Mt Gibson Gold Project

Air Quality Assessment

Tetris Environmental Pty Ltd

09 August 2023

→ **The Power of Commitment**

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Executive summary

Crimson Metals Pty Ltd (a wholly owned subsidiary of Capricorn Metals Ltd) propose the development of the Mt Gibson Gold Project (the Project) in the Murchison region. The Project will expand on a decommissioned mine site, and will include mining pits, processing plant, integrated waste landform (IWL) and run of mine (ROM). It is expected to mine 30 million tonnes per annum (Mtpa) of ore and waste. The processing plant is expected to process 5 Mtpa for approximately 10 years.

Tetris Environmental Pty Ltd is managing the environmental approvals for the Project and have engaged GHD Pty Ltd to undertake an air quality assessment for the Project. This report will investigate the acceptability of predicted impacts to air quality against relevant ambient criteria.

The Project site is situated in a hot and dry climate, with summer droughts and cold winters. It is home to a range of native fauna, such as *Leipoa ocellata* (Malleefowl). And endemic vegetation. Surveys conducted from 2021 to 2023 identified conservation significant species of both vegetation and fauna. This assessment identified three sensitive receptors where people live or regularly spend time. It also included active Malleefowl mounds as sensitive receptors. The impacts on vegetation were considered important at the Malleefowl mounds as the Malleefowl feed on the vegetation and build their mounds with leaf litter. The surveyed vegetation was compared with the relevant criteria using contours.

A qualitative review of the construction process was also considered in this assessment. Sources of airborne pollutants included the exhaust from heavy vehicles, dust generated by equipment used during earthworks and dust from wind erosion of cleared or disturbed areas. The impacts are short-term in nature with no permanent impacts. It is recommended that vehicles are well maintained to minimise impacts due to exhaust. Defined haul routes should be used wherever it is necessary for vehicles to traverse unsealed surfaces or unformed roads and vehicle speeds should be limited to 25 kilometres per hour on unconsolidated or unsealed soil not treated with dust suppression.

A review of meteorological conditions at the nearest Bureau of Meteorology meteorological stations to the site identified the period from July 2018 to June 2019 as a representative year. Due to the distance between these meteorological stations and the Project site, a prognostic meteorological model (The Air Pollution Model (TAPM)) was run to determine local meteorological conditions. The windspeed, wind direction, temperature, relative humidity, net radiation, and daytime mixing height was extracted from TAPM and used as onsite data in AERMET (the meteorological pre-processor for AERMOD), to produce a meteorological file.

One operational scenario was modelled in AERMOD. The pollutants modelled included three dust size fractions including total suspended particulates (TSP), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$). Sources of TSP, PM_{10}, $PM_{2.5}$ and deposited dust included mechanical activities and wind erosion of open areas. In addition, the model included nine, two megawatt natural gas generators that emit PM_{10}, $PM_{2.5}$, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and volatile organic compounds (VOCs).

The predicted ground level concentrations (GLCs) exceeded the 24-hour criteria for TSP, at two of the three sensitive receptors related to human health. There were no other exceedances at these receptors for any pollutant. The predicted GLCs at the Malleefowl mound sensitive receptors had exceedances when compared with the 24-hour criteria for TSP and PM_{10} and, however these criteria are set for human health, and it is unclear what impact these GLCs may have on the Malleefowl. There were no exceedances of the relevant criteria for the annual average GLCs for TSP, PM_{10} and $PM_{2.5}$. The GLCs of dust deposition, NO_2, SO_2, CO, and VOCs were all significantly below the relevant criteria.

Effective management and mitigation measures to reduce the emission of airborne pollutants is important to ensure criteria are not exceeded at sensitive receptors. The following recommendations have been made:

- Prompt mitigation of excessive visible dust emissions, which may involve a combination of stabilisation of surface silt content through application of localised water spray application including the use of hypersaline groundwater.
- Control of mechanically induced dust emissions during material handling by application of water sprays.

- Ensuring a dust management plan/procedure is in place and management measures are implemented across the operation.
- Dust deposition monitoring is advised to be undertaken during operations.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.4 and the assumptions and qualifications contained throughout the report.

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Glossary of terms and abbreviations

Abbreviated term	Description
Air NEPM	*National Environment Protection (Ambient Air Quality) Measure*
Air Toxics NEPM	*National Environment Protection (Air Toxics) Measure*
AQ Guidelines Europe	Air Quality Guidelines for Europe Second Edition
BoM	Bureau of Meteorology
Capricorn	Capricorn Metals Ltd
CO	Carbon monoxide
Crimson Metals	Crimson Metals Pty Ltd
°C	Degrees Celsius
DPAW	Department of Parks and Wildlife
DWER	Department of Water and Environmental Regulation
DWER Air Guideline	*Draft Guideline: Air Emissions*
DWER Dust Guideline	*Draft Guideline: Dust Emissions*
EET	Emissions estimation technique
EFG: Air Quality	Environmental Factor Guideline: Air Quality
EIA	Environmental impact assessment
EPA NSW	New South Wales Environment Protection Authority
EPA Vic	Environment Protection Authority Victoria
EPA WA	Western Australia Environmental Protection Authority
g	Grams
GHD	GHD Pty Ltd
GLC	Ground level concentration
ha	Hectares
kg	Kilograms
km	Kilometres
IWL	Integrated waste landform
Kwinana EPP	*Environmental Protection (Kwinana) (Atmospheric Waste) Policy*
Kwinana EPR	*Environmental Protection (Kwinana) (Atmospheric Waste) Regulations*
m	Metres
Malleefowl	*Leipoa ocellata*
µg	Micrograms
mm	Millimetre
MRE	Mineral Resource Estimate
Mt	Mega tonnes
MW	Megawatts
NEPC	National Environment Protection Council
NPI	National Pollutants Inventory
NO_2	Nitrogen dioxide

Abbreviated term	Description
NO_x	Oxides of nitrogen
NSW AMMAAP	*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*
PBL	Planetary boundary layer
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of 2.5 microns or less
PM_{10}	Particulate matter with an aerodynamic diameter of 10 microns or less
ppm	Parts per million
ROM	Run of mine
s	second
SO_2	Sulphur dioxide
t	Tonnes
TAPM	The Air Pollution Model
Tetris Environmental	Tetris Environmental Pty Ltd
tpa	Tonnes per annum
TSF	Tailings storage facility
TSP	Total suspended particulates
VKT	Vehicle kilometres travelled
VOC	Volatile organic compound
WHO	World Health Organisation
WRD	Waste rock dump

1. Introduction

1.1 Background

Crimson Metals Pty Ltd (Crimson Metals) (a wholly owned subsidiary of Capricorn Metals Ltd (Capricorn)) propose the development of their second mining tenure in Western Australia, the Mt Gibson Gold Project (the Project).

Gold production was historically in operation from 1986 to 1999, where the deepest open pit was only 100 m below the surface and the average depth of mining was between 60-80 m below the surface (Capricorn, 2023).

The Project will expand on the decommissioned mine site, aiming to achieve 30 million tonnes per annum of ore and waste (Mtpa). The Project is expected to mine over 229 million tonnes (Mt) of waste and 49 Mt of ore over 12 years. The processing plant expected to process 5 Mtpa for approximately 10 years. The process plant will operate on three types of ores with the predominate ore being fresh (>70 percent). A Mineral Resource Estimate (MRE) completed for the Project by Capricorn, estimates a gold grade of 0.8 g/t.

1.2 Purpose of this report

Tetris Environmental Pty Ltd (Tetris Environmental) is managing the environmental approvals for the Project and have engaged GHD Pty Ltd (GHD) to undertake an air quality assessment for the Project. The purpose of this report is to evaluate and present predicted impacts to air quality associated with the operation of the proposed Project. This report will investigate the acceptability of predicted impacts to air quality against relevant ambient criteria.

1.3 Scope of works

The scope of works for this assessment is as follows:

- Undertake a desktop assessment to review the existing and receiving environment.
- Review relevant air quality standards to be used as assessment criteria in this report.
- Undertake a qualitative construction dust assessment.
- Produce a meteorological file using The Air Pollution Model (TAPM) and AERMET.
- Determine sources of emissions associated with the operation of the Project and develop an emissions inventory to be used in air dispersion modelling.
- Complete air dispersion modelling for one operational scenario for three dust size fractions including total suspended particulates (TSP), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), as well as deposited dust and gaseous emissions including nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO) and volatile organic compounds (VOCs).
- Assess predicted ground level concentrations (GLCs) of the above pollutants against relevant air quality criteria.
- Provide a report (this document) outlining development of the emissions inventory, meteorological data, dispersion modelling, assessment of results and management and mitigation measures where required.

1.4 Limitations

This report has been prepared by GHD for Tetris Environmental Pty Ltd and may only be used and relied on by Tetris Environmental Pty Ltd for the purpose agreed between GHD and Tetris Environmental Pty Ltd as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Tetris Environmental Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Tetris Environmental Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.5 Assumptions

This report is subject to the following general assumptions at the time of writing:

– All information provided by Tetris Environmental on behalf of Crimson Metals, including operational parameters and project site layout is correct.
– All parameters used in the model and other relevant data are based on best estimates using information provided by Tetris Environmental and other relevant sources.
– The meteorological data used and derived in this assessment is representative of the meteorology at the Project site.
– Operational scenario has been modelled as worst-case and operational sources assume emission controls are in place.

2. Project overview

2.1 Project details

Crimson Metals propose the development of the Mt Gibson Gold Mine Project on the tenements that are located at the southwest portion of the Yalgoo-Singleton Greenstone Belt in the Murchison Province of the Yilgarn Craton. The Project is located less than 10 km from the Great Northern Highway and 280 km northeast of Perth.

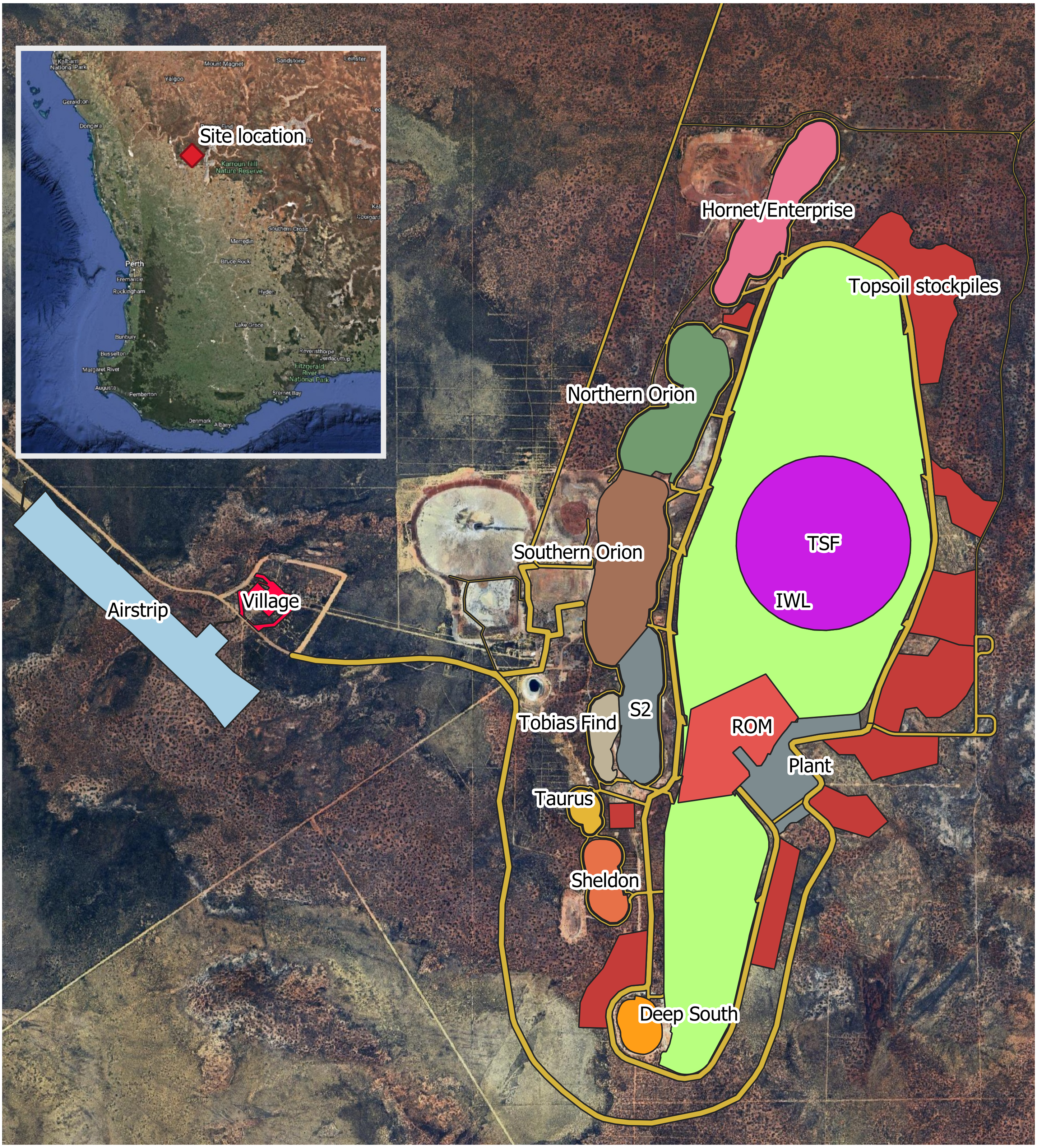
The combined area of tenure covers approximately 139 km^2 and is more than 15 km of strike. The proposed deposit design encompasses historic pits over an 8 km strike within the tenement. This design has further been defined to be 200 m to 250 m below surface. This contrasts with the historically mined average depth of 60 m to 80 m (Capricorn, 2023). The mining location and layout is shown in Figure 2.1.

Upon the completion of a Joint Ore Reserves Committee (2012) compliant MRE for the Project, the estimated gold grade is 0.8 g/t from the Project. The gold ore output is expected to be approximately 5 Mtpa with three types of ores (oxidised, transitional, and fresh), with the Project to be run for a period of 10 years following two years of pre-production. There will be construction of a run of mine (ROM), three-stage processing plant, integrated waste landform (IWL) and tailings storage facility (TSF).

2.2 Mining process

Mining operations will comprise of the following processes:

– Ore and waste are mined from the mining pits at an estimated average rate of 30 Mtpa.
– Ore from all pits will be taken via haul trucks and unloaded at the ROM, located in the IWL. Waste will be hauled to the waste rock dump (WRD) in the IWL (pending a pre-production waste movement of 29 Mt).
– Ore will be processed at three-stage crushing plant and milling circuit at a rate of approximately 5 Mtpa.
– Residue material from the processing of ore will be deposited into the TSF.
– Every one to two years the TSF will undergo a lift stage to ensure adequate storage at the TSF. The lift stage is estimated to be conducted over a three-month period.



Legend

Roads	Topsoil stockpiles	*Mine pits*
ROM	Airstrip	Hornet/Enterprize
IWL	Village	Northern Orion
TSF	Plant	

Southern Orion	Taurus
S2	Sheldon
Tobias Find	Deep South

Paper Size ISO A4

0 0.25 0.5 0.75 1 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Mt Gibson Air Quality Impact Assessment

Mine location and layout

Project No. **12606145**
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FIGURE 2.1

Document Path: \\ghdnet\ghd\AU\Perth\Projects\61\12606145\GIS\Maps\Working\12606145_AirQuality_working.qgz
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

2.3 Key project elements

2.3.1 Mining area

The mining will comprise of the following:

– Mining pits including Deep South, Sheldon Taurus, Tobias, S2, Southern Orion, Northern Orion, and Enterprise/Hornet.
– Load and haul mining fleet which consists of up to four excavators and 26 haul trucks of various capacities.
– Complementing the load and haul is drilling and blasting equipment including up to eight drill rigs and one mobile mining unit.
– Support equipment for the mining operations including up to three watercarts, two dozers, two graders, two loaders, two trucks, three bus, two service trucks and a rock breaker.
– IWL which consists of the following components.
  - ROM stockpile
  - TSF stockpile
  - WRD
– ROM stockpile with one wheeled loader for occasional ROM feed.
– The TSF are will require a lift with the help of four haul trucks, one watercart, one dozer, one excavator, one grader and one loader over a period of approximately three months everyone one to two years.
– Haul and mining roads for pit and IWL inspection.
– Light vehicle roads for general travel.

Mining will occur 24 hours a day, seven days a week.

2.3.2 Processing plant area

The processing plant will comprise of the following:

– Three-stage crushing plant and milling circuit with the following major components:
  - One primary jaw crusher
  - One secondary cone crusher
  - Two tertiary cone crushers
  - Crushed ore stockpile
  - Two vibrating screens or one double deck screen
  - Six major conveyors that are enclosed with chutes and skirts with dust suppression sprays. To be operated at 1.5 m per second (s) and maximum incline of 15 degrees.
– Power station with nine 2 MW generators fuelled by natural gas.
– Support infrastructure.

The crushing circuit will have 70 percent availability and the processing circuit is expected to have 95 percent availability over 24 hours a day, seven days a week.

2.4 Project timeline

The total mined output including waste and ore is expected to be around 30 Mtpa. Note that during production, the project has an approximate 4.7:1 waste to ore ratio.

Over ten years of operation, close to 229 Mt of waste and 49 Mt of ore is expected to be mined. Majority of this will be sourced from Orion North, South and Hornet/Enterprise and with the highest throughput occurring in the third, fourth, and fifth years as highlighted in Figure 2.2. These quantities are based on estimates at the time of writing and are used to calculate throughput for the purpose of modelling.

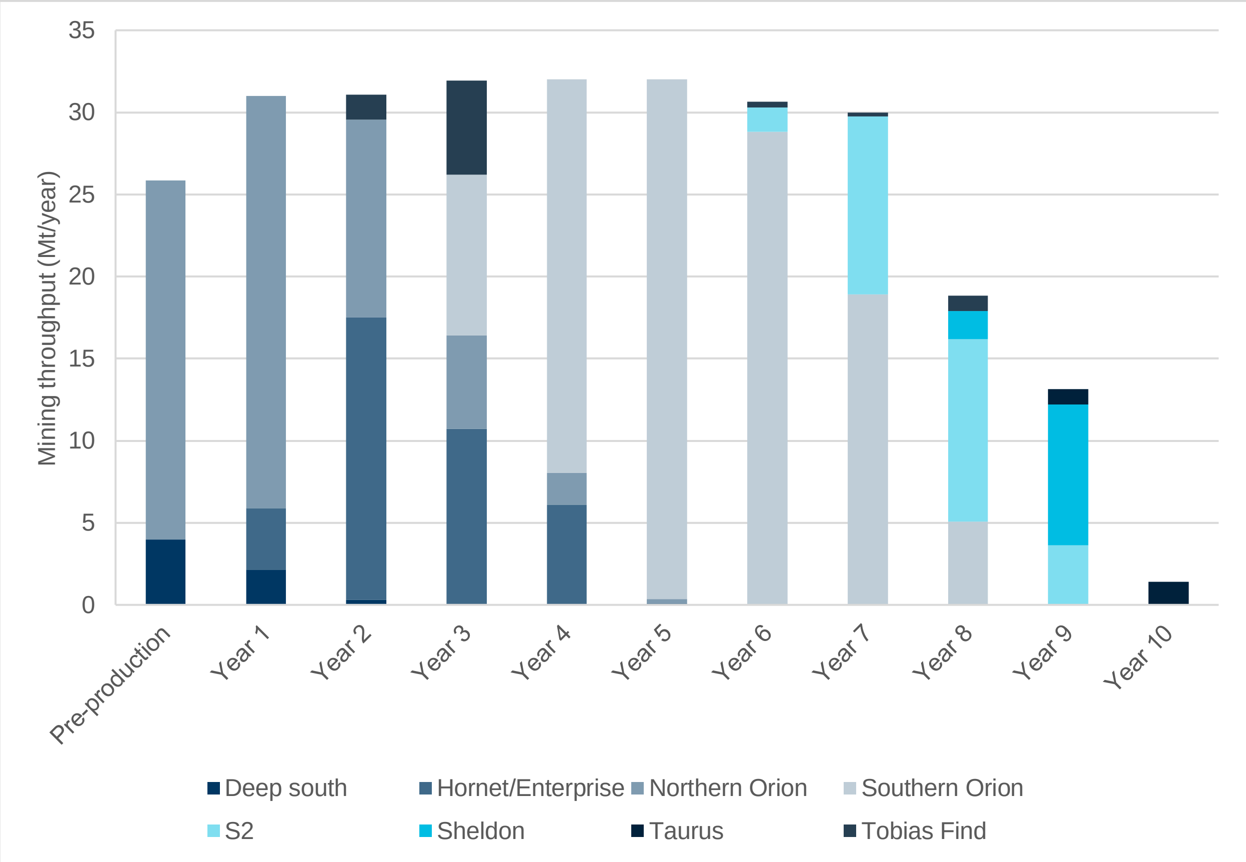

Figure 2.2 Indicative mining schedule

3. Air quality criteria

Results from the air dispersion modelling conducted in this assessment were compared to appropriate air quality criteria to investigate the acceptability of predicted impacts to the local environment. A desktop assessment was undertaken to review the most relevant ambient air quality criteria in terms of both human sensitive receptors, and local native fauna and flora. The sensitive receptors were identified as places where people live or regularly spend time and are therefore sensitive to emissions from industry with implications for human health or amenity (Department of Water and Environmental Regulation (DWER), 2021). This assessment also looks at potential impacts on local fauna and flora.

The following legal framework and standards were reviewed for relevance to the assessment:

– *National Environment Protection (Ambient Air Quality) Measure* (National Enviornment Protection Council (NEPC), 2021), referred to as Air NEPM
– *National Environment Protection (Ambient Air Quality) Measure* (NEPC, 2011), referred to as Air Toxics NEPM
– *Environmental Protection (Kwinana) (Atmospheric Waste) Policy* (1999) (Environmental Protection Authority of Western Australia (EPA WA), 1999), referred to as Kwinana EPP
– *Environmental Protection (Kwinana) (Atmospheric Waste) Regulations* (1992) (EPA WA, 2014), referred to as Kwinana EPR
– DWER Draft Guideline: Dust Emissions (DWER, 2021), referred to as DWER Dust Guideline
– DWER’s Draft Guideline: Air Emissions (DWER, 2019), referred to as DWER Air Guideline
– EPA WA’s Environmental Factor Guideline: Air Quality (EPA WA, 2020), referred to as EFG: Air Quality
– Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (New South Wales Environment Protection Authority (EPA NSW), 2022), referred to as NSW AMMAAP
– Air Quality Guidelines for Europe Second Edition (World Health Organisation (WHO), 2000), referred to as the AQ Guidelines Europe

3.1 National Environment Protection (Ambient Air Quality) Measure

The Air NEPM was developed to provide benchmark standards for ambient air quality to ensure all Australians have protection from the potential health effects of air pollution. Air NEPM standards have been developed for CO, NO_2, ozone (O_3), SO_2, lead, PM_{10} and $PM_{2.5}$. There is a goal to further reduce the maximum concentrations of SO_2 and $PM_{2.5}$ from the current standards by the year 2025. The Air NEPM standards relevant to this assessment are provided in Table 3.1.

Table 3.1 Air NEPM standards

Pollutant	Averaging period	Maximum concentration (µg/m^3)
CO	8-hours	10,310[1]
NO_2	1-hour	151[1]
	Annual	28[1]
SO_2	1-hour	262[1]
	1-hour (2025 goal)	197[1]
	24-hours	52[1]
PM_{10}	24-hours	50
	Annual	25

Pollutant	Averaging period	Maximum concentration (μg/m^3)
$PM_{2.5}$	24-hours	25
	24-hours (2025 goal)	20
	Annual	8
	Annual (2025 goal)	7

1. Gaseous emissions converted from ppm to μg/m^3 at 25 °C and 1 atmosphere

3.2 National Environment Protection (Air Toxics) Measure

The Air Toxics NEPM provides a framework for monitoring, assessing, and reporting on ambient levels of five air toxics, in order to facilitate the collection of information for the future development of air quality standards for these pollutants. In the absence of a criteria for VOCs, this assessment will use the criteria for benzene, as shown in Table 3.2.

Table 3.2 Air Toxics NEPM standards

Pollutant	Averaging period	Maximum concentration (μg/m^3)
Benzene	Annual	9.6[1]
Formaldehyde	24-hours	49.1[1]
Toluene	24-hours	3769[1]
	Annual	377[1]
Xylenes (o, m, p)	24-hours	1084[1]
	Annual	867[1]

1. Gaseous emissions converted from ppm to μg/m^3 at 25 °C and 1 atmosphere

3.3 Environmental Protection (Kwinana) (Atmospheric Waste) Policy and Regulations

The Kwinana region in southern Western Australia is covered by the Kwinana EPP. The Kwinana EPP provides for "ambient air quality standards and ambient air quality limits for the concentration of atmospheric wastes in the relevant portion of the environment" (EPA WA, 1999).

The Kwinana EPP defines the receiving environment as falling into one of three categories:

– Area A – Core heavy industrial area
– Area B – Buffer area beyond area A
– Area C – Beyond Areas A and B, predominately rural and residential

Concentrations for the limits (concentrations of atmospheric waste that shall not be exceeded) and standards (concentrations of atmospheric waste that should desirably not be exceeded) are provided in the Kwinana EPR (EPA WA, 2014) , which falls under the Kwinana EPP. The limits and standards set forth in the Regulations pertain to SO_2 and TSP.

The receiving environment surrounding the Project would most accurately be described as rural. Therefore, the limits and standards for Area C are most appropriate for this assessment. Limits and standards for Area C are shown in Table 3.3.

It is noted the Kwinana EPP is concerned with the environment surrounding the Kwinana Industrial Area, south of Perth, Western Australia. However in lieu of other local criteria, it has been presented here.

Table 3.3 Kwinana EPR criteria

Pollutant	Area	Averaging period	Standard (µg/m^3)	Limit (µg/m^3)
TSP	C	24-hours	90	150

3.4 Draft Guideline: Dust emissions

DWER released the Draft Guideline: Dust Emissions to ensure adequate information if provided to DWER for assessment of applications concerning fugitive dust emissions (DWER, 2021). The DWER Dust Guideline outlines criteria for dust and associated contaminants, which have been adopted from various documents including the Air NEPM. The DWER Dust Guideline provides guideline values for deposited dust, as shown in Table 3.4.

Table 3.4 DWER Dust Guideline criteria

Pollutant	Averaging period	Maximum concentration (µg/m^3)
Deposited dust	Maximum monthly increase (above background)	2 g/m^2/ 30 days
	Maximum monthly total	4 g/m^2/30 days

3.5 Draft Guideline: Air emissions

DWER recently released the Draft Guideline: Air Emissions to ensure adequate information if provided to DWER for assessment of applications concerning air emissions (DWER, 2019). The DWER Air Guideline outlines ambient air quality guideline values for criteria pollutants, taken from a number of sources reviewed in this report (NEPC, 2021; EPA NSW, 2022). The criteria relevant to this assessment are therefore already listed in the relevant sections of this report.

Table 3.5 DWER Air Guideline

Pollutant	Averaging period	Maximum concentration (µg/m^3)
TSP	24-hours	90
CO	1-hour	28,640[1]

1. Gaseous emissions converted from ppm to µg/m^3 at 25 °C and 1 atmosphere

3.6 Environmental Factor Guideline: Air Quality

The EPA WA released the EFG: Air Quality to communicate how the factor Air Quality is considered by the EPA WA in the environmental impact assessment (EIA) process. The EFG: Air Quality recognises that air quality not only impacts human health but also affects social surroundings, flora and vegetation, terrestrial environmental quality, or marine environmental quality (EPA WA, 2020). This outlines the importance of considering the impacts on the vegetation and fauna around the Project site.

3.7 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

The NSW AMMAAP provides methods for assessing emissions of air pollutants in NSW. As the Kwinana EPR provides a 24-hour guideline for TSP only, the annual limit for TSP from the NSW AMMAAP was reviewed, as well as criteria for gaseous ambient concentrations. Maximum allowable concentrations from the NSW AMMAAP are shown in Table 3.6.

Table 3.6 NSW AMMAAP standards

Pollutant	Averaging period	Maximum concentration (µg/m^3)
TSP	Annual	90

3.8 Air Quality Guidelines for Europe Second Edition

The AQ Guidelines Europe provide a basis for protecting public health from adverse effects of air pollutants, to eliminate or reduce exposure to hazardous air pollutants, and to guide national and local authorities in their risk management decisions (WHO, 2000).

The AQ Guidelines Europe also provide guideline values considering the ecological effects on terrestrial vegetation from NO_2, SO_2, ozone and other photochemical oxidants. The effect of particulate matter is not considered in the AQ Guidelines Europe.

Guideline values for oxides of nitrogen (NO_x) and SO_2 based on the effects on vegetation are shown in Table 3.7.

Table 3.7 WHO guideline values based on effects on terrestrial vegetation

Pollutant	Averaging period	Maximum concentration (μg/m^3)
SO_2	Annual	20[1]
NO_x	Annual	30

1. Vegetation category taken as forests and natural vegetation as most representative of the vegetation around the site.

3.9 Adopted assessment criteria

The air quality criteria chosen for use in this assessment were based on the desktop assessment above. Priority was given to Western Australian guidelines (where most applicable) followed by Australian guidelines, guidelines of other Australian states and territories and finally international guidelines. Adopted assessment criteria are shown in Table 3.8.

Table 3.8 Adopted assessment criteria

Pollutant	Averaging period	Criteria (μg/m^3)	Source
TSP	24-hours	90	Kwinana EPP and EPR (Area C)
	Annual	90	NSW AMMAAP
PM_{10}	24-hour	50	Air NEPM
	Annual	25	
$PM_{2.5}$	24-hours	25	Air NEPM
	24-hours (2025 goal)	20	
	Annual	8	
	Annual (2025 goal)	7	
Deposited dust	Maximum monthly increase (above background)	2 g/m^2/ 30 days	DWER Dust Guideline
	Maximum monthly total	4 g/m^2/30 days	
NO_2	1-hour	151	Air NEPM
	Annual	28	
	Annual (based on effects on vegetation)	30	AQ Guidelines Europe
SO_2	1-hour	262	Air NEPM
	24-hours	52	
	Annual	52	DWER Air Guideline
	Annual (based on effects on vegetation)	20	AQ Guidelines Europe
CO	1-hour	28,640	DWER Air Guideline

Pollutant	Averaging period	Criteria (µg/m^3)	Source
	8-hours	10,310	Air NEPM
Benzene	Annual	9.6	Air Toxics NEPM
Formaldehyde	24-hours	49.1	
Toluene	24-hours	3769	
	Annual	377	
Xylenes (o, m, p)	24-hours	1084	
	Annual	867	

4. Existing environment

This section provides a summary of the existing environment in terms a site description, land use, climate, ambient air quality and sensitive receptors.

4.1 Site description and surrounding land use

The Project site is situated within the mid-west region of Western Australia. The site is situated approximately 70 km southeast of former gold rush settlement Paynes Find, and approximately 70 km northwest of wheatbelt town Dalwallinu. The land around the site varies between 300 m and 400 m above mean sea level.

The local Project site is already disturbed due to previous gold mining operations from 1986 to 1999.

4.2 Climate

The local climate is hot and dry, with summer droughts and cold winters (Bureau of Meteorology (BoM), 2022). There is no local meteorological station near the site, so local the local meteorological conditions are unknown. BoM measures a range of meteorological parameters weather stations located at the nearby towns, Paynes Find and Dalwallinu. The locations of these weather stations relative to the Project site are shown in Figure 4.1.

Figure 4.2 to Figure 4.4 show the long-term average temperatures, relative humidity and rainfall measured at BoM meteorological stations at Paynes Find (007139) and Dalwallinu (008297). Paynes Find BoM station is more representative of the topology and terrain at the Project site, however hourly data is not available so meteorological conditions at Dalwallinu were also considered. Description of the climate conditions based on the BoM long term data is shown below:

– The highest mean maximum temperature for both sites occur in January. The mean maximum temperature through the summer months is about 2°C higher at Paynes Find than Dalwallinu. In January the mean maximum temperature reaches 37.4 °C at Paynes Find.
– The lowest mean minimum temperatures for both sites occur in July. The lowest mean minimum temperature occurs at Paynes Find, dropping to 5.5 °C.
– The relative humidity follows the same seasonal trend at both sites, with lower values during summer months and peaking during July. Dalwallinu has higher 9:00 am relative humidity than Paynes Find, and peaks at 86 percent during July. Through the summer months the 3 :00 pm relative humidity sits in the low 20s for both sites.
– Dalwallinu has significantly higher rainfall than Paynes Find in the month of July, with 50.4 mm and 35.0 mm respectively. From July through to November Dalwallinu has higher rainfall than Paynes Find, however from February to June this pattern is reversed.

Legend

- Site location
- Paynes Find BoM station (007139)
- Dalwallinu BoM station (008297)

Paper Size ISO A4
0 5 10 15 20 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Bureau of Meteorology weather station locations.

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Revision No. **2**
Date. **9/08/2023**

FIGURE 4.1

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

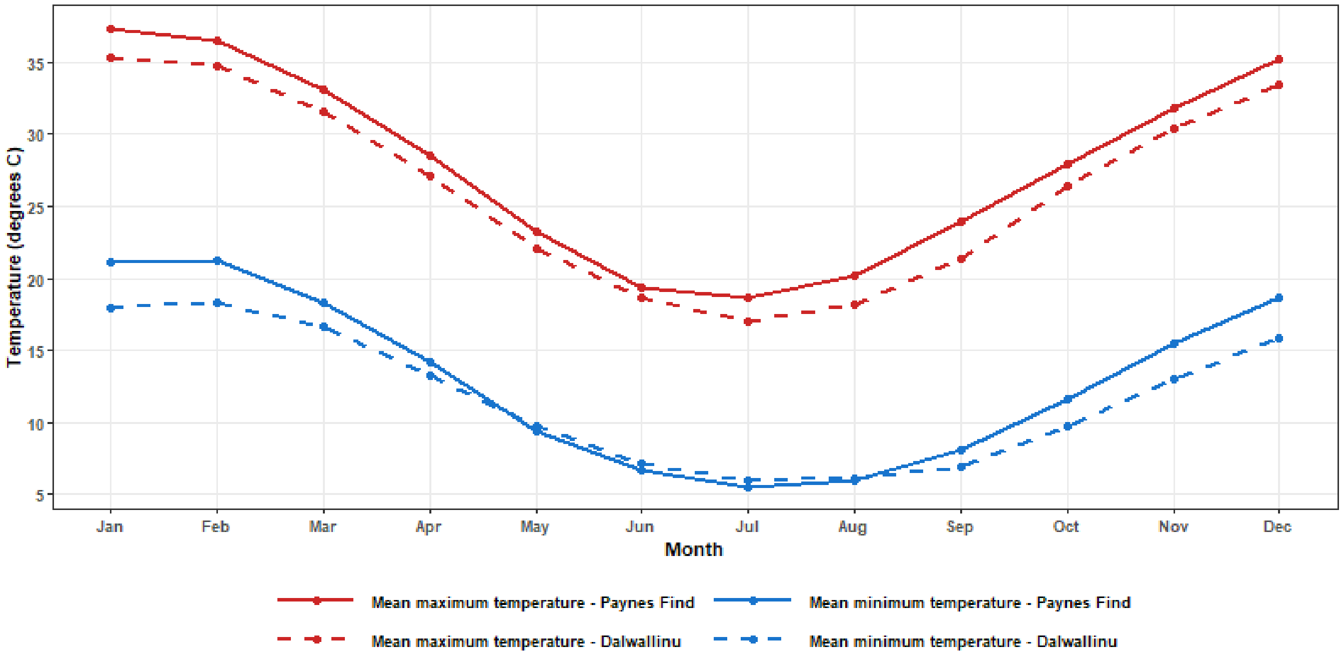


Figure 4.2 ***Long-term maximum and minimum temperatures recorded at BoM meteorological stations at Paynes Find (007139) and Dalwallinu (008297)***

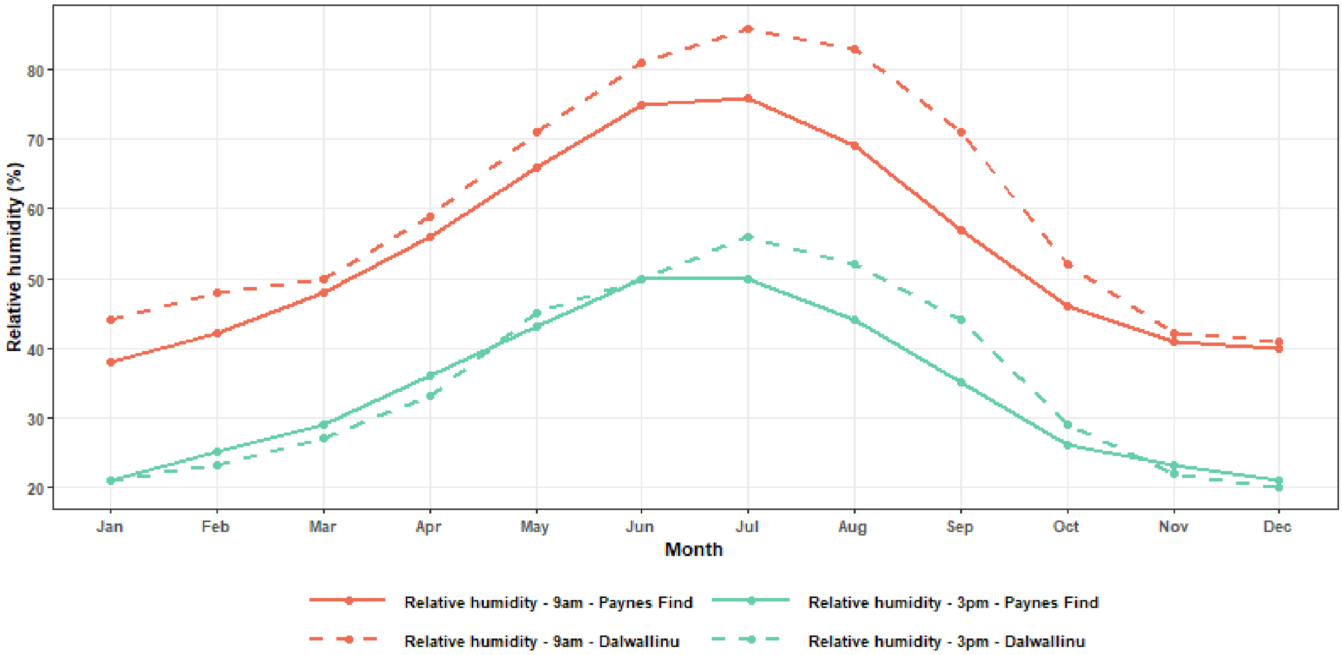


Figure 4.3 ***Long-term relative humidity measured at 9 am and 3 pm at BoM meteorological stations at Paynes Find (007139) and Dalwallinu (008297)***

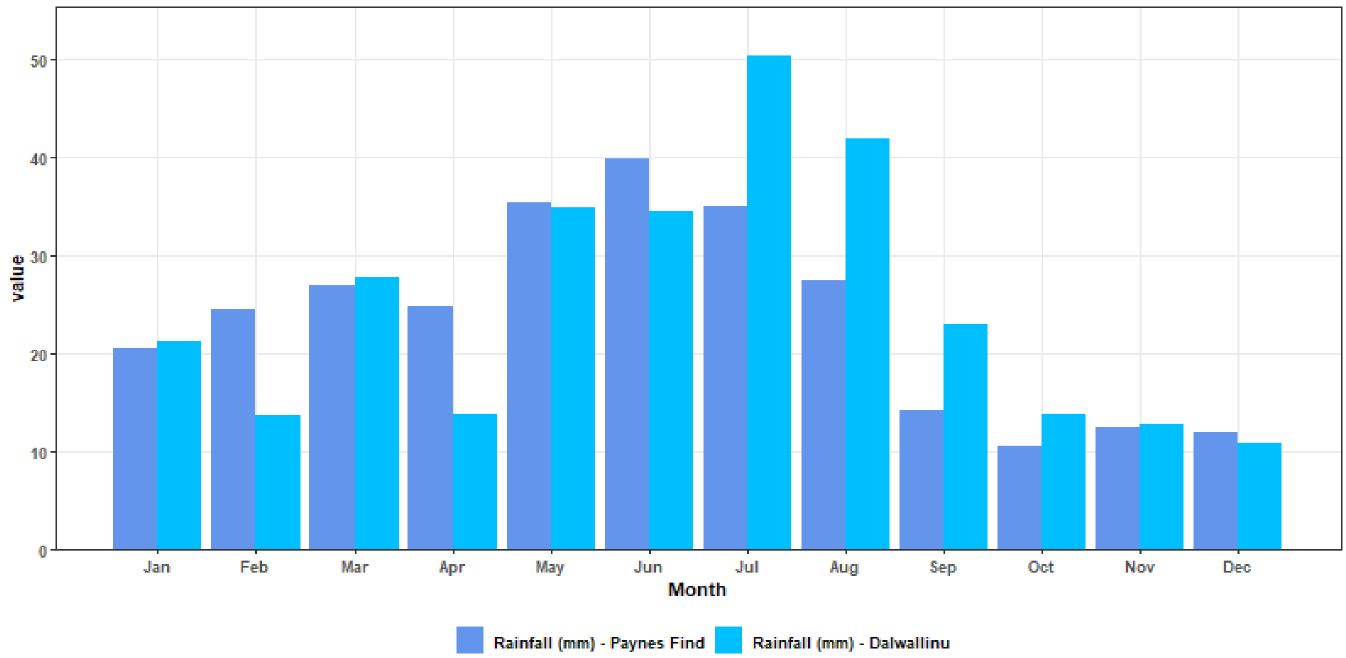


Figure 4.4 ***Long-term mean monthly rainfall (mm) recorded at BoM meteorological stations at Paynes Find (007139) and Dalwallinu (008297)***

4.3 Wind conditions

The local wind conditions vary seasonally in strength and direction. The summer months show winds from the southwest and southeast, with strong wind conditions. Winter shows a higher proportion of winds from the northwest and wind speeds tend to be lower.

Figure 4.5 shows seasonal and annual wind roses from 2017 to 2021. Hourly wind data is not available from Paynes Find station, so the wind roses show data from Dalwallinu meteorological station.

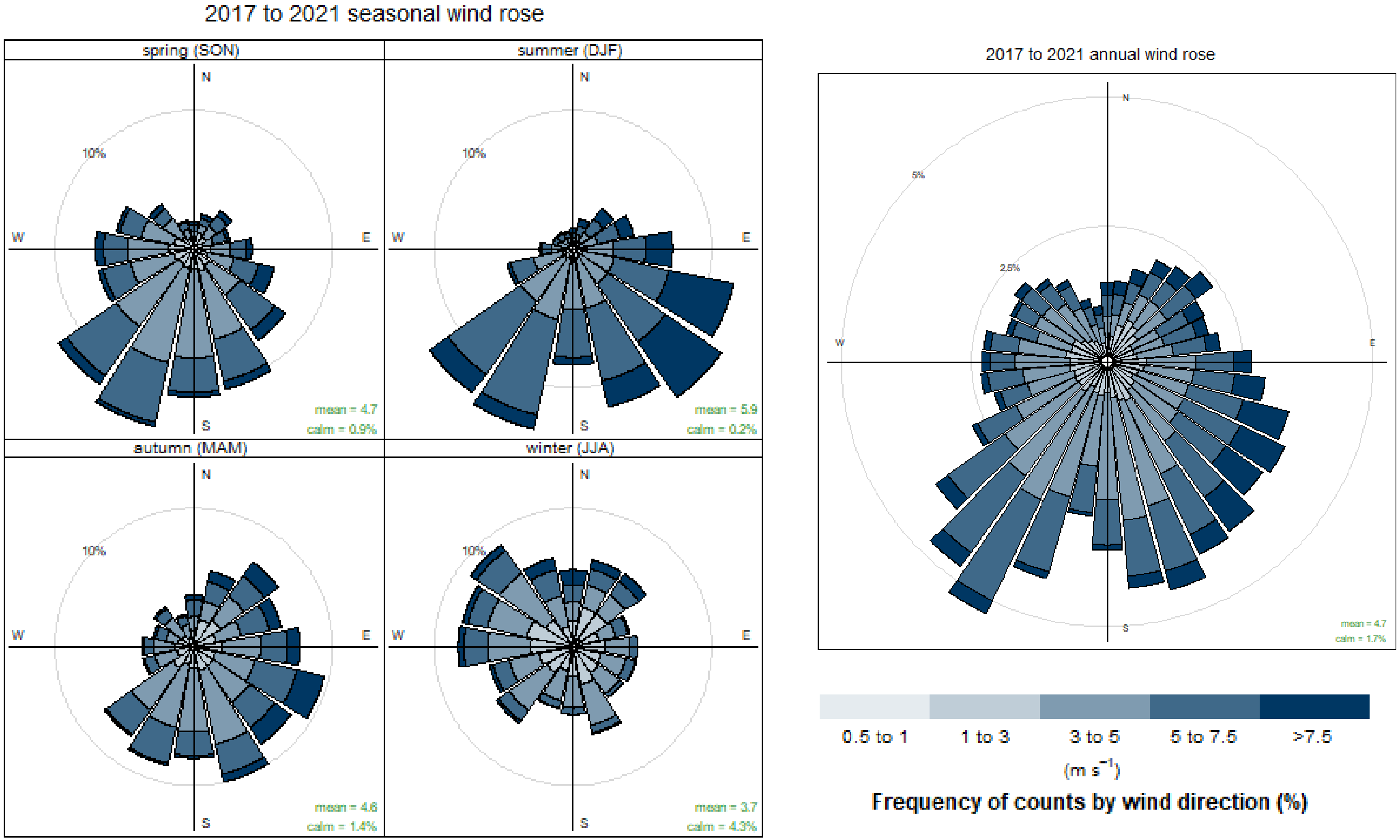


Figure 4.5 ***Seasonal and annual wind roses showing data recorded at Dalwallinu BoM meteorological station (008297) between 2017 and 2021***

4.4 Existing ambient air quality

There is currently no onsite air quality monitoring data to analyse the existing ambient air quality at the Project site. Therefore, a quantitative description of the site is not possible.

Due to the remote location of the Project site, it is expected that the air quality will be generally good, with little to no contribution of anthropogenic gaseous emissions (NO_2, SO_2, CO or VOCs). Minor emissions from local road traffic may contribute to be low levels of these pollutants for very brief periods as vehicles pass through the area but it is expected that these emissions are insignificant.

The dry climate may increase the effect of dust emissions where vegetation cover is sparse, particularly during the summer months, when wind conditions may be strong and soil moisture levels very low. Wheel generated dust is likely to occur on unsealed roads or tracks, however it is likely that this dust would quickly disperse or settle.

Bushfires and controlled burning of the surrounding vegetation may have short-term impacts on the local air quality.

4.5 Sensitive receptors

This assessment evaluated GLCs at locations where people live or regularly spend time as well as impacts on local fauna and vegetation.

4.5.1 Human health

DWER defines sensitive receptors as places people live or regularly spend time (DWER, 2021). The locations identified were the Project accommodation village, a prospecting campground, the Mummaloo mine site and Mummaloo accommodation camp. The location of the Project site is considered regional, as it is not located within close proximity to a city or town. The closest towns are Paynes Find and Wubin, located approximately 70 km northeast and 63 km southwest respectively.

4.5.2 Ecosystem health

The impacts of particulate matter and other airborne pollutants on ecosystems has not been well studied, however the existing research indicates that poor air quality can negatively impact ecosystems (United States Environmental Protection Agency, 2023). Surveys of the area surrounding the Project site identified locations of conservation significant fauna, flora, and vegetation. This assessment considers the impact of airborne pollutants from the mine's operations on these species.

Research into the responses of avian species to air pollution have found many complications including respiratory distress and illness, increased detoxification effort, elevated stress levels, immunosuppression, behavioural changes, and impaired reproductive success (Sanderfoot & Holloway, 2017). The research has only looked at impacts on a few avian species and may not be representative of all species.

The local fauna dataset included active and inactive mounds for the *Leipoa ocellata* (Malleefowl). Some sightings were located over the planned mining pits and infrastructure. These were not considered sensitive receptors as the birds will have moved from the area before mining activities occur. Active mounds outside the Project activities were considered as sensitive receptors in this assessment.

A sighting of *Falco peregrinus* (peregrine falcon) was recorded on the fauna survey. The peregrine falcon is found in a wide range of habitats and is listed as a specially protected fauna in Western Australia (DPAW, 2019). As the peregrine falcon can have a home range of over 30 km (Jenkins & Benn, 1998) it was not considered a sensitive receptor.

Idiosoma kopejtkaorum is a Western Australian listed endangered species of shield-backed trapdoor spiders found close to the Project site. The spider is found around Lake Goorly and Lake Moore catchments and the distribution appears to be strongly correlated with annual rainfall between 250 and 300 mm, in areas with red clay soils (Rix, et al., 2018). The spiders rely on leaf litter, so it is unlikely they will be found in areas cleared of vegetation where mining activities will occur. Limited research on the spiders has identified changes in soil moisture content as a key stressor (Main, 2010). As the spider spends most of its life in burrows underground, the burrows were not considered sensitive receptors.

Nyctophilus major tor (central long-eared bat) is currently listed as a Priority 3 species in Western Australia (DPAW, 2019). As the bats roost in tree hollows and amongst foliage (Andrew, 2015), the locations of bat sightings were not considered as specific sensitive receptors for this assessment.

Egernia stokesii badia (Western spiny-tailed skink) were not sighted during the surveys but is considered likely to live in the area. As there were no sighting locations they could not be included as sensitive receptors.

A summary of protected fauna found surrounding the site is shown in Table 4.1.

Table 4.1 Local fauna species as provided by Tetris Environmental (received 7/6/2023).

Species name	Conservation status
Leipoa ocellata	Vulnerable (State and Commonwealth listed)
Falco peregrinus	Other specifically protected fauna (State listed)
Idiosoma kopejtkaorum	Endangered species (State listed)
Nyctophilus major tor	Priority three (State listed)
Egernia stokesii badia	Vulnerable species (State listed) Endangered (Commonwealth listed)

Particulate matter has been found to affect the physiological responses in plants through many different direct routes, including blocking stomata, causing injury to leaves, increasing leaf temperatures, damage to bark and altering growth rates (Farmer, 1993). However, a study investigating the impact of dust on plant health in a similar climate investigating survivorship in semi-arid environments looked at the impact of dust from a mine on *Tetratheca paynterae paynterae* (a small shrub), in the Goldfields region. While the assessment found signs of physiological stress on the plants nearer the mine, there was no statistically significant relationship between dust deposition on the plants and the survivorship rates (Matsuki, et al., 2016).

Surrounding the Project site are Eucalypt woodlands. These are classified as a priority ecological community (PEC) in Western Australia by the Department of Biodiversity, Conservation and Attractions (DBCA) and listed as a threatened ecological community (TEC) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%. The key dominant or co-dominant species of the tree canopy are species of Eucalyptus trees that typically have a single trunk. Native understorey is present but is of variable composition, being a combination of grasses, other herbs, and shrubs (DBCA, 2023).

The flora surveyed of the area around the Project site identified 16 species of plants native to Western Australia, with conservation classifications of threatened and priority species (poorly known species), as shown in Table 4.2.

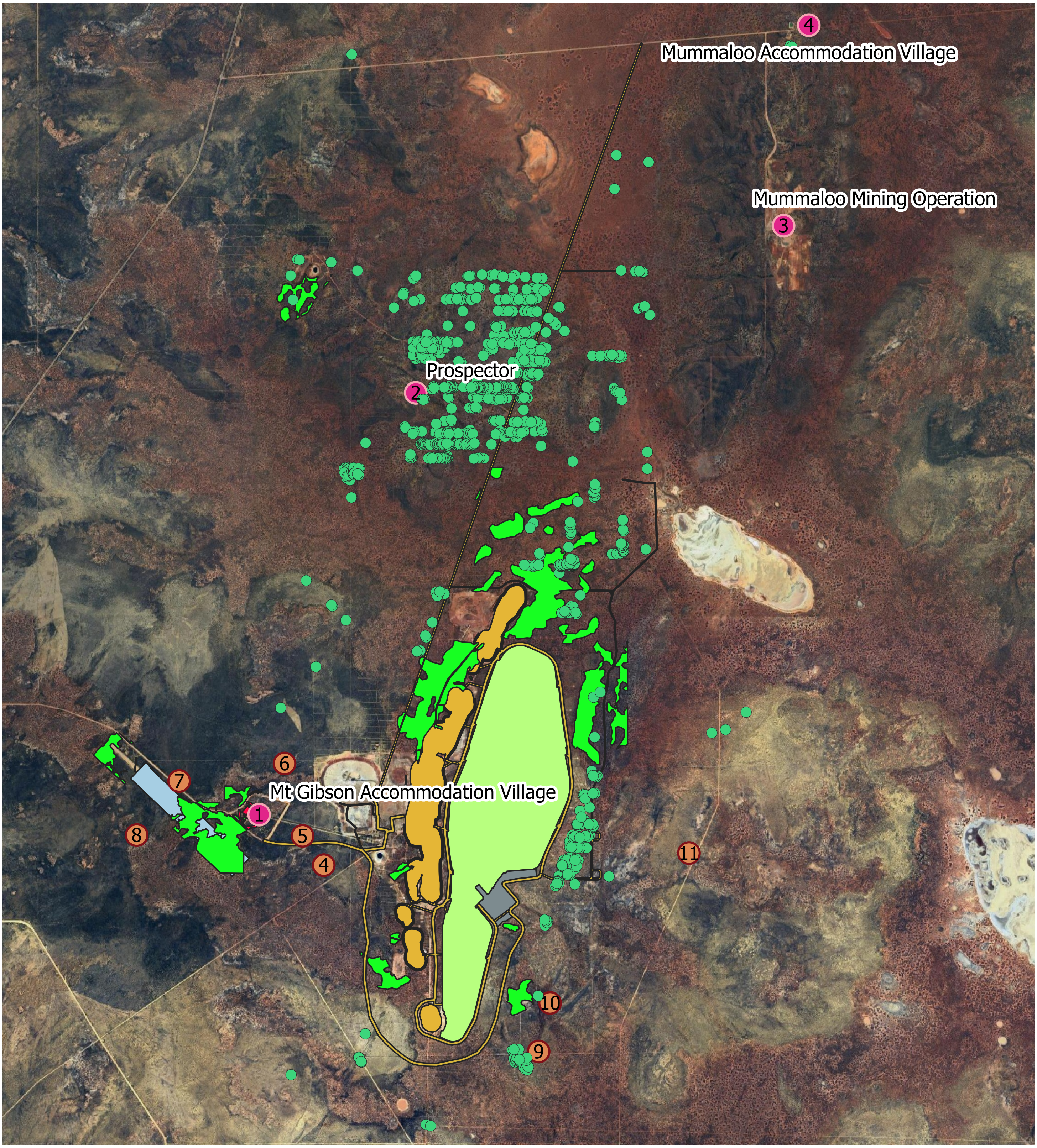
Table 4.2 Local flora species as provided by Tetris Environmental (received 31/5/2023).

Species name	Conservation code
Acacia synoria	Priority two
Allocasuarina tessellata	Priority three
Alyxia tetanifolia	Priority three
Verticordia venusta	Priority three
Calytrix plumulosa	Priority three
Enekbatus longistylus	Priority three
Eremophila viscida	Threatened
Euryomyrtus recurva	Priority three
Grevillea scabrida	Priority three
Grevillea subtiliflora	Priority three

Species name	Conservation code
Hibbertia cockertoniana	Priority three
Lepidosperma sp. Blue Hills	Priority one
Melichrus sp. Bungalbin Hill	Priority three
Microcorys tenuifolia	Priority three
Persoonia pentasticha	Priority three
Philotheca nutans	Priority one

4.5.3 Adopted sensitive receptors

Figure 4.6 and Table 4.3 presents the adopted sensitive receptors for this assessment. This includes places people regularly spend time and active Malleefowl mounds. Native vegetation and flora, including the Eucalypt woodlands (TEC/PEC) will be assessed against criteria outlined in Section 3.9 using contour plots.



Legend

- Mine pits
- Plant Area
- Roads
- Airstrip
- IWL
- Village
- Plant
- Topsoil stockpiles
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Native vegetation
- Eucalypt woodlands (TEC/PEC)

Paper Size ISO A4

0 0.5 1 1.5 2 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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GHD

Tetris Environmental Pty Ltd

Mt Gibson Air Quality Impact Assessment

Human and ecological sensitive receptor locations

Project No. **12606145**
Revision No. **2**
Date. **9/08/2023**

FIGURE 4.6

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
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Table 4.3 Sensitive receptors

Receptor ID	Category	Detail	Easting	Northing	Distance from Project boundary (km)	Direction from Project boundary
R01	Human	Mt Gibson accommodation village	513417	6708687	2.42	W
R02	Human	Prospector	516016	6715686	3.74	N
R03	Human	Mummaloo mining operation	522115	6718459	8.04	NE
R04	Human	Mummaloo accommodation village	522532	6721786	10.84	NE
R05	Fauna	Active mound - *Leipoa ocellata*	514489	6707849	0.87	W
R06	Fauna	Active mound - *Leipoa ocellata*	514138	6708335	1.22	W
R07	Fauna	Active mound - *Leipoa ocellata*	513839	6709536	1.67	W
R08	Fauna	Active mound - *Leipoa ocellata*	512091	6709246	3.34	W
R09	Fauna	Active mound - *Leipoa ocellata*	511387	6708348	3.97	W
R10	Fauna	Active mound - *Leipoa ocellata*	518053	6704757	1.10	SE
R11	Fauna	Active mound - *Leipoa ocellata*	518242	6705563	0.79	SE
R12	Fauna	Active mound - *Leipoa ocellata*	520545	6708050	2.00	E

5. Construction assessment

This section presents the qualitative assessment of air emissions likely to result during construction of the Project.

Potential air quality impacts during construction of the Project will be from:

- Heavy vehicle exhausts
- Dust generation from heavy equipment during earthworks
- Wind erosion from disturbed soil surfaces.

The impacts are considered to be short-term in nature with no permanent impacts, and therefore will only be assessed qualitatively in the sections below.

5.1 Heavy machinery

Emissions from heavy vehicles and diesel-powered equipment may consist of products of combustion, including NO_x, SO_2, CO, PM_{10} and VOCs. Emissions from heavy equipment can be minimised by ensuring all vehicles onsite are well maintained and operated in an efficient manner.

Ensuring vehicles are well maintained, emissions from construction vehicles on-site are not considered to significantly impact air quality at the sensitive receptors.

5.2 Construction dust

The impacts of dust emissions fall under two distinct categories:

- Human health – PM10 and PM2.5
- Nuisance and visibility – TSP and deposited dust

Amenity impacts from dust are most likely to occur in high wind conditions, when large particles may be displaced and transported a significant distance before being deposited and soiling surfaces. Excessive amounts of dust may cause nuisance and in very extreme events, affect visibility onsite.

The following construction activities can be a source of dust emissions:

- Mechanical disturbance: dust emissions resulting from the operation of construction equipment and vehicles.
- Wind erosion: dust emissions from exposed and disturbed soil surfaces under high wind speeds during construction.
- Any blasting associated with the construction phase.

The extent to which these emissions may impact the surrounding land uses (sensitive receptors and native vegetation) would depend on several site-specific factors including type and number of construction equipment/machinery, soil characteristics, meteorology, and shift times.

6. Meteorological modelling

Meteorology is a required component of air quality assessments due to the effects that climate and weather have on air quality and the dispersion of air pollutants. As there is no available site-specific meteorological data, TAPM was used to generate meteorological data to be used in AERMET.

TAPM is a three-dimensional prognostic meteorological model that can predict regional scale meteorology. It is suitable for use with complex geographical sites, such as coastal zones, and/or when the available site representative meteorological data are not adequate. The model accesses databases of global synoptic weather analyses and is configured with surface characteristics, such as terrain elevation, surface roughness/vegetation type, soil type, sea surface temperature and deep soil moisture content. TAPM then provides the link between the synoptic largescale flows and the local climatology.

Prognostic meteorological data were generated by TAPM for July 2018 to June 2019. This year of meteorological data were then input into the meteorological pre-processor, AERMET. AERMET is a general-purpose meteorological pre-processor for configuring available meteorological data into a format suitable for use by the AERMOD dispersion model.

6.1.1 TAPM configuration

For the period 1 July 2018 to 30 June 2019 TAPM was configured with a nested model grid designed to capture:

- Broad scale synoptic flows
- Regional and broader wind channelling around terrain features
- The influence of land use

The nested grids where then configured with the surface characteristics, such as terrain elevation, surface roughness/vegetation type, soil type, monthly varying deep soil moisture content and sea surface temperature for open water bodies. TAPM set up follows the guidance provided by the Environment Protection Authority Victoria (EPA Vic) (EPA Vic, 2014).

Specific model settings were as follows:

- Two day spin up period
- Run from 29 June 2018 to 30 June 2019
- Four nested grids at 1000 m, 3000 m, and 10,000 m and 30,000 m with 41 x 41 grid points
- 25 vertical levels, ranging from the surface to 8000 m
- Grid centred at -29.75° S, 117.17° E at a local grid centre of 516142 m E and 6708874 m S
- Characterised vegetation and land use was determined from the datasets provided

6.1.2 AERMET configuration

AERMET was run with local meteorological data as well as upper air data from TAPM.

The following meteorological parameters taken from the TAPM output were processed through AERMET in line with guidance from EPA Vic (2014):

- Year, month, day and hour
- Wind speed (m/s)
- Wind direction (degrees from true north)
- Temperature (°C)
- Relative humidity (percent)
- Net radiation (Watts/m^2)
- Day time mixing height (m)

Parameters that are used to characterise the planetary boundary layer (PBL), within which, conditions drive the dispersion of pollutants, were defined. Surface roughness is a measure of the friction air flow experiences over the land. Albedo is a measure of the reflectivity of the earth's surface, and Bowen Ratio is a measure of the transfer of heat of the earth's surface. PBL parameters that occur over land and therefore used in AERMET for this assessment are defined in Table 6.1.

Table 6.1 Planetary boundary layer parameter values

Parameter	Value used in AERMET
Surface roughness (m)	0.03 – 0.3 (by sector)
Albedo	0.186
Bowen ratio	1.2 – 1.5 (seasonal range)

Using the above parameters, AERMET generated the surface file and upper air (profile) file required by AERMOD.

Wind roses for the AERMET data used in the dispersion modelling are shown in Figure 6.1. The mean wind speeds from AERMET are lower than the mean windspeeds recorded at the Dalwallinu BoM meteorological station for the same period, as shown in Figure 6.2. The AERMET file has <0.1 percent fresh winds (17 knots (BoM, 2023)) compared with three percent recorded at the Dalwallinu BoM station. The wind directions from the AERMET file and the Dalwallinu BoM station are very similar in spring and summer, however the AERMET file has predominantly easterly winds during winter, which is not seen in the data from the Dalwallinu BoM station.

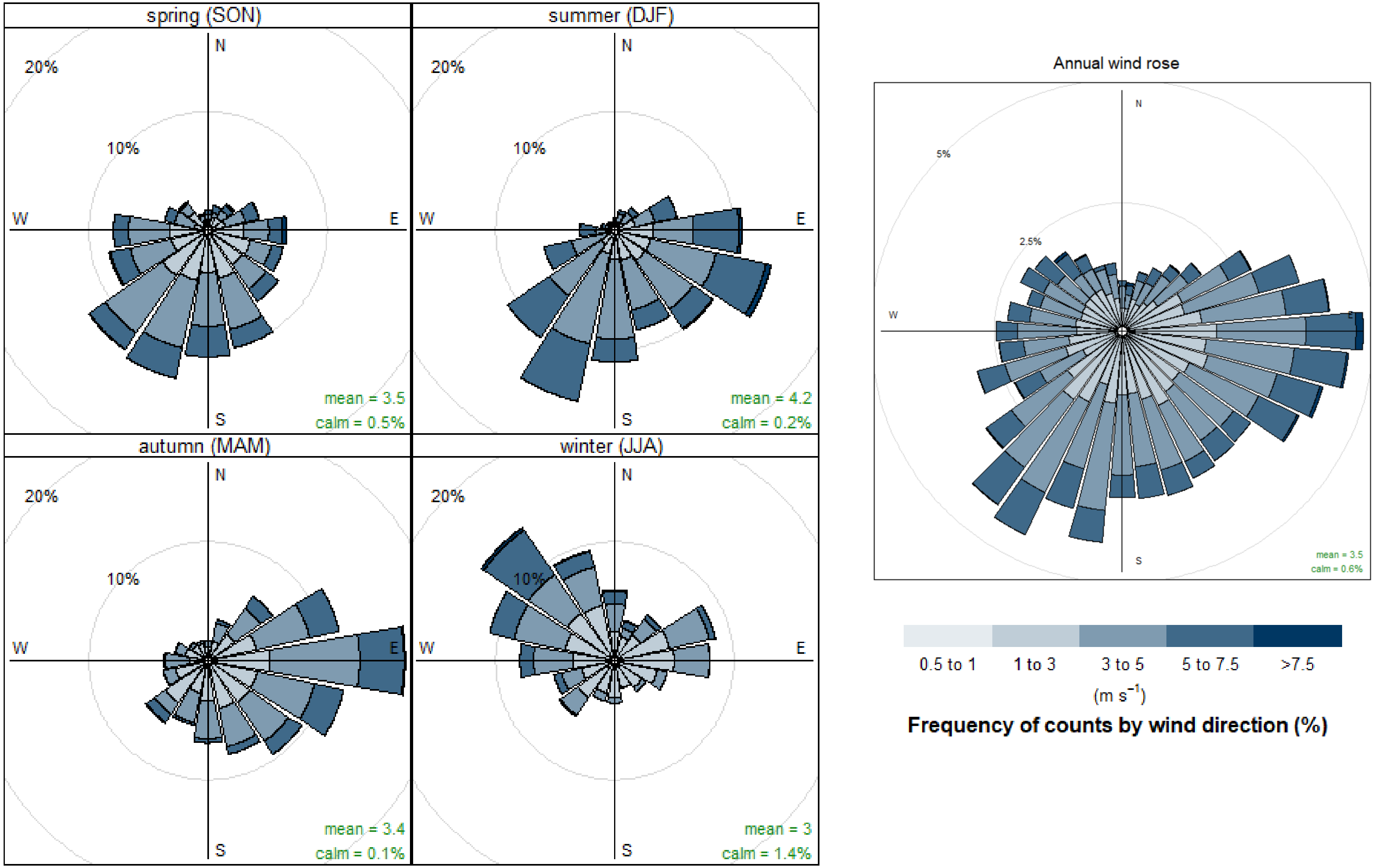


Figure 6.1 Seasonal and annual wind roses showing AERMET predicted wind roses between July 2018 and June 2019

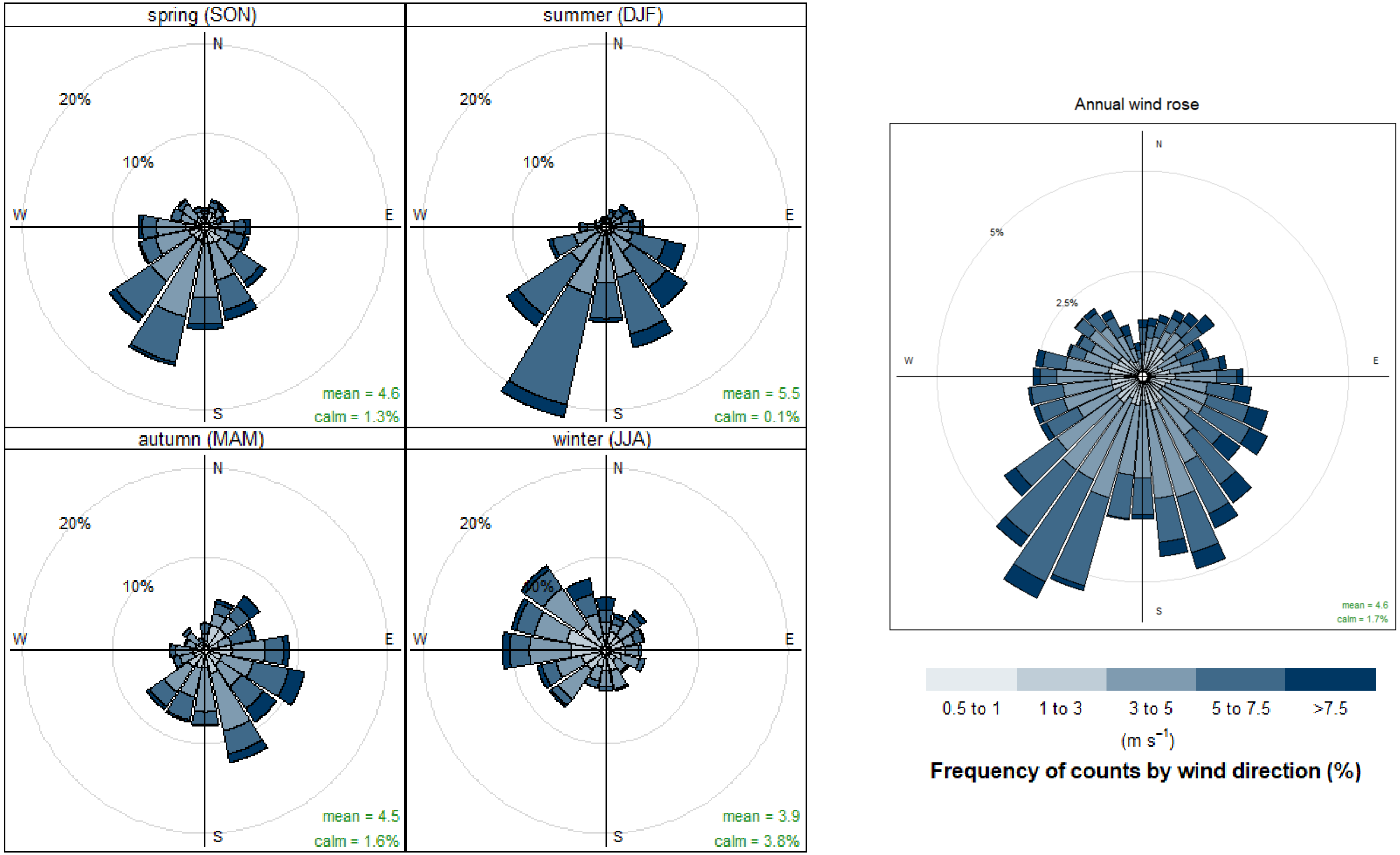


Figure 6.2 *Seasonal and annual wind roses showing data recorded at Dalwallinu BoM meteorological station (008297) between July 2018 and June 2019*

7. Dispersion modelling

7.1 Modelling scenarios

One modelling scenario was scoped for this assessment. Year four was selected for the assessment as it was considered worst case scenario, based on the following:

– The duration of year four mines Hornet/Enterprise pit and the Northern Orion pit both to the north, and which are closest to the human sensitive receptors. Southern Orion is also mined during year four.
– Year five has the highest throughput (32,000,030 t) and mines Southern Orion only. Year four mines 32,000,000 t.
– The amount mined between the two years is insignificant and year four has more activity at the northern pit boundary compared to year five.

7.2 Emission estimation

An hourly emissions inventory was created representing emissions to air associated with the operation of the Project. Air emission sources included wind erosion from the ROM, TSF and the active area of the mining pit, mechanically generated dust emissions from haul trucks, front end loaders and other mobile machinery and emissions from nine natural gas generators. Emissions were reduced based on mitigation measures that will be employed in the operational phase.

Emissions were calculated in line with methodology from the National Pollutant Inventory (NPI) Emission Estimation Technique Manuals (EET) for:

– Mining (Version 3.1) (Australian Government, 2012)
– Combustion engines (Version 3.0) (Australian Government, 2008)

The general equation for estimating hourly emissions is shown below.

$$E_i = A \times EF_i \times \left(1 - \frac{CE_i}{100}\right)$$

Where:

E_i is the emission rate of the pollutant i (kg/hour)

A is the activity rate (tonnes/hour)

EF_i is the uncontrolled emission factor of pollutant i (kg/tonne)

CE_i is the overall control efficiency for the pollutant i (kg/tonne)

For wind erosion sources and mechanically generated dust, default emission factors from the NPI manual for mining (Australian Government, 2012) were used for TSP and PM_{10}. A ratio of 0.15 was assumed for the fraction of PM_{10} to $PM_{2.5}$ for all dust sources included in the dispersion model.

The sources and emissions included in the dispersion model are shown in Table 7.1 and Table 7.2.

Table 7.1 Sources and emission rates included in the dispersion model – Mining and processing activities

Number	Equipment ID	Activity	Dust control measures (percent dust reduction)	Mitigated emission rate (g/s)		
				TSP	PM_{10}	$PM_{2.5}$
			Sources at ROM			
1	LOADER1	Komatsu WA900 wheeled loader	Water sprays (50%)	2.23	1.07	0.16
			Loading and hauling between pit, ROM, and waste landform			
3	EXC1	Excavators in pits (Liebherr R9200 and Komatsu PC1250-8)	Water sprays (70%)	1.90	0.91	0.14
20	DUMP_180	Hitachi EH3500AC-3 haul truck	Water sprays on haul roads with hypersaline water (90%)	1.47	0.43	0.07
6	DUMP_90	Komatsu HD785-7 haul truck	Water sprays on haul roads with hypersaline water (90%)	1.47	0.43	0.07
1	UNLOAD1	Unloading at waste landform	Water sprays and rock armour/topsoil applied (85%)	3.51	1.26	0.19
1	UNLOAD2	Unloading at ROM	Water sprays (50%)	2.67	1.16	0.17
			Drilling and blasting			
8	DRILL	Top hammer drill rigs (approximately 13,600 holes per month)	Water sprays (50%)	0.19	0.10	0.02
1	TRUCK1	Volvo FM9 truck	Level 1 watering (2L/m^2/hr) (50%)	5.88	1.74	0.26
1	BLAST	Blasting (occurring 3 days per week for 1 hour per day)	Water sprays (50%)	26.1	13.5	2.0
			Support vehicles			
3	DOZER1	Caterpillar D10T dozer	Water sprays (50%)	2.36	0.57	0.09
2	GRADER1	Caterpillar 16M grader	Level 1 watering (2L/m^2/hr) (50%)	0.26	0.12	0.02
2	TRUCK2	Scania G410	Level 1 watering (2L/m^2/hr) (50%)	5.88	1.74	0.26
1	ROCKBREAKER	Caterpillar 336DL excavator	Water sprays on pits (50%)	0.10	0.05	0.01
2	LOADER2	Caterpillar IT930 and Caterpillar 988K wheel loader	Water sprays on pits (50%)	4.23	2.03	0.30
2	TRUCK3	2WD Isuzu NPS300	Level 1 watering (2L/m^2/hr) (50%)	1.31	0.46	0.07
1	BUS1	2WD Toyota Coaster	Level 1 watering (2L/m^2/hr) (50%)	1.31	0.46	0.07
2	BUS2	4WD Isuzu Abbel	Level 1 watering (2L/m^2/hr) (50%)	1.31	0.46	0.07
			TSF operations (summer only)			

Number	Equipment ID	Activity	Dust control measures (percent dust reduction)	Mitigated emission rate (g/s)		
				TSP	PM_{10}	$PM_{2.5}$
4	DUMP_40	Bell B40D haul truck	Level 1 watering (2L/m^2/hr) (50%)	5.88	1.74	0.26
1	DOZER2	Caterpillar D9T dozer	Topsoil naturally moist (50%)	2.36	0.57	0.09
1	EXC2	Komatsu PC300 excavator	Topsoil naturally moist (50%)	9.02	4.33	0.65
1	GRADER2	Caterpillar 14M grader	Level 1 watering (2L/m^2/hr) (50%)	0.26	0.12	0.02
1	LOADER3	Komatsu WA600 wheeled loader	Level 1 watering (2L/m^2/hr) (50%)	9.02	4.33	0.65
			Processing plant			
1	CRUSHER1	Primary Jaw Crusher (Metso C160 or equivalent)	Enclosure (70%)	0.53	0.21	0.03
1	CRUSHER2	Secondary Cone Crusher (Sandvik CH860Ci or equivalent)	Enclosure (70%)	1.60	0.64	0.10
2	CRUSHER3	Tertiary Cone Crushers (Sandvik CH865Ci or equivalent)	Enclosure (70%)	0.80	0.27	0.04
2	SCREEN	Vibrating screens	Enclosure (70%)	0.33	0.11	0.02
6	CONVEYOR	Conveyor in processing plant	Water sprays (70%)	0.04	0.02	2.67×10^{-3}
			Wind erosion sources			
1	DEEP_SOUTH	Deep South mine pit (100%)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	HORN_ENT	Hornet/Enterprise mine pit (100%)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	N_ORION	Northern Orion mine pit (100%)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	S_ORION	Southern Orion mine pit (29%)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	T_FIND	Tobias Find mine pit (55%)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	ROM	ROM (including unprocessed ore stockpile)	Water sprays on pits (50%)	*Hourly variable emission rate*		
1	TSF	TSF	Water sprays (50%)	*Hourly variable emission rate*		
1	WASTE	Waste rock landform (north of TSF)	Rock armour/topsoil applied (30%)	*Hourly variable emission rate*		

Table 7.2 Sources and emission rates included in the dispersion model – Natural gas generators

Number	Equipment ID	Activity	Emission rate (g/s)					
			PM_{10}	$PM_{2.5}$	NO_2	SO_2	CO	VOCs
9	LNG	Stacks from 9 x 2MW natural gas generators	1.61×10^{-3}	1.61×10^{-3}	0.28	4.39×10^{-4}	0.07	1.83×10^{-3}

7.2.1 Haul roads

Trucks travelling on haul roads from the pits to the processing plant/ROM produce wheel generated dust. Vehicle kilometres travelled (VKT) per hour, calculated to provide an emission rate in kilograms per kilometre per hour, is estimated based on the following assumptions:

- Truck carrying capacity of 32,000,000 tonnes per annum (tpa)
- Total combined carrying capacity of approximately 3650 t for 180 t and 90 t truck each hour
- Therefore 8767 trips required annually
- Total haul road distance from pits to processing plant approximately on average 12.5 km (most conservative from the Hornet Enterprise)
- 109,589 VKT travelled annually
- Therefore 12.5 VKT is travelled hourly (8760 hours of the year).

7.2.2 Wind erosion

The default emission rates for TSP and PM_{10} were taken from the NPI manual for mining (Australian Government, 2012), as follows:

- E_{TSP} = 0.4 kg/ha/hour
- E_{PM10} = 0.2 kg/ha/hour

A ratio of 0.15 was assumed for the fraction of PM_{10} to $PM_{2.5}$ for wind erosion sources.

The standard hourly wind generated dust was then adjusted for each hour of the modelling period based on the cube of the wind speed for each hour. Wind erosion emissions only occurred when the wind speed was greater than the wind speed threshold of 5.3 m/s.

7.2.3 Natural gas generators

For the emissions from the natural gas generators, the emission rates from the NPI EET *Combustion Engines* (Australian Government, 2008) were used for all pollutants.

Pollutants chosen for assessment were PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, and VOCs. A conservative rate of 100 percent NO_x to NO_2 was assumed.

7.2.4 Dust sources omitted from modelling

The following dust sources were not included in the model based on the following assumptions:

- WRD near the Deep South pit was not included as a source in the modelling. This was because mining the Deep South pit mining was assumed to be completed by Year 4, with all overburden/waste product accumulated in the southern WRD area assumed to be a hard crust or large rocks with no particle lift-off. Furthermore, the WRD at the northern end was included as a wind erosion area source. This is because the WRD in the northern area is closest to all the human receptors and thus would have the maximum impacts.
- The crushed ore stockpile after processing was assumed to be a wet product after moisture was added during crushing and screening and hence does not emit dust.

7.3 Dispersion modelling

7.3.1 AERMOD configuration

This section describes the model used to predict ground level concentrations associated with the operation of the proposed mine based on meteorological data (Section 6) and derived emission rates (Section 7.2). This section provides further information on the model parameters selected for the dispersion model AERMOD.

AERMOD is a steady state model and assumes that over time, the average concentrations distribution within a plume, is Gaussian. AERMOD was used to predict the dispersion of dust and gaseous pollutants at the identified sensitive receptors (see Section 4.5). The main model options and assumptions used are listed below and a sample AERMOD output file used in this assessment is provided in Appendix A.

Terrain elevation data for the model domain was obtained from the US National Aeronautics and Space Administration's Shuttle Radar Topography Missions (SRTM3/SRTM1) at 30 m resolution. Terrain elevation data was incorporated into AERMOD using the AERMAP terrain processor. AERMOD was run using the rural dispersion coefficient.

Model output files were selected for 1-hour, 8-hours, 24-hours, monthly or annual averaging periods in line with the adopted assessment criteria averaging periods discussed in Section 3.9.

7.3.2 Sources

Emissions calculated in Section 7.2 were included in the model as either area sources, volume sources or point sources as shown in Table 7.3.

Table 7.3 Source type used in the dispersion model

Emission type	Source used in AERMOD	Description
Mechanically generated dust	Volume	Dozer
		Loader
		Excavator/rock breaker
		Haul truck
		Drilling
		Blasting
		Crusher
		Haul truck
		Bus
	Line volume	Conveyor
Wind erosion	Area	Mining pits
		ROM are (includes unprocessed ore stockpile)
		TSF
Stack	Point	Natural gas generator

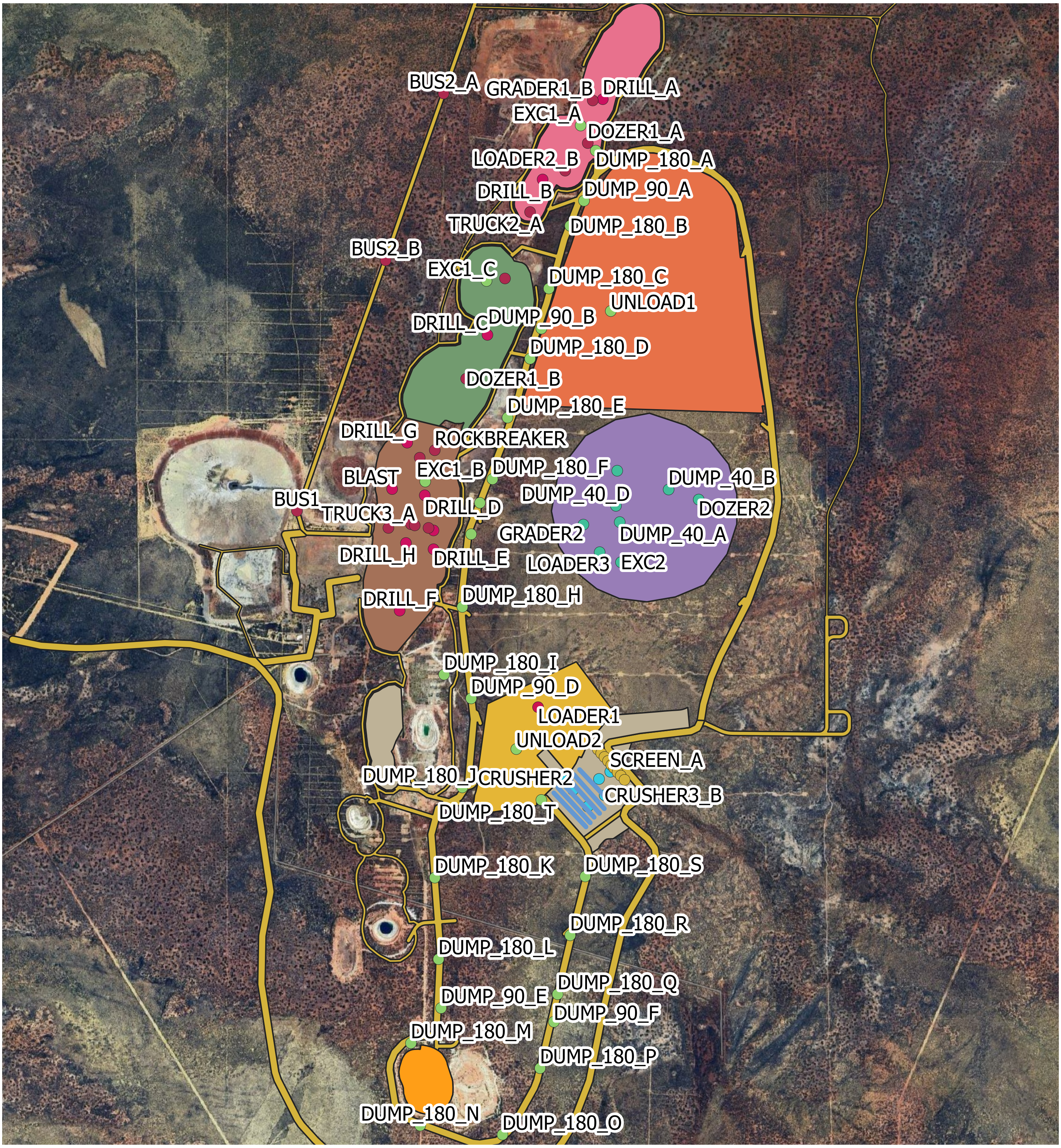
Emissions from equipment, plant and wind erosion sources were active every hour of the day throughout the modelling period, to reflect the 24 hours, 7 days per week mining operation schedule. Blasting only occurred three days per week for one hour at 12 pm. Operations at the TSF only occur during summer months.

Dust deposition was included in the modelling for TSP to predict the amount of dust deposited on surfaces once it is no longer entrained in the air column. Dry deposition was selected in AERMOD. The default method one for handling dry deposition by total particulate mass was selected, where 10 percent or more of the particles have a diameter equal to or greater than 1 micron (i.e., TSP). Particle data, based on values in AP-42 (US EPA, 1996), were included in the model as shown in Table 7.4.

Table 7.4 Particle data used for dust deposition

Particle diameter (μm)	Mass fraction (0 to 1)	Particle density (g/cm^3)
2.5	0.15	1.0
6.0	0.34	1.0
10	0.51	1.0

Figure 7.1 shows the location of the sources included in the dispersion model. It should be noted that the locations of each source included in the dispersion model are indicative only and are intended to generally represent possible worst case emissions within the Project site.



Legend

- Deep South
- Hornet/Enterprize
- Northern Orion
- Southern Orion
- Tobias Find
- ROM /ore stockpile
- TSF
- Waste landform
- Roads
- Plant Area
- Line_sources
- Point_sources

Volume sources

- Load and haul from pit to ROM
- ROM
- Drill and blast in pits
- Processing
- Support vehicles
- TSF operations

Paper Size ISO A4

0 0.25 0.5 0.75 1 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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Source locations in the dispersion model

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FIGURE 7.1

7.3.3 Background concentrations

Background concentrations of air quality were not available for the Project site and were therefore omitted form the assessment.

7.3.4 Receptors

A total of 12 sensitive receptors were included in the model and eight locations where Malleefowl mounds have been recorded, as discussed in Section 4.5. Modelling results for active Malleefowl mounds have been presented in the results.

GLCs were also extracted across a grid with 1 km spacing to assess the impact of NO_2 and SO_2 on vegetation.

Figure 4.6 and Table 4.3 show the location of the sensitive receptors considered in the assessment.

8. Results

Predicted GLCs associated with the operation of the Project are presented in this section. Results tables show GLCs at the sensitive receptors associated with human health/amenities and active Malleefowl mounds.

8.1 Total suspended particulates

The predicted maximum 24-hour averaged GLCs for TSP are shown in Table 8.1, including number of 24-hour periods that exceed the criteria of 90 µg/m³ (shaded red). The predicted annual average GLCs for TSP are shown in Table 8.2. There were no exceedances to the annual average criteria of 90 µg/m³.

Figure 8.1 and Figure 8.2 present the predicted maximum 24-hour averaged and annual average TSP GLCs.

Table 8.1 Predicted maximum 24-hour average TSP GLCs

Receptor ID	Description	Maximum 24-hour averaged GLCs (Criterion = 90 µg/m³)	Percentage of criterion (90 µg/m³)	Number of exceedances
R01	Mt Gibson accommodation village	116	129%	1
R02	Prospector	130	144%	4
R03	Mummaloo mining operation	106	118%	1
R04	Mummaloo accommodation village	70.3	78%	0
R05	Active mound - *Leipoa ocellata*	164	182%	15
R06	Active mound - *Leipoa ocellata*	140	155%	9
R07	Active mound - *Leipoa ocellata*	261	289%	18
R08	Active mound - *Leipoa ocellata*	140	155%	3
R09	Active mound - *Leipoa ocellata*	59.3	66%	0
R10	Active mound - *Leipoa ocellata*	448	497%	21
R11	Active mound - *Leipoa ocellata*	398	443%	32
R12	Active mound - *Leipoa ocellata*	191	212%	12

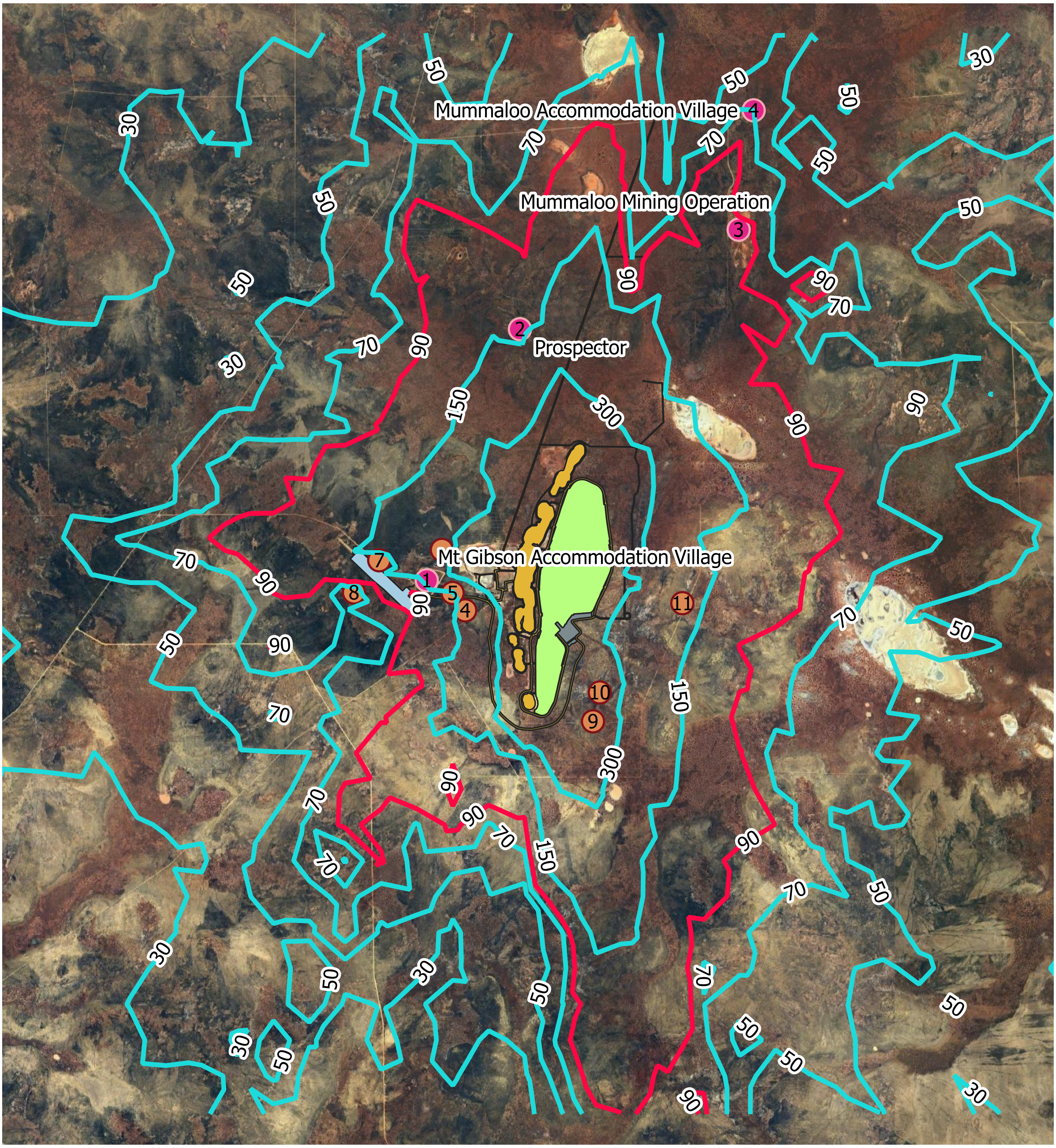
Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.2 Predicted annual average TSP GLCs

Receptor ID	Description	Annual average GLCs (µg/m³) (Criterion = 90 µg/m³)	Percentage of criterion
R01	Mt Gibson accommodation village	15.2	17%
R02	Prospector	8.79	10%
R03	Mummaloo mining operation	3.57	4%
R04	Mummaloo accommodation village	2.49	3%
R05	Active mound - *Leipoa ocellata*	21.0	23%
R06	Active mound - *Leipoa ocellata*	19.2	21%
R07	Active mound - *Leipoa ocellata*	22.7	25%
R08	Active mound - *Leipoa ocellata*	11.6	13%
R09	Active mound - *Leipoa ocellata*	7.54	8%

Receptor ID	Description	Annual average GLCs (µg/m^3) (Criterion = 90 µg/m^3)	Percentage of criterion
R10	Active mound - *Leipoa ocellata*	20.1	22%
R11	Active mound - *Leipoa ocellata*	24.0	27%
R12	Active mound - *Leipoa ocellata*	12.8	14%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- TSP criteria (90 µg/m³)
- TSP concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 24-hour averaged TSP GLCs (µg/m³)

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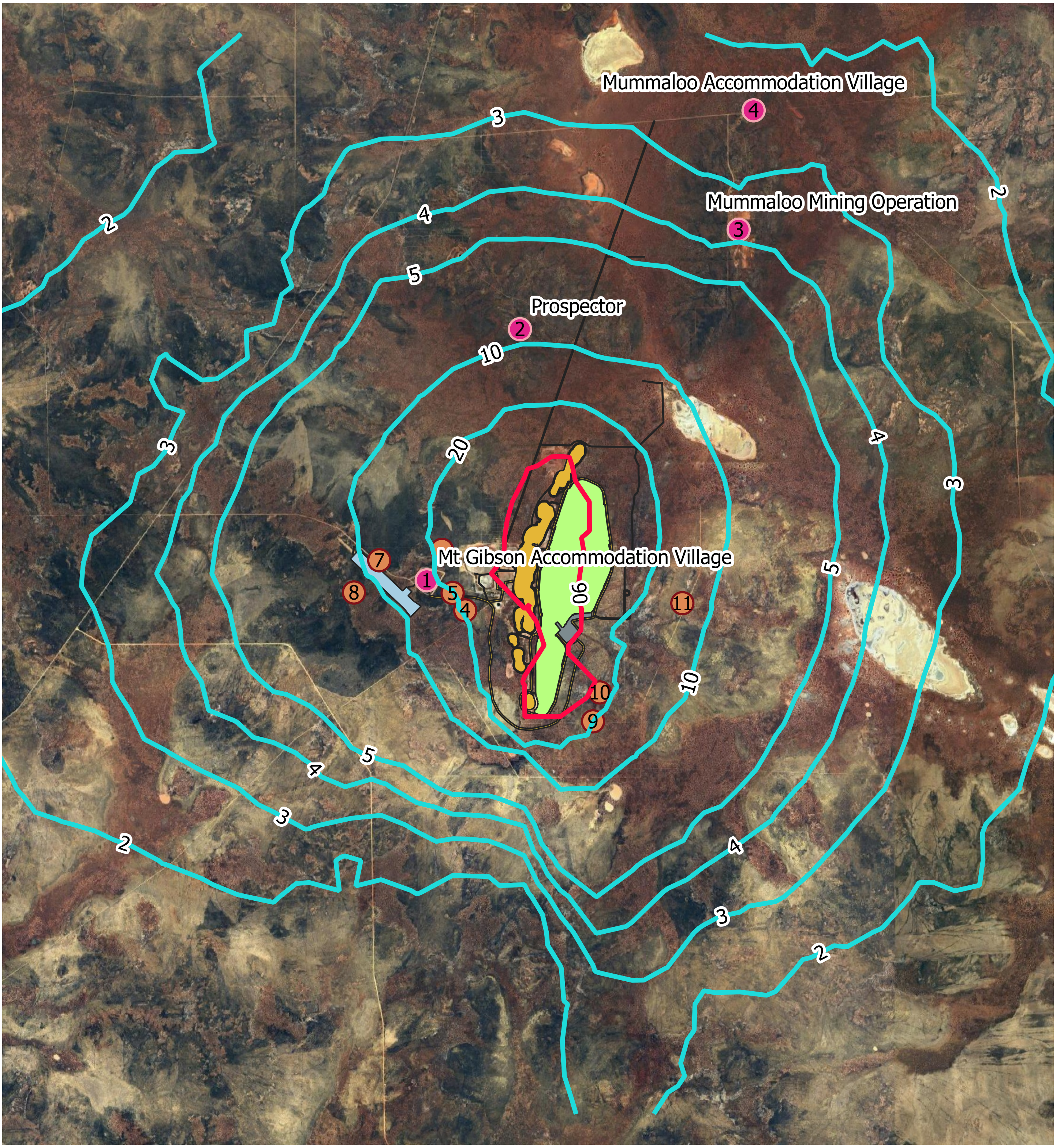
FIGURE 8.1

Document Path: \\ghdnet\ghd\AU\Perth\Projects\61\12606145\GIS\Maps\Working\12606145_AirQuality_working.qgz
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn



Legend

- TSP criteria (90 µg/m³)
- TSP concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted annual average TSP GLCs (µg/m³)

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FIGURE 8.2

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
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8.2 Particles as PM_{10}

Table 8.3 presents the maximum 24-hour averaged PM_{10} GLCs predicted by the model, including the number of exceedances at each receptor. There were no exceedances at the sensitive receptors considered to be a place of residence, however there were exceedances at several Malleefowl mounds. The predicted annual average PM_{10} GLCs are shown in Table 8.4, and there were no exceedances to the criteria of 25 µg/m^3.

Figure 8.3 and Figure 8.4 present the PM_{10} results.

Table 8.3 Predicted maximum 24-hour averaged PM_{10} GLCs

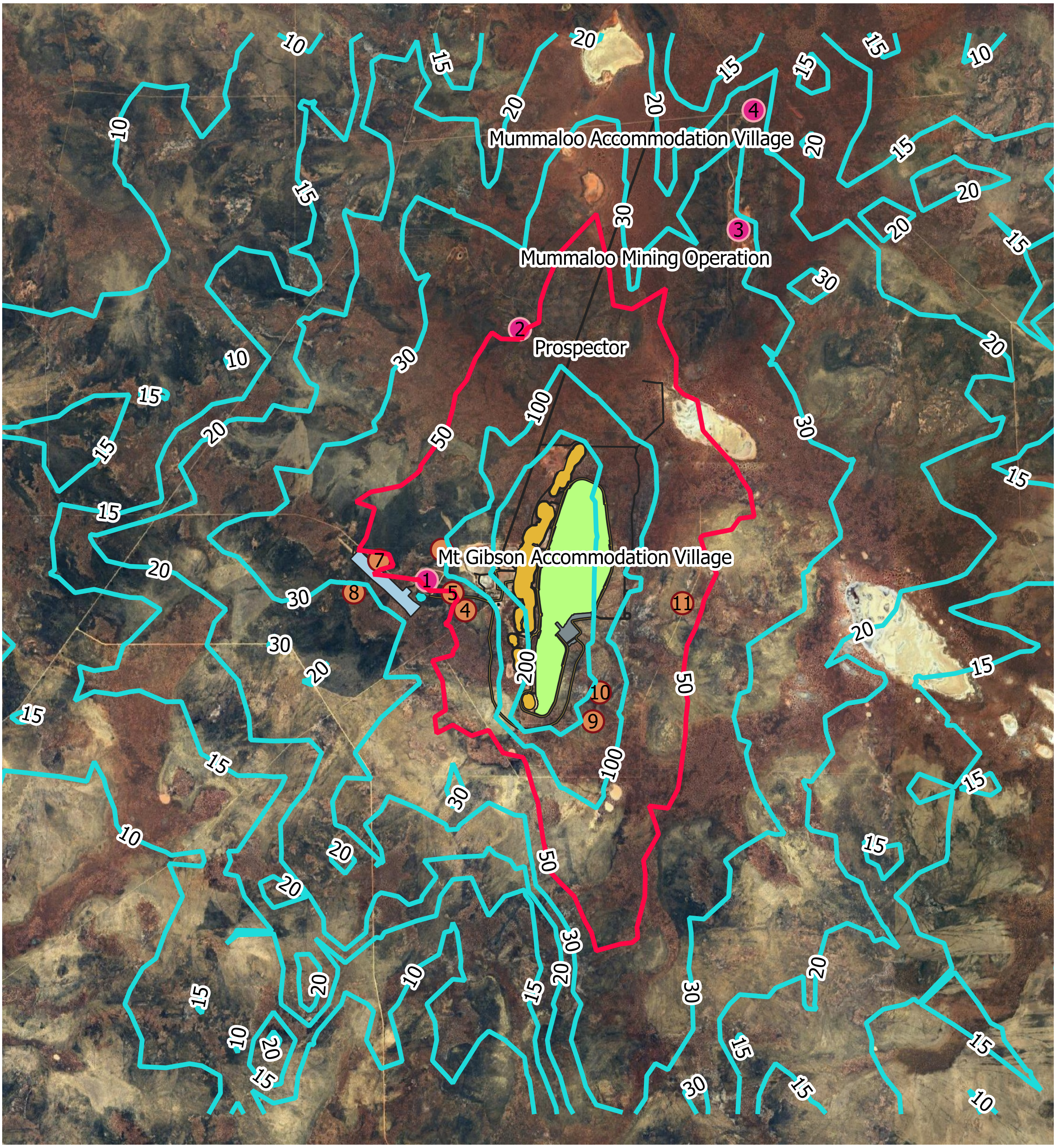
Receptor ID	Description	Maximum 24-hour averaged GLCs (Criterion = 50 µg/m^3)	Percentage of criterion	Number of exceedances
R01	Mt Gibson accommodation village	45.8	92%	0
R02	Prospector	45.1	90%	0
R03	Mummaloo mining operation	36.5	73%	0
R04	Mummaloo accommodation village	24.5	49%	0
R05	Active mound - *Leipoa ocellata*	59.0	118%	3
R06	Active mound - *Leipoa ocellata*	43.7	87%	0
R07	Active mound - *Leipoa ocellata*	90.6	181%	2
R08	Active mound - *Leipoa ocellata*	45.1	90%	0
R09	Active mound - *Leipoa ocellata*	21.1	42%	0
R10	Active mound - *Leipoa ocellata*	152	303%	9
R11	Active mound - *Leipoa ocellata*	139	278%	10
R12	Active mound - *Leipoa ocellata*	63.6	127%	1

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.4 Predicted annual average PM_{10} GLCs

Receptor ID	Description	Annual average GLCs (Criterion = 25 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	5.25	21%
R02	Prospector	3.04	12%
R03	Mummaloo mining operation	1.24	5%
R04	Mummaloo accommodation village	0.86	3%
R05	Active mound - *Leipoa ocellata*	7.11	28%
R06	Active mound - *Leipoa ocellata*	6.62	26%
R07	Active mound - *Leipoa ocellata*	7.81	31%
R08	Active mound - *Leipoa ocellata*	4.02	16%
R09	Active mound - *Leipoa ocellata*	2.59	10%
R10	Active mound - *Leipoa ocellata*	6.50	26%
R11	Active mound - *Leipoa ocellata*	7.84	31%
R12	Active mound - *Leipoa ocellata*	4.36	17%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- PM₁₀ criteria (50 µg/m³)
- PM₁₀ concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 24-hour averaged PM_{10} GLCs (µg/m³)

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FIGURE 8.3

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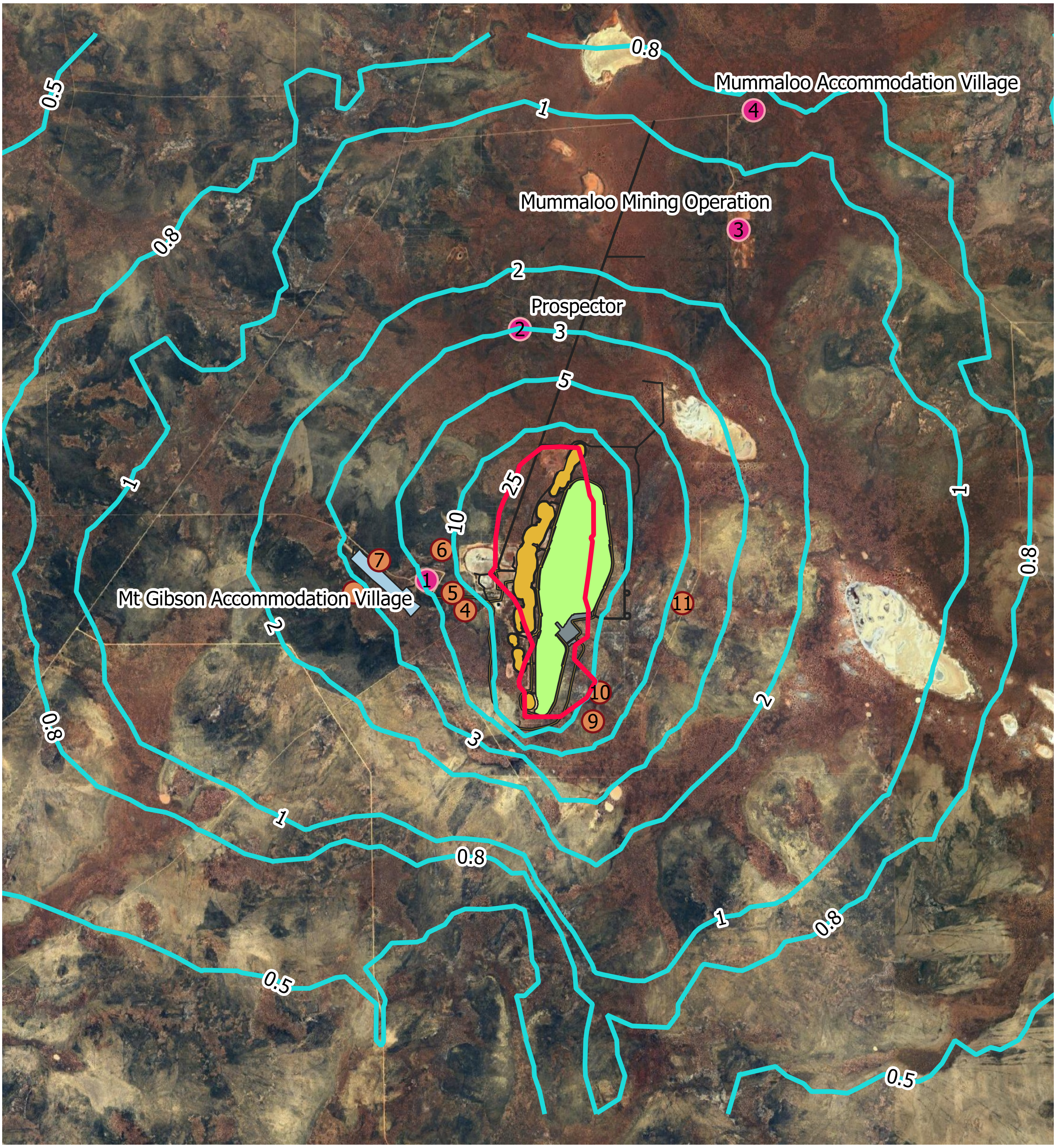
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn



Legend

- PM10 criteria (25 µg/m³)
- PM10 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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Mt Gibson Air Quality Impact Assessment

Predicted annual average PM10 GLCs (µg/m³)

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FIGURE 8.4

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

8.3 Particles as $PM_{2.5}$

The predicted maximum 24-hour averaged and annual average $PM_{2.5}$ concentrations are presented in Table 8.5 and Table 8.6. There were no exceedances for either averaging period.

Air NEPM has set goal criteria for $PM_{2.5}$ for 2025. There was an exceedance of the 24-hour criteria of 20 µg/m^3 at one Malleefowl receptor. There were no exceedances at the three human receptors and no exceedances of the goal annual average criteria of 7 µg/m^3.

Table 8.5 Predicted maximum 24-hour averaged $PM_{2.5}$ GLCs

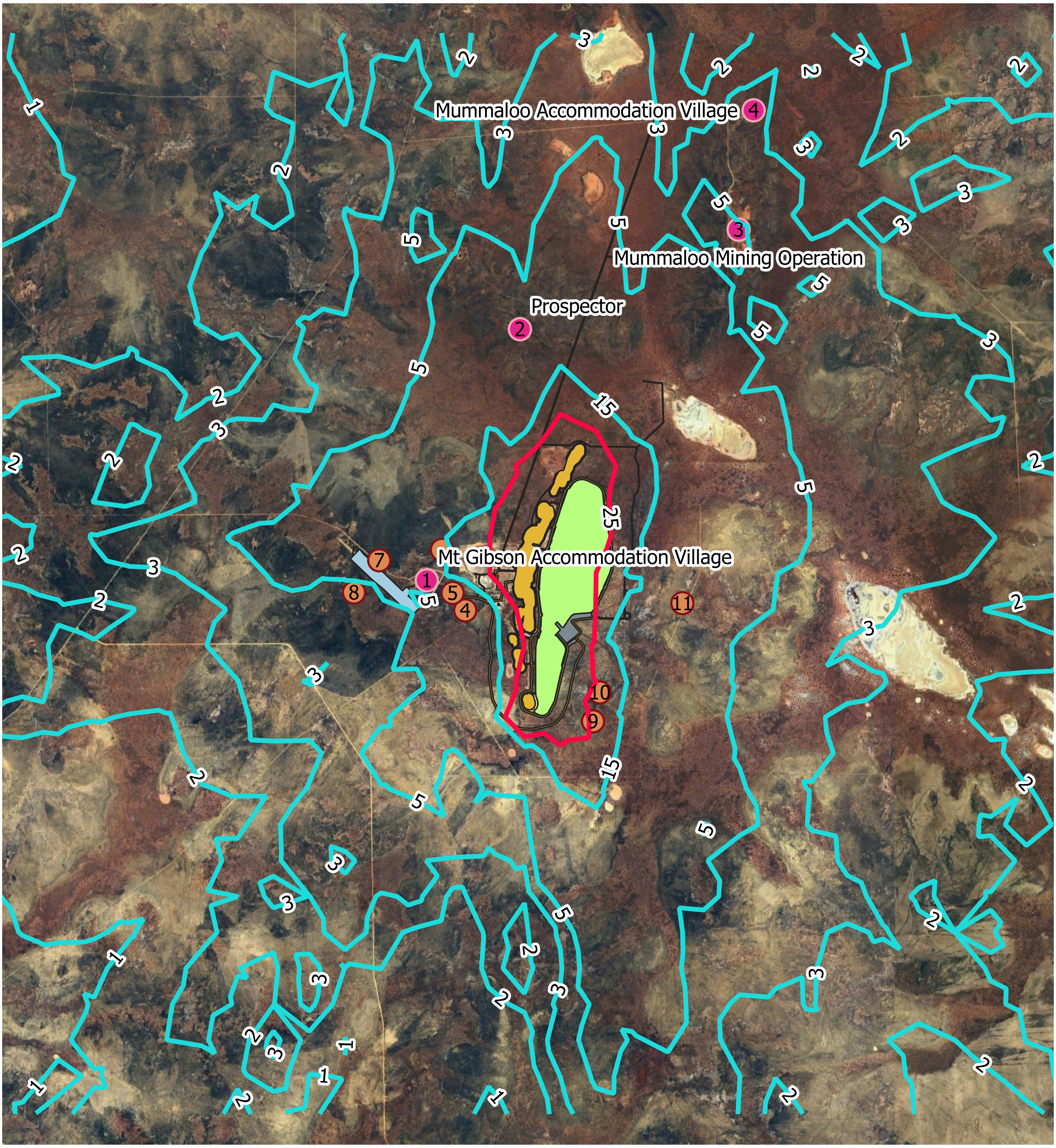
Receptor ID	Description	Maximum 24-hour averaged GLCs (Criterion = 25 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	6.87	27%
R02	Prospector	6.76	27%
R03	Mummaloo mining operation	5.49	22%
R04	Mummaloo accommodation village	3.67	15%
R05	Active mound - *Leipoa ocellata*	8.86	35%
R06	Active mound - *Leipoa ocellata*	6.55	26%
R07	Active mound - *Leipoa ocellata*	13.6	54%
R08	Active mound - *Leipoa ocellata*	6.76	27%
R09	Active mound - *Leipoa ocellata*	3.17	13%
R10	Active mound - *Leipoa ocellata*	22.7	91%
R11	Active mound - *Leipoa ocellata*	20.8	83%
R12	Active mound - *Leipoa ocellata*	9.55	38%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.6 Predicted annual average $PM_{2.5}$ GLCs

Receptor ID	Description	Annual average GLCs (Criterion = 8 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	0.79	10%
R02	Prospector	0.46	6%
R03	Mummaloo mining operation	0.19	2%
R04	Mummaloo accommodation village	0.13	2%
R05	Active mound - *Leipoa ocellata*	1.06	13%
R06	Active mound - *Leipoa ocellata*	0.99	12%
R07	Active mound - *Leipoa ocellata*	1.17	15%
R08	Active mound - *Leipoa ocellata*	0.60	8%
R09	Active mound - *Leipoa ocellata*	0.39	5%
R10	Active mound - *Leipoa ocellata*	0.97	12%
R11	Active mound - *Leipoa ocellata*	1.18	15%
R12	Active mound - *Leipoa ocellata*	0.65	8%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- PM2.5 criteria (25 µg/m³)
- PM2.5 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 24-hour averaged $PM_{2.5}$ GLCs (µg/m³)

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FIGURE 8.5

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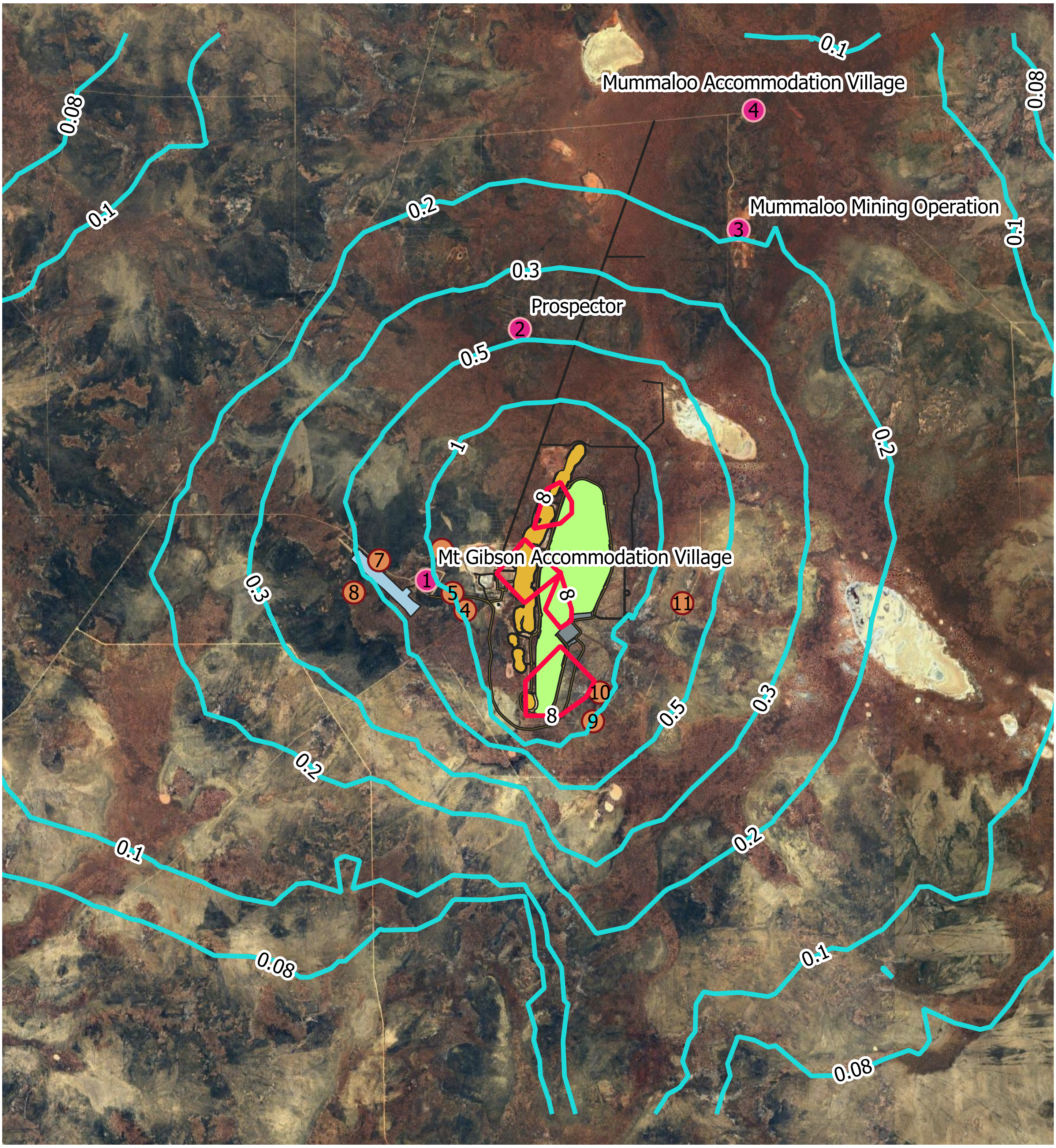
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn



Legend

- PM2.5 criteria (8 µg/m³)
- PM2.5 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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Mt Gibson Air Quality Impact Assessment

Predicted annual average $PM_{2.5}$ GLCs (µg/m³)

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FIGURE 8.6

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

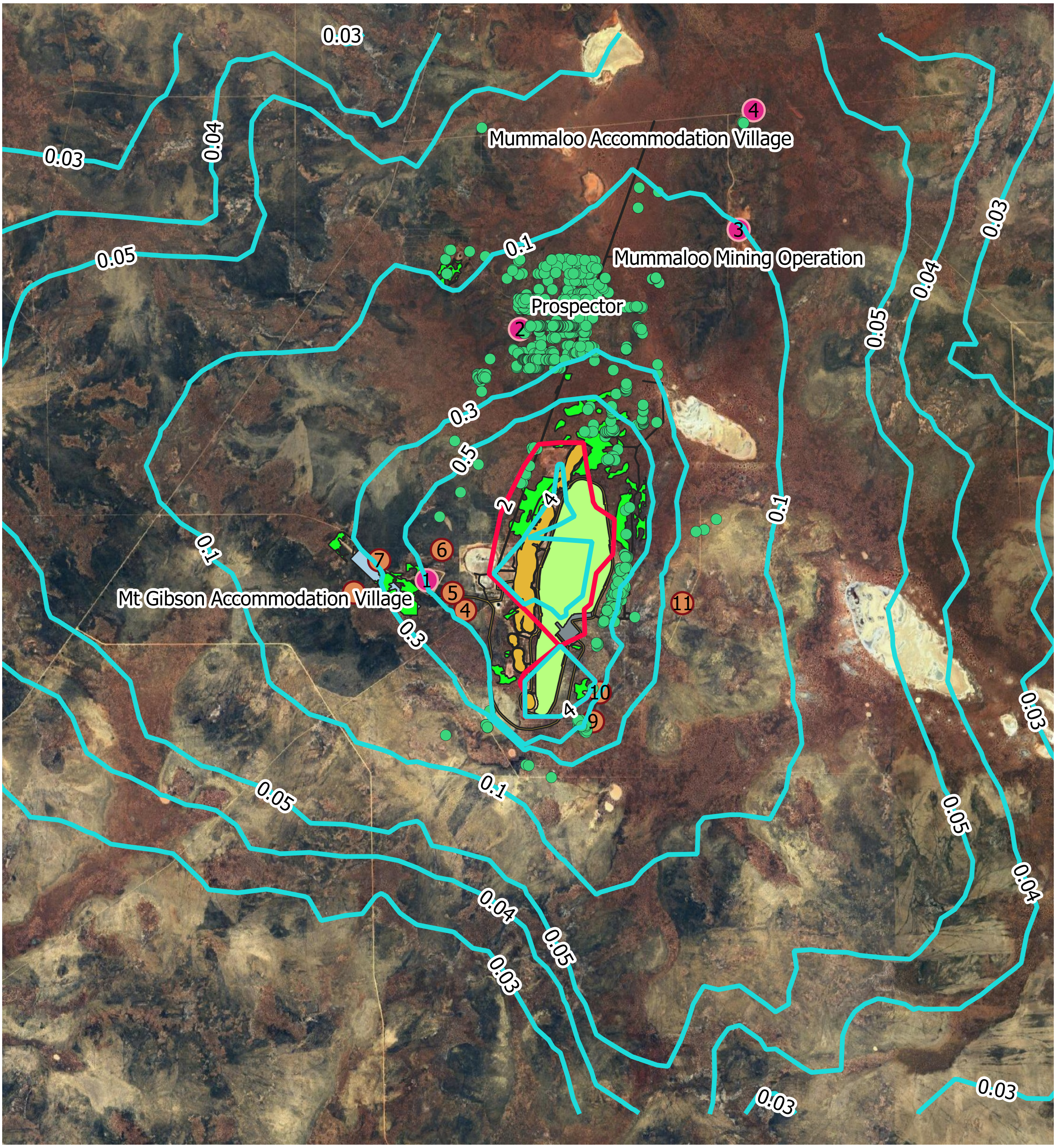
8.4 Dust deposition

The maximum monthly dust deposition at the sensitive receptors is shown in Table 8.7 and compared with the criterion of 2 g/30 days/m^2. Figure 8.7 presents the dust deposition contours.

Table 8.7 Predicted maximum monthly dust deposition

Receptor ID	Description	Maximum monthly dust deposition (Criterion = 2 g/m^2/month)	Percentage of criterion
R01	Mt Gibson accommodation village	0.51	25%
R02	Prospector	0.17	9%
R03	Mummaloo mining operation	0.10	5%
R04	Mummaloo accommodation village	0.07	3%
R05	Active mound - *Leipoa ocellata*	0.60	30%
R06	Active mound - *Leipoa ocellata*	0.62	31%
R07	Active mound - *Leipoa ocellata*	0.75	38%
R08	Active mound - *Leipoa ocellata*	0.32	16%
R09	Active mound - *Leipoa ocellata*	0.23	12%
R10	Active mound - *Leipoa ocellata*	0.42	21%
R11	Active mound - *Leipoa ocellata*	0.50	25%
R12	Active mound - *Leipoa ocellata*	0.24	12%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- Dust deposition criteria (2 g/m²/month)
- Dust deposition (g/m²/month)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Native vegetation
- Eucalypt woodlands (TEC/PEC)
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Mt Gibson Air Quality Impact Assessment

Predicted maximum monthly dust deposition (g/m²/month)

Project No. 12606145
Revision No. 2
Date. 9/08/2023

FIGURE 8.7

Document Path: \\ghdnet\ghd\AU\Perth\Projects\61\12606145\GIS\Maps\Working\12606145_AirQuality_working.qgz
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

8.5 Nitrogen dioxide

Table 8.8 and Table 8.9 present the predicted maximum 1-hour averaged NO_2 GLCs and predicted annual average NO_2 GLCs respectively. The 1-hour averages results were compared to the criterion of 151 µg/m^3. The human health sensitive receptors were compared with the criterion from Air NEPM of 28 µg/m^3 and the Malleefowl receptors were compared with the criterion for vegetation of 30 µg/m^3 as outlined in AQ Guidelines Europe. All NO_2 results were significantly below the relevant criteria.

Table 8.8 Predicted maximum 1-hour averaged NO_2 GLCs

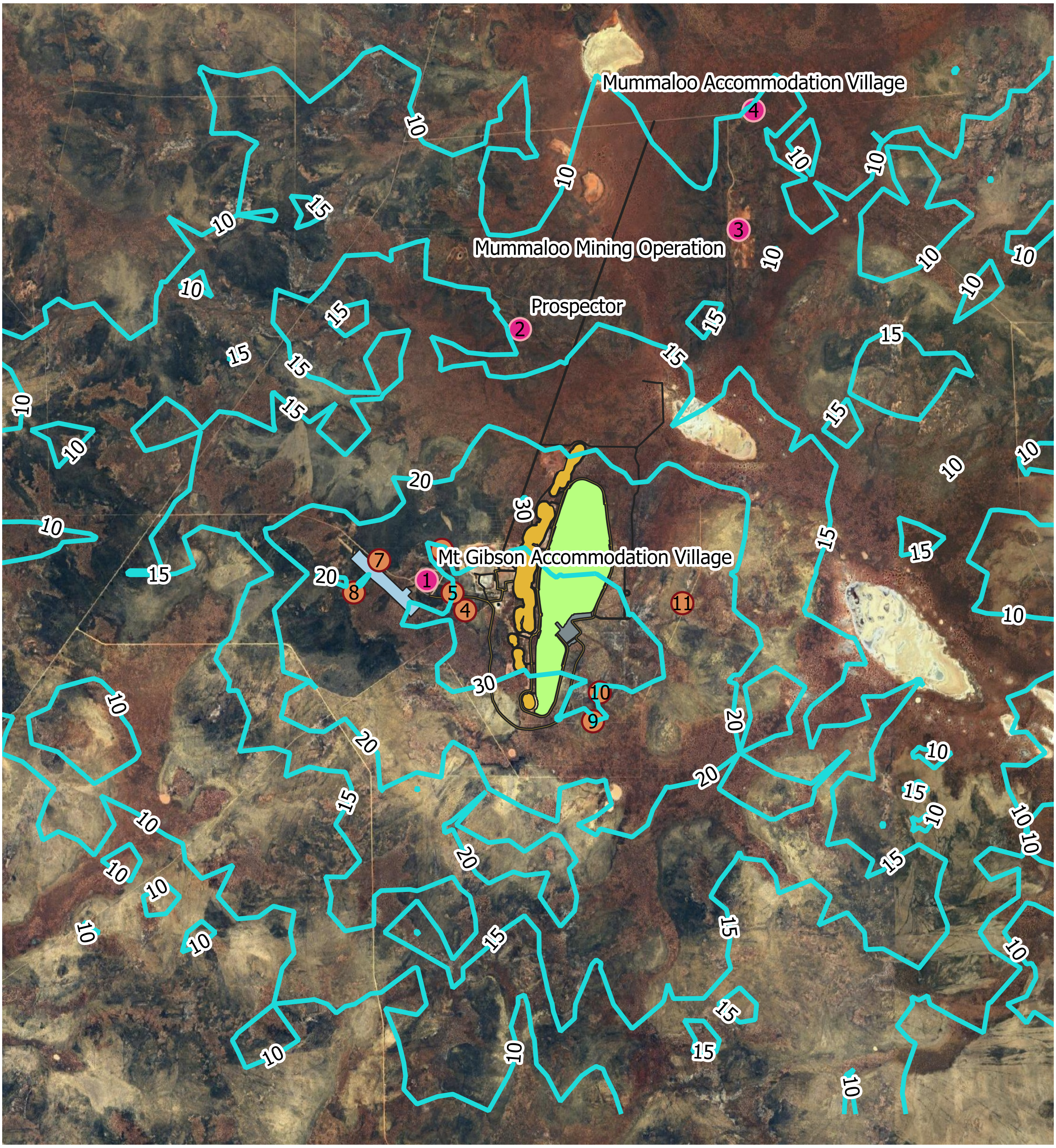
Receptor ID	Description	Maximum 1-hour averaged GLCs (Criterion = 150 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	26.6	18%
R02	Prospector	13.2	9%
R03	Mummaloo mining operation	14.3	10%
R04	Mummaloo accommodation village	10.6	7%
R05	Active mound - *Leipoa ocellata*	36.5	24%
R06	Active mound - *Leipoa ocellata*	28.2	19%
R07	Active mound - *Leipoa ocellata*	31.6	21%
R08	Active mound - *Leipoa ocellata*	25.8	17%
R09	Active mound - *Leipoa ocellata*	21.8	15%
R10	Active mound - *Leipoa ocellata*	30.5	20%
R11	Active mound - *Leipoa ocellata*	26.1	17%
R12	Active mound - *Leipoa ocellata*	24.7	16%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.9 Predicted annual average NO_2 GLCs

Receptor ID	Description	Annual average GLCs (µg/m^3)	Percentage of criteria
NEPM health criterion = 28 µg/m^3			
R01	Mt Gibson accommodation village	0.25	1%
R02	Prospector	0.08	<1%
R03	Mummaloo mining operation	0.06	<1%
R04	Mummaloo accommodation village	0.04	<1%
WHO criterion = 30 µg/m^3			
R05	Active mound - *Leipoa ocellata*	0.37	1%
R06	Active mound - *Leipoa ocellata*	0.32	1%
R07	Active mound - *Leipoa ocellata*	0.23	1%
R08	Active mound - *Leipoa ocellata*	0.19	1%
R09	Active mound - *Leipoa ocellata*	0.15	1%
R10	Active mound - *Leipoa ocellata*	0.16	1%
R11	Active mound - *Leipoa ocellata*	0.20	1%
R12	Active mound - *Leipoa ocellata*	0.22	1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- Note: all modelled concentrations were below the NO_2 criteria of 150 µg/m³
- NO_2 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 1-hour averaged NO_2 GLCs (µg/m³)

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FIGURE 8.8

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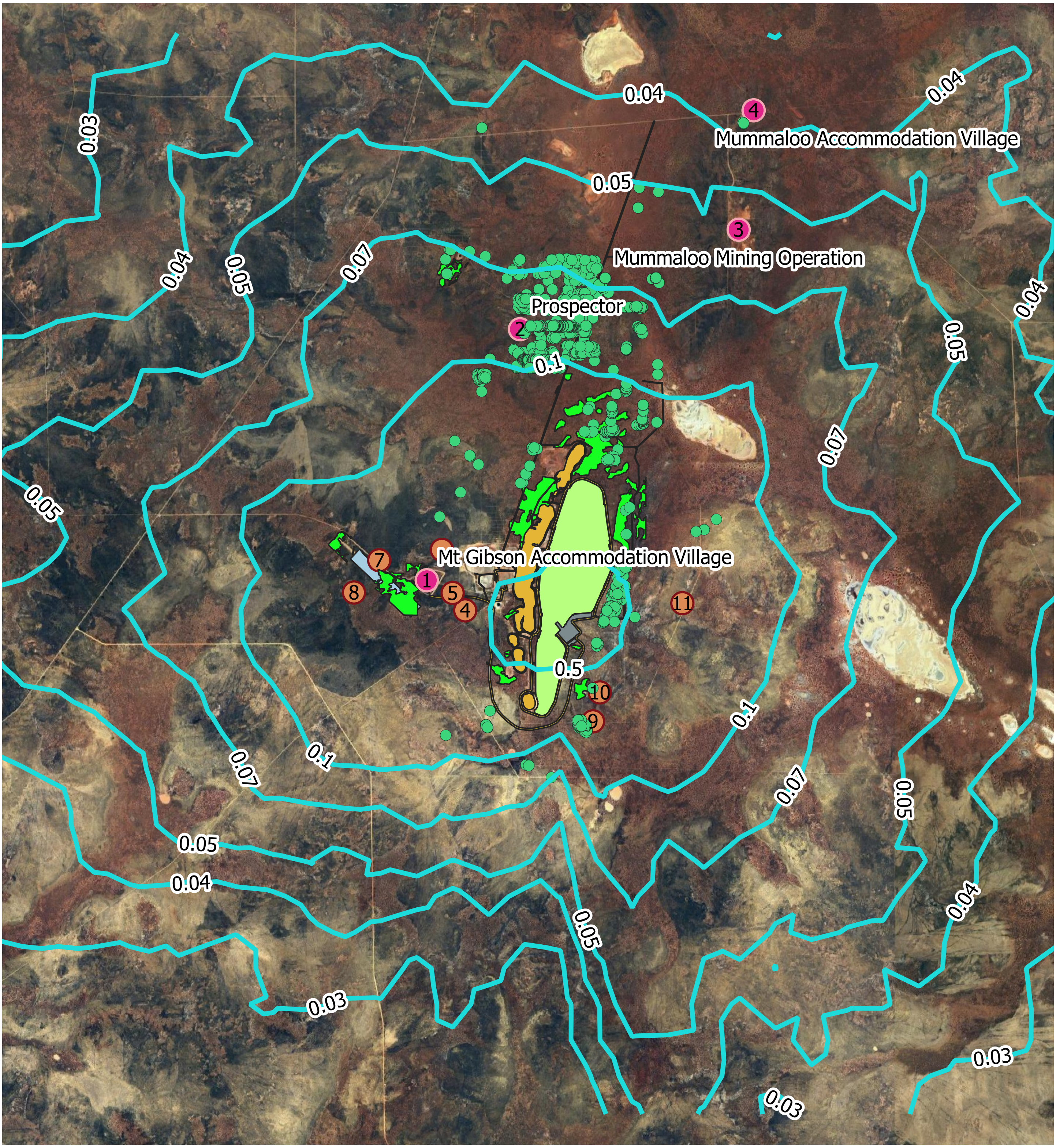
Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn



Legend

- Note: all modelled concentrations were below the NO₂ criteria of 28 µg/m³
- NO₂ concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Native vegetation
- Eucalypt woodlands (TEC/PEC)
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted annual average NO_2 GLCs (µg/m³)

Project No. **12606145**
Revision No. **2**
Date. **9/08/2023**

FIGURE 8.9

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8.6 Sulphur dioxide

The predicted maximum 1-hour averaged GLCs for SO_2, as shown in Table 8.10, were compared with the criterion of 262 µg/m^3 set out in Air NEPM. The predicted maximum 24-hour averaged GLCs for SO_2 are presented in Table 8.11 and compared with the criterion of 52 µg/m^3. All receptors were significantly below the relevant criteria.

The annual average SO_2 GLCs at the sensitive receptors that represent Malleefowl mounds were compared with the criterion of 20 µg/m^3 set out in the AQ Guidelines Europe (see Table 8.12). This criterion is for vegetation and is considered relevant for the Malleefowl as they feed on plants and build mounds with leaf litter (Neilly, et al., 2022).

Table 8.10 Predicted maximum 1-hour averaged SO_2 GLCs

Receptor ID	Description	Maximum 1-hour averaged GLCs (Criterion = 196 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	0.04	<1%
R02	Prospector	0.02	<1%
R03	Mummaloo mining operation	0.02	<1%
R04	Mummaloo accommodation village	0.02	<1%
R05	Active mound - *Leipoa ocellata*	0.06	<1%
R06	Active mound - *Leipoa ocellata*	0.04	<1%
R07	Active mound - *Leipoa ocellata*	0.05	<1%
R08	Active mound - *Leipoa ocellata*	0.04	<1%
R09	Active mound - *Leipoa ocellata*	0.03	<1%
R10	Active mound - *Leipoa ocellata*	0.05	<1%
R11	Active mound - *Leipoa ocellata*	0.04	<1%
R12	Active mound - *Leipoa ocellata*	0.04	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.11 Predicted maximum 24-hour averaged SO_2 GLCs

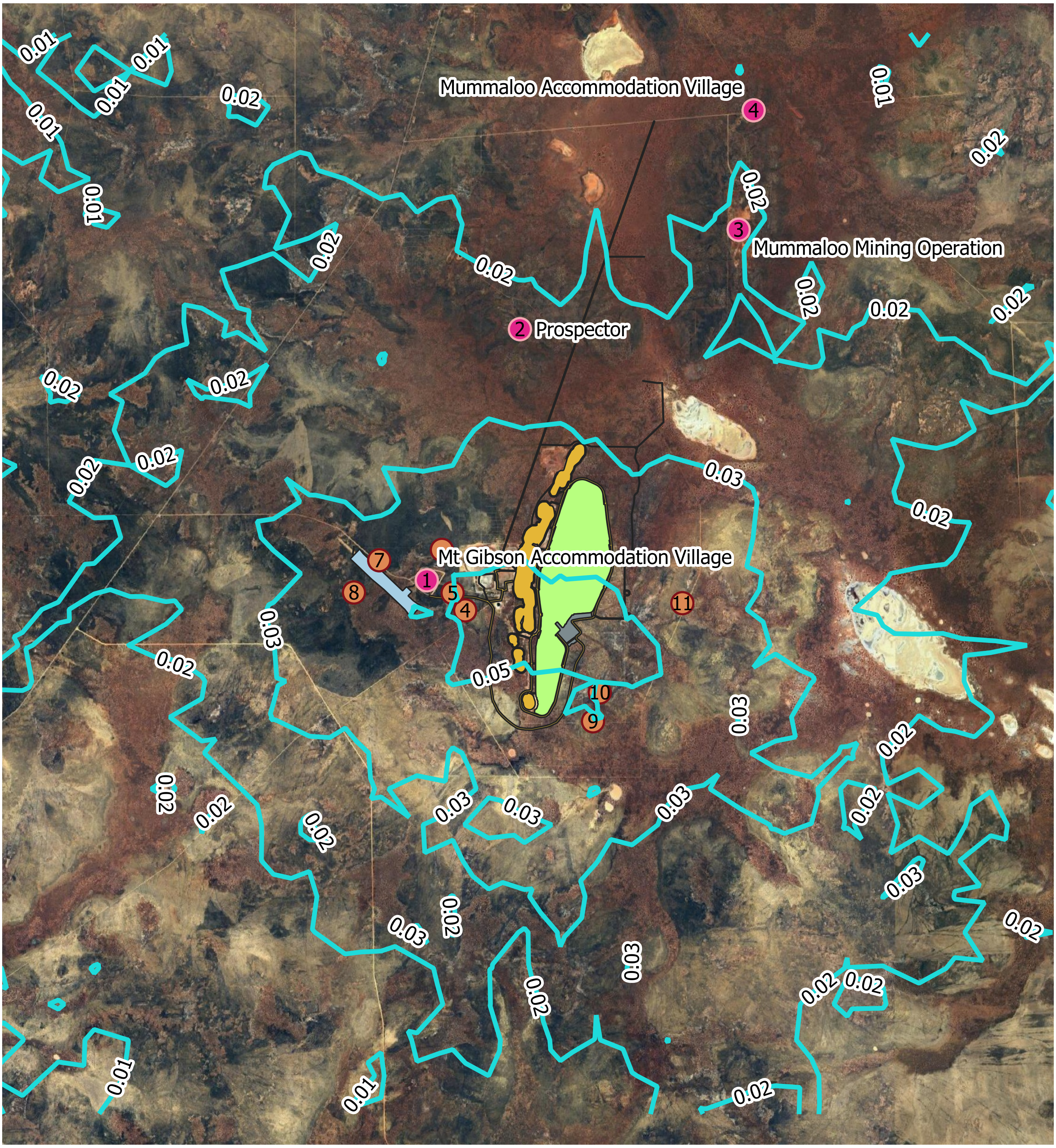
Receptor ID	Description	Maximum 24-hour averaged GLCs (Criterion = 52 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	0.01	<1%
R02	Prospector	2.00×10^{-3}	<1%
R03	Mummaloo mining operation	2.95×10^{-3}	<1%
R04	Mummaloo accommodation village	1.03×10^{-3}	<1%
R05	Active mound - *Leipoa ocellata*	0.01	<1%
R06	Active mound - *Leipoa ocellata*	0.01	<1%
R07	Active mound - *Leipoa ocellata*	4.27×10^{-3}	<1%
R08	Active mound - *Leipoa ocellata*	0.01	<1%
R09	Active mound - *Leipoa ocellata*	3.91×10^{-3}	<1%
R10	Active mound - *Leipoa ocellata*	0.01	<1%
R11	Active mound - *Leipoa ocellata*	0.01	<1%
R12	Active mound - *Leipoa ocellata*	0.01	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.12 Predicted annual average SO_2 GLCs

Receptor ID	Description	Maximum 24-hour averaged GLCs	Percentage of criteria
DWER Air Guidelines health criterion = 52 µg/m^3			
R01	Mt Gibson accommodation village	4.00×10^{-4}	<1%
R02	Prospector	1.30×10^{-4}	<1%
R03	Mummaloo mining operation	9.00×10^{-5}	<1%
R04	Mummaloo accommodation village	6.00×10^{-5}	<1%
WHO criterion = 20 µg/m^3			
R05	Active mound - *Leipoa ocellata*	5.90×10^{-4}	<1%
R06	Active mound - *Leipoa ocellata*	5.10×10^{-4}	<1%
R07	Active mound - *Leipoa ocellata*	3.60×10^{-4}	<1%
R08	Active mound - *Leipoa ocellata*	3.00×10^{-4}	<1%
R09	Active mound - *Leipoa ocellata*	2.30×10^{-4}	<1%
R10	Active mound - *Leipoa ocellata*	2.50×10^{-4}	<1%
R11	Active mound - *Leipoa ocellata*	3.20×10^{-4}	<1%
R12	Active mound - *Leipoa ocellata*	3.40×10^{-4}	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

Note: all modelled concentrations were below the SO_2 criteria of 262 µg/m³

SO_2 concentration (µg/m³)

Senstive receptors - human

Active mounds - Leipoa ocellata

Mining pits

Airstrip

IWL

Plant

Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 1-hour averaged SO_2 GLCs (µg/m³)

Project No. 12606145
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FIGURE 8.10

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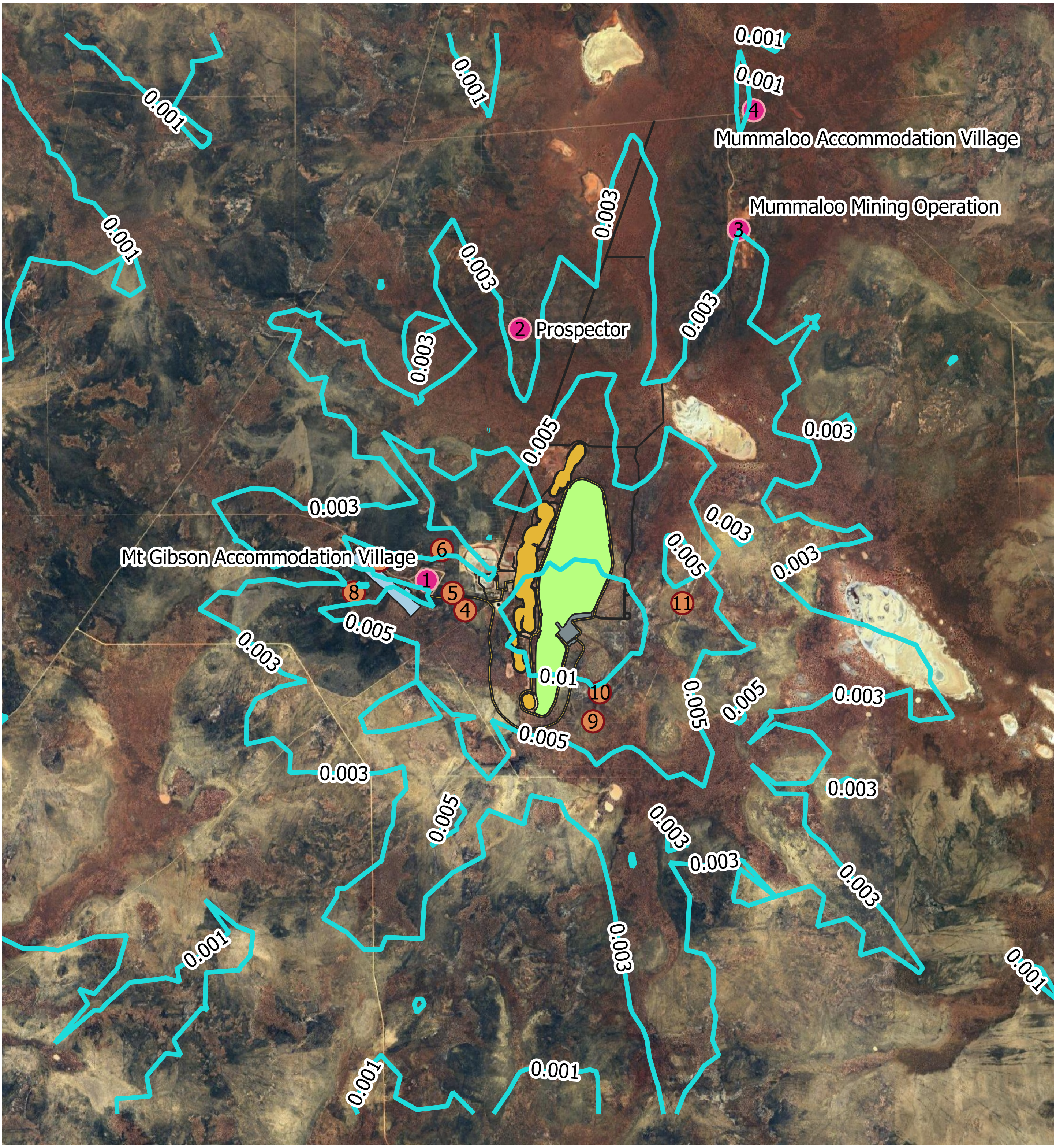

Legend

- Note: all modelled concentrations were below the SO_2 criteria of 52 µg/m³
- SO_2 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 24-hour averaged SO_2 GLCs (µg/m³)

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FIGURE 8.11

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
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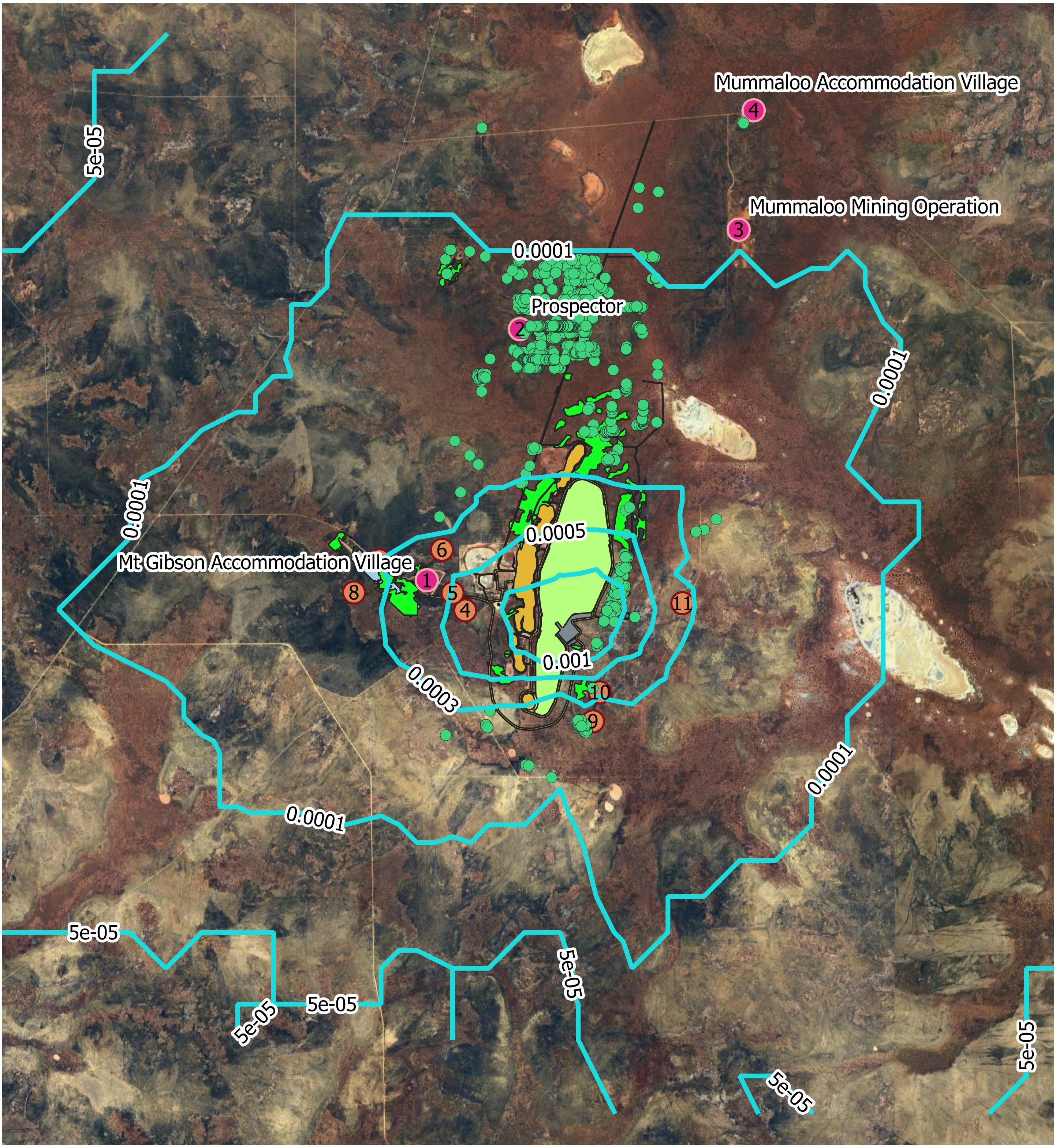

Legend

- Note: all modelled concentrations were below the SO_2 criteria of 52 and 20 µg/m³
- SO_2 concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Native vegetation
- Eucalypt woodlands (TEC/PEC)
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted annual average SO_2 GLCs (µg/m³)

Project No. 12606145
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FIGURE 8.12

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8.7 Carbon monoxide

Table 8.13 and Table 8.14 present the predicted 1-hour and 8-hour averaged GLCs of CO. All receptors were significantly below the criteria of 30,000 µg/m^3 and 10,000 µg/m^3 respectively.

Table 8.13 Predicted maximum 1-hour averaged CO GLCs

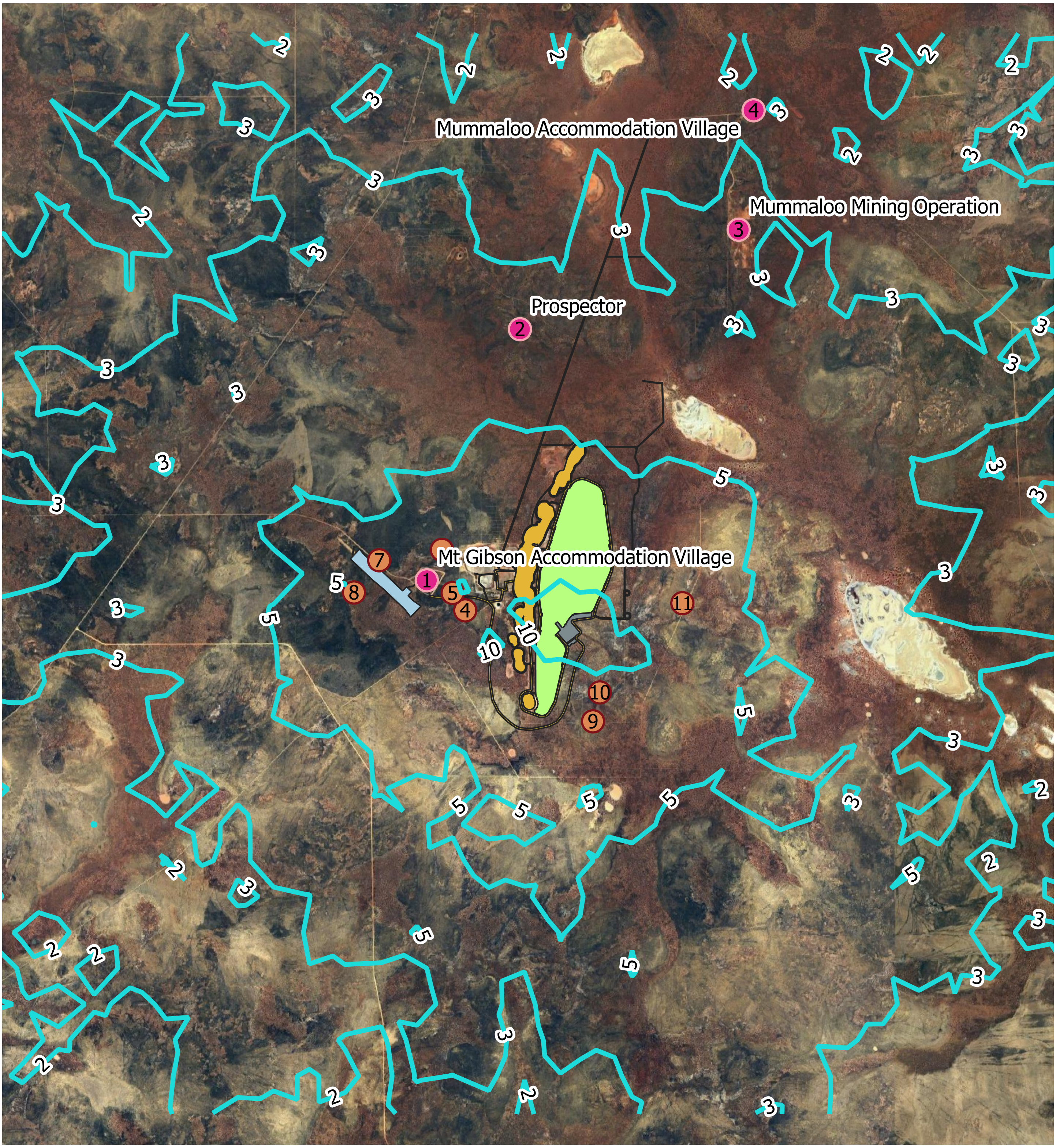
Receptor ID	Description	Maximum 8-hour averaged GLCs (Criterion = 30,000 µg/m^3)	Percentage of criteria
R01	Mt Gibson accommodation village	6.92	<1%
R02	Prospector	3.43	<1%
R03	Mummaloo mining operation	3.71	<1%
R04	Mummaloo accommodation village	2.74	<1%
R05	Active mound - *Leipoa ocellata*	9.49	<1%
R06	Active mound - *Leipoa ocellata*	7.34	<1%
R07	Active mound - *Leipoa ocellata*	8.22	<1%
R08	Active mound - *Leipoa ocellata*	6.70	<1%
R09	Active mound - *Leipoa ocellata*	5.68	<1%
R10	Active mound - *Leipoa ocellata*	7.94	<1%
R11	Active mound - *Leipoa ocellata*	6.78	<1%
R12	Active mound - *Leipoa ocellata*	6.43	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.14 Predicted maximum 8-hour averaged CO GLCs

Receptor ID	Description	Maximum 8-hour averaged GLCs (Criterion = 10,000 µg/m^3)	Percentage of criteria
R01	Mt Gibson accommodation village	3.41	<1%
R02	Prospector	1.03	<1%
R03	Mummaloo mining operation	1.32	<1%
R04	Mummaloo accommodation village	0.43	<1%
R05	Active mound - *Leipoa ocellata*	2.25	<1%
R06	Active mound - *Leipoa ocellata*	3.80	<1%
R07	Active mound - *Leipoa ocellata*	2.10	<1%
R08	Active mound - *Leipoa ocellata*	2.64	<1%
R09	Active mound - *Leipoa ocellata*	1.46	<1%
R10	Active mound - *Leipoa ocellata*	1.87	<1%
R11	Active mound - *Leipoa ocellata*	3.18	<1%
R12	Active mound - *Leipoa ocellata*	2.21	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- Note: all modelled concentrations were below the CO criteria of 30,000 µg/m³
- CO concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

Tetris Environmental Pty Ltd

Mt Gibson Air Quality Impact Assessment

Predicted maximum 1-hour averaged CO GLCs (µg/m³)

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Date. **9/08/2023**

FIGURE 8.13

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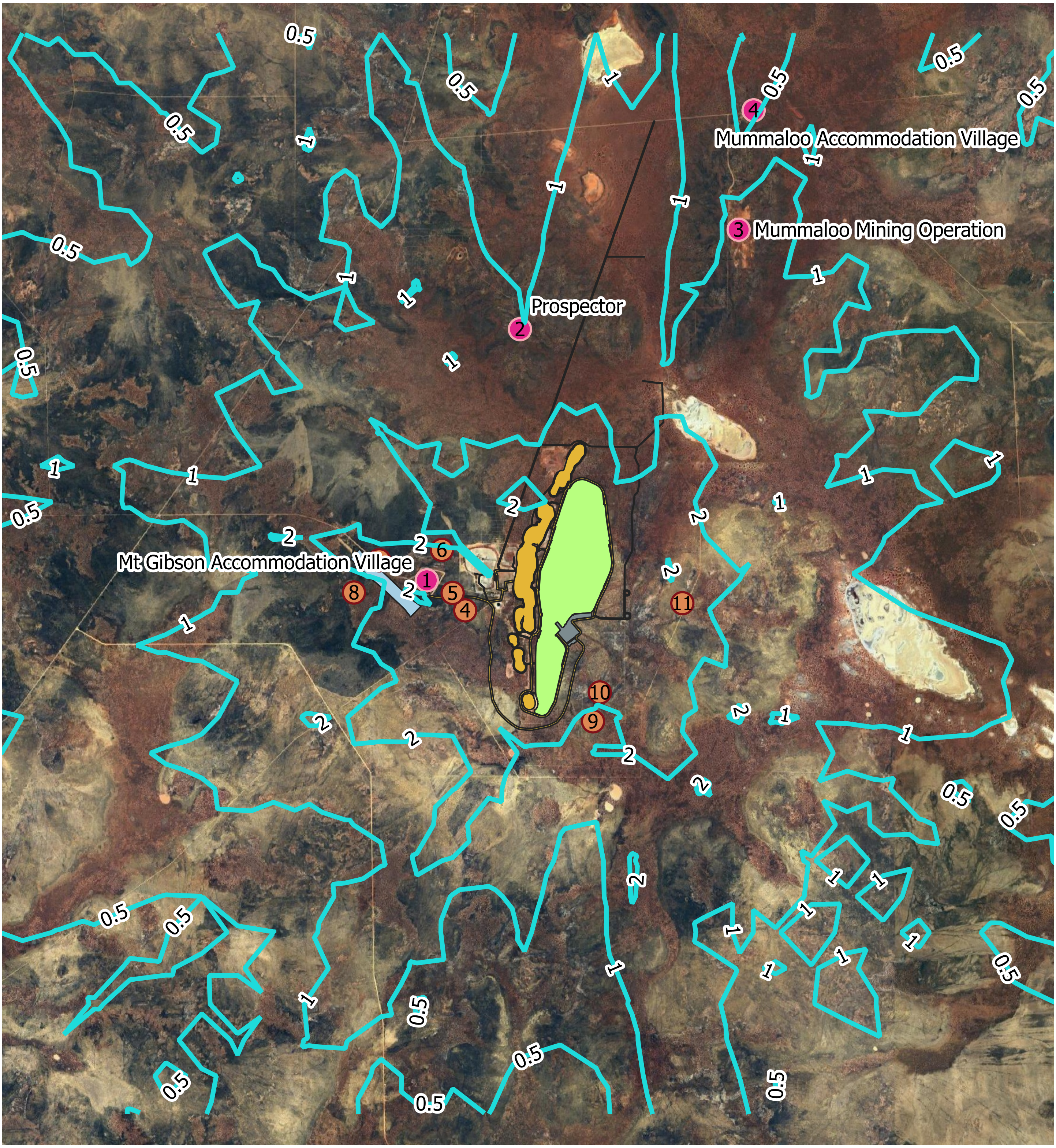

Legend

- Note: all modelled concentrations were below the CO criteria of 10,000 µg/m³
- CO concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

Tetris Environmental Pty Ltd
Mt Gibson Air Quality Impact Assessment

Predicted maximum 8-hour averaged CO GLCs (µg/m³)

Project No. 12606145
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FIGURE 8.14

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
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8.8 Volatile organic compounds

In the absence of a criteria for VOCs, the VOC GLCs were compared with criteria for specific organic compounds. Table 8.15 and Figure 8.15 present the predicted maximum 24-hour averaged GLCs for VOCs. These results were compared with the criterion for formaldehyde of 49.1 µg/m^3 as set out in Air Toxics, and there were no exceedances. Table 8.16 and Figure 8.16 present the predicted annual average GLCs for VOCs. These were compared with the criterion for benzene of 9.6 µg/m^3 as set out in Air Toxics. All results were significantly below the criterion.

Table 8.15 Predicted maximum 24-hour averaged VOCs GLCs

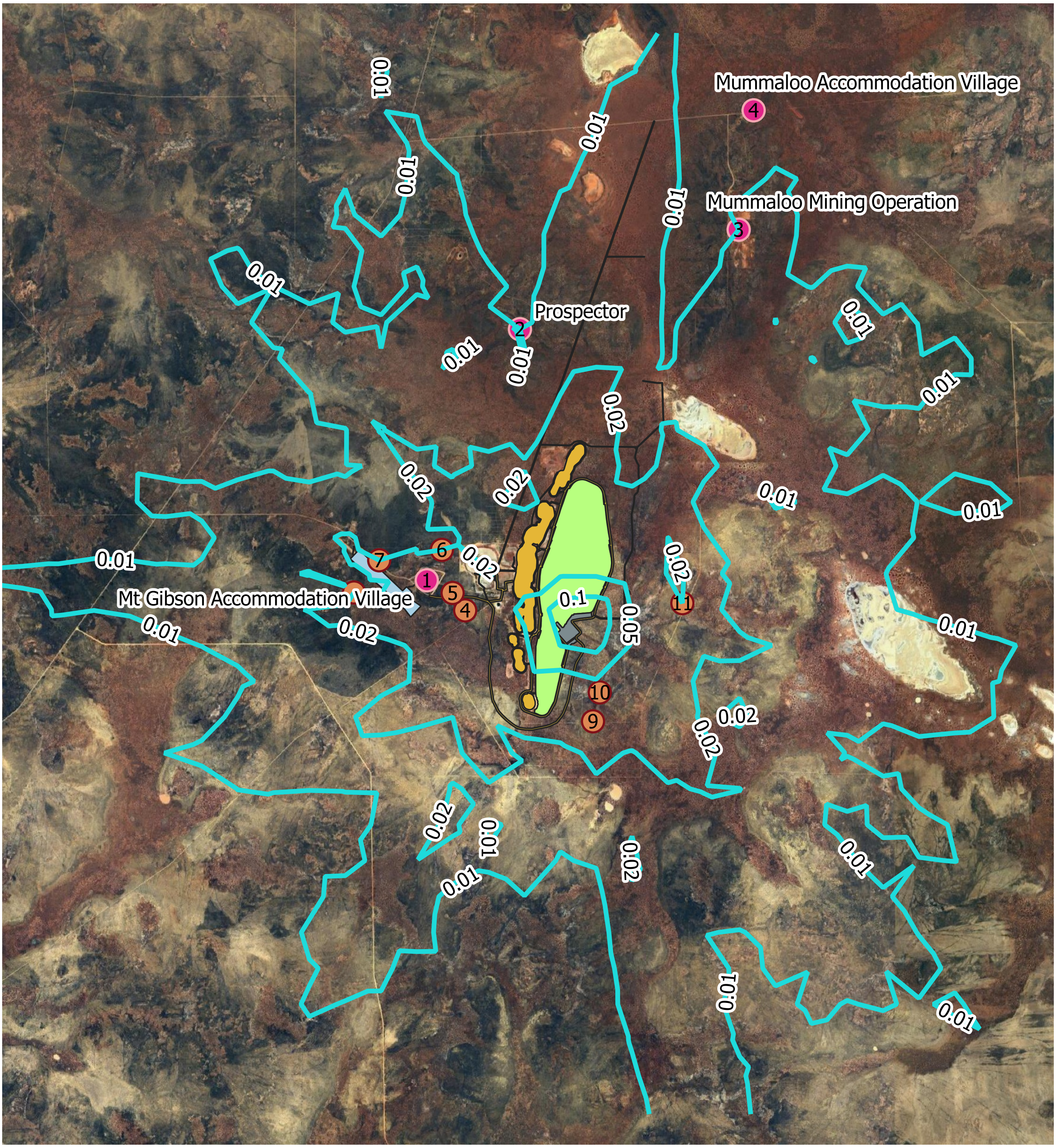
Receptor ID	Description	Annual average GLCs (Criterion = 49.1 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	0.03	<1%
R02	Prospector	0.01	<1%
R03	Mummaloo mining operation	0.01	<1%
R04	Mummaloo accommodation village	4.30×10^{-3}	<1%
R05	Active mound - *Leipoa ocellata*	0.03	<1%
R06	Active mound - *Leipoa ocellata*	0.03	<1%
R07	Active mound - *Leipoa ocellata*	0.02	<1%
R08	Active mound - *Leipoa ocellata*	0.02	<1%
R09	Active mound - *Leipoa ocellata*	0.02	<1%
R10	Active mound - *Leipoa ocellata*	0.03	<1%
R11	Active mound - *Leipoa ocellata*	0.03	<1%
R12	Active mound - *Leipoa ocellata*	0.02	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.

Table 8.16 Predicted annual average VOCs GLCs

Receptor ID	Description	Annual average GLCs (Criterion = 9.6 µg/m^3)	Percentage of criterion
R01	Mt Gibson accommodation village	1.67×10^{-3}	<1%
R02	Prospector	5.50×10^{-4}	<1%
R03	Mummaloo mining operation	3.80×10^{-4}	<1%
R04	Mummaloo accommodation village	2.40×10^{-4}	<1%
R05	Active mound - *Leipoa ocellata*	2.45×10^{-3}	<1%
R06	Active mound - *Leipoa ocellata*	2.11×10^{-3}	<1%
R07	Active mound - *Leipoa ocellata*	1.52×10^{-3}	<1%
R08	Active mound - *Leipoa ocellata*	1.24×10^{-3}	<1%
R09	Active mound - *Leipoa ocellata*	9.60×10^{-4}	<1%
R10	Active mound - *Leipoa ocellata*	1.06×10^{-3}	<1%
R11	Active mound - *Leipoa ocellata*	1.33×10^{-3}	<1%
R12	Active mound - *Leipoa ocellata*	1.43×10^{-3}	<1%

Note: Red shading indicates the value exceeds the relevant criteria and green shading indicates the value is below the relevant criteria.



Legend

- Note: all modelled concentrations were below the VOCs criteria of 49.1 µg/m³
- VOCs concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Mt Gibson Air Quality Impact Assessment

Predicted maximum 24-hour averaged VOCs GLCs (µg/m³)

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FIGURE 8.15

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
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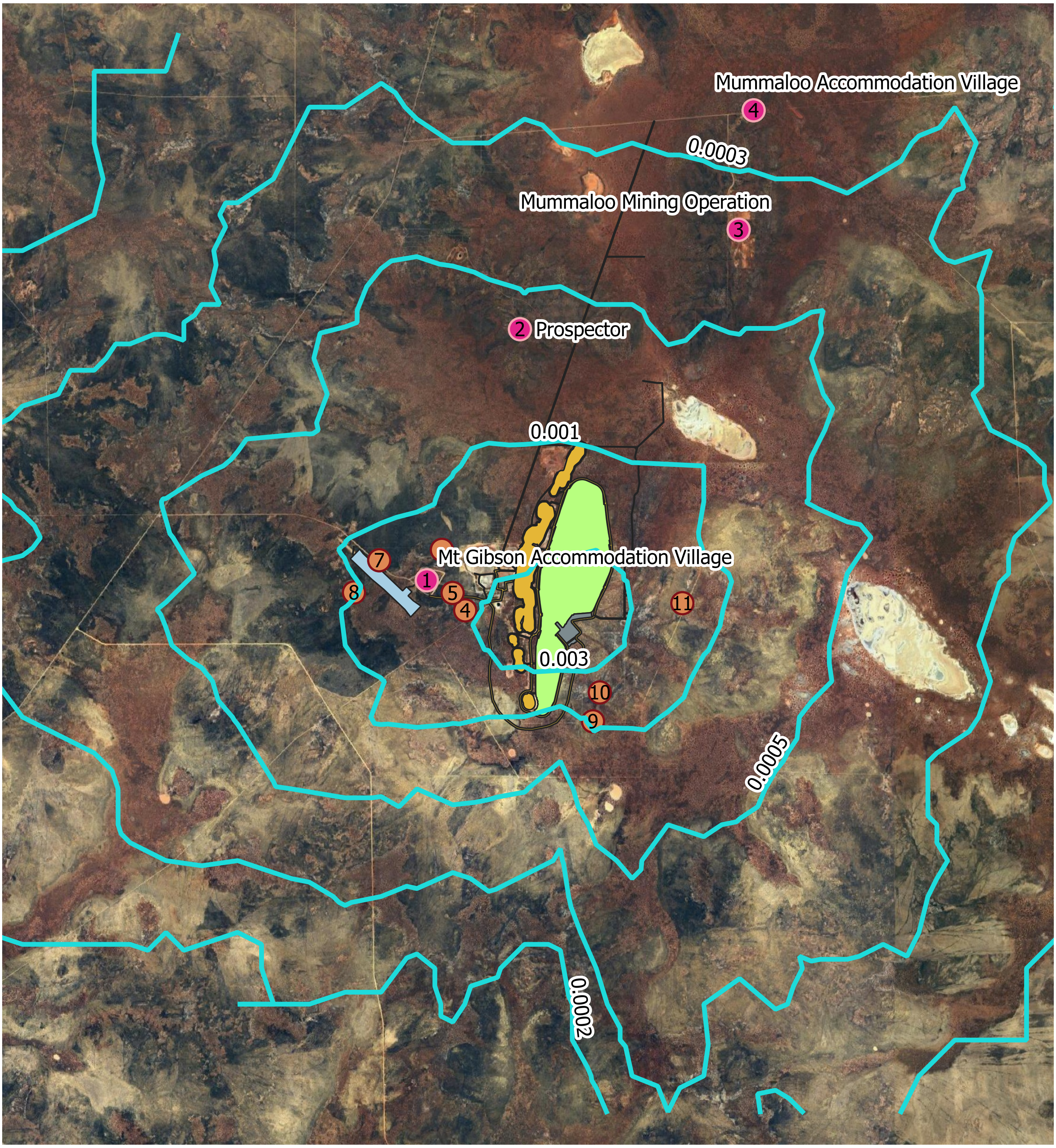

Legend

- Note: all modelled concentrations were below the VOCs criteria of 10 µg/m³
- VOCs concentration (µg/m³)
- Senstive receptors - human
- Active mounds - Leipoa ocellata
- Mining pits
- Airstrip
- IWL
- Plant
- Roads

Paper Size ISO A4

0 1 2 3 4 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

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Tetris Environmental Pty Ltd

Mt Gibson Air Quality Impact Assessment

Predicted annual average VOCs GLCs (µg/m³)

Project No. **12606145**
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FIGURE 8.16

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Print Date: 21/07/2023

Data Source:Google Earth Imagery 2023.
Created By: vhorn

9. Discussion

This assessment investigated the potential impacts of airborne pollutants on amenities, human health, as well as fauna and vegetation near the Project site. These three different categories have been separated into three different discussion points below.

9.1 Amenity impacts

There were six exceedances of the TSP 24-hour criteria at the human sensitive receptors. The loading and haul sources were the largest contributors to TSP emissions, most of the exceedances were due to the significant contribution of dust from activities associated with hauling and unloading/loading. The emissions from the haul trucks were significantly reduced by using water suppression on the haul roads. The extracted groundwater used for water suppression in the project area is hypersaline and acts similarly to chemical sealants by binding the soil particulates. The support vehicles were the second highest contributors. The results of the modelling demonstrate the importance of minimising particulate matter emissions from wheel generated dust through control measures.

Four of the six exceedances occurred on days with mean wind speeds between 1.3 and 1.6 m/s, significantly lower than the average mean wind speed of 3.5 m/s. Low wind speeds can prevent wide dispersion of particulate matter, increasing concentrations near the sources. The wind directions were predominantly from a southerly direction, causing the pollutants to be disbursed north of the sources, in the direction of the human sensitive receptors.

The remaining exceedances occurred during the summer months when additional activities associated with the lift events are occurring at the TSF. This was also compounded by southerly wind conditions in dry conditions influenced dust emissions to emanate toward the northern human sensitive receptors.

9.2 Human health impacts

There were no exceedances of the dust deposition, PM_{10} and $PM_{2.5}$ criteria at any of the human sensitive receptors. The natural gas generators were the only sources in the model emitting NO_2, SO_2, CO and VOCs. The GLCs for these pollutants were significantly below all identified criteria across the model domain.

9.3 Ecological impacts

To assess the ecological impacts on the area surrounding the mine site, the locations of active Malleefowl mounds were included as sensitive receptors. In the absence of criteria for the health of the Malleefowl, they were compared with criteria relevant to human health, as well as criteria relevant to vegetation. The health of vegetation surrounding the mounds is important as the Malleefowl feed on vegetation and use leaf litter to construct their mounds (Neilly, et al., 2022). Airborne pollutants have been shown to impact avian species through respiratory distress and illness, elevated stress levels, immunosuppression, behavioural changes, and impaired reproductive success (Sanderfoot & Holloway, 2017). Recent research has shown that air quality regulation has stemmed the decline in bird population, with the air quality criteria also benefiting the conservation of avian species (Liang, et al., 2020).

There were exceedances of the TSP and PM_{10}, and 24-hour criteria at various Malleefowl receptors across the modelling domain. The proximity of some of the mounds to the mining activities cause up to 31 exceedances of the TSP 24-hour criteria, spread out through the one-year modelling period. There were no exceedances of the TSP annual average criterion, suggesting any negative impacts on the Malleefowl and nearby vegetation would be short term stress. Similarly, PM_{10} concentrations only exceeded the 24-hour criteria, not the annual average criteria, so negative impacts are likely to be short term.

Studies looking at the impact of pollutants on avian species have identified poor health due to benzene, toluene, NO_2, and SO_2 (Richard, et al., 2021), however specific impacts appear to be species specific (Salmon, et al., 2018). In the absence of criteria for NO_2, SO_2, CO and VOCs for the Malleefowl, the concentrations were compared with criteria identified for human health impacts. The results were significantly below the set criteria across all identified sensitive receptors.

The location of vegetation, including the Eucalypt woodlands (TEC/PEC) and species identified in recent surveys, were considered in the assessment of the impacts of NO_2 and SO_2, where relevant criteria exist. This analysis indicated that the levels of NO_2 and SO_2 were significantly lower than the identified criteria across the modelling domain and will be unlikely to impact the vegetation or fauna.

CO has been identified as a signalling molecule in plants and is involved in a variety of processes and has been seen to alleviate or prevent stress to plants (Wang & Liao, 2016). Concentrations were very low across the modelling domain (< 22 $\mu g/m^3$), and not considered problematic for vegetation health.

Dust deposition has been shown to have negative impacts on vegetation (Doley & Rossato, 2010; Farmer, 1993; Rahul & Jain, 2014). A study on the impact of dust deposition on plant health and survivorship in semi-arid environments found no evidence that the plant survivorship surrounding the studied mine sites was impacted by dust deposition (Matsuki, et al., 2016). The Malleefowl rely on vegetation for food, and they use leaflitter to build their mounds (Neilly, et al., 2022). Therefore, negative impacts on vegetation may also negatively impact the Malleefowl. Dust deposition was compared with the criterion for human health impacts, and only exceeded this criterion within one km of the mine site. The criteria for human health are likely lower than the levels required to see significant damage to plant health (Doley & Rossato, 2010). Therefore, it is unlikely that dust deposition from the mining activities will cause damage to the surrounding vegetation.

Eucalypt woodlands (TEC/PEC) boarder the mine pits and IWL, and some areas are likely to exceed the 2 g/m^2/month criteria. Studies on various species of Eucalyptus have shown that they may experience negative physiological responses (Gholami, et al., 2016; Nawaz, et al., 2022; Singh, et al., 2018). Impacts include negative influences on stomatal conductance, photosynthetic rate, and transpiration rate (Nawaz, et al., 2022). Overall, despite the observed negative impacts of dust, it has been shown that Eucalypt species are tolerant to high levels of dust deposition (Nawaz, et al., 2021; Singh, et al., 2018; Gholami, et al., 2016; Nawaz, et al., 2022), and it is likely that the rates of deposition from the Project are unlikely to negatively impact the Eucalypt woodlands.

10. Management and mitigation

10.1 Construction

Dust emissions from construction are short-lived and are unlikely to have long-term impacts. However, typical management measures during construction should be applied:

- All construction and maintenance equipment/vehicles to be operated and maintained to manufacturers' specifications to minimise exhaust emissions.
- Defined haul routes to be used wherever it is necessary for vehicles to traverse unsealed surfaces or unformed roads.
- Vehicle speeds would be limited on areas on unconsolidated or unsealed soil not treated with dust suppression.

10.2 Operations

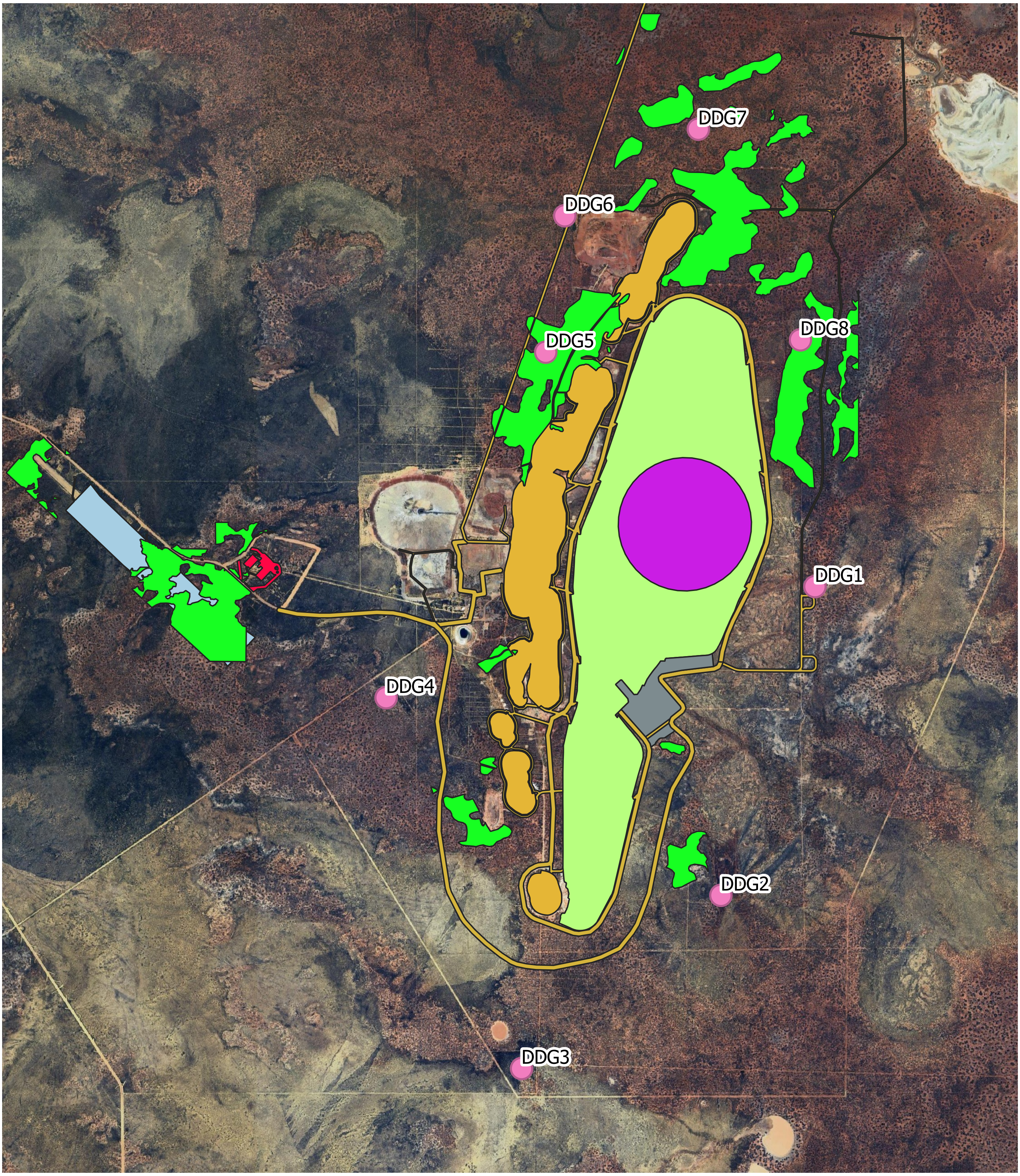
The following dust control management and mitigation measures should be applied during Project operations to ensure minimal dust emissions:

- Prompt mitigation of excessive visible dust emissions, which may involve a combination of stabilisation of surface silt content through application of localised water sprays or the use of groundwater. The groundwater is notably hypersaline, which when used as a water suppressant acts similarly to a chemical sealant and effectively binds the soil.
- Control of mechanically induced dust emissions during materials handling by application of mobile water sprays via truck.
- Ensuring a dust management plan or procedure is in place and management measures are implemented across the operation.

Dust deposition monitoring is advised to be undertaken on a regular basis during operations to meet the maximum criteria of 2 g/m^2/month. These dust deposition gauge locations have been selected based on the areas of maximum impact. A summary of suggested dust deposition gauge locations is provided in Table 10.1 and shown in Figure 10.1.

Table 10.1 Suggested dust deposition gauge locations

ID	Details	Location	Sampling frequency
DDG1	Downwind, situated at the edge of the ROM and processing facility	East	Monthly
DDG2	Downwind of the IWL	Southeast	Monthly
DDG3	Downwind of the pits	South	Monthly
DDG4	Downwind of the pits	West	Monthly
DDG5	Downwind of the pits/in Eucalypt woodlands	Northwest	Monthly
DDG6	Downwind of the pits	Northeast	Monthly
DDG7	Downwind of the pits	North	Monthly
DDG8	Downwind of IWL/in Eucalypt woodlands	Northeast	Monthly



Legend

Mining pits
Airstrip
IWL
TSF
Village
Plant
Roads
Eucalypt woodlands (TEC/PEC)
Dust deposition gauges

Paper Size ISO A4
0 0.25 0.5 0.75 1 km

Map Projection: Transverse Mercator
Horizontal Datum: GDA94
Grid: GDA94 / MGA zone 50

N

GHD

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Mt Gibson Air Quality Impact Assessment

Recommended dust deposition locations.

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Revision No. **2**
Date. **9/08/2023**

FIGURE 10.1

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Data Source:Google Earth Imagery 2023.
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11. Conclusion

Results of this air quality impact assessment indicate that with appropriate dust control measures in place there will be limited negative air quality impacts. Model outputs showed significant contributions to the emissions of particulate matter from wheel generated dust, which must be managed with control measures such as the application of hypersaline groundwater via mobile trucks on unsealed surfaces where required.

TSP is the only pollutant of concern for the human sensitive receptors, with five exceedances of the 24-hour criterion, however there were no exceedances of the annual average criteria. There were no exceedances at the human sensitive receptors at any of the other modelled pollutants (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, and VOCs).

There were exceedances at Malleefowl mound sensitive receptors for TSP and PM_{10} when compared with the 24-hour criteria for human health. Without species specific studies on the impact of particulate matter on Malleefowl it is unclear if these exceedances may have negative health impacts on the birds. The annual average criteria were not exceeded, so it is likely any negative impacts will be short term.

The impact of dust deposition on the Malleefowl was considered in the context of the impacts it would have on vegetation that the Malleefowl feed on and use to build their mounds (Neilly, et al., 2022). Studies have shown negative impacts on plant health and growth due to the deposition of particulate matter (Doley & Rossato, 2010; Farmer, 1993). However, a study looking specifically at the impacts on native vegetation in semi-arid zones in Australia found the dust deposition may have stressed the plants but did not impact survivorship (Matsuki, et al., 2016). Due to the low rates of dust deposition (no exceedances to the human health criterion) it is considered unlikely to cause damage to the native vegetation that the Malleefowl rely on.

Studies investigating impacts of dust deposition on various species of Eucalyptus have shown that while some negative impacts on physiological process may be observed, overall, they are resistant to high levels of dust deposition (Nawaz, et al., 2021; Nawaz, et al., 2022; Singh, et al., 2018). Due to the low rates of dust deposition (no exceedances to the human health criterion) it is considered unlikely to cause damage to the Eucalypt woodlands or the native vegetation that the Malleefowl rely on.

Without relevant criteria for the impact of NO_2, SO_2, CO, and VOCs on the Malleefowl the GLCs of these pollutants were compared with criteria for human health at the Malleefowl mound sensitive receptors. The GLCs were significantly less than the relevant criteria at all sensitive receptors.

The impact of airborne pollutants on native vegetation surrounding the Project site was also considered in this assessment. GLCs of NO_2 and SO_2 were compared with criteria for the annual average concentration set out in AQ Guidelines Europe (WHO, 2000). The GLCs were significantly below the criteria across the model domain (<10 percent).

12. References

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Appendices

Appendix A

Sample AERMOD output file

```
**
****************************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 10.0.1
** Lakes Environmental Software Inc.
** Date: 26-Jun-23
** File: F:\Tetris Environmental\Mt Gibson\MtGibson_TSP\MtGibson_AERMOD.ADI
**
****************************************
**
**
****************************************
** AERMOD Control Pathway
****************************************
**
**
CO STARTING
  TITLEONE F:\Tetris Environmental\Mt Gibson\MtGibson_AERMOD\MtGibson_AERMOD.is
  MODELOPT DFAULT CONC
  AVERTIME 1 24 PERIOD
  POLLUTID TSP
  RUNORNOT RUN
  ERRORFIL MtGibson_AERMOD.err
CO FINISHED
**
****************************************
** AERMOD Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
  LOCATION DEEP_SOUTH   AREAPOLY   516225.724  6705544.439     347.210
** DESCRSRC Deep South mine pit (100%)
  LOCATION HORN_ENT     AREAPOLY   517520.874  6712414.253     324.450
** DESCRSRC Hornet/Enterprise mine pit (100%)
  LOCATION N_ORION      AREAPOLY   516631.333  6710880.194     335.000
** DESCRSRC Northern Orion mine pit (100%)
  LOCATION S_ORION      AREAPOLY   516104.000  6709708.343     351.480
** DESCRSRC Southern Orion mine pit (29%)
  LOCATION T_FIND       AREAPOLY   516045.408  6707945.241     361.740
** DESCRSRC Tobias Find mine pit (83%)
  LOCATION ROM          AREAPOLY   516663.293  6707817.402     353.900
** DESCRSRC ROM
  LOCATION TSF          AREACIRC   517712.630  6709098.450     342.820
** DESCRSRC TSF
```

```
   LOCATION WASTE       AREAPOLY   516905.653  6709833.518     335.740
** DESCRSRC Waste rock landform (north of TSF)
   LOCATION LOADER1     VOLUME     517007.000  6707797.000     357.430
** DESCRSRC ROM
   LOCATION EXC1_A      VOLUME     517291.200  6711676.000     319.760
** DESCRSRC Load and haul from pit to ROM
   LOCATION EXC1_C      VOLUME     516663.400  6710640.000     306.890
** DESCRSRC Load and haul from pit to ROM
   LOCATION EXC1_B      VOLUME     516254.700  6709302.000     345.890
** DESCRSRC Load and haul from pit to ROM
   LOCATION UNLOAD1     VOLUME     517491.800  6710439.000     331.000
** DESCRSRC Load and haul from pit to ROM
   LOCATION UNLOAD2     VOLUME     516861.800  6707518.000     357.880
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_A   VOLUME     517391.500  6711509.000     323.790
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_B   VOLUME     517221.200  6711007.000     327.060
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_C   VOLUME     517079.100  6710589.000     331.410
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_D   VOLUME     516953.700  6710121.000     335.760
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_E   VOLUME     516803.300  6709728.000     339.960
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_F   VOLUME     516703.000  6709319.000     343.000
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_G   VOLUME     516560.900  6708951.000     345.910
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_H   VOLUME     516502.400  6708466.000     353.070
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_I   VOLUME     516380.100  6708015.000     353.170
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_J   VOLUME     516502.400  6707262.000     356.100
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_K   VOLUME     516318.500  6706661.000     351.740
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_L   VOLUME     516343.500  6706117.000     352.420
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_M   VOLUME     516159.600  6705557.000     351.970
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_N   VOLUME     516221.200  6705008.000     348.270
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_O   VOLUME     516769.800  6704947.000     346.730
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_P   VOLUME     517020.600  6705390.000     346.980
** DESCRSRC Load and haul from pit to ROM
   LOCATION DUMP_180_Q   VOLUME     517137.600  6705883.000     347.350
** DESCRSRC Load and haul from pit to ROM
```

```
  LOCATION DUMP_180_R   VOLUME     517221.200  6706276.000     351.710
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  LOCATION DUMP_180_S   VOLUME     517321.500  6706669.000     354.700
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_180_T   VOLUME     517029.000  6707179.000     356.330
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_A    VOLUME     517313.200  6711174.000     326.230
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_B    VOLUME     517029.000  6710322.000     332.700
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_C    VOLUME     516619.400  6709160.000     343.430
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_D    VOLUME     516560.900  6707856.000     356.000
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_E    VOLUME     516360.200  6705791.000     349.000
** DESCRSRC Load and haul from pit to ROM
  LOCATION DUMP_90_F    VOLUME     517112.600  6705699.000     348.730
** DESCRSRC Load and haul from pit to ROM
  LOCATION DRILL_A      VOLUME     517438.600  6711851.000     332.330
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_B      VOLUME     517037.300  6711316.000     330.120
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_C      VOLUME     516669.500  6710280.000     332.000
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_D      VOLUME     516251.600  6709210.000     342.520
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_E      VOLUME     516310.100  6708851.000     342.850
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_F      VOLUME     516084.400  6708441.000     347.740
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_G      VOLUME     516134.600  6709561.000     334.780
** DESCRSRC Drill and blast in pits
  LOCATION DRILL_H      VOLUME     516126.200  6708892.000     331.620
** DESCRSRC Drill and blast in pits
  LOCATION TRUCK1       VOLUME     516310.100  6708976.000     343.000
** DESCRSRC Drill and blast in pits
  LOCATION BLAST        VOLUME     516034.300  6709252.000     339.390
** DESCRSRC Drill and blast in pits
  LOCATION DOZER1_A     VOLUME     517338.200  6711559.000     316.530
** DESCRSRC Support vehicles
  LOCATION DOZER1_B     VOLUME     516527.400  6709987.000     322.100
** DESCRSRC Support vehicles
  LOCATION DOZER1_C     VOLUME     516276.700  6708993.000     343.680
** DESCRSRC Support vehicles
  LOCATION GRADER1_A    VOLUME     516159.600  6709018.000     324.460
** DESCRSRC Support vehicles
  LOCATION GRADER1_B    VOLUME     517371.700  6711843.000     334.420
** DESCRSRC Support vehicles
```

```
  LOCATION TRUCK2_A     VOLUME     516953.700  6711099.000     329.370
** DESCRSRC Support vehicles
  LOCATION TRUCK2_B     VOLUME     516009.200  6708993.000     336.570
** DESCRSRC Support vehicles
  LOCATION ROCKBREAKER  VOLUME     516318.500  6709511.000     350.100
** DESCRSRC Support vehicles
  LOCATION LOADER2_A    VOLUME     516218.100  6709461.000     336.280
** DESCRSRC Support vehicles
  LOCATION LOADER2_B    VOLUME     517187.800  6711375.000     304.810
** DESCRSRC Support vehicles
  LOCATION TRUCK3_A     VOLUME     516184.700  6709009.000     334.500
** DESCRSRC Support vehicles
  LOCATION TRUCK3_B     VOLUME     516786.600  6710656.000     335.690
** DESCRSRC Support vehicles
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** DESCRSRC Support vehicles
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** DESCRSRC Support vehicles
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** DESCRSRC TSF operations
  LOCATION DUMP_40_B    VOLUME     517877.400  6709249.000     341.210
** DESCRSRC TSF operations
  LOCATION DUMP_40_C    VOLUME     517534.700  6709374.000     340.970
** DESCRSRC TSF operations
  LOCATION DUMP_40_D    VOLUME     517526.300  6709140.000     342.120
** DESCRSRC TSF operations
  LOCATION DOZER2       VOLUME     518078.000  6709182.000     340.040
** DESCRSRC TSF operations
  LOCATION EXC2         VOLUME     517559.800  6708764.000     347.010
** DESCRSRC TSF operations
  LOCATION GRADER2      VOLUME     517309.000  6709015.000     343.690
** DESCRSRC TSF operations
  LOCATION LOADER3      VOLUME     517417.700  6708831.000     347.260
** DESCRSRC TSF operations
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** DESCRSRC Processing
  LOCATION CRUSHER2     VOLUME     517240.000  6707246.000     358.330
** DESCRSRC Processing
  LOCATION CRUSHER3_A   VOLUME     517338.200  6707135.000     358.870
** DESCRSRC Processing
  LOCATION CRUSHER3_B   VOLUME     517451.100  6707210.000     360.000
** DESCRSRC Processing
  LOCATION SCREEN_A     VOLUME     517488.700  6707367.000     362.960
** DESCRSRC Processing
  LOCATION SCREEN_B     VOLUME     517413.500  6707319.000     361.220
** DESCRSRC Processing
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** LINE VOLUME Source ID = CONVEYOR_A
** DESCRSRC Processing
** PREFIX
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** Configuration = Separated 2W
** Emission Rate = 0.04
** Vertical Dimension = 1.00
** SZINIT = 0.47
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** 517326.494, 6706999.034, 357.03, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000677     VOLUME   517118.821 6707218.574 357.59
   LOCATION L0000678     VOLUME   517146.309 6707189.515 357.52
   LOCATION L0000679     VOLUME   517173.797 6707160.456 357.44
   LOCATION L0000680     VOLUME   517201.285 6707131.397 357.37
   LOCATION L0000681     VOLUME   517228.773 6707102.339 357.29
   LOCATION L0000682     VOLUME   517256.261 6707073.280 357.22
   LOCATION L0000683     VOLUME   517283.749 6707044.221 357.15
   LOCATION L0000684     VOLUME   517311.237 6707015.163 357.07
** End of LINE VOLUME Source ID = CONVEYOR_A
** ------------------------------------------------------------------
** Line Source Represented by Separated Volume Sources (2W)
** LINE VOLUME Source ID = CONVEYOR_B
** DESCRSRC Processing
** PREFIX
** Length of Side = 20.00
** Configuration = Separated 2W
** Emission Rate = 0.04
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** SZINIT = 0.47
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** 517139.434, 6707261.126, 358.73, 3.00, 18.60
** 517354.810, 6707026.644, 358.92, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000685     VOLUME   517146.199 6707253.761 358.74
   LOCATION L0000686     VOLUME   517173.258 6707224.302 358.76
   LOCATION L0000687     VOLUME   517200.316 6707194.843 358.78
   LOCATION L0000688     VOLUME   517227.375 6707165.384 358.81
   LOCATION L0000689     VOLUME   517254.433 6707135.925 358.83
   LOCATION L0000690     VOLUME   517281.492 6707106.466 358.86
   LOCATION L0000691     VOLUME   517308.551 6707077.007 358.88
   LOCATION L0000692     VOLUME   517335.609 6707047.548 358.90
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** ------------------------------------------------------------------
** Line Source Represented by Separated Volume Sources (2W)
```

```
** LINE VOLUME Source ID = CONVEYOR_C
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** PREFIX
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** Configuration = Separated 2W
** Emission Rate = 0.04
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** SZINIT = 0.47
** Nodes = 2
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** 517380.863, 6707063.119, 359.03, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000693     VOLUME   517180.981 6707278.119 359.37
   LOCATION L0000694     VOLUME   517208.217 6707248.823 359.32
   LOCATION L0000695     VOLUME   517235.452 6707219.528 359.28
   LOCATION L0000696     VOLUME   517262.688 6707190.233 359.23
   LOCATION L0000697     VOLUME   517289.924 6707160.937 359.18
   LOCATION L0000698     VOLUME   517317.159 6707131.642 359.14
   LOCATION L0000699     VOLUME   517344.395 6707102.346 359.09
   LOCATION L0000700     VOLUME   517371.630 6707073.051 359.05
** End of LINE VOLUME Source ID = CONVEYOR_C
** ------------------------------------------------------------------
** Line Source Represented by Separated Volume Sources (2W)
** LINE VOLUME Source ID = CONVEYOR_D
** DESCRSRC Processing
** PREFIX
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** SZINIT = 0.47
** Nodes = 2
** 517214.121, 6707314.970, 358.64, 3.00, 18.60
** 517417.338, 6707089.173, 359.99, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000701     VOLUME   517220.811 6707307.537 358.68
   LOCATION L0000702     VOLUME   517247.569 6707277.805 358.86
   LOCATION L0000703     VOLUME   517274.328 6707248.073 359.04
   LOCATION L0000704     VOLUME   517301.086 6707218.342 359.22
   LOCATION L0000705     VOLUME   517327.845 6707188.610 359.40
   LOCATION L0000706     VOLUME   517354.604 6707158.878 359.57
   LOCATION L0000707     VOLUME   517381.362 6707129.146 359.75
   LOCATION L0000708     VOLUME   517408.121 6707099.415 359.93
** End of LINE VOLUME Source ID = CONVEYOR_D
** ------------------------------------------------------------------
** Line Source Represented by Separated Volume Sources (2W)
** LINE VOLUME Source ID = CONVEYOR_E
** DESCRSRC Processing
```

```
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** Nodes = 2
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** 517448.603, 6707120.437, 360.93, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000709     VOLUME   517252.047 6707340.513 358.72
   LOCATION L0000710     VOLUME   517278.692 6707310.679 359.02
   LOCATION L0000711     VOLUME   517305.337 6707280.846 359.32
   LOCATION L0000712     VOLUME   517331.982 6707251.012 359.62
   LOCATION L0000713     VOLUME   517358.627 6707221.179 359.92
   LOCATION L0000714     VOLUME   517385.272 6707191.345 360.22
   LOCATION L0000715     VOLUME   517411.917 6707161.512 360.52
   LOCATION L0000716     VOLUME   517438.563 6707131.678 360.82
** End of LINE VOLUME Source ID = CONVEYOR_E
** ------------------------------------------------------------------
** Line Source Represented by Separated Volume Sources (2W)
** LINE VOLUME Source ID = CONVEYOR_F
** DESCRSRC Processing
** PREFIX
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** Configuration = Separated 2W
** Emission Rate = 0.04
** Vertical Dimension = 1.00
** SZINIT = 0.47
** Nodes = 2
** 517283.597, 6707380.972, 359.92, 3.00, 18.60
** 517493.762, 6707156.912, 361.00, 3.00, 18.60
** ------------------------------------------------------------------
   LOCATION L0000717     VOLUME   517290.438 6707373.679 359.96
   LOCATION L0000718     VOLUME   517317.803 6707344.504 360.10
   LOCATION L0000719     VOLUME   517345.169 6707315.330 360.24
   LOCATION L0000720     VOLUME   517372.534 6707286.155 360.38
   LOCATION L0000721     VOLUME   517399.899 6707256.981 360.52
   LOCATION L0000722     VOLUME   517427.264 6707227.806 360.66
   LOCATION L0000723     VOLUME   517454.629 6707198.632 360.80
   LOCATION L0000724     VOLUME   517481.994 6707169.458 360.94
** End of LINE VOLUME Source ID = CONVEYOR_F
** Source Parameters **
   SRCPARAM DEEP_SOUTH   5.5556E-06     1.000       14
   AREAVERT DEEP_SOUTH   516225.724 6705544.439 516366.186 6705482.867
   AREAVERT DEEP_SOUTH   516396.973 6705421.294 516441.228 6705251.969
   AREAVERT DEEP_SOUTH   516414.290 6705155.762 516337.324 6705088.417
   AREAVERT DEEP_SOUTH   516258.434 6705082.645 516181.468 6705107.658
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AREAVERT DEEP_SOUTH   516121.820 6705178.852 516110.275 6705269.287
AREAVERT DEEP_SOUTH   516077.565 6705352.025 516094.882 6705450.156
AREAVERT DEEP_SOUTH   516148.758 6705505.956 516225.724 6705515.577
SRCPARAM HORN_ENT     5.5556E-06     1.000       27
AREAVERT HORN_ENT     517520.874 6712414.253 517646.049 6712483.498
AREAVERT HORN_ENT     517731.275 6712488.825 517805.847 6712419.579
AREAVERT HORN_ENT     517824.490 6712225.159 517808.510 6712174.556
AREAVERT HORN_ENT     517683.335 6711988.125 517520.874 6711862.950
AREAVERT HORN_ENT     517502.231 6711767.072 517438.312 6711647.223
AREAVERT HORN_ENT     517417.006 6711450.139 517366.403 6711452.803
AREAVERT HORN_ENT     517294.494 6711298.331 517209.268 6711261.045
AREAVERT HORN_ENT     517129.369 6711279.688 517025.501 6711047.981
AREAVERT HORN_ENT     516937.612 6711037.328 516865.703 6711093.257
AREAVERT HORN_ENT     516844.397 6711175.820 516972.235 6711407.526
AREAVERT HORN_ENT     516972.235 6711474.109 517092.083 6711719.132
AREAVERT HORN_ENT     517142.686 6711745.765 517227.911 6711753.755
AREAVERT HORN_ENT     517337.107 6712094.657 517440.975 6712299.731
AREAVERT HORN_ENT     517512.884 6712352.997
SRCPARAM N_ORION      5.5556E-06     1.000       25
AREAVERT N_ORION      516631.333 6710880.194 516767.161 6710877.530
AREAVERT N_ORION      516847.060 6710770.999 516913.642 6710749.692
AREAVERT N_ORION      516953.592 6710691.100 516977.562 6710467.383
AREAVERT N_ORION      516889.673 6710344.871 516663.293 6709825.528
AREAVERT N_ORION      516527.464 6709628.444 516498.168 6709628.444
AREAVERT N_ORION      516503.495 6709697.690 516391.636 6709708.343
AREAVERT N_ORION      516359.677 6709665.730 516117.317 6709732.313
AREAVERT N_ORION      516098.674 6709876.131 516173.246 6710057.235
AREAVERT N_ORION      516346.360 6710203.716 516482.188 6710214.370
AREAVERT N_ORION      516498.168 6710275.625 516556.761 6710302.258
AREAVERT N_ORION      516607.363 6710395.474 516524.801 6710430.097
AREAVERT N_ORION      516482.188 6710507.332 516503.495 6710755.019
AREAVERT N_ORION      516570.077 6710837.581
SRCPARAM S_ORION      5.5556E-06     1.000       10
AREAVERT S_ORION      516104.000 6709708.343 516058.724 6709628.444
AREAVERT S_ORION      515962.845 6709529.902 515912.243 6709330.155
AREAVERT S_ORION      516466.209 6709207.643 516487.515 6709271.562
AREAVERT S_ORION      516468.872 6709378.094 516444.902 6709428.697
AREAVERT S_ORION      516495.505 6709535.229 516463.545 6709625.781
SRCPARAM T_FIND       5.5556E-06     1.000        9
AREAVERT T_FIND       516045.408 6707945.241 515901.590 6707886.648
AREAVERT T_FIND       515848.324 6707700.217 515901.590 6707436.551
AREAVERT T_FIND       515893.600 6707364.642 516042.744 6707452.531
AREAVERT T_FIND       516034.755 6707503.133 516117.317 6707668.258
AREAVERT T_FIND       516090.684 6707923.934
SRCPARAM ROM          5.5556E-06     1.000       12
AREAVERT ROM          516663.293 6707817.402 516570.077 6707084.996
AREAVERT ROM          516998.868 6707146.252 517134.696 6707292.733
AREAVERT ROM          517124.043 6707335.346 516996.205 6707481.827
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AREAVERT ROM        517057.460 6707524.440 517190.625 6707385.948
AREAVERT ROM        517217.258 6707372.632 517278.514 6707465.847
AREAVERT ROM        517520.874 6707750.820 517265.198 6708097.049
SRCPARAM TSF        5.5556E-06    1.000   635.460      20
SRCPARAM WASTE       3.8889E-06    1.000       8
AREAVERT WASTE       516905.653 6709833.518 517393.036 6711253.055
AREAVERT WASTE       517582.130 6711466.119 517768.561 6711492.752
AREAVERT WASTE       518178.708 6711319.638 518317.200 6711165.166
AREAVERT WASTE       518378.456 6710792.305 518514.284 6709766.936
SRCPARAM LOADER1         2.23     1.000     1.000     2.150
SRCPARAM EXC1_A          1.9     1.000     1.000     2.150
SRCPARAM EXC1_C          1.9     1.000     1.000     2.150
SRCPARAM EXC1_B          1.9     1.000     1.000     2.150
SRCPARAM UNLOAD1     3.514112485     1.000     1.000     2.150
SRCPARAM UNLOAD2     2.670298241     1.000     1.000     2.150
SRCPARAM DUMP_180_A       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_B       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_C       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_D       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_E       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_F       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_G       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_H       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_I      1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_J      1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_K       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_L       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_M       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_N       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_O       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_P       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_Q       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_R       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_S       1.47     1.000     1.000     2.150
SRCPARAM DUMP_180_T       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_A       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_B       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_C       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_D       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_E       1.47     1.000     1.000     2.150
SRCPARAM DUMP_90_F       1.47     1.000     1.000     2.150
SRCPARAM DRILL_A     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_B     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_C     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_D     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_E     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_F     0.193479938     1.000     1.000     2.150
SRCPARAM DRILL_G     0.193479938     1.000     1.000     2.150
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   SRCPARAM DRILL_H      0.193479938     1.000     1.000     2.150
   SRCPARAM TRUCK1          5.875     1.000     1.000     2.150
   SRCPARAM BLAST            26.1     1.000     1.000     2.150
   SRCPARAM DOZER1_A         2.36     1.000     1.000     2.150
   SRCPARAM DOZER1_B         2.36     1.000     1.000     2.150
   SRCPARAM DOZER1_C         2.36     1.000     1.000     2.150
   SRCPARAM GRADER1_A        0.26     1.000     1.000     2.150
   SRCPARAM GRADER1_B        0.26     1.000     1.000     2.150
   SRCPARAM TRUCK2_A        5.875     1.000     1.000     2.150
   SRCPARAM TRUCK2_B        5.875     1.000     1.000     2.150
   SRCPARAM ROCKBREAKER  0.208333333     1.000     1.000     2.150
   SRCPARAM LOADER2_A        4.23     1.000     1.000     2.150
   SRCPARAM LOADER2_B        4.23     1.000     1.000     2.150
   SRCPARAM TRUCK3_A    1.305555556     1.000     1.000     2.150
   SRCPARAM TRUCK3_B    1.305555556     1.000     1.000     2.150
   SRCPARAM BUS1       1.305555556     1.000     1.000     2.150
   SRCPARAM BUS2_A      1.305555556     1.000     1.000     2.150
   SRCPARAM BUS2_B      1.305555556     1.000     1.000     2.150
   SRCPARAM DUMP_40_A       5.875     1.000     1.000     2.150
   SRCPARAM DUMP_40_B       5.875     1.000     1.000     2.150
   SRCPARAM DUMP_40_C       5.875     1.000     1.000     2.150
   SRCPARAM DUMP_40_D       5.875     1.000     1.000     2.150
   SRCPARAM DOZER2      2.361111111     1.000     1.000     2.150
   SRCPARAM EXC2       9.024619054     1.000     1.000     2.150
   SRCPARAM GRADER2     0.263888889     1.000     1.000     2.150
   SRCPARAM LOADER3     9.024619054     1.000     1.000     2.150
   SRCPARAM CRUSHER1    0.534059648     1.000     1.000     2.150
   SRCPARAM CRUSHER2    1.602178944     1.000     1.000     2.150
   SRCPARAM CRUSHER3_A   0.801089472     1.000     1.000     2.150
   SRCPARAM CRUSHER3_B   0.801089472     1.000     1.000     2.150
   SRCPARAM SCREEN_A    0.33378728     1.000     1.000     2.150
   SRCPARAM SCREEN_B    0.33378728     1.000     1.000     2.150
** LINE VOLUME Source ID = CONVEYOR_A
   SRCPARAM L0000677       0.005     3.00     18.60     0.47
   SRCPARAM L0000678       0.005     3.00     18.60     0.47
   SRCPARAM L0000679       0.005     3.00     18.60     0.47
   SRCPARAM L0000680       0.005     3.00     18.60     0.47
   SRCPARAM L0000681       0.005     3.00     18.60     0.47
   SRCPARAM L0000682       0.005     3.00     18.60     0.47
   SRCPARAM L0000683       0.005     3.00     18.60     0.47
   SRCPARAM L0000684       0.005     3.00     18.60     0.47
** ------------------------------------------------------------------------
** LINE VOLUME Source ID = CONVEYOR_B
   SRCPARAM L0000685       0.005     3.00     18.60     0.47
   SRCPARAM L0000686       0.005     3.00     18.60     0.47
   SRCPARAM L0000687       0.005     3.00     18.60     0.47
   SRCPARAM L0000688       0.005     3.00     18.60     0.47
   SRCPARAM L0000689       0.005     3.00     18.60     0.47
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   SRCPARAM L0000690       0.005    3.00    18.60    0.47
   SRCPARAM L0000691       0.005    3.00    18.60    0.47
   SRCPARAM L0000692       0.005    3.00    18.60    0.47
** ------------------------------------------------------------------------
** LINE VOLUME Source ID = CONVEYOR_C
   SRCPARAM L0000693       0.005    3.00    18.60    0.47
   SRCPARAM L0000694       0.005    3.00    18.60    0.47
   SRCPARAM L0000695       0.005    3.00    18.60    0.47
   SRCPARAM L0000696       0.005    3.00    18.60    0.47
   SRCPARAM L0000697       0.005    3.00    18.60    0.47
   SRCPARAM L0000698       0.005    3.00    18.60    0.47
   SRCPARAM L0000699       0.005    3.00    18.60    0.47
   SRCPARAM L0000700       0.005    3.00    18.60    0.47
** ------------------------------------------------------------------------
** LINE VOLUME Source ID = CONVEYOR_D
   SRCPARAM L0000701       0.005    3.00    18.60    0.47
   SRCPARAM L0000702       0.005    3.00    18.60    0.47
   SRCPARAM L0000703       0.005    3.00    18.60    0.47
   SRCPARAM L0000704       0.005    3.00    18.60    0.47
   SRCPARAM L0000705       0.005    3.00    18.60    0.47
   SRCPARAM L0000706       0.005    3.00    18.60    0.47
   SRCPARAM L0000707       0.005    3.00    18.60    0.47
   SRCPARAM L0000708       0.005    3.00    18.60    0.47
** ------------------------------------------------------------------------
** LINE VOLUME Source ID = CONVEYOR_E
   SRCPARAM L0000709       0.005    3.00    18.60    0.47
   SRCPARAM L0000710       0.005    3.00    18.60    0.47
   SRCPARAM L0000711       0.005    3.00    18.60    0.47
   SRCPARAM L0000712       0.005    3.00    18.60    0.47
   SRCPARAM L0000713       0.005    3.00    18.60    0.47
   SRCPARAM L0000714       0.005    3.00    18.60    0.47
   SRCPARAM L0000715       0.005    3.00    18.60    0.47
   SRCPARAM L0000716       0.005    3.00    18.60    0.47
** ------------------------------------------------------------------------
** LINE VOLUME Source ID = CONVEYOR_F
   SRCPARAM L0000717       0.005    3.00    18.60    0.47
   SRCPARAM L0000718       0.005    3.00    18.60    0.47
   SRCPARAM L0000719       0.005    3.00    18.60    0.47
   SRCPARAM L0000720       0.005    3.00    18.60    0.47
   SRCPARAM L0000721       0.005    3.00    18.60    0.47
   SRCPARAM L0000722       0.005    3.00    18.60    0.47
   SRCPARAM L0000723       0.005    3.00    18.60    0.47
   SRCPARAM L0000724       0.005    3.00    18.60    0.47
** ------------------------------------------------------------------------

** Variable Emissions Type: "By Hour / Seven Days (HRDOW7)"
** Variable Emission Scenario: "Blasting"
   EMISFACT BLAST        HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
```

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   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 1.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT BLAST       HRDOW7 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

** Variable Emissions Type: "By Season (SEASON)"
** Variable Emission Scenario: "TSF operations"
** Southern Hemisphere seasonal categories
   EMISFACT DUMP_40_A    SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT DUMP_40_B    SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT DUMP_40_C    SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT DUMP_40_D    SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT DOZER2       SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT EXC2         SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT GRADER2      SEASON 1.0 0.0 0.0 0.0
** Southern Hemisphere seasonal categories
   EMISFACT LOADER3      SEASON 1.0 0.0 0.0 0.0
   HOUREMIS TSP.EMI DEEP_SOUTH HORN_ENT N_ORION
   HOUREMIS TSP.EMI S_ORION T_FIND ROM
   HOUREMIS TSP.EMI TSF WASTE
   SRCGROUP Wind_ero DEEP_SOUTH HORN_ENT N_ORION S_ORION T_FIND ROM WASTE
   SRCGROUP Wind_ero TSF
   SRCGROUP Processi L0000677 L0000678 L0000679 L0000680 L0000681 L0000682
   SRCGROUP Processi L0000683 L0000684 L0000685 L0000686 L0000687 L0000688
   SRCGROUP Processi L0000689 L0000690 L0000691 L0000692 L0000693 L0000694
   SRCGROUP Processi L0000695 L0000696 L0000697 L0000698 L0000699 L0000700
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   SRCGROUP Processi L0000701 L0000702 L0000703 L0000704 L0000705 L0000706
   SRCGROUP Processi L0000707 L0000708 L0000709 L0000710 L0000711 L0000712
   SRCGROUP Processi L0000713 L0000714 L0000715 L0000716 L0000717 L0000718
   SRCGROUP Processi L0000719 L0000720 L0000721 L0000722 L0000723 L0000724
   SRCGROUP Processi CRUSHER1 CRUSHER2 CRUSHER3_A CRUSHER3_B SCREEN_A SCREEN_B
   SRCGROUP Load_hau EXC1_A EXC1_C EXC1_B UNLOAD1 UNLOAD2 DUMP_180_A DUMP_180_B
   SRCGROUP Load_hau DUMP_180_C DUMP_180_D DUMP_180_E DUMP_180_F DUMP_180_G
   SRCGROUP Load_hau DUMP_180_H DUMP_180_I DUMP_180_J DUMP_180_K DUMP_180_L
   SRCGROUP Load_hau DUMP_180_M DUMP_180_N DUMP_180_O DUMP_180_P DUMP_180_Q
   SRCGROUP Load_hau DUMP_180_R DUMP_180_S DUMP_180_T DUMP_90_A DUMP_90_B
   SRCGROUP Load_hau DUMP_90_C DUMP_90_D DUMP_90_E DUMP_90_F
   SRCGROUP Support_ DOZER1_A DOZER1_B DOZER1_C GRADER1_A GRADER1_B TRUCK2_A
   SRCGROUP Support_ TRUCK2_B ROCKBREAKER LOADER2_A LOADER2_B TRUCK3_A TRUCK3_B
   SRCGROUP Support_ BUS1 BUS2_A BUS2_B
   SRCGROUP TSF      DUMP_40_A DUMP_40_B DUMP_40_C DUMP_40_D DOZER2 EXC2
   SRCGROUP TSF      GRADER2 LOADER3
   SRCGROUP Drill_bl DRILL_A DRILL_B DRILL_C DRILL_D DRILL_E DRILL_F DRILL_G
   SRCGROUP Drill_bl DRILL_H TRUCK1 BLAST
   SRCGROUP ROM      LOADER1
   SRCGROUP ALL
SO FINISHED
**
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
   GRIDCART UCART1 STA
          XYINC 501141.58 31 1000.00 6693873.70 31 1000.00
          ELEV   1  325.70  329.00  328.60  320.80  325.10  331.50
          ELEV   1  341.60  346.00  338.10  327.20  326.90  336.00
          ELEV   1  347.80  356.00  340.60  337.30  331.10  342.50
          ELEV   1  350.00  362.10  380.30  380.70  386.00  368.10
          ELEV   1  362.60  365.00  355.40  357.70  361.00  355.00
          ELEV   1  346.20
          ELEV   2  310.80  319.00  312.00  313.20  321.10  331.50
          ELEV   2  343.60  347.90  355.60  339.50  336.50  350.70
          ELEV   2  365.00  366.40  348.60  343.60  345.90  350.80
          ELEV   2  357.80  362.10  373.50  377.50  368.00  359.50
          ELEV   2  348.10  351.40  342.80  344.40  351.60  349.00
          ELEV   2  342.40
          ELEV   3  303.00  305.90  311.20  317.80  331.80  347.30
          ELEV   3  359.00  360.70  362.20  353.80  343.00  350.50
          ELEV   3  371.00  370.90  357.40  346.50  361.80  363.80
          ELEV   3  369.90  370.00  378.90  377.90  372.00  362.00
          ELEV   3  351.20  344.00  339.70  338.20  337.20  339.60
          ELEV   3  334.40
```

ELEV	4	307.30	313.10	319.10	321.00	334.80	352.30
ELEV	4	353.20	352.90	352.00	359.00	355.30	359.10
ELEV	4	372.00	372.80	371.00	355.00	372.10	374.30
ELEV	4	364.90	364.90	380.90	371.90	367.80	371.10
ELEV	4	366.40	361.10	352.70	346.10	334.00	332.20
ELEV	4	332.00					
ELEV	5	301.10	306.50	311.60	325.50	333.50	337.40
ELEV	5	336.80	336.00	340.20	345.60	351.50	368.70
ELEV	5	383.20	385.00	372.40	377.00	376.10	369.30
ELEV	5	355.80	352.50	367.90	356.30	352.50	371.00
ELEV	5	371.50	372.90	362.10	346.60	336.50	332.90
ELEV	5	330.00					
ELEV	6	305.10	306.10	304.40	316.20	325.80	320.20
ELEV	6	324.30	327.00	335.50	346.80	359.00	372.40
ELEV	6	383.20	388.00	385.10	379.60	374.70	360.80
ELEV	6	350.40	347.30	357.40	349.80	340.30	355.20
ELEV	6	358.40	365.30	369.00	347.10	334.20	332.70
ELEV	6	328.80					
ELEV	7	306.10	306.40	307.30	307.90	309.00	316.50
ELEV	7	322.70	328.90	350.40	364.50	369.10	371.00
ELEV	7	375.70	384.10	381.50	379.00	365.10	353.30
ELEV	7	344.00	341.10	355.10	342.90	332.80	336.10
ELEV	7	351.40	359.00	365.40	352.00	336.70	328.40
ELEV	7	328.00					
ELEV	8	316.70	317.90	311.80	310.00	311.40	313.30
ELEV	8	322.00	335.60	349.20	363.50	379.00	375.50
ELEV	8	367.50	374.50	371.60	360.30	354.50	344.70
ELEV	8	343.00	339.00	343.10	332.20	332.00	340.10
ELEV	8	351.00	358.00	362.50	352.60	342.50	334.30
ELEV	8	327.50					
ELEV	9	321.60	331.30	322.40	312.60	315.10	312.40
ELEV	9	313.80	327.30	335.20	348.60	366.20	371.00
ELEV	9	360.30	367.20	361.10	353.00	340.20	335.00
ELEV	9	335.90	332.70	329.80	332.20	335.70	341.20
ELEV	9	340.00	351.00	346.00	345.30	349.20	335.10
ELEV	9	328.70					
ELEV	10	329.70	333.90	331.90	319.20	319.80	312.10
ELEV	10	315.70	323.10	329.00	339.60	356.20	365.90
ELEV	10	348.40	347.00	352.90	347.80	339.80	332.30
ELEV	10	334.00	339.00	333.30	330.90	332.10	336.00
ELEV	10	331.70	339.90	333.10	330.60	328.90	328.00
ELEV	10	327.80					
ELEV	11	346.50	340.90	335.10	324.20	319.50	320.70
ELEV	11	331.90	339.90	341.40	349.20	351.20	361.00
ELEV	11	362.10	345.40	344.50	341.60	342.00	338.40
ELEV	11	338.70	332.50	332.40	327.40	325.10	323.40
ELEV	11	325.10	329.00	326.20	326.10	324.50	322.00
ELEV	11	326.10					

ELEV	12	353.80	358.80	344.00	328.60	324.70	326.10
ELEV	12	337.60	354.10	360.50	362.90	361.70	363.40
ELEV	12	372.60	356.20	345.80	349.00	344.90	344.30
ELEV	12	341.10	338.90	333.50	328.00	325.00	325.40
ELEV	12	328.20	326.00	320.20	320.40	321.50	322.80
ELEV	12	318.90					
ELEV	13	376.00	365.80	343.80	335.40	329.80	328.60
ELEV	13	335.60	354.00	365.90	372.20	372.20	374.70
ELEV	13	377.70	367.20	357.60	352.00	347.20	364.90
ELEV	13	352.00	340.00	339.90	339.80	328.10	323.60
ELEV	13	323.50	322.90	315.50	317.60	322.10	322.50
ELEV	13	323.70					
ELEV	14	375.50	363.00	352.20	339.00	334.10	332.00
ELEV	14	335.10	340.40	351.40	367.00	379.10	384.60
ELEV	14	373.30	366.00	363.70	354.60	353.00	369.80
ELEV	14	363.00	350.40	350.50	348.80	332.40	326.80
ELEV	14	317.20	316.60	317.00	323.00	325.40	323.60
ELEV	14	325.50					
ELEV	15	371.80	375.00	364.00	350.90	342.20	336.60
ELEV	15	338.50	336.20	358.30	372.00	381.80	380.60
ELEV	15	380.80	373.90	371.00	360.50	359.40	367.30
ELEV	15	358.50	351.20	351.10	349.10	339.90	326.90
ELEV	15	319.30	314.50	316.10	325.20	325.00	333.90
ELEV	15	336.80					
ELEV	16	371.60	379.00	379.60	359.40	354.00	345.70
ELEV	16	343.90	343.10	357.80	372.50	378.00	374.50
ELEV	16	377.00	362.80	359.80	339.30	345.90	351.40
ELEV	16	348.30	341.00	341.80	346.30	341.00	325.00
ELEV	16	317.70	320.10	322.40	327.00	323.90	331.00
ELEV	16	342.00					
ELEV	17	381.70	381.50	377.20	367.20	368.40	366.30
ELEV	17	352.00	356.00	362.80	366.00	367.90	361.60
ELEV	17	365.30	354.00	346.50	344.70	333.90	334.50
ELEV	17	339.50	332.00	332.30	333.20	338.60	331.80
ELEV	17	321.50	326.00	327.80	328.60	330.00	332.70
ELEV	17	334.00					
ELEV	18	377.00	381.20	380.60	382.40	381.80	370.00
ELEV	18	363.10	364.60	365.30	361.60	357.00	353.20
ELEV	18	348.80	336.20	337.50	341.80	328.70	329.20
ELEV	18	332.50	326.20	324.60	323.20	325.00	325.80
ELEV	18	326.50	331.80	333.50	338.00	337.00	338.50
ELEV	18	332.90					
ELEV	19	367.30	366.00	368.20	378.00	388.10	389.10
ELEV	19	374.00	371.00	364.00	353.00	344.30	342.90
ELEV	19	341.40	334.10	330.50	329.40	333.00	325.70
ELEV	19	325.40	322.90	319.70	326.60	325.20	323.80
ELEV	19	333.70	334.20	343.00	345.00	347.00	340.00
ELEV	19	341.90					

ELEV	20	351.70	351.50	364.50	380.00	394.50	390.60
ELEV	20	380.80	367.50	359.20	349.30	343.50	343.60
ELEV	20	340.70	334.10	331.40	329.70	325.60	324.80
ELEV	20	321.10	320.90	315.80	314.80	321.00	326.70
ELEV	20	337.60	345.50	349.90	355.60	357.10	357.70
ELEV	20	357.10					
ELEV	21	344.00	358.10	376.30	381.20	381.70	380.20
ELEV	21	383.80	371.90	364.00	354.40	349.90	341.30
ELEV	21	338.70	335.00	333.00	332.30	325.80	324.20
ELEV	21	320.00	315.10	320.20	318.30	324.80	327.80
ELEV	21	345.70	357.00	369.50	369.60	373.70	367.90
ELEV	21	370.70					
ELEV	22	345.70	364.00	371.40	376.40	363.90	366.00
ELEV	22	383.70	388.80	373.70	363.50	360.00	347.00
ELEV	22	342.90	339.90	337.30	339.40	333.00	324.60
ELEV	22	322.20	321.90	318.90	322.00	327.00	331.70
ELEV	22	347.80	365.90	366.10	367.80	363.90	358.20
ELEV	22	363.90					
ELEV	23	360.80	372.00	357.70	360.60	349.60	348.80
ELEV	23	367.00	375.00	380.50	366.70	357.10	348.40
ELEV	23	345.80	342.00	348.10	341.30	347.10	340.60
ELEV	23	336.50	321.90	348.70	337.10	328.90	336.50
ELEV	23	346.00	356.10	350.00	345.40	347.90	348.80
ELEV	23	366.50					
ELEV	24	365.50	363.10	353.60	348.40	341.40	347.40
ELEV	24	355.00	375.00	385.50	374.40	361.70	356.60
ELEV	24	361.90	356.80	355.20	345.70	336.80	323.20
ELEV	24	321.00	324.00	345.60	348.30	337.00	339.40
ELEV	24	343.80	345.30	338.80	339.00	344.00	357.80
ELEV	24	375.90					
ELEV	25	352.80	347.90	342.80	339.80	337.00	336.70
ELEV	25	343.00	352.80	368.20	374.10	366.20	358.00
ELEV	25	360.90	353.90	344.30	333.30	327.80	315.90
ELEV	25	321.00	326.10	339.80	354.10	339.90	331.60
ELEV	25	328.40	331.90	332.10	335.00	348.00	357.00
ELEV	25	368.90					
ELEV	26	331.20	332.10	333.20	329.80	333.40	338.50
ELEV	26	343.70	351.90	360.40	373.20	369.60	363.00
ELEV	26	359.80	343.60	334.30	328.50	326.00	318.00
ELEV	26	319.20	325.60	349.80	362.40	340.00	332.00
ELEV	26	329.30	330.90	334.80	342.70	341.60	349.40
ELEV	26	354.90					
ELEV	27	316.00	321.00	326.00	337.60	345.80	349.70
ELEV	27	353.60	370.70	373.80	376.10	362.90	349.00
ELEV	27	344.00	351.90	341.20	326.20	316.20	313.90
ELEV	27	319.50	322.80	359.30	353.40	337.70	327.90
ELEV	27	331.00	330.70	337.90	347.50	353.80	358.10
ELEV	27	361.10					

ELEV	28	315.00	320.90	323.60	344.80	355.90	360.40
ELEV	28	371.10	378.10	389.00	378.00	355.00	345.70
ELEV	28	342.00	334.90	339.00	326.90	314.10	315.10
ELEV	28	320.60	321.90	339.30	342.80	331.90	327.50
ELEV	28	329.60	336.00	346.90	359.40	369.20	375.20
ELEV	28	378.40					
ELEV	29	313.20	316.00	322.80	335.50	349.10	353.60
ELEV	29	363.90	368.90	373.00	372.60	372.40	358.60
ELEV	29	340.30	333.50	330.10	324.80	318.50	316.50
ELEV	29	320.70	323.40	328.00	338.70	330.00	328.60
ELEV	29	331.30	334.00	347.40	358.00	378.00	374.80
ELEV	29	383.80					
ELEV	30	308.00	311.80	321.60	336.70	334.20	335.90
ELEV	30	351.20	353.00	353.80	351.70	352.00	358.90
ELEV	30	344.20	334.00	327.00	324.60	322.00	315.30
ELEV	30	320.90	326.70	326.50	326.10	328.90	332.00
ELEV	30	332.40	335.80	340.20	354.90	367.30	364.40
ELEV	30	370.10					
ELEV	31	307.20	305.00	318.30	329.00	322.80	325.30
ELEV	31	336.50	333.90	335.50	333.60	343.90	344.90
ELEV	31	345.70	337.20	330.30	324.80	316.20	313.50
ELEV	31	317.60	337.80	324.60	330.20	331.10	338.30
ELEV	31	335.40	337.80	338.30	344.00	350.90	355.70
ELEV	31	355.10					
HILL	1	325.70	329.00	328.60	320.80	325.10	331.50
HILL	1	341.60	346.00	338.10	327.20	326.90	336.00
HILL	1	347.80	356.00	340.60	337.30	331.10	342.50
HILL	1	350.00	362.10	380.30	380.70	386.00	368.10
HILL	1	362.60	365.00	355.40	357.70	361.00	355.00
HILL	1	346.20					
HILL	2	310.80	319.00	312.00	313.20	321.10	331.50
HILL	2	343.60	347.90	355.60	339.50	336.50	350.70
HILL	2	365.00	366.40	348.60	343.60	345.90	350.80
HILL	2	357.80	362.10	373.50	377.50	368.00	359.50
HILL	2	348.10	351.40	342.80	344.40	351.60	349.00
HILL	2	342.40					
HILL	3	303.00	305.90	311.20	317.80	331.80	347.30
HILL	3	359.00	360.70	362.20	353.80	343.00	350.50
HILL	3	371.00	370.90	357.40	346.50	361.80	363.80
HILL	3	369.90	370.00	378.90	377.90	372.00	362.00
HILL	3	351.20	344.00	339.70	338.20	337.20	339.60
HILL	3	334.40					
HILL	4	307.30	313.10	319.10	321.00	334.80	352.30
HILL	4	353.20	352.90	352.00	359.00	355.30	359.10
HILL	4	372.00	372.80	371.00	355.00	372.10	374.30
HILL	4	364.90	364.90	380.90	371.90	367.80	371.10
HILL	4	366.40	361.10	352.70	346.10	334.00	332.20
HILL	4	332.00					

HILL	5	301.10	306.50	311.60	325.50	333.50	337.40
HILL	5	336.80	336.00	340.20	345.60	351.50	368.70
HILL	5	383.20	385.00	372.40	377.00	376.10	369.30
HILL	5	355.80	352.50	367.90	356.30	352.50	371.00
HILL	5	371.50	372.90	362.10	346.60	336.50	332.90
HILL	5	330.00					
HILL	6	305.10	306.10	304.40	316.20	325.80	320.20
HILL	6	324.30	327.00	335.50	346.80	359.00	372.40
HILL	6	383.20	388.00	385.10	379.60	374.70	360.80
HILL	6	350.40	347.30	357.40	349.80	340.30	355.20
HILL	6	358.40	365.30	369.00	347.10	334.20	332.70
HILL	6	328.80					
HILL	7	306.10	306.40	307.30	307.90	309.00	316.50
HILL	7	322.70	328.90	350.40	364.50	369.10	371.00
HILL	7	375.70	384.10	381.50	379.00	365.10	353.30
HILL	7	344.00	341.10	355.10	342.90	332.80	336.10
HILL	7	351.40	359.00	365.40	352.00	336.70	328.40
HILL	7	328.00					
HILL	8	316.70	317.90	311.80	310.00	311.40	313.30
HILL	8	322.00	335.60	349.20	363.50	379.00	375.50
HILL	8	367.50	374.50	371.60	360.30	354.50	344.70
HILL	8	343.00	339.00	343.10	332.20	332.00	340.10
HILL	8	351.00	358.00	362.50	352.60	342.50	334.30
HILL	8	327.50					
HILL	9	321.60	331.30	322.40	312.60	315.10	312.40
HILL	9	313.80	327.30	335.20	348.60	366.20	371.00
HILL	9	360.30	367.20	361.10	353.00	340.20	335.00
HILL	9	335.90	332.70	329.80	332.20	335.70	341.20
HILL	9	340.00	351.00	346.00	345.30	349.20	335.10
HILL	9	328.70					
HILL	10	329.70	333.90	331.90	319.20	319.80	312.10
HILL	10	315.70	323.10	329.00	339.60	356.20	365.90
HILL	10	348.40	347.00	352.90	347.80	339.80	332.30
HILL	10	334.00	339.00	333.30	330.90	332.10	336.00
HILL	10	331.70	339.90	333.10	330.60	328.90	328.00
HILL	10	327.80					
HILL	11	346.50	340.90	335.10	324.20	319.50	320.70
HILL	11	331.90	339.90	341.40	349.20	351.20	361.00
HILL	11	362.10	345.40	344.50	341.60	342.00	338.40
HILL	11	338.70	332.50	332.40	327.40	325.10	323.40
HILL	11	325.10	329.00	326.20	326.10	324.50	322.00
HILL	11	326.10					
HILL	12	353.80	358.80	344.00	328.60	324.70	326.10
HILL	12	337.60	354.10	360.50	362.90	361.70	363.40
HILL	12	372.60	356.20	345.80	349.00	344.90	344.30
HILL	12	341.10	338.90	333.50	328.00	325.00	325.40
HILL	12	328.20	326.00	320.20	320.40	321.50	322.80
HILL	12	318.90					

HILL	13	376.00	365.80	343.80	335.40	329.80	328.60
HILL	13	335.60	354.00	365.90	372.20	372.20	374.70
HILL	13	377.70	367.20	357.60	352.00	347.20	364.90
HILL	13	352.00	340.00	339.90	339.80	328.10	323.60
HILL	13	323.50	322.90	315.50	317.60	322.10	322.50
HILL	13	323.70					
HILL	14	375.50	363.00	352.20	339.00	334.10	332.00
HILL	14	335.10	340.40	351.40	367.00	379.10	384.60
HILL	14	373.30	366.00	363.70	354.60	353.00	369.80
HILL	14	363.00	350.40	350.50	348.80	332.40	326.80
HILL	14	317.20	316.60	317.00	323.00	325.40	323.60
HILL	14	325.50					
HILL	15	371.80	375.00	364.00	350.90	342.20	336.60
HILL	15	338.50	336.20	358.30	372.00	381.80	380.60
HILL	15	380.80	373.90	371.00	360.50	359.40	367.30
HILL	15	358.50	351.20	351.10	349.10	339.90	326.90
HILL	15	319.30	314.50	316.10	325.20	325.00	333.90
HILL	15	336.80					
HILL	16	371.60	379.00	379.60	359.40	354.00	345.70
HILL	16	343.90	343.10	357.80	372.50	378.00	374.50
HILL	16	377.00	362.80	371.00	389.00	345.90	351.40
HILL	16	348.30	341.00	341.80	346.30	341.00	325.00
HILL	16	317.70	320.10	322.40	327.00	323.90	331.00
HILL	16	342.00					
HILL	17	381.70	381.50	377.20	367.20	368.40	366.30
HILL	17	352.00	356.00	362.80	366.00	367.90	361.60
HILL	17	365.30	354.00	346.50	344.70	333.90	334.50
HILL	17	339.50	332.00	332.30	333.20	338.60	331.80
HILL	17	321.50	326.00	327.80	328.60	330.00	332.70
HILL	17	334.00					
HILL	18	377.00	381.20	380.60	382.40	381.80	370.00
HILL	18	363.10	364.60	365.30	361.60	357.00	353.20
HILL	18	348.80	336.20	337.50	341.80	328.70	329.20
HILL	18	332.50	326.20	324.60	323.20	325.00	325.80
HILL	18	326.50	331.80	333.50	338.00	337.00	338.50
HILL	18	332.90					
HILL	19	367.30	366.00	368.20	378.00	388.10	389.10
HILL	19	374.00	371.00	364.00	353.00	344.30	342.90
HILL	19	341.40	334.10	330.50	329.40	337.00	325.70
HILL	19	325.40	322.90	319.70	326.60	325.20	323.80
HILL	19	333.70	334.20	343.00	345.00	347.00	340.00
HILL	19	341.90					
HILL	20	351.70	351.50	364.50	380.00	394.50	390.60
HILL	20	380.80	367.50	359.20	349.30	343.50	343.60
HILL	20	340.70	334.10	331.40	329.70	325.60	324.80
HILL	20	321.10	320.90	315.80	314.80	321.00	326.70
HILL	20	337.60	345.50	349.90	355.60	357.10	357.70
HILL	20	357.10					

HILL	21	344.00	358.10	376.30	381.20	381.70	380.20
HILL	21	383.80	371.90	364.00	354.40	349.90	341.30
HILL	21	338.70	335.00	333.00	332.30	325.80	324.20
HILL	21	320.00	315.10	320.20	318.30	324.80	327.80
HILL	21	345.70	357.00	369.50	369.60	373.70	367.90
HILL	21	370.70					
HILL	22	345.70	364.00	371.40	376.40	363.90	366.00
HILL	22	383.70	388.80	373.70	363.50	360.00	347.00
HILL	22	342.90	339.90	337.30	339.40	333.00	324.60
HILL	22	322.20	321.90	318.90	322.00	327.00	331.70
HILL	22	347.80	365.90	366.10	367.80	363.90	358.20
HILL	22	363.90					
HILL	23	360.80	372.00	357.70	360.60	349.60	348.80
HILL	23	367.00	375.00	380.50	366.70	357.10	348.40
HILL	23	345.80	342.00	348.10	341.30	347.10	340.60
HILL	23	355.00	321.90	348.70	337.10	328.90	336.50
HILL	23	346.00	356.10	350.00	345.40	347.90	348.80
HILL	23	366.50					
HILL	24	365.50	363.10	353.60	348.40	341.40	347.40
HILL	24	355.00	375.00	385.50	374.40	361.70	356.60
HILL	24	361.90	356.80	355.20	345.70	336.80	323.20
HILL	24	321.00	324.00	345.60	348.30	337.00	339.40
HILL	24	343.80	345.30	338.80	339.00	344.00	357.80
HILL	24	375.90					
HILL	25	352.80	347.90	342.80	339.80	337.00	336.70
HILL	25	343.00	352.80	368.20	374.10	366.20	358.00
HILL	25	360.90	353.90	344.30	333.30	327.80	315.90
HILL	25	321.00	326.10	339.80	354.10	339.90	331.60
HILL	25	328.40	331.90	332.10	335.00	348.00	357.00
HILL	25	368.90					
HILL	26	331.20	332.10	333.20	329.80	333.40	338.50
HILL	26	343.70	351.90	360.40	373.20	369.60	363.00
HILL	26	359.80	343.60	334.30	328.50	326.00	318.00
HILL	26	319.20	325.60	349.80	362.40	340.00	332.00
HILL	26	329.30	330.90	334.80	342.70	341.60	349.40
HILL	26	354.90					
HILL	27	316.00	321.00	326.00	337.60	345.80	349.70
HILL	27	353.60	370.70	373.80	376.10	362.90	349.00
HILL	27	344.00	351.90	341.20	326.20	316.20	313.90
HILL	27	319.50	322.80	359.30	353.40	337.70	327.90
HILL	27	331.00	330.70	337.90	347.50	353.80	358.10
HILL	27	361.10					
HILL	28	315.00	320.90	323.60	344.80	355.90	360.40
HILL	28	371.10	378.10	389.00	378.00	355.00	345.70
HILL	28	342.00	334.90	339.00	326.90	314.10	315.10
HILL	28	320.60	321.90	339.30	342.80	331.90	327.50
HILL	28	329.60	336.00	346.90	359.40	369.20	375.20
HILL	28	378.40					

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            HILL  29  313.20  316.00  322.80  335.50  349.10  353.60
            HILL  29  363.90  368.90  373.00  372.60  372.40  358.60
            HILL  29  340.30  333.50  330.10  324.80  318.50  316.50
            HILL  29  320.70  323.40  328.00  338.70  330.00  328.60
            HILL  29  331.30  334.00  347.40  358.00  378.00  374.80
            HILL  29  383.80
            HILL  30  308.00  311.80  321.60  336.70  334.20  335.90
            HILL  30  351.20  353.00  353.80  351.70  352.00  358.90
            HILL  30  344.20  334.00  327.00  324.60  322.00  315.30
            HILL  30  320.90  326.70  326.50  326.10  328.90  332.00
            HILL  30  332.40  335.80  340.20  354.90  367.30  364.40
            HILL  30  370.10
            HILL  31  307.20  305.00  318.30  329.00  322.80  325.30
            HILL  31  336.50  333.90  335.50  333.60  343.90  344.90
            HILL  31  345.70  337.20  330.30  324.80  316.20  313.50
            HILL  31  317.60  337.80  324.60  330.20  331.10  338.30
            HILL  31  335.40  337.80  338.30  344.00  350.90  355.70
            HILL  31  355.10
   GRIDCART UCART1 END
** DESCRREC "" ""
   DISCCART   516015.00   6715685.00  340.00  340.00
   DISCCART   516016.00   6715686.00  340.00  340.00
   DISCCART   522115.00   6718459.00  357.63  357.63
   DISCCART   522532.00   6721786.00  335.12  335.12
   DISCCART   514489.00   6707849.00  370.65  370.65
   DISCCART   514138.00   6708335.00  373.07  373.07
   DISCCART   513839.00   6709536.00  364.01  364.01
   DISCCART   512091.00   6709246.00  370.47  370.47
   DISCCART   511387.00   6708348.00  382.40  382.40
   DISCCART   518053.00   6704757.00  343.39  343.39
   DISCCART   518242.00   6705563.00  356.70  356.70
   DISCCART   520545.00   6708050.00  351.67  351.67
   DISCCART   514333.00   6707891.00  370.57  370.57
   DISCCART   513940.00   6707676.00  375.27  375.27
   DISCCART   514060.00   6707565.00  373.17  373.17
   DISCCART   514709.00   6707443.00  368.43  368.43
   DISCCART   514197.00   6708881.00  361.43  361.43
   DISCCART   514311.00   6708632.00  363.25  363.25
   DISCCART   514294.00   6709676.00  354.87  354.87
   DISCCART   514197.00   6710637.00  342.10  342.10
   DISCCART   514243.00   6711194.00  334.26  334.26
   DISCCART   514076.00   6710989.00  337.73  337.73
   DISCCART   514116.00   6710749.00  340.17  340.17
   DISCCART   512359.00   6708651.00  375.00  375.00
   DISCCART   513080.00   6708858.00  376.00  376.00
   DISCCART   513094.00   6708870.00  376.13  376.13
   DISCCART   513258.00   6708229.00  383.00  383.00
   DISCCART   511319.00   6709423.00  371.57  371.57
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   DISCCART    511106.00   6709487.00  370.57  370.57
   DISCCART    511176.00   6709548.00  369.60  369.60
   DISCCART    511514.00   6709533.00  368.00  368.00
   DISCCART    511405.00   6709121.00  374.17  374.17
   DISCCART    511291.00   6709117.00  373.97  373.97
   DISCCART    511122.00   6709602.00  370.20  370.20
   DISCCART    511833.00   6708701.00  376.53  376.53
   DISCCART    511809.00   6708840.00  374.00  374.00
   DISCCART    511256.00   6708833.00  377.23  377.23
   DISCCART    511126.00   6708563.00  381.34  381.34
   DISCCART    511132.00   6708542.00  382.18  382.18
   DISCCART    511129.00   6708518.00  382.83  382.83
   DISCCART    511248.00   6708449.00  382.39  382.39
   DISCCART    511448.00   6708411.00  380.89  380.89
   DISCCART    511574.00   6708539.00  380.43  380.43
   DISCCART    511700.00   6708549.00  379.10  379.10
   DISCCART    514194.00   6705930.00  365.20  365.20
   DISCCART    516075.00   6703657.00  339.38  339.38
   DISCCART    517893.00   6705409.00  357.30  357.30
   DISCCART    518241.00   6705419.00  351.27  351.27
   DISCCART    518410.00   6705374.00  352.82  352.82
   DISCCART    518129.00   6705253.00  351.45  351.45
   DISCCART    518077.00   6705203.00  349.00  349.00
   DISCCART    518205.00   6705163.00  350.22  350.22
   DISCCART    518154.00   6705038.00  347.73  347.73
   DISCCART    517704.00   6704757.00  343.00  343.00
   DISCCART    518768.00   6707182.00  374.93  374.93
   DISCCART    519034.00   6708682.00  351.90  351.90
   DISCCART    515319.00   6715324.00  340.91  340.91
   DISCCART    515167.00   6716321.00  356.13  356.13
   DISCCART    515057.00   6716379.00  356.00  356.00
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
   SURFFILE ..\AERMET\MtGibson_AERMET.SFC
   PROFFILE ..\AERMET\MtGibson_AERMET.PFL
   SURFDATA 0 2018
   UAIRDATA 9999 2018
   SITEDATA 9999 2018
   PROFBASE 357.0 METERS
ME FINISHED
**
****************************************
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** AERMOD Output Pathway
***************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST
   RECTABLE 1 1ST
   RECTABLE 24 1ST
   MAXIFILE 24 ALL 90 MtGibson_AERMOD.AD\TSP_exceedances.MAX 31
** Auto-Generated Plotfiles
   PLOTFILE 1 ALL 1ST MtGibson_AERMOD.AD\01H1GALL.PLT 32
   PLOTFILE 24 ALL 1ST MtGibson_AERMOD.AD\24H1GALL.PLT 33
   PLOTFILE 1 Wind_ero 1ST MtGibson_AERMOD.AD\01H1G001.PLT 34
   PLOTFILE 24 Wind_ero 1ST MtGibson_AERMOD.AD\24H1G001.PLT 35
   PLOTFILE 1 Processi 1ST MtGibson_AERMOD.AD\01H1G002.PLT 36
   PLOTFILE 24 Processi 1ST MtGibson_AERMOD.AD\24H1G002.PLT 37
   PLOTFILE 1 Load_hau 1ST MtGibson_AERMOD.AD\01H1G003.PLT 38
   PLOTFILE 24 Load_hau 1ST MtGibson_AERMOD.AD\24H1G003.PLT 39
   PLOTFILE 1 Support_ 1ST MtGibson_AERMOD.AD\01H1G004.PLT 40
   PLOTFILE 24 Support_ 1ST MtGibson_AERMOD.AD\24H1G004.PLT 41
   PLOTFILE 1 TSF 1ST MtGibson_AERMOD.AD\01H1G005.PLT 42
   PLOTFILE 24 TSF 1ST MtGibson_AERMOD.AD\24H1G005.PLT 43
   PLOTFILE 1 Drill_bl 1ST MtGibson_AERMOD.AD\01H1G006.PLT 44
   PLOTFILE 24 Drill_bl 1ST MtGibson_AERMOD.AD\24H1G006.PLT 45
   PLOTFILE 1 ROM 1ST MtGibson_AERMOD.AD\01H1G007.PLT 46
   PLOTFILE 24 ROM 1ST MtGibson_AERMOD.AD\24H1G007.PLT 47
   PLOTFILE PERIOD ALL MtGibson_AERMOD.AD\PE00GALL.PLT 48
   PLOTFILE PERIOD Wind_ero MtGibson_AERMOD.AD\PE00G001.PLT 49
   PLOTFILE PERIOD Processi MtGibson_AERMOD.AD\PE00G002.PLT 50
   PLOTFILE PERIOD Load_hau MtGibson_AERMOD.AD\PE00G003.PLT 51
   PLOTFILE PERIOD Support_ MtGibson_AERMOD.AD\PE00G004.PLT 52
   PLOTFILE PERIOD TSF MtGibson_AERMOD.AD\PE00G005.PLT 53
   PLOTFILE PERIOD Drill_bl MtGibson_AERMOD.AD\PE00G006.PLT 54
   PLOTFILE PERIOD ROM MtGibson_AERMOD.AD\PE00G007.PLT 55
   SUMMFILE MtGibson_AERMOD.sum
OU FINISHED
**
***************************************
** Project Parameters
***************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    Geocentric Datum of Australia (1994)
** DTMRGN   Australia
** UNITS    m
** ZONE     -50
** ZONEINX  0
**
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