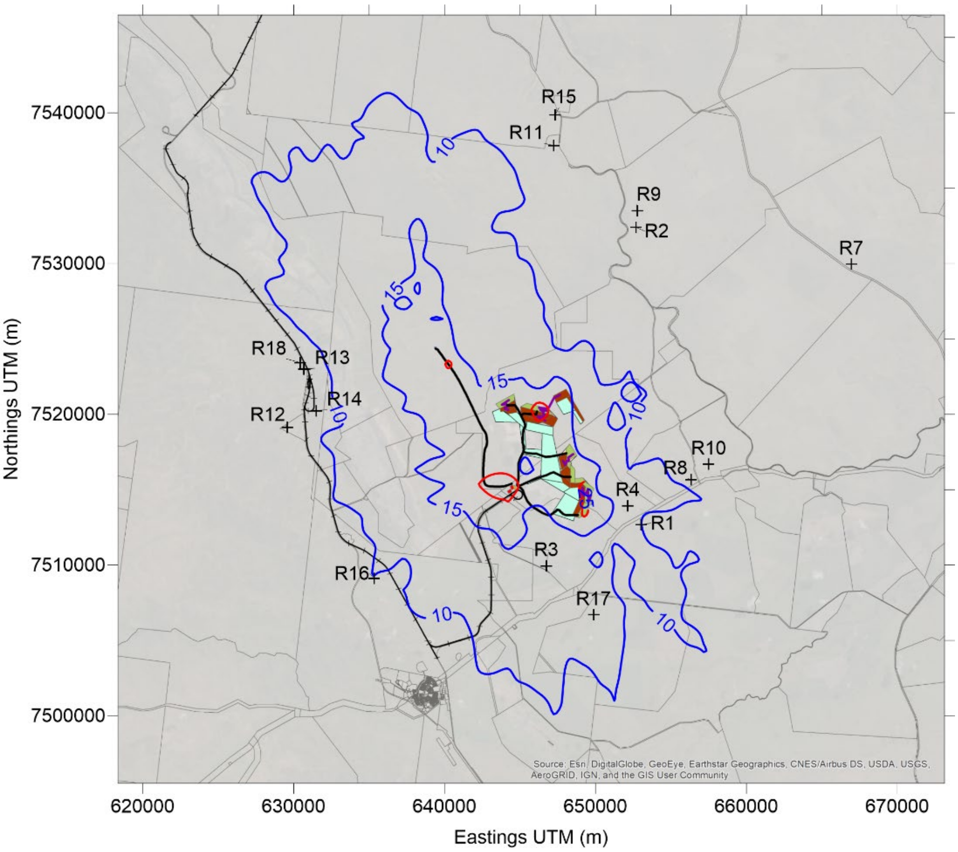

Figure 13.11: Predicted 24-hour maximum $PM_{2.5}$ ($\mu g/m^3$) cumulative emissions Year 7

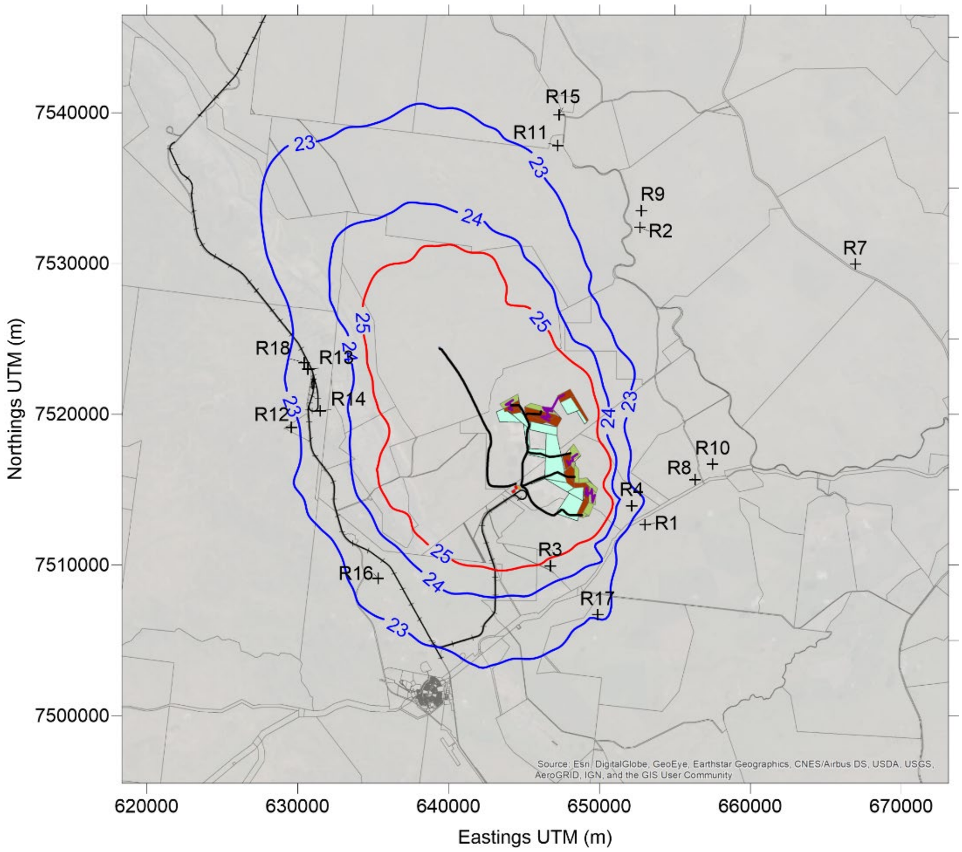

Figure 13.12: Predicted annual average PM_{10} ($\mu g/m^3$) cumulative emissions Year 7

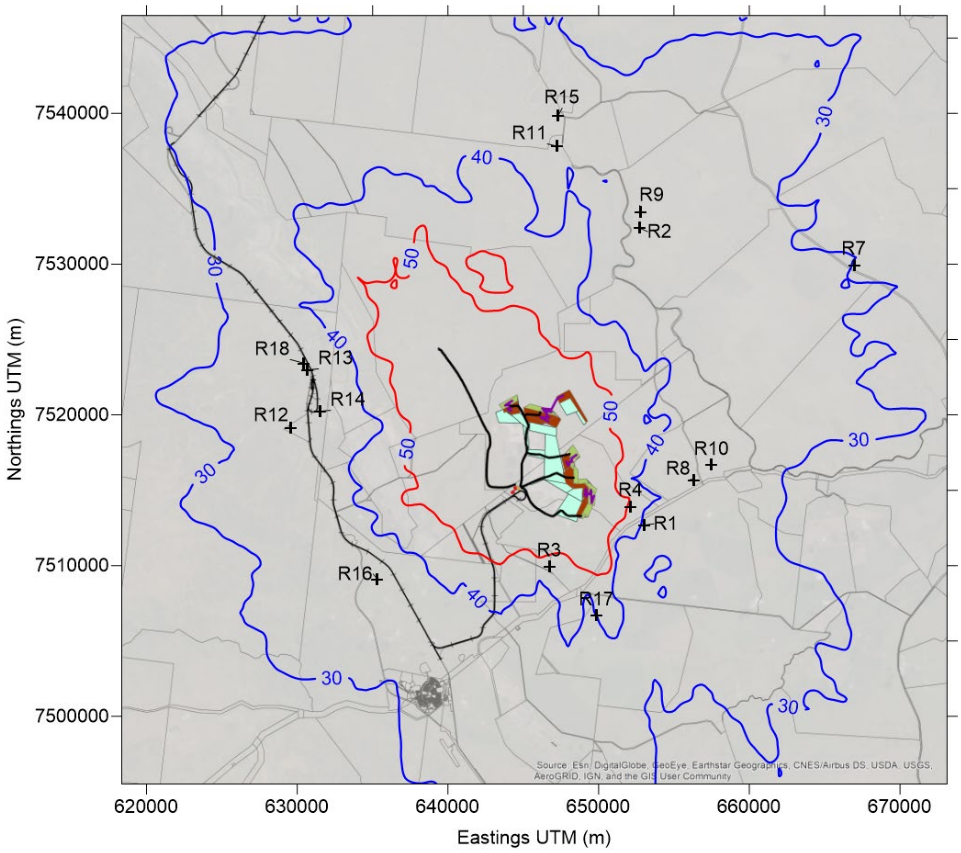

Figure 13.13: Predicted 24-hour maximum PM^{10} ($\mu g/m^3$) cumulative emissions Year 7

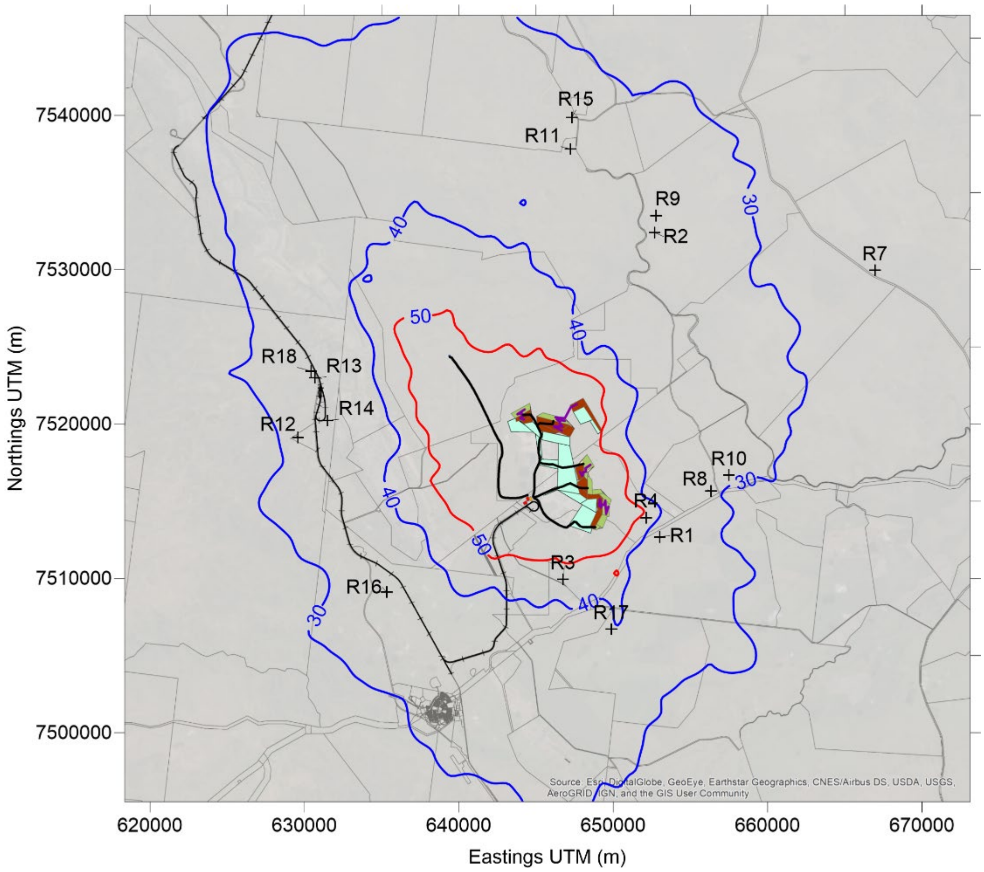

Figure 13.14: Predicted 6th highest PM_{10} ($\mu g/m^3$) cumulative emissions Year 7

13.3.2.2 Project Year 22

Predicted ground-level concentrations of TSP and dust deposition rates for Project Year 22 are presented in Table 13.8. Predicted ground-level concentrations of $PM_{2.5}$ and PM_{10} are presented in Table 13.9. The results of the cumulative assessment are presented as contour plots in Figure 13.15 to Figure 13.21. Results are sourced from Appendix L (Air Quality and GHG Assessment, Section 3.6) and have been presented as:

- Proposed—the Project underground mine operations and Lake Vermont Mine open-cut mine operations in isolation;
- Combined—the Project underground mine operations, open-cut mine operations and existing Lake Vermont Mine operations in isolation; and
- Cumulative—combined emissions with ambient backgrounds included.

Results from Year 22 modelling illustrate that:

- Predicted annual average concentrations of TSP comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted maximum monthly dust deposition rates comply with the EA limit at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted 24-hour average concentrations of $PM_{2.5}$ comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.

- Predicted annual average concentrations of $PM_{2.5}$ comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.
- Predicted 24-hour average concentrations of PM_{10} comply with the EA limit at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations. Additional dust mitigation measures have been applied that reflect current proactive management practices.
- Predicted annual average concentrations of PM_{10} comply with the Air EPP objective at all assessed Project sensitive receptors in isolation and cumulatively, using standard mitigation measures for the Project and the existing operations.

Table 13.8: Predicted annual average TSP and dust deposition rates for Project Year 22

Receptors		**TSP (µg/m³)**			**Dust deposition (mg/m²/day)**		
		Annual			**Max monthly**		
		Proposed	**Combined**	**Combined + BG**	**Proposed**	**Combined**	**Combined + BG**
R1	Pownalls	0.1	0.4	44.6	0.2	1.5	80.9
R2	Seloh Nolem 1	0.1	0.6	44.8	0.3	0.8	80.2
R3	Old Kyewong	0.3	1.3	45.5	0.6	1.9	81.3
R4	Mockingbird Downs	0.1	0.7	44.9	0.3	2.8	82.2
R7	Willunga	0.02	0.1	44.3	0.1	0.6	80.0
R8	Leichardt	0.05	0.3	44.5	0.1	1.3	80.7
R9	Seloh Nolem 2	0.1	0.5	44.7	0.2	0.6	80.0
R10	Old Bombandy	0.04	0.2	44.4	0.1	1.2	80.6
R11	Vermont Park	0.2	1.0	45.2	0.2	1.4	80.8
R12	Saraji Homestead 1	0.6	1.3	45.5	1.8	4.4	83.8
R13	Saraji Homestead 3	0.9	1.9	46.1	2.0	6.2	85.6
R14	BMA Saraji	1.0	2.0	46.2	2.6	5.8	85.2
R15	Iffley	0.2	0.8	45.0	0.2	1.0	80.4
R16	Tay Glen	0.5	1.3	45.5	1.3	4.9	84.3
R17	Semple Residence	0.1	0.6	44.8	0.3	0.8	80.2
R18	Saraji Homestead 2	0.9	1.9	46.1	1.9	5.8	85.2
Objective		**90 µg/m³ (EPP, Air)**			**120 µg/m³ (DES 2017b)**		

Table 13.9: Predicted 24-hour and annual average $PM_{2.5}$ and PM_{10} for Year 22

Receptors		PM2.5 (µg/m3)						PM10 (µg/m3)								
		24-hour			Annual			24-hour Maximum			24-hour 6th Highest			Annual		
		Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG
R1	Pownalls	0.96	3.0	9.6	0.02	0.1	6.5	2.4	9.1	36.3	1.3	5.1	32.3	0.1	0.4	22.5
R2	Seloh Nolem 1	1.39	3.2	9.8	0.04	0.1	6.5	4.4	10.4	37.6	2.3	7.6	34.8	0.1	0.5	22.6
R3	Old Kyewong	2.36	7.4	14.0	0.09	0.3	6.7	5.9	17.0	44.2	2.9	12.7	39.9	0.2	1.2	23.3
R4	Mockingbird Downs	1.53	4.4	11.0	0.03	0.1	6.5	3.5	13.8	41.0	1.9	8.8	36.0	0.1	0.6	22.7
R7	Willunga	0.31	1.0	7.6	0.01	0.02	6.4	0.7	4.2	31.4	0.3	1.4	28.6	0.01	0.1	22.2
R8	Leichardt	1.12	2.8	9.4	0.01	0.1	6.5	2.7	9.9	37.1	0.6	4.1	31.3	0.04	0.2	22.3
R9	Seloh Nolem 2	1.15	3.9	10.5	0.03	0.1	6.5	3.5	11.4	38.6	2.0	6.3	33.5	0.11	0.5	22.6
R10	Old Bombandy	0.89	3.0	9.6	0.01	0.04	6.4	2.1	11.9	39.1	0.4	2.3	29.5	0.03	0.2	22.3
R11	Vermont Park	1.49	7.2	13.8	0.06	0.2	6.6	5.3	20.7	47.9	3.8	10.9	38.1	0.20	1.0	23.1
R12	Saraji Homestead 1	1.36	2.8	9.4	0.17	0.3	6.7	3.7	6.9	34.1	2.5	5.5	32.7	0.5	1.1	23.2
R13	Saraji Homestead 3	2.03	3.6	10.2	0.27	0.5	6.9	5.7	9.8	37.0	3.9	8.0	35.2	0.8	1.6	23.7
R14	BMA Saraji	1.96	3.8	10.4	0.28	0.5	6.9	5.5	9.7	36.9	4.6	8.8	36.0	0.8	1.7	23.8
R15	Iffley	1.41	5.6	12.2	0.05	0.2	6.6	4.2	16.9	44.1	2.7	8.4	35.6	0.2	0.7	22.8

Receptors		PM2.5 (µg/m3)						PM10 (µg/m3)								
		24-hour			Annual			24-hour Maximum			24-hour 6th Highest			Annual		
		Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG	Proposed	Combined	Combined + BG
R16	Tay Glen	1.55	2.9	9.5	0.16	0.3	6.7	3.7	9.6	36.8	2.5	7.8	35.0	0.4	1.1	23.2
R17	Semple Residence	1.07	4.9	11.5	0.04	0.2	6.6	2.6	16.9	44.1	1.5	5.5	32.7	0.1	0.5	22.6
R18	Saraji Homestead 2	2.13	3.6	10.2	0.27	0.5	6.9	6.1	9.2	36.4	3.9	8.0	35.2	0.8	1.6	23.7
Objective		**25 µg/m3**			**8 µg/m3**			**50 µg/m3**						**25 µg/m3**		

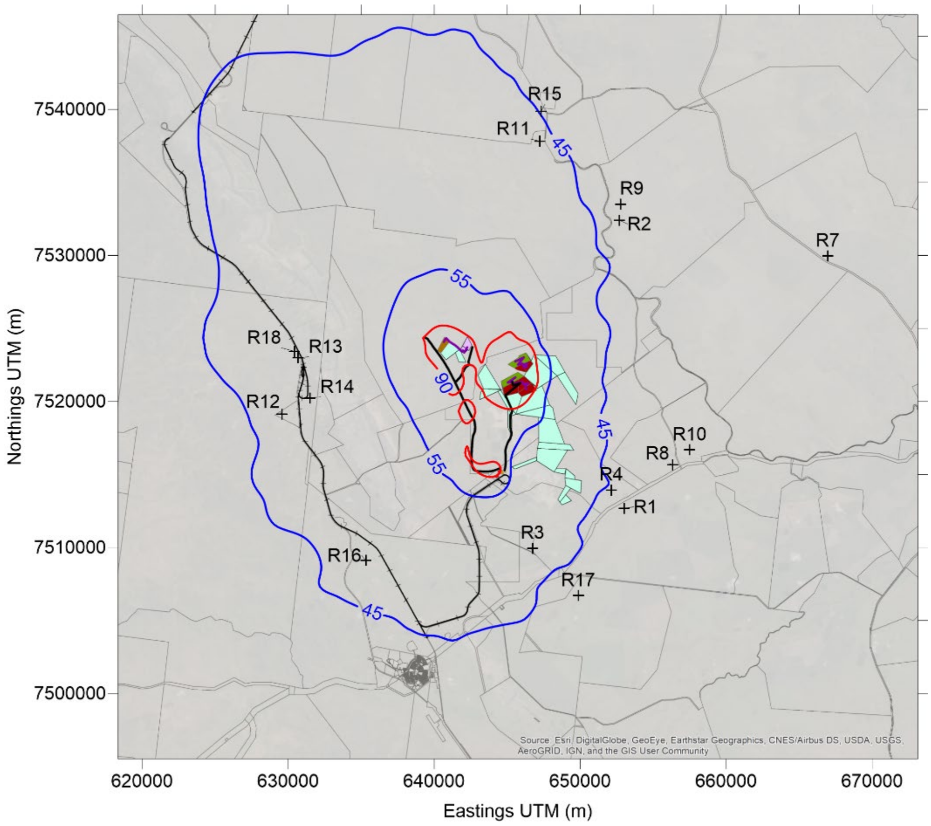

Figure 13.15: Predicted annual average TSP (µg/m³) cumulative emissions Year 22

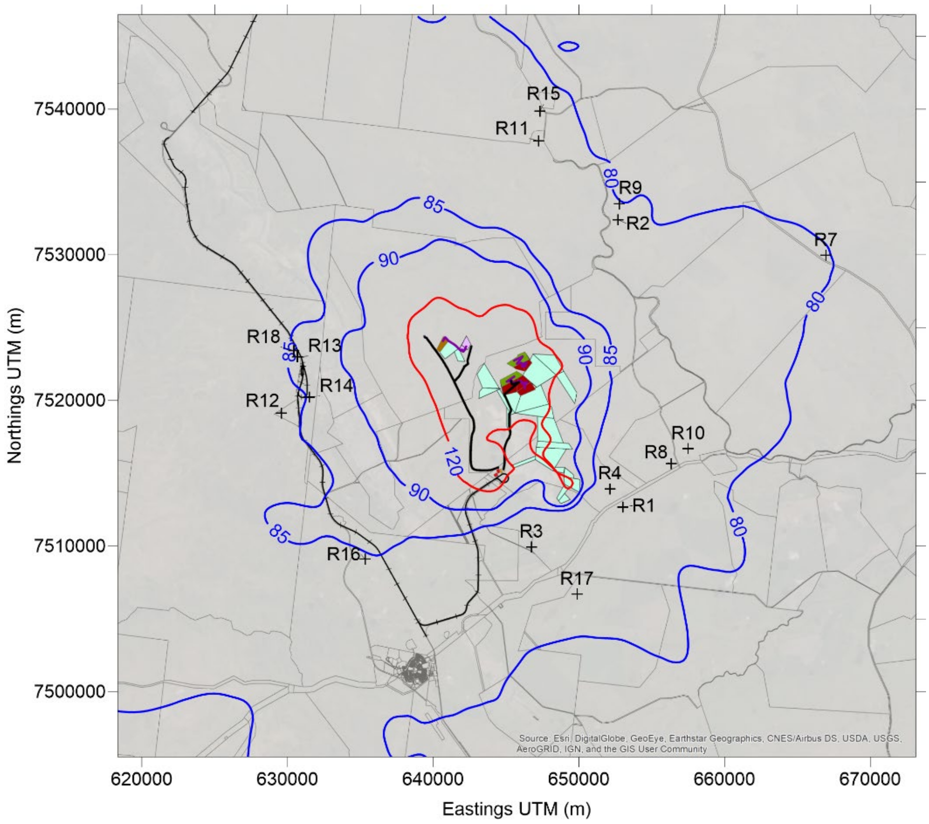

Figure 13.16: Predicted maximum monthly dust deposition (mg/m²/day) cumulative emissions Year 22

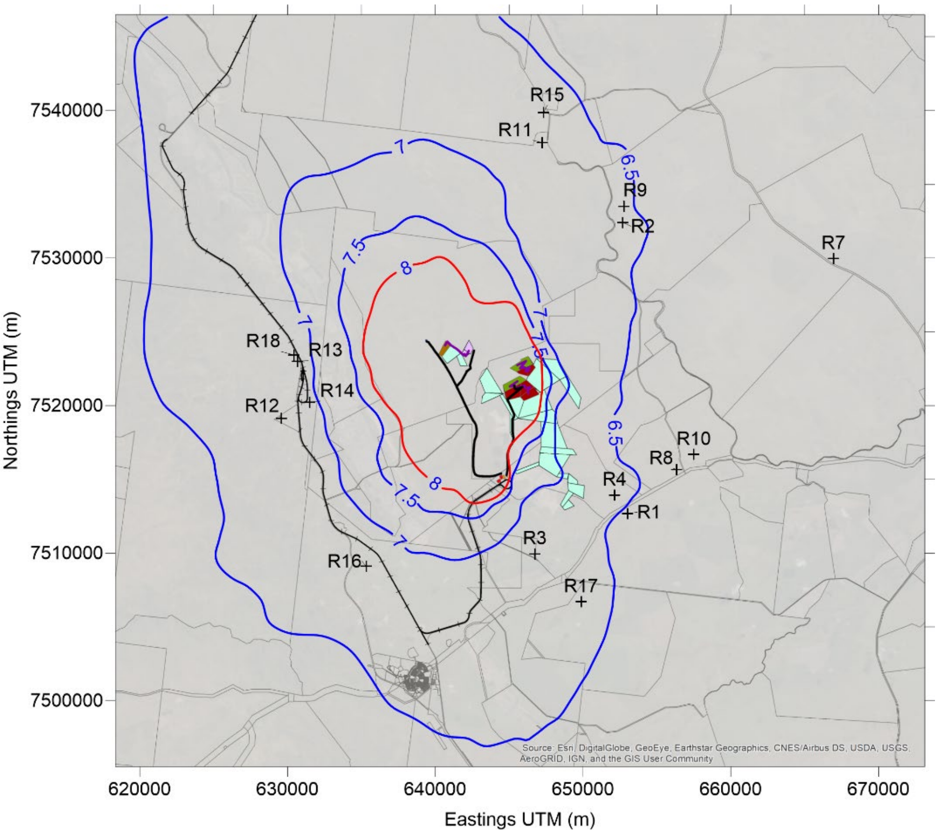

Figure 13.17: Predicted annual average $PM^{2.5}$ levels ($\mu g/m^3$) cumulative emissions for Year 22

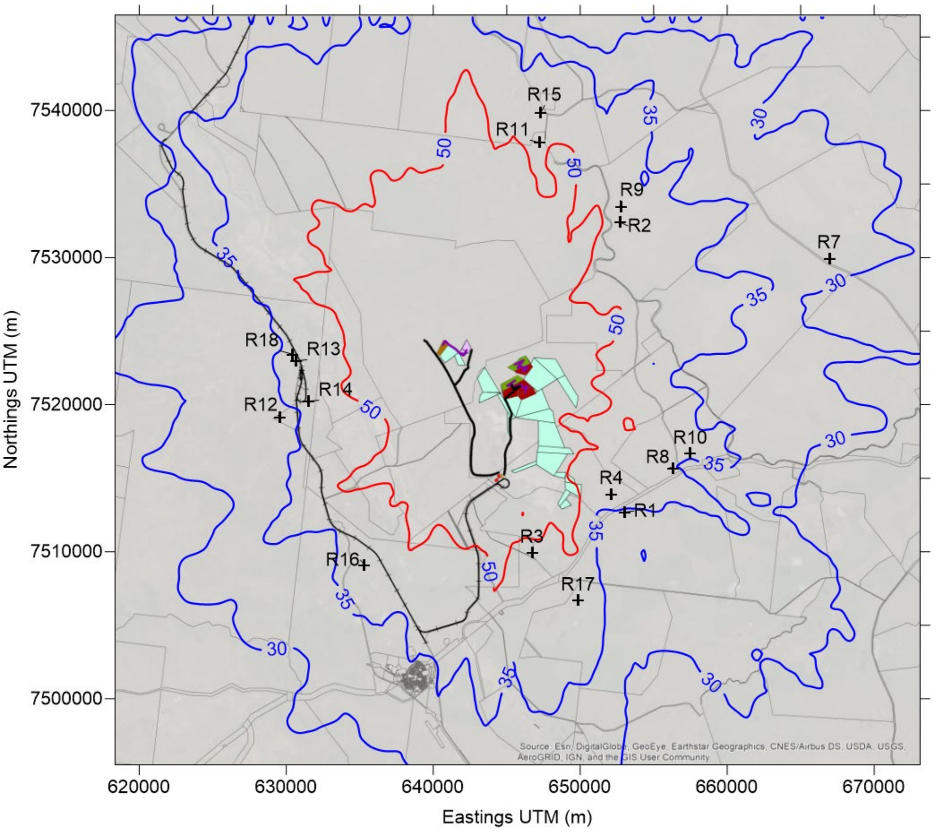

Figure 13.18: Predicted 24-hour maximum $PM^{2.5}$ levels ($\mu g/m^3$) cumulative emissions for Year 22

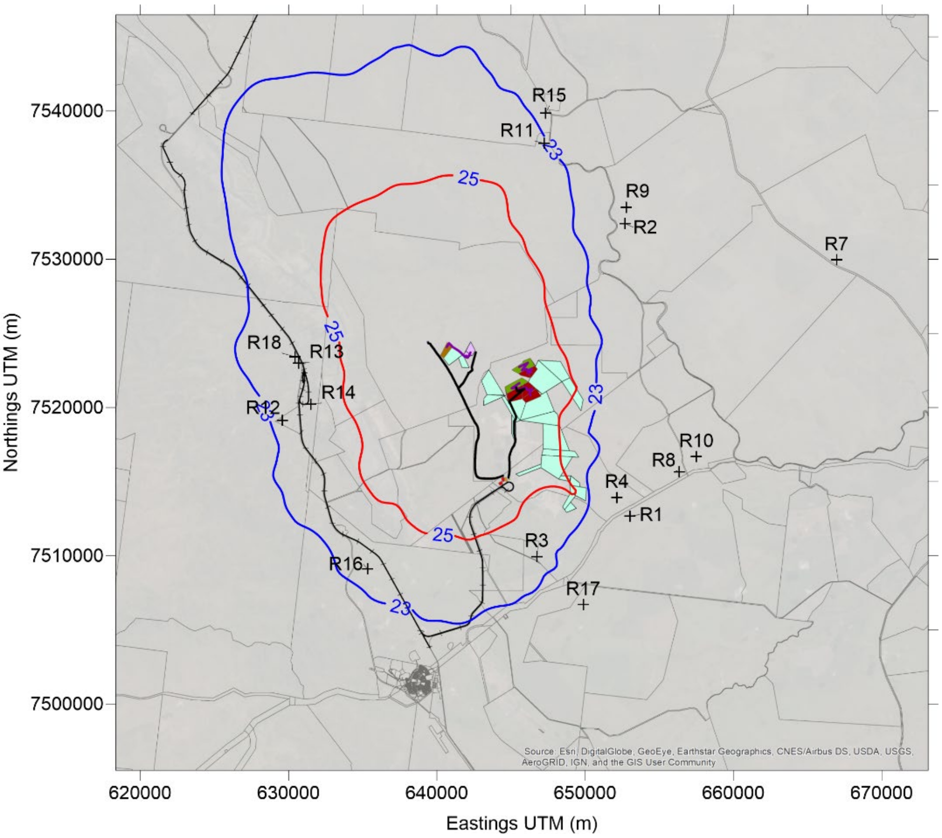

Figure 13.19: Predicted annual average PM_{10} levels (µg/m^3) cumulative emissions for Year 22

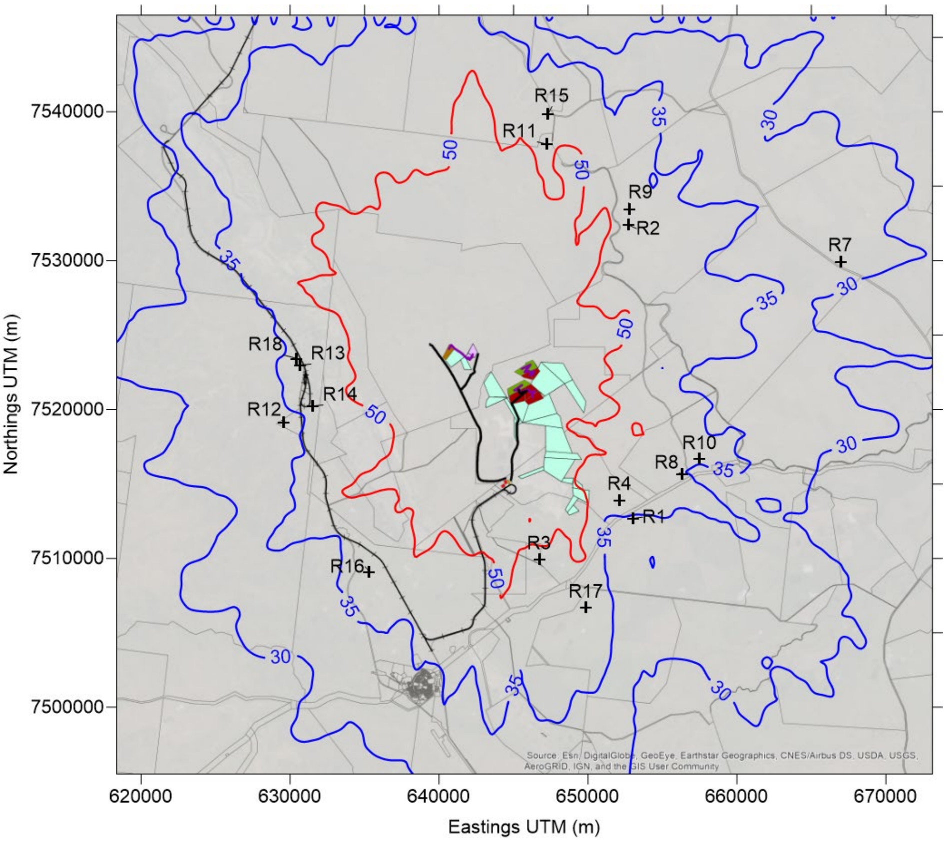

Figure 13.20: Predicted 24-hour maximum PM_{10} levels (µg/m^3) cumulative emissions for Year 22

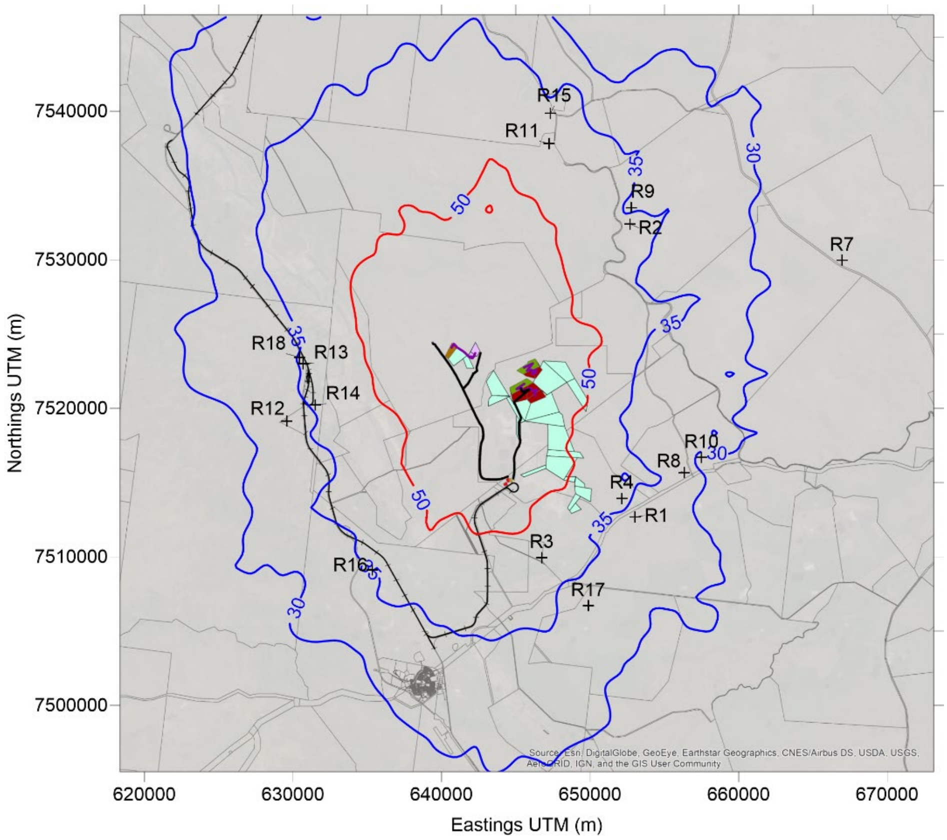

Figure 13.21: Predicted 6th highest PM_{10} 24hr levels (µg/m^3) cumulative emissions for Year 22

13.3.3 GHG assessment methodology

The GHG assessment methodology (Appendix L, Air Quality and GHG Assessment, Section 4.4) includes the assessment of the emissions of GHGs from the Project during the construction and operation phases of the existing and approved Lake Vermont operations and the proposed Meadowbrook open-cut and underground operations.

Pollutants of importance associated with the Project include CO_2, CH_4 and N_2O, with total emissions expressed in 'CO_2 equivalent' terms. Methodology considers relevant legislation and regulations in Australia associated with the reporting and monitoring of GHG emissions (Appendix L, Air Quality and GHG Assessment, Section 4.4).

13.3.3.1 Reporting thresholds

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act), and its subordinate legislation the National Greenhouse and Energy Reporting Regulations 2008, assist corporations in reporting GHG emissions and energy consumption. Emissions of GHG in relation to a facility means the release of GHG into the atmosphere as a direct result of:

- an activity or series of activities (including ancillary activities) that constitute the facility (Scope 1 emissions); and
- one or more activities that generate electricity, heating, cooling or steam that is consumed by the facility but that do not form part of the facility (Scope 2 emissions).

Emissions that occur as a consequence of the activities of a facility, but from sources not owned or controlled by the facility's business, are indirect GHG emissions (Scope 3 emissions). These emissions are generated in the wider economy and are not included in the NGER reporting. Potential Scope 3 emissions are still considered as part of the GHG assessment (Appendix L, Air Quality and GHG Assessment, Section 4.4).

Corporations reporting under section 19 of the NGER Act must report Scope 1 and Scope 2 emissions, energy production and energy consumption data when one or more of the thresholds under section 13 of the NGER Act are met. NGER reporting thresholds and recent NGER reporting for Lake Vermont Mine are summarised in Appendix L, Air Quality and GHG Assessment, Section 4.2.

The regulatory obligations for NGER and the Safeguard Mechanism in consideration of cumulative annual GHG emissions (Scope 1 + Scope 2, excluding land use, land use change and forestry [LULUCF] emissions for the combined Lake Vermont Mine and the Project) are outlined in Section 4.6 of Appendix L, Air Quality and GHG Assessment, Section 4.5.

In all years of operation, with the exception of the final years (Project Year 35 and 36), estimated Scope 1 emissions (excluding LULUCF) exceed the reporting threshold of 100 kt CO_2-e/y. Under the current Safeguard Mechanism, facilities with Scope 1 emissions of more than 100 kt CO_2-e/y are required to keep their emissions within baseline levels. This Safeguard Mechanism would apply to the Project; however, the exact implications of this would need to be reviewed on an annual basis in communication with the Clean Energy Regulator (Appendix L, Air Quality and GHG Assessment, Section 4.5).

13.3.4 GHG emissions results

Scopes 1, 2 and 3 GHG emissions have been estimated on an annual basis for the Project against the background of ongoing existing and approved Lake Vermont Mine operations and for the proposed Project. Potential GHG emissions have been identified in Table 13.10. A summary of the emissions factors (Scopes 1, 2, and 3) and energy content for emission sources associated with the existing and proposed operations at the facility is presented in Appendix L, Air Quality and GHG Assessment, Section 4.4.

Table 13.10: Scopes 1, 2 and 3 emissions

Emission factor	Potential source
Scope 1 (direct)	Diesel combustion: • heavy machinery and equipment • haulage vehicles • fugitive emissions of methane from mining of coal deposits (waste mine gas) • explosives use
Scope 2 (direct)	Electricity usage: • conveyors • underground operations • coal processing plant • amenities

Scope 3 (indirect)	• Transport of coal:
	  o rail transport to coal terminal
	  o shipping to international customers
	• Use of coal:
	  o thermal application
	• Electricity distribution losses
	• Diesel extraction and processing

Table 13.11 provides a summary of the energy content and emissions factors for emissions sources associated with the existing and proposed operations at the facility (Appendix L, Air Quality and GHG Assessment, Section 4.4).

Table 13.11: Summary of energy content and emissions factors

Emission source	Energy content	Units	Emission factor			Units
			Scope 1	Scope 2	Scope 3	
Diesel	38.6	GJ/kL	70.4		3.6	kg CO_2-e/GJ[1]
Fugitive methane (Qld–open-cut)	37.7 x 10^{-3}	GJ/t	0.023			t CO_2-e/tROM[1]
Explosives (Ammonium Nitrate Fuel Oil–ANFO)	2.4	GJ/t	0.17			t CO_2-e/tANFO[3]
Electricity (Queensland)	3.6	MJ/kWh		0.80	0.12	kg CO_2-e/kWh[1]
Coking coal	30	GJ/t			92.03	kg CO_2-e/GJ[1]
Thermal coal	22–24	GJ/t			90.24	kg CO_2-e/GJ[1,5]
Forest clearing	29.83	tC/ha	109			t CO_2-e/ha[4]
Shipping–bulk carrier					0.00354	kg CO_2-e/ tonne.km[5]

[1] 'National Greenhouse and Energy Reporting (Measurement) Determination 2008', as amended in June 2021, and 'National Greenhouse Accounts Factors' (Australian Government, Department of Industry, Science, Energy and Resources 2021)
[2] 'National Inventory Report 2019' (April 2021) (DISER 2021), Figure 3.22
[3] 'National Greenhouse Accounts (NGA) Factors' (Department of Climate Change 2008)
[4] Fullcam model based on 100% conversion of C to CO_2, Latitude: -25.5N, Longitude: 148.6E, 50% Acacia Shrubland +50% Agricultural annual grass
[5] 'UK Government GHG Conversion Factors for Company Reporting' (DEFRA 2021). GJ/kL = gigajoules per kilolitre, kg CO_2-e/GJ = kilograms of carbon dioxide equivalent per gigajoule, GJ/t = gigajoules per tonne, t CO_2-e/tROM = tonnes of carbon dioxide equivalent per tonne of ROM coal, t CO_2-e/tA NFO = tonnes of carbon dioxide equivalent per tonne of ANFO, MJ/kWh = megajoules per kilowatt-hour, kg CO_2-e/kWh = kilograms of carbon dioxide equivalent per kilowatt-hour and kg CO_2-e/t.km = kilograms of carbon dioxide equivalent per tonne per kilometre, t C/ha = tonnes of carbon per hectare of clearing.

GHG emissions associated with land clearing are not covered by the NGER scheme. Estimated GHG emissions from land clearing account for approximately 1% of the overall annual GHG emissions for the Project. As mining operations progress, spent pits and waste emplacement landforms will progressively be rehabilitated, with the aim of offsetting any previous GHG emissions from land clearing (Appendix L, Air Quality and GHG Assessment, Section 4.4).

13.3.4.1 Estimated GHG emissions

A comparative assessment has been made in Appendix L (Air Quality and GHG Assessment, Section 4.5) of the Project emissions against the background of the existing Lake Vermont Mine operations emissions. Emissions associated with LULUCF have also been assessed.

Scope 1 and Scope 2 GHG emissions

The maximum annual GHG emissions of combined Scope 1 and Scope 2 associated with the Project nominally occurring in Year 12 are 884 ktCO_2-e.

The average annual GHG emissions of combined Scope 1 and Scope 2 associated with the Project are:

- 348,469 tCO_2-e (including LULUCF emissions); and
- 346,461 tCO_2-e (excluding LULUCF emissions).

A summary of the estimated Scope 1 and Scope 2 emissions associated with the Project are presented in Table 13.13:. Scope 1 includes the potential sources from diesel (mining), fugitive gas, blasting and land clearing. Scope 2 includes electricity.

A summary of the contribution of the Project to annual GHG emissions associated with Lake Vermont mining operations is presented in (excluding LULUCF) is presented in Table 13.14 This includes assessment of the total emissions for the Project and Lake Vermont Mine separately, comparing to existing and proposed operations combined. In comparison to combined mining operations (Lake Vermont Mine + Project) the Project accounts for 49% of total mine emissions over the life of the Project.

State and National GHG emissions

GHG emissions from the Project would contribute to Australia's and Queensland's annual GHG emissions inventories (Appendix L, Air Quality and GHG Assessment, Section 4.5). A summary of the impact of the maximum estimated annual (Scopes 1 and 2) GHG emissions from the Lake Vermont and Meadowbrook operations at a State and National scale is provided in Table 13.12. This refers to a summary of data from Queensland's and Australia's most recently published GHG emissions inventories from 2019 (Australian Government Department of Industry, Science, Energy and Resources 2021).

Table 13.12: Comparison of estimated Project annual State and National GHG emissions

Category	Project[1]	Australia[2]		Queensland[2]	
	Emissions (Mt CO_2-e)	Emissions (Mt CO_2-e)	Project %	Emissions (Mt CO_2-e)	Project %
Inventory total	0.88	554.36	0.16%	148.22	0.60%

[1] Estimated maximum annual GHG emissions

[2] National Greenhouse Gas Inventory, Paris Agreement Inventory 2019 (Australian Government Department of Industry, Science, Energy and Resources, 2021), GHG emissions, excludingLand Use and Land Use Change

Scope 3 GHG emissions

A summary of key parameters used in the quantification of potential Scope 3 emissions associated with coal transportation is provided in Table 20 of Appendix L, Air Quality and GHG Assessment, Section 4.5. Scope 3 GHG emissions associated with the Lake Vermont Mine operations and the Project have been estimated on an annual basis for the life of the Project. Estimated annual Scope 3 GHG emissions associated with the Project are 7,956,355 tCO_2-e on average and will account for approximately 35% of Scope 3 GHG emissions for Lake Vermont Mine over the life of the Project.

The estimated annual Scope 3 GHG emissions associated with the Project are presented below in Table 13.15. Additionally, Table 13.16 provides combined annual emissions for Lake Vermont Mine operations and the Project.

Table 13.13: Estimated Project annual Scope 1 and 2 GHG emissions and energy use

Project Year	Energy GJ	Scope 1					Scope 2	TOTAL (Scope 1 + Scope 2)	
		Diesel (mining) tCO_2-e	Fugitive gas tCO_2-e	Blasting tCO_2-e	Land clearing tCO_2-e	Total tCO_2-e	Electricity tCO_2-e	Including LULUCF tCO_2-e	Excluding LULUCF tCO_2-e
-1	118,320	3,261	—	—	4,813	8,074	16,000	24,074	19,261
0	154,320	3,261	—	—	4,813	8,074	24,000	32,074	27,261
1	186,250	4,242	31,000	—	—	35,242	28,000	63,242	63,242
2	246,070	4,651	31,579	—	—	36,230	40,000	76,230	76,230
3	382,729	10,075	99,304	—	—	109,379	53,250	162,628	162,628
4	591,803	13,695	426,096	—	—	439,791	88,283	528,074	528,074
5	618,018	14,149	352,765	—	—	366,914	92,676	459,590	459,590
6	636,233	14,464	370,895	—	—	385,359	95,728	481,087	481,087
7	587,712	13,624	392,269	—	—	405,893	87,598	493,491	493,491
8	504,994	12,192	422,742	—	—	434,934	73,737	508,671	508,671
9	506,621	12,220	583,656	—	—	595,876	74,010	669,886	669,886
10	466,334	11,522	685,045	—	—	696,567	67,259	763,826	763,826
11	514,017	12,348	560,605	—	—	572,953	75,249	648,202	648,202
12	389,094	10,185	819,188	—	—	829,373	54,317	883,689	883,689
13	465,775	11,513	803,976	—	—	815,489	67,165	882,654	882,654
14	508,288	12,249	620,041	—	—	632,290	74,289	706,579	706,579
15	546,846	12,538	522,341	—	—	534,879	81,946	616,824	616,824

Project Year	Energy GJ	Scope 1					Scope 2	TOTAL (Scope 1 + Scope 2)	
		Diesel (mining) tCO_2-e	Fugitive gas tCO_2-e	Blasting tCO_2-e	Land clearing tCO_2-e	Total tCO_2-e	Electricity tCO_2-e	Including LULUCF tCO_2-e	Excluding LULUCF tCO_2-e
16	428,017	10,480	593,650	—	—	604,130	62,034	666,164	666,164
17	448,553	10,836	563,348	—	—	574,184	65,475	639,659	639,659
18	475,492	11,302	403,183	—	—	414,485	69,989	484,474	484,474
19	435,212	10,604	361,806	—	—	372,410	63,240	435,650	435,650
20	1,025,839	50,097	316,206	1,403	14,013	381,720	65,401	447,121	433,108
21	1,278,079	63,262	390,607	1,655	10,671	466,195	79,102	545,297	534,626
22	1,207,708	63,893	336,511	1,823	8,350	410,577	60,942	471,519	463,170
23	1,048,397	58,998	276,185	1,827	4,857	341,868	40,978	382,845	377,988
24	736,950	50,111	238,641	1,771	4,586	295,108	—	295,108	290,522
25	775,915	52,836	34,228	1,789	11,788	100,640	—	100,640	88,852
26	841,312	57,379	33,187	1,849	3,233	95,648	—	95,648	92,415
27	768,371	52,245	30,286	1,848	3,486	87,866	—	87,866	84,380
28	731,586	49,730	33,375	1,774	2,890	87,768	—	87,768	84,878
29	589,690	40,191	44,264	1,323	806	86,585	—	86,585	85,779
30	67,951	4,669	9,100	115	—	13,884	—	13,884	13,884
31	171,963	12,106	—	—	—	12,106	—	12,106	12,106
32	196,130	13,808	—	—	—	13,808	—	13,808	13,808
33	191,070	13,451	—	—	—	13,451	—	13,451	13,451

Project Year	Energy GJ	Scope 1					Scope 2	TOTAL (Scope 1 + Scope 2)	
		Diesel (mining) tCO_2-e	Fugitive gas tCO_2-e	Blasting tCO_2-e	Land clearing tCO_2-e	Total tCO_2-e	Electricity tCO_2-e	Including LULUCF tCO_2-e	Excluding LULUCF tCO_2-e
34	160,640	11,309	—	—	—	11,309	—	11,309	11,309
35	23,352	1,644	—	—	—	1,644	—	1,644	1,644
TOTAL	**19,025,652**	**815,136**	**10,386,080**	**17,178**	**74,305**	**11,292,698**	**1,600,669**	**12,893,367**	**12,819,063**
Average	**514,207**	**22,031**	**280,705**	**464**	**2,008**	**305,208**	**43,261**	**348,469**	**346,461**
%	Scope 1	7%	92%	0.2%	0.7%	100%	—	—	—
	Scope 1 + 2	6%	81%	0.1%	0.6%	88%	12%	100%	—

Table 13.14: Estimated Project and Lake Vermont Mine annual Scope 1 and 2 GHG emissions

Mine Year	Project			Lake Vermont Existing Operations			Lake Vermont Mine (TOTAL)			Project (%)
	Scope 1 tCO_2-e	**Scope 2 tCO_2-e**	**Scope 1 + 2 tCO_2-e**	**Scope 1 tCO_2-e**	**Scope 2 tCO_2-e**	**Scope 1 + 2 tCO_2-e**	**Scope 1 tCO_2-e**	**Scope 2 tCO_2-e**	**Scope 1 & 2 tCO_2-e**	**Scope 1 + 2**
-3	—	—	—	517,075	59,200	576,275	517,075	59,200	576,275	0%
-2	—	—	—	524,312	59,200	583,512	524,312	59,200	583,512	0%
-1	3,261	16,000	19,261	527,175	59,200	586,375	530,436	75,200	605,636	3%
0	3,261	24,000	27,261	524,506	59,200	583,706	527,767	83,200	610,967	4%
1	35,242	28,000	63,242	519,845	59,200	579,045	555,087	87,200	642,287	10%
2	36,230	40,000	76,230	516,697	59,200	575,897	552,928	99,200	652,128	12%
3	109,379	53,250	162,628	337,012	59,200	396,212	446,391	112,450	558,840	29%
4	439,791	88,283	528,074	219,367	59,200	278,567	659,157	147,483	806,641	65%
5	366,914	92,676	459,590	206,143	59,200	265,343	573,056	151,876	724,932	63%
6	385,359	95,728	481,087	210,411	59,200	269,611	595,770	154,928	750,698	64%
7	405,893	87,598	493,491	252,404	59,200	311,604	658,297	146,798	805,095	61%
8	434,934	73,737	508,671	280,527	59,200	339,727	715,461	132,937	848,398	60%
9	595,876	74,010	669,886	288,677	59,200	347,877	884,553	133,210	1,017,763	66%
10	696,567	67,259	763,826	297,446	59,200	356,646	994,013	126,459	1,120,472	68%
11	572,953	75,249	648,202	323,913	59,200	383,113	896,865	134,449	1,031,314	63%
12	829,373	54,317	883,689	357,657	59,200	416,857	1,187,029	113,517	1,300,546	68%
13	815,489	67,165	882,654	340,845	59,200	400,045	1,156,333	126,365	1,282,699	69%

Mine Year	Project			Lake Vermont Existing Operations			Lake Vermont Mine (TOTAL)			Project (%)
	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 + 2 tCO_2-e	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 + 2 tCO_2-e	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 & 2 tCO_2-e	Scope 1 + 2
14	632,290	74,289	706,579	335,608	59,200	394,808	967,897	133,489	1,101,386	64%
15	534,879	81,946	616,824	330,099	59,200	389,299	864,977	141,146	1,006,123	61%
16	604,130	62,034	666,164	354,521	59,200	413,721	958,651	121,234	1,079,885	62%
17	574,184	65,475	639,659	359,899	59,200	419,099	934,083	124,675	1,058,758	60%
18	414,485	69,989	484,474	334,187	59,200	393,387	748,672	129,189	877,862	55%
19	372,410	63,240	435,650	333,869	59,200	393,069	706,280	122,440	828,720	53%
20	367,706	65,401	433,108	243,394	59,200	302,594	611,100	124,601	735,701	59%
21	455,524	79,102	534,626	184,206	59,200	243,406	639,730	138,302	778,032	69%
22	402,227	60,942	463,170	211,389	59,200	270,589	613,616	120,142	733,759	63%
23	337,011	40,978	377,988	257,758	59,200	316,958	594,769	100,178	694,946	54%
24	290,522	—	290,522	183,411	59,200	242,611	473,933	59,200	533,133	54%
25	88,852	—	88,852	170,256	59,200	229,456	259,108	59,200	318,308	28%
26	92,415	—	92,415	163,121	59,200	222,321	255,536	59,200	314,736	29%
27	84,380	—	84,380	170,667	59,200	229,867	255,047	59,200	314,247	27%
28	84,878	—	84,878	159,206	59,200	218,406	244,084	59,200	303,284	28%
29	85,779	—	85,779	124,849	59,200	184,049	210,628	59,200	269,828	32%
30	13,884	—	13,884	154,994	59,200	214,194	168,878	59,200	228,078	6%
31	12,106	—	12,106	110,856	59,200	170,056	122,962	59,200	182,162	7%

Mine Year	Project			Lake Vermont Existing Operations			Lake Vermont Mine (TOTAL)			Project (%)
	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 + 2 tCO_2-e	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 + 2 tCO_2-e	Scope 1 tCO_2-e	Scope 2 tCO_2-e	Scope 1 & 2 tCO_2-e	Scope 1 + 2
32	13,808	—	13,808	108,225	59,200	167,425	122,033	59,200	181,233	8%
33	13,451	—	13,451	108,225	59,200	167,425	121,677	59,200	180,877	7%
34	11,309	—	11,309	102,964	59,200	162,164	114,273	59,200	173,473	7%
35	1,644	—	1,644	94,602	59,200	153,802	96,246	59,200	155,446	1%
36	—	—	—	52,411	59,200	111,611	52,411	59,200	111,611	0%
TOTAL	**11,218,393**	**1,600,669**	**12,819,063**	**10,892,729**	**2,368,000**	**13,260,729**	**22,111,122**	**3,968,669**	**26,079,792**	**49%**
Average	**303,200**	**43,261**	**346,461**	**272,318**	**59,200**	**331,518**	**552,778**	**99,217**	**651,995**	**—**

Table 13.15: Estimated annual Scope 3 GHG emissions for the Project

Year	Diesel + Electricity* t CO_2-e	Rail transport of coal t CO_2-e	Shipping of coal t CO_2-e	End use of product coal (industrial)** t CO_2-e	End use of product coal (coking) t CO_2-e	Total t CO_2-e
-1	2,567	—	—	—	—	2,567
0	3,767	—	—	—	—	3,767
1	4,417	1,262	3,813	19,616	270,473	299,582
2	6,238	4,492	13,573	91,434	941,797	1,057,534
3	8,503	40,981	123,821	744,445	8,678,345	9,596,095
4	13,943	69,034	208,579	1,162,571	14,707,230	16,161,358
5	14,625	72,917	220,311	1,030,639	15,725,036	17,063,527
6	15,099	75,058	226,781	934,922	16,308,542	17,560,401
7	13,836	68,486	206,924	1,134,502	14,608,679	16,032,427
8	11,684	56,892	171,894	1,030,474	12,050,555	13,321,499
9	11,726	53,797	162,543	2,531,788	9,890,728	12,650,583
10	10,678	48,871	147,659	2,382,754	8,905,005	11,494,967
11	11,919	54,166	163,658	2,906,402	9,613,455	12,749,600
12	8,668	39,519	119,404	2,153,689	6,981,842	9,303,123
13	10,664	49,466	149,458	2,236,872	9,182,465	11,628,924
14	11,770	54,650	165,118	2,218,323	10,388,948	12,838,809
15	12,933	60,794	183,683	2,277,474	11,740,799	14,275,684
16	9,841	47,300	142,912	771,356	10,101,275	11,072,684

Year	Diesel + Electricity* t CO_2-e	Rail transport of coal t CO_2-e	Shipping of coal t CO_2-e	End use of product coal (industrial)** t CO_2-e	End use of product coal (coking) t CO_2-e	Total t CO_2-e
17	10,375	50,340	152,099	781,098	10,789,088	11,783,000
18	11,076	53,679	162,187	789,334	11,546,825	12,563,102
19	10,028	48,243	145,763	699,927	10,386,649	11,290,611
20	12,372	51,601	155,908	1,105,101	10,765,268	12,090,251
21	15,100	68,207	206,080	1,792,235	13,909,326	15,990,947
22	12,409	56,187	169,764	1,808,150	11,137,762	13,184,272
23	9,164	40,770	123,183	1,363,065	8,032,394	9,568,576
24	2,562	13,679	41,328	650,215	2,508,567	3,216,351
25	2,702	13,933	42,097	843,073	2,380,612	3,282,416
26	2,934	12,453	37,627	1,016,774	1,873,561	2,943,350
27	2,672	11,522	34,813	821,851	1,848,310	2,719,168
28	2,543	13,832	41,792	785,014	2,413,544	3,256,725
29	2,055	18,990	57,376	880,600	3,504,000	4,463,022
30	239	3,906	11,800	175,731	725,851	917,527
31	619	—	—	—	—	619
32	706	—	—	—	—	706
33	688	—	—	—	—	688
34	578	—	—	—	—	578
35	84	—	—	—	—	84

Year	Diesel + Electricity* t CO_2-e	Rail transport of coal t CO_2-e	Shipping of coal t CO_2-e	End use of product coal (industrial)** t CO_2-e	End use of product coal (coking) t CO_2-e	Total t CO_2-e
TOTAL	**281,784**	**1,255,030**	**3,791,950**	**37,139,429**	**251,916,930**	**294,385,123**
Average	**7,616**	**33,920**	**102,485**	**1,003,768**	**6,808,566**	**7,956,355**
%	0.10%	0.43%	1.29%	12.62%	85.57%	100.00%

*Full fuel cycle GHG emissions including production and distribution related emissions
**Industrial coal approximated as thermal coal

Table 13.16: Cumulative annual Scope 3 GHG emissions for the Project and Lake Vermont Mine

Year	Project tCO_2-e	Lake Vermont Existing Operations tCO_2-e	Lake Vermont Mine (TOTAL) tCO_2-e	Project (%)
-3	—	25,699,136	25,699,136	0%
-2	—	25,533,027	25,533,027	0%
-1	2,567	25,056,273	25,058,840	0%
0	3,767	25,001,723	25,005,490	0%
1	299,582	24,390,742	24,690,324	1%
2	1,057,534	23,589,833	24,647,368	4%
3	9,596,095	15,499,017	25,095,111	38%
4	16,161,358	9,954,128	26,115,486	62%
5	17,063,527	9,297,920	26,361,447	65%
6	17,560,401	9,658,496	27,218,897	65%
7	16,032,427	9,436,074	25,468,501	63%
8	13,321,499	11,626,065	24,947,564	53%
9	12,650,583	12,578,891	25,229,475	50%
10	11,494,967	13,260,776	24,755,743	46%
11	12,749,600	11,965,738	24,715,338	52%
12	9,303,123	14,937,182	24,240,305	38%
13	11,628,924	12,952,231	24,581,156	47%
14	12,838,809	12,087,524	24,926,332	52%
15	14,275,684	11,678,302	25,953,985	55%
16	11,072,684	13,150,507	24,223,191	46%
17	11,783,000	13,760,400	25,543,400	46%
18	12,563,102	12,229,574	24,792,676	51%
19	11,290,611	12,476,792	23,767,404	48%
20	12,090,251	8,244,451	20,334,702	59%
21	15,990,947	4,027,851	20,018,798	80%
22	13,184,272	5,189,311	18,373,583	72%
23	9,568,576	9,312,600	18,881,176	51%
24	3,216,351	7,144,168	10,360,519	31%
25	3,282,416	6,147,419	9,429,836	35%

Year	Project tCO_2-e	Lake Vermont Existing Operations tCO_2-e	Lake Vermont Mine (TOTAL) tCO_2-e	Project (%)
26	2,943,350	4,765,127	7,708,477	38%
27	2,719,168	5,031,049	7,750,217	35%
28	3,256,725	4,723,225	7,979,950	41%
29	4,463,022	3,664,685	8,127,707	55%
30	917,527	5,106,984	6,024,511	15%
31	619	3,411,568	3,412,187	0%
32	706	3,184,956	3,185,662	0%
33	688	3,184,956	3,185,644	0%
34	578	2,731,733	2,732,311	0%
35	84	2,505,124	2,505,209	0%
36	—	1,925,048	1,925,048	0%
TOTAL	**294,385,123**	**436,120,610**	**730,505,733**	**40%**
Average	**7,956,355**	**10,903,015**	**18,262,643**	

13.4 Regulatory obligations—NGER and the Safeguard Mechanism

Cumulative annual GHG emissions (Scope 1 + Scope 2, excluding LULUCF) for the combined Lake Vermont Mine and the Project, range are:

Scope 1: 2–829 ktCO_2-e/y

Scope 2: 16–95 ktCO_2-e/y

Total: 2–884 ktCO_2-e/y.

In all years of operation, except for the final years (Years 35 and 36), estimated Scope 1 emissions (excluding LULUCF) will exceed the reporting threshold of 100 kt CO_2-e/y. Under the current Safeguard Mechanism, facilities with Scope 1 emissions of more than 100 kt CO_2-e/y are required to keep their emissions within baseline levels. This Safeguard Mechanism would apply to the Project; however, the exact implications of this would need to be reviewed on an annual basis in communication with the Clean Energy Regulator (Appendix L, Air Quality and GHG Assessment, Section 4.6).

13.5 Mitigation and management measures

The impact of particulates was assessed as the critical air pollutant for determining impacts and achieving no impact from particulates is considered to sufficient to manage potential impacts from other pollutants (refer section 13.1.2.3). Practices to mitigate air quality emissions are in place for the existing Lake Vermont Mine and will be continued for the duration of the proposed Project. The proposed measures to mitigate air quality impacts are targeted to managing potential impacts from particulates and will also provide benefits to mitigate potential impacts from other pollutants. These mitigation measures include:

- application of water to haul roads;

- watering during handling activities;
- machine and vehicle maintenance;
- vegetation establishment on recontoured/rehabilitated areas
- watering of stockpiles; and
- sealing of the ROM haul road from the Project to the existing CHPP.

Additional emissions controls are proactively applied when necessary at the Lake Vermont Mine and will be implemented during the Project. These controls typically are applied during periods when meteorological conditions promote an increase in dust generation, including:

- additional road watering concentrated at problem areas;
- speed restrictions imposed on haul trucks when dust is visible, which reduces the overall hauling capacity by approximately 20%;
- re-routing haul trucks to reduce waste haulage distances by up to 50%; and
- re-assigning haulage location(s) to areas experiencing less dust.

The proposed mitigation measures are considered sufficient to manage potential air quality impacts to within the proposed limits (refer section 13.1.2). Restricting impacts to within the proposed limits will achieve the objectives of the Environmental Protection (Air) Policy and ensure compatibility of the Project activities with existing and potential land uses of the area which are low intensity cattle grazing, mining and resource exploration.

13.5.1 Additional air quality controls

Additional air quality control measures may be implemented, if and as required, following a complaint; for example:

- applying additional at-source dust air quality controls;
- increasing the intensity of air quality controls;
- modifying certain operations to reduce impacts to air quality; and
- investigating exceedances of air quality objectives.

13.5.2 GHG mitigation and management

The Queensland resources sector is in position to contribute to emission reduction actions, as identified in ‘A Queensland zero net emissions economy: Resources’ (Queensland Government, 2022b). The resources industry can promote low emissions transitions through approaches to attract investment and facilitate growth for low emissions outcomes identified as follows:

- maintain a reputation as a global leader through;
  - innovative practices;
  - skilled workforce development; and
  - automation and reliable supply;
- sustain a skilled and adaptable workforce;
- invest in training programs; and
- conduct strategic planning for areas to be affected by a mine closure.

The resources sector can also contribute to the facilitation of growth in pursuit of GHG emission reduction through:

- support the labour force to transition to new opportunities in growing areas of the resources sector as mines reach the end of their operational life:
- advocate to the government for policies that are likely to improve certainty around future demand and governance frameworks;
- develop forward looking strategies which incorporate projected changes in global resources and leverage opportunities; and
- develop infrastructure for re-using existing gas and coal infrastructure for critical minerals.

Bowen Basin Coal has incorporated these approaches into the proposed Project and the Project is an example of the attraction of investment and efforts to facilitate growth in the interests of realising opportunities, optimising skilled labour and infrastructure to mitigate climate change risks. Bowen Basin Coal will investigate preferred and alternative measures to contribute towards the Queensland Government emissions reduction and renewable energy targets by taking climate action measures advised by the Queensland Government recommended climate actions (Queensland Government 2022c) including:

- assess and manage the exposure of the Project to climate change risks (refer Chapter 4, Climate);
- investigate the development of a Project emissions reduction target;
- investigate renewable energy options;
- acquire carbon credits through carbon farming initiatives where practicable to offset Project carbon emissions; and
- investigate options for producing energy onsite from waste materials.

For measures designed to mitigate, reduce, control or manage GHG emissions from the Project Bowen Basin Coal is committed to implementing the following initiatives:

- regular plant and equipment maintenance will occur to minimise fuel consumption and associated emissions, including training staff on continuous improvement strategies regarding efficient use of plant and equipment;
- adherence to a Waste Management Plan which includes provisions for the monitoring and reduction of waste;
- regular assessments, reviews and evaluations of GHG reduction opportunities will occur;
- procurement policies that require the selection of energy-efficient equipment and vehicles will apply;
- monitoring and maintenance of equipment will occur in accordance with manufacturer recommendations;
- optimisation of diesel consumption through logistics analysis and planning will occur (e.g. review of the mine plan to optimise haul lengths, dump locations and road gradients); and
- flaring waste coal mine gas as part of gas drainage activities will occur when practicable to reduce equivalent CO_2 emissions. generation of on-site power from waste coal mine gas as part of gas drainage activities will be assessed as an alternative measure should it prove practical and economically viable

13.5.3 Monitoring and reporting

The predictive modelling shows that the Project air quality impacts are unlikely to exceed the proposed limits (refer section 13.1.2) and are likely to achieve the objectives of the Environmental Protection (Air) Policy. The Project will be subject to reporting obligations, in conjunction with Lake Vermont Mine. Where the Project exceeds the air quality limits or receives a complaint of nuisance at a sensitive place, targeted monitoring will be required to investigate potential impacts.

The Project will be subject to annual monitoring and reporting of GHG emissions under requirements of the NGER scheme, described in section 13.4.