BARALABA SOUTH

Baralaba South Project

Environmental Impact Statement

CHAPTER 11

Air Quality, Greenhouse Gas and Decarbonisation

ARC ENVIRONMENTAL SOLUTIONS

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11 Air Quality

This chapter describes the assessment of potential air quality impacts on the existing air environment, with specific regard to receptors surrounding the Project, and potential greenhouse gas emissions.

An air quality and greenhouse gas (GHG) Assessment for the Project has been undertaken by Trinity Consultants Australia (Trinity) and is presented as Appendix L, Air Quality and Greenhouse Gas Assessment. Further to that assessment, a decarbonisation plan has been undertaken by Katestone Pty Ltd and is presented in Appendix Z.

11.1 Environmental objectives and performance outcomes

This chapter has been prepared to assist the DES in carrying out the environmental objective assessment in respect of the following environmental objective prescribed in Schedule 8, Part 3, Division 1 of the EP Regulation:

> *The [Project] will be operated in a way that protects the environmental values of air.*

The detailed assessment presented in this chapter and in the Air Quality and Greenhouse Gas Assessment (Appendix L) demonstrates that the Project will achieve performance outcome 2 for the environmental objective, as outlined in Schedule 8 of the EP Regulation because the Project will be operated 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 air quality 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 2022); and
- Guideline: Application requirements for activities with impacts to air (DES 2023b).

11.1.1. Air quality and GHG terminology

The Environmental Protection (Air) Policy 2019 (Qld) (EPP Air) and the ‘EIS Guideline–Air (DES 2022)’ 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 for coal projects will include indirect sources such as rail and shipping of product coal, and the use of the product coal by third parties.
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.

11.1.2. Air quality objectives

Schedule 1 of the EPP (Air) sets out the air quality objectives for Queensland, and the relevant air quality objectives for the Project are summarised in Table 11.1.

Table 11.1: Project objectives

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

11.1.2.1 Suspended dust particulates

During the life of the Project, mining activities have the potential to generate particulate matter (i.e. dust) emissions through combustion processes, operations and transport. 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}).

PM_{10} and $PM_{2.5}$ include inhalable particles that are small enough to penetrate the thoracic region of the respiratory system. The health effects may include respiratory and cardiovascular morbidity, asthma, mortality from cardiovascular and respiratory diseases and from lung cancer. Susceptible groups with pre-existing lung or heart disease, as well as elder people and children, are particularly vulnerable.

11.1.2.2 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' 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. Dust impacts on flora and fauna are also considered in Appendix L, Air Quality and Greenhouse Gas Assessment.

11.1.2.3 Other pollutants

The main air pollutant from mining activities is particulates. Emissions of other air pollutants will also arise from mining operations associated with diesel powered equipment and blasting. These emissions may 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 these and other pollutants will be transient in nature and likely to have negligible impact outside of the active working areas of the Project site. Gaseous emissions have been assessed in section 11.3.8.

11.1.2.4 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 product coal to the existing TLO for shipment. 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. Coal will be processed and handled 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 14, Waste Management and Chapter 3, Rehabilitation. The key elements of an emergency response to spontaneous combustion are described in Chapter 17, Hazards and Safety.

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

11.1.2.5 Odour

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 11.1.2.4).

The Project is unlikely to cause elevated odour levels due to the minimal gaseous pollutants (Appendix L, Air Quality and Greenhouse Gas Assessment) and therefore no management measures are considered necessary for odours.

11.2 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, resulting from the proposed Project.

11.2.1. Overview

The Project MLA is located in a rural area surrounded by agricultural land. Mining, and then processing of a maximum of approximately 1.9 Mtpa product coal is proposed to occur within the MLA. There are isolated dwellings interspersed around and within the proposed mining lease boundary. The closest town is Baralaba which is located approximately 8 km north of the Project. Further north of Baralaba township is the Baralaba North Mine.

Product coal is proposed to be transported on public Council controlled road via covered road train to an existing TLO facility located approximately 40 km south of the Project MLA, and approximately 2 km east of the town of Moura. The TLO facility is located in a rural area surrounded by agricultural land. The existing TLO throughput will briefly increase from approximately 1.8 Mtpa to approximately 2.5 Mtpa when both mines are in operation, before Baralaba North closes and throughput settles to the maximum of approximately 1.9 Mtpa from the Project.

There are isolated dwellings approximately 1 km to the west of the TLO, and approximately 2 to 3 km to the east of the TLO are industries including Queensland Nitrates (QNP) and Dyno Nobel Moura. Approximately 4 km east of the TLO is Anglo Coal’s Dawson Mine. To the south-east and south of the TLO are networks of coal seam gas extraction wells.

11.2.2. Local topography and climate

Climate and local topography can influence dust dispersion in the surrounding environment. The closest weather station with continuous monitoring of wind is the Baralaba Mine weather station.

A review of wind conditions over the Years 2014 to 2021 has determined Year 2015 as being an appropriate year for modelling purposes as it has conservative proportions of calm and higher wind speed conditions (Appendix L, Air Quality and Greenhouse Gas Assessment). Meteorological data from the Baralaba Mine weather station for the period 1 January 2015 to 31 December 2015 has been analysed by Trinity (Appendix L, Air Quality and Greenhouse Gas Assessment). A wind rose of wind monitoring data shows a higher proportion of calm conditions and winds from the south-south-east (shown in Figure 11.1). Local climate parameters are further described in section 2.3 in Chapter 2, Project Description.

Atmospheric stability can also affect noise dispersion and is used as an input for noise impact modelling. Six classes of atmospheric stability are commonly identified using the Pasquill-Turner Scheme as follows:

- Class A: Extremely unstable conditions, clear skies, warmer temperatures.
- Class B: Moderately unstable conditions, clear skies, day-time temperatures.
- Class C: Slightly unstable conditions, moderate winds, slightly overcast and day-time temperatures
- Class D: Neutral conditions, cloudy overcast, moderate winds during either day or night-time.
- Class E: Slightly stable conditions, overcast skies and night-time cooler temperatures.
- Class F: Moderately stable conditions, clear skies, very cold night temperatures

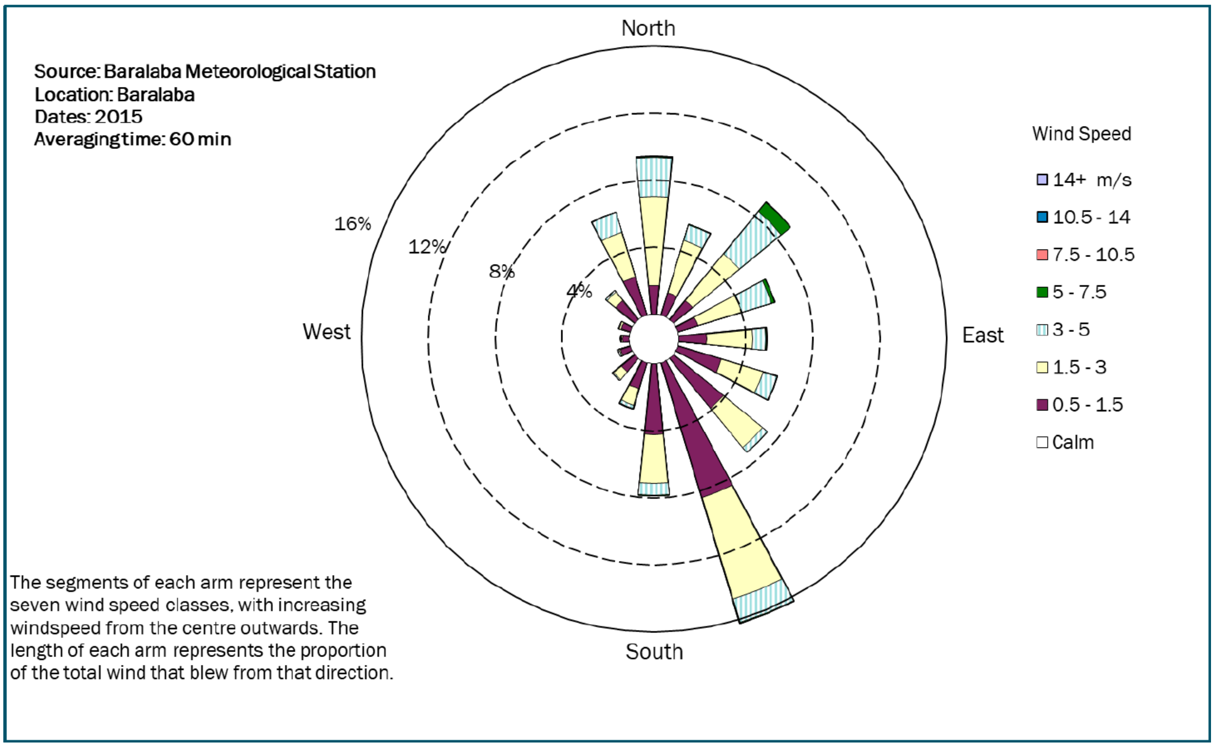

Figure 11.1: Wind rose: Baralaba Mine weather station data

Day-time conditions range from neutral to unstable as a result of solar heating of the ground inducing atmospheric mixing and night-time conditions at the Project are predominantly stable but range from stable to neutral (refer Figure 11.2 for stability classes near the Project and Figure 11.3 for stability classes near the TLO).

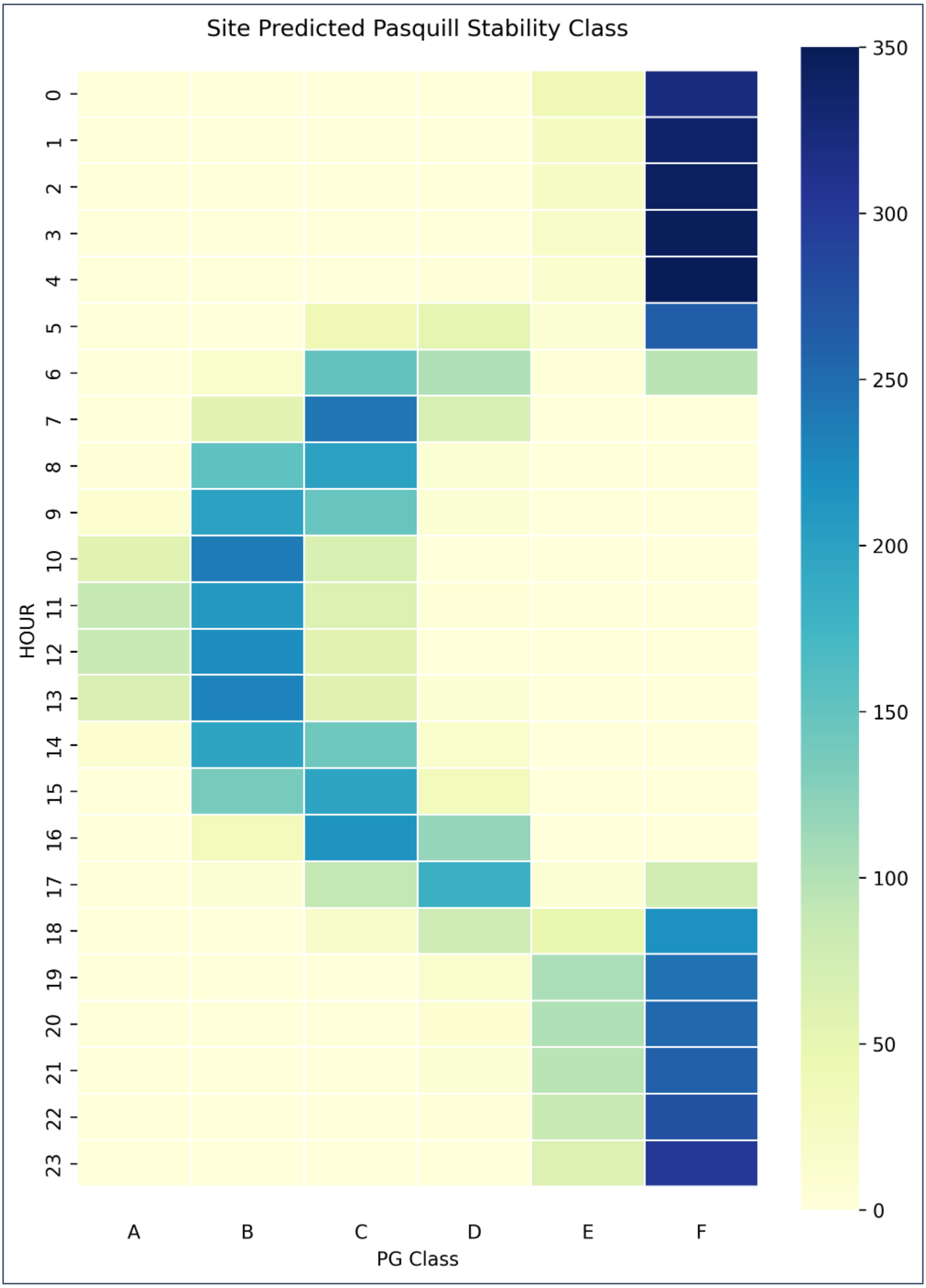

Figure 11.2: Stacked proportions of stability classes by time of day - Project site

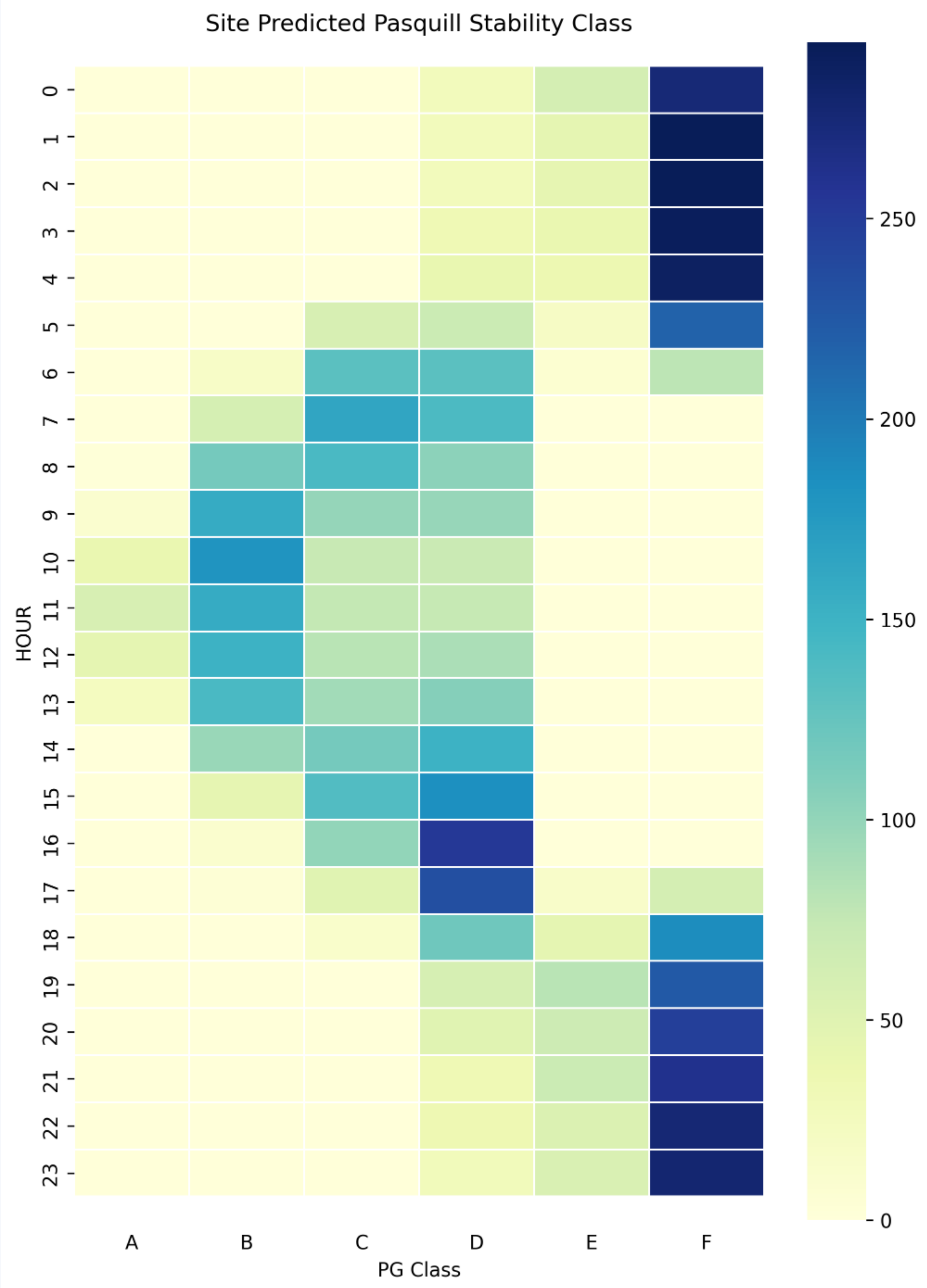

Figure 11.3: Stacked proportions of stability classes by time of day – TLO site

Local to the Project, there are two distinct topographical profiles present including the lower Dawson River floodplain to the west of the Project and the higher landform to the east of the site approaching Mount Ramsay. Ground elevations across the site range between 75 mAHD and 110 mAHD, with the Project best described as predominantly flat with only slight undulations (Figure 11.4). At 445 mAHD, Mount Ramsay, located approximately 1.2 km to the east of the MLA boundary, is a key topographical feature in the region and influences wind speed and direction in the immediate area. Winds flow around Mount Ramsay and wind speeds are generally lower immediately upwind compared to downwind where wind speeds are generally higher (Appendix L, Air Quality and Greenhouse Gas Assessment).

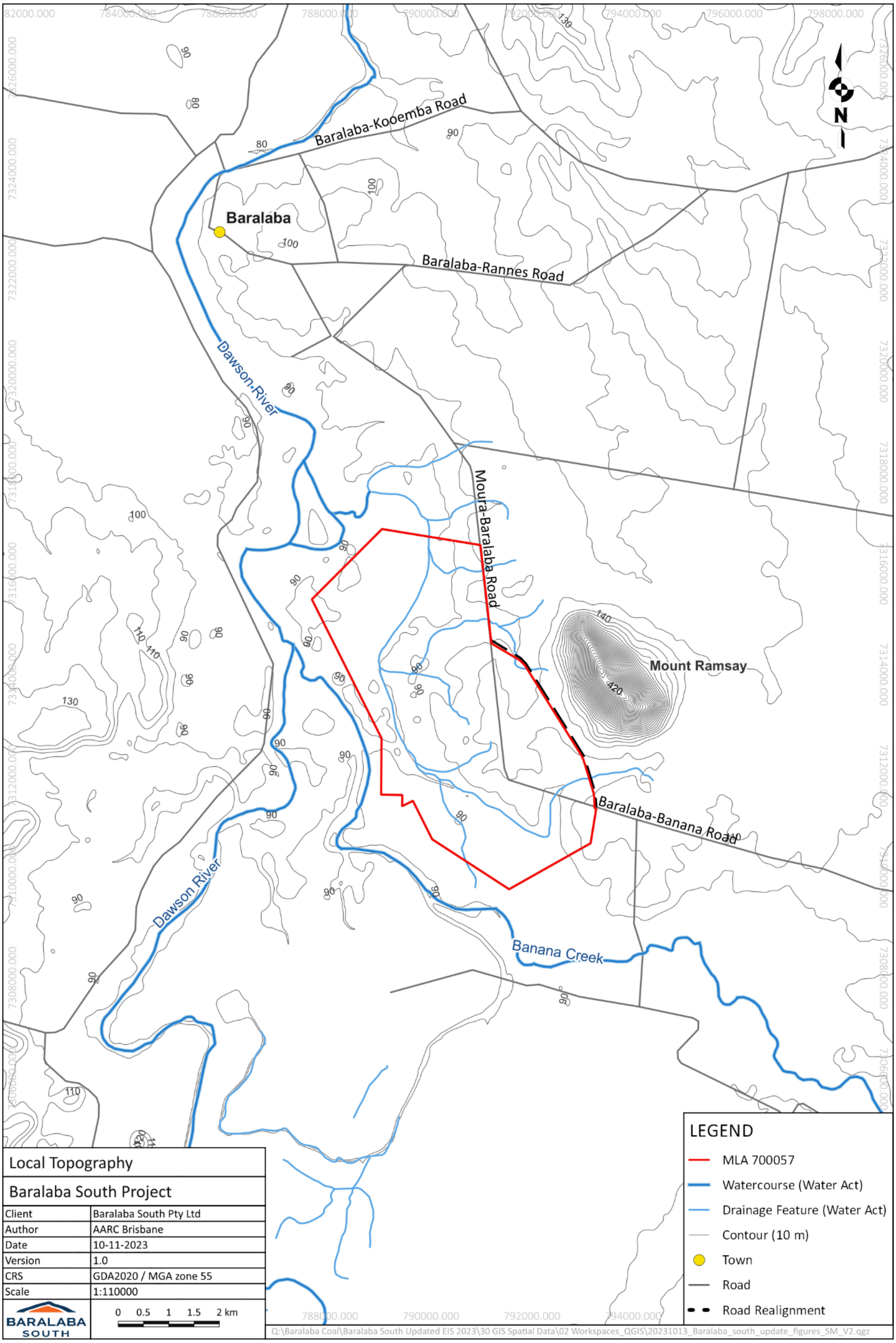

Figure 11.4: Local topography

11.2.3. Mining lease area

11.2.3.1 Sensitive receptors

There are 21 sensitive receptors (SRs) located within 5 km of the Project MLA, all of which are residential (Table 11.2). Four SRs, SR1, SR2, SR3 and SR14, are located within the MLA and SR9 is on land which partially underlies the MLA (Figure 11.5). Baralaba South Pty Ltd must agree compensation and reach agreement with these five SRs before the mining lease may be granted. Where appropriate and where requested by the landholders, such agreements will involve the relocation of the living arrangements before operations commence.

Table 11.2: Sensitive receptors

SR ID	Real property description	Approximate distance and direction from the Project boundary
1	Lot 11 on FN153	Within the Project boundary
2	Lot 11 on FN153	Within the Project boundary
3	Lot 26 on FN153	Within the Project boundary
4	Lot 35 on FN141	3.6 km south-west
5	Lot 141 on FN137	3.7 km north
6	Lot 5 on RP856832	2.9 km north-west
7	Lot 3 on RP856832	4.9 km north-west
8	Lot 110 on FN103	4.8 km north-west
9	Lot 1 on RP801031	900 m north-east
10	Lot 126 on FN148	3.2 km north-east
11	Lot 102 on SP107139	2.9 km north
12	Lot 80 on SP131479	4.9 km north
13	Lot 133 on FN143	3.1 km north-east
14	Lot 135 on FN143	Within the Project boundary
15	Lot 6 on KM50	3.5 km west
16	Lot 4 on FN514	1.8 km south-west
17	Lot 28 on FN514	4.1 km south-east
18	Lot 30 on FN 154	4.5 km south-east
19	Lot 5 on RP856832	3.2 km north-west
20	Lot 12 on FN514	2.2 km south-west
21	Lot 12 on FN514	4.6 km south-west

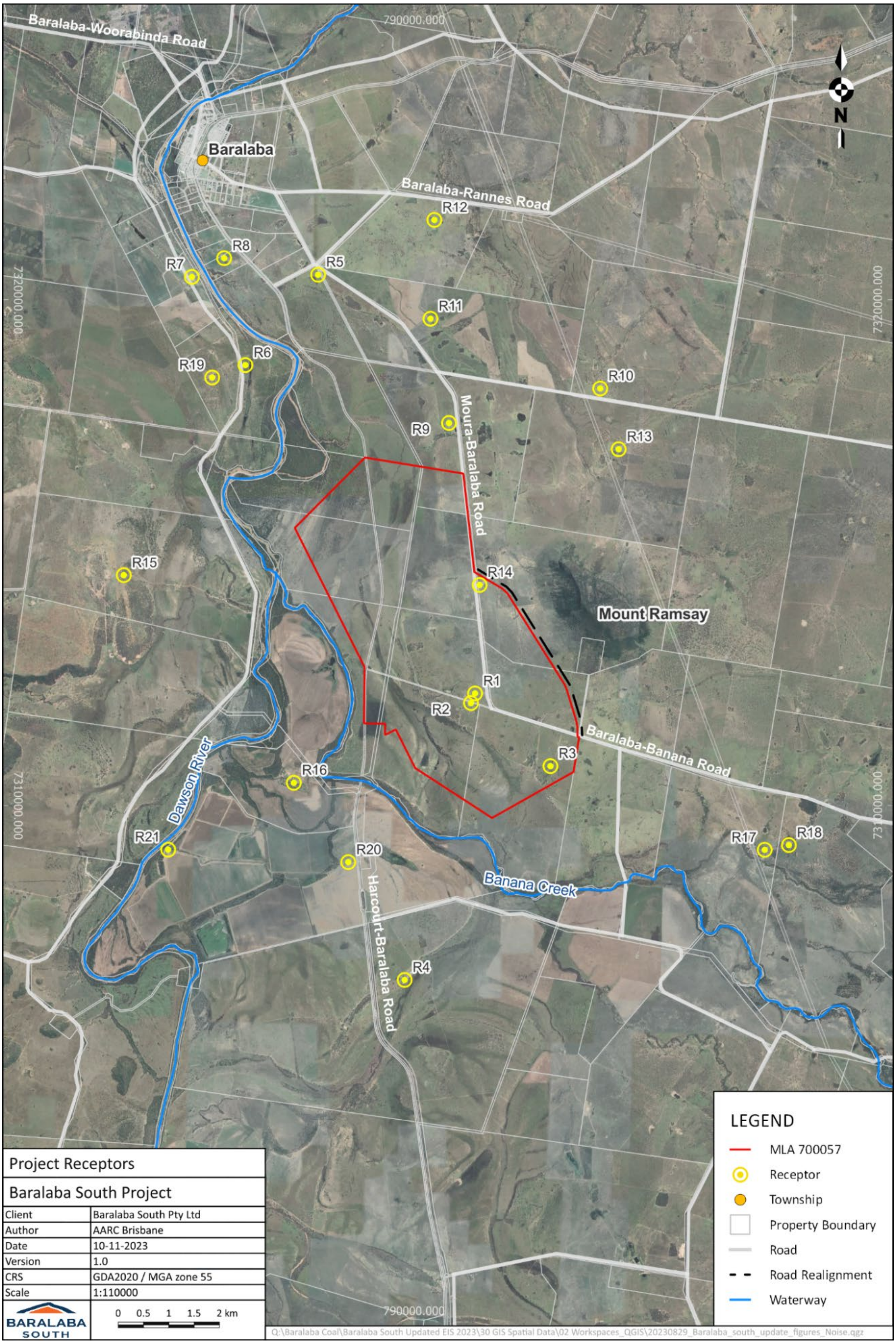

Figure 11.5: Sensitive receptors near Project

11.2.4. Train load out

There are 17 SRs in proximity to the TLO including residential and commercial places. SRs listed in Table 11.3 and illustrated Figure 11.6.

Table 11.3: Sensitive receptors - TLO

SR ID	Real property description	Approximate distance and direction from the Project boundary
A	1/RP613366	6 km north-east
B	27/FN187	4.5 km north-east
C	1/RP909511	3 km north-east
D	6/SP101809	3 km north-east
E	7/FN464	6 km east-southeast
F	22/RP911707	3 km south
G	17/M86313	3.6 km south-west
H	1/SP118855	2.6 km north
I	1/RP616586	2.6 km north
J	40/FN508	4 km north
K	13/FN399	4.5 km north
L	7/SP118855	2 km west
M	2/SP252890	1 km south-west
N	34/FN499	800 m west
O	2/SP252890	1.6 km south-west
P	1/SP188953	2 km south-west
Q	106/M8699	2.8 km south-west

Figure 11.6: Sensitive receptors near TLO

11.2.5. Background air quality

Based on the rural nature of the regional area, it is expected that the existing air quality for the study area would be within air quality objectives for the majority of the time with possible exceptions including dust and particulates. The existing air quality would be influenced by sporadic traffic on unsealed roads as well as bushfires, controlled burning and dust from agriculture. Localised or short-term degradation of the air quality environment would most likely be due to smoke and dust from fires.

The Air Quality and Greenhouse Gas Assessment (Appendix L) estimates the expected background concentrations of relevant air contaminants (Table 11.4). The background levels of PM_{10} and $PM_{2.5}$ were calculated based on publicly available data recorded from similar locations as part of the DES air quality monitoring project. Values obtained and described as the background level were taken at the 70th percentile as a conservative measure (Victoria, 2001).

Site-specific data was unavailable for TSP background levels. Therefore, the 24-hour average and the annual average TSP background levels have been calculated by Trinity (2023) based on a typical ratio of PM_{10} to TSP of 0.39.

Background dust deposition levels vary according to locality. For the purpose of this assessment, Trinity (2023) adopted typical background levels from rural agricultural or industrial areas, with consideration of dust deposition levels at the Project site, and those adopted for the Baralaba North Continued Operations Project.

Contributions from Baralaba North Mine were considered in the selection of conservative background concentrations applied in the assessment. Typical dust emission concentrations in the vicinity of the Baralaba North Mine are lower than the modelled background concentrations for the Project.

The Dawson Mine, held by Anglo Coal (Dawson) Limited, is approximately 25 km south-east of the mining area. Operation of the Dawson Mine open cut mining operations are too far from the mining area to have discernible cumulative impacts. However, Dawson Mine is likely to contribute to background air quality at and surrounding the TLO facility. Hence, the background concentrations used for the assessment of the TLO facility have been increased to account for Dawson Mine's contribution.

A more detailed description of the methodology for determining background dust concentrations is provided in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.4: Background concentrations

Air quality indicator	Period	Background concentration MLA	Background concentration TLO
TSP	Annual	40.0 (µg/m^3)	45.9 (µg/m^3)
PM_{10}	24-hour	17.0 (µg/m^3)	19.5 (µg/m^3)
	Annual	15.6 (µg/m^3)	17.9 (µg/m^3)
$PM_{2.5}$	24-hour	5.8 (µg/m^3)	6.6 (µg/m^3)
	Annual	5.5 (µg/m^3)	6.3 (µg/m^3)
Dust deposition	1-month	50 (mg/m^2/day)	50 (mg/m^2/day)

11.3 Potential impacts

11.3.1. Particulate emissions—mining operations

11.3.1.1 Air modelling

Modelling scenarios

The mining operation stages are based on an indicative schedule described in Chapter 2, Project Description. The Project mine life includes up to two-year construction period, followed by an operational life of approximately 23 years (referred to as Years 1 to 23) under optimal mining conditions.

Potential air quality impacts have been assessed for the mining operation during scenario Years 1, 3 and 11. These scenarios have been selected to represent the highest potential to cause impact on existing SRs (i.e. worst-case scenarios). The modelled scenarios also factored in the assimilative capacity of the ambient environment to accept and dissipate potential air pollution generated through the Project.

Emission inventories

Trinity reviewed mine activities proposed during construction, operation, upset and closure that will generate emissions to air. Particulate emissions have been assessed to be substantially higher during operations than any other stage of mine development. Conservatively, air quality modelling of particulate emissions has been undertaken for three operating scenarios over the mine life. Operational emission sources include:

- ROM coal extraction;
- waste rock removal;
- truck haulage emissions;
- drilling;
- blasting;
- grading;
- dozing;
- crushing material;
- material handling; and
- wind erosion.

Detailed emissions inventories of predicted emission sources and quantities over the years modelled are presented in Table 11.5, Table 11.6 and Table 11.7.

Dust emission estimates have been calculated with consideration of the dust mitigation methods that will be adopted by the Project, as outlined in section 11.5.2.

Meteorological model

Trinity analysed meteorological data from the Baralaba North Mine weather station for the years 2014 to 2021 and concluded that meteorological data from the year 2015 was the most appropriate to use for analysis in dispersion modelling (Appendix L, Air Quality and Greenhouse Gas Assessment). With this data, Trinity has used TAPM and CALMET modelling configurations to generate a three-dimensional meteorological dataset for the Project area which is suitable for use with CALPUFF dispersion modelling—the model used to determine likely dust concentrations and dust deposition rates (Appendix L, Air Quality and Greenhouse Gas Assessment).

Dispersion model

Dispersion modelling has been conducted using the CALPUFF dispersion model for the year 2015, as it had conservative proportions of both calm and higher wind speed conditions. The CALPUFF dispersion model is a non-steady state Lagrangian puff dispersion modelling system. Full description of the dispersion model, meteorology, emission inventories and modelling outputs can be found in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.5: Total controlled emission inventory for Year 1

Source	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Loading trucks with overburden	6,626	5,955	949
Loading trucks with rejects	221	105	16
Loading trucks with ROM coal	14,386	3,494	547
Loading trucks with product coal	72,623	9,283	1,380
Dozing on overburden in pit	14,805	4,995	3,109
Dozing on overburden in WRE	74,024	13,146	7,772
Trucks unloading overburden	13,252	6,268	949
Trucks unloading rejects	41	19	3
Trucks unloading ROM coal	3,753	1,576	71
Drilling	7,275	3,822	579
Blasting	86,825	45,149	2,605
Trucks hauling (segment 1)	42,593	13,039	1,304
Trucks hauling (segment 2)	21,686	6,639	664
Trucks hauling (segment 3)	182	56	6
Trucks hauling (segment 4)	63	19	4
Trucks hauling (segment 5)	5,050	1,546	309
Trucks hauling (segment 6)	8,517	2,607	521
Trucks hauling (segment 7)	8,252	2,526	505
Trucks hauling (segment 8)	5,441	1,666	333
Trucks hauling (segment 9)	8,591	2,630	526
Trucks hauling (segment 10)	451	138	28
Trucks hauling (segment 11)	960	294	59
Trucks hauling (segment 12)	74,360	22,763	2,276
Trucks hauling (segment 13)	40,760	12,477	1,248
Trucks hauling (segment 14)	570	174	17
Trucks hauling (segment 15)	3,880	1,188	119
Scraper in travel mode	64,283	8,839	1,993
Scraper removing topsoil	18,481	4,620	573
Scraper unloading topsoil	12,746	3,186	395
Grader (in pit)	1,069	908	66
Grader (out of pit)	6,415	2,869	199
Crushing, transfers to stockpiles	33,779	14,200	404
Unloading coal to stockpile (conveying transfer point)	213	101	4
Wind erosion	81,054	40,527	3,040
Total	**733,226**	**236,824**	**32,572**

Table 11.6: Total controlled emission inventory for Year 3

Source	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Loading trucks with overburden	8,227	7,393	1,179
Loading trucks with rejects	403	191	29
Loading trucks with ROM coal	23,343	5,669	887
Loading trucks with product coal	112,665	14,401	2,141
Dozing on overburden in pit	44,414	7,887	4,663
Dozing on overburden in WRE	103,633	18,404	10,881
Trucks unloading overburden	16,455	7,783	1,179
Trucks unloading rejects	75	35	5
Trucks unloading ROM coal	6,090	2,558	116
Drilling	9,021	4,740	718
Blasting	107,665	55,986	3,230
Trucks hauling (segment 1)	1,649	959	101
Trucks hauling (segment 2)	4,893	2,846	300
Trucks hauling (segment 3)	8,418	4,896	515
Trucks hauling (segment 4)	34,162	19,870	2,092
Trucks hauling (segment 5)	42,030	12,866	1,287
Trucks hauling (segment 6)	805	468	49
Trucks hauling (segment 7)	815	474	50
Trucks hauling (segment 8)	64	37	4
Trucks hauling (segment 9)	21,797	6,673	667
Trucks hauling (segment 10)	309	95	9
Trucks hauling (segment 11)	2,582	1,502	158
Trucks hauling (segment 12)	632	193	19
Trucks hauling (segment 13)	5,544	1,697	170
Trucks hauling (segment 14)	73,250	22,424	2,242
Trucks hauling (segment 15)	43,081	13,188	1,319
Scraper in travel mode	64,283	8,839	1,993
Scraper removing topsoil	11,269	2,817	349
Scraper unloading topsoil	7,772	1,943	241
Grader (in pit)	1,069	908	66
Grader (out of pit)	6,415	2,869	199
Crushing, transfers to stockpiles	54,811	23,041	656
Unloading coal to stockpile (conveying transfer point)	331	156	6
Wind erosion	86,287	43,144	3,236
Total	**882,188**	**296,622**	**40,755**

Table 11.7: Total controlled emission inventory for Year 11

Source	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Loading trucks with overburden	5,991	5,384	858
Loading trucks with rejects	425	201	30
Loading trucks with ROM coal	25,872	6,283	983
Loading trucks with product coal	127,451	16,291	2,422
Dozing on overburden in pit	22,207	7,493	4,663
Dozing on overburden in WRE	88,828	15,775	9,327
Trucks unloading overburden	11,982	5,667	858
Trucks unloading rejects	79	37	6
Trucks unloading ROM coal	6,750	2,835	128
Drilling	6,547	3,440	521
Blasting	78,143	40,634	2,344
Trucks hauling (segment 1)	13,927	4,263	426
Trucks hauling (segment 2)	316	97	10
Trucks hauling (segment 3)	11,882	3,637	727
Trucks hauling (segment 4)	6,208	1,900	380
Trucks hauling (segment 5)	4,175	1,278	256
Trucks hauling (segment 6)	884	271	54
Trucks hauling (segment 7)	36,343	11,125	2,225
Trucks hauling (segment 8)	4,693	1,436	144
Trucks hauling (segment 9)	838	257	26
Trucks hauling (segment 10)	1,474	451	45
Trucks hauling (segment 11)	2,520	772	154
Trucks hauling (segment 12)	1,021	312	31
Scraper in travel mode	64,283	8,839	1,993
Scraper removing topsoil	5,979	1,495	185
Scraper unloading topsoil	4,124	1,031	128
Grader (in pit)	1,069	908	66
Grader (out of pit)	4,276	1,913	133
Crushing, transfers to stockpiles	60,750	25,537	727
Unloading coal to stockpile (conveying transfer point)	374	177	7
Wind erosion	97,240	48,620	3,647
Total	**696,803**	**218,432**	**33,505**

11.3.1.2 Modelled impacts at sensitive receptors

TSP concentrations

For the years assessed, all SRs outside of the MLA are predicted to experience TSP concentrations well below the Project objective of 90 µg/m³ (Table 11.8). The maximum annual average TSP predicted at SRs outside of the MLA is 43 µg/m³ at SR 9, which is on land partially within the MLA. The maximum annual average TSP predicted at SRs completely outside of the MLA is 42 µg/m³. Complete TSP modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.8: Predicted annual average TSP (µg/m³)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Objective	**90**		
Background	**40**		
	Cumulative		
1	42.3	44.2	192.5
2	42.8	45.0	95.9
3	40.8	41.1	41.4
4	40.5	40.7	40.8
5	40.8	40.7	40.3
6	40.8	40.8	40.4
7	40.5	40.5	40.3
8	40.5	40.5	40.3
9	42.9	42.5	40.6
10	40.2	40.2	40.2
11	41.3	41.1	40.4
12	40.7	40.7	40.3
13	40.1	40.2	40.1
14	41.9	43.4	47.0
15	40.7	40.8	40.5
16	41.6	42.1	41.7
17	40.0	40.0	40.0
18	40.0	40.0	40.0
19	40.8	40.8	40.4
20	41.1	41.8	41.9
21	40.7	40.9	40.7

Predicted annual average PM_{10}

For the years assessed, all SRs outside of the MLA are predicted to experience annual average annual PM_{10} concentrations below the Project objective of 25 µg/m³ (Table 11.9). The maximum annual average PM_{10} concentration predicted at any SR outside of the MLA is 18 µg/m³. Complete PM_{10} modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.9: Predicted annual average PM_{10} (µg/m³)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Objective		**25**	
Background		**15.6**	
	Cumulative		
1	17.4	18.9	90.2
2	17.9	19.6	40.6
3	16.2	16.4	16.6
4	16.0	16.2	16.4
5	16.3	16.3	15.9
6	16.4	16.4	16.0
7	16.1	16.1	15.8
8	16.1	16.1	15.9
9	18.2	17.9	16.2
10	15.7	15.8	15.7
11	16.9	16.7	16.0
12	16.3	16.2	15.8
13	15.7	15.7	15.7
14	17.2	18.4	19.7
15	16.2	16.4	16.1
16	17.1	17.6	17.1
17	15.6	15.6	15.6
18	15.6	15.6	15.6
19	16.3	16.4	15.9
20	16.6	17.3	17.3
21	16.3	16.5	16.3

Predicted maximum 24-hour average PM_{10}

For the years assessed, all SRs outside of the MLA are predicted to experience 24-hour average PM_{10} concentrations below the Project objective of 50 µg/m³ (Table 11.10). The maximum 24-hour average PM_{10} concentration predicted at any SR outside of the MLA is 49 µg/m³ at SR 9, which is on land partially within the MLA. The maximum 24-hour average PM_{10} predicted at SRs completely outside of the MLA is 38 µg/m³. Complete PM_{10} modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

The 24-hour average PM_{10} concentration contours are provided for Years 1, 3 and 11 in Figure 11.7, Figure 11.8 and Figure 11.9.

Table 11.10: Predicted maximum 24-hour average PM10 (µg/m³)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Objective	**50**		
Background	**17**		
	Cumulative		
1	43.9	45.8	654.0
2	58.4	59.5	171.2
3	31.7	32.7	37.4
4	23.5	24.4	25.7
5	25.4	26.6	21.2
6	23.6	25.2	21.6
7	21.1	21.2	20.7
8	21.8	22.6	20.9
9	47.5	49.0	26.3
10	21.2	20.8	19.8
11	33.4	31.9	23.6
12	26.2	26.8	22.2
13	20.3	20.3	20.5
14	43.6	60.8	33.6
15	20.7	21.9	22.4
16	26.6	30.3	38.1
17	17.7	17.9	17.9
18	17.8	17.9	17.8
19	21.8	23.8	20.5
20	26.6	27.7	32.2
21	23.1	23.7	25.9

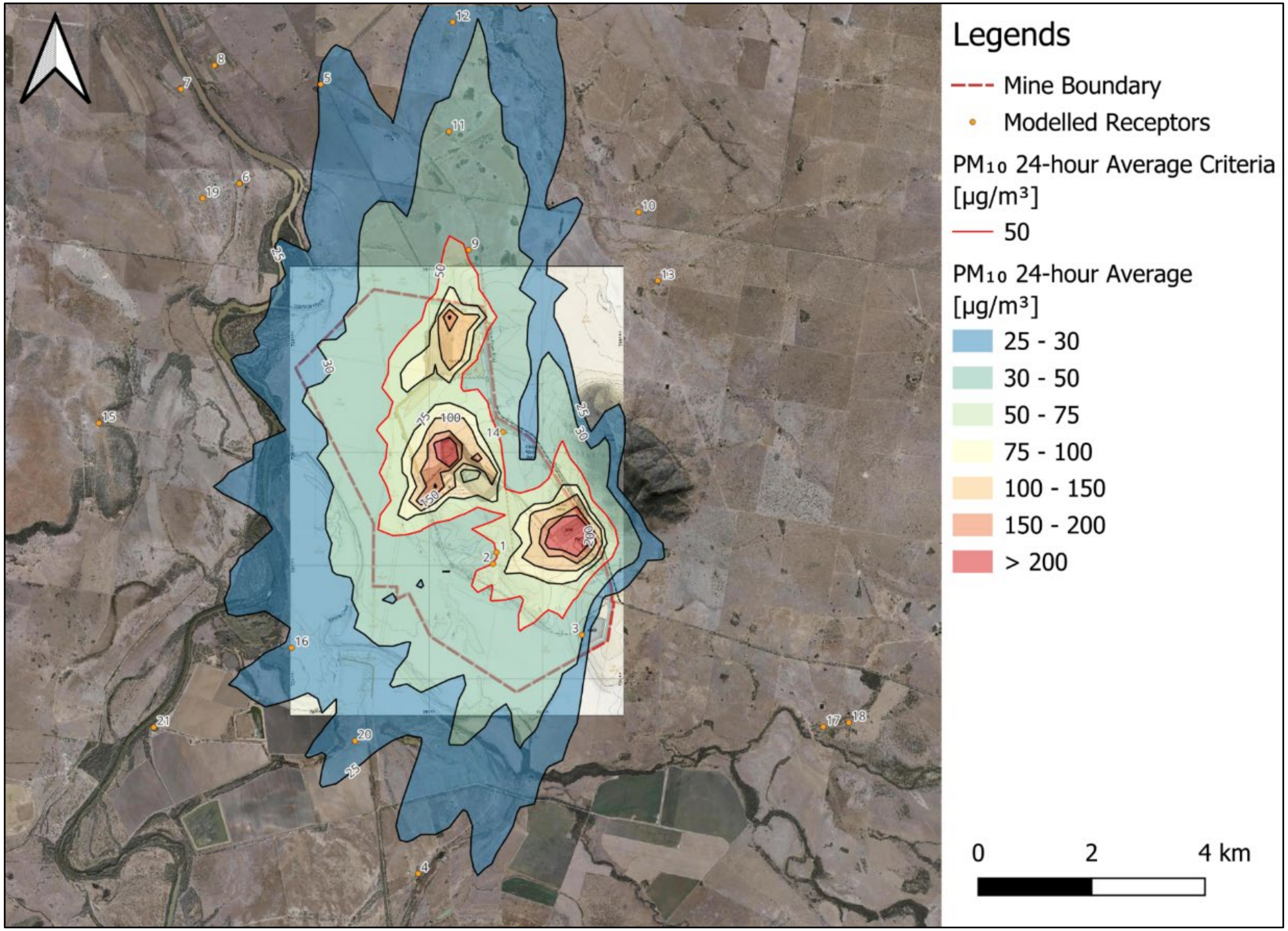

Figure 11.7: Predicted max. 24-hour average PM_{10} (µg/m³) incl. background—Year 1

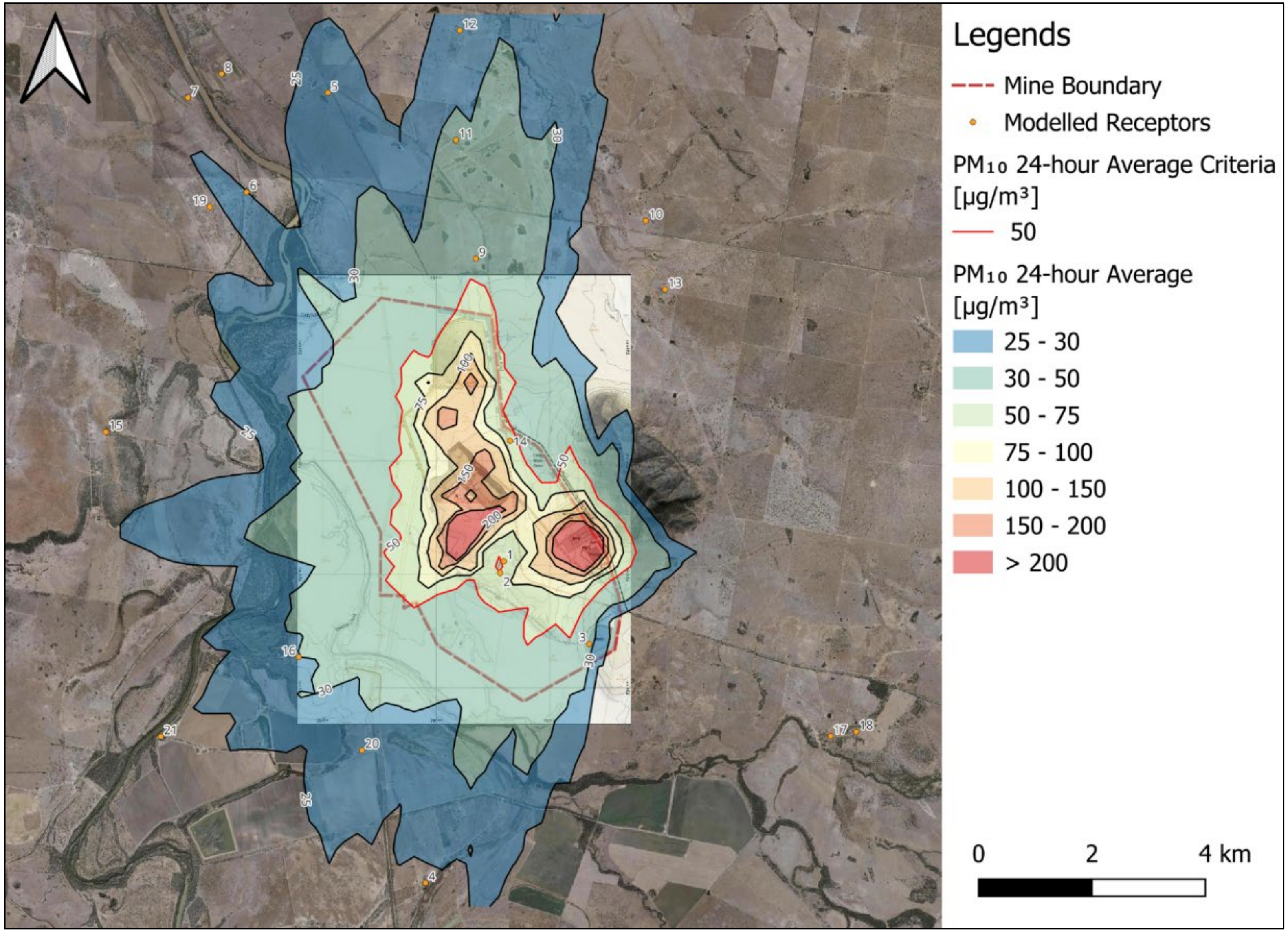

Figure 11.8: Predicted max. 24-hour average PM_{10} (µg/m³) incl. background—Year 3

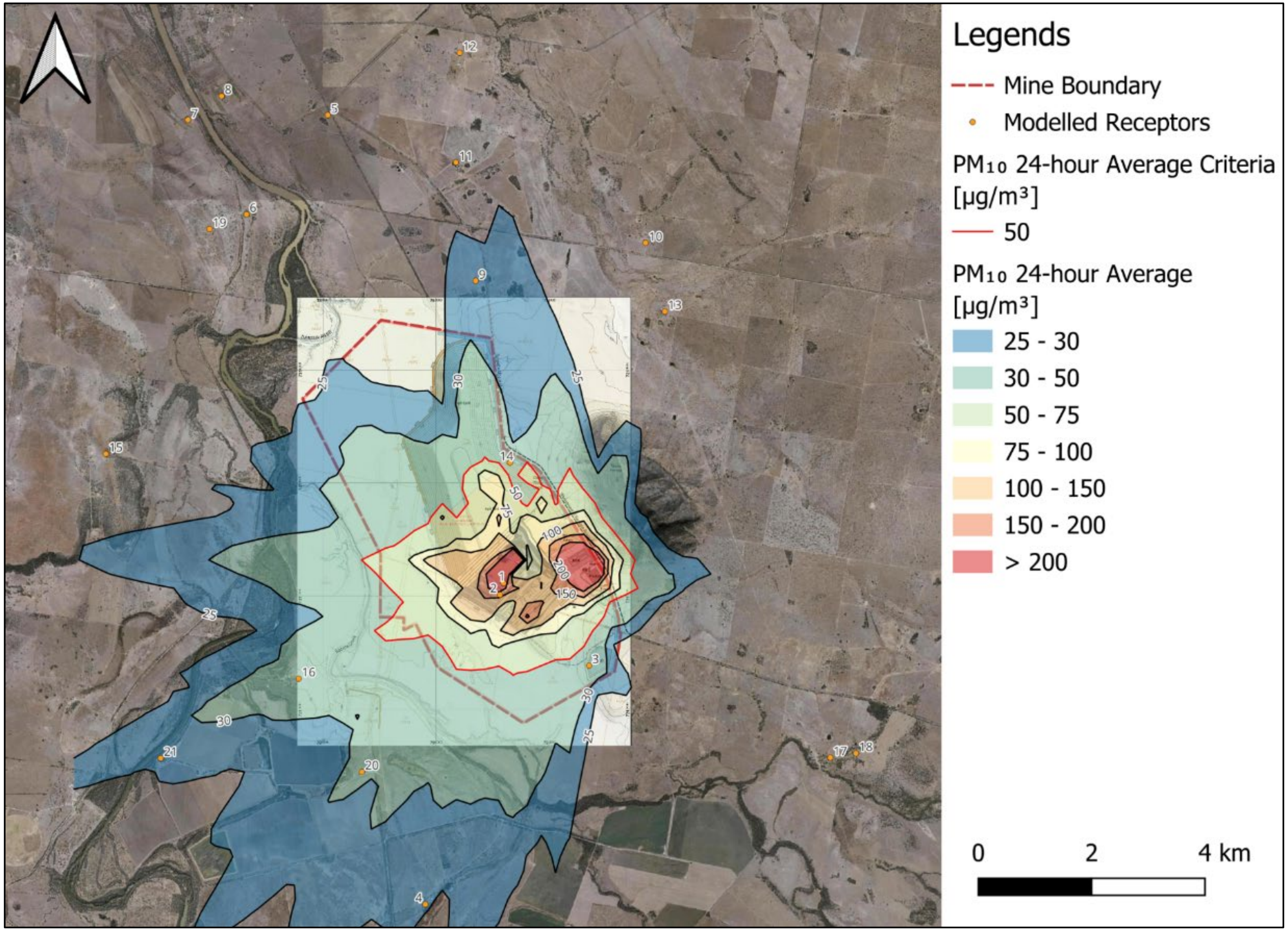

Figure 11.9: Predicted max. 24-hour average PM_{10} (μg/m³) incl. background—Year 11

Predicted maximum 24-hour average $PM_{2.5}$

For the years assessed, all SRs outside of the MLA are predicted to experience maximum 24-hour average $PM_{2.5}$ levels below the Project objective of 25 µg/m³ (Table 11.11). The maximum 24-hour predicted $PM_{2.5}$ at any SR outside of the MLA is 13.0 µg/m³. Complete maximum 24-hour average $PM_{2.5}$ modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.11: Predicted maximum 24-hour average $PM_{2.5}$ (µg/m³)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Objective		**25**	
Background		**5.8**	
	Cumulative		
1	10.1	13.1	84.7
2	9.8	17.8	57.4
3	7.1	9.2	14.6
4	6.7	7.4	7.0
5	7.7	7.9	6.8
6	7.1	7.3	6.9
7	6.5	6.8	6.6
8	6.7	6.8	6.7
9	13.0	12.1	7.6
10	7.0	6.6	6.5
11	9.4	8.8	7.2
12	7.8	7.8	6.8
13	6.7	6.9	6.5
14	28.1	16.3	14.5
15	6.7	7.0	7.1
16	7.8	9.3	8.2
17	6.1	6.1	6.1
18	6.1	6.0	6.0
19	6.9	7.1	6.7
20	7.3	8.4	8.3
21	7.4	8.0	6.8

Predicted annual average $PM_{2.5}$

For the years assessed, all SRs outside of the MLA are predicted to experience annual average $PM_{2.5}$ levels below the Project objective of 8 µg/m³ (Table 11.12). The highest annual average predicted $PM_{2.5}$ at any SR outside of the MLA is 6.2 µg/m³. Complete annual average $PM_{2.5}$ modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.12: Predicted annual average $PM_{2.5}$ (µg/m³)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Objective	**8**		
Background	**5.5**		
	Cumulative		
1	5.7	6.1	14.8
2	5.8	6.2	10.7
3	5.6	5.6	5.7
4	5.6	5.6	5.6
5	5.7	5.7	5.6
6	5.7	5.7	5.6
7	5.6	5.6	5.6
8	5.6	5.6	5.6
9	6.2	6.0	5.7
10	5.5	5.5	5.5
11	5.8	5.7	5.6
12	5.7	5.6	5.6
13	5.5	5.5	5.5
14	5.9	6.0	7.6
15	5.6	5.7	5.6
16	5.8	5.9	5.8
17	5.5	5.5	5.5
18	5.5	5.5	5.5
19	5.7	5.7	5.6
20	5.7	5.8	5.8
21	5.6	5.7	5.6

Deposited dust

For the years assessed, all SRs outside of the MLA are predicted to experience cumulative monthly average dust deposition levels below the Project objective of 120 mg/m^2/day (Table 11.13, Figure 11.10, Figure 11.11 and Figure 11.12). The highest cumulative monthly average dust deposition level at any SR outside of the MLA is 59.3 mg/m^2/day. Complete deposited dust modelling results are included in Appendix L, Air Quality and Greenhouse Gas Assessment.

Table 11.13: Predicted dust deposition levels (mg/m^2/day)

SR ID	Year 1 scenario	Year 3 scenario	Year 11 scenario
Guideline		**120**	
Background		**50**	
	Cumulative		
1	63.0	70.8	1378.3
2	64.6	72.3	398.8
3	54.4	56.1	58.2
4	51.3	51.7	52.4
5	50.8	50.5	50.4
6	51.0	50.5	50.4
7	50.4	50.3	50.2
8	50.4	50.3	50.2
9	59.3	54.9	52.8
10	50.5	50.5	50.8
11	52.7	51.7	51.4
12	51.0	50.8	50.8
13	50.6	50.6	50.8
14	57.4	64.3	83.5
15	51.3	51.0	51.4
16	53.7	55.4	57.0
17	50.0	50.1	50.1
18	50.0	50.1	50.1
19	50.9	50.6	50.4
20	52.3	53.5	56.3
21	51.5	51.7	52.0

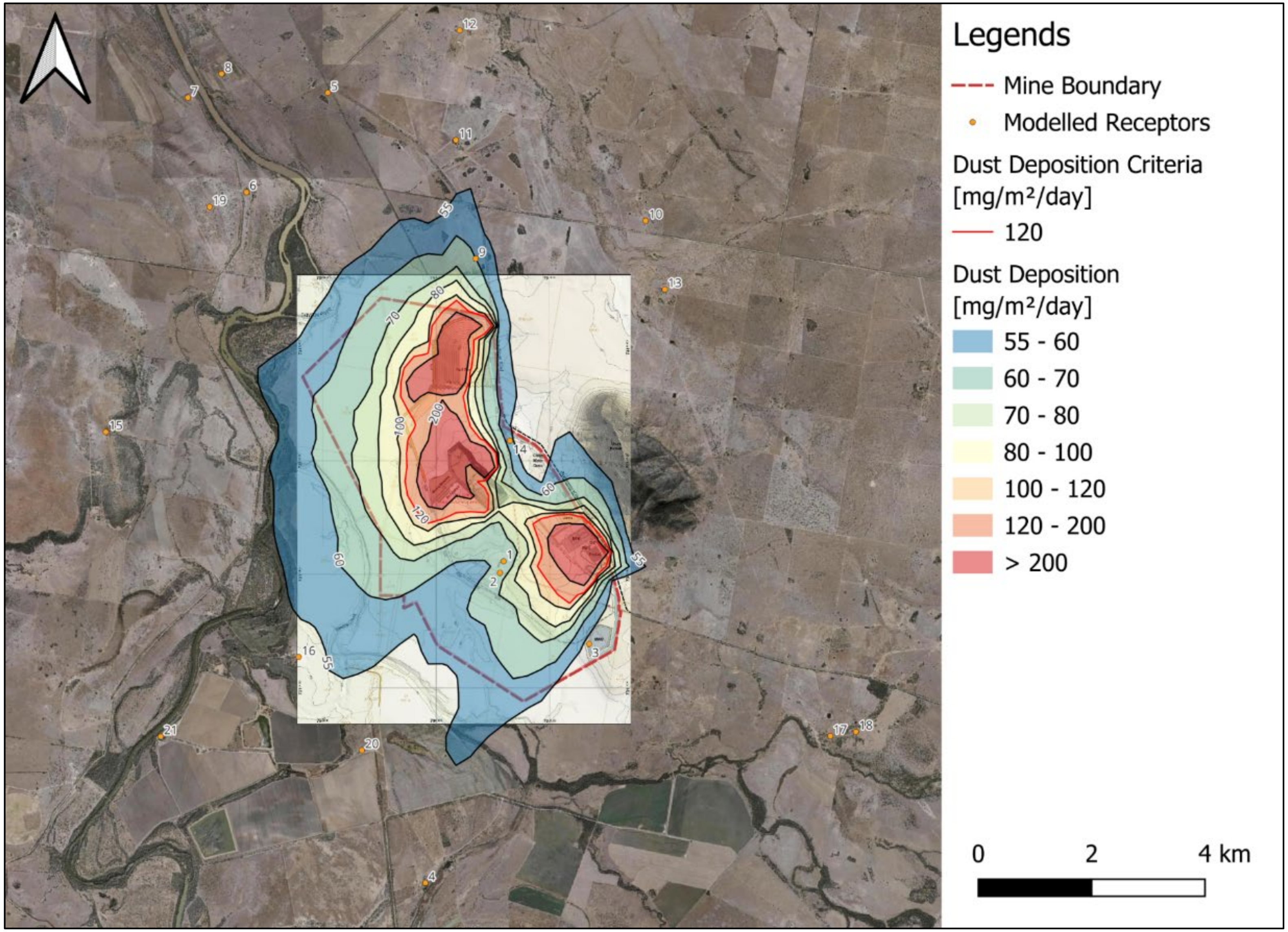

Figure 11.10: Predicted max. 30-day dust deposition levels (mg/m^2/day) incl. background —Year 1

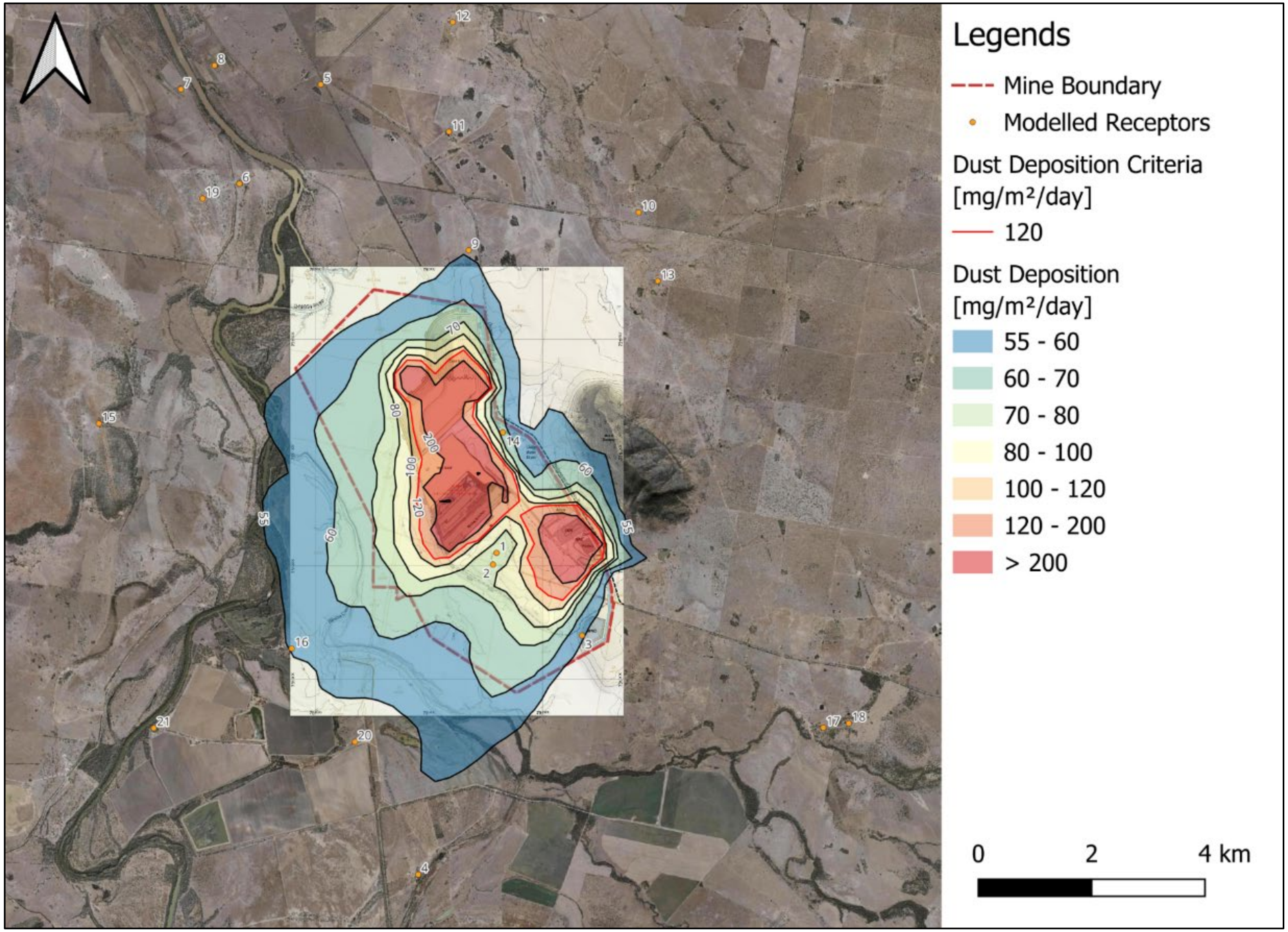

Figure 11.11: Predicted max. 30-day dust deposition levels (mg/m²/day) incl. background —Year 3

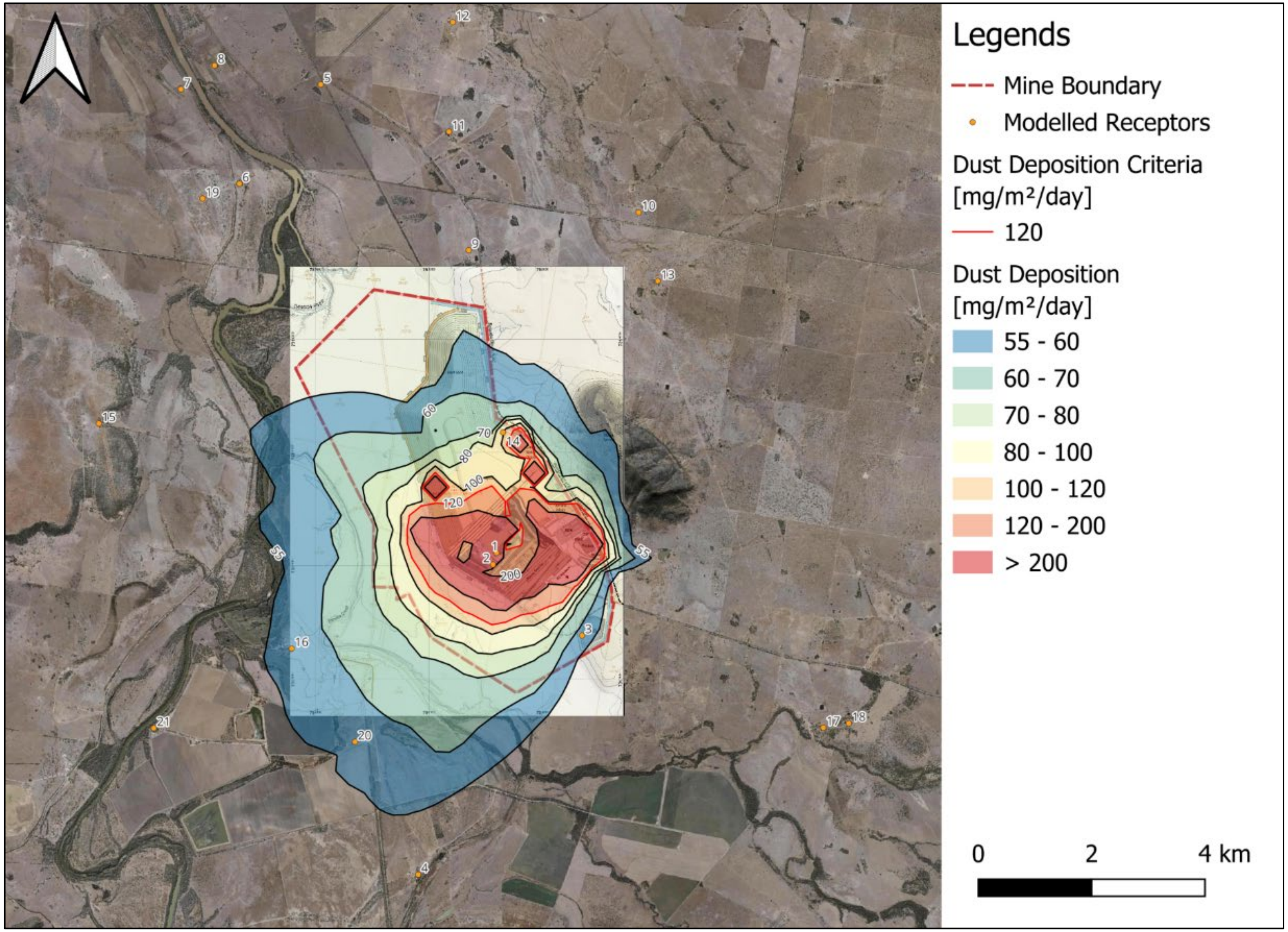

Figure 11.12: Predicted max. 30-day dust deposition levels (mg/m^2/day) incl. background —Year 11

11.3.2. Particulate emissions—TLO

11.3.2.1 Air modelling

Potential air quality impacts have been assessed for the maximum cumulative throughput scenario for the TLO, being 2.5 Mtpa.

Emission inventories

Detailed emissions inventories of predicted sources for the operation of the TLO are presented in Table 11.14.

Table 11.14: TLO emission inventories

Source	TSP (kg/y)	PM_{10} (kg/y)	$PM_{2.5}$ (kg/y)
Dozing coal	1,709	304	32
Trucks unloading coal	7,500	3,150	143
Trucks hauling	14,525	2,705	271
Loading stockpiles (stacker dropping coal onto stockpile)	3,750	1,594	116
Loading from stockpiles to conveyor (under-stockpile chutes)	750	325	14
Transfer to reclaim conveyor	144	68	3
Load out to train wagons	1,000	425	19
Train locomotives 1	113	113	113
Wind erosion	282	141	21
Total	**29,774**	**8,825**	**732**

Meteorological modelling

TAPM was set up using four nested 25 x 25 grids centred on the TLO. Meteorological data from the year 2015 was the most appropriate to use for analysis in dispersion modelling (Appendix L, Air Quality and Greenhouse Gas Assessment). With this data, Trinity has used TAPM and CALMET modelling configurations to generate a three-dimensional meteorological dataset which is suitable for use with CALPUFF dispersion modelling. For the TLO, the radius of influence of terrain features was set to 3 km.

Dispersion modelling

The three-dimensional wind fields from CALMET were entered into CALPUFF for the full year 2015. For the TLO assessment, CALPUFF was run over a computational grid (12 km x 12 km) with spacing of 200 m, the same as the outer CALMET grid, and with receptors gridded over a smaller domain (8.2 km x 8.2 km) with a nesting factor of 1.

11.3.2.2 Modelled impacts at sensitive receptors

Suspended particulates

The predicted cumulative suspended particulate concentrations at SRs are provided in Table 11.15. From the table it can be noted that all the predicted suspended particulate concentrations including background levels are within the relevant criteria at the sensitive receptor locations. The results of the 24-hour average $PM_{2.5}$ and annual average PM_{10} modelling are illustrated in Figure 11.13 and Figure 11.14, respectively.

Table 11.15: Predicted cumulative suspended particulate concentrations

SR ID	Annual Average TSP (µg/m³)	Maximum 24 h Average PM_{10} (µg/m³)	Annual Average PM_{10} (µg/m³)	Maximum 24 h Average $PM_{2.5}$ (µg/m³)	Annual Average $PM_{2.5}$ (µg/m³)
Criterion	90	50	25	25	8
Background	45.9	19.5	17.9	6.6	6.3
A	0.0	0.6	0.0	0.1	0
B	0.1	1.7	0.1	0.2	0
C	0.2	2.2	0.2	0.2	0
D	0.1	1.5	0.1	0.1	0
E	0.0	0.7	0.0	0.1	0
F	0.1	1.1	0.1	0.1	0
G	0.1	1.1	0.1	0.1	0
H	0.2	2.7	0.2	0.2	0
I	0.2	2.8	0.2	0.3	0
J	0.1	1.8	0.1	0.2	0
K	0.1	2.0	0.1	0.2	0
L	0.2	3.3	0.2	0.3	0
M	0.5	3.5	0.4	0.3	0
N	0.5	6.1	0.5	0.6	0
O	0.3	2.6	0.3	0.2	0
P	0.2	1.9	0.2	0.2	0
Q	0.2	1.7	0.1	0.2	0

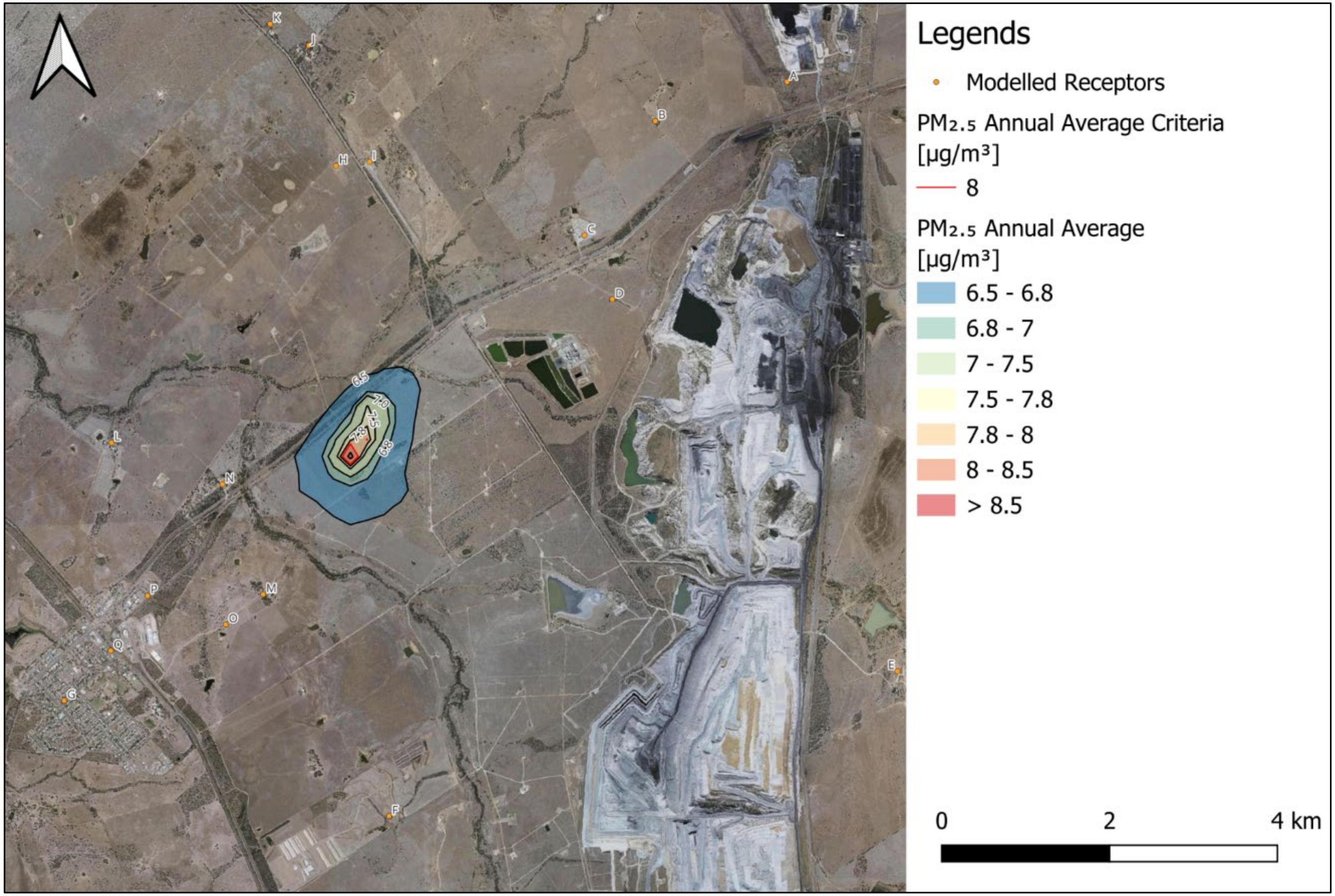

Figure 11.13: TLO predicted annual average $PM_{2.5}$ concentrations (µg/m³) incl. background

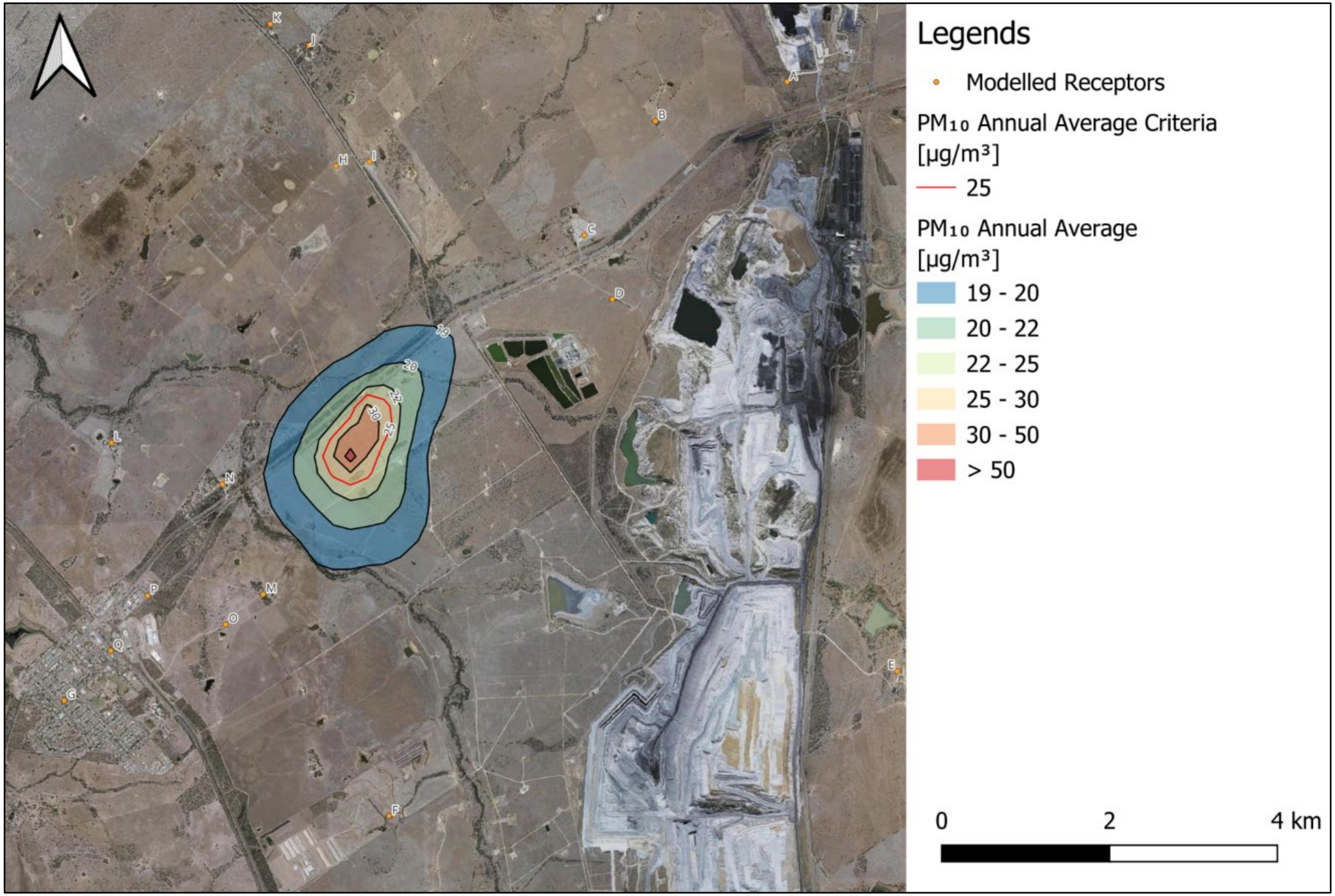

Figure 11.14: TLO Predicted max. 24-hour PM_{10} concentrations ($\mu g/m^3$) incl. background

Dust deposition

The predicted dust deposition levels at SRs are shown in Table 11.16 and Figure 11.15. The predicted cumulative levels including background are well within criterion at all SRs.

Table 11.16: Predicted cumulative dust deposition levels

Receptor ID	Maximum 30-day deposition ($mg/m^2/day$)
Criterion	120
Background	50
A	50.0
B	50.1
C	50.2
D	50.2
E	50.0
F	50.1
G	50.2
H	50.3
I	50.3
J	50.1
K	50.1
L	50.4
M	51.0
N	51.8
O	50.7
P	50.6
Q	50.4

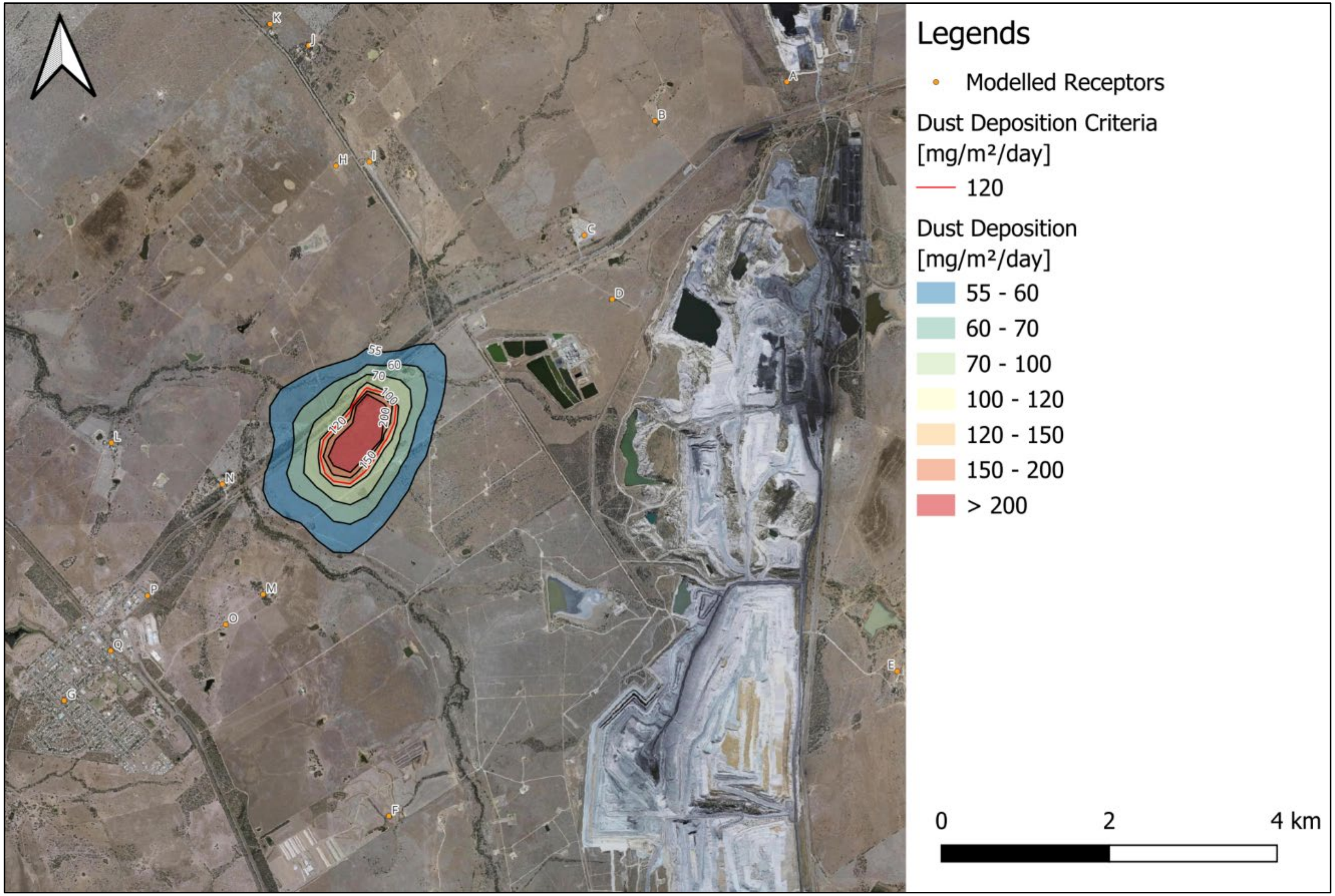

Figure 11.15: TLO Predicted max. 30-day dust deposition levels (mg/m²/day) incl. background

11.3.3. Particulate emissions—haul route

Product coal from the Project will be transported via covered road trains along the existing Baralaba North Mine haul route, approximately 40 km by public road south to the existing TLO facility. The entire haul route is sealed and has been designed and constructed for coal haulage. Baralaba South Pty Ltd will ensure that all road trains it uses for road haulage will be covered.

Given this, Trinity determined that the dust emissions from the covered road trains over sealed roads will be insubstantial. The closest residence to the haul route is approximately 100 m, and the likelihood of dust impacts at SRs 100 m or more from the route has been assessed to be negligible. It was, therefore, determined that modelling of the dust emissions along the haul route was not warranted.

GHG emissions related to the haul route are described in Section 11.4.3.5.

11.3.4. Dust on the rail route to Gladstone

The Moura rail system is owned and operated by Aurizon (formerly QR National). It is described as a single line with passing loops. Balloon loops are located at Boundary Hill, Callide Coalfields, and Moura Mine. The line roughly parallels the Dawson Highway and serves the industrial operators and rural communities in the Dawson and Callide Valleys. Towns located along the rail line include Banana, Calliope, and the Gladstone suburbs of Burua and Beecher. Outside of the populated areas, the land use is primarily comprised of agricultural land and forested areas.

The primary pollutants of concern along the rail line are fugitive emissions of coal dust and particles which are lost during transport. Coal dust can be lost during transport due to lift off from the surface of loaded wagons, leakage from wagon doors, dust deposits left on sills of wagons and/or parasitic or residual coal on unloaded wagons.

Aurizon's Coal Dust Monitoring Program requires that all coal wagons travelling on the Moura rail system undergo profiling and veneering immediately after loading, prior to transport to Gladstone Port.

Trinity (Appendix L, Air Quality and Greenhouse Gas Assessment) undertook a review of data and other literature investigating the risk of dust from coal trains on surrounding SRs. Monitoring studies completed at Boonal, Callemondah and along the Western-Metropolitan Rail System were reviewed. The background literature and data from the available monitoring stations indicates compliance with the health and wellbeing criteria set in the EPP (Air) could be expected to be maintained in consideration of the small additional rail traffic associated with the Project. Given that these locales experience both higher levels of rail traffic and in the case of Boonal, Callemondah and Western-Metropolitan were in closer proximity (10 m) to the rail line, it is expected that the residents along the Moura rail line will experience similar or better air quality. The minor proportion of future rail traffic associated with the Project is expected to have negligible additional impacts.

11.3.5. Dust in rainwater tanks

The concentration of metals from dust that will end up in water tanks has been calculated based on the maximum metal concentration results from WRE samples.

Table 11.17 presents the calculated concentrations using the maximum predicted 30-day average dust deposition level without background at the worst affected receptor over all three scenarios, which is SR1 during the year 11 scenario. The table also shows the health and aesthetic drinking water guidelines (Appendix L, Air Quality and Greenhouse Gas Assessment).

Based on the results, the metal concentrations in tank waters are predicted to be well below the health and aesthetic objective. Since no health-based criterion is predicted to be exceeded, health risks are acceptable (Appendix L, Air Quality and Greenhouse Gas Assessment).

Note that these predictions are conservative for the following reasons:

- actual depositions are likely to be lower due to wind re-entrainment of dust from the roofs; and
- this assessment assumes that no first flush diverters or filters are used in the tanks.

Table 11.17: Metals from dust in water tanks

Metal	Maximum concentration (mg/L)[1]	Metals in tanks (mg/L)[2,3]	Health (mg/L)[4]	Aesthetic (mg/L)[4]
antimony	0.02	0.00007	0.003	-
arsenic	0.74	0.003	0.01	-
cadmium	<0.02	<0.00007	0.002	-
chromium	<0.02	<0.00007	0.05	-
copper	<0.02	<0.00007	2	1
iron	<0.2	<0.0007	-	0.3
lead	<0.02	<0.00007	0.01	-
manganese	<0.02	<0.00007	0.5	0.1
Mercury	<0.0001	<0.0000004	0.001	-
molybdenum	0.16	0.0006	0.05	
nickel	<0.02	<0.00007	0.02	-
selenium	0.04	0.00014	0.01	-
zinc	<0.02	<0.00007	-	3

1 Source: Table B9 of the 2019 Geochemical Assessment of Potential Spoil and Coal Reject Materials – Baralaba South Project (note: same as Table C4 of the 2023 version). For concentrations below the analytical detection limit, the detection limit was used for conservatism

2 Calculated using the maximum 30-day average dust deposition level at the worst affected receptor (Receptor 1, Year 18 scenario).
3 Calculated based on the mean monthly rainfall of 56.9 mm, which equates to 56.9 L/m^2/month at Belvedere from 1938 to 2022.
4 Drinking Water Guidelines (NHMRC, 2022)

11.3.6. Impacts of dust on flora

11.3.6.1 Regional ecosystems

The landscape surrounding the Project has been heavily cleared and is subject to dust deposition caused by agricultural activities and wind erosion from exposed soils.

Much of the remnant vegetation surrounding MLA 700057 would be subject to dust deposition rates equal to or only marginally above background levels and as a result there is no anticipated detrimental effect on their functioning due to the operation of the Project.

The highest dust deposition levels over sensitive flora not being cleared are predicted to occur at RE 11.3.25 Eucalyptus open woodland located on a drainage line outside the western boundary of the MLA. However, those deposition levels are well within the nuisance criterion. Impacts (reduction in growth) to this vegetation community at the levels of dust deposition predicted are likely to be indiscernible compared to changes due to temperature and water availability. To ensure dust levels are minimised, watering should be undertaken on areas traversed by vehicles or equipment operating in the vicinity of the coolabah woodland in the southwest of the lease.

As mining activities will commence in the centre of the MLA and progress in a southerly direction, dust deposition levels at any location will vary over the mine life. It is also likely that seasonal rainfall would wash dust from the vegetation. Dust from the Project is considered unlikely to significantly impact surrounding native vegetation.

11.3.6.2 Crops and pastures

The closest agricultural crops are located approximately 500 m west of the MLA boundary. Dust deposition levels are predicted to be highest at this location during Year 3 and 11, with a maximum 30-day average dust deposition level of approximately 65 mg/m^2/day (including background) at the closest edge only slightly over the adopted background level of 50 mg/m^2/day. For the year 1 scenario, the maximum 30-day average dust deposition level is predicted to be approximately 64 mg/m^2/day at the closest edge. These dust deposition levels are below the Project objective of 120 mg/m^2/day (Appendix L, Air Quality and Greenhouse Gas Assessment).

Dust deposited onto the surface of the crops will be washed off regularly during irrigation as well as during rainfall. The most-affected areas of dust would be at the edge where drying winds would have similar effect and where winds may dislodge dust to a greater extent. Hence, effects of dust deposition onto these irrigated crops are likely to be indiscernible. For unirrigated crops and pastures surrounding MLA 700057, the dust deposition rates are equal to or only marginally above background levels. As mining activities will commence in the centre of the MLA and progress in a southerly direction, dust deposition levels at any location will vary over the Project life. While dust may accumulate on pasture foliage during the dry season, the growth of these pastures is dominated by water availability, and during the dry periods, leaves of unirrigated pastures are most likely inactive. Hence dust deposition on to these pastures is less likely to have harmful effects on production.

11.3.7. Impacts of dust on fauna

Trinity (2023) investigated the potential impact of dust on fauna through ingestion of coal dust from deposition on plant feed and coal dust inhalation and confirmed that the potential impacts of particulates from the Project onto cattle or other fauna are likely to be insubstantial. A number of sources were used to determine this outcome as follows:

- Andrews and Skriskandaraha (1992) found that cattle did not have a preference for feed free of coal dust over feed containing coal dust equivalent to deposition rates of up to 8,000 mg/m^2/day. This very high threshold indicates that impacts of ingestion of dust from coal mining are not likely to cause impacts given the nuisance criterion of 120 mg/m^2/day. The New Acland Noise and Dust Project determined cattle grazing adjacent to an active mine where dust deposition would be expected to be greater showed similar weight gain compared to animals grazing at the control site (Pembroke and Sunland Cattle Co, 2020).
- Cox *et al.* (2016) studied cattle mortality over a Belgian summer, with average PM_{10} concentrations of 25 µg/m^3 and an increase of 10 µg/m^3. Findings were consistent with the results of human health effects studies. Hence cattle and other mammals are considered no more sensitive to particulates than humans. At the New Acland Noise and Dust Project, where the concentration of PM_{10} was 29% higher at the trial site compared with the control site, the difference in weight gain for the cattle on the two sites was negligible, and there was no material difference between the stress level of cattle at the two sites.
- Cox *et al.* (2016) found that in a Belgian summer, with average PM_{10} concentrations of 25 µg/m^3, an increase of 10 µg/m^3 resulted in a 3.2% increase in mortality of cattle over the following 25 days. These findings were consistent with the results of human health effects studies. Hence cattle and other mammals

are considered no more sensitive to particulates than humans. At the New Acland Noise and Dust Project, where the concentration of PM_{10} was 29% higher at the trial site compared with the control site, the difference in weight gain for the cattle on the two sites was negligible, and there was no material difference between the stress level of cattle at the two sites (Pembroke and Sunland Cattle Co, 2020). Egberts, van Schaik, Brunekreef, and Hoek (2019) demonstrated that PM_{10} has no significant short-term influence on cattle mortality. In this study, PM_{10} maximum concentration was 75% higher than the predicted level surrounding the Project.

- Recent research has shown significant correlation between particulate matter exposure and its impact on milk production in cows. Beaupied, et al. (2022) and Anderson, Rezamand, and Skibiel (2022) found a reduction in milk yield and quality as cows experience increased exposure to $PM_{2.5}$. It is important to highlight that the effects observed in these studies are linked to significantly elevated $PM_{2.5}$ concentrations, increasing to levels as high as 49.8 µg/m^3 and up to 282.54 µg/m^3 during episodes of wildfire.
- In a separate study, Chirinos-Peinado and Castro-Bedriñana (2020) detected high levels of cadmium and lead in blood and milk of cows farmed near a metallurgical mine. This contamination was attributed to smelting activities. Similarly, Nieckarz, *et al.* (2023) observed significant differences only in cadmium and lead levels in milk samples collected during periods of high and low particulate pollution. Notably, these differences were observed when cows were exposed to maximum recorded PM_{10} and $PM_{2.5}$ levels of 138.8 and 119.7 µg/m^3, respectively. It is important to note that the predicted maximum PM_{10} and $PM_{2.5}$ concentrations in receptors outside the MLA, at 49 µg/m^3 and 13 µg/m^3, respectively, fall well below the maximum observed concentrations in the aforementioned studies which may be considered as thresholds at which adverse effects in cattle are observed.

In general, dust has the potential to impact organic farming if it also introduced toxic compounds such as heavy metals into soil and animal tissues. Further, the geochemical assessment (Appendix E) indicates that bulk overburden and interburden (WRE) materials – and potential coal reject materials – have low levels of metal and metalloid enrichment, which is consistent with Permian-age coal measures throughout eastern Australia, and consistent with the Rangal Coal Measures in the Bowen Basin. Thus, there is no substantial risk of such contamination occurring in the areas surrounding the Project. It is worth noting that dust from mining has been generally found to contain fewer toxic compounds than dust from combustion sources in urban air. By applying human health and nuisance criteria as a conservative indicator, dispersion modelling also affirms that predicted suspended particulates and dust deposition levels in receptors outside the MLA are below the applicable limits.

It is understood that cattle grazing occurs to the north of the Project, but none will occur on the mining lease, which is common practice at Australian coal mines. Overall, the potential impacts of particulates from the Project onto cattle or other fauna are likely to be insubstantial.

11.3.8. Cumulative air impacts

The Project is located approximately 11 km south of the Baralaba North Mine. Trinity reviewed particulate matter monitoring data from operations at Baralaba North for the period 2016 to 2023. Associated emissions were included in the determination of appropriate background concentrations for modelling.

Operations at Baralaba North may contribute to some background dust in the northern vicinity of the Project, however, adverse wind conditions cannot occur at both mines simultaneously. Peak contributions from Baralaba North at residences to the south of Baralaba North will occur when northerly wind conditions are blowing emissions from the Project away from those residences.

Additionally, Baralaba North will continue to mine in a northerly direction while the Project will mine in a southerly direction, increasing the distance between the mines by the time peak production is reached. It is considered unlikely that cumulative air quality impacts from both mines will result in significant impacts at any SR.

Additional industries in the broader region include the Dawson Mine and coal seam gas extraction wells to the south near Moura. The Meridian Coal Seam Gas project is located approximately 25 km southeast of the Project, and at this distance cumulative air quality impacts are unlikely. ML 5656 extends from the Dawson northern open cut pit 23 km to the north, close to the southern boundary of the Project. This portion of the ML represents future mining rights. However, there is no clear project definition or timeline available in the public domain. Operation of the Dawson Mine open cut mining operations are too far from the Project to have discernible cumulative impacts. However, Dawson Mine will likely contribute to background air quality at and surrounding the TLO facility. Hence, the background concentrations used to assess the TLO facility have been increased to account for Dawson Mine's contribution.

The proposed Mungi North Gas Field extends within 5 km to the south of the Project. Operation of gas fields have limited particulate emissions and are very unlikely to contribute substantially to cumulative impacts.

No other significant new developments have been identified in the area in the near future and as such, no cumulative air quality impacts from regional developments are predicted.

11.3.9. Odour and fume impacts

Potential odour and fume sources sometimes associated with coal mining include spontaneous combustion and blasting. Potential secondary sources include odour emissions from hydrocarbons and effluent discharge areas.

Odour and fume impacts are currently not expected for the Project. Spontaneous combustion is not a significant risk for the nature of the coal deposit or the waste materials.

11.4 GHG emissions

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 do not form part of the facility (Scope 2 emissions).

Coverage of Scope 1 emissions include:

- fuel combustion, which deals with emissions released from fuel combustion;
- fugitive emissions from fuels, which deals with emissions mainly released from the extraction, production, processing and distribution of fossil fuels;
- industrial process emissions, which deal with emissions released from the consumption of carbonates and the use of fuels as feedstock and carbon reductants; and the emission of synthetic gases in particular cases; and
- waste emissions, which deal with emissions mainly released from the decomposition of organic material in landfill, other facilities, and wastewater handling facilities.

Scope 2 emissions are generally emissions that result from activities that generate power off-site for consumption on-site. The largest contributor to Scope 2 emissions is the consumption of electricity.

Scope 3 emissions are those created downstream of the operation, specifically from the usage of the product produced by the operation.

11.4.1. Emission sources

The National Greenhouse Accounts Factors is designed for estimating GHG emissions and defines the three scopes for different emission categories (direct and indirect). Potential sources of Scope 1, Scope 2 and Scope 3 GHG emissions from the Project have been identified in Table 11.18.

Table 11.18: Scope 1, 2 and 3 emissions

Emission type	Potential source
Scope 1 (direct)	Carbon stock loss associated with land/vegetation clearing
	Fugitive gas emissions from open cut and coal stockpiles
	Diesel consumption by mining equipment, light vehicles, fixed plant such as lighting rigs and pump, coal handling processing plant and power generators
	Diesel consumption in ANFO
Scope 2 (indirect)	Electricity consumption from the grid
Scope 3 (indirect)	Combustion of coal (coking coal), diesel and fuel oil consumption from rail and ship transportation to export markets

11.4.2. Reporting thresholds

Corporations reporting under section 19 of the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) must report Scope 1 and Scope 2 emissions, energy production and energy consumption data where one or more of the thresholds under section 13 of the NGER Act are met.

Section 13 of the NGER Act sets reporting thresholds for the operation of a facility or corporations, as per the following:

1) A controlling corporation's group meets a threshold for a financial year if in that year:
   a) the total amount of greenhouse gases emitted from the operation of facilities under the operational control of entities that are members of the group has a carbon dioxide equivalence of:
      i) if the financial year starts on 1 July 2008—125 kt or more; or
      ii) if the financial year starts on 1 July 2009—87.5 kt of more; or
      iii) if the year is a later financial year—50 kt or more; or
   b) the total amount of energy produced from the operation of facilities under the operational control of entities that are members of the group is:
      i) if the financial year starts on 1 July 2008—500 terajoules or more; or
      ii) if the financial year starts on 1 July 2009—350 terajoules or more; or
      iii) if the year is a later financial year—200 terajoules or more; or
   c) the total amount of energy consumed from the operation of facilities under the operational control of entities that are members of the group is:
      i) if the financial year starts on 1 July 2008—500 terajoules or more; or
      ii) if the financial year starts on 1 July 2009—350 terajoules or more; or
      iii) 200 terajoules or more; or
   d) an entity that is a member of the group has operational control of a facility the operation of which during the year causes:
      i) emission of greenhouse gases that have a carbon dioxide equivalence of 25 kt or more; or
      ii) production of energy of 100 terajoules or more; or
      iii) consumption of energy of 100 terajoules or more.

11.4.3. Estimated GHG emissions

11.4.3.1 Mine site emissions

The following data and assumptions have been used in emission calculations for the Project:

- Fugitive gas emissions from coal extraction have been determined using the Method 1 formula for fugitive gas emission calculation from the NGER (National Greenhouse and Energy Reporting) Technical Guidelines.
- The maximum ROM coal extracted in a year is 2.5 Mt.
- The maximum annual amount of diesel combusted on-site for mobile plant equipment is likely to be 43 ML, corresponding to year 6 of the Project. This consists of 9 ML for excavators, 26 ML for mine haul trucks, 7 ML for ancillary equipment, 677 kL for small/medium vehicles and service trucks, and 555 kL for small engines.
- The maximum diesel used for explosives was estimated to be 645 kL per year.
- The amount of diesel used for the off-site haulage of product coal to the TLO facility was calculated to be up to 1,196 kL per year.
- Mains electricity consumption was estimated to be 3,900 kW, consisting of 2,700 kW for the CHPP and 1,200 kW for workshop and offices.
- Areas to be cleared of vegetation have been determined by Ecological Survey & Management (Appendix F, Terrestrial Ecology Assessment) as part of the ecological assessment for the Project.
- Emissions resulting from the combustion of petrol are assumed to be insignificant for the purposes of this assessment.
- Upset conditions may include severe weather such as flood, extreme winds, or drought leading to no water being available. Under these conditions, mining will cease, and emissions will be significantly reduced.

11.4.3.2 TLO emissions

The calculation of GHG emissions for the TLO considers the incremental increase in throughput associated with the Project. The following data and assumptions were used in emission calculations for the TLO:

- Mains electricity consumption was 128 kW based on recent consumption records.
- The maximum annual amount of diesel combusted on-site is likely to be 125 kL, corresponding to Year 17 of the Project. This consists of 117 kL for dozers, 6 kL for other mobile equipment and 2 kL for stationary engines.

11.4.3.3 Emissions from vegetation clearing

Emissions from vegetation clearing were calculated using the plot module of the FullCAM software v6.20.03.0827 (Department of the Environment and Energy 2020). Only vegetation with cover greater than 20% needs to be assessed under the NGER scheme, a threshold specified by Department of the Environment and Energy (2020). Spatial data (rainfall, evaporation, temperature, local tree species) was downloaded for latitude -24.265°2’ longitude 149.860°59’, a location within the Project mining lease.

Each of the areas and vegetation types listed in Table 11.19 were entered into FullCAM as a plot. The default biomass values were used. The fate of cleared timber has not yet been decided so the worst-case scenario was assumed being that all branches were placed in windrows and burned with no product recovery. Bark, leaves and grass are assumed to be mixed with topsoil and placed back on the land as part of rehabilitation.

Table 11.19: Vegetation in the study area that may have crown cover >20%

Regional ecosystem type	Vegetation type (both remnant and regrowth)	Modelled as:	Area to be cleared (ha)
Regional ecosystem			
11.3.25	Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines	Eucalyptus Open Woodland	0.4
11.5.9	Eucalyptus crebra and other Eucalyptus spp. and Corymbia spp. woodland on Cainozoic sand plains and/or remnant surfaces	Eucalyptus Open Woodland	8.7
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains and/or remnant surfaces	Rainforest and Vine Thickets	1.1
High value regrowth			
11.3.3a	Eucalyptus coolabah woodland on alluvial plains	Eucalyptus Open Woodland	0.1
11.4.9a	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Acacia Open Woodland	7.6
11.5.9	Eucalyptus crebra and other Eucalyptus spp. and Corymbia spp. woodland on Cainozoic sand plains and/or remnant surfaces	Eucalyptus Open Woodland	4.6
Threatened ecological communities			
Brigalow	-	Acacia Open Woodland	10.8
Total	-	-	33.3

The decay or combustion of vegetation will emit CO_2 and, in anaerobic conditions, CH_4. Literature provided by DoEE and its predecessors, specifies some factors for the proportion of non-CO_2 gases released by combustion, but not by decay. Therefore, the assessment assumed that the carbon is released as CO_2.

The results of the model simulation are shown in Table 11.20.

Table 11.20: Carbon emissions from vegetation clearing

Area	Cleared area (ha)	Net carbon mass (t)	Emission (kt CO_{2-e})
Vegetation clearing	1,279	28,484	105
Revegetation sink	-1,091	-46,820	-172
Total	**188**	**-18,336**	**-66**

Although the cleared area is larger than the revegetated area, the net emissions from clearing and rehabilitation are negative. This is due to the higher carbon storage of Mitchell grass compared to open woodlands, presumably because of the dense growth and root network. Moreover, when an area is cleared, the carbon is stored in the soil and released slowly over many years, whereas when it is replanted, there is a surge in carbon absorbed from the atmosphere.

11.4.3.4 Fugitive gas emissions

Fugitive gas emissions from coal extraction have been determined using the Method 1 formula for calculating fugitive gas emissions for open cut coal mines as presented in the NGER Technical Guidelines (DoEE, 2023). Based on the Method 1 formula (Appendix L, Air Quality and Greenhouse Gas Assessment), the emission factor for Queensland and the expected quantity of ROM coal to be extracted, advised by Baralaba South Pty Ltd to be 2.5 Mt in the peak year, the GHG emissions from fugitive gas has been calculated to be 1,507 kt CO_2-e over the 23-year life-of-mine.

11.4.3.5 Liquid fuel emissions

Diesel fuel will be used primarily by mining equipment, light vehicles, fixed plant such as lighting rigs and pumps, coal handling processing plant, and power generators. GHG emission factors for liquid fuel consumption are shown in Table 11.21.

The GHG emission from fuel usage is calculated by multiplying the fuel consumption by the emission factor from the last column in Table 11.21. Table 11.22 presents the total fuel consumption and the resultant emissions, with a total GHG emission of 273 kt CO_2-e from on-site fuel combustion.

Table 11.21: Liquid fuel greenhouse gas emission factors

Fuel type	Energy content (GJ/kL) [1]	Scope 1 emission factor (kg CO_2-e/GJ) [1, 2]	GHG emission factor (tonnes eCO2/ kL) [3]
Diesel oil (stationary energy purposes)	38.6	70.2	2.71
Diesel in ANFO	38.6	70.2	2.71
Diesel oil (transport)	38.6	70.4	2.72

Note 1: Energy content of fuel is sourced from Schedule 1, Part 3 and 4 of DoEE (2023b).
Note 2: Emission factors include contributions from CO_2, CH_4 and N_2O.
Note 3: GHG Emission Factor is the Energy Content multiplied by Scope 1 Emission Factor converted to tonnes.

Table 11.22: Estimated on-site fuel combustion emission summary

Activity	Total fuel consumed (kL)	Emission factor (t CO_2-e/kL) 1	Total emissions (kt CO_2-e)
Stationary plant diesel combustion	704,435 (mine) 2359 (TLO)	2.71	1,909 (mine) 6 (TLO)
Mobile plant diesel combustion	14,107 (mine) 37 (TLO)	2.71	38 (mine) 0.1 (TLO)
ANFO diesel combustion	15,525	2.72	42 (mine)

Note 1: Emission factors from Table 11.21

The diesel consumption for off-site haulage of product coal to the TLO facility was calculated to be up to a peak year of 1,196,840 L/year. This is based on 1.85 Mtpa of product coal and 105 t payload of trucks, resulting in up to 17,601 trips per year. A fuel consumption rate of 85 L/100 km has been used (Appendix L, Air Quality and Greenhouse Gas Assessment). Table 11.23 presents the total fuel consumption and the resultant emissions from off-site product haulage, with a total GHG emission of 63 kt CO_2- e.

Table 11.23: Estimated off-site (on-road) product transport fuel combustion emission summary

Activity	Total fuel consumed (kL)	Emission factor (t CO_2-e/kL) 1	Total emissions (kt CO_2-e)
On-road trucks	23,007	2.71	63

Note 1: Emission factors from Table 11.21

11.4.3.6 Scope 2 Emissions

Emission factors associated with consumption of purchased electricity are shown in Table 11.24.

Table 11.24: Estimated purchased electricity (Scope 2) emission summary

Total electricity consumed (kWh)	Emission factor (kg CO_2-e/kWh)	Total emissions (kt CO_2-e)
34,164,000 (mine) 1,124,255 (TLO)	0.73	25.8

Note 1: Source is Schedule 1, Part 6 of DoE (2023b)

11.4.3.7 Scope 3 Emissions

Scope 3 emissions are indirect emissions that occur outside the site boundary as a result of actions by the organisation. These emissions include upstream emissions, such as those generated during the extraction and production of fossil fuels used by the organisation, as well as downstream emissions from the transportation of the final product to customers or emissions from outsourced activities.

Therefore, Scope 3 emissions are not attributable to the Project and do not need to be reported under the NGER scheme. In any event, potential Scope 3 emissions have been considered as part of this assessment. Emission factors associated with combustion of the coal produced are shown in Table 11.25.

Table 11.25: Estimates fuel combustion (Scope 3) emission summary

Fuel combusted	Energy content (GJ/t)[1]	Scope 3 emission factor (kg CO_2-e/GJ)[1, 2]	Supply emission factor (kg CO_2-e/GJ)[1, 2]	GHG emission factor (t CO_2-e/unit of fuel)[3]	Total emissions (kt CO_2-e)
Coking Coal	30.0	92.03	-	2.76	98,051
Diesel (mobile plant on-site)	38.6	-	17.3	0.67	508
Diesel (product transportation by rail)	38.6	70.4	-	2.72	82
Fuel Oil	39.7	73.84	-	2.93	475
Total					**99,116**

Note 1: Energy content of fuel and emission factors are sourced from DoEE (2023b).
Note 2: Emission factors include contributions from CO_2, CH_4 and N_2O.
Note 3: GHG Emission Factor is the Energy Content multiplied by Scope 3 Emission Factor.

11.4.3.8 Summary of Project GHG emissions

The overall Scope 1 and 2 GHG emissions associated with the Project, prior to decarbonisation measures in Section 11.5.5, are presented in Table 11.26, and the yearly emissions are shown in Table 11.27. For the purpose of this assessment, emissions were calculated on a worst-case scenario basis i.e. under conditions where emissions are predicted to be at the maximum, which factors in emissions during construction, commissioning, upset conditions, operation and closure. The predicted total Scope 1 and 2 emissions are 4,085 kt CO_{2-e} with the main source of emissions predicted to be the consumption of diesel and fugitive gas emissions (Table 11.26).

Decarbonisation measures resulting in reduced Scope 1 and 2 GHG emissions are presented in Section 11.5.5.

Table 11.26: Predicted overall GHG emissions (prior to decarbonisation measures)

Activity	**Total (50 year) emissions (kt CO_{2-e})**	**Overall (50 year) average annual emissions (kt CO_{2-e})**	**Life-of-mine (23 year) average annual emissions (kt CO_{2-e})**	**Decommissioning (7 year) average annual emissions (kt CO_{2-e})**	**Maximum average annual emissions (kt CO_{2-e})**
Scope 1: Vegetation Cleared	-66	-1	-0.3	-12	4.5
Scope 1: Fugitive gas emissions	1,507	30	66	0	77
Scope 1: Fuel combustion (on-site-mine)	1,989	40	86	1.3	119
Scope 1: Fuel combustion (on-site-TLO)	6	0.1	0.3	0	0.3
Scope 1: Fuel combustion (off-site road product haulage)	63	1	2.7	0.0	3.3
Scope 2: Grid electricity consumption	592	12	26	0	26
Total Scope 1 and Scope 2	**4,091**	**82**	**180**	**-11**	**222**

Table 11.27: Predicted yearly GHG emissions (prior to decarbonisation measures)

Activity	Scope 1 Vegetation clearing & rehab (kt CO_{2-e})	Scope 1 Fugitive gas emissions (kt CO_{2-e})	Scope 1 Combustion on-site (mine) (kt CO_{2-e})	Scope 1 Combustion on-site (TLO) (kt CO_{2-e})	Scope 1 Fuel Combustion off-site (kt CO_{2-e})	Total Scope 1 Emissions (kt CO_{2-e})	Scope 2 Grid electricity consumption (kt CO_{2-e})	Total annual emissions (kt CO_{2-e})
1	4.5	39	106	0.2	1.7	152	26	177
2	-1	66	94	0.3	2.8	162	26	187
3	1	63	110	0.3	2.6	177	26	203
4	2.3	65	116	0.3	2.7	186	26	212
5	2.6	68	116	0.3	2.8	190	26	216
6	2.7	71	119	0.3	3	196	26	222
7	-0.7	74	75	0.3	3.1	152	26	178
8	-1.7	77	72	0.3	3.2	151	26	177
9	-1.9	77	86	0.3	3.2	165	26	191
10	-1.8	72	88	0.3	2.9	162	26	187
11	-1.7	70	94	0.3	2.9	166	26	191
12	-2.1	70	68	0.3	2.9	139	26	165
13	-2.1	70	69	0.3	2.9	140	26	166
14	-2	68	83	0.3	2.8	152	26	178
15	-3.2	75	93	0.3	3.1	168	26	194
16	-4.5	77	97	0.3	3.2	174	26	200
17	-0.6	77	78	0.3	3.3	158	26	184
18	0.6	68	90	0.3	2.8	161	26	187
19	0.7	65	76	0.3	2.7	144	26	170

Activity	Scope 1 Vegetation clearing & rehab (kt $CO_{2\text{-}e}$)	Scope 1 Fugitive gas emissions (kt $CO_{2\text{-}e}$)	Scope 1 Combustion on-site (mine) (kt $CO_{2\text{-}e}$)	Scope 1 Combustion on-site (TLO) (kt $CO_{2\text{-}e}$)	Scope 1 Fuel Combustion off-site (kt $CO_{2\text{-}e}$)	Total Scope 1 Emissions (kt $CO_{2\text{-}e}$)	Scope 2 Grid electricity consumption (kt $CO_{2\text{-}e}$)	Total annual emissions (kt $CO_{2\text{-}e}$)
20	0.8	63	83	0.3	2.6	149	26	175
21	0.8	66	92	0.3	2.8	163	26	188
22	0.7	41	47	0.2	1.7	90	26	116
23	0.5	23	27	0.1	1	52	26	78
24	-1	0	2	0	0	1	0	1
25	-13	0	2	0	0	-11	0	-11
26	-17	0	2	0	0	-15	0	-15
27	-18	0	1	0	0	-17	0	-17
28	-18	0	1	0	0	-17	0	-17
29	-16	0	1	0	0	-16	0	-16
30	-3.1	0	1	0	0	-2	0	-2
31	1	0	0	0	0	1	0	1
32	1.6	0	0	0	0	2	0	2
33	1.5	0	0	0	0	2	0	2
34	1.5	0	0	0	0	2	0	2
35	1.5	0	0	0	0	1	0	1
36	1.4	0	0	0	0	1	0	1
37	1.4	0	0	0	0	1	0	1
38	1.4	0	0	0	0	1	0	1
39	1.3	0	0	0	0	1	0	1

Activity	Scope 1 Vegetation clearing & rehab (kt CO_{2-e})	Scope 1 Fugitive gas emissions (kt CO_{2-e})	Scope 1 Combustion on-site (mine) (kt CO_{2-e})	Scope 1 Combustion on-site (TLO) (kt CO_{2-e})	Scope 1 Fuel Combustion off-site (kt CO_{2-e})	Total Scope 1 Emissions (kt CO_{2-e})	Scope 2 Grid electricity consumption (kt CO_{2-e})	Total annual emissions (kt CO_{2-e})
40	1.3	0	0	0	0	1	0	1
41	1.3	0	0	0	0	1	0	1
42	1.3	0	0	0	0	1	0	1
43	1.2	0	0	0	0	1	0	1
44	1.2	0	0	0	0	1	0	1
45	1.2	0	0	0	0	1	0	1
46	1.2	0	0	0	0	1	0	1
47	1.1	0	0	0	0	1	0	1
48	1.1	0	0	0	0	1	0	1
49	1.1	0	0	0	0	1	0	1
50	1.1	0	0	0	0	1	0	1
Total	-66	1,507	1,989	6	63	3,499	592	4,091
Average	-1	30	40	0.1	1	70	12	82
Life-of-Mine Average	-0.3	66	86	0.3	2.7	154	26	180
Decommissioning Average	-12	0	1.3	0	0	-11	0	-11
Maximum	4.5	77	119	0.3	3.3	196	26	222

11.5 Mitigation and management measures

The management hierarchy for air emissions as set out in section 9 of the EPP (Air) requires that, to the extent that is it reasonable to do so, air emissions must be dealt with in the following order of preference:

- avoid (e.g. using technology that avoids air emissions);
- recycle (e.g. re-using air emissions in another industrial process);
- minimise (e.g. treating air emissions before release); and
- manage.

Exceedances of the air quality criteria is predicted at dwellings within the mining lease (SRs 1 to 3 and 14). However, Baralaba South Pty Ltd must agree compensation and reach agreement with these SRs before the mining lease may be granted. Where appropriate and where requested by the landholders, such agreements will involve the relocation of the SRs before operations commence.

11.5.1. Air Quality Management Plan

For the Project, a Draft Air Quality Management Plan has been prepared and includes:

- details of the of mitigation and management measures that are to be implemented at the site to minimise dust and other air emissions from the mine;
- requirements for monitoring weather conditions and the impacts of mine operations on ambient air quality;
- remedial actions for air emission controls in the event adverse air quality conditions are predicted or detected, complaints are received, exceedances of objectives being recorded, or other trigger levels being breached; and
- roles and responsibilities for implementation, monitoring and review of the plan.

The Draft Air Quality Management Plan for the Project is provided in Appendix M.

11.5.2. Dust emission controls

Baralaba South Pty Ltd intends to implement dust mitigation and management measures where appropriate to help reduce/or avoid impacts on nearby SRs. Detailed mitigation and management measures are provided in the Draft Air Quality Management Plan (Appendix M). These mitigation and management measures are summarised as follows:

- watering and regular maintenance of haul roads;
- watering of other trafficked areas;
- use of gravel, sheeting or surfactants on haul roads;
- where required and practical, use water sprays on the equipment;
- drilling and blasting operation to include properly fitted and undamaged shrouds on drills, dust extraction for drill rigs and blasting during day-time hours only;
- personnel training;
- monitor and modify mining operations as required in order to achieve compliance with applicable air quality objectives at the nearest privately-owned SR;
- material drop heights during loading and unloading are to be reduced as far as practical.;
- blasting controls put in place to avoid dust blowing towards SRs; and

- minimise exposed areas as much as practicable by rehabilitation and vegetating as soon as possible after activity has ceased.

The following controls will continue to be implemented at the TLO:

- use of water sprays on coal stockpiles to minimise dozing emissions and wind erosion;
- use of water sprays at the unloading hopper;
- use of water sprays while loading stockpiles;
- use of a reclaim tunnel for the coal stockpile;
- use of water sprays at conveyor transfer points; and
- use of sealed road.

With implementation of the management and monitoring measures detailed in the Draft Air Quality Management Plan (Appendix M), air quality levels at nearby SRs outside of the ML are predicted to achieve compliance with the proposed objectives.

11.5.3. Odour and fume management

Odour and fume impacts are currently not expected for the Project. Spontaneous combustion is not a significant risk for the nature of the coal deposit or the waste materials. Nonetheless, management strategies are provided for control of potential odour and fume sources:

- If required, the management of spontaneous combustion through personnel inductions, the use of designated WRE areas and WRE parameters for rejects, handing procedures where heat is being generated and the use of barricades.
- All blasting events will be video-captured and visually monitored. Records will be maintained for the generation of NO_x fume. Should NOx fume generation be identified as a risk, the following measures are to be implemented:
  - review of blast design parameters to minimise risk of fume;
  - market assessment for lower fume potential blasting agents; and
  - blasting restrictions when wind conditions are not favourable.
- Housekeeping checklists will include an assessment of nuisance fume in the vicinity of diesel/fuel storage areas, sewerage treatment plants and water treatment plants.

11.5.4. Air quality monitoring

An Air Quality Monitoring Program will be developed and implemented to ensure compliance with the Project objectives. Details of the proposed Air Quality Monitoring Program have been provided in the Draft Air Quality Management Plan (Appendix M). The monitoring program will be based on best practice guidelines, including relevant Australian Standards. A summary of the proposed Air Quality Monitoring Program is provided below:

- Monitoring of atmospheric conditions including temperature, relative humidity, wind speed and wind direction will be monitored at the Project.
- Monitoring to be undertaken at a site meeting the requirements of 'AS3580.14-2014 Methods for sampling and analysis of ambient air - Meteorological monitoring for ambient air quality monitoring applications' as far as practical.
- Monitoring of air quality levels will occur on a regular basis, and at times when the progressive operations will be likely to increase particulate levels within the surrounding environment.

- Monitoring of PM_{10} concentrations using an Australian Standard method such as 'AS 3580.9.9-2017 Determination of suspended particulate matter – PM_{10} low volume sampler – Gravimetric method' or 'AS/NZS 3580.9.11-2022 Determination of suspended particulate matter – PM_{10} beta attenuation monitors'.
- Should a non-frivolous complaint regarding dust nuisance be received, dust deposition monitoring will be undertaken at a site representative of the complainant's residence according to 'AS/NZS 3580.10.1 2016 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method'. This monitoring will be undertaken for 12 months and the results reviewed to determine the extent of future monitoring.
- Should a non-frivolous complaint regarding health concerns about dust be received, PM_{10} concentrations will be monitored at a site representative of the complainant's residence using an Australian Standard method such as 'AS/NZS 3580.9.9-2017 Determination of suspended particulate matter – PM_{10} low volume sampler – Gravimetric method'.

Reporting and corrective actions

The monitoring results will be assessed against the relevant Project objectives summarised in Table 11.1 and reported to the mine management on a monthly basis. The cause of any exceedances will be investigated, and preventative measures identified to avoid similar incidents from happening in the future. These corrective actions may include increasing water application on dust sources and/or modifying, reducing or ceasing activities. If necessary, a weather forecasting system will also be applied with dispersion modelling to assist in predicting adverse conditions.

11.5.5. GHG decarbonisation and management

The GHG emissions in the prior sections represent the GHG measures prior to the implementation of decarbonisation measures proposed for the Project (Appendix Z, Decarbonisation Plan).

The decarbonisation plan has been developed with the goal of having an energy efficient mining operation that enables progressive emissions reduction in line with Queensland's emissions reduction targets of net zero by 2050

The Project objective is to meet the Safeguards Mechanism emissions reduction targets against a production-adjusted baseline. Under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015, the Clean Energy Regulator is required to publish information relating to emissions reduction targets and emissions baseline determinations (baselines) as part of the Safeguards Mechanism. The current emissions target is a 4.9% per annum reduction until 2030, with subsequent emissions targets to be published as determined.

11.5.5.1 Management controls

The management controls proposed to be applied where practicable and cost-effective to achieve the objective include the following five key results:

- Key result 1: Baralaba South will apply best practice and design loading, transit, and unloading areas to minimise unnecessary slowing or stopping of heavy trucks and optimise operational efficiency (Crittenden *et al.*, 2016). This will include:
  - planning and scheduling to minimise material handling and double handling;
  - optimising payload;
  - minimising the slope of haul roads; and
  - minimising rolling resistance.

Mining activities will be undertaken by contractors; however, Baralaba South is responsible for the emissions of these contractors under the NGER Act. Consequently, Baralaba South will require contractors and plant suppliers to meet diesel use efficiency measures, which may include:

  - use of most fuel-efficient vehicles or plant, including alternative drive trains, e.g., diesel-electric hybrids or battery electric vehicles;
  - engine, gearing, and/or timing controls for efficiency;
  - training in efficient operation/driving and monitoring of operator/driver behaviour;
  - use of premium diesel or biodiesel if available; and
  - automation where practicable.

- Key Result 2: Baralaba South will evaluate the cost-effectiveness of engaging in a Power Purchase Agreement with a supplier of renewably generated electricity for use by the Baralaba South Coal Mine. This would both support investment in renewably generated electricity in Queensland, helping to meet Queensland targets for renewable energy, and provide for significantly reduced Scope 2 emissions for the mine.

  Baralaba South will also evaluate whether Agrivoltaic farming, i.e., the simultaneous use of land for producing photovoltaic electricity and farming, on land owned by the company could be a positive investment and investigate options for making this happen. This management control would also contribute to meeting Queensland's renewable energy generation targets if implemented.

- Key Result 3: Baralaba South is committed to having a workforce that understands the importance of energy efficiency and emissions reduction to the success of the company and will implement key performance indicators at the appropriate levels of management and training of staff to ensure that management controls are implemented and monitored. Baralaba South will incorporate energy efficiency in standard operating procedures and will promote a process of constant improvement.
- Key Result 4: The Carbon Farming Initiative (CFI) is a voluntary carbon offsets scheme that allows land managers to earn carbon credits by changing land use or management practices to store carbon or reduce greenhouse gas emissions. Baralaba South will investigate and identify best management practices to increase the carbon stock in soil and vegetation in land owned by the company and will implement a CFI project if appropriate. Options such as the production of biochar from locally grown biomass and wood waste and sequestration of this in soil will be investigated. Baralaba South will also consider whether rehabilitation activities on the mine site can be optimised for added carbon sequestration.
- Key Result 5: Baralaba South is committed to a process of continuous improvement to meet its decarbonisation goal and objective. It will scope for new technologies and processes that may be implemented cost-effectively to improve efficiency and reduce GHG emissions. Baralaba South will also continue to support the Australian Coal Industry Research Program (ACARP) in research to develop best practice environmental management measures.

Further to the above list, consideration has been given to reducing fugitive gas emissions. It is technically possible to pre-drain coal seam gas ahead of open cut mining where coal seams are thick enough and where gas pressure and methane content makes it practical to extract the gas and flare it or use it for electricity generation. The Baralaba South Coal Project seams are fractured which means that gas drainage and harvesting is unlikely to be practicable. However, Baralaba South will continue to investigate management control options for fugitive methane abatement and implement them if practicable.

11.5.5.2 Outcomes

The proposed decarbonisation measures (Key results 1 to 5) are predicted result in a 10% decrease in emissions associated with Scope 1 diesel consumption due to a range of efficiency measures, and a minimum 50% (up to 100%) decrease in emissions associated with Scope 2 electric consumption due to the purchase of 50 to 100% renewable energy.

The overall Scope 1 and 2 GHG emissions from Table 11.26 have been recalculated with the proposed decarbonisation measures and are shown in Table 11.28. The predicted total Scope 1 and 2 emissions are reduced from 4,091 kt CO_{2-e} to a range of 3,293 to 3,589 kt CO_{2-e} with the main sources of emissions predicted to remain as the consumption of diesel and fugitive gas emissions.

Table 11.28: Predicted overall GHG emissions with decarbonisation measures

Activity	Total (50 year) emissions (kt CO_{2-e})	Overall (50 year) average annual emissions (kt CO_{2-e})	Life-of-mine (23 year) average annual emissions (kt CO_{2-e})	Decommissioning (7 year) average annual emissions (kt CO_{2-e})	Maximum average annual emissions (kt CO_{2-e})
Scope 1: Vegetation Cleared	-66	-1	-0.3	-12	4.5
Scope 1: Fugitive gas emissions	1,507	30	66	0	77
Scope 1: Fuel combustion (on-site-mine)	1,790	36	77	1.3	107
Scope 1: Fuel combustion (on-site-TLO)	6	0.1	0.3	0	0.3
Scope 1: Fuel combustion (off-site road product haulage)	56	1	2.5	0.0	3.0
Scope 2: Grid electricity consumption (50 to 100% reduction)	0 to 296	0 to 6	0 to 13	0	0 to 13
Total Scope 1 and Scope 2	**3,293 to 3,589**	**66 to 72**	**146 to 159**	**-11**	**192 to 205**

The Project is estimated to contribute up to a maximum of 192 to 205 kt CO_{2-e} per year, which exceeds the 25 kt threshold outlined in the NGER Act, requiring Baralaba South Pty Ltd to report to the NGER system. Scope 3 emissions are attributable to the locations where coal is consumed, rather than the Project.

The total Scope 1 and Scope 2 GHG emissions in 2021 – 2022 from Australian corporations that had to report to NGER was 394 Mt CO_{2-e} (Clean Energy Regulator, 2023). Under the Kyoto Protocol Accounting Framework, the total emissions in 2021 from Queensland was 140 Mt CO_{2-e} (DoEE, 2021). Based on the totals from each activity, average annual emissions from the Project during the life-of-mine will be up to 159 kt CO_{2-e}, representing 0.040% of Australian NGER emissions and 0.113% of Queensland emissions for the modelled worst-case scenario.

11.5.5.3 Human rights

A Decarbonisation Plan, which aims to meet the requirements of the as yet to be released Queensland Decarbonisation Plan Guideline, has been prepared and is provided with the EIS (Appendix Z). It is noted that the Project is positioned to meet obligations under the Safeguard Mechanism when they apply. Given the Project is expected to meet all legal greenhouse gas obligations, it is considered to be compatible with human rights associated with potential climate change impacts.