Whitehaven

Blackwater North Extension Project

Appendix F
Air Quality Assessment



REPORT

BLACKWATER NORTH EXTENSION PROJECT

BLACKWATER, QUEENSLAND

AIR QUALITY ASSESSMENT
RWDI # 2510129
17 April 2026

SUBMITTED TO

Brendan Dillon
Manager – Approvals
Whitehaven Coal Limited

SUBMITTED BY

Francoise Robe. Ph.D.
Technical Director | Associate Principal
Air Quality
Francoise.robe@rwdi.com

Rebecca Warren
Project Manager
Rebecca.Warren@rwdi.com

RWDI Australia Pty Ltd (RWDI)
ABN: 86 641 303 871

BEST MANAGED COMPANIES Platinum member

Certified System Quality ISO 9001 SAI GLOBAL

2026 RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015 for the provision of consultancy services in acoustic engineering and air quality; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.
This document is intended for the sole use of the party to whom it is addressed and may contain information that is privileged and/or confidential. If you have received this in error, please notify us immediately. Accessible document formats provided upon request. ® RWDI name and logo are registered trademarks in Canada and the United States of America

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Draft	6 February 2026	Holly Scoble Francoise Robe	Francoise Robe Rebecca Warren
B	Final	17 April 2026	Rama Robbi Francoise Robe	Francoise Robe Rebecca Warren

NOTE

The information contained in this document produced by RWDI is solely for the use of the client identified on the front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. RWDI undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

RWDI

RWDI is a team of highly specialised consulting engineers and scientists working to improve the built environment through three core areas of practice: building performance, climate engineering and environmental engineering. More information is available at www.rwdi.com.

QUALITY ASSURANCE

RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and Licence No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering and air quality; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1 INTRODUCTION 2

2 PROJECT DESCRIPTION 3

2.1 Blackwater North Extension Project 3

2.2 Site Location 3

2.3 Air Pollutants of Concern 5

3 REGULATORY FRAMEWORK 6

3.1 Relevant Legislation 6

3.1.1 Environmental Protection Act 1994 6

3.1.2 National Environmental Protection (Ambient Air Quality) Measure 6

3.1.3 Environmental Authority EPML00717813 7

3.2 Adopted Air Quality Criteria 8

3.3 Sensitive and Commercial Places 8

4 EXISTING ENVIRONMENT 10

4.1 Climatology 10

4.2 Local Meteorology 13

4.2.1 Winds 13

4.2.2 Atmospheric Stability and Mixing Height 15

4.3 Local Ambient Air Quality 16

4.4 Local Terrain and Land Use 19

4.5 Receptors 19

4.6 Background Levels 23

5 AIR QUALITY ASSESSMENT METHODOLOGY 24

5.1 Overview 24

5.2 Assessment Scenarios 25

5.3 Meteorological Modelling 26

5.3.1 TAPM 26

5.3.2 CALMET 26

5.4 Dispersion Modelling - CALPUFF 27

6 DUST EMISSION INVENTORY 29

6.1 Emissions Sources 29

6.2 Mining Activity 29

6.3 Quarries 34

6.4 Applied Mitigation 36

6.5 Emission Rates 36

7 AIR QUALITY IMPACT ASSESSMENT 39

7.1 TSP 39

7.2 PM_{10} 43

7.3 $PM_{2.5}$ 51

7.4 Dust Deposition 58

7.5 Mitigation Control Measures 62

7.5.1 Overall Control Measures 62

7.5.2 Receptor-specific Control Measures 62

7.6 Summary and Discussion 63

8 CONCLUSION 65

9 REFERENCES 66

10 STATEMENT OF LIMITATIONS 67

APPENDIX A - ANNUAL ROM & OVERBURDEN PRODUCTION RATES BY PIT 68

APPENDIX B - BWM ACTIVITY DATA 70

APPENDIX C – EMISSIONS ESTIMATION METHODOLOGY 71

LIST OF FIGURES

Figure 2-1 Project General Arrangement 4
Figure 4-1 Regional Meteorological and Air Quality Monitoring Stations 11
Figure 4-2 Windrose at Blackwater Airport AWS (2013 to 2024) 13
Figure 4-3 Annual Windroses at Blackwater Airport AWS (2020 to 2024) 14
Figure 4-4 Stability Class Frequency vs. Time of the Day at the Centre of the Project Area in 2021 (from CALMET) 15
Figure 4-5 Diurnal Variation of the Mixing Height at the Centre of the Project Area in 2021 (from CALMET) 16
Figure 4-6 Topography and Land Use over the Project Area (CALMET Domain Outlined in Red). 19
Figure 4-7 Sensitive Receptors Locations 22
Figure 5-1 ROM and Overburden Amount for the Selected Modelling Scenarios 25
Figure 6-1 General Arrangement FY30 30
Figure 6-2 General Arrangement FY32 31
Figure 6-3 General Arrangement FY46 32
Figure 6-4 General Arrangement FY55 33
Figure 6-5 Proposed Quarry Locations 35
Figure 7-1 Predicted Annual Average Ground-level TSP Concentrations (µg/m^3) 42
Figure 7-2 Predicted Maximum 24-hour Average Ground-level PM_{10} Concentrations (µg/m^3) 47
Figure 7-3 Predicted Annual Average Ground-level PM_{10} Concentrations (µg/m^3) 50
Figure 7-4 Predicted Maximum 24-hour Average Ground-level $PM_{2.5}$ Concentrations (µg/m^3) 54
Figure 7-5 Predicted Annual Average Ground-level $PM_{2.5}$ Concentrations (µg/m^3) 57
Figure 7-6 Predicted 30-day Average Dust Deposition (mg/m^2/day) 61

LIST OF TABLES

Table 3-1 Adopted Air Quality Criteria 8
Table 4-1 Climate Averages at Blackwater Airport AWS (2013 to 2025) 10
Table 4-2 Monthly Rainfall at Blackwater Airport AWS (2020 to 2025) (mm) 12
Table 4-3 Monthly Minimum and Maximum Temperature at Blackwater Airport AWS 12
Table 4-4 Summary of Particulate Matter Monitoring Results at DETSI Blackwater AQMS (2020 to 2024) (µg/m^3) 17
Table 4-5 Summary of Ambient Dust Deposition Gauge Measurements at BWM by Year 17

Table 4-6 Summary of Ambient Dust Deposition Gauge Measurements at BWM by Location 18
Table 4-7 Receptors 20
Table 4-8 Background Air Quality Adopted for the Assessment 23
Table 5-1 Modelling Scenarios 25
Table 5-2 CALMET Model Setup 27
Table 5-3 CALPUFF Model Setup and Source Configuration 28
Table 6-1 ROM and Overburden Production for the Modelled Years 29
Table 6-2 Emission Inventory for BWM (tonnes/year) 37
Table 6-3 Summary of BWM Particulate Matter Emissions by Activity 38
Table 7-1 Predicted Annual Average Ground-level TSP Concentrations (µg/m^3) 39
Table 7-2 Predicted Maximum 24-hour Average Ground-level PM_{10} Concentrations (µg/m^3) and Number of Days of Predicted Exceedance at Sensitive Receptors 44
Table 7-3 Predicted Annual Average Ground-level PM_{10} Concentrations (µg/m^3) 48
Table 7-4 Predicted Maximum 24-hour Average Ground-level $PM_{2.5}$ Concentrations (µg/m^3) 51
Table 7-5 Predicted Annual Average Ground-level $PM_{2.5}$ Concentrations (µg/m^3) 55
Table 7-6 Predicted 30-day Average Dust Deposition (mg/m^2/day) 58

EXECUTIVE SUMMARY

RWDI Australia Pty Ltd (RWDI) conducted an Air Quality Assessment for the Blackwater North Extension Project (the Project). The Project involves the expansion of the existing open-cut metallurgical coal mine located in the Bowen Basin, Queensland.

The existing Blackwater Mine (BWM) operation is an open-cut coal mine extracting primarily metallurgical coal, located near Blackwater in the Bowen Basin, Queensland. It comprises a series of open-cut mining pits along an approximate 45 kilometres (km) long roughly north-south strike length. The BWM extracts coal using drill and blast methods, draglines, and truck and shovel fleets for overburden removal and haulage. The BWM currently produces up to 19 million tonnes per annum (Mtpa) of ROM coal, predominantly high-quality coking coal for use in steelmaking as well as high energy thermal coal. The amendment proposes to extend the current operation of BWM to the east of current operations until approximately Financial Year 2055 (FY55), at an extraction rate of up to 19 Mtpa.

This Air Quality Assessment was conducted in accordance with regulatory guidelines. Detailed meteorological and air dispersion modelling was performed for four representative scenarios based on the planned mining operations (FY30, FY32, FY46 and FY55). Ground-level concentrations of total suspended particle (TSP), particulate matter less than 10 micrometres (µm) (PM_{10}), particulate matter less than 2.5 µm ($PM_{2.5}$) and dust deposition were predicted at sensitive receptors and over the whole Project area and compared with the relevant criteria. Background dust concentrations were considered in the cumulative impact assessment.

The main findings of the assessment are as follows:

- **TSP:** Predicted cumulative concentrations of TSP *comply* with the relevant air quality objective at all receptors for all scenarios.
- **PM_{10}:** Predicted cumulative concentrations of PM_{10} *comply* with the air quality objectives at most sensitive receptors. Exceedances of the 24-hour PM_{10} objective were predicted at five (5) privately-owned sensitive receptors to the west and north-west of the BWM in the early years of the Project when mining is planned at the northern margin of the BWM, and at one (1) privately-owned sensitive receptor to the south-east of the Project which is affected in later years as the mine moves eastward. Such occurrences can be prevented with a proactive dust management approach, including weather forecasting, real-time monitoring near those residences, and mine activity adjustment when warning levels are reached. Predicted cumulative PM_{10} concentrations also exceeded the annual PM_{10} objective at one (1) privately-owned sensitive receptor, which is located close to the main haul road. Alternative arrangements as defined in Environmental Authority (EA) EPML00717813 would be sought with these receptors.
- **$PM_{2.5}$:** Predicted cumulative concentrations of $PM_{2.5}$ *comply* with the relevant air quality objectives at all public and private sensitive receptors for all modelled scenarios.
- **Dust deposition:** Predicted 30-day dust deposition due the planned BWM mining activities *comply* with the relevant air quality guideline at all public and private sensitive receptors for all modelled scenarios.

1 INTRODUCTION

The Blackwater Mine (BWM) is an existing, open-cut metallurgical coal mine located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland.

The BWM has been in operation since 1967 and operates in accordance with, amongst other authorisations, Environmental Authority (EA) EPML00717813, granted under the *Environmental Protection Act 1994* (EP Act).

The BWM is a joint venture between Whitehaven Coal Limited (Whitehaven) (70 percent [%]), Nippon Steel Corporation (20%) and JFE Steel Corporation (10%). Whitehaven Blackwater Pty Ltd (Whitehaven Blackwater), a wholly owned subsidiary of Whitehaven, is the operator of the BWM.

The existing BWM comprises a series of open-cut mining pits along an approximate 80 km long strike length. The BWM extracts coal using drill and blast methods, draglines, dozers and truck and shovel fleets for overburden removal and haulage. Existing infrastructure at the BWM includes two rail spurs and balloon loops from the Bauhinia Railway Line, a coal handling and preparation plant (CHPP), a thermal coal plant (TCP), product stockpiles, run-of-mine (ROM) coal stockpiles, tailings storage facility, in-pit spoil (i.e. waste rock) dumps, train load out facilities, water management infrastructure and other supporting infrastructure (e.g. haul roads, access roads, laydown areas, electricity transmission lines, workshops and offices).

Whitehaven Blackwater proposes to develop the Blackwater North Extension Project (the Project), which would extend the current open-cut mining development at the BWM to within Surface Area (SA) 7 on Mining Lease (ML) 1762 and SA 10 on ML 1759. The Project is expected to optimise mining operations at the BWM allowing ongoing employment and economic benefits from the BWM to the local area, region, and State of Queensland.

The air quality assessment summarised in the present document has the following main components:

- Description of the regulatory requirements relevant to the Project, including air quality criteria and objectives.
- Characterisation of the existing environment, including climatology and local meteorology, existing ambient air quality, surrounding land use and terrain.
- Identification of nearby sensitive receptors.
- Description of the planned operations and selection of four representative operational scenarios during the life of the Project.
- Description of the sources of air pollutants and development of an emission inventory for the four representative scenarios.
- Meteorological modelling for a full year representing typical meteorological conditions, with input from regional and local meteorological observations and three-dimensional (3D) output suitable to drive the dispersion modelling (including hourly wind speed and direction, temperature, atmospheric stability and inversion height).
- Air quality dispersion modelling using CALPUFF for each operational scenario for the following pollutants: total suspended particle (TSP), particulate matter less than 10 micrometres (µm) (PM_{10}), particulate matter less than 2.5 µm ($PM_{2.5}$) and dust deposition.
- Determination of the incremental and cumulative dust impacts at the receptors associated with planned mining operations, and comparison against the relevant air quality criteria and objectives.
- Drafting of recommendations for mitigation and management measures to limit severity of air quality impacts on sensitive receptors.

2 PROJECT DESCRIPTION

2.1 Blackwater North Extension Project

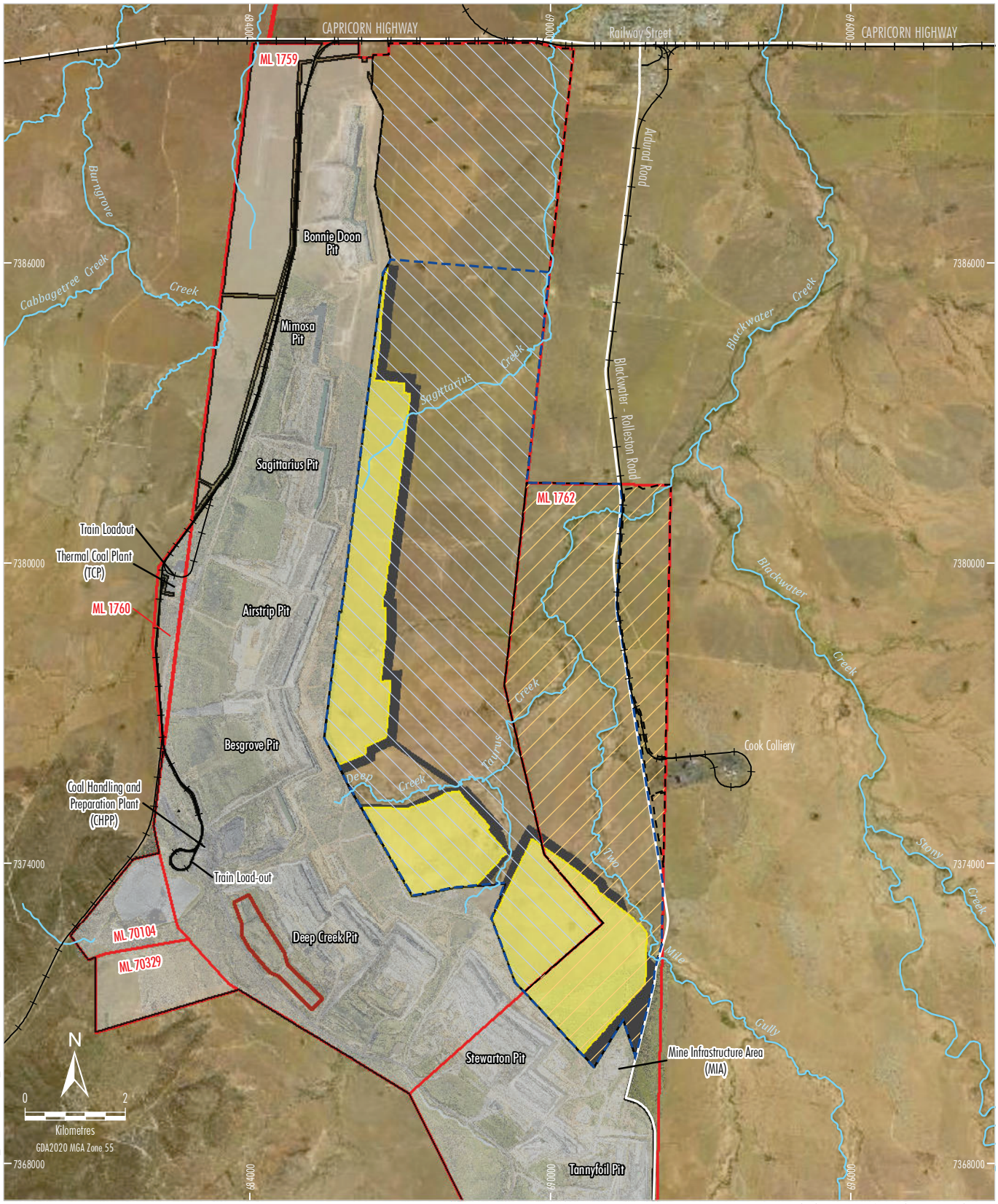
The Project would include the following activities (Figure 2-1):

- extension of open-cut operations into SA 7 on ML1762 and SA 10 on ML1759 to allow mining of additional coal reserves to approximately 2055;
- extraction of an additional 200 million tonnes (Mt) (approximately) of ROM coal;
- continued extraction of up to 19 million tonnes per annum (Mtpa) of ROM coal;
- continued use of existing BWM infrastructure (e.g. CHPP, TCP, ROM and product coal stockpiles, train load-out, water management, tailings management and other supporting infrastructure);
- construction and operation of new water management and water storage infrastructure in support of extended mining operations;
- development of waste rock emplacement areas;
- continued co-disposal of coarse rejects with waste rock and disposal of tailings into an approved tailings storage facility or in-pit void;
- construction of semi-permanent tailings cells to be utilised for the disposal of fine rejects;
- progressive rehabilitation of the Project;
- ongoing exploration activities in the Project area; and
- other associated infrastructure, equipment and activities.

2.2 Site Location

The BWM is located in the Bowen Basin in Central Queensland, approximately 460 km inland of the Queensland coast and 570 km north-west of Brisbane. It is located approximately 20 km south-west of Blackwater, 70 km south-east of Emerald, 250 km north-west of the Port of Gladstone.

The land uses surrounding the BWM and the town are predominantly rural, comprising of cattle grazing land, grassland and low density regional residential areas. The region is also occupied by several other MLs that are not associated with the Project, which may contribute to a cumulative air quality impact in the area.



LEGEND

- Mining Lease
- Railway
- Road
- Watercourse
- Approved Disturbance Footprint
- SA 7
- SA 10

Project Components[1]

- Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Potential Semi Permanent Tailings Cell

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2025)
Orthophoto: Queensland Department of Resources (2017); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Project General Arrangement

Note: [1] Excludes some ancillary Project components such as water management, access tracks, topsoil stockpiles, power supply, temporary offices, and other ancillary works and construction disturbance.

Figure 2-1

2.3 Air Pollutants of Concern

Pollutants of concern for this assessment consist of particulate matter emissions resulting from earthworks, active mining, wheel borne dust along surrounding roads and wind erosion. The following pollutants of concern have been assessed in regard to human health impacts:

TSP – TSP is characterised as less than 100 µm and can impact human health via respiratory effects and cause nuisance impact from dust fallout.

PM_{10} – PM_{10} is generated by earthworks and mining processes and can contain heavy metals and carcinogenic material. PM_{10} is capable of penetrating the lower lungs and can lead to respiratory and cardiopulmonary effects (Queensland Government, 2025).

$PM_{2.5}$ – $PM_{2.5}$ is generated by earthworks and mining processes and can contain heavy metals and carcinogenic material. $PM_{2.5}$ is capable of penetrating the lower lungs and bloodstream and can lead to respiratory and cardiopulmonary effects (Queensland Government, 2025).

Dust deposition – Particulate matter that has fallen out of suspension and can cause nuisance impacts when deposited upon surfaces.

Emissions of other pollutants such as nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO_2) and volatile organic compounds (VOCs) may be generated by diesel combustion of the mining fleet and generators, and from blasting, but are small and have not been further included in this assessment.

Odour is unlikely to be emitted from typical mining activities. Spontaneous combustion could generate transient odours in the near vicinity, but the potential for this is very low and has not been observed at the BWM.

Greenhouse Gases (GHG) associated with the mining activities, including fugitive methane emissions (Scope 1 emissions), as well as Scope 2 and Scope 3 GHG emissions are discussed in a companion report.

3 REGULATORY FRAMEWORK

3.1 Relevant Legislation

This assessment has been conducted in accordance with the following environmental legislation and policy:

- EP Act;
- *Environmental Protection Regulation 2019* (EP Regulation);
- *Environmental Protection (Air) Policy 2019* (EPP [Air]);
- *Environmental Protection (Air) Amendment Policy 2024* (EPP [Air] Amendment);
- *Guideline - Application requirements for activities with impacts to air* (Department of the Environment, Tourism, Science and Innovation [DETSI], 2024a); and
- *National Environment Protection (Ambient Air Quality) Measure* (Ambient Air Quality NEPM) (National Environmental Protection Council [NEPC], 2021).

3.1.1 Environmental Protection Act 1994

The EP Act aims to protect environmental values of the atmosphere that are conducive to the health and well-being of humans and biological integrity. Division 1, Part 3 of Schedule 8 of the EP Regulation refers specifically to air, stating the Environmental Objective of activities being to "operate in a way that protects the environmental values of air".

The EPP (Air) was made under the EP Act and gazetted in 1997, revised and reissued in 2019 and amended most recently in 2024. The objective of the EPP (Air) is to identify the environmental values of the air environment to be enhanced or protected and to achieve the objective of the EP Act, i.e. ecologically sustainable development.

3.1.2 National Environmental Protection (Ambient Air Quality) Measure

The Ambient Air Quality NEPM was established under the *National Environment Protection Council Act 1994* to provide a nationally consistent framework for monitoring and reporting on seven common ambient air pollutants. The standards contained in the Ambient Air Quality NEPM informed the objectives specified in the EPP (Air). An update to the Ambient Air Quality NEPM was released in April 2021.

3.1.3 Environmental Authority EPML00717813

Under EA EPML00717813, Whitehaven Blackwater is required to operate in accordance with the air conditions set out in Condition B4 to comply with the following air limits:

> *Monitoring of dust and particulate matter resulting from the mining activities, undertaken in accordance with condition **A11**, must be carried out at a place relevant to the potentially affected sensitive place or commercial place and must not exceed the following levels when measured at any sensitive place or commercial place:*
>
> *a. dust deposition, measured as total insoluble matter, of 120 milligrams per square metre per day, averaged over one month, when monitored in accordance with the most recent version of Australian Standard AS3580.10.1 Methods for sampling and analysis of ambient air – Determination of particulate matter – Deposited matter – Gravimetric method.*
> *b. a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24-hour averaging time, when monitored in accordance with the most recent version of either:*
> *i. Australian Standard AS3580.9.6 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 high volume sampler with size selective inlet – Gravimetric method; or*
> *ii. Australian Standard AS3580.9.8 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 continuous direct mass method using a tapered element oscillating microbalance analyser; or*
> *iii. Australian Standard AS3580.9.9 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 low volume sampler – Gravimetric method; or*
> *iv. Australian Standard AS3580.9.11 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter – PM10 beta attenuation monitors.*
>
> *NOTE: Exceedances due to events that cannot be managed by the environmental authority holder, such as bushfires, fuel reduction burning for fire management purposes or dust storms, would not be considered to be in breach of condition B4 if the environmental authority holder can demonstrate that the exceedance was caused by such events.*

3.2 Adopted Air Quality Criteria

Air quality criteria adopted for the Project are outlined in Table 3-1.

Table 3-1 Adopted Air Quality Criteria

Pollutant	Averaging Period	Criteria	Source
TSP	Annual	90 µg/m³	EPP (Air) (NEPC, 2021)
PM_{10}	Annual	25 µg/m³	EA EPML00717813 EPP (Air) (NEPC, 2021)
	24-hour[1]	50 µg/m³	
$PM_{2.5}$	Annual	7 µg/m³	EPP (Air) Amendment (NEPC, 2021)
	24-hour[1]	20 µg/m³	
Dust deposition (as insoluble solids)	30-day	120 mg/m²/day	(DETSI, 2024a) EA EPML00717813

Note:

µg/m³ = micrograms per cubic metre; mg/m²/day = milligrams per square metre per day.

1 Clause 18 of the Ambient Air Quality NEPM (NEPC, 2021) states that "*For the purpose of reporting compliance against the PM_{10} and $PM_{2.5}$ 1 day average..., participating jurisdictions shall exclude monitoring data that has been determined as being directly associated with an exceptional event*". Exceptional event is defined in the Ambient Air Quality NEPM (NEPC, 2021) as "fire or dust occurrence that adversely affects air quality at a particular location that causes an exceedance of 1 day average standards for particles that is in excess of normal historical fluctuations and background levels, and is directly related to bushfire, jurisdiction authorised hazard reduction burning or continental scale windblown dust".

3.3 Sensitive and Commercial Places

EA EPML00717813 defines sensitive and commercial places as follows:

> ***Sensitive place*** *means:*
>
> *a) Any of the following:*
> - *i. a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or*
> - *ii. a motel, hotel or hostel; or*
> - *iii. an educational institution; or*
> - *iv. a medical centre or hospital; or*
> - *v. a protected area; or*
> - *vi. a public park or gardens.*
>
> *b) Despite paragraph (a), the following places are not sensitive places:*
> - *I. subject to paragraph (c), a place that is the subject of an alternative arrangement; or*
> - *II. a mining camp (i.e. accommodation and ancillary facilities for mine employees or contractors or both, associated with the mine the subject of the environmental authority), whether or not the mining camp is located within a mining tenement that is part of the mining project the subject of the environmental authority. For example, the mining camp might be located on neighbouring land owned or leased by the same company as one of the environmental authority holders for the mining project, or a related company; or*

III. a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.

c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a sensitive place for the purposes of that type(s) of environmental nuisance, however remains a sensitive place for the purpose of other types of environmental nuisances.

***Commercial place** means:*

a) A work place that is used as:
- *i. an office; or*
- *ii. a place of business; or*
- *iii. a place used for commercial purposes.*

b) Despite paragraph (a), the following places are not commercial places:
- *i. subject to paragraph (c), a place that is the subject of an alternative arrangement; or*
- *ii. places that are part of the mining activity; or*
- *iii. employees accommodation or public roads; or*
- *iv. a property owned or leased by one or more of the environmental authority holders, or a related company, whether or not it is subject to an alternative arrangement.*

c) A place that is the subject of a current alternative arrangement in relation to a particular type(s) of environmental nuisance, is not a commercial place for the purposes of that type(s) of environmental nuisance, however remains a commercial place for the purpose of other types of environmental nuisances.

Receptors identified for the Project are detailed in Section 4.5.

4 EXISTING ENVIRONMENT

4.1 Climatology

The BWM is located in central Queensland, which experiences a subtropical climate with hot, wet and stormy summers and drier, cooler winters.

Long-term meteorological data for the area surrounding the site is available from the Blackwater Airport Automatic Weather Station (AWS) operated by the Bureau of Meteorology (BoM), and the Blackwater air quality monitoring station (AQMS) operated by DETSI (DETSI Blackwater AQMS). The Blackwater Airport AWS is located within the existing ML, approximately 1 km west of the main haul road and records observations of several meteorological parameters including wind speed, wind direction, temperature, humidity and rainfall. The DETSI Blackwater AQMS was established in 2019 to the north of the ML, in the Blackwater township, and records observations of wind speed, wind direction, temperature, humidity and rainfall.

Whitehaven Blackwater also operates three weather stations on the ML, where wind speed and direction, temperature, relative humidity, pressure, solar radiation and rainfall have been recorded since 2016.

Figure 4-1 shows the locations of regional meteorological and air quality monitoring stations in the vicinity of the BWM.

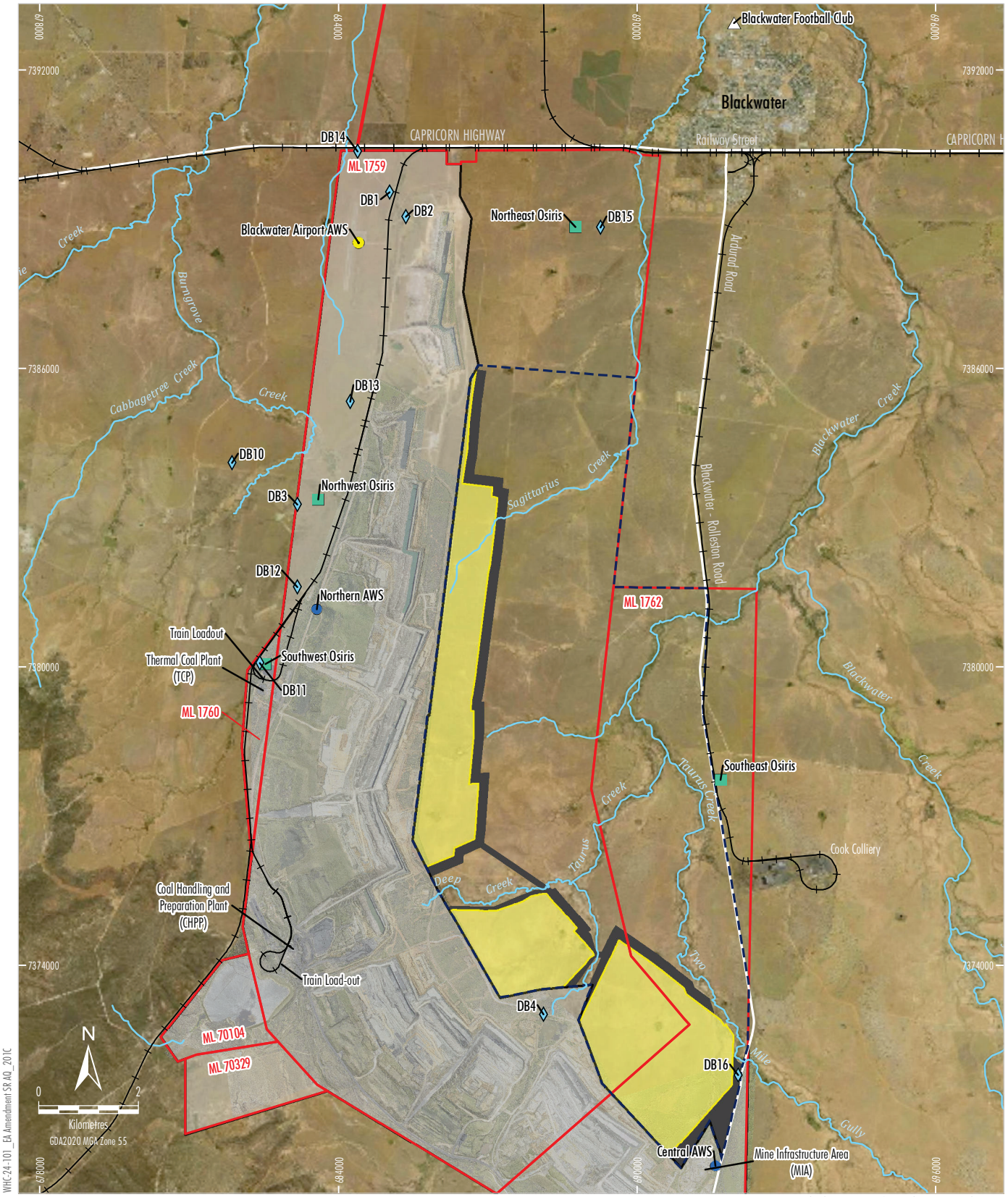
Long-term climate statistics for Blackwater Airport AWS are presented in Table 4-1, Table 4-2 and Table 4-3. Temperature data recorded at the Blackwater Airport AWS indicates that January is typically the hottest and wettest month of the year, and July is the coolest month. Annual statistics of rainfall depict rather large interannual variability, and the region experiences both periods of drought and floods.

Table 4-1 Climate Averages at Blackwater Airport AWS (2013 to 2025)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max temperature (°C)	34.6	34.3	33.2	30.3	27.0	24.2	24.0	26.2	29.5	32.6	34.0	34.8
Min temperature (°C)	22.0	21.7	21.0	16.9	13.2	10.2	9.3	10.0	13.4	17.3	19.4	21.0
Rainfall (mm)	92.3	73.1	65.6	19.7	21.0	19.0	29.9	18.4	17.5	50.3	51.0	72.6
Number of days of rain >= 1 mm	6.4	4.8	4.3	2.1	1.4	2.1	2.1	1.8	1.7	3.5	5.3	4.7

Source: BoM (2026)

Note: °C = degree Celsius; mm = millimetre



Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2025)
Orthophoto: Queensland Department of Resources (2017); Whitehaven (2025)

LEGEND

- Mining Lease
- Railway
- Road
- Watercourse

Meteorological Stations

- BoM Blackwater Airport AWS
- Whitehaven AWS

Air Quality Monitoring Stations

- DETSI Blackwater AQMS
- Whitehaven Osiris AQMS
- Whitehaven Deposited Dust Gauge
- Existing Blackwater Mine

Project Components[1]

- Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Note: [1] Excludes some incidental Project components such as water management, access tracks, topsoil stockpiles, power supply, temporary offices, and other ancillary works and construction disturbance.

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Regional Meteorological and Air Quality Monitoring Station

Figure 4-1

Table 4-2 Monthly Rainfall at Blackwater Airport AWS (2020 to 2025) (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2013-2025	92.3	73.1	65.6	19.7	21.0	19.0	29.9	18.4	17.5	50.3	51.0	72.6	532.1
2020	204.0	66.2	1.6	0.2	2.6	2.2	1.0	0.2	1.2	3.2	6.8	65.6	354.8
2021	52.4	41.8	79.0	6.4	11.2	9.0	46.2	48.2	6.0	118.8	159.6	13.0	591.6
2022	37.6	69.0	3.4	40.4	163.8	9.2	75.6	33.6	68.8	160.4	63.4	66.6	791.8
2023	136.0	2.2	2.0	0.0	0.0	0.2	62.6	0.0	0.0	0.0	135.4	178.6	517
2024	84.0	44.2	11.8	17.2	0.4	50.4	14.2	61.8	4.8	22.2	43.6	54.2	408.8
2025	140.4	24.2	85.8	79.8	47.0	12.4	42.4	17.2	13.0	34.8	34.8	87.8	619.6

From https://www.bom.gov.au/jsp/ncc/cdio/cvg/av and 30-minute data obtained from BoM for Station 035134 (Blackwater Airport AWS)

Table 4-3 Monthly Minimum and Maximum Temperature at Blackwater Airport AWS

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Minimum Temperature (°C)													
2013-2025	21.9	21.7	21.0	16.9	13.4	10.2	9.3	10.0	13.4	17.3	19.4	21.0	16.3
2020	22.8	22.9	19.9	17.6	12.3	11.2	9.1	9.3	15.1	17.4	19.5	21.8	16.6
2021	21.4	22.1	21.2	16.9	12.4	10.6	9.7	11.8	13.1	18.4	19.8	20.9	16.5
2022	22.1	21.1	20.7	18.7	16.3	9.9	8.8	10.3	14.0	17.2	18.0	18.9	16.3
2023	20.9	21.1	21.2	15.8	9.3	10.8	9.8	9.5	13.4	16.3	19.5	21.3	15.7
2024	23.2	22.3	21.3	16.6	13.5	8.5	9.0	11.6	13.2	17.5	20.4	21.9	16.6
2025	21.2	20.8	21.3	15.8	13.9	8.8	8.2	9.7	13.6	18.6	21.3	20.7	16.2
Mean Maximum Temperature (°C)													
2013-2025	34.5	34.2	33.3	30.3	26.8	24.2	24.0	26.2	29.5	32.6	34.0	34.8	30.4
2020	35.3	33.7	31.8	32.1	25.0	24.3	23.5	26.4	29.7	32.5	35.0	35.4	30.4
2021	33.5	35.3	33.2	30.0	27.4	23.5	24.2	26.4	28.4	33.4	30.7	33.2	29.9
2022	36.2	34.7	35.5	30.9	26.0	22.6	20.7	23.6	26.6	30.2	30.6	32.0	29.1
2023	31.9	33.8	34.2	30.9	26.3	27.2	24.5	27.7	30.4	33.5	32.9	34.2	30.6
2024	34.4	33.7	33.3	30.2	27.6	24.4	22.8	26.7	29.5	32.9	34.9	35.2	30.5

From https://www.bom.gov.au/jsp/ncc/cdio/cvg/av from BoM for Station 035134 (Blackwater Airport AWS)

4.2 Local Meteorology

Meteorological conditions strongly influence air quality. Most significantly, wind speed, wind direction, temperature, atmospheric stability and rainfall affect the transport, dispersion and deposition of air pollutants. The following sub-sections discuss the local meteorology near the Project site based on observations at the Blackwater Airport AWS and identify a representative set of meteorological data for use in the dispersion modelling to be undertaken for this assessment.

4.2.1 Winds

Wind speed and wind direction are critical in creating and determining the fate of dust emissions from mining operations through transport and dispersion. Strong winds also contribute to significant surface erosion, adding natural dust emissions, especially in disturbed, non-rehabilitated areas, to the dust created by mining operations.

The windrose plots, based on wind data recorded at the Blackwater Airport AWS between 2013 and 2024, show that winds in the Project area most frequently blow from the north-east towards the south-west quadrants (Figure 4-2 and Figure 4-3).

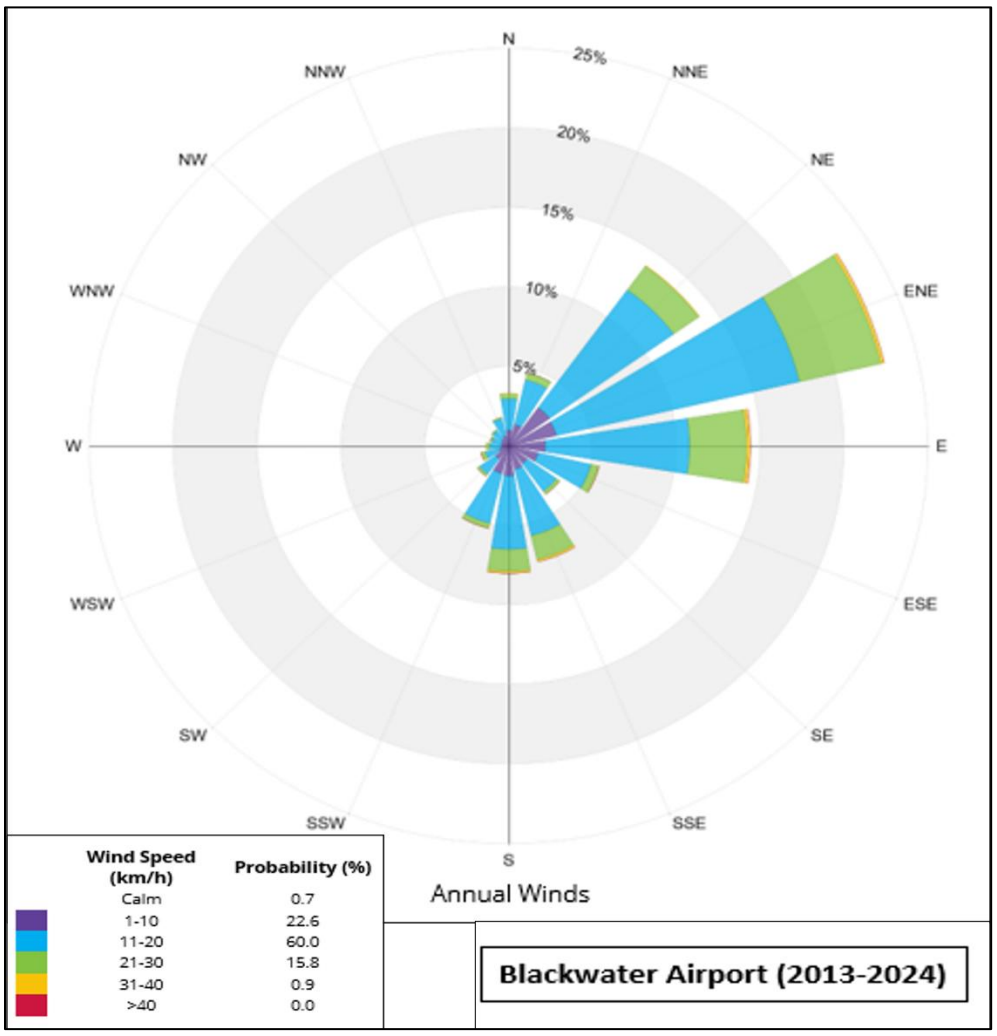


Figure 4-2 Windrose at Blackwater Airport AWS (2013 to 2024)

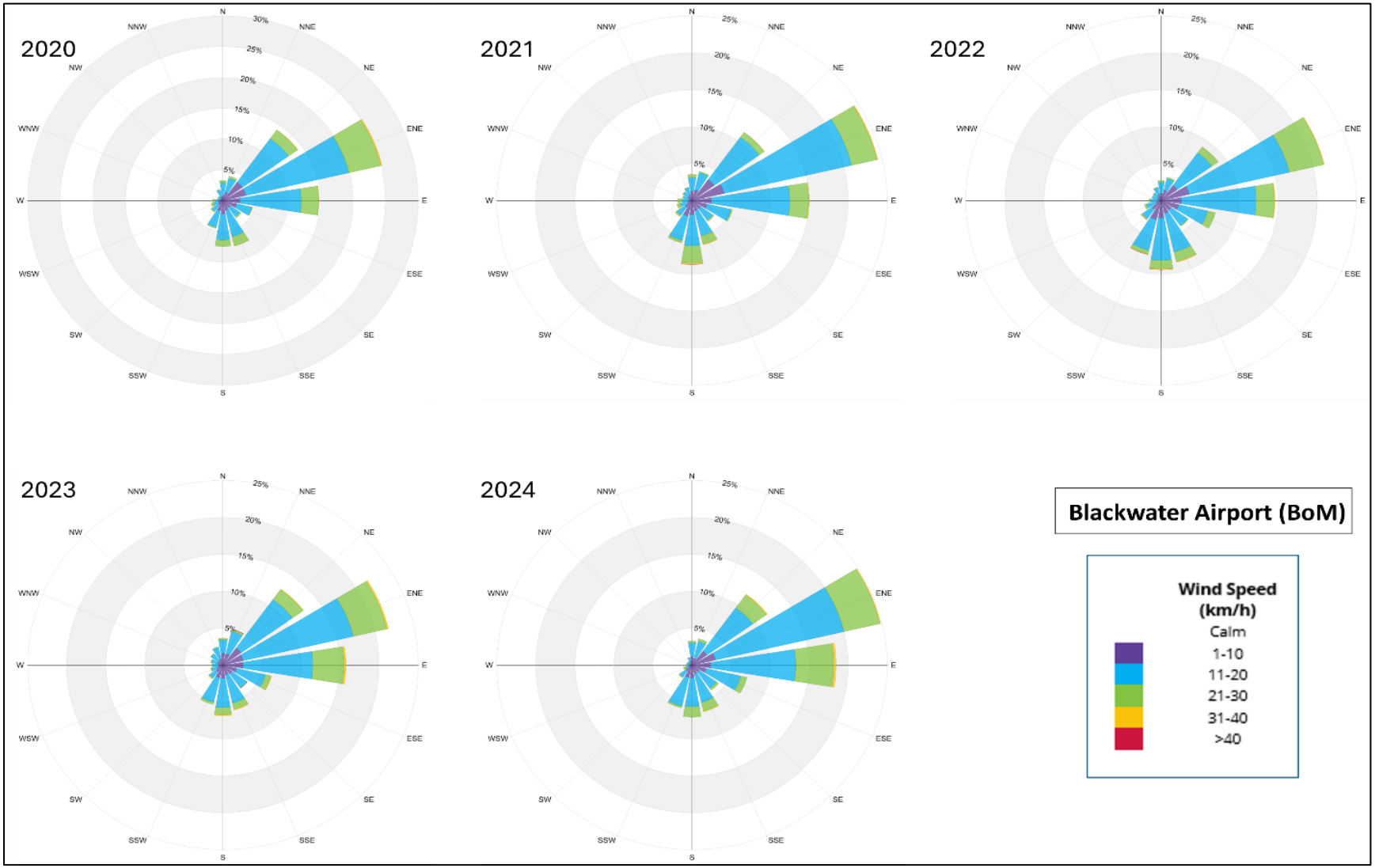


Figure 4-3 Annual Windroses at Blackwater Airport AWS (2020 to 2024)

Based on the climatology, data availability, and annual windroses, 2021 was selected as generally representative of the conditions over the Project area and adopted for modelling purposes. Indeed, 2021 exhibits an average pattern of temperature and rainfall, indicating a representative passage of weather systems throughout the area in 2021. Windroses show little variable from year to year, with dominant northeasterly wind and very rare westerly winds.

4.2.2 Atmospheric Stability and Mixing Height

Atmospheric stability is a measure of the turbulence (both convective and mechanical) experienced by the lower atmospheric boundary layer. Stability Classes range from A (most unstable, reflecting lots of convective turbulence and good dispersion, typical of hot cloudless days) to F (most stable, reflecting poor dispersion conditions, typical of clear nights and light winds); stability class D depicts a neutral atmosphere (typical of cloudy days and windy nights).

The mixing height represents the depth of the lower atmospheric boundary layer where pollutants emitted near the ground typically disperse. During the day, convection builds up the boundary layer, and the mixing height increases after sunrise; once the sun sets, mechanical turbulence dominates and the mixing height typically collapses. Strong thermal inversions can develop at night, especially during calm cloudless nights, effectively trapping dust in open-cut pits and creating poor dispersion conditions overall.

Atmospheric stability and mixing height computed by the meteorological model CALMET (which was used as input to the dispersion model CALPUFF) are displayed in Figure 4-4 and Figure 4-5. CALMET was driven by the surface meteorological observations at the Blackwater Airport AWS, as well as 3D mesoscale The Air Pollution Model (TAPM) model output and terrain and land use data.

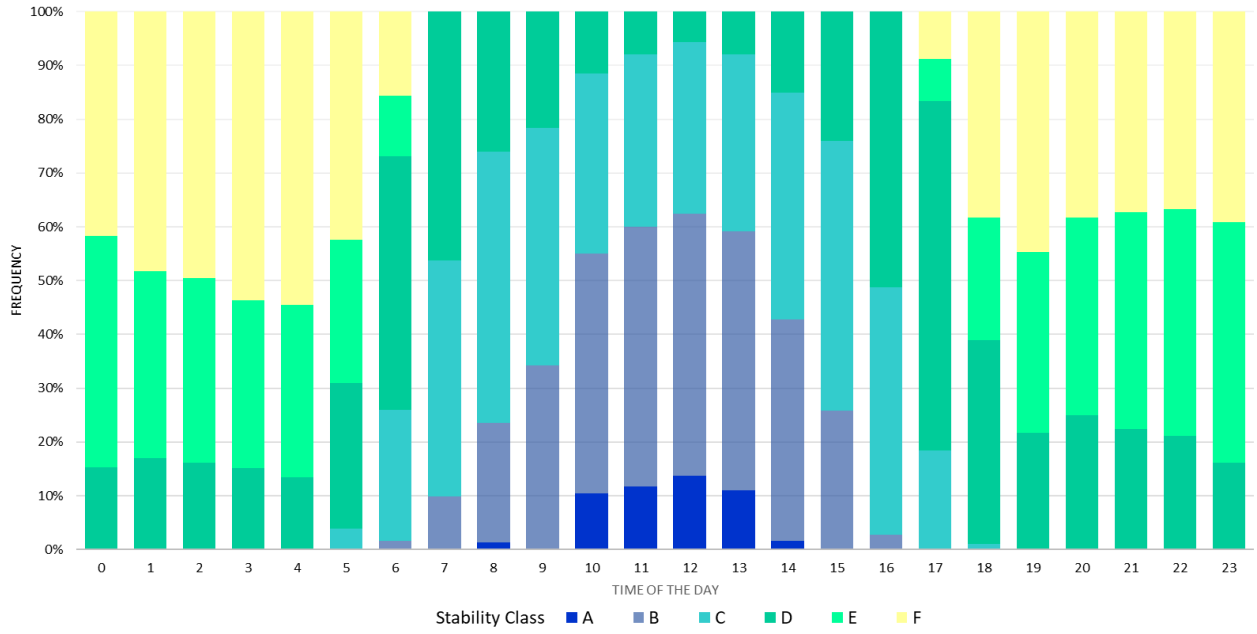


Figure 4-4 Stability Class Frequency vs. Time of the Day at the Centre of the Project Area in 2021 (from CALMET)

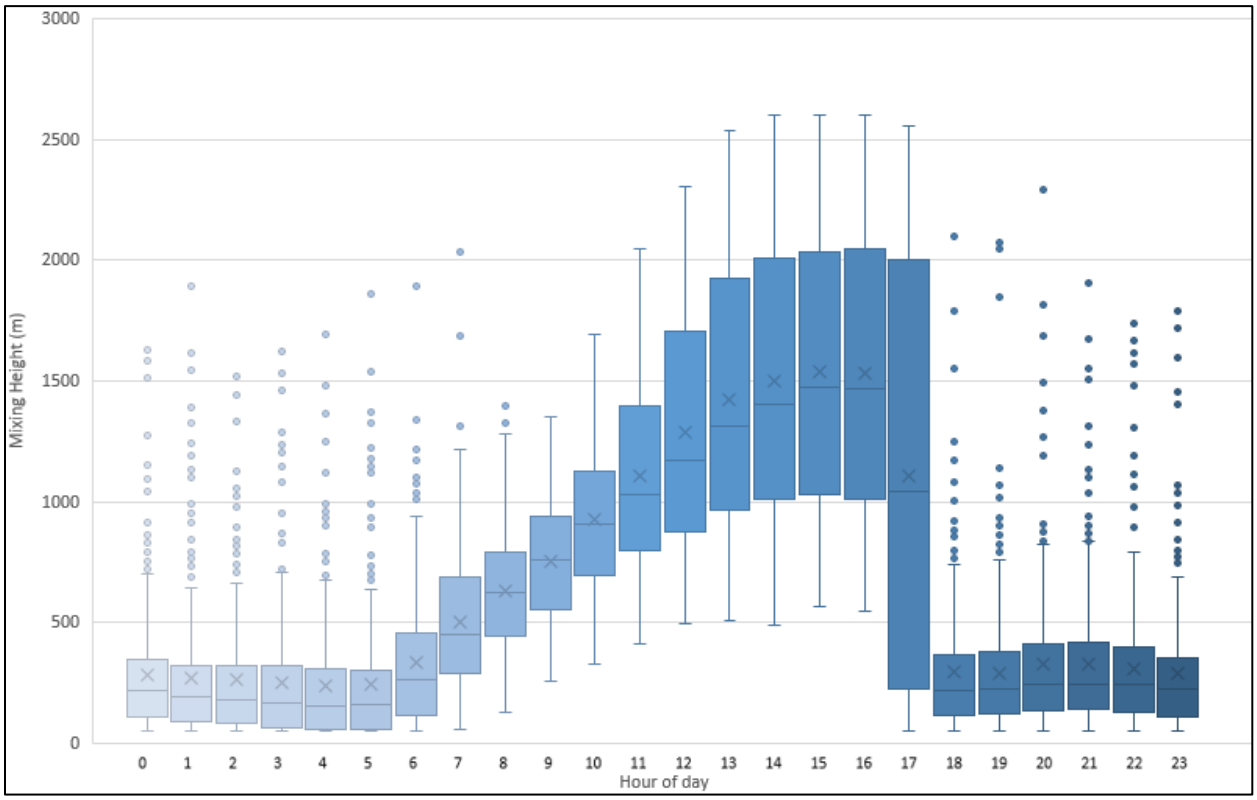


Figure 4-5 Diurnal Variation of the Mixing Height at the Centre of the Project Area in 2021 (from CALMET)

4.3 Local Ambient Air Quality

DETSI has been operating the DETSI Blackwater AQMS within the township of Blackwater, located north of the Blackwater Sports Centre. PM_{10}, $PM_{2.5}$ and meteorological variables have been recorded at that location since February 2019. This location is representative of air quality in the township of Blackwater and was used to determine background ambient air quality for the cumulative air quality assessment. It is affected by dust emissions from the BWM, under south-westerly winds (which are not very frequent), mines north of Blackwater under northerly winds and soil erosion during strong wind episodes, as well as closer anthropogenic and mobile dust emissions in the town. During very windy days, dust levels have occasionally exceeded the 24-hour PM_{10} and $PM_{2.5}$ ambient air quality criteria. Extensive bushfires have also contributed to elevated PM_{10} and $PM_{2.5}$ levels at times[1]. PM_{10} and $PM_{2.5}$ are monitored at the DETSI Blackwater AQMS using scattered light spectrometry (TAPI Model 640X) operated in accordance with the United States Environmental Protection Agency (US EPA) equivalence method designation requirements.

A summary of the PM_{10} and $PM_{2.5}$ monitoring results collected at the DETSI Blackwater AQMS is presented in Table 4-4. In consideration of allowable exceptional circumstances, air quality at Blackwater is generally compliant with the criteria.

[1] For example, DETSI (2025) notes that PM_{10} and $PM_{2.5}$ levels increased in 2023 in most regions due to bushfires and hazard reduction burns.

Table 4-4 Summary of Particulate Matter Monitoring Results at DETSI Blackwater AQMS (2020 to 2024) (µg/m³)

Year	Annual average			24-hour Max				24-hour 70th percentile	
	TSP	PM_{10}	$PM_{2.5}$	PM_{10}		$PM_{2.5}$		PM_{10}	$PM_{2.5}$
Criteria	**90**	**20**	**7**	**50**	**# Exc**	**20**	**# Exc**	**50**	**20**
2020	*no data available*	16.17	5.07	**60.95**	**1**	17.54	0	17.42	5.47
2021		15.54	4.73	**54.57**	**2**	**24.92**	**1**	17.45	5.18
2022		13.91	4.50	32.33	0	8.30	0	15.66	5.17
2023		19.28	6.83	**91.95**	**4**	**62.60**	**11**	21.58	6.54
2024		16.73	5.32	45.89	0	19.18	0	18.53	5.85

Whitehaven Blackwater operates four Osiris AQMS within the boundaries of the ML to monitor TSP, PM_{10} and $PM_{2.5}$ (which are used for diagnostic purposes for dust management only, and not used for compliance monitoring).

Whitehaven Blackwater also operates dust deposition gauges in the vicinity of the BWM (Figure 4-1). Monitoring results at the dust deposition gauges are summarised in Table 4-5 and Table 4-6.

Table 4-5 Summary of Ambient Dust Deposition Gauge Measurements at BWM by Year

	Year			
	2023	**2024**	**2025**	**Jan-2026**
Number of samples	7	89	86	7
Number of exceedances of guideline (120 mg/m²/day)	3	24	12	1
Highest exceedance (date, gauge recorded at)	726 mg/m²/day (14/11/2023, DB5)	836 mg/m²/day (23/10/2024, DB5)	526 mg/m²/day (15/01/2025, DB5)	127 mg/m²/day (28/01/2026, DB12)

Table 4-6 Summary of Ambient Dust Deposition Gauge Measurements at BWM by Location

	# Samples	Median	10th percentile	40th percentile	90th percentile	# Exceedances
DB1	14	49	12	44	142	3
DB2	11	53	30	47	63	0
DB3	21	40	23	40	83	0
DB4	11	316	156	303	360	10
DB5	13	470	231	459	739	13
DB6	0	-	-	-	-	-
DB7	0	-	-	-	-	-
DB8	0	-	-	-	-	-
DB9	20	43	7	35	70	1
DB10	20	78	27	70	161	5
DB11	23	57	14	50	209	5
DB12	19	76	19	64	110	2
DB13	13	57	17	32	111	1
DB14	8	52	25	39	77	0
DB15	8	50	17	47	77	0
DB16	8	55	27	52	76	0

4.4 Local Terrain and Land Use

The region is predominantly rural, with nearby mines located north of the township of Blackwater and forested ridges cutting across the Project area from north-west to south-east (Figure 4-6). The BWM has been in operation since 1967 and is thus visible on the satellite imagery and is part of the current-day topography datasets.

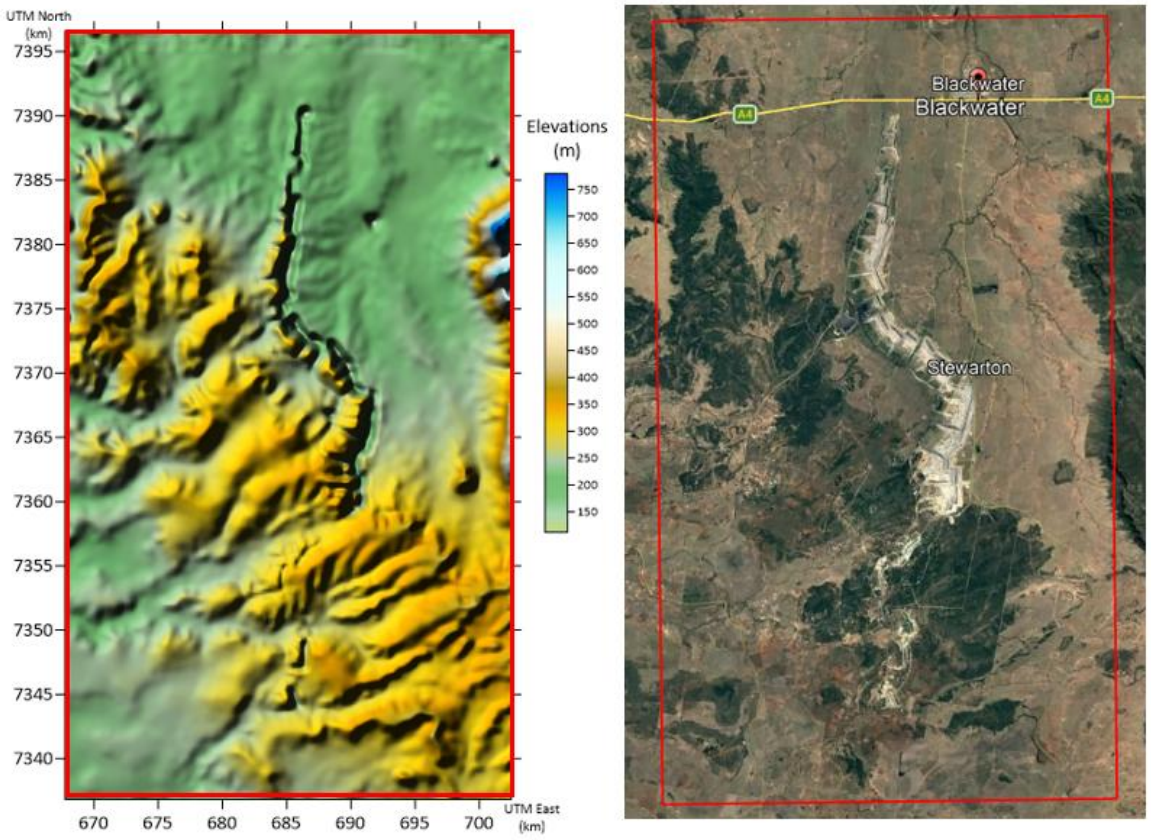


Figure 4-6 Topography and Land Use over the Project Area (CALMET Domain Outlined in Red).

4.5 Receptors

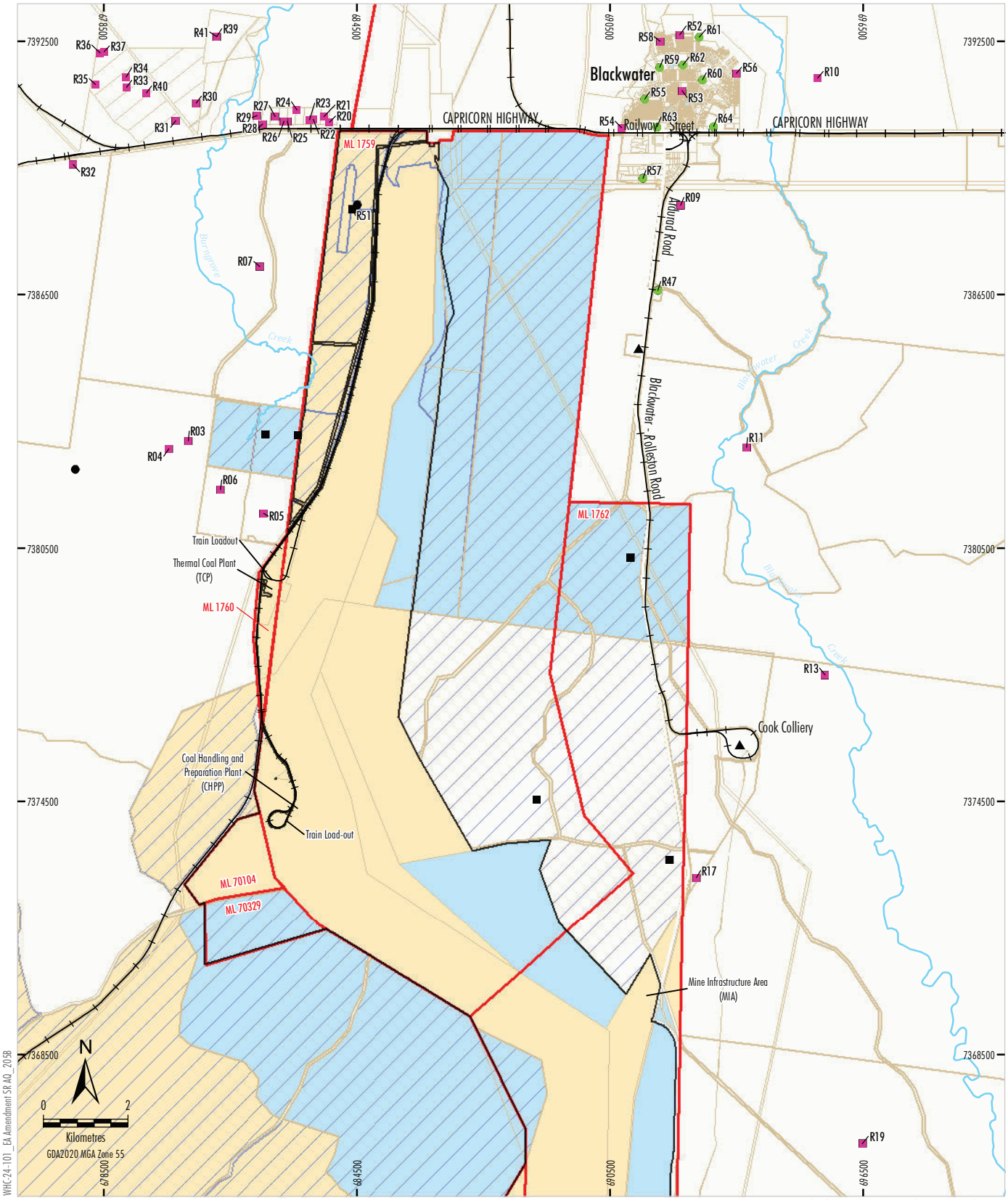
In total, 59 air quality receptors were considered and are summarised as follows (Table 4-7 and Figure 4-7):

- 39 privately-owned sensitive receptors, comprising 34 rural properties and five dwellings representative of Blackwater;
- eight other sensitive receptors, comprising three schools, a childcare centre, a hospital, a medical centre, a camp accommodation and a cemetery (all located in Blackwater except for the cemetery); and
- 12 non-sensitive receptors (including five mine-owned residential dwellings, two privately-owned residential dwellings currently under agreements, and five commercial/industrial receptors in the surrounding rural areas).

Table 4-7 Receptors

Rec ID	Description	Coordinates (GDA 2020 / MGA zone 55)	
		Easting	Northing
Privately-owned Sensitive Receptors			
R03	Tolmies Creek Homestead (HS)	680506	7383036
R04	Tolmies Creek HS	680046	7382848
R05	Ausbute HS	682295	7381314
R06	-	681271	7381884
R07	Burngrove HS	682199	7387165
R09	Minyango HS	692174	7388618
R10	Cardona HS	695420	7391637
R11	Tantallon HS	693741	7382883
R13	Yarrawonga HS	695598	7377492
R17	Retreat HS	692554	7372690
R19	Tannyfoil HS	696492	7366393
R20	-	683854	7390585
R21	-	683725	7390717
R22	-	683471	7390656
R23	-	683386	7390637
R24	-	683088	7390869
R25	-	682852	7390613
R26	-	682776	7390604
R27	-	682564	7390721
R28	-	682268	7390548
R29	-	682136	7390744
R30	Tulloch Ard HS	680696	7391034
R31	-	680210	7390623
R32	Maryvale HS	677776	7389581
R33	Malamy HS	679048	7391412
R34	Malamy HS	679029	7391655
R35	Sherborne HS	678311	7391482
R36	-	678413	7392228
R37	-	678517	7392258
R39	-	681182	7392608
R40	-	679512	7391279
R41	-	681184	7392609
R42	Monash HS	669266	7367221

Rec ID	Description	Coordinates (GDA 2020 / MGA zone 55)	
		Easting	Northing
Privately-owned Sensitive Receptors			
R43	-	670323	7368118
R52	Generic Blackwater Town - North	692157	7392658
R53	Generic Blackwater Town - Centre	692206	7391333
R54	Generic Blackwater Town – South-west	690784	7390455
R55	Generic Blackwater Town - East	693500	7391743
R56	Generic Blackwater Town – North-west	691688	7392501
Other Sensitive Receptors			
R57	Blackwater Hospital	691683	7391888
R58	Medical centre	692697	7391586
R59	Blackwater North State School	692620	7392600
R60	Blackwater State High School	692235	7391939
R61	Blackwater State School	691617	7390472
R62	C&K Childcare Centre	691330	7391139
R47	Blackwater Lawn Cemetery	691633	7386604
R63	Camp Accommodation	692964	7390493
Non-sensitive Commercial/Industrial Receptors			
R14	Qcoal (Cook Colliery - north)	693576	7375833
R46	Qcoal (Cook Colliery - south)	692423	7363643
R48	Resource recovery centre	691184	7385223
R49	Quarry	677837	7382368
R64	Blackwater Water Treatment Plant	691286	7389259
Non-sensitive Mine-owned Receptors			
R01	Whitehaven	682332	7383198
R02	Whitehaven	683118	7383184
R12	Whitehaven	690992	7380267
R50	BWM Airport	684514	7388628
R51	BWM Airport caretaker	684398	7388526
Non-sensitive Privately-owned Receptors Currently Under Agreements			
R15	Taurus HS	688762	7374534
R16	Stewarton HS	691913	7373114



Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2025)

LEGEND

- Mining Lease
- Railway
- Road
- Watercourse
- Property Boundary
- Approved Disturbance Footprint
- Lessee or Agistee Boundary
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Sensitive Receptors Locations

Figure 4-7

4.6 Background Levels

One of the objectives for reviewing the air quality monitoring data was to determine appropriate background levels to be applied in the air quality dispersion modelling. Background air quality concentrations adopted for the quantitative assessment were based on average annual and 70th percentile 24-hour values at the DETSI Blackwater AQMS for the past five years and are summarised in Table 4-8. DETSI does not monitor TSP in Blackwater and background TSP was thus estimated to be twice of the annual PM_{10} baseline concentration (based on typical erosion TSP/PM_{10} ratios).

Baseline dust deposition was estimated based on the gauge data least affected by the BWM (DB1, DB9, DB15), and the 40th percentile of dust deposition data at DB1, DB9, DB15 was used as baseline.

Table 4-8 Background Air Quality Adopted for the Assessment

Pollutant	Averaging Period	Adopted Background
$PM_{2.5}$	24-hour	5.6 µg/m^3
	Annual	5.3 µg/m^3
PM_{10}	24-hour	18.1 µg/m^3
	Annual	16.3 µg/m^3
TSP	Annual	36.3 µg/m^3
Dust deposition	30-day	42.0 mg/m^2/day

5 AIR QUALITY ASSESSMENT METHODOLOGY

5.1 Overview

Air quality dispersion modelling uses computational models to predict cumulative impacts from air pollutants generated by the Project emission sources at sensitive receptors. Although Queensland does not have specific modelling requirements, the *Air – EIS Information Guideline* (DETSI, 2024b), which although the Project is an amendment not an EIS, was used as a guidance for this work. The guideline recommends following the New South Wales (NSW) modelling guidance provided in the *Approved methods for the modelling and assessment of air pollutants in NSW* (NSW Environment Protection Authority, 2022).

Although the Project focuses on the northern part of the BWM, already approved production is ongoing and will continue in the southern part of the BWM, and the cumulative air quality impact of mining activities in the full BWM has to be assessed at the sensitive receptors. Mining activities from all pits, including south of the Project area, haulage and processing thereof at the CHPP and TCP, were thus considered in this assessment. All mining sources that can potentially impact the sensitive receptors were included in the model (including all pit mining activities down to Ramp 62S); haulage and processing of ROM extracted from pits south of Ramp 62S were also included as they will occur on the main haul road, CHPP and TCP areas and may as such affect the sensitive receptors near the Project area. Mining in areas south of Ramp 62S, as well as quarrying, would not contribute materially to air quality at receptors relevant to the Project which are both far and typically upwind of those areas, and were thus not modelled.

Consideration was given to cumulative impacts from other nearby mining operations. However, explicit modelling was not warranted because:

- the Cook Colliery (approximately 14 km south-west of the Project), temporarily ceased operations in 2025;
- the Curragh Mine Complex (approximately 28 km north of the Project) is considered too far north and emissions from this mine would not contribute emissions to receivers on the same day; and
- these mines would be included in the background data used (because Curragh Mine Complex is north of the Project and prevailing winds would not result in impacts from both operations on one day).

The methodology used in this air quality assessment is outlined hereafter:

- **Emissions**: for representative years throughout the lifetime of the Project. The selection of representative assessment scenarios is discussed in Section 5.2 and emission inventories are detailed in Section 6.
- **Meteorological modelling**: 3D meteorological modelling was conducted to drive the transport and dispersion of pollutants over the Project area, for a representative modelling year. The meteorological modelling approach is discussed in Section 5.3.
- **Dispersion modelling**: was conducted with CALPUFF, a regulatory Lagrangian puff model suitable to assess the transport, dispersion and deposition of particulate matter in complex terrain over the Project area and predict impact at the sensitive receptors, using representative 3D meteorological input and time-dependent emission inventories. The CALPUFF set-up is discussed in Section 5.4.

- **Air quality assessment**: predicted cumulative ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ and dust deposition are summarised and compared with relevant air quality criteria and guidelines in Section 7. Possible mitigation measures are discussed as well.

5.2 Assessment Scenarios

Four representative years were selected throughout the lifetime of the Project. Financial Year 2032 (FY32), FY46 and FY55 represent early, mid and end of the Project lifetime, with high ROM and/or overburden production rates, as the BWM overall expands to the east. An additional early scenario was selected in FY30 when the northernmost activities (i.e. closest to Blackwater township residential areas) are planned.

Based on the indicative Project production rate, four modelling scenarios have been developed. These are outlined in Table 5-1, and respective ROM and overburden amounts are graphically presented in Figure 5-1. A detailed Project production schedule by pit and by year is included in Appendix A.

Table 5-1 Modelling Scenarios

Modelling Year	Total ROM (Mtpa)	Total Overburden (Mbcm)	Comment
FY32	19.0	279.8	First peak year for ROM amount
FY30	14.8	246.4	Production planned in the northernmost pit
FY46	18.8	289.2	Peak overburden amount, similar ROM amount to the peak ROM
FY55	16.0	275.6	End of Project and mining near eastern sensitive receptors

Note: Mbcm = million bank cubic metres

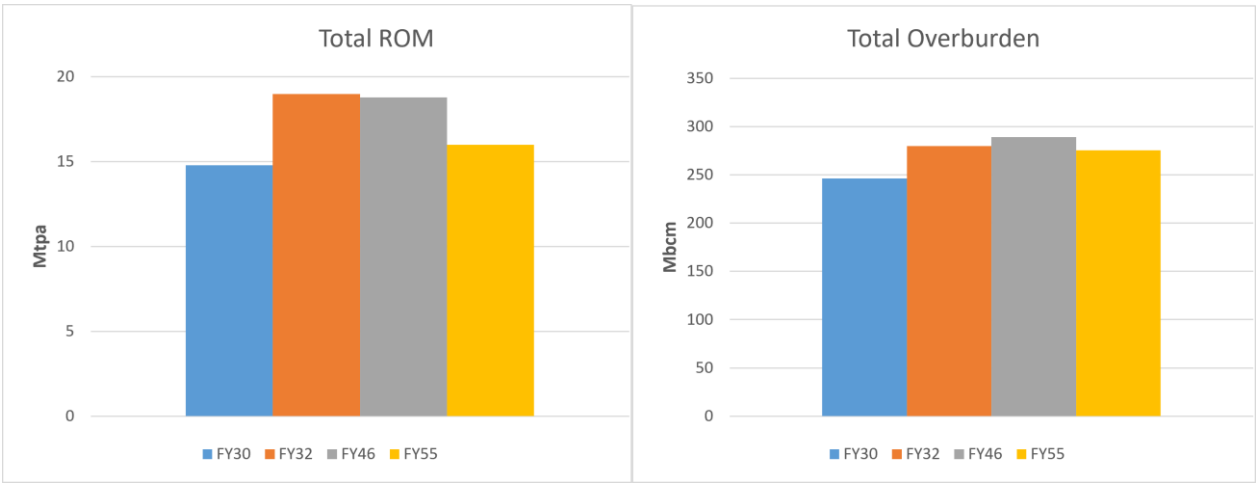


Figure 5-1 ROM and Overburden Amount for the Selected Modelling Scenarios

5.3 Meteorological Modelling

5.3.1 TAPM

TAPM, developed and distributed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), was configured to generate regional wind fields over the Project area.

TAPM is an incompressible, non-hydrostatic, primitive equations prognostic model with terrain-following vertical coordinates for 3D simulations. It predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of large-scale meteorology provided by synoptic analyses. TAPM benefits from having access to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world.

TAPM was run over nested grids centred on the Project, with increasing horizontal resolution down to 3 km. Hourly upper air soundings were extracted from TAPM for input into CALMET.

5.3.2 CALMET

CALMET is a diagnostic meteorological model that refines prognostic model output (in this case TAPM) by incorporating additional observational data, and the influences of local topography and land uses on the weather. It produces hourly wind and temperature fields on a 3D gridded modelling domain, as well as 3D fields of mixing heights and turbulence-related properties. It is typically used to drive the CALPUFF dispersion model.

CALMET was run at 250 metres (m) resolution over a 35 km by 60 km modelling domain encompassing the whole BWM, sensitive receptors and the township of Blackwater for each scenario, incorporating mine topography based on the planned mining schedule (with the pits getting deeper and moving eastward). The extent of the CALMET domain is outlined in Figure 4-6 and key setup parameters are summarised in Table 5-2.

Hourly output from TAPM was used as input into CALMET in addition to hourly surface observations of winds, temperature relative humidity, precipitation at Blackwater Airport. Hourly observations at the Emerald Airport, west of the Project area were used to provide cloud data to CALMET and supplement any other missing data in the Blackwater Airport records.

Table 5-2 CALMET Model Setup

CALMET Features	Selection
Modelling Year	2021
Horizontal Extent	35 km EW x 60 km NS (140 x 240 grid cells)
Upper Air Data	Hourly upper air soundings extracted from TAPM
Surface Observations	Hourly observations at Blackwater Airport (BoM), supplemented by observations at Emerald Airport (BoM)
Horizontal Resolution	250 m
Vertical Layers	10 Layers with increasing thickness from the surface to 2.8 km
Topography	High resolution topography based on mining schedule for each modelling year
Key input Parameters	TERRAD = 5 km; IEXTRP = -4, R1 = R2 = 1 km

5.4 Dispersion Modelling - CALPUFF

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation and removal, and is capable of simulating varying wind flow patterns and varying land use.

CALPUFF version 7.2.1 was run in CALMET mode over a 14 km by 30 km modelling domain encompassing the Project area and the sensitive receptors for a full modelling year for each scenario, using meteorological and emission data pertaining to those years. CALPUFF predicted hourly ground-level concentrations of particulate matter concentrations as well as dry and wet dust deposition at the sensitive receptors and at 4,320 additional ground-level receptors spread over the modelling domain. Wet deposition is part of the dust transport and dispersion process and was modelled accordingly in CALPUFF. However wet deposition only accounts for a tiny fraction of the overall dust deposition. Rainfall also significantly reduces dust emissions, during and after a rainy episode, but this mitigating effect was conservatively not taken into account in the emission calculations.

Three particulate matter species were defined based on size, from which $PM_{2.5}$, PM_{10} and TSP impacts could be calculated. All mining sources that can potentially impact the sensitive receptors were included in the model (including all pit mining activities down to Ramp 62S; haulage and processing of ROM extracted from pits south of Ramp 62S, were also included as they will occur on the main haul road, CHPP and TCP areas within the modelling domain). Mining in areas south of Ramp 62S, as well as quarrying, would not contribute materially to air quality at receptors relevant to the Project which are both far and typically upwind of those areas, and were thus not modelled. The CALPUFF modelling domain was outlined in Figure 4-6, key model parameters are summarised in Table 5-3.

Table 5-3 CALPUFF Model Setup and Source Configuration

Model Feature	Selected Configuration
Modelling Scenarios	FY30, FY32, FY46 and FY55
Horizontal Extent	14 km EW x 30 km NS
Meteorological Input	Hourly CALMET 3D fields (based on 2021 meteorological data, TAPM and scenario-specific topography and land use)
Discrete Receptors	4384 (including sensitive receptors)
Deposition	Size-dependent dry and wet deposition.
Pollutants	$PM_{2.5}$, PM_{10} and TSP modelled as a combination of particulate species P1, P2 and P3 of Geometric Mass Mean Diameters: P1: 1.25 μ; P2: 5 μ; P3: 20 μ and geometric standard deviations for the size distribution of 1.25 μ with $PM_{2.5}$ = P1; PM_{10}= P1 + P2; TSP = P1 + P2 + P3
Emissions Sources	• Area sources: for all mining activities except haulage • Haul roads: lines of volumes sources • Blasting during daytime only (7 am to 6 pm) ; all other sources are 24/7 • Time and wind-speed dependent wind erosion area sources
Key input Parameters	• Puff Mode • Dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables • Terrain adjustment method: Partial plume path adjustment

6 DUST EMISSION INVENTORY

6.1 Emissions Sources

The significant sources of dust emissions associated with the mining operations include:

- **Blasting and drilling:** drilling, preparing and executing blasting.
- **Pit Mining Activities**: draglines, excavators, bulldozing, loaders and shovels.
- **Loading/unloading** of ROM and overburden in the pits, stockpiles, and processing plants.
- **ROM and Overburden Haulage**: ROM coal is transported from the pits up to the main haul road on Komatsu 930E and Caterpillar 793F trucks, then transferred onto Kress 200C trucks and transported to the CHPP and TCP; overburden is transported from the active pits onto the overburden areas behind them.
- **Grading:** preparing and maintain haul roads.
- **ROM Processing**: crushing, grinding, screening, transfer, stockpiling and loading onto trains at the CHPP for the coking coal, and at the TCP for the thermal coal.
- **Wind Erosion:** wind erosion of stockpiles and disturbed areas including the active pit zones, overburden areas, partially rehabilitated areas, and recently stripped areas, under strong winds.

6.2 Mining Activity

Overall ROM and total overburden production breakdown for the four modelled years is summarised in Table 6-1. General Arrangements for FY30, FY32, FY46 and FY55 are displayed in Figure 6-1, Figure 6-2, Figure 6-3 and Figure 6-4 respectively. Detailed ROM and overburden production rates by pit are included in Appendix A for the four modelled scenarios.

Table 6-1 ROM and Overburden Production for the Modelled Years

	FY30	FY32	FY46	FY55
Total ROM (Mt)	14.8	19.0	18.8	16.0
Total Coking Coal (Mt)	12.4	14.5	13.3	10.1
Thermal Coal (Mt)	1.1	2.8	1.9	3.5
% Thermal of total ROM	7.4%	14.7%	10.1%	21.9%
% Coking (incl. rejects)	92.6%	85.3%	89.9%	78.1%
Rejects[1] (Mt)	1.3	1.7	3.6	2.4
% Rejects of Coking Coal	9.5%	10.5%	21.3%	19.2%
Total Overburden (Mbcm)	246.4	279.8	289.2	275.6

Note:

1. Rejects from Total Coking Coal

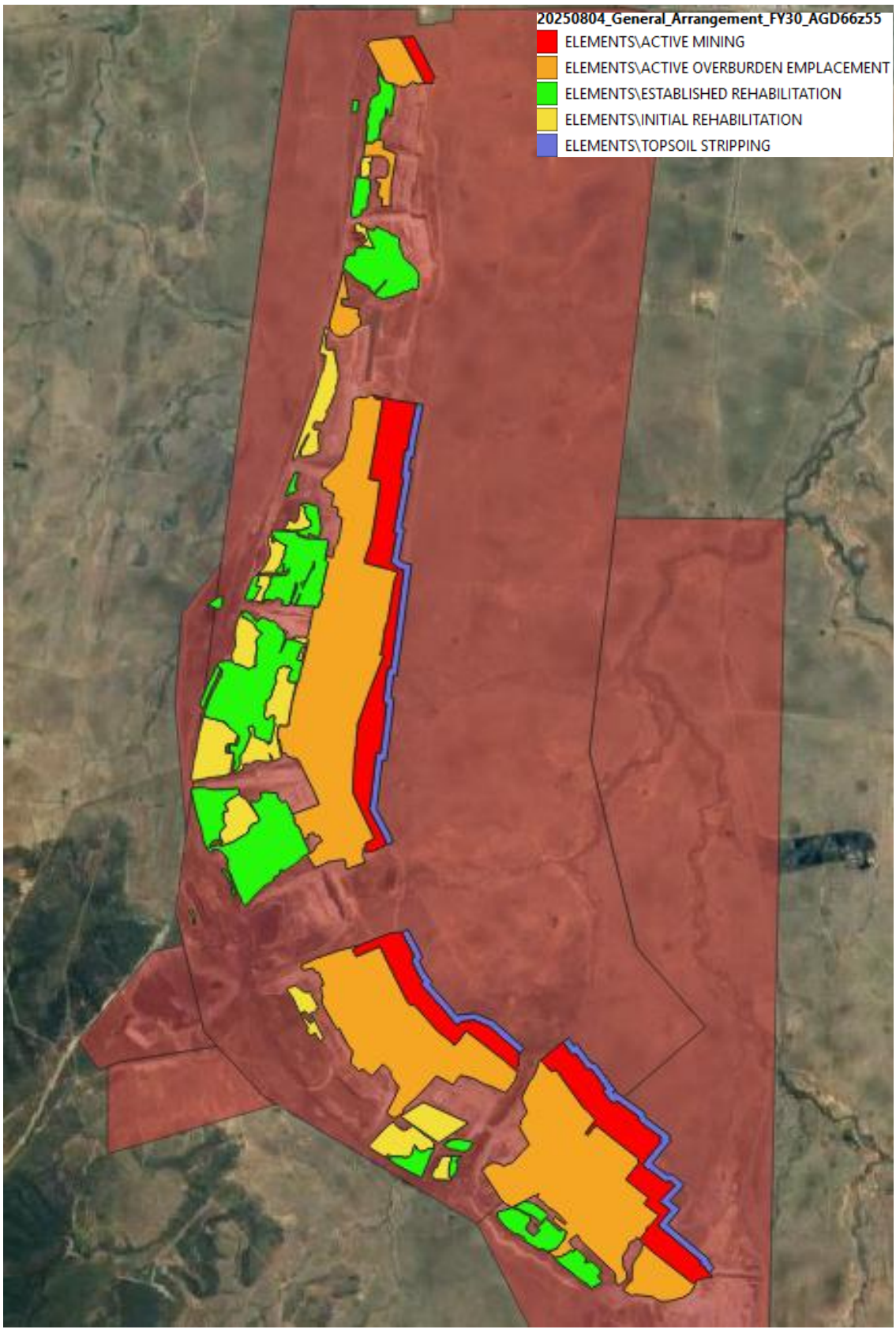


Figure 6-1 General Arrangement FY30

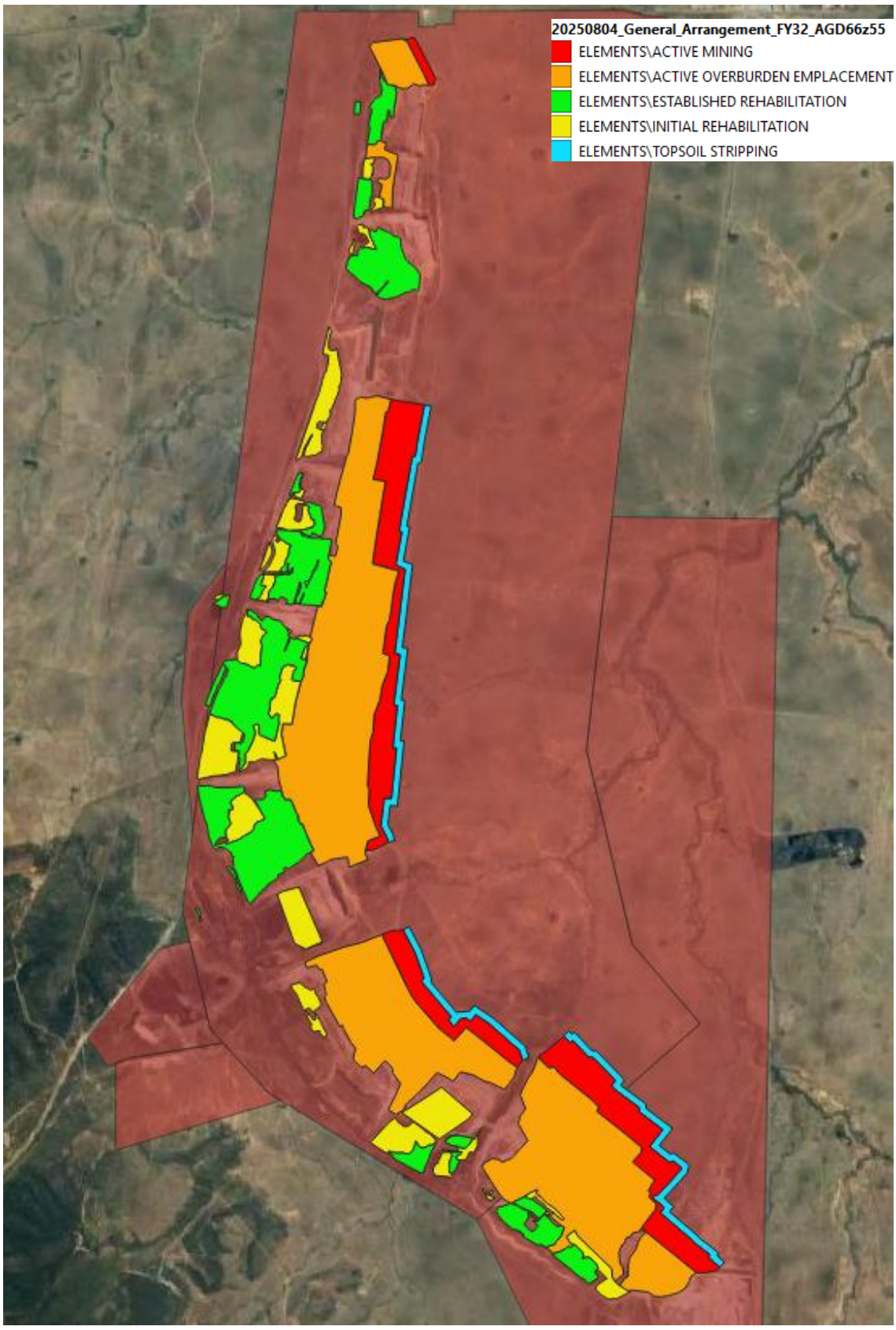


Figure 6-2 General Arrangement FY32

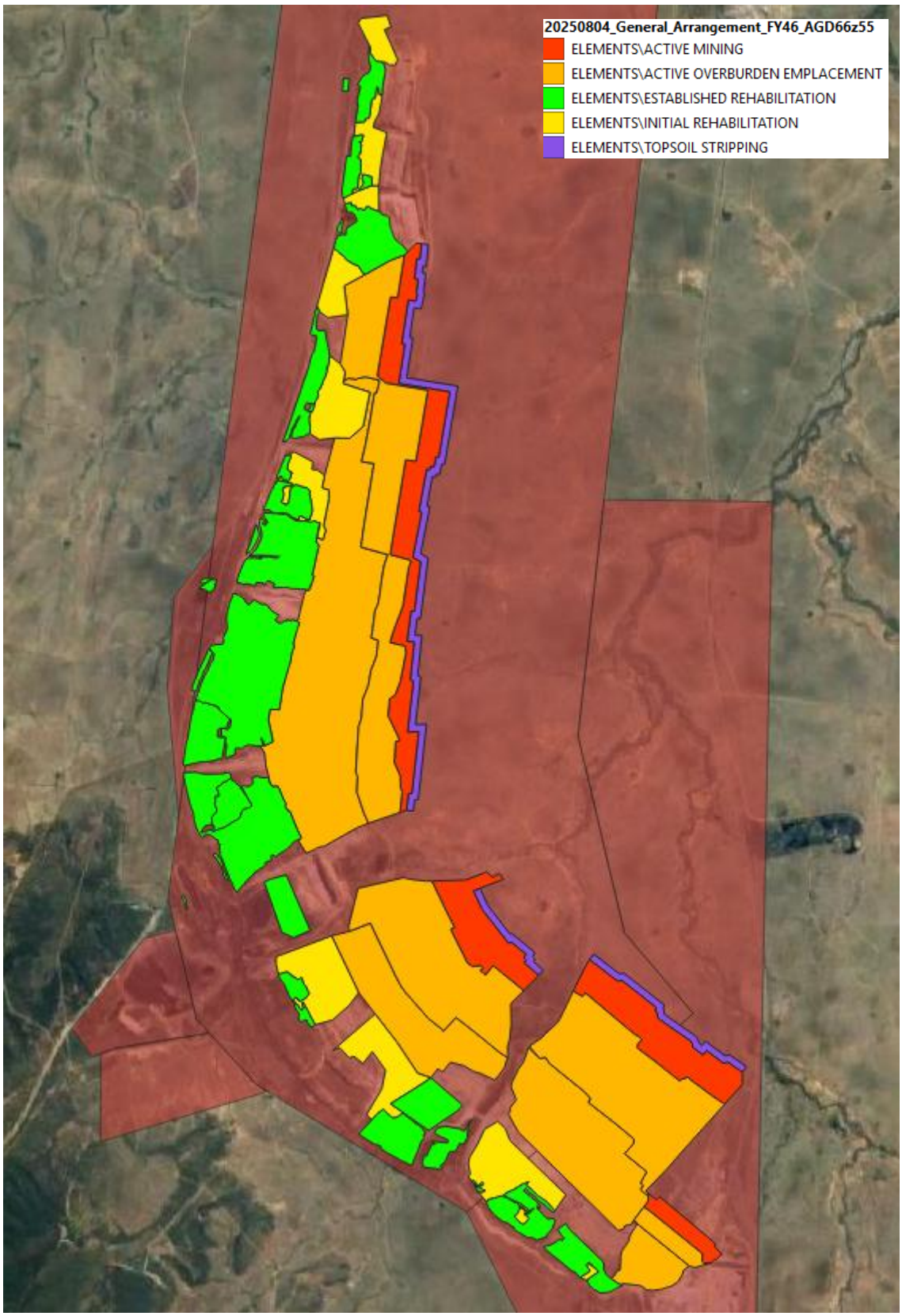


Figure 6-3 General Arrangement FY46

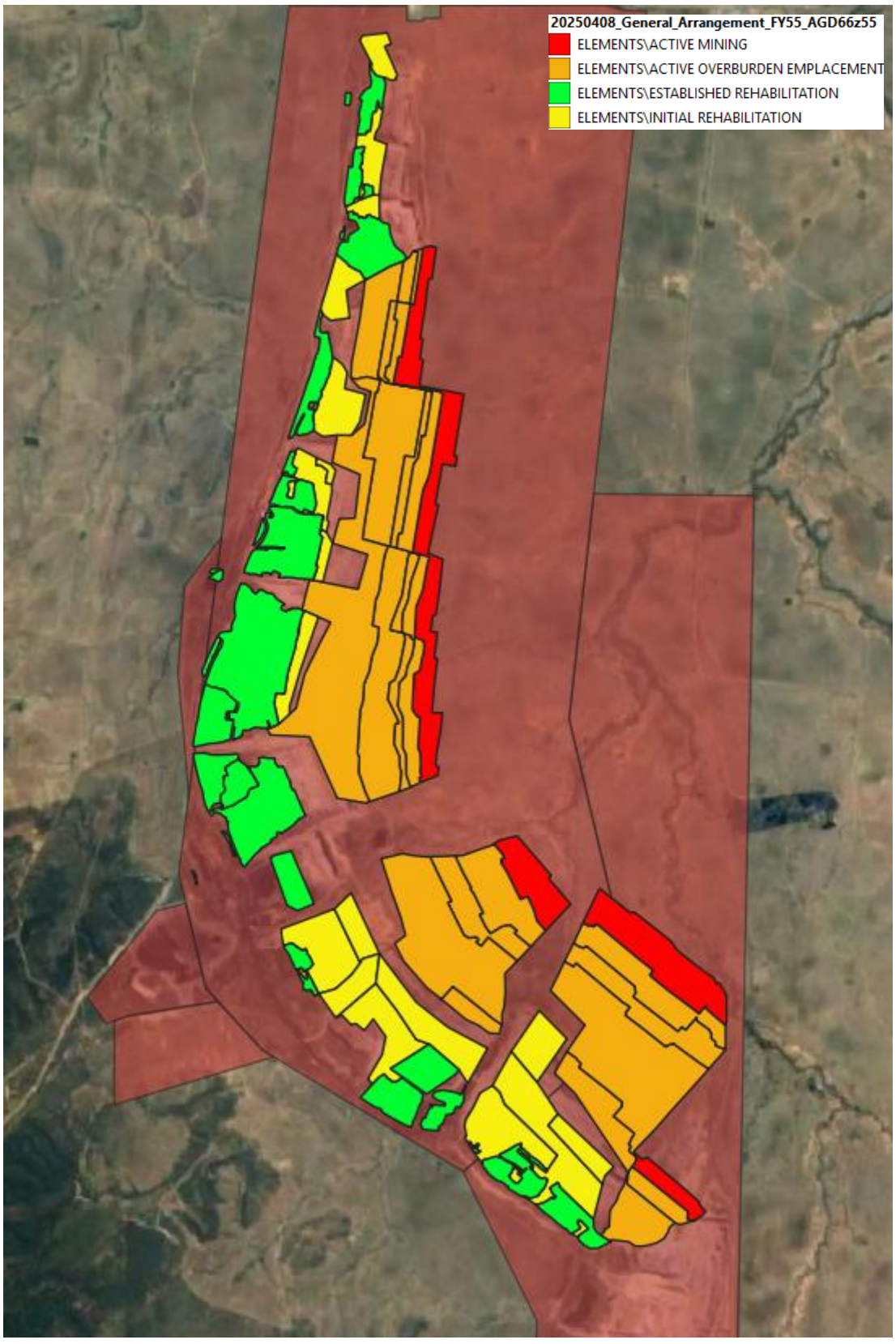
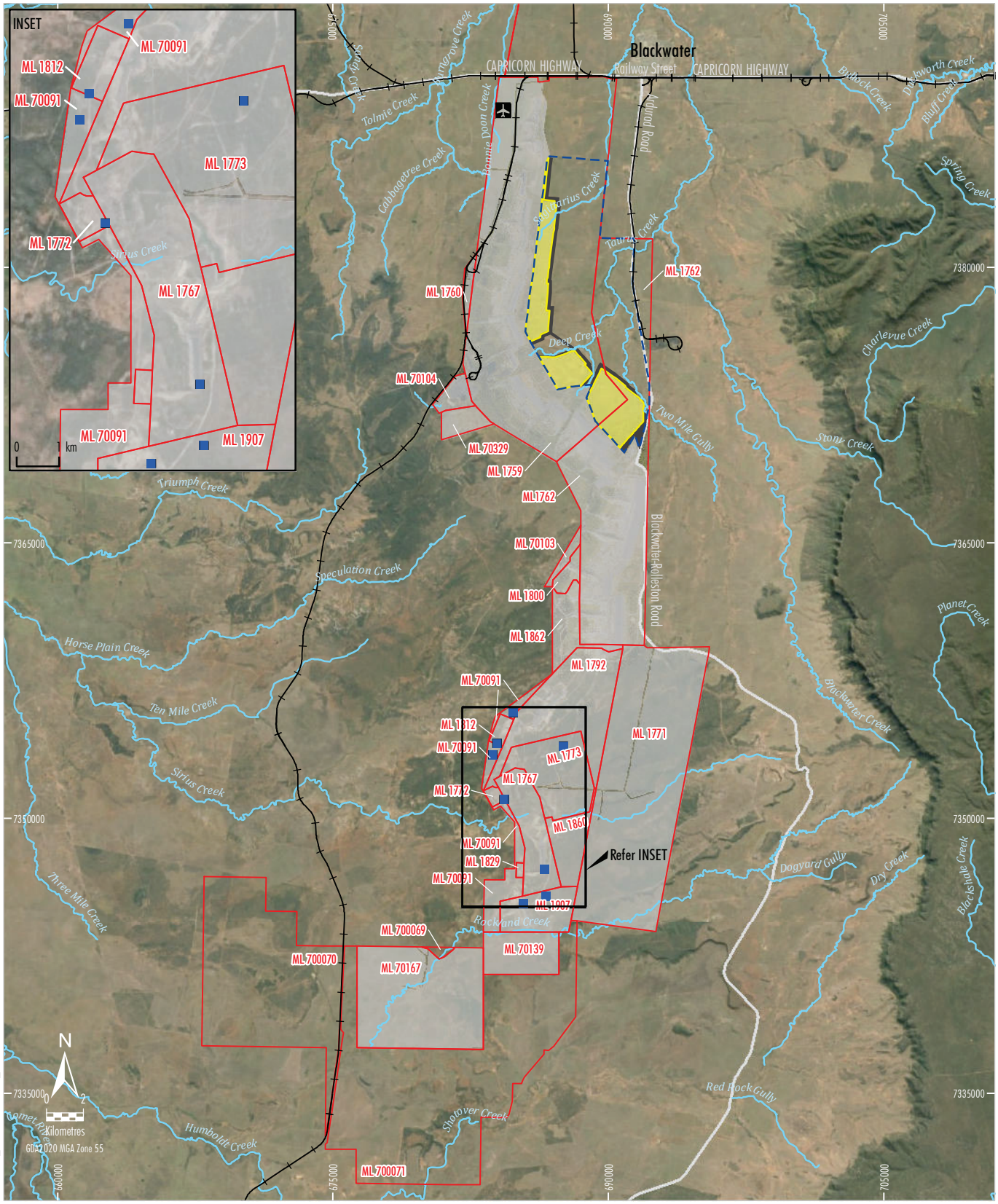


Figure 6-4 General Arrangement FY55

6.3 Quarries

Quarry activities are also planned as part of the Project at eight locations south of the Project Area (Figure 6-5). Activities will take place one location at a time with the use of a mobile screening plant. Material will be used across the whole site for road base, stemming and rehabilitation. It is estimated that approximately 300,000 to 800,000 tonnes of rock will be processed per year, with a daily run rate of 3,000 to 5,000 tonnes per day. Equipment will operate during daylight only. Dust generated by these activities is not expected to significantly affect any of the sensitive receptors, which are located much further north and typically upwind of the quarries; quarry activities were thus not included in the modelling.



WHC-24-101_EA Amendment SR AQ_213A

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2026)
Orthophoto: Esri (2025); Whitehaven (2025)

LEGEND

- Mining Lease
- Railway
- Road
- Watercourse
- Airport
- Approved Disturbance Footprint
- Proposed Quarry Location

Project Components[1]

- Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Note: [1] Excludes some ancillary Project components such as water management, access tracks, topsoil stockpiles, power supply, temporary offices, and other ancillary works and construction disturbance.

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Proposed Quarry Locations

Figure 6-5

6.4 Applied Mitigation

Dust mitigation measures which are currently implemented at the BWM have been taken into account in the modelling. These include:

- Watering of main haul roads (75% control with watering > 2 litres per square metre per hour [L/m^2/hr]).
- Watering of pit haul roads (50% control watering approximately 2 L/m^2/hr).
- Water spraying at the CHPP and TCP hoppers (90% efficiency).
- Dragline drop height: 6 m.
- Ongoing revegetation of exposed areas (50% efficiency for partially rehabilitated areas and 100% for fully rehabilitated areas).

6.5 Emission Rates

A full emission inventory has been developed for each scenario based on the BWM production schedule, activities and equipment lists, and in conjunction with published literature from the National Pollutant Inventory (2012) and US EPA AP-42 (1998, 2006). Key parameters describing the specific mining activities at the BWM are summarised in Appendix B and emission parameterisations are included in Appendix C.

Emission rates have been compiled for the planned mining activities across the BWM. The breakdown of the particulate matter emissions for FY30, FY32, FY46 and FY55 is summarised in Table 6-2 and Table 6-3.

On an annual basis and for the BWM, haulage and pit activities emit the most dust. Wind erosion only contributes to dust generation on windy days (when winds are stronger than 5.4 metres per second [m/s]), which occur only approximately 16% of the year. This accounts for the smaller overall contribution of wind erosion to the total dust generation per year; however, on windy days, wind erosion can be a significant contributor to dust levels and could cause exceedances of the 24-hour PM_{10} objectives at some of the sensitive receptors located downwind of the active overburden areas.

Activities related to the production, haulage and disposal of overburden generate the most dust overall. Similarly, wind erosion of active overburden areas dominates the wind erosion landscape.

Table 6-2 Emission Inventory for BWM (tonnes/year)

Activity	FY30			FY32			FY46			FY55		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Pit Operations (drilling, blasting, draglines dozers, excavators)	7,398	1,734	313	8,271	1,910	331	8,415	1,952	338	7,786	1,820	312
Truck Handling (load/dump)												
ROM Stockpile	579	270	41	741	346	52	735	343	51	626	292	44
Overburden (handling)	2,957	1,060	207	3,358	1,203	235	3,470	1,244	243	3,307	1,185	231
CHPP/TCP Operations	396	182	27	491	226	34	484	223	33	417	192	29
Haulage												
Overburden	8,694	2,824	282	9,459	3,070	307	8,390	2,726	273	8,893	2,891	289
ROM Main Haul Road	2,097	602	60	2,861	822	82	3,355	963	96	3,775	1,084	108
ROM within pit	543	176	18	742	239	24	911	296	30	887	288	29
Grading	72	32	2	83	37	3	83	37	3	83	37	3
Wind Erosion												
ROM Stockpiles	23	11	2	23	11	2	23	11	2	23	11	2
Active Pit	799	399	60	813	406	61	638	319	48	1,035	517	78
Active Overburden	3,027	1,513	227	2,747	1,373	206	3,873	1,937	290	3,072	1,536	230
Stripped and partially rehabilitated areas	598	299	45	886	443	66	792	396	59	900	450	67
TOTAL	**27,184**	**9,105**	**1,284**	**30,474**	**10,086**	**1,403**	**31,170**	**10,447**	**1,466**	**30,803**	**10,304**	**1,422**

Table 6-3 Summary of BWM Particulate Matter Emissions by Activity

Activity	FY30			FY32			FY46			FY55		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
TOTAL (tonnes/year)	**27,184**	**9,105**	**1,284**	**30,474**	**10,086**	**1,403**	**31,170**	**10,447**	**1,466**	**30,803**	**10,304**	**1,422**
Activity Contribution (tonnes/year)												
Pit Operations	10,935	3,064	561	12,369	3,459	618	12,620	3,539	632	11,718	3,297	587
CHPP/TCP	396	182	27	491	226	34	484	223	33	417	192	29
Haulage (incl. grading)	11,406	3,635	362	13,146	4,168	416	12,740	4,022	401	13,638	4,301	429
Wind Erosion	4,446	2,223	333	4,468	2,234	335	5,326	2,663	399	5,030	2,515	377
Activity Contribution (% of total)												
Pit Operations	40%	34%	44%	41%	34%	44%	40%	34%	43%	38%	32%	41%
CHPP/TCP	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%	2%	2%
Haulage (incl. grading)	42%	40%	28%	43%	41%	30%	41%	39%	27%	44%	42%	30%
Wind Erosion	16%	24%	26%	15%	22%	24%	17%	25%	27%	16%	24%	27%

7 AIR QUALITY IMPACT ASSESSMENT

CALPUFF air dispersion modelling was conducted for the four emission scenarios to predict hourly $PM_{2.5}$, PM_{10} and TSP concentrations and dust deposition at each of the 4,384 ground-level receptors in the modelling domain. Background concentrations were then added to the incremental model predictions, and the cumulative results are presented and discussed in the following sections.

Maximum cumulative impacts predicted at the sensitive receptors were compared with the relevant air quality criteria and guidelines. Modelling results are also presented as isopleths (concentration and deposition contours) over the modelling domain. To create these contour plots, maximum concentrations and deposition for the relevant temporal average (e.g. 24-hour average) at each of the 4,384 receptors were contoured: these plots thus depict the worst possible conditions predicted at any given point in the modelling domain, but these predictions may have occurred on different days (or months) for each grid point (i.e. these plots are not snapshots).

Note that some of the receptors are within the ML, or are owned by the BWM, and predictions are at those receptors are included for information only. By FY55, R15 will no longer exist as the mining operations would progress eastward.

7.1 TSP

Predicted incremental and cumulative annual average TSP concentrations are compared with the ambient air quality objective (AAQO) in Table 7-1 for the four scenarios. Contour plots of annual average TSP concentrations over the whole modelling domain are displayed in Figure 7-1. Mine-owned receptors and privately-owned receptors currently under agreements are included for information only.

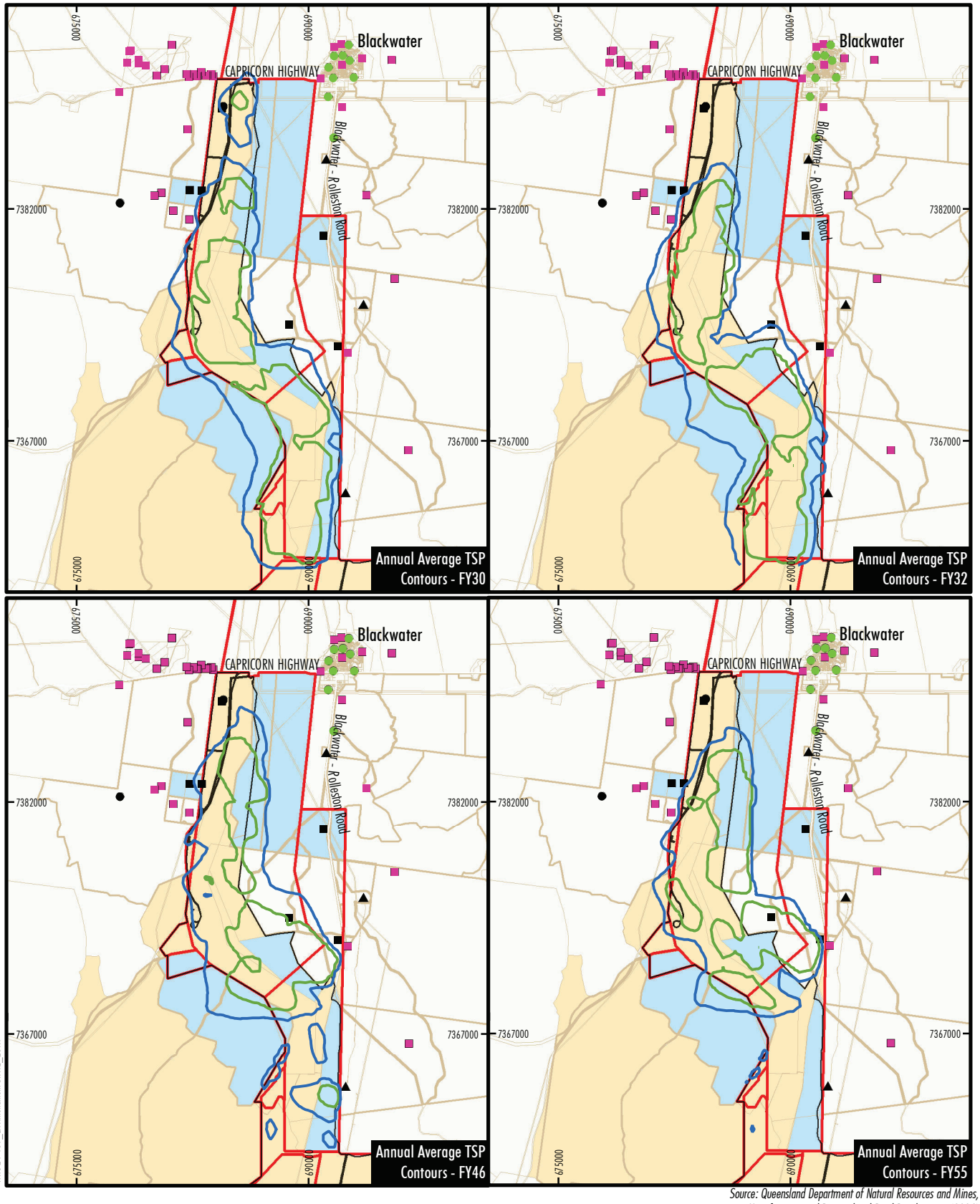
There are no predicted exceedances of the EPP (Air)/NEPM TSP annual average criteria at any of the receptors for any of the scenarios.

Table 7-1 Predicted Annual Average Ground-level TSP Concentrations (μg/m³)

Annual Average TSP								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	90	90	90	90	90	90	90	90
Privately-owned Sensitive Receptors								
R03	8.2	44.5	7.2	43.5	10.7	47.0	7.8	44.1
R04	7.5	43.7	6.6	42.8	9.5	45.7	7.2	43.4
R05	19.4	55.7	20.0	56.2	14.9	51.1	16.9	53.2
R06	12.7	49.0	11.9	48.2	13.6	49.9	12.2	48.4
R07	11.8	48.1	6.3	42.6	7.1	43.3	5.3	41.6
R09	3.2	39.4	3.5	39.8	3.7	39.9	3.4	39.6
R10	1.4	37.6	1.5	37.8	1.5	37.8	1.5	37.7
R11	3.3	39.6	3.6	39.8	3.3	39.6	2.7	39.0

Annual Average TSP								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	90	90	90	90	90	90	90	90
R13	2.1	38.4	2.1	38.4	1.9	38.1	1.4	37.7
R17	8.7	45.0	6.7	43.0	10.9	47.1	6.6	42.9
R19	1.6	37.8	1.1	37.4	0.7	37.0	0.4	36.7
R20	8.5	44.7	4.5	40.8	5.7	41.9	4.8	41.0
R21	7.6	43.9	4.4	40.6	5.4	41.6	4.6	40.8
R22	7.3	43.6	4.3	40.6	5.0	41.3	4.4	40.6
R23	7.2	43.5	4.3	40.6	5.0	41.2	4.3	40.6
R24	6.1	42.4	4.1	40.4	4.5	40.8	4.0	40.2
R25	6.7	42.9	4.2	40.5	4.6	40.8	4.0	40.2
R26	6.6	42.9	4.2	40.5	4.5	40.8	3.9	40.2
R27	6.1	42.3	4.1	40.4	4.3	40.6	3.8	40.0
R28	6.3	42.5	4.2	40.5	4.4	40.6	3.7	40.0
R29	5.7	41.9	4.1	40.3	4.2	40.4	3.6	39.8
R30	4.5	40.8	3.5	39.8	3.5	39.7	3.0	39.3
R31	4.5	40.7	3.4	39.7	3.3	39.6	2.9	39.2
R32	3.2	39.4	2.5	38.7	2.4	38.7	2.1	38.4
R33	3.4	39.6	2.8	39.1	2.7	38.9	2.4	38.6
R34	3.2	39.5	2.8	39.0	2.6	38.9	2.3	38.6
R35	3.0	39.2	2.5	38.7	2.4	38.7	2.1	38.4
R36	2.8	39.0	2.4	38.7	2.3	38.6	2.1	38.4
R37	2.8	39.1	2.5	38.7	2.4	38.6	2.1	38.4
R39	3.8	40.1	3.3	39.5	3.1	39.4	2.8	39.0
R40	3.7	39.9	3.0	39.3	2.9	39.1	2.6	38.8
R41	3.8	40.1	3.3	39.5	3.1	39.4	2.8	39.0
R42	2.5	38.7	2.6	38.9	2.4	38.7	2.4	38.6
R43	3.1	39.4	3.3	39.6	3.0	39.3	3.1	39.3
R52	2.2	38.5	2.4	38.6	2.5	38.7	2.3	38.5
R53	2.4	38.6	2.6	38.9	2.6	38.8	2.4	38.7
R54	3.6	39.9	3.6	39.9	4.3	40.5	4.0	40.2
R55	1.9	38.1	2.1	38.4	2.1	38.4	1.9	38.2
R56	2.5	38.8	2.6	38.9	2.8	39.1	2.6	38.9
Other Sensitive Receptors								
R57	2.6	38.8	2.7	39.0	2.9	39.2	2.7	39.0
R58	2.1	38.4	2.4	38.6	2.3	38.6	2.2	38.4

Annual Average TSP								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	90	90	90	90	90	90	90	90
R59	2.0	38.3	2.2	38.5	2.2	38.5	2.1	38.3
R60	2.2	38.5	2.4	38.7	2.5	38.7	2.3	38.6
R61	2.9	39.2	3.1	39.4	3.2	39.5	3.1	39.3
R62	3.0	39.2	3.1	39.3	3.4	39.6	3.1	39.4
R47	4.1	40.4	4.3	40.5	4.3	40.6	4.0	40.2
R63	2.3	38.6	2.7	38.9	2.7	38.9	2.5	38.7
Non-sensitive Commercial/Industrial Receptors								
R14	4.0	40.2	3.7	40.0	3.4	39.7	2.5	38.8
R46	13.5	49.7	5.5	41.7	4.5	40.7	1.0	37.2
R48	4.6	40.9	4.9	41.1	4.9	41.1	4.5	40.8
R49	5.3	41.6	4.4	40.7	5.8	42.1	4.8	41.1
R64	3.6	39.8	3.8	40.0	4.1	40.4	3.9	40.1
Non-sensitive Mine-owned Receptors								
R01	15.3	51.5	14.4	50.7	20.9	57.2	15.0	51.3
R02	18.2	54.4	18.3	54.6	28.2	64.5	20.7	56.9
R12	5.6	41.9	6.7	43.0	7.1	43.3	6.7	43.0
R50	27.6	63.9	7.0	43.2	9.2	45.4	7.4	43.7
R51	25.2	61.5	7.0	43.2	9.0	45.3	7.3	43.6
Non-sensitive Privately-owned Receptors Currently Under Agreements								
R15	16.0	52.2	23.7	60.0	38.9	75.1	315.6	351.9
R16	9.6	45.8	7.6	43.8	11.9	48.2	15.7	52.0



WHC-24-101_EA Amendment SR AQ_207A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

Annual Average TSP
- 60 $\mu g/m^3$
- Exceedance Cumulative (90 $\mu g/m^3$)

Criteria: 90 $\mu g/m^3$

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); RWDI (2026); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Predicted Annual Average Ground-level TSP Concentrations ($\mu g/m^3$)

Figure 7-1

7.2 PM_{10}

Predicted incremental and cumulative maximum 24-hour and annual average ground-level PM_{10} concentrations are compared with the respective AAQO in Table 7-2 and Table 7-3 for the four scenarios. Corresponding contour plots of 24-hour and annual average ground-level PM_{10} concentrations over the whole modelling domain are displayed in Figure 7-2 and Figure 7-3. Mine-owned receptors and privately-owned receptors currently under agreements are included for information only.

Predicted cumulative maximum 24-hour average ground-level PM_{10} concentrations exceed the 24-hour EPP (Air)/NEPM PM_{10} criteria at six (6) non-sensitive mine-owned receptors and privately-owned receptors currently under agreements (R1, R2, R15, R16, R50 and R51) and one (1) non-sensitive commercial/industrial receptor (R46). The model also predicted potential exceedances at six (6) privately-owned sensitive receptors (R5, R6, R7, R17, R20 and R21).

- R5 and R6 are located near the BWM western boundary. The model predicted three exceedances at R5 in FY30, two of which were caused by strong wind erosion under south-southeasterly winds (160° -180°) and one during stable calm conditions. One potential exceedance was modelled at both receivers in FY32 on a day starting with a strong night-time inversion under weak south-easterly winds, blowing very undiluted dust from the active overburden areas directly to those receptors.
- R7 sits west of the northern part of the Project. The model predicted only one exceedance at R7 in FY30 under sustained strong winds (> 7 m/s) from the south-southeast (160°-170°), blowing both eroded and operational dust from the overburden and active areas.
- R17 is located near the Project southeastern boundary. The model predicted one exceedance due to sustained wind erosion in the FY30 scenario, and nine and four exceedances due to the approaching mining activities in FY46 and FY55 respectively under rare south-southwesterly or south-westerly wind conditions, with high impact especially around sunrise during the morning inversion break-up (freeing dust that accumulated in the pit overnight), or near sunset when the mixing height collapses trapping and concentrating dust near the surface.
- R20 to R21 are located northwest of the BWM near the Capricorn Highway. Three exceedances were predicted at those locations in the FY30 scenario, when mining is planned in the northernmost part of the Project. Two exceedances were due to very strong sustained southerly winds (165°-185°) creating enhanced erosion of all exposed areas lining up their cumulative impact with R20 and R21 in addition to the mining operations taking place close to those receptors in FY30. The third exceedance was non-erosion related and occurred on a day starting with a strong night-time inversion under weak south-easterly winds, blowing undiluted dust from the northernmost active overburden area directly to those receptors.

These exceedances at privately-owned sensitive receptors can be prevented with a proactive dust management approach, including real-time monitoring and mine activity adjustment when warning levels are reached. In addition, alternative arrangements as defined in EA EPML00717813 would be sought with R5, R6, R7 and R17.

Predicted cumulative annual average ground-level PM_{10} concentrations exceed the annual EPP (Air)/NEPM PM_{10} criteria at five (5) non-sensitive mine-owned receptors and privately-owned receptors currently under agreements (R1, R2, R15, R50 and R51), and also at one (1) privately-owned sensitive receptor (R5), which is located close to the BWM western boundary in FY30 and FY32.

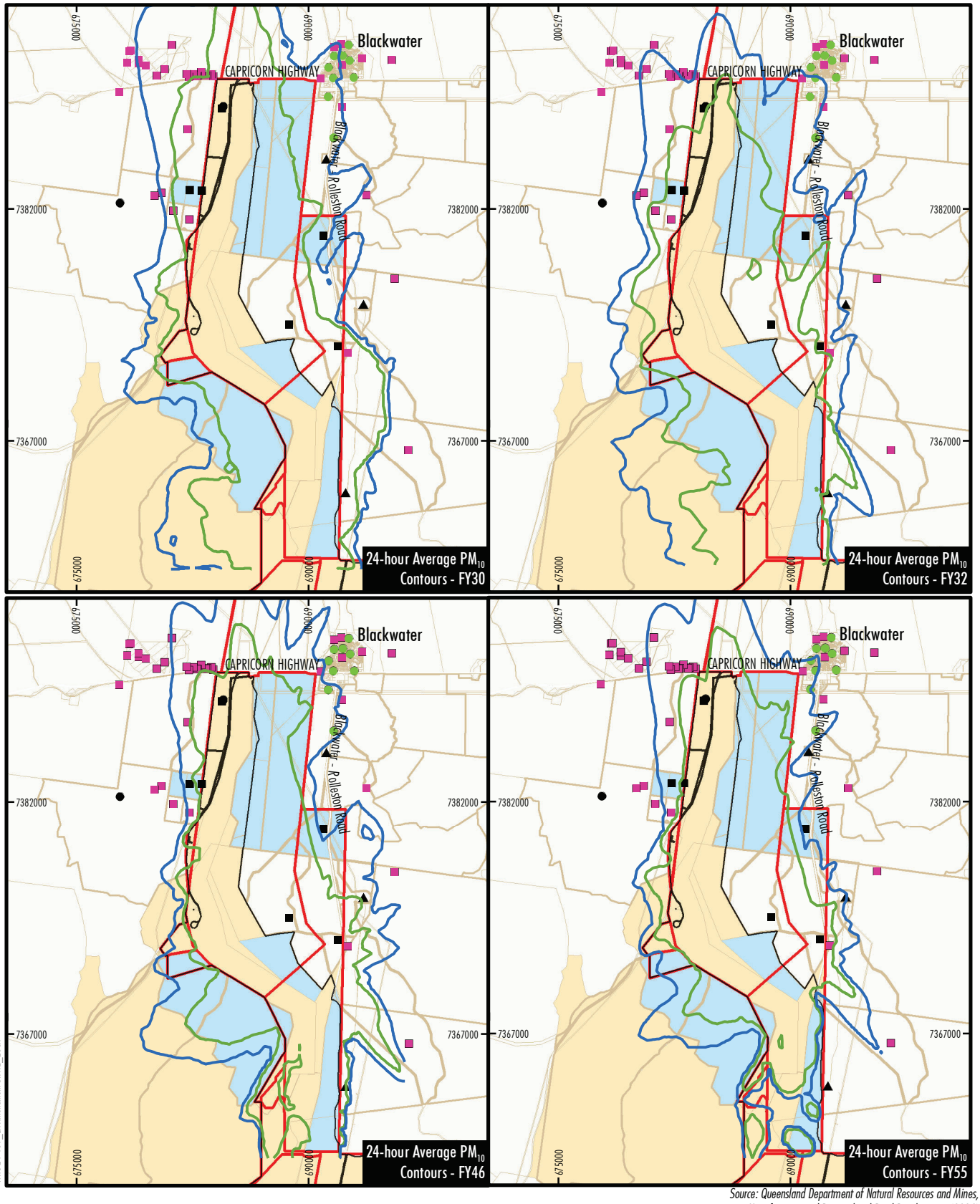
Table 7-2 Predicted Maximum 24-hour Average Ground-level PM_{10} Concentrations ($\mu g/m^3$) and Number of Days of Predicted Exceedance at Sensitive Receptors

Maximum 24-hour Average PM_{10}																
	FY30				FY32				FY46				FY55			
	BWM		Cumulative		BWM		Cumulative		BWM		Cumulative		BWM		Cumulative	
	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc
AAQO	50		50		50		50		50		50		50		50	
Privately-owned Sensitive Receptors																
R03	22.7	0	40.9	0	27.8	0	45.9	0	14.1	0	32.2	0	13.6	0	31.7	0
R04	17.8	0	35.9	0	24.2	0	42.3	0	12.2	0	30.3	0	11.6	0	29.7	0
R05	**52.2**	**1**	**70.3**	**3**	42.0	0	**60.1**	**1**	23.3	0	41.4	0	26.3	0	44.5	0
R06	30.6	0	48.8	0	36.7	0	**54.8**	**1**	17.5	0	35.6	0	17.5	0	35.6	0
R07	35.2	0	**53.4**	**1**	31.0	0	49.1	0	30.6	0	48.8	0	26.6	0	44.7	0
R09	22.0	0	40.1	0	20.5	0	38.6	0	19.7	0	37.8	0	18.3	0	36.4	0
R10	9.5	0	27.6	0	9.0	0	27.1	0	11.2	0	29.3	0	10.0	0	28.1	0
R11	20.9	0	39.0	0	24.6	0	42.7	0	20.9	0	39.0	0	18.4	0	36.5	0
R13	16.8	0	34.9	0	15.5	0	33.6	0	15.7	0	33.8	0	11.3	0	29.4	0
R17	33.3	0	**51.5**	**1**	31.1	0	49.2	0	49.1	0	**67.2**	**9**	38.3	0	**56.4**	**4**
R19	8.3	0	26.4	0	8.2	0	26.3	0	9.8	0	27.9	0	10.7	0	28.8	0
R20	37.8	0	**55.9**	**3**	22.4	0	40.5	0	30.9	0	49.0	0	29.9	0	48.0	0
R21	36.0	0	**54.1**	**3**	21.3	0	39.4	0	30.5	0	48.6	0	29.6	0	47.7	0
R22	31.2	0	49.4	0	20.5	0	38.6	0	31.2	0	49.3	0	30.0	0	48.2	0
R23	30.7	0	48.9	0	20.8	0	38.9	0	31.4	0	49.5	0	30.1	0	48.2	0
R24	29.9	0	48.1	0	20.7	0	38.8	0	30.4	0	48.5	0	29.0	0	47.2	0
R25	31.0	0	49.1	0	21.6	0	39.8	0	30.8	0	49.0	0	29.4	0	47.5	0
R26	31.1	0	49.2	0	22.1	0	40.2	0	30.6	0	48.7	0	29.2	0	47.3	0
R27	30.8	0	49.0	0	22.7	0	40.8	0	29.4	0	47.5	0	28.3	0	46.5	0
R28	31.0	0	49.1	0	24.1	0	42.2	0	28.1	0	46.2	0	27.6	0	45.7	0
R29	30.3	0	48.4	0	23.7	0	41.9	0	27.1	0	45.2	0	26.8	0	44.9	0
R30	27.3	0	45.4	0	22.8	0	40.9	0	19.8	0	38.0	0	21.7	0	39.8	0
R31	26.8	0	44.9	0	21.8	0	39.9	0	18.4	0	36.5	0	19.8	0	37.9	0
R32	14.8	0	32.9	0	14.9	0	33.0	0	9.1	0	27.2	0	8.7	0	26.9	0
R33	22.5	0	40.6	0	17.0	0	35.1	0	14.6	0	32.7	0	15.6	0	33.8	0
R34	22.5	0	40.6	0	17.1	0	35.2	0	14.8	0	32.9	0	15.8	0	33.9	0
R35	18.6	0	36.7	0	13.5	0	31.7	0	11.5	0	29.7	0	12.5	0	30.6	0
R36	19.9	0	38.1	0	14.7	0	32.8	0	12.9	0	31.1	0	13.8	0	31.9	0
R37	20.5	0	38.6	0	15.2	0	33.3	0	13.4	0	31.5	0	14.3	0	32.4	0

Maximum 24-hour Average PM_{10}																
	FY30				FY32				FY46				FY55			
	BWM		Cumulative		BWM		Cumulative		BWM		Cumulative		BWM		Cumulative	
	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc
AAQO	**50**		**50**		**50**		**50**		**50**		**50**		**50**		**50**	
R39	26.7	0	44.9	0	21.5	0	39.6	0	22.1	0	40.3	0	22.9	0	41.0	0
R40	24.4	0	42.6	0	19.1	0	37.2	0	16.3	0	34.4	0	17.5	0	35.6	0
R41	26.7	0	44.9	0	21.5	0	39.6	0	22.1	0	40.3	0	22.9	0	41.0	0
R42	5.9	0	24.1	0	6.0	0	24.1	0	5.2	0	23.4	0	5.1	0	23.3	0
R43	7.8	0	26.0	0	8.1	0	26.2	0	6.6	0	24.7	0	6.4	0	24.6	0
R52	21.7	0	39.8	0	19.3	0	37.4	0	16.6	0	34.7	0	18.2	0	36.3	0
R53	21.4	0	39.5	0	20.2	0	38.3	0	14.8	0	33.0	0	20.9	0	39.0	0
R54	30.5	0	48.6	0	22.0	0	40.2	0	23.5	0	41.7	0	24.8	0	42.9	0
R55	14.8	0	32.9	0	15.9	0	34.0	0	14.3	0	32.4	0	14.3	0	32.4	0
R56	23.0	0	41.1	0	20.4	0	38.5	0	17.5	0	35.6	0	18.7	0	36.8	0
Other Sensitive Receptors																
R57	23.1	0	41.3	0	20.2	0	38.3	0	18.6	0	36.7	0	20.0	0	38.1	0
R58	18.6	0	36.7	0	19.1	0	37.2	0	13.5	0	31.6	0	17.0	0	35.2	0
R59	20.1	0	38.2	0	18.5	0	36.7	0	14.7	0	32.8	0	19.5	0	37.6	0
R60	20.8	0	39.0	0	19.1	0	37.3	0	15.3	0	33.4	0	21.3	0	39.5	0
R61	24.4	0	42.5	0	22.1	0	40.3	0	16.8	0	34.9	0	24.3	0	42.4	0
R62	25.2	0	43.4	0	21.0	0	39.1	0	19.4	0	37.6	0	21.7	0	39.9	0
R47	25.7	0	43.8	0	23.6	0	41.8	0	25.2	0	43.4	0	27.6	0	45.8	0
R63	16.9	0	35.0	0	18.6	0	36.8	0	16.5	0	34.6	0	17.0	0	35.1	0
Non-sensitive Commercial/Industrial Receptors																
R14	16.7	0	34.8	0	18.6	0	36.7	0	31.1	0	49.3	0	23.0	0	41.1	0
R46	**81.0**	**4**	**99.1**	**7**	23.5	0	41.6	0	28.5	0	46.7	0	8.4	0	26.5	0
R48	26.2	0	44.3	0	21.9	0	40.1	0	18.8	0	36.9	0	19.2	0	37.3	0
R49	13.8	0	32.0	0	12.5	0	30.7	0	9.4	0	27.5	0	9.8	0	27.9	0
R64	25.0	0	43.1	0	24.2	0	42.3	0	29.5	0	47.7	0	21.2	0	39.4	0
Non-sensitive Mine-owned Receptors																
R01	38.4	0	**56.5**	**5**	35.1	0	**53.2**	**2**	24.6	0	42.7	**0**	26.4	0	44.6	**0**
R02	43.0	0	**61.2**	**8**	45.3	0	**63.5**	**7**	41.2	0	**59.3**	**5**	35.0	0	**53.1**	**2**
R12	26.0	0	44.1	0	22.9	0	41.1	0	19.7	0	37.8	0	19.5	0	37.6	0
R50	**53.9**	**2**	**72.0**	**12**	30.2	0	48.3	0	39.1	0	**57.3**	**3**	37.3	0	**55.4**	**3**
R51	**51.2**	**1**	**69.4**	**10**	29.9	0	48.0	0	40.5	0	**58.6**	**3**	38.4	0	**56.6**	**2**
Non-sensitive Privately-owned Receptors Currently Under Agreements																

Maximum 24-hour Average PM_{10}																
	FY30				FY32				FY46				FY55			
	BWM		Cumulative		BWM		Cumulative		BWM		Cumulative		BWM		Cumulative	
	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc	Max	# Exc
AAQO	**50**		**50**		**50**		**50**		**50**		**50**		**50**		**50**	
R15	**64.1**	**1**	**82.2**	**10**	**64.1**	**2**	**82.3**	**28**	**77.8**	**14**	**95.9**	**63**	**-**	**-**	**-**	**-**
R16	34.1	0	**52.2**	**1**	27.6	0	45.7	0	42.7	0	**60.8**	**6**	**61.2**	**5**	**79.3**	**22**

Note: Bolded values indicate an exceedance as per EPP (Air) and NEPC (2021).



WHC-24-101_EA Amendment SR AQ_208A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

24-hour Average PM_{10}
- 40 $\mu g/m^3$
- Exceedance Cumulative (50 $\mu g/m^3$)

Criteria: 50 $\mu g/m^3$

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); RWDI (2026); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Predicted Maximum 24-hour Average Ground-level PM_{10} Concentrations ($\mu g/m^3$)

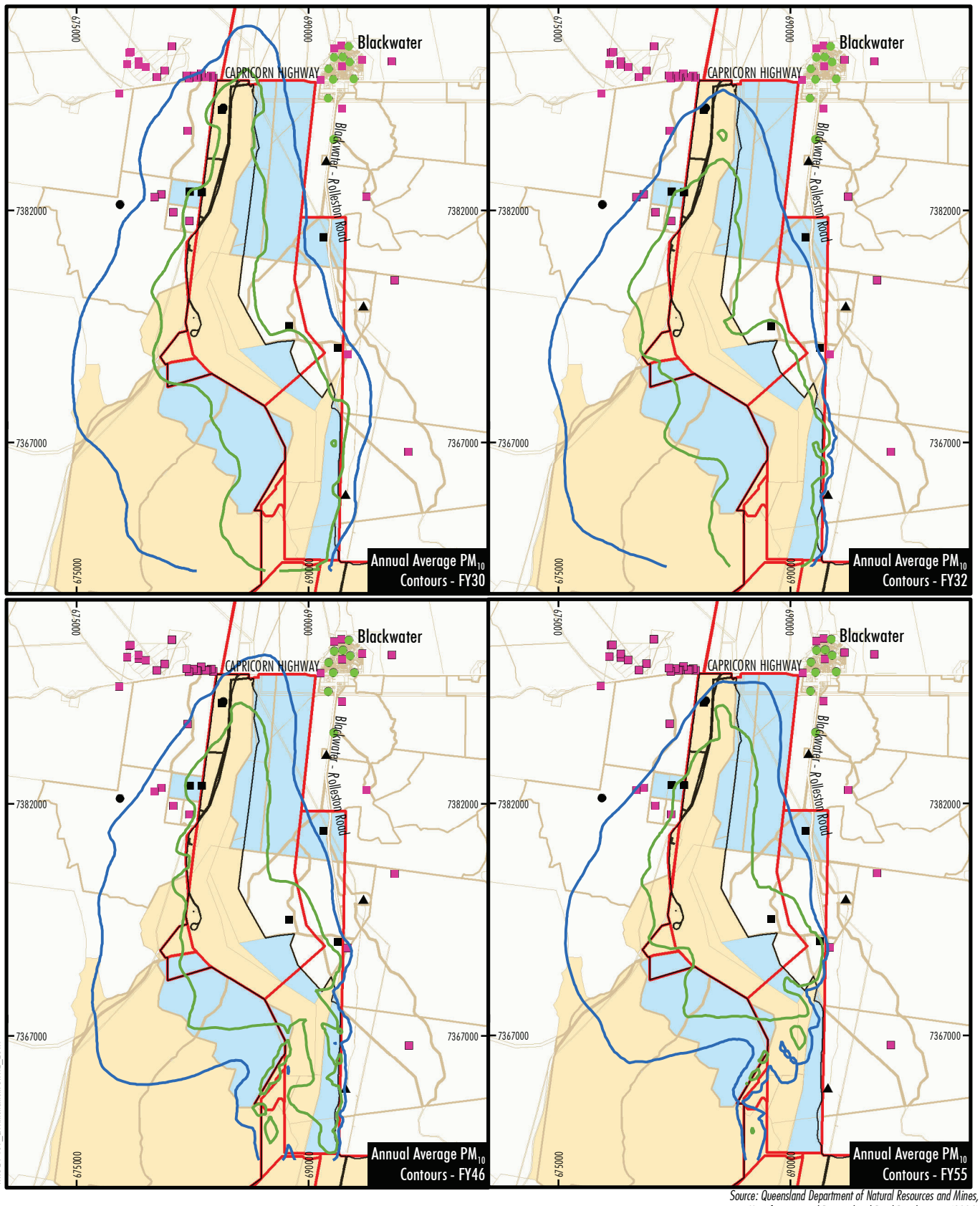
Figure 7-2

Table 7-3 Predicted Annual Average Ground-level PM_{10} Concentrations (µg/m³)

Annual Average PM_{10}								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	25	25	25	25	25	25	25	25
Privately-owned Sensitive Receptors								
R03	4.7	21.0	3.9	20.2	5.3	21.6	4.2	20.5
R04	4.3	20.6	3.5	19.9	4.7	21.0	3.8	20.1
R05	10.2	**26.6**	9.8	**26.1**	7.4	23.7	8.4	24.7
R06	6.9	23.3	6.1	22.4	6.6	23.0	6.1	22.4
R07	6.6	22.9	3.6	19.9	3.7	20.1	3.0	19.3
R09	2.0	18.3	2.0	18.3	2.0	18.3	1.8	18.2
R10	0.9	17.2	0.9	17.2	0.9	17.2	0.9	17.2
R11	2.0	18.3	1.9	18.2	1.7	18.0	1.4	17.7
R13	1.2	17.5	1.1	17.4	0.9	17.2	0.7	17.0
R17	4.7	21.0	3.1	19.4	4.3	20.6	2.8	19.1
R19	0.8	17.1	0.5	16.9	0.4	16.7	0.2	16.6
R20	4.9	21.2	2.6	18.9	3.1	19.4	2.7	19.0
R21	4.5	20.8	2.5	18.9	2.9	19.3	2.6	18.9
R22	4.3	20.7	2.5	18.9	2.8	19.1	2.5	18.8
R23	4.3	20.6	2.5	18.8	2.8	19.1	2.4	18.8
R24	3.7	20.1	2.4	18.7	2.5	18.9	2.3	18.6
R25	4.0	20.3	2.5	18.8	2.6	18.9	2.3	18.6
R26	4.0	20.3	2.5	18.8	2.5	18.9	2.3	18.6
R27	3.7	20.0	2.4	18.8	2.5	18.8	2.2	18.5
R28	3.8	20.1	2.5	18.8	2.5	18.8	2.2	18.5
R29	3.5	19.8	2.4	18.7	2.4	18.7	2.1	18.4
R30	2.8	19.2	2.1	18.4	2.0	18.4	1.8	18.1
R31	2.8	19.1	2.1	18.4	2.0	18.3	1.7	18.1
R32	2.0	18.4	1.5	17.8	1.4	17.8	1.3	17.6
R33	2.2	18.5	1.7	18.0	1.6	17.9	1.4	17.8
R34	2.1	18.4	1.7	18.0	1.6	17.9	1.4	17.8
R35	2.0	18.3	1.5	17.8	1.4	17.8	1.3	17.6
R36	1.8	18.2	1.5	17.8	1.4	17.7	1.3	17.6
R37	1.9	18.2	1.5	17.8	1.4	17.7	1.3	17.6
R39	2.5	18.8	2.0	18.3	1.8	18.2	1.7	18.0
R40	2.4	18.7	1.8	18.2	1.7	18.0	1.5	17.9

Annual Average PM_{10}								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	25	25	25	25	25	25	25	25
R41	2.5	18.8	2.0	18.3	1.8	18.2	1.7	18.0
R42	1.8	18.1	1.8	18.1	1.6	18.0	1.6	18.0
R43	2.3	18.6	2.3	18.6	2.1	18.4	2.1	18.4
R52	1.5	17.8	1.5	17.8	1.5	17.8	1.4	17.7
R53	1.6	17.9	1.6	17.9	1.5	17.8	1.4	17.8
R54	2.3	18.6	2.1	18.4	2.3	18.6	2.2	18.5
R55	1.3	17.6	1.3	17.6	1.2	17.6	1.2	17.5
R56	1.7	18.0	1.6	17.9	1.6	18.0	1.5	17.9
Other Sensitive Receptors								
R57	1.7	18.0	1.6	17.9	1.7	18.0	1.6	17.9
R58	1.4	17.8	1.4	17.8	1.4	17.7	1.3	17.6
R59	1.4	17.7	1.4	17.7	1.3	17.6	1.2	17.6
R60	1.5	17.8	1.5	17.8	1.5	17.8	1.4	17.7
R61	1.9	18.2	1.8	18.1	1.8	18.1	1.7	18.1
R62	1.9	18.3	1.8	18.1	1.9	18.2	1.8	18.1
R47	2.5	18.8	2.4	18.7	2.3	18.6	2.1	18.4
R63	1.5	17.8	1.6	17.9	1.5	17.8	1.4	17.7
Non-sensitive Commercial/Industrial Receptors								
R14	2.2	18.5	1.8	18.2	1.6	17.9	1.2	17.5
R46	6.8	23.2	2.4	18.7	2.0	18.4	0.5	16.8
R48	2.8	19.1	2.6	19.0	2.5	18.8	2.4	18.7
R49	3.1	19.5	2.5	18.8	3.0	19.3	2.6	18.9
R64	2.2	18.6	2.1	18.5	2.2	18.5	2.1	18.4
Non-sensitive Mine-owned Receptors								
R01	8.8	**25.1**	7.6	24.0	9.8	**26.1**	7.7	24.1
R02	10.1	**26.4**	9.5	**25.8**	13.2	**29.5**	10.3	**26.6**
R12	3.2	19.5	3.4	19.7	3.4	19.7	3.2	19.5
R50	13.4	**29.7**	3.9	20.2	4.7	21.1	4.0	20.3
R51	12.5	**28.8**	3.9	20.2	4.7	21.0	3.9	20.3
Non-sensitive Privately-owned Receptors Currently Under Agreements								
R15	8.2	24.6	9.6	**26.0**	15.9	**32.2**	-	**-**
R16	5.1	21.4	3.4	19.8	4.7	21.1	6.1	22.4

Note: Bolded values indicate an exceedance as per EPP (Air) and NEPC (2021).



WHC-24-101_EA Amendment SR AQ_209A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

Annual Average PM_{10}
- 20 $\mu g/m^3$
- Exceedance Cumulative (25 $\mu g/m^3$)

Criteria: 25 $\mu g/m^3$

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Predicted Annual Average Ground-level PM_{10} Concentrations ($\mu g/m^3$)

Figure 7-3

7.3 $PM_{2.5}$

Predicted incremental and cumulative maximum 24-hour and annual average ground-level $PM_{2.5}$ concentrations are compared with their respective AAQO in Table 7-4 and Table 7-5 respectively for the four scenarios. Corresponding contour plots of the maximum 24-hour and annual average ground-level $PM_{2.5}$ concentrations over the whole modelling domain are displayed in Figure 7-4 and Figure 7-5. Mine-owned receptors and privately-owned receptors currently under agreements are included for information only.

There are no predicted exceedances of the EPP (Air) Amendment/NEPM 24-hour $PM_{2.5}$ criteria at any of the sensitive receptors for any of the scenarios. One (1) non-sensitive privately-owned receptor currently under agreements (R15) is predicted to exceed these criteria in FY30 and FY46 due to erosion under strong westerly winds.

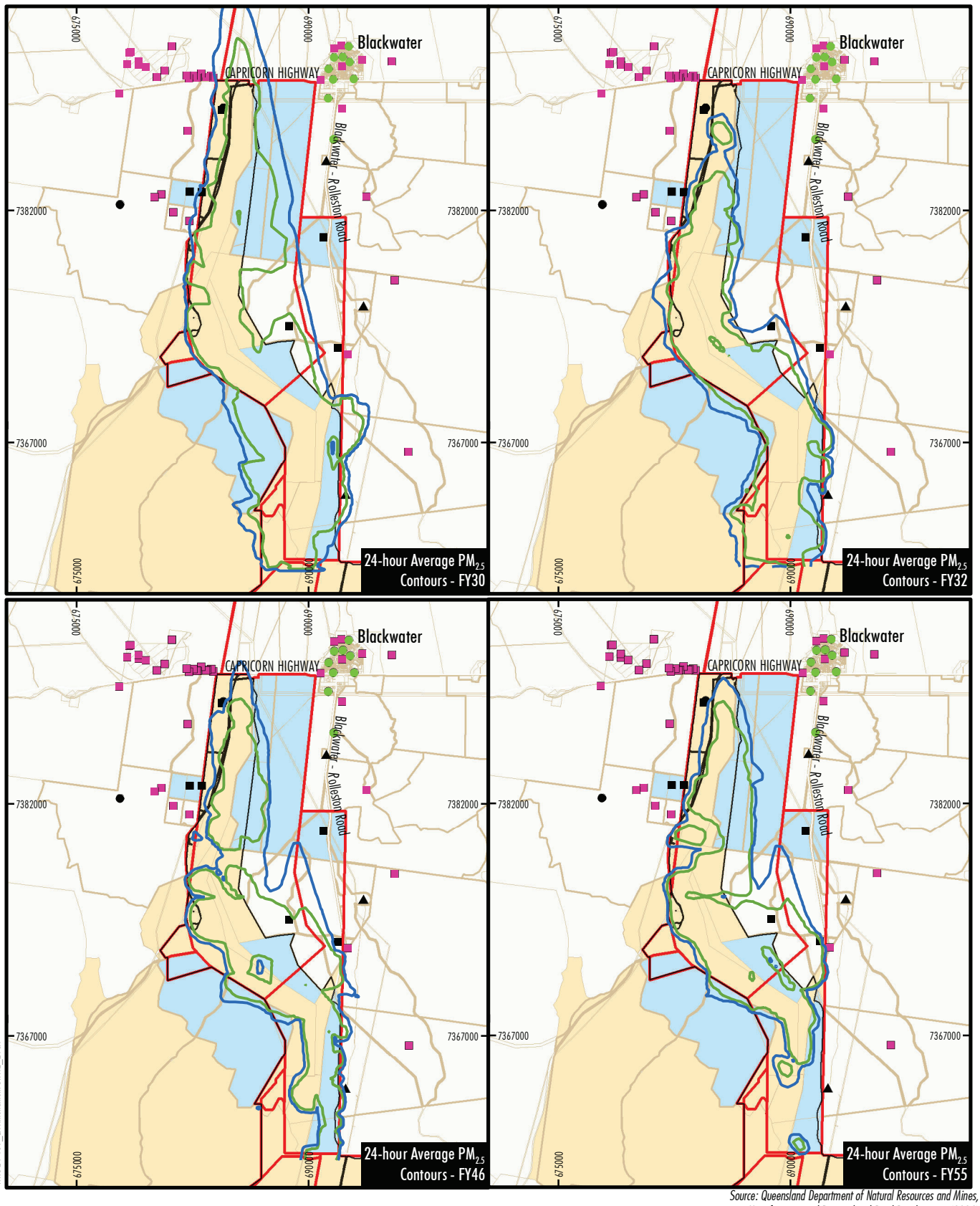
Predicted cumulative annual average ground-level $PM_{2.5}$ concentrations do not exceed the EPP (Air) Amendment/NEPM criteria at any public or private sensitive receptors. Four (4) non-sensitive receptors are predicted to slightly exceed these criteria (mine-owned receptors R50 and R51 in FY32, and mine-owned receptor R2 and privately-owned receptor currently under agreements R15 in FY46). Background $PM_{2.5}$ accounts for 75% of those exceedances which occurred under particular strong winds causing enhanced erosion.

Table 7-4 Predicted Maximum 24-hour Average Ground-level $PM_{2.5}$ Concentrations ($\mu g/m^3$)

Maximum 24-hour Average $PM_{2.5}$								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	20	20	20	20	20	20	20	20
Privately-owned Sensitive Receptors								
R03	4.4	10.0	4.7	10.3	2.4	8.0	2.4	8.1
R04	3.1	8.8	4.1	9.7	2.1	7.7	1.9	7.6
R05	9.1	14.8	6.9	12.5	4.7	10.4	5.2	10.8
R06	5.8	11.4	6.1	11.8	2.9	8.5	3.2	8.9
R07	8.0	13.6	6.3	11.9	5.4	11.0	5.7	11.3
R09	3.4	9.1	2.9	8.5	2.8	8.4	2.7	8.3
R10	1.5	7.1	1.3	6.9	1.5	7.1	1.5	7.1
R11	3.2	8.8	3.5	9.2	2.9	8.5	2.6	8.3
R13	2.6	8.2	2.3	8.0	2.6	8.2	1.6	7.3
R17	5.8	11.5	4.3	10.0	6.9	12.6	5.6	11.3
R19	1.8	7.5	1.2	6.9	1.5	7.2	2.1	7.7
R20	8.8	14.4	5.1	10.8	6.5	12.1	6.1	11.7
R21	8.2	13.9	4.9	10.5	6.5	12.1	6.0	11.7
R22	7.0	12.6	4.4	10.0	6.7	12.3	6.1	11.8
R23	6.7	12.3	4.2	9.8	6.7	12.4	6.2	11.8
R24	6.4	12.1	4.2	9.8	6.6	12.2	6.0	11.7

Maximum 24-hour Average $PM_{2.5}$								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	20	20	20	20	20	20	20	20
R25	6.8	12.4	4.7	10.4	6.6	12.3	6.1	11.7
R26	6.8	12.5	4.8	10.4	6.6	12.2	6.1	11.7
R27	6.8	12.5	4.9	10.6	6.3	12.0	5.9	11.6
R28	6.9	12.6	5.2	10.8	6.0	11.7	5.8	11.4
R29	6.8	12.5	5.1	10.8	5.8	11.5	5.6	11.3
R30	6.6	12.2	4.9	10.5	4.3	10.0	4.8	10.4
R31	6.5	12.1	4.6	10.2	4.0	9.6	4.4	10.0
R32	3.1	8.7	2.2	7.8	1.7	7.3	1.7	7.3
R33	5.6	11.2	3.6	9.2	3.3	8.9	3.5	9.1
R34	5.6	11.2	3.6	9.3	3.3	8.9	3.5	9.1
R35	4.6	10.2	2.8	8.5	2.6	8.2	2.7	8.4
R36	4.9	10.6	3.1	8.8	2.9	8.5	3.0	8.7
R37	5.1	10.7	3.2	8.9	3.0	8.6	3.2	8.8
R39	6.2	11.9	4.7	10.3	4.9	10.5	5.0	10.6
R40	6.0	11.7	4.0	9.7	3.6	9.2	3.9	9.5
R41	6.2	11.9	4.7	10.3	4.9	10.5	5.0	10.6
R42	1.0	6.7	0.9	6.6	1.0	6.6	1.1	6.7
R43	1.2	6.9	1.2	6.9	1.1	6.8	1.2	6.9
R52	3.4	9.0	2.9	8.5	2.3	8.0	2.7	8.3
R53	3.2	8.8	2.9	8.6	2.2	7.9	3.2	8.8
R54	4.7	10.4	3.2	8.8	3.1	8.7	3.6	9.3
R55	2.3	8.0	2.3	8.0	2.2	7.9	2.2	7.8
R56	3.6	9.3	3.0	8.7	2.3	8.0	2.8	8.4
Other Sensitive Receptors								
R57	3.6	9.3	3.0	8.6	2.5	8.2	3.0	8.6
R58	2.8	8.4	2.8	8.4	2.1	7.7	2.6	8.2
R59	3.1	8.7	2.7	8.4	2.2	7.8	3.0	8.6
R60	3.2	8.8	2.8	8.5	2.3	8.0	3.3	8.9
R61	3.6	9.3	3.2	8.9	2.5	8.2	3.6	9.3
R62	3.9	9.5	3.1	8.7	2.8	8.4	3.3	8.9
R47	4.0	9.7	3.5	9.2	3.9	9.6	4.1	9.8
R63	2.6	8.3	2.7	8.3	2.5	8.2	2.6	8.2
Non-sensitive Commercial/Industrial Receptors								
R14	2.6	8.2	2.7	8.3	4.4	10.0	3.3	8.9

Maximum 24-hour Average $PM_{2.5}$								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	20	20	20	20	20	20	20	20
R46	14.0	19.7	3.3	9.0	5.2	10.9	1.7	7.4
R48	3.9	9.6	3.2	8.9	3.1	8.8	2.9	8.5
R49	2.0	7.7	1.8	7.4	1.4	7.1	1.4	7.1
R64	3.7	9.4	3.4	9.1	3.7	9.3	3.2	8.8
Non-sensitive Mine-owned Receptors								
R01	8.7	14.3	6.2	11.8	4.8	10.5	5.5	11.1
R02	9.5	15.1	7.6	13.3	6.8	12.4	6.5	12.1
R12	3.9	9.6	3.3	9.0	3.7	9.4	3.5	9.2
R50	12.0	17.6	6.9	12.5	8.0	13.7	7.5	13.1
R51	11.4	17.0	6.8	12.4	8.4	14.0	7.6	13.3
Non-sensitive Privately-owned Receptors Currently Under Agreements								
R15	15.9	**21.5**	9.8	15.4	14.8	**20.4**	-	-
R16	6.0	11.6	3.9	9.5	5.9	11.6	8.8	14.5



WHC-24-101_EA Amendment SR AQ_210A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

24-hour Average $PM_{2.5}$
- 15 $\mu g/m^3$
- Exceedance Cumulative (20 $\mu g/m^3$)

Criteria: 20 $\mu g/m^3$

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); RWDI (2026); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

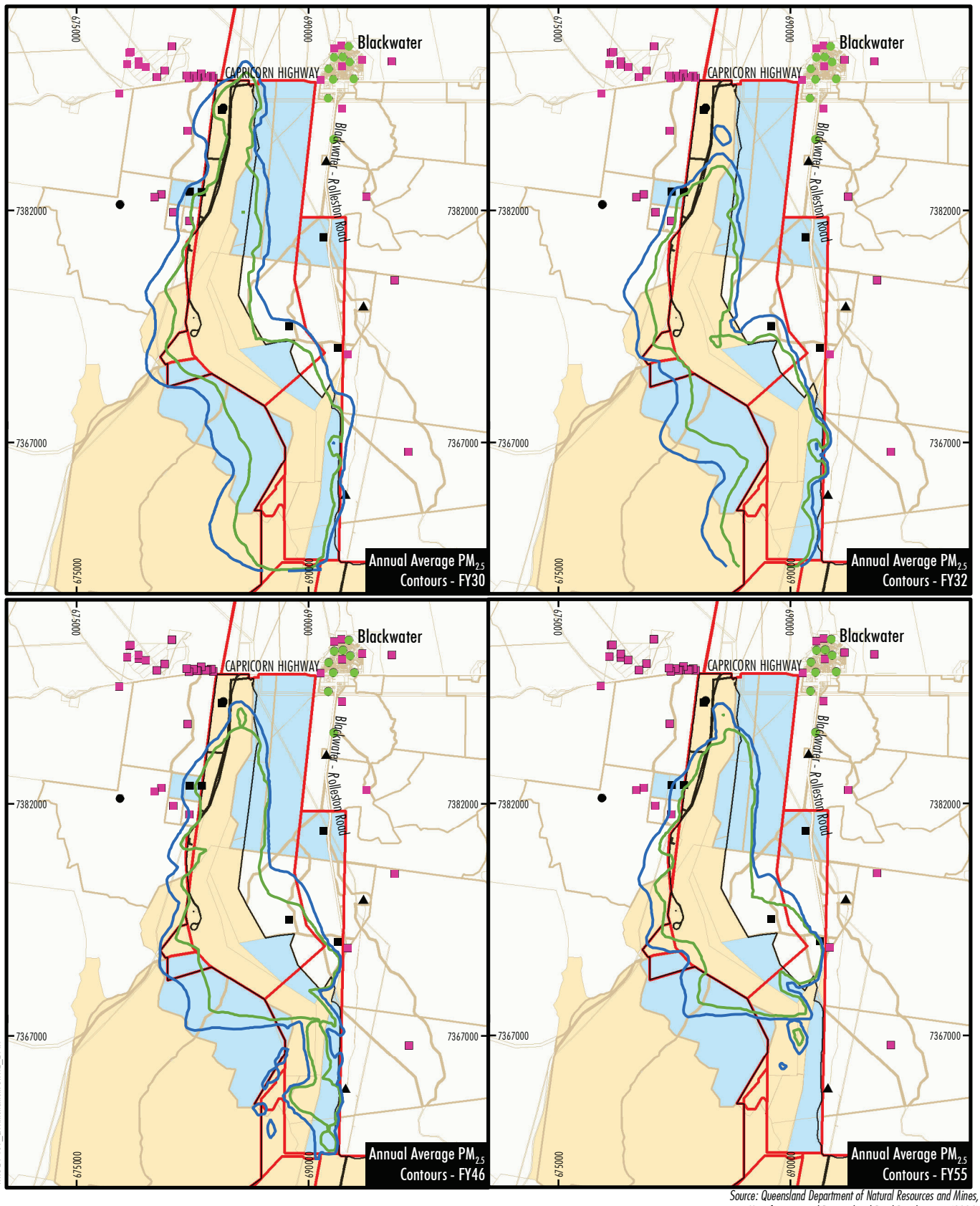
Predicted Maximum 24-hour Average Ground-level $PM_{2.5}$ concentrations ($\mu g/m^3$)

Figure 7-4

Table 7-5 Predicted Annual Average Ground-level $PM_{2.5}$ Concentrations (µg/m³)

Annual Average $PM_{2.5}$								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	7	7	7	7	7	7	7	7
Privately-owned Sensitive Receptors								
R03	0.8	6.0	0.6	5.9	0.8	6.1	0.7	5.9
R04	0.7	6.0	0.5	5.8	0.7	6.0	0.6	5.9
R05	1.6	6.9	1.5	6.8	1.2	6.5	1.3	6.5
R06	1.1	6.4	0.9	6.2	1.0	6.3	0.9	6.2
R07	1.1	6.4	0.6	5.9	0.6	5.9	0.5	5.8
R09	0.3	5.6	0.3	5.6	0.3	5.6	0.3	5.6
R10	0.1	5.4	0.1	5.4	0.1	5.4	0.1	5.4
R11	0.3	5.6	0.3	5.6	0.3	5.5	0.2	5.5
R13	0.2	5.5	0.2	5.5	0.1	5.4	0.1	5.4
R17	0.8	6.0	0.5	5.7	0.6	5.9	0.4	5.7
R19	0.1	5.4	0.1	5.4	0.1	5.3	0.0	5.3
R20	0.9	6.1	0.4	5.7	0.5	5.8	0.4	5.7
R21	0.8	6.1	0.4	5.7	0.5	5.8	0.4	5.7
R22	0.8	6.0	0.4	5.7	0.5	5.7	0.4	5.7
R23	0.7	6.0	0.4	5.7	0.4	5.7	0.4	5.7
R24	0.6	5.9	0.4	5.7	0.4	5.7	0.4	5.7
R25	0.7	6.0	0.4	5.7	0.4	5.7	0.4	5.7
R26	0.7	6.0	0.4	5.7	0.4	5.7	0.4	5.7
R27	0.6	5.9	0.4	5.7	0.4	5.7	0.4	5.6
R28	0.7	5.9	0.4	5.7	0.4	5.7	0.4	5.6
R29	0.6	5.9	0.4	5.7	0.4	5.7	0.3	5.6
R30	0.5	5.8	0.3	5.6	0.3	5.6	0.3	5.6
R31	0.5	5.8	0.3	5.6	0.3	5.6	0.3	5.6
R32	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
R33	0.4	5.7	0.3	5.6	0.3	5.5	0.2	5.5
R34	0.4	5.7	0.3	5.6	0.3	5.5	0.2	5.5
R35	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
R36	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
R37	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
R39	0.4	5.7	0.3	5.6	0.3	5.6	0.3	5.6
R40	0.4	5.7	0.3	5.6	0.3	5.6	0.2	5.5

Annual Average $PM_{2.5}$								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
AAQO	7	7	7	7	7	7	7	7
R41	0.4	5.7	0.3	5.6	0.3	5.6	0.3	5.6
R42	0.3	5.6	0.3	5.6	0.3	5.6	0.3	5.6
R43	0.4	5.7	0.4	5.7	0.4	5.7	0.4	5.6
R52	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R53	0.3	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R54	0.4	5.7	0.3	5.6	0.3	5.6	0.3	5.6
R55	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R56	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
Other Sensitive Receptors								
R57	0.3	5.6	0.2	5.5	0.2	5.5	0.2	5.5
R58	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R59	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R60	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
R61	0.3	5.6	0.3	5.6	0.3	5.6	0.3	5.6
R62	0.3	5.6	0.3	5.6	0.3	5.6	0.3	5.6
R47	0.4	5.7	0.4	5.6	0.3	5.6	0.3	5.6
R63	0.2	5.5	0.2	5.5	0.2	5.5	0.2	5.5
Non-sensitive Commercial/Industrial Receptors								
R14	0.3	5.6	0.3	5.6	0.2	5.5	0.2	5.5
R46	1.1	6.4	0.3	5.6	0.3	5.6	0.1	5.4
R48	0.4	5.7	0.4	5.7	0.4	5.7	0.4	5.6
R49	0.5	5.8	0.4	5.7	0.4	5.7	0.4	5.7
R64	0.4	5.6	0.3	5.6	0.3	5.6	0.3	5.6
Non-sensitive Mine-owned Receptors								
R01	1.4	6.7	1.2	6.5	1.4	6.7	1.2	6.5
R02	1.6	6.9	1.5	6.8	2.0	**7.2**	1.5	6.8
R12	0.5	5.8	0.5	5.8	0.5	5.8	0.5	5.8
R50	2.3	**7.5**	0.6	5.9	0.8	6.0	0.6	5.9
R51	2.1	**7.4**	0.6	5.9	0.7	6.0	0.6	5.9
Non-sensitive Privately-owned Receptors Currently Under Agreements								
R15	1.3	6.6	1.4	6.7	2.4	**7.7**		
R16	0.8	6.1	0.5	5.8	0.7	6.0	0.9	6.2



WHC-24-101_EA Amendment SR AQ_211A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

24-hour Average $PM_{2.5}$
- 6.5 $\mu g/m^3$
- Exceedance Cumulative (7 $\mu g/m^3$)

Criteria: 7 $\mu g/m^3$

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); RWDI (2026); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Predicted Annual Average Ground-level $PM_{2.5}$ concentrations ($\mu g/m^3$)

Figure 7-5

7.4 Dust Deposition

Predicted 30-day average dust deposition are compared with the DETSI guideline 30-day average dust deposition criterion in Table 7-6 for the four scenarios. Contour plots of the predicted 30-day average dust deposition over the whole modelling domain are displayed in Figure 7-6. Mine-owned receptors and privately-owned receptors currently under agreements are included for information only.

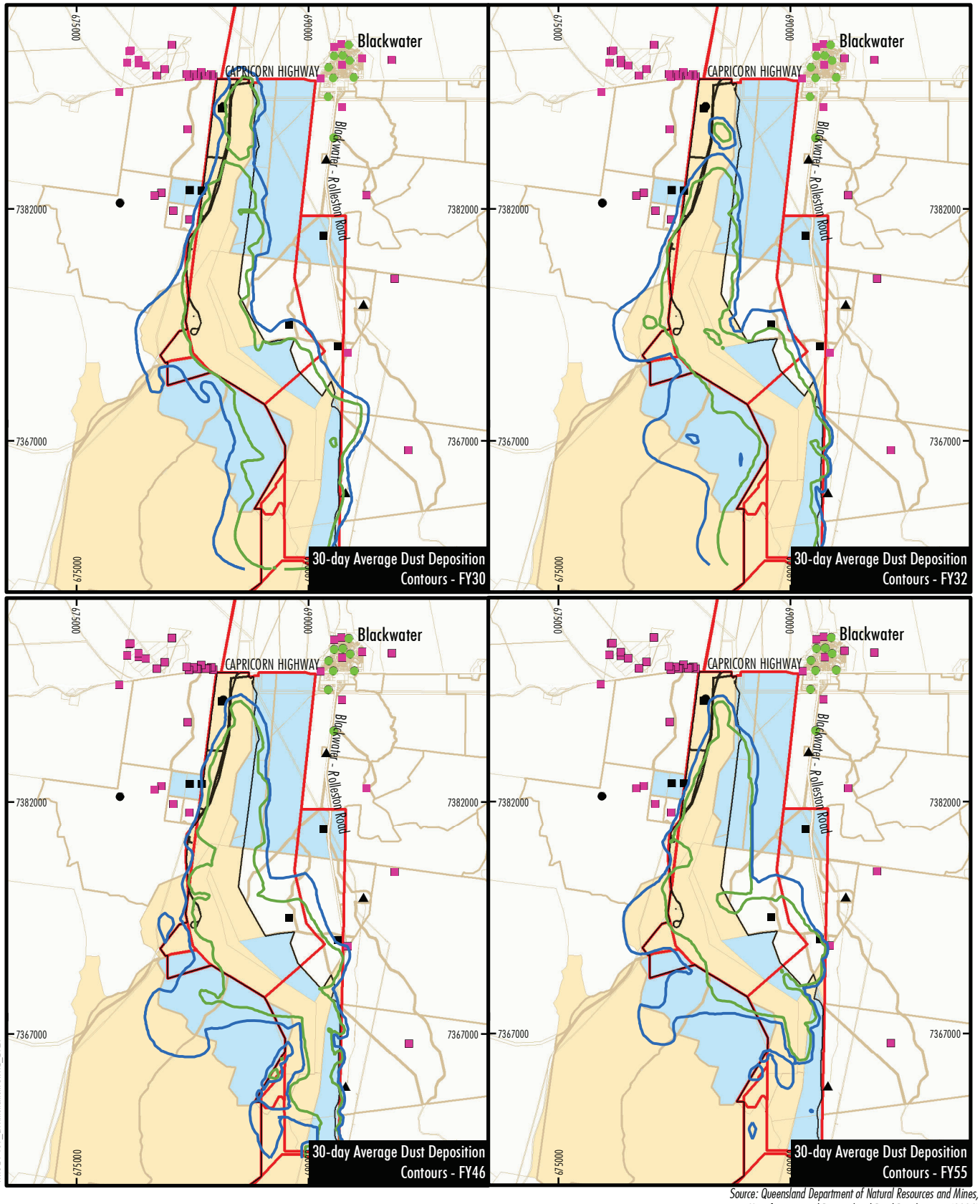
There are no predicted exceedances of the DETSI guideline criterion at any of the sensitive receptors for any of the scenarios. One (1) non-sensitive privately-owned receptor currently under agreements (R15) is predicted to exceed the criterion in FY46 (when the eastward progression of the active pit will have nearly reached R15 by then).

Table 7-6 Predicted 30-day Average Dust Deposition (mg/m²/day)

30-day Average Dust Deposition								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
DETSI Guideline Criterion	120	120	120	120	120	120	120	120
Privately-owned Sensitive Receptors								
R03	15.3	57.3	15.7	57.7	17.6	59.6	13.1	55.1
R04	13.6	55.6	14.3	56.3	16.8	58.8	12.4	54.4
R05	40.6	82.6	40.2	82.2	30.2	72.2	33.6	75.6
R06	22.6	64.6	22.7	64.7	24.7	66.7	21.5	63.5
R07	22.9	64.9	18.9	60.9	17.8	59.8	14.8	56.8
R09	8.7	50.7	10.3	52.3	11.3	53.3	10.2	52.2
R10	4.0	46.0	5.0	47.0	5.1	47.1	4.7	46.7
R11	10.3	52.3	12.2	54.2	11.9	53.9	10.2	52.2
R13	6.6	48.6	6.7	48.7	6.1	48.1	5.3	47.3
R17	33.5	75.5	22.3	64.3	45.6	87.6	35.8	77.8
R19	6.4	48.4	4.1	46.1	3.3	45.3	2.1	44.1
R20	28.4	70.4	18.4	60.4	27.4	69.4	25.1	67.1
R21	26.6	68.6	17.9	59.9	26.4	68.4	24.3	66.3
R22	26.6	68.6	17.7	59.7	25.5	67.5	23.7	65.7
R23	26.6	68.6	17.5	59.5	25.2	67.2	23.5	65.5
R24	24.0	66.0	16.5	58.5	23.4	65.4	22.1	64.1
R25	25.8	67.8	18.0	60.0	23.4	65.4	22.0	64.0
R26	25.6	67.6	18.2	60.2	23.2	65.2	21.8	63.8
R27	24.6	66.6	18.4	60.4	22.4	64.4	21.1	63.1
R28	23.9	65.9	19.1	61.1	21.5	63.5	20.1	62.1
R29	22.8	64.8	18.7	60.7	20.7	62.7	19.5	61.5

30-day Average Dust Deposition								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
DETSI Guideline Criterion	120	120	120	120	120	120	120	120
R30	17.4	59.4	16.6	58.6	14.9	56.9	14.1	56.1
R31	16.6	58.6	15.8	57.8	13.2	55.2	12.5	54.5
R32	9.9	51.9	8.9	50.9	7.6	49.6	7.0	49.0
R33	12.7	54.7	11.8	53.8	9.7	51.7	9.2	51.2
R34	12.4	54.4	11.6	53.6	9.6	51.6	9.2	51.2
R35	10.8	52.8	10.3	52.3	8.3	50.3	7.8	49.8
R36	10.4	52.4	9.9	51.9	8.1	50.1	7.7	49.7
R37	10.6	52.6	10.0	52.0	8.3	50.3	7.9	49.9
R39	14.9	56.9	13.4	55.4	13.5	55.5	12.9	54.9
R40	13.9	55.9	13.2	55.2	10.8	52.8	10.4	52.4
R41	14.9	56.9	13.4	55.4	13.5	55.5	12.9	54.9
R42	6.5	48.5	6.8	48.8	6.5	48.5	6.7	48.7
R43	9.3	51.3	9.8	51.8	9.3	51.3	9.6	51.6
R52	8.5	50.5	10.1	52.1	11.3	53.3	10.3	52.3
R53	11.4	53.4	13.8	55.8	16.8	58.8	15.6	57.6
R54	12.6	54.6	14.2	56.2	18.0	60.0	16.5	58.5
R55	7.8	49.8	9.9	51.9	11.4	53.4	10.3	52.3
R56	9.3	51.3	10.9	52.9	12.2	54.2	11.3	53.3
Other Sensitive Receptors								
R57	10.4	52.4	12.6	54.6	14.7	56.7	13.6	55.6
R58	10.0	52.0	12.3	54.3	14.7	56.7	13.6	55.6
R59	7.9	49.9	9.5	51.5	10.8	52.8	9.8	51.8
R60	9.9	51.9	12.0	54.0	14.3	56.3	13.1	55.1
R61	13.3	55.3	15.8	57.8	20.0	62.0	18.8	60.8
R62	12.4	54.4	14.9	56.9	18.3	60.3	17.0	59.0
R47	9.4	51.4	10.8	52.8	12.4	54.4	11.8	53.8
R63	10.4	52.4	13.1	55.1	15.4	57.4	14.1	56.1
Non-sensitive Commercial/Industrial Receptors								
R14	16.4	58.4	17.9	59.9	17.2	59.2	16.0	58.0
R46	70.7	112.7	25.3	67.3	20.0	62.0	6.4	48.4
R48	10.8	52.8	12.8	54.8	15.0	57.0	14.5	56.5
R49	8.7	50.7	8.4	50.4	10.7	52.7	9.5	51.5
R64	11.0	53.0	13.0	55.0	15.8	57.8	14.3	56.3

30-day Average Dust Deposition								
	FY30		FY32		FY46		FY55	
	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative	BWM	Cumulative
DETSI Guideline Criterion	120	120	120	120	120	120	120	120
Non-sensitive Mine-owned Receptors								
R01	30.4	72.4	33.4	75.4	34.5	76.5	25.4	67.4
R02	41.2	83.2	46.4	88.4	46.5	88.5	36.8	78.8
R12	15.5	57.5	21.2	63.2	23.0	65.0	22.8	64.8
R50	72.5	114.5	22.8	64.8	34.2	76.2	30.5	72.5
R51	67.3	109.3	22.7	64.7	33.6	75.6	29.8	71.8
Non-sensitive Privately-owned Receptors Currently Under Agreements								
R15	56.5	98.5	66.2	108.2	100.2	**142.2**	-	-
R16	34.3	76.3	22.7	64.7	38.6	80.6	56.8	98.8



WHC-24-101_EA Amendment SR AQ_212A

LEGEND

- Mining Lease
- Road
- Property Boundary
- Approved Disturbance Footprint
- Whitehaven Freehold Land
- Whitehaven Leasehold Land

Sensitive Receiver
- Community
- Private

Non-sensitive Receiver
- Mine-owned or Privately-owned
- Under Agreement
- Commercial
- Community

30-day AverageDust Deposition
- 90 mg/m²/day
- Exceedance Cumulative (120mg/m²/day)

Criteria: 120 mg/m²/day

N

0 5

Kilometres

GDA2020 MGA Zone 55

Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); RWDI (2026); Whitehaven (2025)

Whitehaven

BLACKWATER NORTH EXTENSION PROJECT

Predicted 30-day Average Dust Deposition (mg/m²/day)

Figure 7-6

7.5 Mitigation Control Measures

7.5.1 Overall Control Measures

Control measures that are currently implemented at the BWM are outlined below. These controls would be continued upon commencement of the Project.

- Planning Controls:
  - construction of bunds (if required) in operational areas;
  - utilising of dust forecasting and assessing meteorological conditions to allow for forward planning;
  - minimising exposed surface areas by only clearing vegetation/disturbing areas required for mining activities;
  - progressive rehabilitations to reduce exposed areas and reduce dust;
  - sufficient provision of sheltered dumping during adverse wind conditions;
  - optimising of base construction materials during road design to reduce the silt content of surface and increase the retention of coarser aggregates; and
  - sufficient water within BWM's site water balance model to undertake dust suppression activities;
- Operational Controls:
  - use of a real-time dust monitoring system to clarify and understand where and what operations need to be modified to reduce dust emissions;
  - implementation of the BWM Dust Trigger Action Response Plan (TARP) in conjunction with the real-time monitoring system;
  - limited speed of heavy machinery and vehicle traffic on haul roads;
  - machinery to operate in less exposed/sensitive areas during adverse meteorological conditions;
  - utilisation of available water trucks to provide dust suppression in required locations including haul roads, light vehicle roads and hardstands;
  - progressive backfilling and rehabilitation of overburden dumps;
  - dust suppression sprays installed on the stacker reclaimer units located at both the CHPP and TCP;
  - dust suppression sprays installed on the ROM hoppers located at both the CHPP and TCP; and
  - trains are sprayed with veneer once loaded and prior to departure at the train loadout.

7.5.2 Receptor-specific Control Measures

There were a few predicted potential exceedances of the 24-hour EPP (Air)/NEPM PM_{10} criteria at privately-owned sensitive receptors (R5, R6, R7, R17, R20 and R21). These can be prevented with a proactive dust management approach, including real-time monitoring and weather forecasting, and mine activity adjustment when warning levels are reached:

- Weather forecasting and real-time weather and dust monitoring can ensure that sustained strong wind episodes trigger a reduced and/or more sheltered overburden handling and dumping activity in the pits upwind of those sensitive receivers, along with enhanced watering of the overburden areas.
- For R5, R6 and R7, sustained strong winds from the south-southeast and clear stable nights with weak south-southeasterly winds will have to be monitored closely during the early Project years when the mining activities have not yet materially progressed eastward.

- For R20 and R21, mitigation of overburden handling and dumping activities in Ramp 8 will have to occur when sustained strong southerly winds are picking up and during quiet clear nights when weak south-easterly winds are blowing directly from the northernmost pit to these residences (potentially during early stage of the Project [e.g. FY30]). The implementation of adaptative management measures when winds are blowing from the east-southeast (90º-150º) during night-time is anticipated to achieve compliance with the air quality objectives at these sensitive receptors.
- For R17, potentially during late stage of the Project (e.g. FY46, FY55), a forecast of westerly winds around sunrise should trigger adaptative management measures in the Stewarton and Deep Creek ramps, especially during clear calm (very stable) nights to achieve compliance with the air quality objectives.

NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining (Katestone Environmental Pty Ltd, 2011) found that proactive and reactive management tools were found to be best practice for reducing emissions of particulate matter from open-cut coal mines. Mining operations in Queensland and NSW have successfully demonstrated that proactive dust management can be effectively implemented to minimise dust emissions and achieve compliance with the air quality objectives.

In the event when monitoring indicates that adaptative management measures are not effective, Whitehaven Blackwater would seek an alternative arrangement (as defined in EA EPML00717813) with the requisite sensitive receptor.

7.6 Summary and Discussion

The air quality modelling assessment found the following:

TSP:

- There are no predicted exceedances of the EPP (Air)/NEPM annual TSP criterion at any of the receptors for any of the scenarios.

PM_{10}:

- Predicted cumulative maximum 24-hour average ground-level PM_{10} concentrations exceed the 24-hour EPP (Air)/NEPM PM_{10} criteria at six (6) non-sensitive mine-owned receptors and privately-owned receptors currently under agreements (R1, R2, R15, R16, R50 and R51) and one (1) non-sensitive industrial receptor (R46). Exceedances were also predicted at six (6) privately-owned sensitive receptors (R5, R6, R7, R17, R20 and R21). The predicted exceedances at the privately-owned sensitive receptors occurred on years when mining activity is planned at the northern margin of the BWM, with the exception of R17 which is located south-east of the Project Area and is affected in later years when the mine progresses eastward.
- Such occurrences can be prevented with a proactive dust management approach, including weather forecasting, real-time monitoring near those residences, and mine activity adjustment when warning levels are reached.

- Predicted cumulative annual average ground-level PM_{10} concentrations exceed the annual EPP (Air)/NEPM PM_{10} criteria at five (5) non-sensitive mine-owned receptors and privately-owned receptors currently under agreements (R1, R2, R15, R50 and R51), and also at one (1) privately-owned sensitive receptor (R5) which is located close to the BWM western boundary west of the main haul road in FY30 and FY32.
- Alternative arrangements as defined in EA EPML00717813 would be sought with R5, R6, R7 and R17.

$PM_{2.5}$:

- There are no predicted exceedances of the EPP (Air) Amendment/NEPM 24-hour $PM_{2.5}$ criteria at any of the sensitive receptors for any of the scenarios. One (1) non-sensitive privately-owned receptor currently under agreements receptor (R15) is predicted to exceed the criteria in FY30 and FY46 due to erosion under strong westerly winds.
- Predicted cumulative annual average ground-level $PM_{2.5}$ concentrations do not exceed the EPP (Air) Amendment/NEPM criteria at any public or private sensitive receptors. Four (4) non-sensitive receptors slightly exceed the criteria (mine-owned receptors R50 and R51 in FY32, and mine-owned receptor R2 and privately-owned receptor currently under agreements R15 in FY46). Background $PM_{2.5}$ accounts for 75% of those exceedances which occurred under particular strong winds causing enhanced erosion.

Dust deposition:

- There are no predicted exceedances of the DETSI guideline criterion at any of the sensitive receptors for any of the scenarios. One (1) non-sensitive privately-owned receptor currently under agreements (R15) is predicted to exceed the criterion in FY46 (when the eastward progression of the active pit will have nearly reached R15 by then).

8 CONCLUSION

This Air Quality Assessment has estimated the potential dust impact of the BWM on its surroundings for the Project. The assessment has been conducted in accordance with regulatory guidelines.

Detailed meteorological and air dispersion modelling was conducted for four representative scenarios based on the planned mining operations (FY30, FY32, FY46 and FY55). Ground-level concentrations of TSP, PM_{10}, $PM_{2.5}$ as well as dust deposition were predicted at sensitive receptors and over the whole Project area and compared with the relevant air quality criteria and guideline. Background air quality concentrations and dust deposition were taken into account in the cumulative impact assessment.

The main findings of the assessment are as follows:

- **TSP:** Predicted cumulative concentrations of TSP *comply* with the relevant air quality objective at all receptors for all scenarios.
- **PM_{10}:** Predicted cumulative concentrations of PM_{10} *comply* with the air quality objectives at most sensitive receptors. Exceedances of the 24-hour PM_{10} objective were predicted at five (5) privately-owned sensitive receptors to the west and north-west of the BWM in the early years of the Project when mining is planned at the northern margin of the BWM, and one (1) privately-owned sensitive receptor to the south-east of the Project which is affected in later years as the mine moves eastward. Such occurrences can be prevented with a proactive dust management approach, including weather forecasting, real-time monitoring near those residences, and mine activity adjustment when warning levels are reached. Predicted cumulative PM_{10} concentrations also exceeded the annual PM_{10} objective at one (1) privately-owned sensitive receptor, which is located close to the main haul road. Alternative arrangements as defined in EA EPML00717813 would be sought with these receptors.
- **$PM_{2.5}$**: Predicted cumulative concentrations of $PM_{2.5}$ *comply* with the relevant air quality objectives at all public and private sensitive receptors for all modelled scenarios.
- **Dust deposition:** Predicted 30-day dust deposition due the planned BWM mining activities *comply* with the relevant air quality guideline at all public and private sensitive receptors for all modelled scenarios.

9 REFERENCES

Bureau of Meteorology (2026) "*Climate Statistics for Australian Locations – Blackwater Airport".* Accessible at: https://www.bom.gov.au/climate/averages/tables/cw_035134_All.shtml

Department of Tourism, Environment, Science and Innovation (2024a) "*Guideline - Application requirements for activities with impacts to air*". Accessible at: https://www.des.qld.gov.au/policies?a=272936:policy_registry/era-gl-air-impacts.pdf

Department of Tourism, Environment, Science and Innovation (2024b) "*Air – EIS information guideline*". Accessible at: https://www.des.qld.gov.au/policies?a=272936:policy_registry/eis-tm-air-information-guide.pdf

Department of Tourism, Environment, Science and Innovation (2025) "*Particulate concentrations*". Accessible at: https://www.stateoftheenvironment.detsi.qld.gov.au/pollution/air-quality/particulate-concentrations

Katestone Environmental Pty Ltd (2011) "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*". Accessible at: https://www.epa.nsw.gov.au/sites/default/files/ke1006953volumei.pdf

National Environment Protection Council (2021) "*National Environment Protection (Ambient Air Quality) Measure. Variation to the Ambient Air Quality NEPM – 2021*". Accessible at: https://www.nepc.gov.au/nepms/ambient-air-quality

National Pollutant Inventory (2012) "*Emission Estimation Technique Manual for Mining. Version 3.1*". Accessible at: https://www.dcceew.gov.au/sites/default/files/documents/mining.pdf

New South Wales Environmental Protection Authority (2022) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*". Accessible at: https://www.epa.nsw.gov.au/sites/default/files/22p3963-approved-methods-for-modelling-and-assessment-of-air-pollutants.pdf

Queensland Government (2025) *"Particles".* Accessible at: https://www.qld.gov.au/environment/management/monitoring/air/air-pollution/pollutants/particles

United States Environmental Protection Agency (1998) "*Compilation of Air Pollutant Emissions Factors from Stationary Sources, AP 42, Fifth Edition, Volume I Chapter 11.9: Western Surface Coal Mining*". Accessible at: https://www.epa.gov/sites/default/files/2020-10/documents/c11s09.pdf

United States Environmental Protection Agency (2006) "*Compilation of Air Pollutant Emissions Factors from Stationary Sources, AP 42, Fifth Edition, Volume I Chapter 13.2.5: Industrial Wind Erosion*". Accessible at: https://www.epa.gov/sites/default/files/2020-10/documents/13.2.5_industrial_wind_erosion.pdf

10 STATEMENT OF LIMITATIONS

This report entitled Blackwater Mine North Extension – AIR QUALITY ASSESSMENT dated 02 April 2026, was prepared by RWDI Australia Pty Ltd ("RWDI") for Whitehaven Coal Limited and Resource Strategies Pty Ltd ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the Project. The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the Project to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilise the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

APPENDIX A - Annual ROM & Overburden Production Rates by Pit

Pit	Ramp	ROM (Tonnes)				Total Overburden (Mbcm)			
		FY30	FY32	FY46	FY55	FY30	FY32	FY46	FY55
BON	R08N	912,001				10,194,487			
MIM	R14N			413,134				4,374,422	
	R14S			805,683	773,166			14,750,030	11,148,960
SAG	R16N	812,456	773,079		900,710	13,796,220	12,185,180	8,890,365	15,834,443
	R16S		323,706	805,126	353,562	3,972,775	9,356,625	11,231,633	14,016,190
AIR	R20N			712,156	687,283			4,152,901	9,721,275
	R20S	652,934	1,650,899	763,625	721,496	25,750,811	22,073,767	8,288,201	10,018,956
BES	R30N	573,614	1,069,808	764,600	675,445	20,931,313	25,241,869	9,164,565	12,334,657
	R30S								
	R32								
DPC	R32S			516,964				3,680,965	
	R34S	1,615,323		326,138		21,969,536		7,563,501	
	R38N			1,034,035	1,293,936			15,123,133	23,212,589
	R38S			831,443				13,055,327	
STE	R42N	172,952	1,755,518	1,619,743	1,724,833	6,397,099	22,886,459	26,500,232	30,955,380
	R42S		2,049,311	1,680,967	1,498,547	6,304,000	22,959,411	30,188,054	30,963,436
	R46S	1,550,057	1,334,302	1,100,445		10,955,630	14,275,516	19,986,106	
	R47S	1,404,373	1,307,972			16,058,722	19,066,070		

Pit	Ramp	ROM (Tonnes)				Total Overburden (Mbcm)			
		FY30	FY32	FY46	FY55	FY30	FY32	FY46	FY55
TAN	R48N								
	R52N	832,416	467,955			12,073,275	1,334,636		
	R52S	1,120,270	624,283			20,534,159	17,816,610		
WIL	R54S	866,330	1,239,420	1,366,418		17,296,030	18,487,860	20,930,590	
BLA	R56N	1,263,407	1,080,855			17,982,631	15,336,018		
	R56S	662,490	1,483,601			3,288,901	12,716,368		
	R62S	625,659	423,828			7,329,232	8,130,077		
BAS	R63N			1,011,933	1,909,811			16,661,409	22,323,519
	R63S			988,792	696,074			7,596,383	14,959,971
LAL	R64N				212,815				3,369,008
	R64S			275,860				8,583,491	1,030,940
	R66N								
	R66S				496,130				5,743,427
	R68S			324,001				4,118,042	
TON	R78N	889,505	734,921	190,528	876,327	11,066,987	11,213,219	5,256,108	12,579,692
	R78S	536,115	1,252,998	379,214	944,143	8,984,741	13,373,787	6,604,584	12,165,801
TOS	R80N		21,260	333,962	277,074	574,324	3,720,883	5,316,999	2,880,013
	R80S			302,970	432,849	126,619	4,786,577	4,610,244	10,412,830
MAN	R82N			712,617	581,862		3,256,045	10,259,446	9,204,205
	R82S	359,967	1,406,253	1,579,318	989,687	10,857,061	21,577,226	22,310,819	22,710,284

APPENDIX B - BWM Activity Data

Activity	Units	Value
Mine operations		
Hours of operation	hours	24/7 Except for blasting from 7 am to 6 pm
Overburden density	kg/m³	2.2
Overburden moisture content	%	3.2
Overburden silt content	%	6.9
Coal density	kg/m3	1.51
Coal moisture content	%	4.0
Coal silt content	%	5.0
Pit operations		
Drilling/blasting		
Average holes drilled per blast	Holes per blast	500
Average Blasts per week	Blasts/week	3
Average area per blast	m³	793,977
Dragline Drop height	m	6
Dozers/ Excavators/shovels/loaders	operating hours per year	5462
Grading		
Grader Vehicle speed	km/hr	5
Hours of operation per year	Hours of operation per year	5,851
Number of Graders	Units	13 in FY30, 15 in FY32, FY46 and FY55
Total Haulage		
Speed limit	Km/hr	40
930E -loaded	tonnes	505.6
930E -empty	tonnes	215.3
930E - payload	tonnes	360.5
793F -loaded	tonnes	386
793F -empty	tonnes	159.4
793F - payload	tonnes	226.6
Kress 200C III -loaded	tonnes	368.5
Kress 200C III -empty	tonnes	148.5
Kress 200C III - payload	tonnes	220
Wind		
Mean Wind speed	m/s	3.8
Wind erosion above 5.4m/s	% of time at Blackwater Airport	16

APPENDIX C – Emissions Estimation Methodology

Activity	Emission factors	Source
Pit operations		
Drilling	EF_{TSP} = 0.59 (kg/hole) EF_{PM10} = 0.31 (kg/hole) $EF_{PM2.5}$ = 3% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1 (Blasting)
Blasting	$EF_{TSP} = 0.00022 \times A^{1.5}$ (kg/blast) EF_{PM10} = 52% of TSP $EF_{PM2.5}$ = 3% of TSP where A is area blasted (m^2)	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1
Draglines	$EF_{TSP} = 0.0046 \times (d^{1.1}/M^{0.3})$ $EF_{PM10} = 0.0022 \times (d^{0.7}/M^{0.3})$ $EF_{PM2.5}$ = 1.7% of TSP where d is drop height (m), M is the moisture content (%) and EF is in kg/bcm	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1
Bulldozing coal	$EF_{TSP} = 35.6 \times (S^{1.2})/(M^{1.4}))$ $EF_{PM10} = 6.33 \times (S^{1.5})/(M^{1.4}))$ $EF_{PM2.5}$ = 2.2% of TSP where S is silt content (%), M is moisture content (%) and EF is in (kg/hr/vehicle)	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1
Bulldozing overburden	$EF_{TSP} = 2.6 \times (S^{1.2})/(M^{1.3}))$ $EF_{PM10} = 0.34 \times (S^{1.5})/(M^{1.4}))$ $EF_{PM2.5}$ = 10.5% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2

Activity	Emission factors	Source
	where S is silt content (%), M is moisture content (%) and EF is in (kg/hr/vehicle)	$PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1
Excavator / shovels / loaders on overburden in pit	$EF_{TSP} = 0.74 \times 0.0016 \times (U/2.2)^{1.3}/(M/2)^{1.4}$ $EF_{PM10} = 0.35 \times 0.0016 \times (U/2.2)^{1.3}/(M/2)^{1.4}$ $EF_{PM2.5} = 0.053 \times 0.0016 \times (U/2.2)^{1.3}/(M/2)^{1.4}$ where U is mean wind speed (m/s), M is overburden moisture content (%) and EF is in (kg/t)	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Equation 10, Equation 11
Excavator / shovels / loaders on coal in pit	EF_{TSP} (kg/t) $= 0.580/M^{1.2}$ EF_{PM10} (kg/t) $= 0.0447/M^{0.9}$ $EF_{PM2.5}$ (kg/t) = 2.2% of TSP where M is coal moisture content (%)	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Equation 12, Equation 13 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1 (Bulldozers on coal)
ROM truck unloading near haul road)	EF_{TSP} (kg/t) = 0.01 kg/t EF_{PM10} (kg/t) = 0.0042 kg/t $EF_{PM2.5}$ (kg/t) = 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: Conservative assumption
ROM Loading to Kress trucks near haul road	EF_{TSP} (kg/t) = 0.029 kg/t EF_{PM10} (kg/t) = 0.014 kg/t $EF_{PM2.5}$ (kg/t) = 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: Conservative assumption
OVB truck unloading	EF_{TSP} (kg/t) = 0.012 kg/t EF_{PM10} (kg/t) = 0.0043 kg/t $EF_{PM2.5}$ (kg/t) = 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: Conservative assumption
Processing (CHPP and TCP)		

Activity	Emission factors	Source
Dumping coal at main CHPP/TCP stockpiles and into rotary breaker	TSP: 0.01 kg/t PM_{10}: 0.0042 kg/t $PM_{2.5}$: 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: Conservative assumption
Loading coal to truck at main CHPP/TCP stockpiles	EF_{TSP} (kg/t) = 0.029 kg/t EF_{PM10} (kg/t) = 0.014 kg/t $EF_{PM2.5}$ (kg/t) = 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining, Table 2 $PM_{2.5}$: Conservative assumption
Crushing	EF_{TSP} (kg/t) = 0.0006 kg/t EF_{PM10} (kg/t) = 0.00027 kg/t $EF_{PM2.5}$ (kg/t) = 0.00005 kg/t	TSP, PM_{10}, $PM_{2.5}$: AP 42 Chapter 11.19.2.1 Crushed Stone Processing and Pulverized Mineral Processing Table 11.19.2-1
Screening (CHPP only)	EF_{TSP} (kg/t) = 0.0011 kg/t EF_{PM10} (kg/t) = 0.00037 kg/t $EF_{PM2.5}$ (kg/t) = 0.000025 kg/t	TSP, PM_{10}, $PM_{2.5}$: AP 42 Chapter 11.19.2.1 Crushed Stone Processing and Pulverized Mineral Processing Table 11.19.2-1
Conveyors Wind erosion	EF_{TSP} (g/m/s) = 0.031 x 0.2 x (0.00006 x U^2 + -0.0002 x U + 0.0001)/(0.00006 x $Uref^2$ + -0.0002 U*ref* + 0.0001) EF_{PM10} (g/m/s) = 47% of TSP $EF_{PM2.5}$ (g/m/s) = 7% of TSP where U is avg wind speed (m/s), Uref=10 m/s, a = 0.00006, b = -0.0002; c= 0.0001, and total emissions are dependent on conveyor length	TSP, PM_{10}, $PM_{2.5}$: referencing Dawson Air Quality Assessment (Katestone 2024)
Conveyors Transfer points	EF_{TSP} (kg/t) = 0.74*0.0016* $(U/2.2)^{1.3}$ / $(M/2)^{1.4}$ EF_{PM10} (kg/t) = 0.35*0.0016* $(U/2.2)^{1.3}$ / $(M/2)^{1.4}$ $EF_{PM2.5}$ (kg/t) = 7 % of TSP where U is avg wind speed (m/s), M is moisture content (%)	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining Table 2 $PM_{2.5}$: Conservative assumption

Activity	Emission factors	Source
Loading to Train	TSP: 0.0004 kg/t PM_{10}: 0.00017 kg/t $PM_{2.5}$: 7% of TSP	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining Table 2 $PM_{2.5}$: Conservative assumption
Haul Roads		
Grading	TSP = 0.0034 * S2.5 (kg/VKT) PM_{10} = 0.0034 * S2.0 (kg/VKT) $PM_{2.5}$ = 3.1 % of TSP where S is average grader speed in km/h	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining Table 2 $PM_{2.5}$: AP 42 Chapter 11.9 Western Surface Coal Mining Table 11.9-1
Haulage	TSP = $0.4536/1.6093 * 4.9 * (S/12)^{0.7} * (W/3)^{0.45}$ $PM_{10} = 0.4536/1.6093 * 1.5 * (S/12)^{0.9} * (W/3)^{0.45}$ $PM_{2.5}$ = 10% of PM_{10} with EF in kg/VKT	TSP, PM_{10}: NPI Emissions Estimation Technique Manual for Mining Table 2 $PM_{2.5}$: Conservative assumption
Wind Erosion (ROM stockpiles and Active Exposed Surfaces (active pit, active overburden areas, partially rehabilitated areas and stripped areas)		
Wind erosion	TSP = 850 kg/ha/yr PM_{10} = 50% of TSP $PM_{2.5}$ = 7.5 % of TSP with wind speed dependent hourly emission rates (cubic formula by Shao and wind speed threshold of 5.4 m/s)	AP-42 Chapter11.9 Western Surface Coal mining and Chapter 13.2.5 Industrial Wind Erosion