AIR QUALITY IMPACT ASSESSMENT

Goschen Mineral Sands and Rare Earths Project

Prepared for:

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SLR Ref: 640.30299.00100-R02
Version No: -v0.7
June 2023

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BASIS OF REPORT

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This document is based on the information available, and the assumptions made, as at the date of the document. This document is to be read in full. No excerpts are to be taken as representative of the findings without appropriate context. For further information, please refer to the limitations, uncertainties and assumptions set out in the methodology section of this document.

EXECUTIVE SUMMARY

Overview

This technical report is an attachment to VHM Limited's Goschen Rare Earth and Mineral Sands Project (the Project) Environment Effects Statement (EES). It has been used to inform the EES required for the Project.

Existing Environment

The Project is located within flat farmland, with several rural residences surrounding the Project area. Wind roses for nearby Swan Hill indicate that overall, winds from the south and southwest are predominant, with very few winds from the east.

Ambient air quality monitoring undertaken between January 2019 and September 2020 indicates that like any Victorian rural area with little anthropogenic activity, the area may be subject to periods of elevated concentrations of particulate with equivalent aerodynamic diameters of less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) due to regional bushfire and backburning impacts, and dust storms. Bushfires across Victoria in January 2020 were clearly evident in the data with elevated $PM_{2.5}$, and to a lesser extent PM_{10}, concentrations. However, the non-bushfire impacted year 2019 demonstrates elevated concentrations in the summer months such that the distinction between the years representing normal and bushfire conditions is not significant. Both years include periods of elevated background PM_{10} and $PM_{2.5}$ concentrations which exceed the relevant 24-hour average criteria. Monitored concentrations of respirable crystalline silica (RCS) were well below the annual average APAC. In the absence of NO_x monitoring in the Project area, with little anthropogenic activity, the background concentrations of NO_x are likely to be low, approaching zero. However for assessment purposes, alternative data is sourced to conservatively represent potential background concentrations.

Impact Assessment Findings

An iterative assessment was undertaken to evaluate potential impacts associated with the Project, considering the existing environment within the study area and associated construction, operational and closure/rehabilitation activities.

The assessment found the following key impacts:

- The risk of impacts to health and the environment due to dust soiling from construction and closure/rehabilitation works of the Project site and the pipeline corridor were assessed to be low, or in some cases negligible, with the application of the proposed dust management and mitigation strategies.
- Elevated background concentrations of PM_{10} and $PM_{2.5}$ result in exceedances of the 24-hour criteria at all receptors before the Project contribution is considered.
- The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project are few (between 0 and 3 depending on receptor and stage of mining).
- An exceedance of the PM_{10} 24-hour APAC due to Project impacts alone is predicted at a nearby receptor under one of the modelled mining scenarios.
- The risk of impacts to surrounding agricultural industry and local water supplies (rainwater tanks) were assessed to be low.

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- Power station and pumping station NO_2 impacts due to diesel generator emissions are predicted to comply with relevant 1-hour average and 24-hour average criteria at nearby sensitive receptors, however, exceedances of the 1-hour average APAC are predicted at and beyond the Project site boundaries.

While elevated background concentrations of PM_{10} and $PM_{2.5}$ result in exceedances of the 24-hour criteria at all receptors before the Project contribution is considered, one exceedance of the PM_{10} 24-hour APAC due to Project impacts alone is predicted at a nearby receptor under one scenario, and approached under other scenarios. However, over the 5 years of meteorological conditions assessed, significantly elevated concentrations are very few with annual average PM_{10}, $PM_{2.5}$, RCS and metals criteria predicted to be met at all receptors. Likewise, dust deposition rates are not predicted to result in significant impacts to the rainwater tanks of nearby sensitive receptors, nor to surrounding vegetation.

Worst-case Power station and pumping station dual-fuel generator emissions are predicted to result in exceedances of the 1-hour average NO_2 concentration beyond the Project boundaries when using diesel fuel. However, due to the rural and relatively remote nature of these locations, the likelihood of a third party occupying these impacted areas for more than a few minutes at a time is low. While impacts of NO_2 from the power station are predicted to exceed the annual average APAC relating to terrestrial vegetation beyond the Project boundary, the extent to which the exceedance is predicted is limited to approximately 50 m from the boundary, covering and an area of approximately 2.5 hectares. APAC $PM_{2.5}$ ground level concentrations resulting from pumping station emissions to air are negligible at the modelled receptors such that cumulative concentrations are unlikely to be increased by a measurable amount. These findings indicate that the risk of impacts from other products of diesel combustion (e.g. sulphur dioxide, volatile organic compounds, PAHs etc) will also be low. Use of liquified petroleum gas (LPG) instead of diesel would result in significantly lower emissions of NO_X (and $PM_{2.5}$), likely negating impacts predicted for diesel in these areas.

Mitigation and Contingency Measures

The mining schedule, which will generally include only six active blocks at any one time will limit exposed areas subject to wind erosion, with surface consolidation and revegetation occurring throughout the mine life, rather than at the end. Each mining block will nominally take 1.5 to 2 months to mine for removal of its material and is estimated to be 'open' for a duration of 8 to 12 months.

Best practice dust emission mitigation measures will be employed for all aspects of the Project operations including use of water sprays, misting systems and water trucks. Wheel generated dust from haul roads have been identified as the primary potential source of dust emissions, therefore preparing and maintaining level and well finished haul road surfaces will be considered a priority. Contingency measures may include reducing the site speed limit for haul trucks during periods of hot and dry weather coupled with increased water truck application.

Conclusion

The risk of impacts to health and the environment from the construction, operation and decommissioning of the Project were assessed to be low, or in some cases negligible. With the application of the proposed management and mitigation strategies, potential impacts on air quality due to the Project would be avoided, minimised or managed to required standards such that the health and wellbeing of residents and the local community would be protected.

Abbreviations

Abbreviation	Description
APAC	Air pollution assessment criterion
AAQMS	Ambient air quality monitoring station
Air NEPM	National Environment Protection (Ambient Air Quality) Measure
AQIA	Air quality impact assessment
AWS	Automatic weather station
BoM	Bureau of Meteorology
CO	Carbon monoxide
DCCEEW	Department of Climate Change, Energy, Environment and Water
EE Act	*Environment Effects Act 1978*
EES	Environment Effects Statement
EPA	Environment Protection Authority Victoria
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GED	General environmental duty
GLC	Ground level concentration
GMW	Goulburn Murray Water
HAL	Hot acid leach
HMC	Heavy mineral concentrate
kg	Kilograms
kg/h	Kilograms per hour
km	Kilometre
kW	Kilowatt
LPG	Liquified petroleum gas
m	Metre
mg/m^3	Milligrams per cubic metre
Mt	Million tonnes
MREC	Mixed rare earth carbonate
m/s	Metres per second
MSP	Mineral separation plant
MUP	Mining unit plant
MW	Megawatt
MW_m	Mechanical megawatt
NEPC	National Environment Protection Council

Abbreviation	Description
NEPM	National Environment Protection Measures
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PAH	Polycyclic aromatic hydrocarbons
PEM	Protocol for environmental management.
PM_{10}	Particles with equivalent aerodynamic diameters of less than 10 µm
$PM_{2.5}$	Particles with equivalent aerodynamic diameters of less than 2.5 µm
ppm	Parts per million
RCS	Respirable crystalline silica
REMC	Rare earth mineral concentrate
SO_2	Sulfur dioxide
SRTM DEM	Shuttle Radar Topography Mission Derived Digital Elevation Model
tpa	Tonnes per annum
TSP	Total suspended particulate
$\mu g/m^3$	Micrograms per cubic metre
µm	Micrometre
WCP	Wet concentrator plant
WRF	Weather Research and Forecasting model
VOC	Volatile organic compound

Glossary

Term	Definition
AERMET	Meteorological data pre-processor for AERMOD
AERMOD	The American Meteorological Society (AMS)/USEPA Regulatory Model
Air Guideline	EPA Victoria Guideline for Assessing and Minimising Air Pollution

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APPENDICES

1 Introduction

This technical report is an attachment to VHM Limited's Goschen Rare Earth and Mineral Sands Project (the Project) Environment Effects Statement (EES). It has been used to inform the EES required for the Project.

1.1 Requirement for an EES

The Project was referred to the Minister for Planning to seek advice on the need for an EES under the *Environment Effects Act 1978* (Vic) (EE Act).

On 10 October 2018, the Minister for Planning decided that an EES was required on the basis that the Project has the potential for a range of significant environmental effects.

On 19 December 2018 under delegated authority from the Minister for the Environment, the Department of the Environment and Energy (now referred to as the Department of Climate Change, Energy, Environment and Water (DCCEEW)) made a decision that the Project is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and would require assessment and a decision about whether approval should be given under the EPBC Act. DCCEEW also confirmed the Victorian Government's advice that the Project will be assessed under a bilateral agreement under the EE Act.

The EES allows stakeholders to understand the likely environmental impacts of the Project and how they are proposed to be managed. The Minister's assessment of the EES will also inform statutory decisions that need to be made on the Project.

The EES was developed in consultation with the community and stakeholders.

2 Project Description

2.1 Project Overview

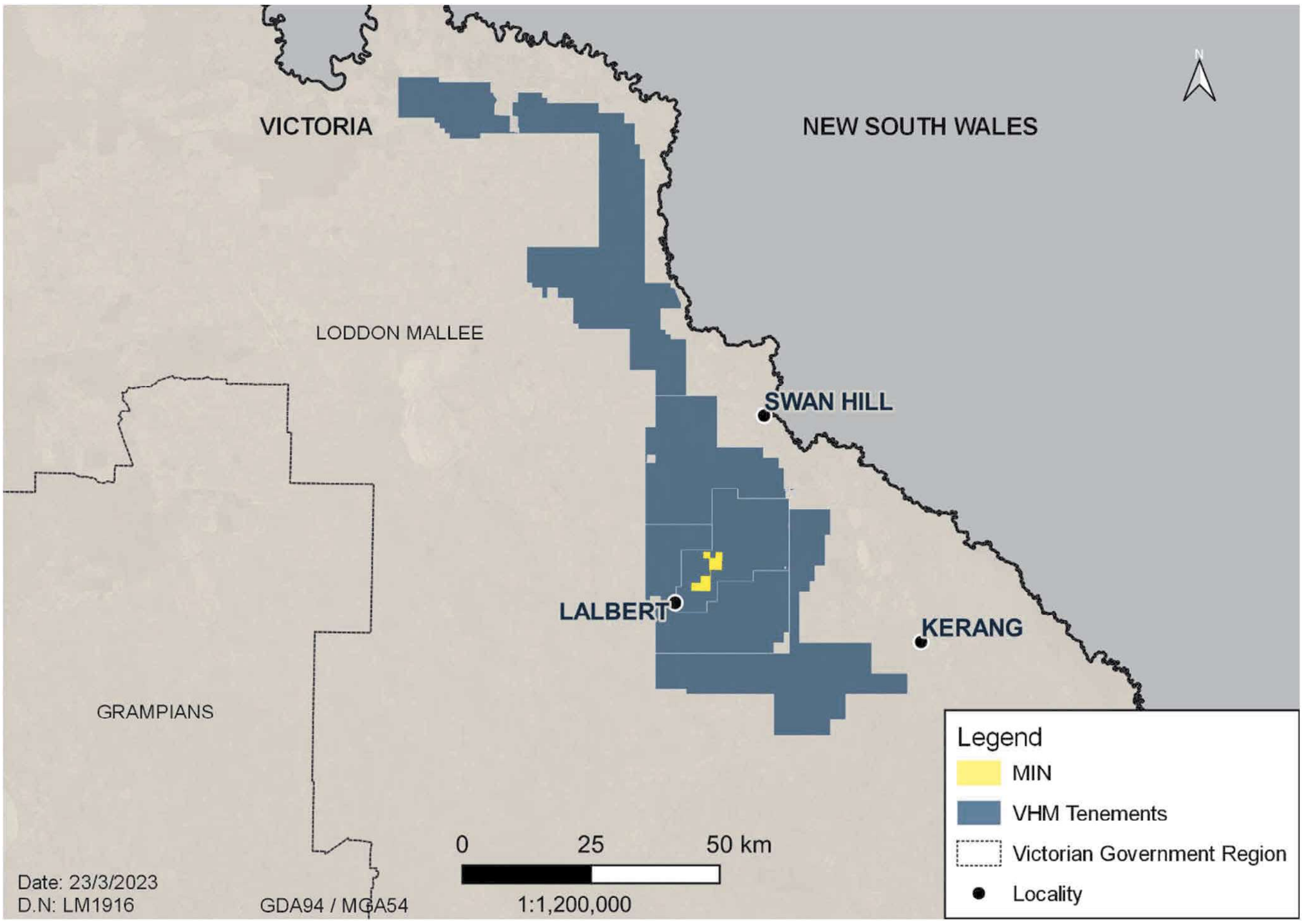
The Project is a rare earth and mineral sands mine and processing facility, proposed to be operational for approximately 20 years. VHM has been developing the Project in the context of a rapidly growing global demand for rare earths. One of the world's largest, highest grade zircon, rutile and rare earth mineral deposits is in the Loddon Mallee region of Victoria in Australia. VHM intends to establish the Project to mine these deposits and process to produce and market a range of products to national and international consumers.

The mine footprint has been restricted to avoid intersection with groundwater and significant areas of remnant native vegetation. VHM will implement a staged development approach. Initially developing phase 1 consisting of a mining unit plant (MUP), wet concentrator plant (WCP), rare earth mineral concentrate (REMC) flotation plant and a hydrometallurgical plant that will further refine the REMC that is produced at Goschen. The product suite for phase 1 consists of a zircon/titania heavy mineral concentrate (HMC) and mixed rare earth carbonate (MREC).

Phase 2 will commence approximately 2 years post-production and consist of an additional mineral separation plant (MSP) and, subject to prevailing market circumstances at that time, hot acid leach (HAL) and chrome removal circuit, that will produce additional products such as premium zircon, zircon concentrate, HiTi rutile, HiTi leucoxene, LoTi leucoxene, low chromium ilmenite.

The Project is located approximately 4 hours' drive (275 kilometres; km) northwest of Melbourne and 30 minutes (35 km) south-southwest of Swan Hill within Gannawarra Shire (**Figure 1**).

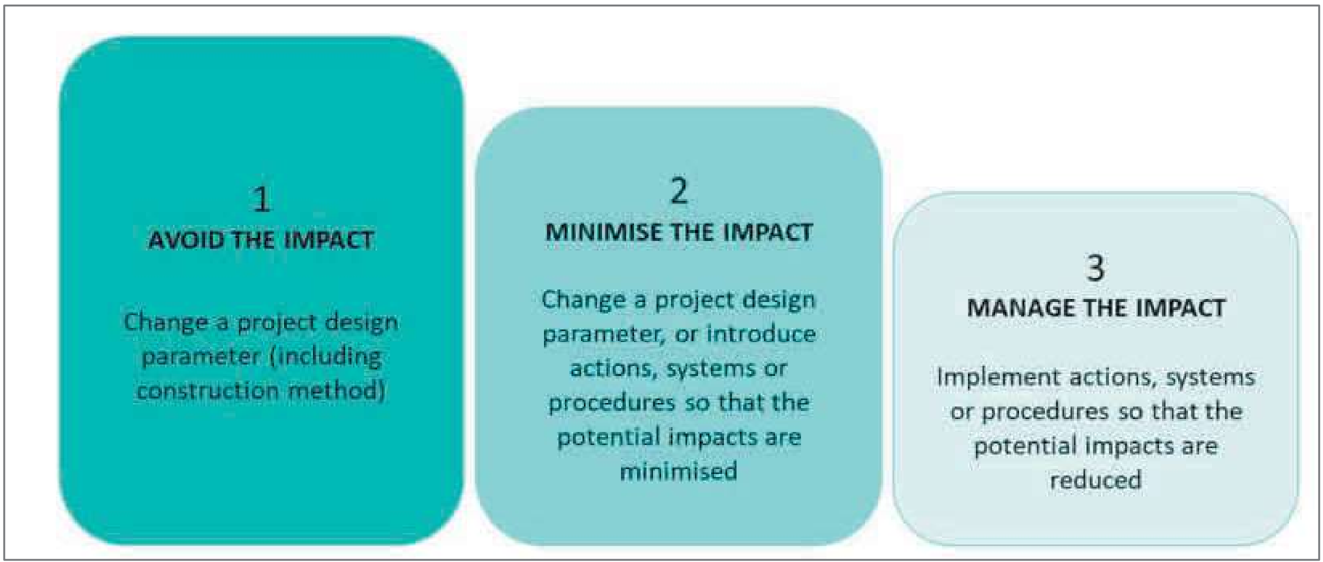
Figure 1 Project Location



2.2 Project Development

It is recognised that there are opportunities to avoid and minimise environmental impacts during the many stages of Project development. During Project inception and early design development stages of the Project, decisions on the location of the Project, its design and construction techniques have enabled impacts to be significantly avoided and minimised in accordance with the hierarchy presented in **Figure 2**.

Figure 2 Mitigation Hierarchy



Avoidance and minimisation of social and environmental impacts is central to the Project's decision making and as such, the Project will continue to be refined in response to technical requirements and potential environmental and social impacts identified during the development phase.

This was considered in the preparation of a project description which is found at Chapter 4: Project description. A description of how avoidance of impact has informed the design in relation to air quality can be found in **Section 7.4**.

Examples of this include the decision to create vegetation protection zones within the Project (mining area), restricting mining operations to daylight hours only to avoid noise related impacts to certain receptors, and restricting mining to depths above the water table to avoid impacts to the groundwater table.

After opportunities to avoid impact were incorporated into the Project, minimisation and management measures were developed. These are described in the construction and operation impact assessment sections below.

2.3 Key Project Components

The Project site consists of a heavy mineral sand mining and processing operation that will produce several HMCs and a range of critical rare earth minerals across two defined mining areas known as Area 1 and Area 3 (**Figure 3** and **Figure 4**).

2.3.1 Construction

Construction within Area 1 will include vegetation and topsoil stripping before establishment of hardstand areas, construction of the processing plant and MUP, and roadways. Construction equipment will be as per typical industry usage, and may include cranes and mobile lifting plant, service vehicles, welding plant, lighting towers, assembly workshops, etc.

Construction of the pipeline will progress linearly. In the absence of geotechnical information at this time, trenching methods have not yet been decided, but depending on geotechnical parameters and soil matrix are likely to involve open trench by excavator, trenching machine or spider plough. Finite rail and channel crossings will be by trenchless methods.

2.3.2 Operation

Conventional open pit mining equipment (truck and excavator) will be used for a strip-mining operation in Area 1 and Area 3. Mining will progress by blocks, each with a final floor footprint of approximately 250 m x 200 m. Topsoil and overburden will be stockpiled in waste dumps in the first instance. Ore will be transported by haul truck to the MUP where it will be turned into a slurry and piped to the processing plant. As the mining of the blocks continues, waste material (topsoil, overburden and tailings) from the initial mining voids will backfill the mined voids, reducing haulage and double handling. The stockpiled material on the surface will ultimately be rehandled to the final mine void. The land will then be rehabilitated to its original, or other approved, land use.

Figure 3 Area 1 Project

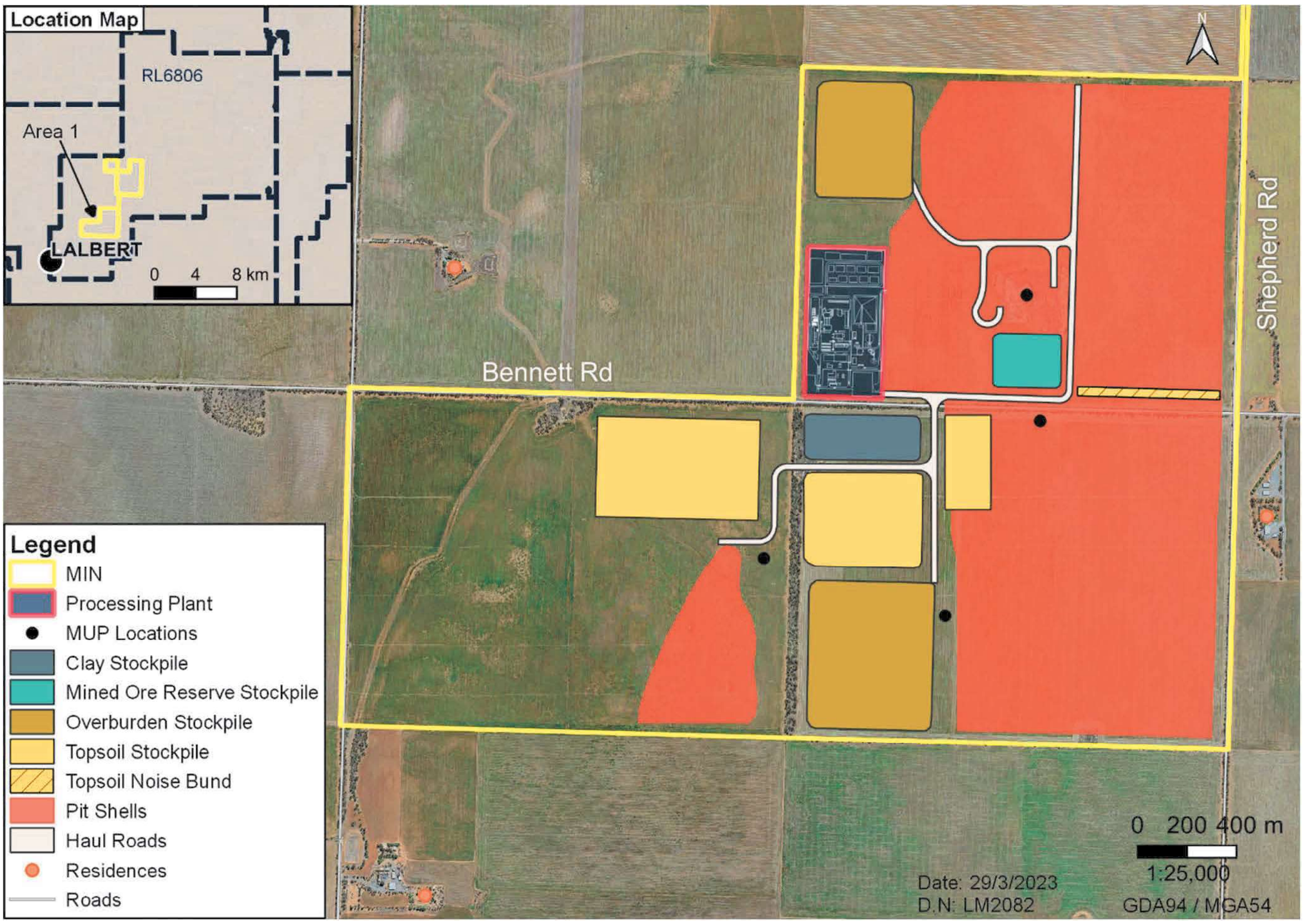
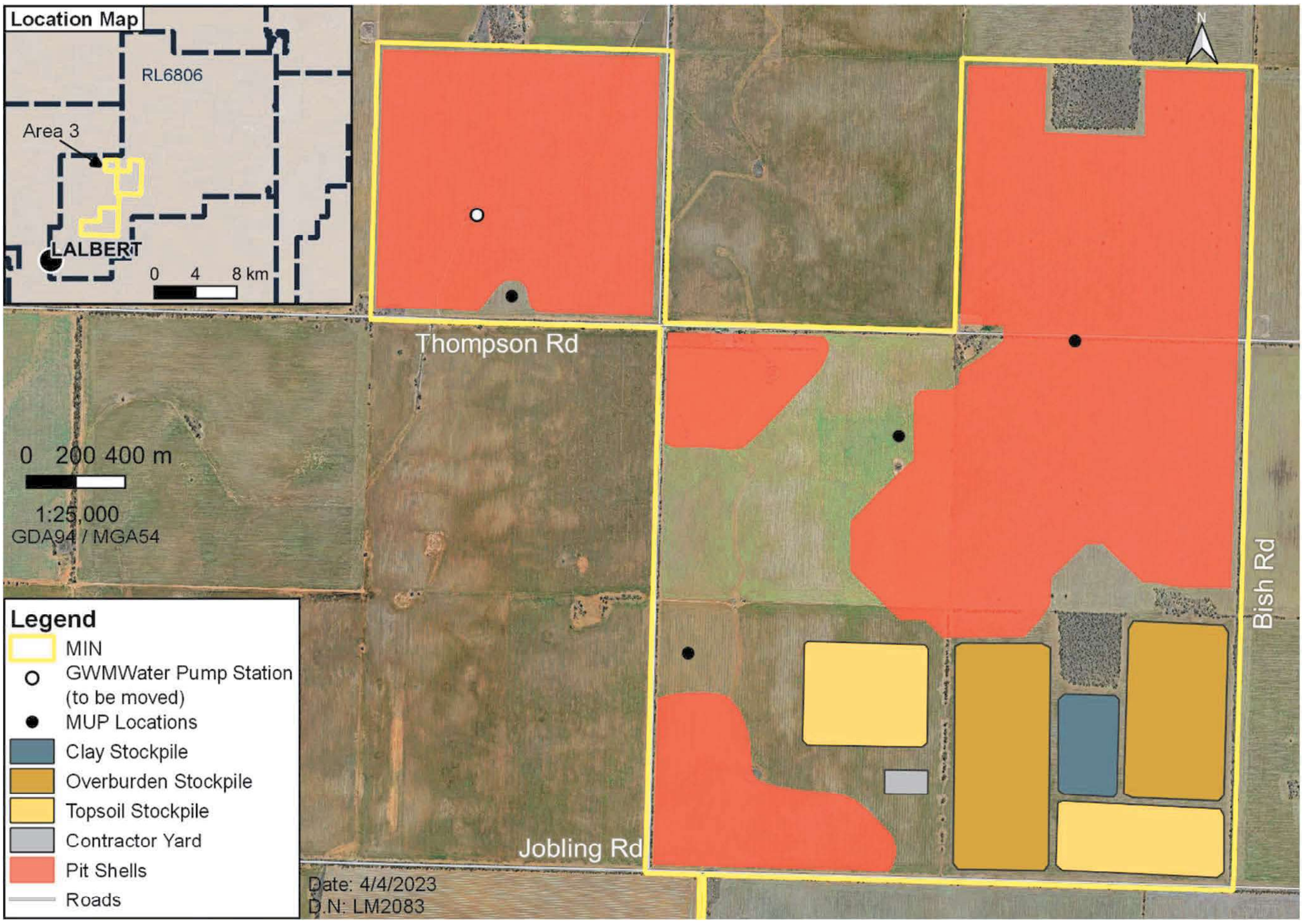


Figure 4 Area 3 Project



The key components that make up the Project are described below.

Mining – Mining will take approximately 20-25 years at 5 million tonnes (Mt) of ore produced per year and will occur only above groundwater (no dewatering) across approximately 1,479 hectares of farmland using conventional open cut mining methods of excavation, load, and haul.

Processing – Heavy mineral sands and rare earths ore will be separated via an on-site WCP and MSP to generate a REMC. Refining of the REMC on-site is limited to hydrometallurgical extraction to produce a mixed rare earth carbonate. Tailings from the various mineral processes will be homogenised and placed back into the ore zone earlier mined.

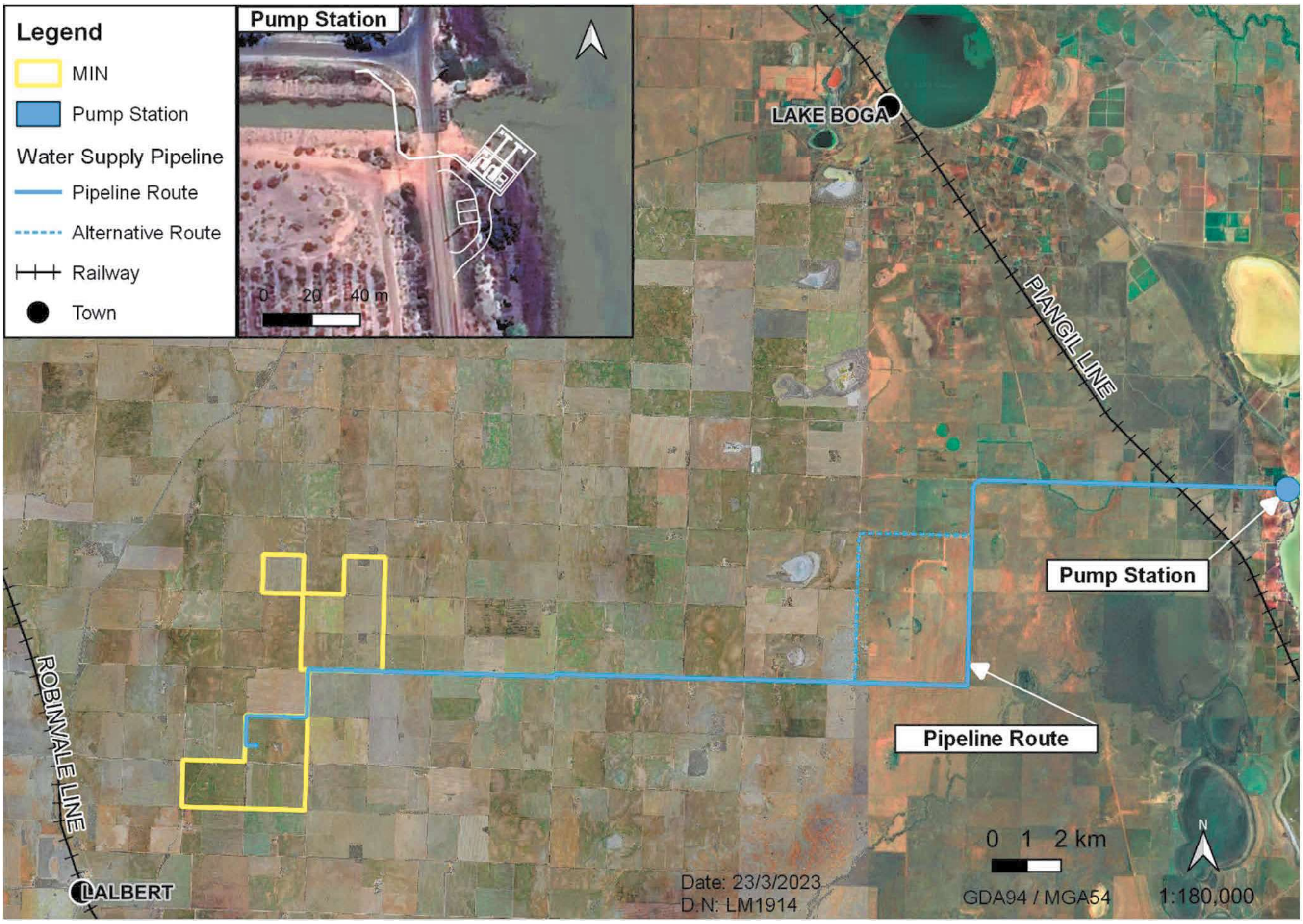
Rehabilitation – The mined areas will be progressively backfilled in a staged manner, with tailings dewatered in-pit to allow overburden and topsoil placement in a profile that reinstates the background soil structure. This will result in the ability for a return to the current agricultural land uses within 3 years.

Power – Electrical power needed for mining and processing will be produced on-site from dual fuel diesel/LNG fired power generators, with a gradual evolution over the life of mine to renewables, hydrogen and/or battery as technologies and commercial viability increase. Heat energy for the on-site gas fired appliances shall be provided from an extension of the distribution network from the main LNG storage and regasification system.

Transport – Final products shall be containerised in 20ft sealed sea containers on site and exported via Melbourne Port using road and/or rail-based land logistics solutions. Ultima will provide intermodal rail solution, to reach the shipping export ports.

Water – Water will be required for construction earthworks, processing, dust suppression and rehabilitation. Up to 4.5 GL a year will be needed for the start-up of the Project. Water will be sourced from Goulburn Murray Water (GMW) from a new pumpstation at Kangaroo Lake via the open water market. A 38 km underground pipeline is proposed beneath existing local road easements as presented in **Figure 5**. Although the section of the proposed pipeline marked 'alternative route' has been assessed as part of this EES, VHM does not proposed to construct the water supply pipeline in this section of the alignment.

Figure 5 Proposed Water Supply Pipeline Route



2.3.3 Closure/Rehabilitation

Closure/Rehabilitation would involve the dismantling and removal of above-ground infrastructure, with the following two aims.

- return the land to a condition that is as near as practicable to pre-existing environmental conditions
- decommission the infrastructure in a manner that minimises potential impacts to the environment, land use and third parties.

For the purposes of the EES, it is assumed that decommissioning would be undertaken in line with regulatory standards at time of decommissioning, involving the dismantling and removal of processing plant, equipment and ancillary facilities, including decommissioning of the water pipeline and removal of offtake pumping station unless it could be used by the local community.

2.3.4 Project Area Soils Physical and Chemical Characteristics

Particle size analysis of samples collected from the Project area are generally indicative of sandy clay loam. The samples indicate that in general, the chemical composition would not pose a risk to ecological or human health receptors. In particular:

- All sampled lithologies were enriched in aluminium, iron, and sodium, with magnesium, calcium and potassium also enriched in the topsoil and Blanchetown Clay.
- Concentrations of metals in topsoil material were below protection levels for Human Health Investigation Levels for a commercial/industrial setting (HIL) and Ecological Investigation Level for areas of significance (EIL). With the exception of one sample (of 22), which reported elevated concentrations of arsenic, molybdenum and nickel, all concentrations also met the Preferred Levels for Plant Regrowth (PLPR).
- There were no metals exceedances of any criteria (HIL, EIL, and PLPR) in the Blanchetown Clay.
- The Geera Clay reported exceedances of the EIL and PLPR for arsenic only.
- Within the LPS waste units, including the waste above mineralisation, high-grade, low-grade, and waste below mineralisation zones, numerous exceedances of the EIL for arsenic are present. No other metals exceeded relevant assessment criteria.

3 Mining Air Quality Indicators

The primary air pollutants of concern from the proposed mining activities are related to fugitive dust generation from activities common to mining and extractive industry operations:

- land clearing and exposure of dusty surfaces (further exacerbated by windy conditions)
- removal of topsoil and overburden
- construction of landforms
- mining of the ore body
- loading and transport of ore to the MUP
- transportation of the product for export
- mobile plant and vehicles on unsealed roads.

The ore processing is for the most part a wet process and therefore dust emissions are likely to be limited relative to the mining activities. No drilling/blasting is proposed.

Emitted dust may contain respirable crystalline silica (RCS), heavy metals and radionuclide and emissions from the onsite power station and off-site water pumping station will include products of diesel or liquified petroleum gas (LPG) combustion (depending on the fuel used).

3.1 Particulate Matter

Particulate matter has the capacity to affect human health and to cause nuisance effects and is categorised by size and/or by chemical composition. The potential for harmful effects depends on both. In air quality assessments, particulate size ranges are commonly described as:

- TSP – refers to all (total) suspended particles in the air. In practice, the upper size range is typically 30 micrometres (µm) to 50 µm.
- PM_{10} – refers to all particles with equivalent aerodynamic diameters of less than 10 µm.
- $PM_{2.5}$ – refers to all particles with equivalent aerodynamic diameters of less than 2.5 µm diameter. These are often referred to as 'fine' particles and are a sub-component of PM_{10}.
- Deposited dust – refers to particulate matter that has settled out of the air and is measured as a dust deposition rate, which is dust settled out over a given area and time under the influence of gravity. Deposited dust can include particles of any size, but it generally comprises particles larger than 20 µm in diameter that rapidly settle out of the air near the point of emission. It is measured to assess if an emission source is causing a nuisance, such as soiling of property and materials, including rain water tanks.

Both natural and anthropogenic processes contribute to the atmospheric load of particulate matter. Coarse particles ($PM_{2.5-10}$) are derived primarily from mechanical processes, resulting in the suspension of dust, soil, or other crustal materials from roads, farming, mining, dust storms, and so forth. Coarse particles also include sea salts, pollen, mould, spores, and other plant parts.

Fine particles, or $PM_{2.5}$, are derived primarily from combustion processes, such as vehicle emissions, wood burning, gas, diesel or coal burning for power generation, hazard reduction burns and bush fires. Fine particles also consist of transformation products, including sulphate and nitrate particles, and secondary organic aerosols formed from volatile organic compound emissions.

The size of particles determines their behaviour in the respiratory system, including how far the particles are able to penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. Additionally, particle size is an important parameter in determining the residence time and spatial distribution of particles in ambient air, which are key considerations in assessing exposure.

$PM_{2.5}$, and in particular the ultrafine sub-micron particles, may penetrate beyond the larynx and into the thoracic respiratory tract and evidence suggests that particles in this size range are more harmful than the coarser component of PM_{10}.

3.1.1 Respirable Crystalline Silica

Silica is one of the most abundant minerals found in the earth's crust. Crystalline silica is most dangerous to health when dust is generated, becomes airborne and is then inhaled. Respirable crystalline silica (RCS) dust particles are small enough to penetrate deep into the lungs and can cause irreversible lung damage.

In the context of ambient air concentrations, RCS is generally represented by the $PM_{2.5}$ fraction. RCS is a hazardous substance, the inhalation of which can lead to silicosis, an incurable lung disease that can lead to disability and death. RCS can also contribute to lung cancer, renal cancer and chronic obstructive pulmonary disease.

3.1.2 Heavy Metals and Radionuclides

Dust emissions from mineral sands mining can include heavy metals and radionuclides such as uranium (U) and thorium (Th). Heavy metals that have been considered as a fraction of PM_{10} and deposited dust include:

- Arsenic (As)
- Cadmium (Cd)
- Chromium (Cr)
- Copper (Cu)
- Lead (Pb)
- Manganese (Mn)
- Mercury (Hg)
- Nickel (Ni)
- Vanadium (V)
- Zinc (Zn).

Radionuclides are not specifically assessed in this assessment; rather the required modelling outputs have been generated for input to the radionuclide assessment report.

3.2 Other Air Quality Indicators Potentially Relevant to the Project

It is intended that Area 1 operations will be powered from a standalone 12-megawatt (MW) dual-fuel (diesel/LPG) power station until alternate renewable energy supplies are established in the district. The power station and adjacent fuel farm will be located close to the primary consumer points (namely the processing plant).

In addition, the water pumping station located at Kangaroo Lake, approximately 30 km east of the Project, will potentially be powered, at least temporarily, by a dual-fuel generator (approx. 1.5 MW). For the purposes of the EES it is conservatively assumed that these generators will be powered by diesel and will be required for the life of mine.

Potential air pollutants of interest associated with the operation of the power station and the pumping station include:

- carbon monoxide (CO)
- oxides of nitrogen (NO_x)
- PM_{10} and $PM_{2.5}$
- sulfur dioxide (SO_2)
- volatile organic compounds (VOCs)
- polycyclic aromatic hydrocarbons (PAHs).

3.2.1 CO

CO is an odourless, colourless gas formed from the incomplete burning of fuels. It can be a common pollutant at the roadside and highest concentrations are typically found in the kerbside environments with concentrations decreasing rapidly with increasing distance from the road.

3.2.2 NO_x

In atmospheric chemistry, NO_x generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 after leaving the combustion source at a rate dependent on ambient and atmospheric conditions.

3.2.3 SO_2

Sulfur in fuel converts to sulfur oxides during combustion, hence emissions of SO_2 are directly related to the concentration of sulfur in the fuel. Diesel contains more sulfur than gas, as there is negligible sulfur content in Australian natural gas and LPG.

3.2.4 VOCs

VOCs have high vapour pressure at normal room-temperature conditions. Their high vapour pressure leads to evaporation from liquid or solid form and emission release to the atmosphere. VOCs are emitted by a variety of sources, including motor vehicles and other stationary and mobile engines. VOCs that are often typical of these sources include benzene, toluene, ethylbenzene and xylenes (often referred to as 'BTEX'). Biogenic (natural) sources of VOC emissions are also significant (e.g. vegetation).

3.2.5 PAHs

PAHs typically result from the incomplete combustion of organic material (such as coal, petrol, diesel, and wood). PAHs are toxic and carcinogenic, the degree to which is dependent on the type of PAH. PAHs typically occur in mixtures, and it is therefore difficult to establish the risk that that the mixture may pose. The toxicity of a mixture of PAHs is therefore often expressed as a single number representing the equivalent concentration of the most toxic or carcinogenic congener, benzo(a)pyrene (B(a)P).

3.2.6 Summary

The rate and composition of air pollutant emissions from the power station and from the pumping station will be a function of a number of factors, including the type and size of the generators, operational load and inclusion of emissions controls (e.g. low-NO_x burners etc). For diesel fired generators, the pollutants with the highest emission rates relative to their ambient air quality criteria, and therefore the pollutants with the highest risk of exceeding that criteria are NO_2 and $PM_{2.5}$. This assessment therefore considers only emissions of NO_x and $PM_{2.5}$ from the power station and the pumping station, the rationale being that if meeting the requirements of the GED with respect to NO_2 and $PM_{2.5}$ is demonstrated, meeting the requirements of the GED with respect to the other pollutants would also be implicitly demonstrated.

Note that using LPG instead of diesel would significantly reduce emissions of NO_x and $PM_{2.5}$.

4 Scoping

4.1 EES Evaluation Objectives and Scoping Requirements

The scoping requirements for the Goschen Mineral Sands and Rare Earths Project Environment Effects Statement (May 2019; 'scoping requirements') prepared by the Minister for Planning, set out the specific environmental matters the Project must address in order to satisfy the Victorian assessment and approval requirements.

The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the Project in accordance with the Ministerial guidelines for assessment of environmental effects under the EE Act.

The following evaluation objective is relevant to air quality:

- *To protect the health and wellbeing of residents and local communities, and minimise effects on air quality, noise and the social amenity of the area, having regard to relevant limits, targets or standards.*

The aspects from the scoping requirements relevant to the evaluation objective are shown in **Table 1** as well as the location where these items have been addressed in this report.

Table 1 Scoping Requirements Relevant to Air Quality

Aspect	Scoping Requirement	Section Addressed
Key Issues	The potential for risks to public health and safety and diminished social wellbeing at all stages of the Project due to a range of factors including but not limited to exposure to dust and air pollution.	**Section 3** and **Section 5.2**
Existing Environment	Describe the physical and chemical characteristics of overburden, ore, product, tailings and mining by-products to be removed during mine development and operations including specific aspects relevant to air quality.	**Section 2.3** and **Section 3**
	Identify dwellings and any other potentially sensitive receptors (e.g. community centres, schools, recreation facilities and agricultural businesses) that could be affected by the Project's potential effects on air quality.	**Section 8.2**
	Monitor and characterise background levels of air quality in accordance with PEM [a] requirements, including air pollution indicators (dust, PM_{10}, $PM_{2.5}$, crystalline silica, metals, and greenhouse gas emissions from equipment) including adjacent sensitive receptors and along potential transport routes.	**Section 8.5**

Aspect	Scoping Requirement	Section Addressed
Assessment of Likely Effects	Predict likely atmospheric concentrations of particulate matter and other relevant Class 1, 2 or 3 indicators in surrounding areas during mine construction, operation and rehabilitation, using an air quality impact assessment undertaken in accordance with the PEM. The air quality impact assessment is to also include an assessment using the SEPP (Ambient Air Quality) environmental objectives. [a]	**Section 10** and **Section 11**
	Assess any effects of dust emissions on surrounding agricultural industry and local water supplies, including privately owned rainwater tanks.	
Design and Mitigation Measures	Identify potential and proposed design responses and/or other mitigation measures in accordance with best management practice, to avoid, reduce and/or manage significant effects for sensitive receptors, during the Project construction, operation, decommissioning and post-closure, arising from air pollution.	**Section 13.1**
Approach to Manage Performance	Describe monitoring programs for potential effects on amenity, environmental quality, health and social wellbeing including a framework for identifying and responding to any emerging issues.	**Section 13.2**

a The "*Protocol for Environmental Management: Mining and Extractive Industries*" (the PEM) and the "*State Environment Protection Policy (Ambient Air Quality)*" (the SEPP(AAQ)) are no longer in effect. The assessment requirements are now provided by the draft "*Guideline for assessing and minimising air pollution*" (EPA Victoria, 2022) and the "*Environmental Reference Standard*" (Victorian Government, 2021). Refer **Section 5.1.**

5 Evaluation Framework

5.1 Legislation, Policy, Guidelines and Standards

The legislation, policy, guidelines and standards relevant to this assessment are summarised in **Table 2**.

Table 2 Legislation, Policy, Guidelines and Standards Relevant to the Assessment

Document Title	Summary	Relevance to Project
Commonwealth Government		
National Environment Protection (Ambient Air Quality) Measure (NEPC, 2021)	The National Environment Protection (Ambient Air Quality) Measure (Air NEPM) developed by the National Environment Protection Council (NEPC) contains standards and goals for key pollutants that are required to be achieved nationwide, with due regard to population exposure. Air NEPM standards apply at performance monitoring locations, with each station located in such a manner that it obtains a representative measure of air quality likely to be experienced by the general population in a region or sub-region of 25,000 people or more. The desired environmental outcome of the Air NEPM is ambient air quality that allows for the adequate protection of human health and well-being.	The standards are not intended to be applied as modelling criteria for assessing air emissions from individual sources, specific industries or roadside locations and are therefore not strictly appropriate for this AQIA. However, the Victorian Environmental Reference Standard which provides assessment criteria relevant to this AQIA adopts (in part) the Air NEPM standards.
Australian Drinking Water Guidelines (NHMRC, 2022)	The Australian Drinking Water Guidelines provide a basis for determining the quality of water to be supplied to consumers in all parts of Australia. They are intended to provide a framework for the good management of drinking water supplies that if implemented will assure safety at the point of use. The Australian Drinking Water Guidelines are not mandatory legally enforceable standards and the implementation of the guidelines is at the discretion of each state and territory. The Australian Drinking Water Guidelines are used by state and territory health departments and drinking water regulators, local health authorities and water utilities.	Emissions of dust have the potential to impact local water supplies, including privately owned rainwater tanks. Indicative predictions of impacts to rainwater tanks are compared with drinking water guidelines.

Document Title	Summary	Relevance to Project
Victorian Government		
Environment Protection Act 2017 (Vic) (Victoria State Government, 2017)	The *Environment Protection Act 2017* as amended by the *Environment Protection Amendment Act 2018* (Victoria State Government, 2018), took effect on 1 July 2021 and introduced: • a general environmental duty (GED), which will require everyone, including businesses and individuals, conducting activities that pose a risk to human health or the environment from pollution or waste to understand those risks and take reasonably practicable steps to eliminate or minimise them. • a duty to notify, which requires a person in management or control of land to notify EPA as soon as practicable if the contamination may pose a significant risk to human health or the environment.	The GED is relevant to the Project requiring emissions to air to be eliminated or minimised as far as reasonably practicable. In determining whether it is reasonably practicable to minimise risks of harm to human health and the environment, the following matters are relevant: • the likelihood of the risk eventuating • the degree of harm that would result if the risk eventuated • what the person knows, or ought reasonably to know about the harm or risks of harm and ways of eliminating or reducing those risks • the availability and suitability of ways to eliminate or reduce the risk • the cost of eliminating or reducing the risk.
Environment Reference Standard (Victorian Government, 2021)	Under the *Environmental Protection Act 2017*, the Environment Reference Standard (ERS) is to be used to assess and report on environmental conditions in the whole or any part of Victoria. It sets out indicators and objectives for the ambient air environment. The ERS provides a reference to help make decisions. It does not: • create specific obligations that must be followed • set out enforceable compliance limits • describe levels that it is permitted to pollute up to.	The ERS sets out ambient air quality objectives for *criteria pollutants,* some of which are relevant to the Project, including: • PM_{10} • $PM_{2.5}$ • CO • NO_2 • SO_2 For the most part, the ERS adopts the Air NEPM standards for these pollutants which aim to provide for the adequate protection of human health and well-being.

Document Title	Summary	Relevance to Project

Guideline for Assessing and Minimising Air Pollution in Victoria (EPA Victoria, 2022)	The guideline for Assessing and Minimising Air Pollution in Victoria (the Air Guideline) provides a framework to assess and control risks associated with air pollution. It is a technical guideline for air quality practitioners and specialists with a role managing pollution discharges to air.
	The air quality assessment criteria in the Air Guideline are concentrations of air pollutants that provide a benchmark to understand potential risks. They are risk-based concentrations that help identify when or if an activity is likely to pose an unacceptable risk to human health and the environment. This represents a change in attitude to air quality criteria which were previously concentrations that facilities could effectively 'pollute up to'. There are now no concentrations below which no action, management and/or mitigation of emissions to air is required.
		The Air Guideline sets out levels of quantitative assessment and air pollution assessment criteria (APACs) that the Project must comply with, noting the requirements of the GED.
		The Air Guideline APACs for criteria pollutants are adopted from the ERS and should be updated to reflect any future update to the ERS.
		The Air Guideline defines a quantitative assessment appropriate for the Project to include:
		• air pollution modelling carried out using EPA's preferred model in line with standard modelling methodologies directed by United States Environmental Protection Agency (US EPA) AERMOD modelling guidance
		• air pollution monitoring including:
		  • real time continuous 24-hour PM_{10} and $PM_{2.5}$ data for a 12-month period
		  • analysis of crystalline silica ($PM_{2.5}$ fraction) and heavy metal content (PM_{10}) and/or other air toxics (where applicable).
		The Air Guideline discourages the modelling assessment of nuisance dust deposition rates.

5.2 Assessment Criteria

Relevant air quality criteria provided in **Table 3** have been sourced from the Air Guideline, which lists numerous air pollution assessment criteria (APACs). The APACs are risk-based concentrations that help identify when or if an activity is likely to pose an unacceptable risk to human health and the environment and are not to be considered concentrations below which no management and/or mitigation of emissions to air is required. In accordance with the GED, the Project must take steps to eliminate or minimise those emissions so far as reasonably practicable.

In relation to the application of APACs to modelling outputs, the Air Guideline advises that APACs with averaging periods of one hour or less apply to the 99.9th percentile predicted concentration at any location at or beyond the boundary of the facility. For all averaging periods greater than one hour, the APACs apply to the 100th percentile predicted concentration at discrete receptor locations. This is because acute exposures can plausibly occur in most locations (e.g. a park, a shopping strip or at a place of work), while longer exposures are more likely at sensitive receptors, such as a nearby residence.

Table 3 Air Pollution Assessment Criteria

Substance	Cumulative/Incremental	Averaging Period	APAC ($\mu g/m^3$)
Health Based			
PM_{10}	Cumulative [a]	24 hours	50 [c]
		Annual	20 [c]
$PM_{2.5}$	Cumulative [a]	24 hours	25 [c]
		Annual	8 [c]
RCS (as $PM_{2.5}$)	Cumulative [a]	Annual	3 [c]
Arsenic	Cumulative [a]	Annual	0.015 [c]
Cadmium	Cumulative [a]	Annual	0.005 [c]
Chromium (hexavalent)	Cumulative [a]	Annual	0.005 [c]
Lead	Cumulative [a]	Annual	0.5 [c]
Manganese	Cumulative [a]	Annual	0.15 [c]
Mercury	Cumulative [a]	Annual	1 [c]
Nickel	Cumulative [a]	Annual	0.09 [c]
Zinc	Cumulative [a]	Annual	2 [c]
NO_2 [b]	Cumulative [a]	1 hour	150 (80 ppb) [d]
		Annual	28 (15 ppb) [c]
Environmental			
NO_2 [b]	Cumulative [a] – relating to terrestrial vegetation	Annual	30

a Cumulative APACs apply to the total concentration (Project plus background).
B Relating to power station and pumping station emissions.
C 100th percentile at discrete sensitive receptor locations.
D 99.9th percentile at any location at or beyond the boundary of the facility.

5.2.1 Dust Deposition Guidance

Note that there is no APAC associated with dust deposition. The Air Guideline states that a deposition rate of 4 g/m^2/month (no more than 2 g/m^2/month above background), as a monthly average, previously used as a criterion can continue to be used as a *rule of thumb* level for requiring further investigation and addressing dust issues. The Air Guideline does not offer guidance on assessing the potential impacts of dust deposition on vegetation. Dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration (Highways England, 2019). Literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 30 g/m^2/month (Farmer, 1993), with most species appear to be unaffected until dust deposition rates are at levels considerably higher than this.

6 Consultation and Engagement

Development of the Project and preparation of the EES have been informed by consultation with stakeholders and the community. **Table 4** lists specific community and stakeholder feedback on air quality and how this feedback has been considered by the project in this impact assessment.

Table 4 Stakeholder Engagement Undertaken for Air Quality

Community and Stakeholder Feeback	Consideration in Project Design or Impact Assessment
EPA were consulted on the adequacy of the baseline air quality monitoring data collected for the AQIA (17 July 2020)	In accordance with EPA's request, in addition to consideration of representative background PM_{10} and $PM_{2.5}$ concentrations, the AQIA also includes consideration of elevated background PM_{10} and $PM_{2.5}$ concentrations associated with regional bushfires years. This approach also addresses the concerns of several neighbouring properties at Stakeholder Reference Group meetings.
Stakeholder Reference Group meetings were held in late 2019. Queries regarding air quality were associated with concerns about the potential impacts dust could have on the health and well-being of the community and how dust contamination could affect crops and livestock. Residences collect rainwater from roofs for consumption and domestic use. Concerns were raised that potential increased dust levels could cause contamination of that water.	Emissions of PM_{10} and $PM_{2.5}$ from the operation of the Project were identified as having the greatest potential to the impact health and well-being of the community. These dust size fractions are therefore the focus of the operational impact assessment, which predicts the potential concentrations of PM_{10} and $PM_{2.5}$ at sensitive receptors in the vicinity of the Project. Dust deposition resulting from the Project was identified as having the potential to affect crops and livestock, and impact nearby residences rainwater tanks. The operational impact assessment therefore also predicts indicative dust deposition rates in fields surrounding the Project and at nearby sensitive receptors to address these concerns.

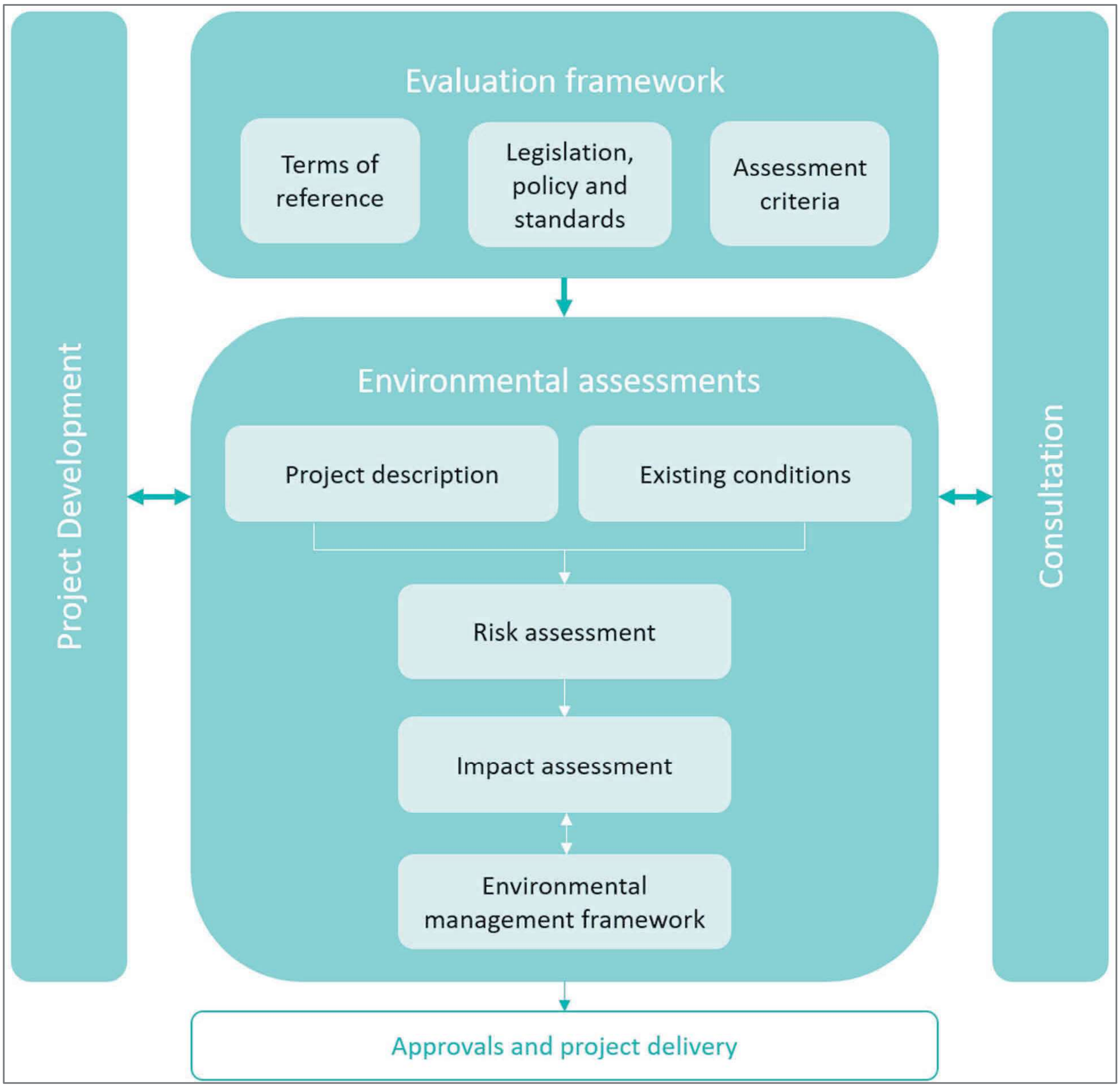
7 Methodology

7.1 Overview of Method

This section describes the method that was used to assess the potential impacts of the Project. **Figure 6** shows an overview of the assessment method. A risk-based approach was applied to prioritise the key issues for assessment and inform measures to avoid, minimise and offset potential effects.

The approach used in the assessment has been guided by the evaluation framework that applies to the Project comprising the regulatory framework (that is, applicable legislation and policy) as well as the scoping requirements set by the Victorian Minister for Planning.

Figure 6 Overview of Assessment Framework



The environmental assessments were undertaken according to the following steps:

- Establishment of a study area and characterisation of existing environment
- Review of the Project description, comprising the key Project components (including locations and form), proposed construction and operation activities (in the context of existing environment) and decommissioning activities to determine the location, type, timing, intensity, duration and spatial distribution of potential Project interactions with sensitive receptors

- An initial risk-based analysis to evaluate the potential effects of proposed Project activities and their likelihood of occurring (considering initial mitigation measures) to determine the relative importance of environmental impacts associated with the Project and therefore prioritise issues for attention in the subsequent assessment of impacts. Initial mitigation measures would include measures that are common industry practice or required to meet legislation.
- An assessment of impacts that examines the severity, extent, and duration of the potential impacts and considers the sensitivity and significance of the affected receptors
- Evaluation of predicted outcomes against benchmarks and criteria such as those described in applicable legislation, policy and standards
- Evaluation of the potential for cumulative impacts (where relevant) caused by impacts of the Project in combination with impacts of other existing and proposed projects that may have an overall significant impact on the same environmental asset
- Identification of additional mitigation measures where necessary to address potentially significant environmental impacts
- Evaluation and reporting of the residual environmental impacts including magnitude, duration and extent, taking into account the proposed mitigation measures and their likely effectiveness.

Based on the findings of the environmental assessments, an Environmental Management Framework (EMF) has been prepared to monitor and control environmental performance during project implementation. The EMF has specified the committed mitigation measures to avoid, minimise and manage impacts, proposed contingency measures and offset commitments, and describe the roles and responsibilities for implementation throughout Project construction, operation and decommissioning.

The specific methods adopted during the key steps are described in the sections below.

7.2 Study Area

An appropriate study area may be defined as the approximate geographical extent required for the dispersion of emissions to air from various Project activities to result in incremental increases in ground level concentrations (i.e. due to Project impacts) that approach zero, or some small fraction of the relevant ambient air quality criteria.

For significant surface-based fugitive emissions such as those that may be expected from the Project activities, a study area of approximately 10 km by 10 km (100 km^2) approximately centred on the Project would generally be considered sufficient to meet the definition of an appropriate study area. Due to the geographical spread of the Project Areas (Area 1 and Area 3) and the distribution of nearby sensitive receptors around the Project, a study area of 15 km by 15 km (225 km^2), centred towards the southeastern corner of Area 3 has been chosen (**Figure 7**).

Note the pipeline (refer **Sections 10.1.2** and **10.2.2**) and pumping station (refer **Section 11.1.6**) are considered separately.

The

Figure 7 Study Area

7.3 Existing Environment

A comprehensive assessment was undertaken to understand the existing environment of the study area to inform the environmental impact assessment for the works. This assessment incorporated:

- Swan Hill Bureau of Meteorology (BoM) (Station no. 77094) meteorological datasets for 2017 to 2021
- BoM average summer and annual evaporation rates (BoM, n.d.)
- Ambient air quality monitoring campaign dataset including concentrations of PM_{10}, $PM_{2.5}$, heavy metals (as PM_{10}) and respirable crystalline silica (as $PM_{2.5}$) (SLR documents 640.11763-R01-v5.0 and 640.11763.00300-M01-v3.0)
- Consultation with EPA (refer **Section6**)
- Aerial imagery (Nearmap Australia Pty Ltd, 2022)
- VHM soil assay metals analysis data from 2019 drilling program.

7.4 Avoidance and Minimisation

Relevant to this topic, the following measures have been adopted in relation to the design, construction and operation of the Project to avoid and minimise impacts:

- In Area 1 and Area 3, ore will be hauled by truck between the mining blocks and the MUP where it will be turned into a slurry and piped to the processing plant in Area 1. This minimises truck haulage in Area 1 and avoids truck haulage between Area 3 and Area 1, reducing the potential for wheel generated dust emissions.
- There will generally be six blocks active at any one time, with one of the following activities occurring in each:
    - clearing/overburden removal
    - ore mining
    - tailings fill
    - tailings consolidation
    - overburden fill
    - shaping/rehabilitation.

  Topsoil and overburden will be stockpiled in waste dumps in the first instance. As the mining of the blocks continues, waste material (topsoil, overburden and tailings) from the initial mining voids will backfill the mined voids, reducing haulage and double handling and therefore the potential for dust emissions. Each mining block will nominally take 1.5 to 2 months to mine for removal of its material and is estimated to be 'open' for a duration of 8 to 12 months.
- For mining block operations closer to sensitive receptors, mining will be limited to daytime hours. Solar heating during the daytime drives vertical atmospheric turbulence which increases entrainment and mixing. This generally leads to reduced pollutant concentrations in the vicinity of a source of emissions, compared to at night.
- Wheel generated dust emissions from internal haul roads and trafficable areas will be supressed as far as practicable by:
    - sealing unpaved roads where practicable

  - strictly restricting access to those vehicles that require access to unpaved surfaces
  - limiting speed of vehicles on unpaved surface
  - maintaining moisture content of unsealed surfaces by use of a water cart and sprays and increasing or decreasing the frequency and amount of application depending on weather conditions
  - applying crushed rock and gravel with aggregate mixes or soil adhesives and geotextile fabrics as required
  - applying chemical stabilizers to bind unsealed surface fine particles together or onto larger particles
- Drop height to be minimised when loading trucks.
- Sweeping and wetting of sealed surfaces to minimise dust generation.
- Dust emissions resulting from wind erosion of exposed areas and stockpiles will be supressed as far as practicable by use of water sprays, primary earthworks and chemical stabilizers, as appropriate.
- Maintenance of existing vegetation and progressive re-vegetation of completed mining blocks and non-trafficable areas will reduce the potential for wind erosion.
- Product will be transported from site in sealed freight containers.

The Project will aim to meet its obligations under the GED by minimising the emission of dust for all operations and meteorological conditions as far as practicable.

7.5 Risk Assessment

A risk assessment of Project activities was performed to prioritise the focus of the impact assessments and development of mitigation measures. The risk pathways link Project activities (causes) to their potential effects on the environmental assets, values or uses that are considered in more detail in the impact assessment. Risks were assessed for the construction, operation and decommissioning phases of the Project.

The likelihood and consequence ratings determined during the risk assessment process and the adopted mitigation measures are presented in **Appendix A**. The risk assessment has been undertaken in line with the Preparation of Work Plans and Work Plan Variations Guideline for Mining Projects (Victoria State Government, 2020).

7.6 Impact Assessment

A change to baseline conditions (or the no-Project case) caused by Project activities in any of the Project phases (construction, operation or decommissioning) may give rise to impacts.

The impact assessment involved identifying the severity, extent and duration of any impacts, positive or negative, that the Project may have on the existing environment.

The significance of the impacts has been assessed in accordance with the evaluation framework, based on applicable legislation, policy and standards and the evaluation objectives and environmental significance guidelines arising from the government terms of reference established to guide the assessments.

This study has assessed the impacts of construction, operation and decommissioning of the Project on air quality assets and values to be protected.

7.6.1 Project Construction and Closure/Rehabilitation Assessment Methodology

Quantitatively assessing impacts of fugitive dust emissions from construction using predictive modelling is seldom considered appropriate, primarily due to the uncertainty in the details of the construction activities, including equipment type, number, location and scheduling, which are unlikely to be available at the time of the assessment. Furthermore, they are also likely to change as construction progresses.

Instead, it is considered appropriate to conduct a qualitative assessment of potential construction related air quality impacts. Potential impacts of dust emissions associated with proposed construction activities at the Site has been performed based on the methodology outlined in the Institute of Air Quality Management (UK) (IAQM) document, "*Assessment of dust from demolition and construction*" (IAQM, 2014). This guidance document provides a structured approach for classifying construction sites according to the risk of air quality impacts, to identify relevant mitigation measures appropriate to the risk (see **Appendix B** for full methodology).

The IAQM approach has been used widely in Australia for the assessment of air quality impacts from construction projects and the identification of appropriate mitigation measures and has been accepted by regulators across all states and territories for a variety of construction projects.

The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1**: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2**: Assess risk of dust effects from activities based on:
  - the scale and nature of the works, which determines the potential dust emission magnitude; and
  - the sensitivity of the area surrounding dust-generating activities.
- **Step 3**: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4**: Assess significance of remaining activities after management measures have been considered.

It is noted that that accurate information regarding construction activities and equipment are not available at this stage, hence conservative assumptions have been made where necessary to assess impacts from construction activities. If these parameters were to be significantly modified, re-assessment of construction impacts would be recommended.

7.6.2 Project Operation Assessment Methodology

In accordance with the Air Guideline, the dispersal of pollutant emissions of PM_{10} and $PM_{2.5}$ to air from the Project were modelled using AERMOD. The American Meteorological Society (AMS)/USEPA Regulatory Model (AERMOD Version 19191) was specifically designed to support the USEPA's regulatory programs, however it is also the Victorian regulatory model. AERMOD is a steady-state plume modelling system with three components: AERMOD (dispersion model), AERMAP (terrain data pre-processor) and AERMET (meteorological data pre-processor).

AERMOD was used to predict maximum cumulative pollutant ground level concentrations (GLCs) resulting from the Project emissions to air and existing background concentrations.

The dispersal and deposition of pollutant emissions of TSP were also modelled using AERMOD. However, it is noted that the Air Guideline asserts that caution should be applied in using dust dispersion modelling predictions because they present some significant challenges due to uncertainty in emission source estimations, and the difficulties in setting acceptable threshold levels for nuisance dust risks. Modelled dust deposition rates are therefore considered indicative and were primarily used to inform the assessment of potential dust impacts on surrounding agricultural industry (crops) and local water supplies (rainwater tanks), and to inform the radionuclide assessment (**Section 7.6.2.3.6**) and the risk assessment (**Appendix A**).

7.6.2.1 Environmental Inputs

AERMOD requires a range of inputs to describe the Project environment:

- topographical data
- meteorological data
- background pollutant concentrations.

The sources of the required data are summarised in **Table 5** and these inputs are discussed in the following sections.

Table 5 Air Dispersion Model Input Data

Item	Source	Description
Topographical data	Shuttle Radar Topography Mission (SRTM) Derived Digital Elevation Model (DEM)	1 second (~30m) resolution
Meteorological data	Weather Research and Forecasting (WRF) model and AERMET pre-processor.	A site specific synthetic meteorological dataset representative of the Project location provides input to AERMOD's meteorological pre-processor, AERMET.
Background pollutant concentrations	Project site specific monitoring campaign	12 months monitoring of PM_{10}, $PM_{2.5}$, RCS, heavy metals and dust deposition.
	EPA monitoring station at Alphington	NO_2 concentration 2016 to 2020

7.6.2.1.1 Topography

Shuttle Radar Topography Mission (SRTM) one arc-second (approximately 30 metres) global digital surface model data is commonly used for plume dispersion modelling purposes. The raw SRTM data cannot distinguish between ground surface topography and other elevated features such as tree canopies and buildings and is therefore subject to editing and processing, such as: delineating and flattening water bodies, better defining coastlines, removing spikes and wells and filling small voids. Due to the relatively flat topography, few trees and few buildings in the Project area, the dataset is considered adequate for the assessment. Data was processed with AERMAP for use in AERMOD.

7.6.2.1.2 Meteorology

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke, 2002).

For this study, a site-representative three-dimensional meteorological dataset was compiled using WRF before extracting the necessary on-site and upper air input files for the AERMOD meteorological pre-cursor model, AERMET, details of which are provided in **Appendix C**.

In accordance with EPA guidance, five years of meteorological data (2016 to 2020) was modelled for this assessment.

7.6.2.1.3 Background Pollutant Concentrations

Existing air quality in the area surrounding the Project will be affected by a combination of emissions from sources in the local area, as well as emissions that flow into the area from the wider region.

The air environment surrounding the Project site will be affected by:

- Dust from agricultural activities, wind erosion during periods of dry and dusty wind conditions and long-range transport of fine particulate matter from other regions.
- Intermittent and short-term emissions of particulate matter and products of combustion from grass/bush fires, controlled burns and dust storms.

The Air Guideline states that level 2 and level 3 assessments require real time continuous 24-hour average PM_{10} and $PM_{2.5}$ data for a 12-month period from the area where the operation is proposed, with analysis of RCS (as $PM_{2.5}$) and heavy metal content (PM_{10}), where applicable.

Time varying background concentrations (24-hour averages) of PM_{10} and $PM_{2.5}$ recorded at the Project site between January 2019 and September 2020 were included in the models such that the cumulative 24-hour and annual average concentrations (Project impact plus background) could be assessed against the criteria. In consultation with EPA, the 2020 dataset was deeded to be representative of a bushfire impacted air quality year, with 2019 being representative of a 'normal' air quality year. By utilising both datasets, the potential cumulative impacts during a bush-fire impacted year and a normal year were assessed.

For RCS and metals, the annual average background concentration recorded at the Project site was added to the predicted annual average Project impact to give the cumulative annual average concentrations. For NO_2, conservative 1-hour and annual average background concentrations were estimated based on data from the Alphington ambient air quality monitoring site operated by EPA.

Further details on the data used is provided in **Section 8.5**.

7.6.2.2 Dispersion Model Configuration

7.6.2.2.1 Modelled Project Mining Scenarios

The proposed mining activities in Area 1 and Area 3 are scheduled to move around the extraction area, block by block. As such, the extent of potential impacts to air quality beyond the extraction boundary and at nearby sensitive receptors will change as the locations of the emission sources change. As a result, there may be more than one worst-case scenario, given that different sensitive receptors may be impacted differently for any given mining scenario. **Table 6** provides the justification for the scenarios chosen to be assessed. Full emission source details and overviews of the source locations for each scenario are provided in **Section 11.1** and **Section 11.2**.

Table 6 Modelled Project Scenario Descriptions

Mining Area	Scenario	Description
Area 1	Scenario 1: Area1_Y1Q1	Moderate combined topsoil, clay and overburden and ore extraction rate. High haulage (VKT) rate of topsoil, clay and overburden to temporary stockpiles. No haulage between mining blocks. Activities assumed: • Block 101: ore mining. • Block 102: clearing/overburden removal.
	Scenario 2: Area1_Y6Q2	High combined topsoil, clay and overburden and ore extraction rate. Moderate haulage (VKT) rate of topsoil, clay and overburden to temporary stockpiles. Moderate haulage between mining blocks. Close to receptor 13 – daytime operations only (7:00 am – 6:00 pm) Activities assumed: • Block 125: backfilling • Block 126: ore mining • Block 127: clearing/overburden removal
Area 3	Scenario 3: Area3_Y11Q3	High combined topsoil, clay and overburden and ore extraction rate. High haulage (VKT) rate of topsoil, clay and overburden to temporary stockpiles. Moderate haulage between mining blocks. Close to receptor 7 – daytime operations only (7:00 am – 6:00 pm) Activities assumed: • Block 110: backfilling • Block 111: ore mining • Block 112: clearing/overburden removal

Mining Area	Scenario	Description
	Scenario 4: Area3_Y15Q2	High combined topsoil, clay and overburden and ore extraction rate. High haulage (VKT) rate of topsoil, clay and overburden to temporary stockpiles. No haulage between mining blocks – all to stockpiles. • Activities assumed: • Block 101: clearing/overburden removal • Block 102: ore mining

VKT = vehicle kilometres travelled

7.6.2.2.2 Particulate Modelling Methodology

Emissions from the site were represented in the model by a series of volume sources, except for wind erosion from the exposed areas, which was represented by area sources.

Based on the sensitivity of each activity to wind speed, hourly varying emission files representing hourly TSP, PM_{10} and $PM_{2.5}$ emissions from each source were compiled based on the daily average emission rates estimated for each activity. Details of the algorithm used to generate the variable emission files are presented in **Appendix D**.

TSP emissions were used to predict indicative dust deposition rates to inform the radionuclide assessment (refer **Section 7.6.2.3.6** and **Section 7.8**) and to indicate the potential for dust impacts on surrounding crops and rainwater tanks.

The following operating conditions were also incorporated into the variable emission files:

- Wind erosion occurs every hour of the year adjusted for windspeed.
- For 24-hour operations, dust generating extractive activities occur 24 hours per day, 7 days per week
- For daytime only operations, dust generating extractive activities occur 11 hours per day, 7 days per week.

7.6.2.2.3 NO_2 to NO_x Ratio

NO_x emitted from combustion processes mainly consist of NO with a small portion (approximately 10%) of NO_2. In the atmosphere however, NO emitted from the source oxidises to NO_2 in the presence of ozone (O_3) and sunlight as it travels further from the source. The rate of oxidation depends on a number of parameters including the ambient O_3 concentration. Assuming 100% conversion of NO to NO_2 before the plume arrives at the receptor location can significantly over-predict NO_2 concentrations at nearfield receptors as this assumes that the atmospheric reaction is instantaneous when in reality, the reaction takes place over a number of hours.

This assessment conservatively assumes a NO_2 to NO_x ratio of 30%.

7.6.2.2.4 Model Parameters and Options

A summary of additional AERMOD modelling options and parameters used for the assessment is provided in **Table 7**.

Table 7 Model Parameters

Parameter	Option
Adjusted U* (friction velocity)	Yes
Output type	PM_{10} and $PM_{2.5}$: concentration (µg/m^3) TSP: deposition (g/m^2; for indicative purposes only)
Depletion options	PM_{10} and $PM_{2.5}$: None TSP: None
Dispersion coefficient	Rural
Building downwash	None (no buildings included)
Gridded receptors	Gridded: Uniform cartesian 0 m (AGL)
Discrete receptors	Discrete: Sensitive receptor locations (Refer **Table 9** and **Table 10)** 0 m (AGL)

AGL Above ground level

7.6.2.3 Emission Estimation Methodology

7.6.2.3.1 Fugitive Particulate Emissions

Fugitive emissions of TSP, PM_{10} and $PM_{2.5}$ were estimated using published emission factors from the National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Mining (DSEWPC, 2012) [incorporating (SPCC, 1986)] and USEPA AP-42 Compilation of Air Emissions Factors (USEPA, 2006 and Updates), as appropriate (refer **Appendix E**).

Notable assumptions made in calculating the emission rates for each activity are as follows:

- A water cart will be used on internal haul roads.
- An area equal to the proposed active areas of the pit, the overburden and topsoil stockpiles and ROM stockpile was used to estimate windblown dust from the Project.
- The modelled scenarios assume that a water cart and water sprays will be used around the pit and the earthworks of the overburden dump. In reality, additional management and mitigation measures may be implemented to minimise dust (refer **Section 13.1**).
- Haulage distances (expressed in total vehicle kilometres travelled (VKT)) on unsealed roads were estimated based on the length of the haulage route and number of trips per hour calculated from the total daily tonnage and truck payload).

7.6.2.3.2 Wheel Generated Dust

The "*NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*" (Donnelly, et al., 2011) commissioned under the NSW EPA Dust Stop Program found that wheel generated dust emissions, primarily generated by trucks travelling on unsealed haul roads was the largest contributor to the total emissions of TSP and PM_{10}, and the second largest contributor of $PM_{2.5}$.

The amount of wheel generated particulate matter from an unpaved haul road is a function of:

- the erodibility of the wearing course

- the erosivity of the actions to which the wearing course is subjected.

The first is a property of the design of the haul road whilst the second is affected by how the road is used and managed. The second is road down to maintenance and management, which for the Project, may include:

- Surface treatments or suppressants (water and/or chemical), which by their nature will require periodic reapplication. Donnelly et al. (2011) reports that the use of suppressant solution could achieve a 57% reduction in water applied per square metre and a 167% increase in time between watering, compared with use of water alone.
- Constructing haul roads using materials with low silt content. Typically haul road construction material is sourced onsite, if this material has poor bonding properties or a high proportion of fine material (e.g. silt) the dustiness of the haul road may increase along with the costs of maintaining the road surface. Increasing the amount of large aggregates in the construction material by adding gravel or slag can reduce the dustiness of haul roads and reduce maintenance costs as the road is less susceptible to deterioration.

Monitoring programs undertaken as part of the NSW EPA Dust Stop Program found that the haul road particulate matter control efficiencies of between 80 and 99% could be achieved with 16 of the 42 results (38%) of the studies reporting control efficiencies of 95% or greater.

Project Site Specific Haul Road Watering Control Efficiency Calculation

A site-specific watering emission control factor (*C,* expressed as a percentage) can be estimated from typical evaporation rates for the area and the haul road traffic rate using the following equation (Air & Waste Management Association, 2000):

$$C = 100 - \frac{0.8pdt}{i}$$

where

- *p* is the average hourly daytime evaporation rate (mm/h),
- *d* is the average hourly daytime traffic rate (trips/h),
- *t* is the time (h) between water application, and
- *i* is the application intensity (L/m^2).

Based on the typical evaporation rates for the area (**Section 8.4.5**) and a worst-case traffic frequency of up to 25 trips per hour, a control of greater than 95% is calculated for the Project onsite haul roads for an hourly water application rate of 1.6 L/m^2,. The estimated hourly water application rate rises to 2.9 L/m^2/h during the summer months to achieve this level of control. In general, traffic frequency is estimated to be less than this, requiring a lower application intensity rate.

For modelling purposes therefore, a 95% control factor was applied to the uncontrolled unpaved haul road wheel generated dust estimates for the worst-case wheel generated dust conditions associated.

These control factors reflect the Project's consideration of the GED. In practise, this level of control will be achieved by a combination of water application, chemical suppressant application, good road design and management including:

- considering water cart/suppressant needs for various seasons and planning for this

- adjusting water cart usage on the day in response to forecast and observed weather conditions (for example, hot seating water carts through crib breaks and use of water extender products as required)
- optimising the spray volume to increase efficiency of water carts whilst maintaining a safe travelling surface for haul trucks
- increasing the frequency of watering on active haul roads (i.e. watering to reflect use) including attentive monitoring and application of suppressants as surface dries out to avoid excessive emissions
- constructing the road surface using materials with low silt content
- scheduling grading and gravelling of heavy traffic areas such as intersections with regular resurfacing of high traffic areas such as intersections to reduce silt build up.

7.6.2.3.3 Wind Speed Dependent Wind Erosion

The base wind erosion emission rates were varied hourly based on a cubic relationship with the wind speed for each hour to accurately simulate the increased dust generation at higher wind speeds. That is, for each hour, *h,* the hourly emission rate, *E* is:

$$E(h) = E_{base} * u(h)^3/\overline{u^3}$$

where $\underline{E_{base}}$ is the base emission rate in kg/h, and *u* is the hourly wind speed in m/s contained within the meteorological file. Note that although increased wind speeds generate increased wind erosion emission rates, they also promote increased plume dispersion. This offsetting effect generally leads to reduced downwind ground level particulate concentrations at higher wind speeds.

7.6.2.3.4 RCS and Metals Emissions

For the purpose of this study, it has been conservatively assumed that the RCS emission rates for all activities are equal to 100% of the $PM_{2.5}$ emission rates. The emission rate of individual metals in PM_{10} and in deposited dust have been conservatively assumed to be equal to the fractions of metals as indicated by the background metals (as PM_{10}) monitoring (refer **Section 8.5.2**, **Table 16**).

7.6.2.3.5 Power Station and Pumping Station Emissions

Emissions from the 12 MW power station were estimated based on it comprising (nominally) 12 duty and 2 standby 1.0 MW_m diesel reciprocating generators. The generators are to be housed in a single building, each serviced by an individual exhaust stack. The Project proposes to use dual fuel diesel/LNG fired generators, however, for the purposes of this assessment they are conservatively assumed to run on diesel for which greater pollutant emissions are generally associated.

To achieve the power requirements, the twelve duty diesel generators will target operating between 70-90% of full load for optimal efficiency. For modelling purposes, the *continuous power rating* generator specifications were used.

Up to 1.5 MW of power is assumed to be required for the water pumping station. For modelling purposes, the emission parameters for the pumping station generators are conservatively based on two 1.0 MW_m diesel reciprocating generators.

Emission parameters for the generators are derived from the generator specifications, provided in **Appendix F**.

7.6.2.3.6 Radionuclide Emissions

The method for estimating radon emission rates from mining projects is to conservatively assume that all radon contained within the extracted materials will be emitted. This is highly conservative given that generally the radon and thoron are only emitted from the surface of mineral grains.

Therefore modelling has been performed based on the methodology and estimation method described in JRHC Enterprises Pty Ltd's Technical Note: VHM-09 "*Radon (Rn-222 and Rn-220) AQM Source Term Inputs Proposed VHM Goschen Plant and Processing Facility*" dated 12 November 2021. The assessment predicts the resulting Becquerels (Bq)/m^3 over the model domain based on the following conservatively estimated emissions from the Project:

- Rn-222: 0.090 MBq/s
- Rn-220: 13.5 MBq/s

These emission sources have been modelled as a large volume source representing the significant sources (ore, product and tailings) with an initial horizontal spread of 500 m, located near the centre of Area 1 and Area 3.

7.6.2.3.7 Particle Size Distributions for Modelling Dust Deposition

Indicative dust deposition rates to indicate the potential for dust impacts on surrounding vegetation and local rainwater tanks and to inform the radionuclide assessment were predicted using estimated TSP emission rates and particle size distributions derived from the US EPA's *AP42 Emission Factor Handbook* emission factors for aggregate handling processes, unpaved industrial (haul) roads and wind erosion as provided in **Table 8.**

Model outputs to inform the radionuclide exposure assessment are provided in **Appendix G**.

Table 8 Particle Size Distribution for Dust Deposition

Source Type	Particle Diameter (µm)	Mass Fraction	Particle Density (g/cm^3)
Material handling [a]	2.5	0.072	2.5
	5.0	0.199	2.5
	10	0.203	2.5
	15	0.176	2.5
	30	0.351	2.5
Wheel generated dust	2.5	0.031	2.5
	10	0.276	2.5
	30	0.694	2.5
Wind erosion	2.5	0.075	2.5
	10	0.425	2.5
	15	0.100	2.5
	30	0.400	2.5

a Trucks dumping, loading trucks, crushing, bulldozing etc.

7.7 Limitation, Uncertainties and Assumptions

The following limitations, uncertainties and assumptions apply to this assessment.

All atmospheric dispersion models, including AERMOD, represent a simplification of the many complex processes involved in the dispersion of pollutants in the atmosphere. To obtain good quality results it is important that the most appropriate model is used and the quality of the input data (meteorological, terrain, source characteristics) is adequate.

The main sources of uncertainty in dispersion models, and their effects, are discussed below:

- **Oversimplification of physics:** This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Uncertainties are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally-varying meteorology).
- **Uncertainties in emission rates:** GLCs are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst-case emission levels or are based on the results of a small number of stack tests, however operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- **Uncertainties in wind direction and wind speed**: Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Uncertainties in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.
- **Uncertainties in mixing height:** If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- **Uncertainties in temperature:** Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- **Uncertainties in stability estimates:** Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind (which are used directly or indirectly to estimate stability class for Gaussian models). In either case, uncertainties in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

The USEPA makes the following statement in its Modelling Guideline (US EPA, 2005) on the relative accuracy of models:

> *"Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ±10 to 40% are found to be typical, i.e., certainly well within the often-quoted factor-of-two accuracy that has long been recognised for these models. However, estimates of concentrations that occur at a specific time and site are poorly correlated with actually observed concentrations and are much less reliable."*

7.8 Linkages to Other Technical Reports

This report has interdependencies with the Radionuclide Assessment report in relation to the assessment of impacts associated with deposition of dust containing radionuclides. The air quality specialists undertaking this assessment worked collaboratively to evaluate these potential impacts and design suitable mitigation measures to be adopted by the Project.

8 Existing Environment

8.1 Local Setting

The majority of the Project would occur on farmland, with remnant native vegetation existing principally along road reserves. Rural residences are located within the Project area and surrounds, which are identified and discussed below.

8.2 Sensitive Receptors

In general, sensitive receptors includes houses, schools, kindergartens, recreation areas and sporting ovals, however, sensitive receptors identified in the vicinity of the Project comprise only of a number of nearby rural/farming residences. Lalbert is the nearest community to the Project and includes several residences, recreation areas and a post-office, and at more than 4.5 km to the southwest of the Project, is unlikely to experience any measurable impacts as a result of the Project.

In accordance with the Air Guideline, the potential impacts at these residences have been assessed as part of this AQIA. The two closest sensitive receptors to the Project site boundaries are at a distance of 200 m and 1,000 m. The nearest existing sensitive receptors to the Project and the pumping station included in the assessment are listed in **Table 9** and **Table 10,** and presented in **Figure 8** and **Figure 9**. Several other sensitive receptors are located in the vicinity of, but further away than those listed in **Table 9** and **Table 10**. While these are not included in the assessment, due to their increased separation from the Project and the pumping station, these will be impacted by Project emissions to a lesser degree than those receptors that are included**.**

Note that VHM have indicated that receptor R14 will be vacated for the duration of the entire Project and receptor R9 will be vacated when works begin in Area 3. Impacts predicted at these locations will therefore be of little consequence as strictly speaking, they will not be sensitive receptors during the Project.

Table 9 Identified Nearest Sensitive Receptors

ID	Description	UTM Coordinates (Zone 54)		Distance and Direction from Project Boundary
		(m E)	(m S)	
R1	Residence	728,695	6,057,913	4.9 km E (Area 3)
R2	Residence	724,850	6,053,261	3.2 km E (Area 1)
R3	Residence	720,945	6,050,305	2.0 km S (Area 1)
R4	Residence	725,900	6,064,002	5.0 km NNE (Area 3)
R5	Residence	725,979	6,063,658	4.0 km NNE (Area 3)

ID	Description	UTM Coordinates (Zone 54)		Distance and Direction from Project Boundary
		(m E)	(m S)	
R6	Residence	727,086	6,061,550	4.0 km NE (Area 3)
R7	Residence	724,968	6,060,540	1.6 km NE (Area 3)
R8	Residence	718,405	6,060,955	2.3 km NW (Area 3)
R9	Residence	721,880	6,058,420	0.0 km (Area 3)
R10	Residence	717,293	6,057,603	3.0 km SWS (Area 3)
R11	Residence	717,489	6,055,795	2.6 km WNW (Area 1)
R12	Residence	720,623	6,051,214	1.0 km S (Area 1)
R13	Residence	718,485	6,054,126	0.6 km NW (Area 1)
R14	Residence	721,779	6,053,064	0.2 km E (Area 1)
R15	Residence	718,344	6,051,555	1.0 km SW (Area 1)
R16	Residence	715,051	6,051,041	4.2 km SWS (Area 1)
R17	Residence	723,762	6,049,984	3.1 km SE (Area 1)

Table 10 Identified Nearest Sensitive Receptors to Pumping Station

ID	Description	UTM Coordinates (Zone 54)		Distance and Direction from Project Boundary
		(m E)	(m S)	
R18	Residence	750,316	6,061,809	0.3 km NNE
R19	Residence	750,498	6,061,913	0.5 km NE
R20	Residence	750,317	6,060,709	0.8 km S

Figure 8 Identified Nearest Sensitive Receptors

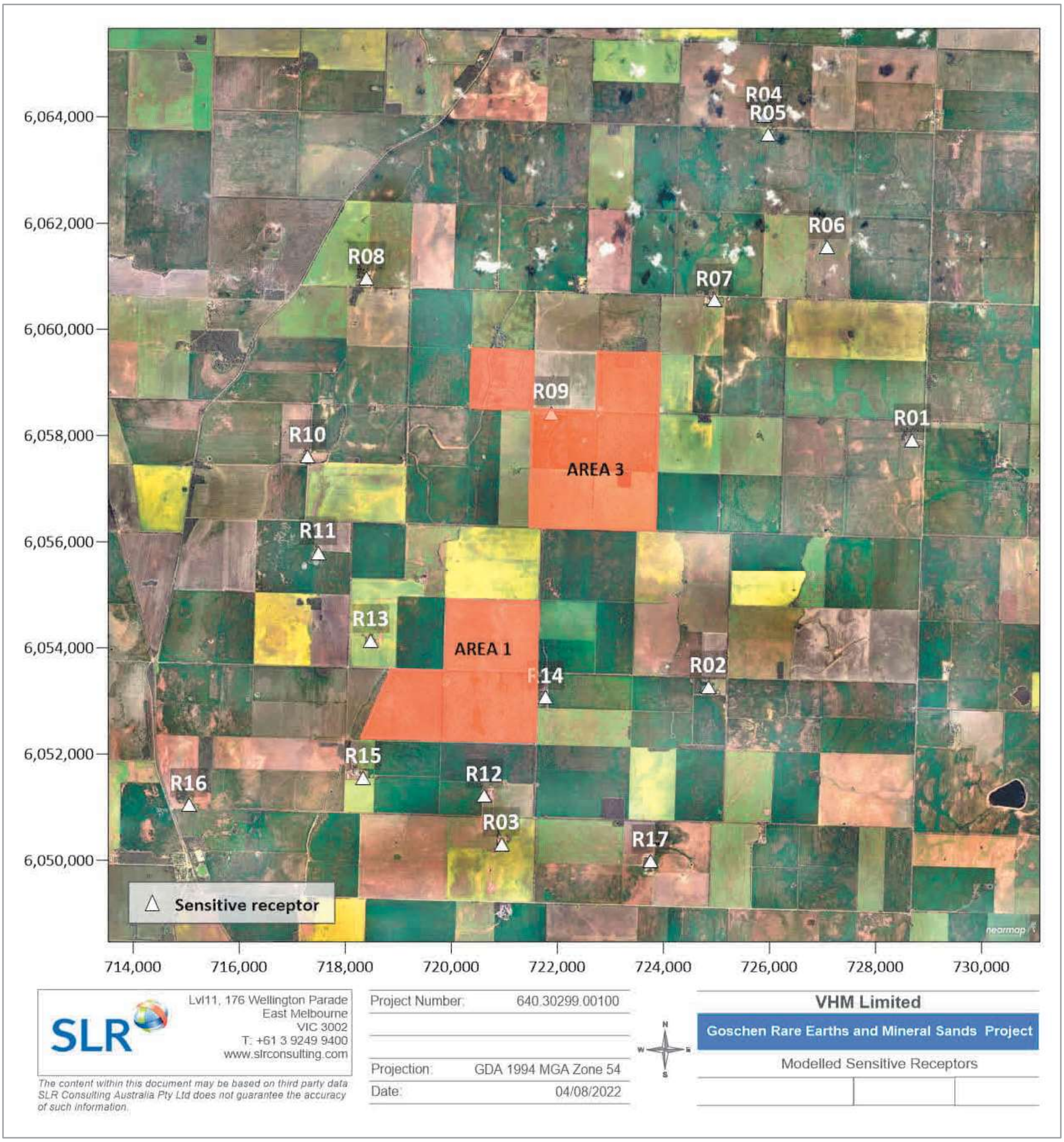
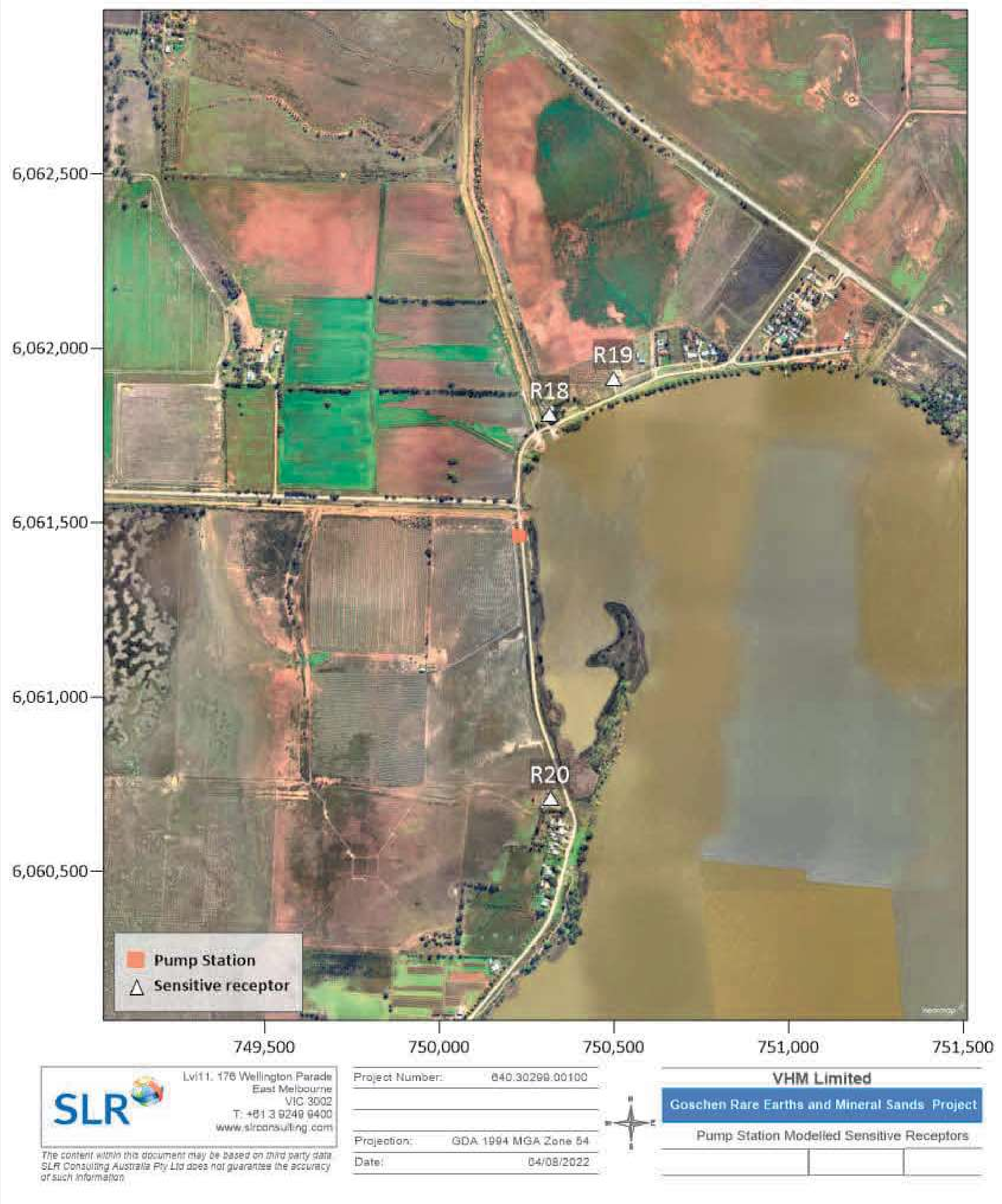


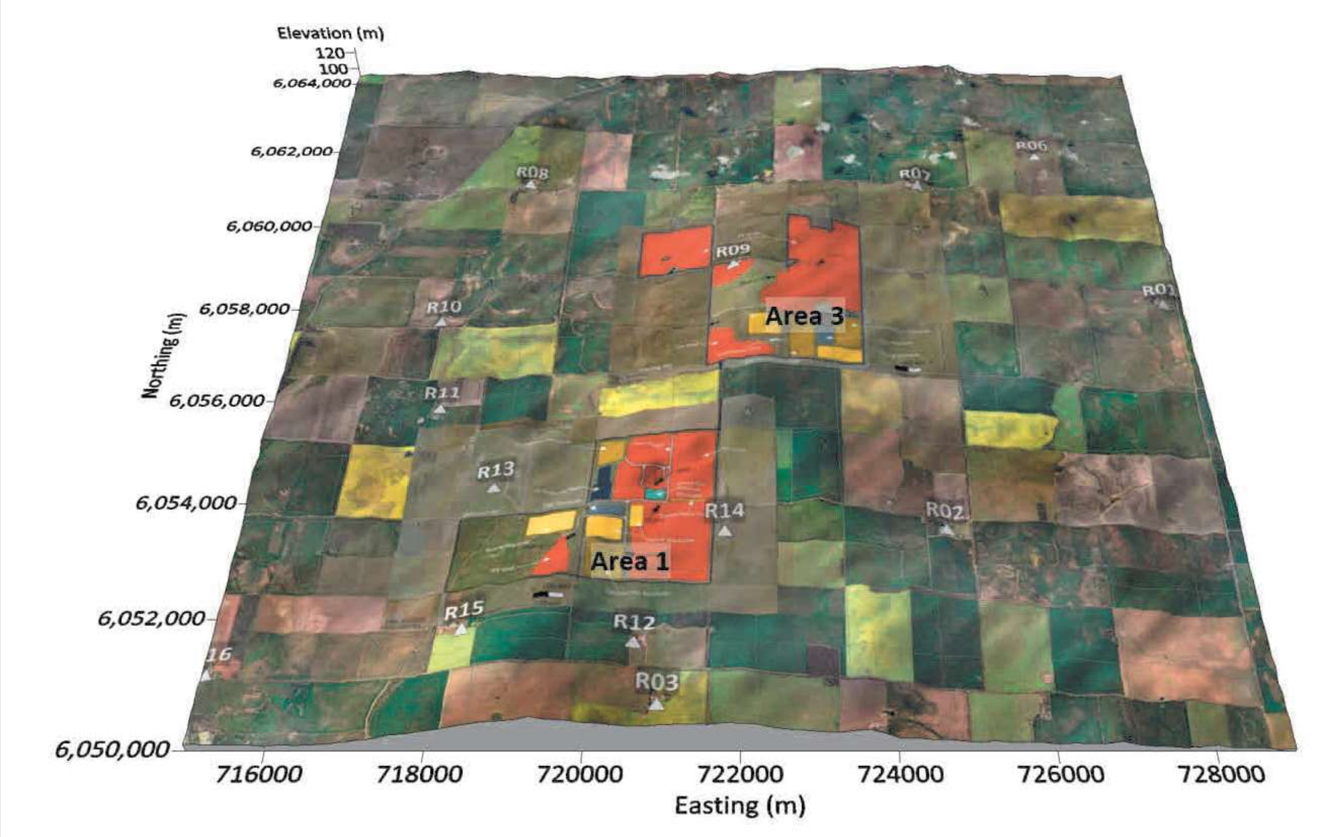
Figure 9 Identified Nearest Sensitive Receptors to Pumping Station



8.3 Topography

The Project area and surrounds are generally flat with less than 50 m elevation change over 50 km from the Project in any direction. A three-dimensional representation of the topographical features in the Project study area is presented in **Figure 10**.

Figure 10 Project Study Area Topography



8.4 Meteorology

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) affects the degree of mechanical turbulence, which also influences the rate of dispersion of air pollutants.

In relation to dust emissions due to wind erosion, temperature, rainfall and relative humidity all influence the soil moisture content and hence the threshold friction velocity, which is the minimum friction velocity required to initiate movement of soil particles by wind.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The nearest available automatic weather station (AWS) collecting data suitable for use in a quantitative air dispersion modelling study operated by the BoM is located at Swann Hill Aerodrome, approximately 25 km to the northeast of the Project (see **Figure 10**). Given the proximity and lack of significant terrain features between the AWS and the Project, it's likely that weather observations at the AWS would be representative of that experienced at the Project.

The Swan Hill Aerodrome AWS (Station 77094, elevation 71 m), has data available from 1996 to present for the following parameters:

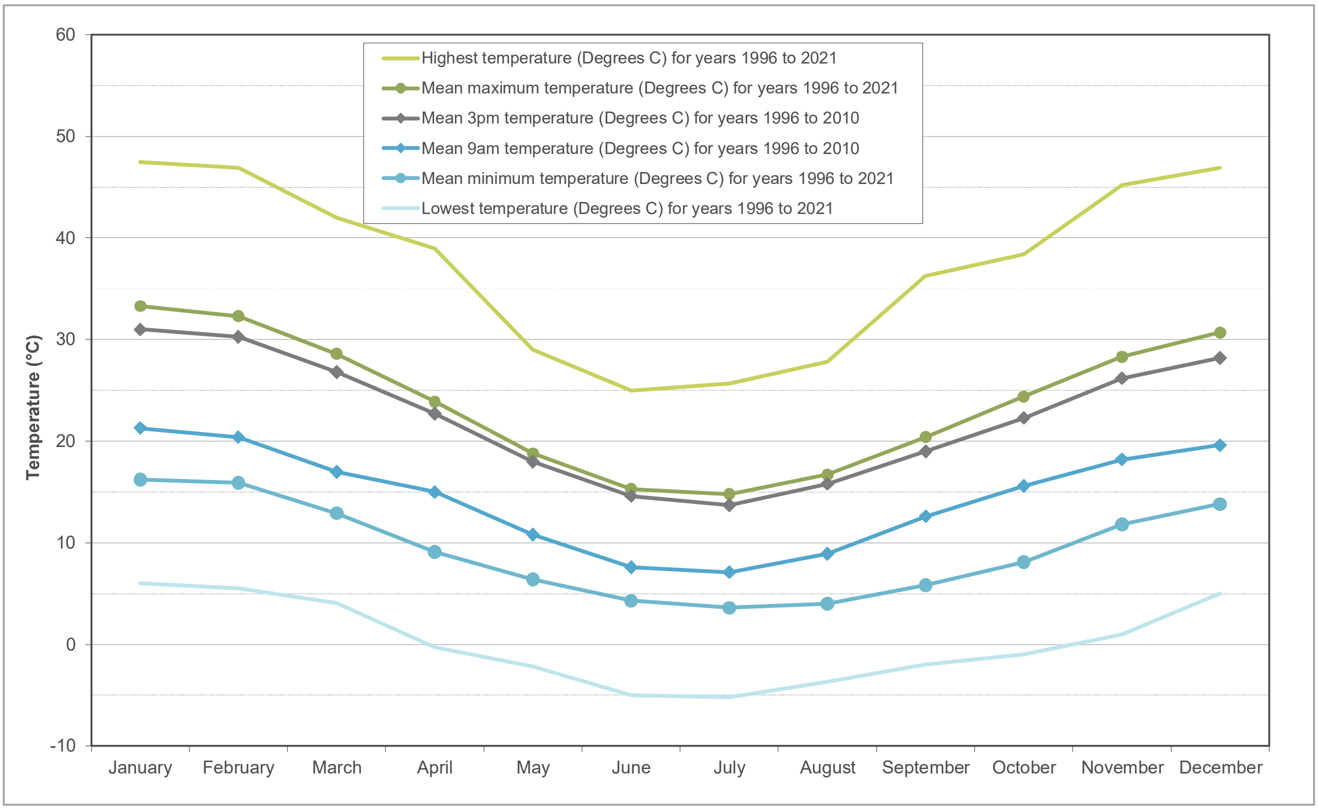
- temperature (°C)
- rainfall (mm)
- relative humidity (%)
- wind speed (m/s) and wind direction (degrees).

A review of the long-term data collected by this AWS is provided in the following sections.

8.4.1 Temperature

Long-term temperature statistics for Swan Hill Aerodrome are summarised in **Figure 11**. Mean maximum temperatures range from 14.8°C in winter to 33.3°C in summer, while mean minimum temperatures range from 3.6°C in winter to around 16.2°C in summer. Longer periods of higher temperatures can dry out soil resulting in both higher background dust and on-site dust emissions.

Figure 11 Long Term Temperature Data for Swan Hill Aerodrome

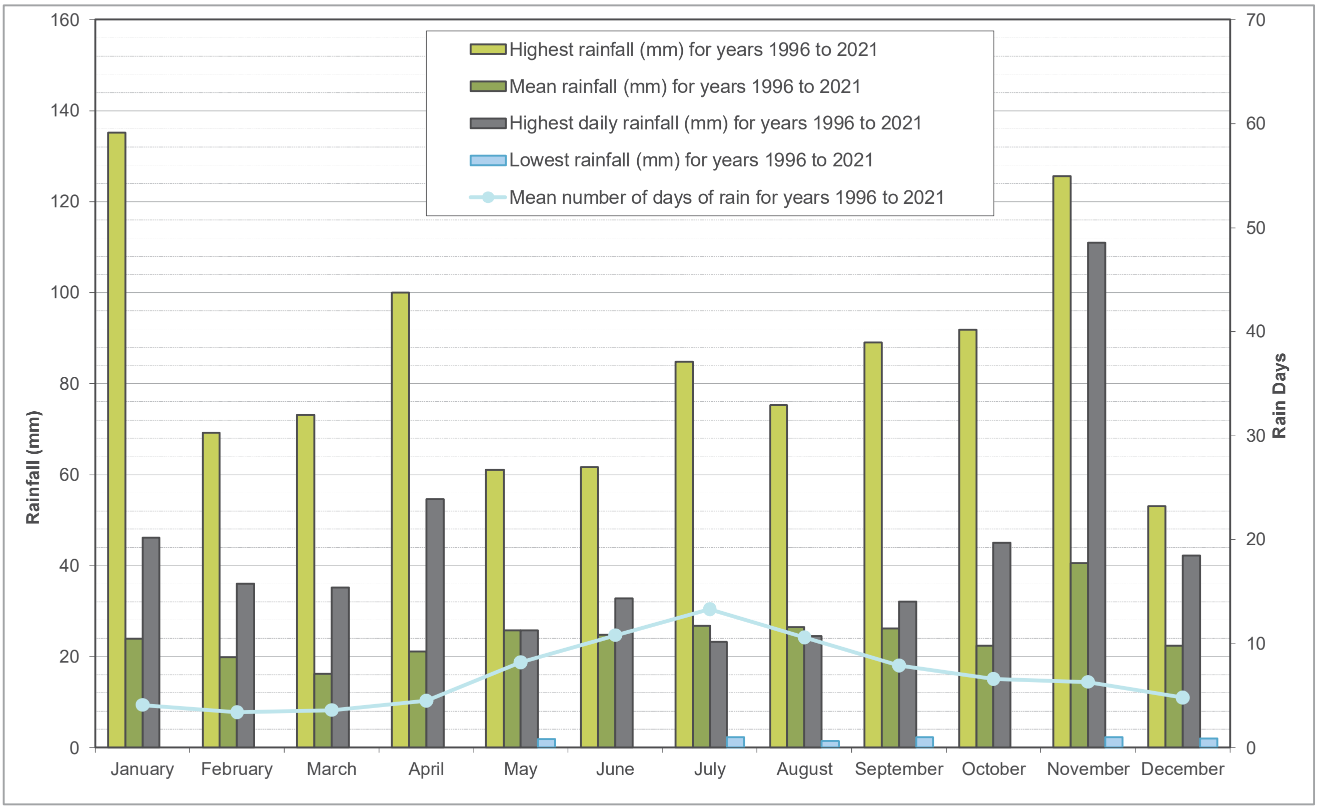


8.4.2 Rainfall

Long-term rainfall statistics for Swan Hill Aerodrome are summarised in **Figure 12**. The mean annual rainfall is 301 millimetres (mm), with the highest average monthly rainfall of 40.5 mm/month in November and an average of 6.3 rain days recorded in this month. The average monthly rainfall is highest in winter, reducing from spring through to early autumn, with the lowest average of 16.2 mm/month recorded in March. This month also recorded an average of around 3.6 rain days per month. The highest monthly rainfall recorded over the time period examined was 135.2 mm recorded in January 2011. Peak rainfall events occur during summer, with the maximum daily rainfall of 46.2 mm recorded on 14 January 2011.

Rainfall suppresses on-site dust emissions but has conservatively not been considered in this assessment.

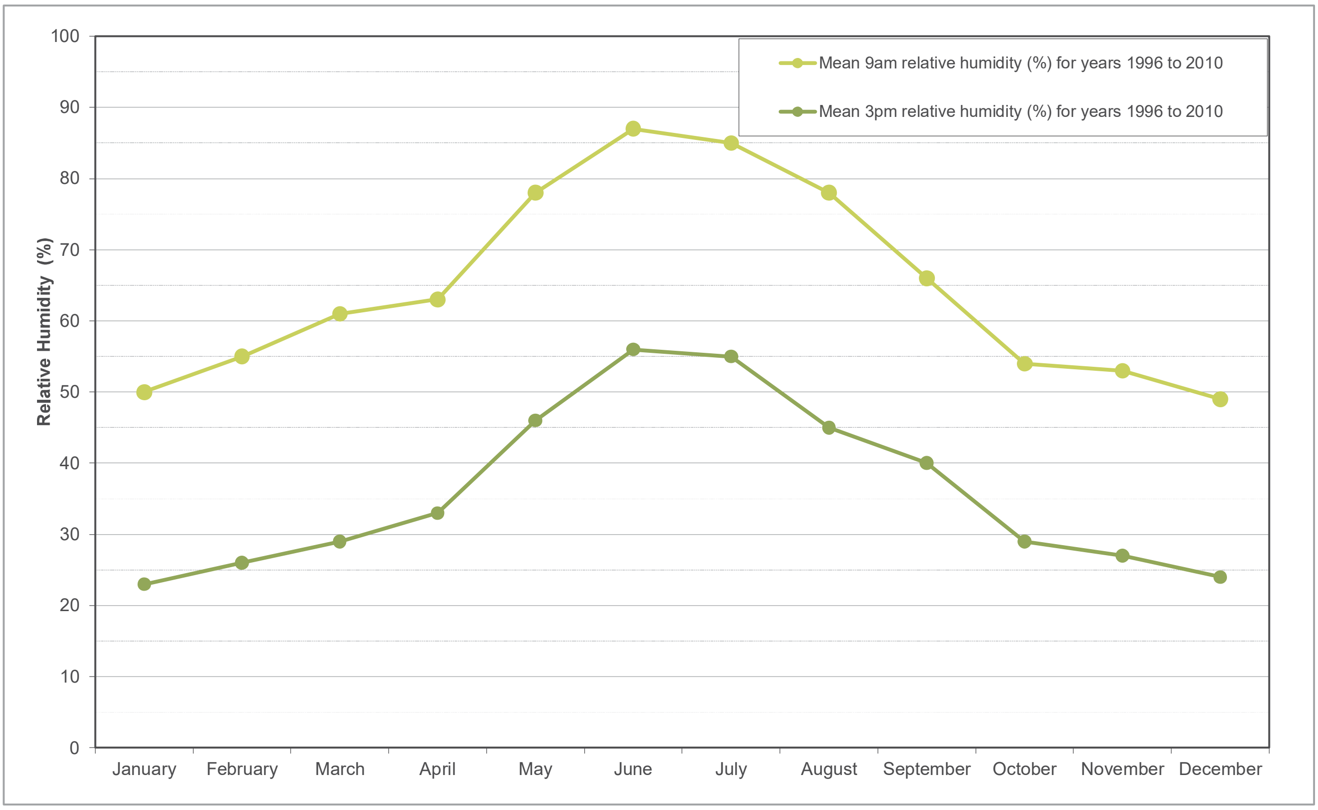
Figure 12 Long Term Monthly Rainfall Data for Swan Hill Aerodrome



8.4.3 Relative Humidity

Long-term humidity statistics (9 am and 3 pm monthly averages) for Swan Hill Aerodrome are summarised in **Figure 13**. Morning humidity levels range from an average of around 85% in winter to around 50% in summer. Afternoon humidity levels are lower, at around 55% in winter dropping to around 25% in summer.

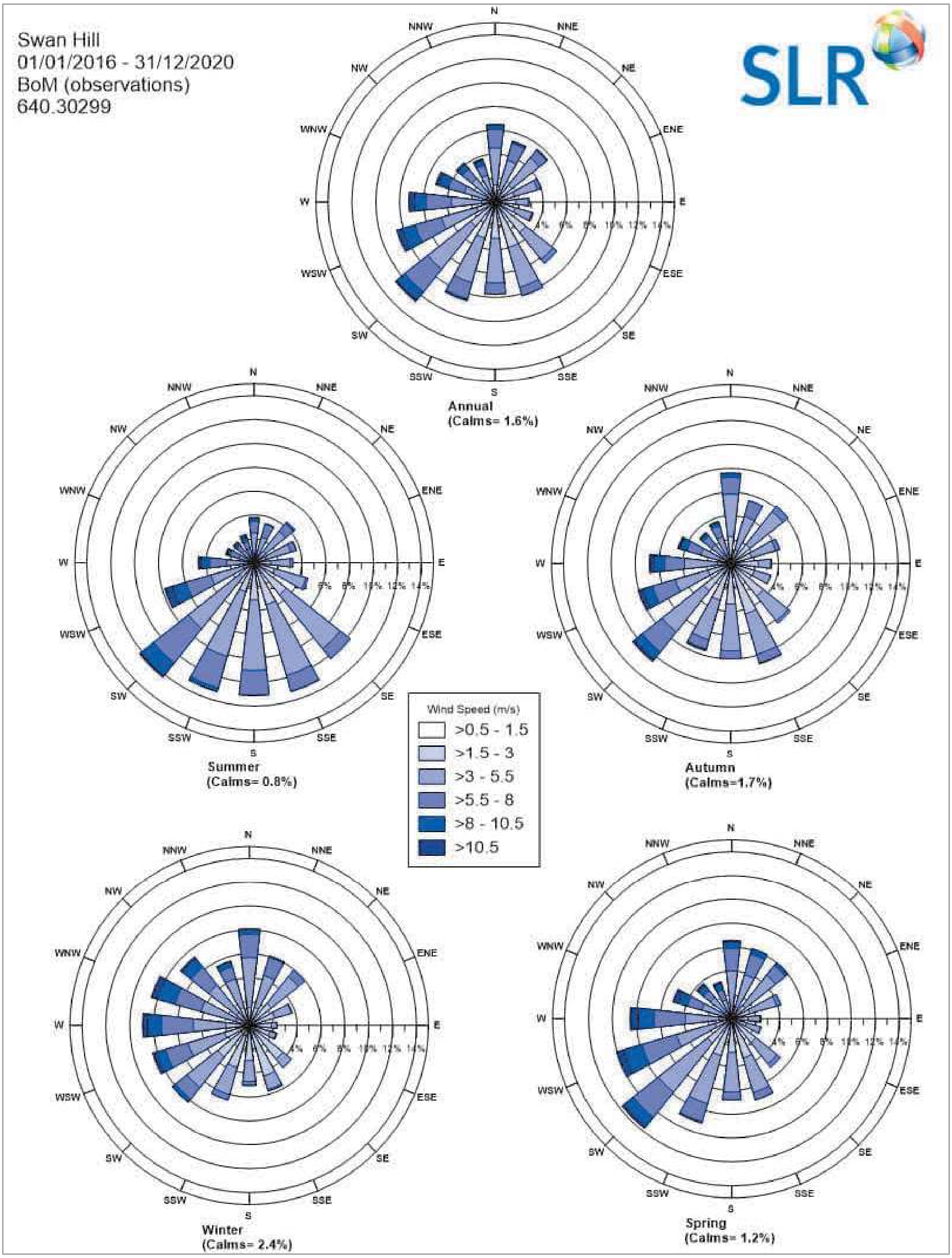
Figure 13 Long Term Humidity Data for Swan Hill Aerodrome



8.4.4 Wind

Annual and seasonal wind roses for Swan Hill Aerodrome for the years 2016-2020 are presented in **Figure 14**. The wind roses show that overall, winds from the south and southwest are predominant, with very few winds from the east. Spring and autumn winds are similar to the annual distribution. Summer is more dominated by winds from the southern quadrant, while winter has more winds from the western quadrant.

Figure 14 Annual and Seasonal Wind Roses – Swan Hill Aerodrome (2016 – 2020)



8.4.5 Evaporation

The BoM publishes total evaporation maps for Australia showing the amount of water that evaporates from an open pan (BoM, n.d.). Annual average and seasonal average evaporation rates for the area in which the Project is situated have been conservatively estimated from these maps, which indicate the following:

- approximate total annual average evaporation rate: 1800 mm, or 0.41 mm/h assuming evaporation occurs during daytime (12 hours) only
- approximate total summer average evaporation rate: 800 mm, or 0.73 mm/h assuming evaporation occurs during daytime (12 hours) only.

Using water carts and water sprays to supress dust emissions will achieve less control in areas with greater evaporation than areas with less evaporation. Greater rates of watering are likely to be required in summer when evaporation rates are increased to achieve adequate dust control.

8.4.6 Meteorological Modelling

In accordance with EPA guidance, five years of meteorological data (2017 to 2021) was modelled for this assessment. Surface characteristics (albedo, Bowen ratio and surface roughness) of the assessment location were determined in accordance with EPAV guidance (EPAV, 2013) informed from publicly available on-line aerial imagery.

A summary of the AERMET modelling options and parameters used for the assessment is provided in **Table 11**. A summary of the AERMOD meteorological files is provided in **Table 12**.

Table 11 AERMET Model Parameters

Parameter	Option / Source			
Adjusted U* (surface friction velocity)	Yes			
Threshold wind speed (m/s)	0.28			
Wind speed and direction	WRF			
Temperature	WRF			
Upper air data	WRF			
Scalar Parameters	**Summer**	**Autumn**	**Winter**	**Spring**
Albedo	0.18	0.18	0.20	0.18
Bowen ratio	0.80	1.0	1.0	0.40
Surface roughness 0° – 359° (m)	0.1	0.1	0.01	0.05

Table 12 AERMOD Meteorological Input Data

Meteorological Year	Available Hours	Calms [a] and Missing Data	Valid Hours [b]
2016	8,784	9	8775
2017	8,760	2	8758
2018	87,60	2	8758
2019	87,60	8	8752
2020	87,84	3	8781

a <0.28 m/s

b AERMOD does not predict GLCs during calms

8.5 Background Air Quality

To inform the AQIA for the Project, and specifically to establish appropriate existing background concentrations with which to predict cumulative (Project plus background) concentrations, VHM engaged SLR to undertake a baseline ambient air quality monitoring programme (AAQMP) at the Project site. The monitoring program was conducted between January 2019 and September 2020 and, in consultation with EPA, included the following:

- continuous monitoring of PM_{10} and $PM_{2.5}$ at one location
- batch monitoring of respirable crystalline silica (as $PM_{2.5}$) and heavy metals (as PM_{10}) at one location
- dust deposition monitoring at five locations.

No nearby significant sources of PM_{10} or $PM_{2.5}$ other than those associated with surrounding farming were identified. The concentrations monitored within the Project area are considered to be representative of regional background conditions during the monitoring period such that they are also considered generally representative of, for example, the Kangaroo Lake pumping station location and pipeline route.

Details of the monitoring campaign are provided in **Table 13**. The monitoring locations are presented in **Figure 15**.

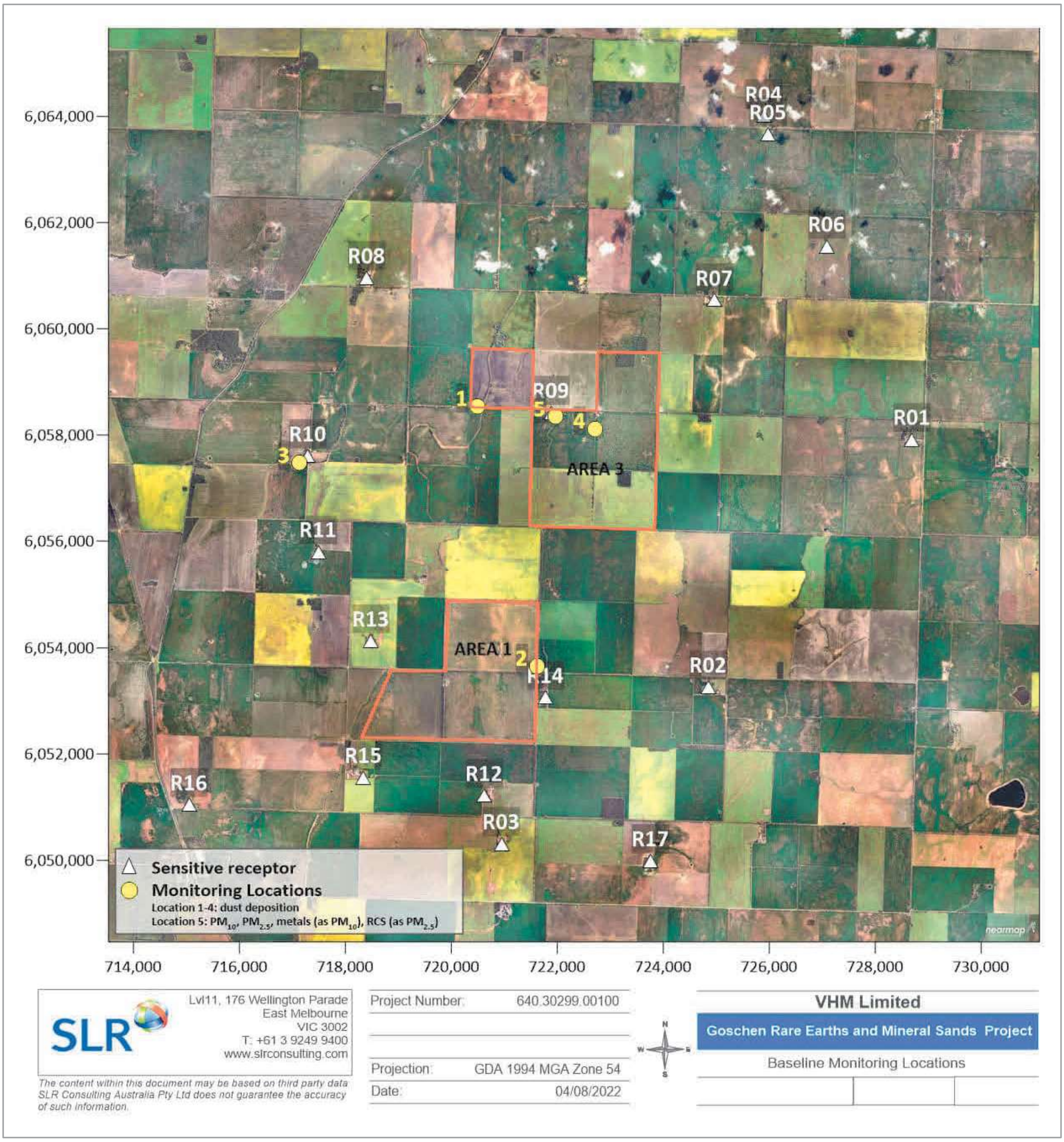
Table 13 Project Background Air Quality Monitoring Details

Parameter	Method and Standard	Frequency / Sample Period
PM_{10}	EBAM Plus (AS/NZS 3580.9.11, 2016)	Continuous
$PM_{2.5}$	BAM1022 (AS/NZS 3580.9.12, 2013)	Continuous
Metals (as PM_{10})	Partisol (AS/NZS 3580.9.9, 2017)	One 7-day sample per month
Silica (as $PM_{2.5}$)	Partisol (AS/NZS 3580.9.10, 2017)	One 7-day sample per month
Dust deposition	Dust deposit gauge (AS/NZS 3580.10.1, 2016)	30 days $\pm$ 2 days

SLR report 640.11763.00300-R1-v5.0 and supporting document 640.11763.00300-M01-v3.0 (provided in **Appendix H**) detail the monitoring campaign and provide full results. EPA were presented these documents and at a meeting endorsed the monitoring results and post-processing methodologies described in 640.11763.00300-M01-v3.0[1].

[1] Meeting with EPA Victoria to discuss air quality monitoring assessment, 17 July 2020.

Figure 15 Baseline Ambient Air Quality Monitoring Programme Monitoring Locations



8.5.1 PM_{10} and $PM_{2.5}$

The annual average PM_{10} and $PM_{2.5}$ concentrations monitored at the Project Site are provided in **Table 14.**

Table 14 Project Annual Average PM_{10} and $PM_{2.5}$ Concentrations (2019-2020)

Year	PM_{10}	$PM_{2.5}$
2019	19	2.7
2020 a	20	3.5

a 1 January to 13 September only.

Plots of the 24-hour average PM_{10} and $PM_{2.5}$ concentration data reported for January 2019 to September 2020, taken from 640.11763.00300-R1-v5.0 and 640.11763.00300-M01-v3.0, are presented in **Figure 16** and **Figure 17** respectively. The monitored concentrations regularly exceed the APACs, primarily during the warmer, drier conditions of the summer months which generally promote the generation of dust from exposed surfaces (e.g. unsealed roads, fields etc). The effects of bushfires that occurred across Victoria during the 2019/2020 summer are also evident with greatly elevated PM_{10} and $PM_{2.5}$ concentrations during January 2020. It is noted that there are no nearby significant sources of PM_{10} or $PM_{2.5}$ other than those associated with surrounding farming.

Figure 16 Project Site Background 24-Hour Average PM_{10} Concentrations

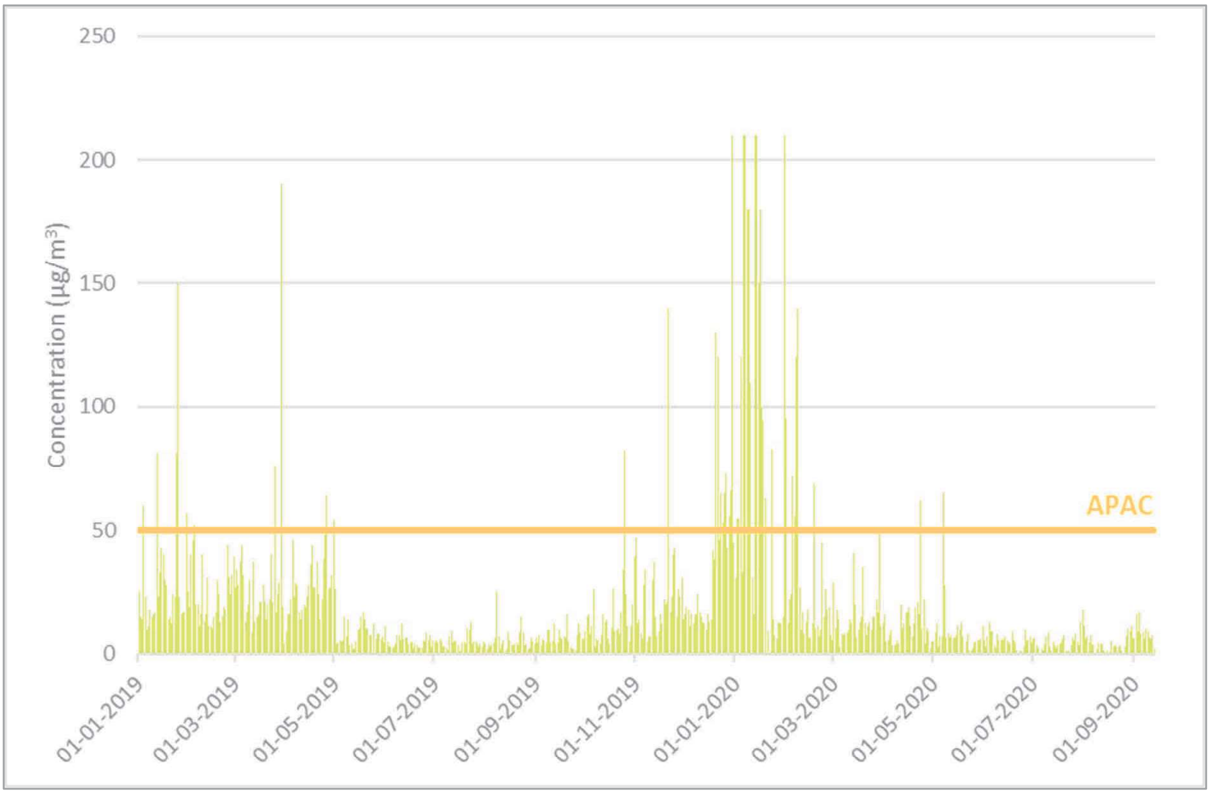
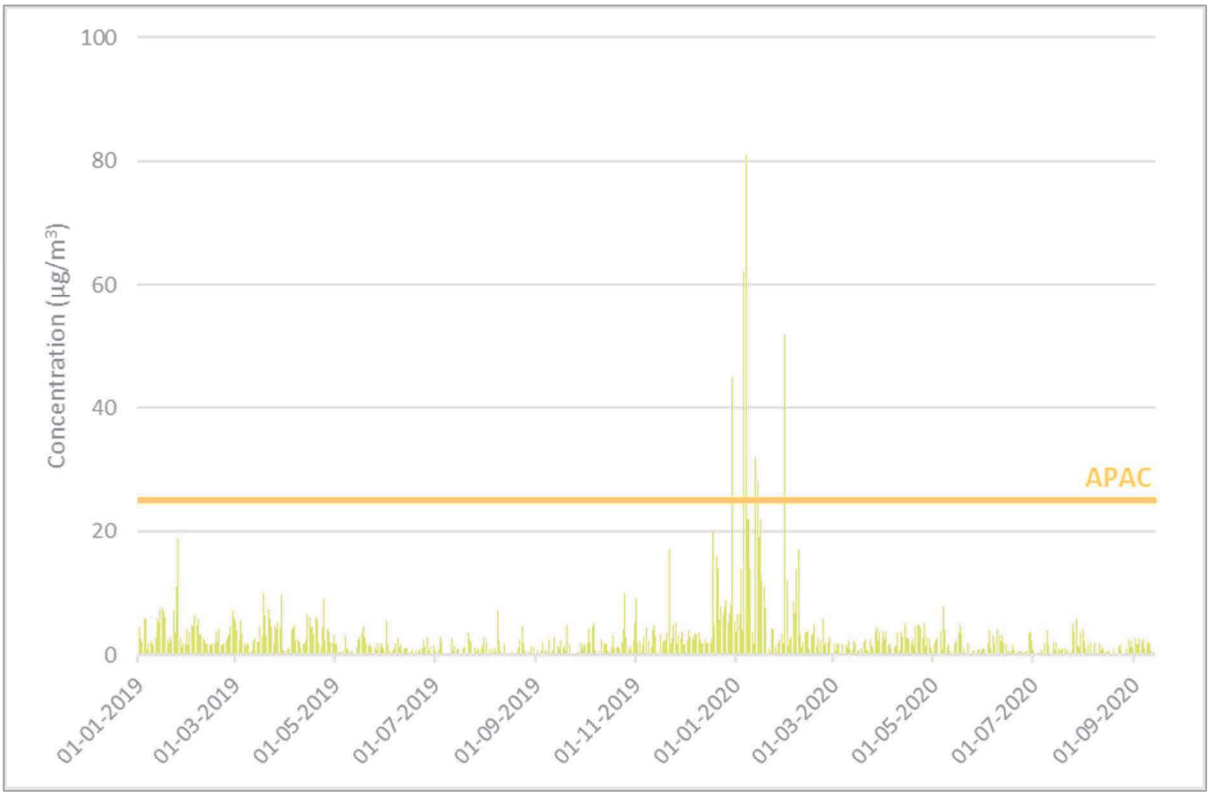


Figure 17 Project Site Background 24-Hour Average $PM_{2.5}$ Concentrations



To enable predictions of cumulative impacts (Project plus background), suitable datasets representing background concentrations of PM_{10} and $PM_{2.5}$ for normal and bushfire impacted years were constructed from the baseline ambient air quality monitoring datasets. Complete calendar year datasets representing a normal air quality year were based on the data collected between 1 January 2019 and 31 December 2019.

Ambient air quality monitoring ceased in September 2020 meaning that a full calendar year of bushfire impacted data were not collected. A complete calendar year representing a bushfire impacted year was therefore constructed from data collected between 1 January 2020 to 13 September 2020, supplemented with data from between 14 September 2019 and 31 December 2019.

The PM_{10} and $PM_{2.5}$ datasets are presented in **Figure 18** and **Figure 19.** and indicate that while there are a number of elevated concentrations towards the start of the bushfire impacted dataset, the distinction between the two datasets is not entirely evident. Regardless, the two datasets provide an increased number of cumulative model predictions with which to assess the Project mining scenarios.

It is noted that the periods of elevated background PM_{10} and $PM_{2.5}$ concentrations indicated by both datasets result in exceedances of the 24-hour average criteria before the contribution of the Project is added.

Figure 18 PM$_{10}$ Background Concentrations used to Predict Cumulative Concentrations

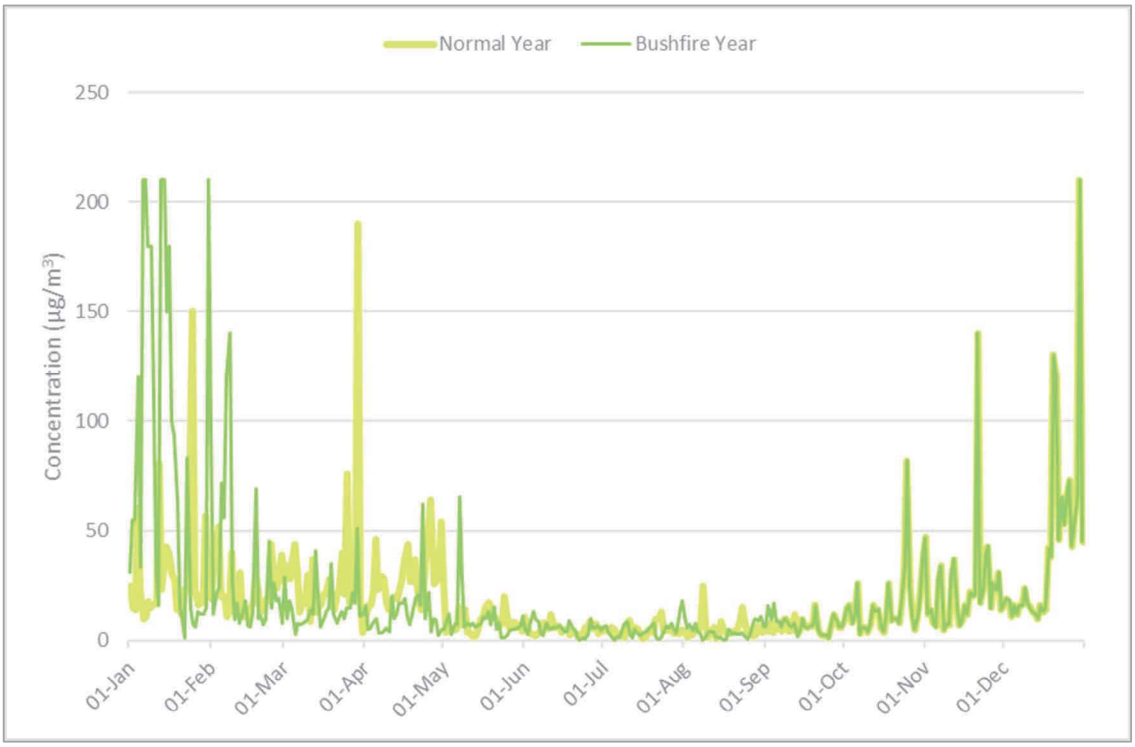
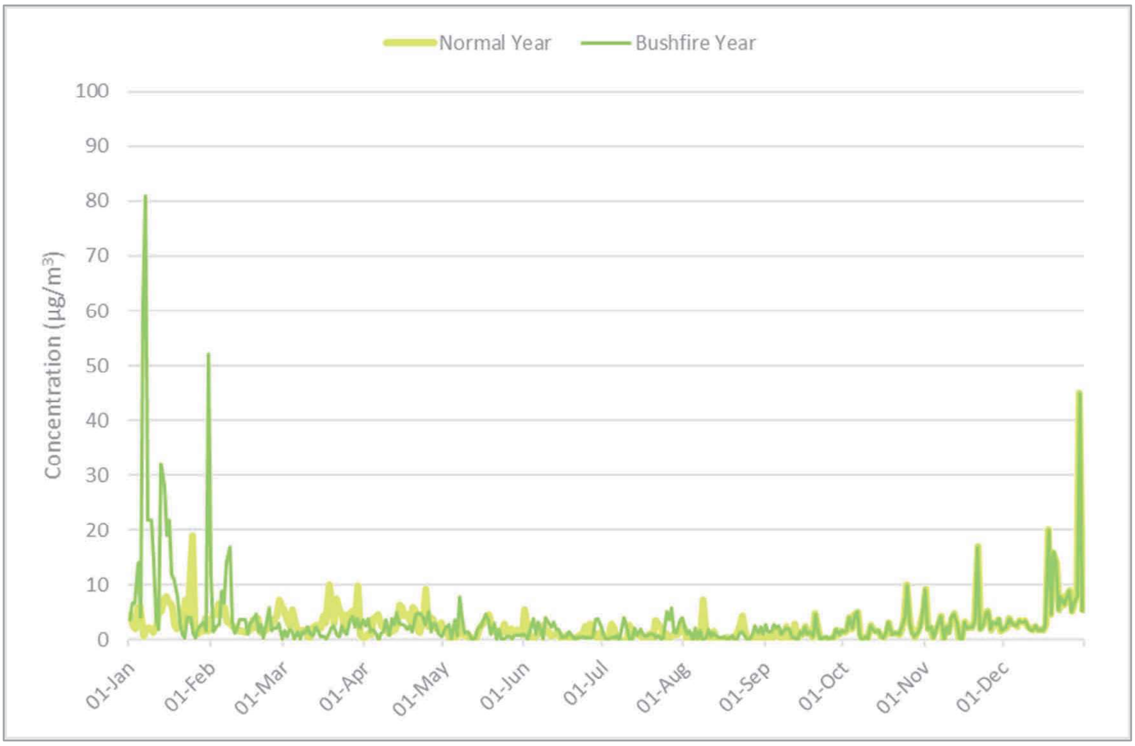


Figure 19 PM$_{2.5}$ Background Concentrations used to Predict Cumulative Concentrations



8.5.2 RCS and Metals

Annual average background RCS and metals concentrations reported in 640.11763.00300-R1-v5.0 for 2019 and 2020 are provided in **Table 15.** RCS, and all metals with the exception of chromium, indicate compliance with the relevant APACs. The APAC for chromium is sourced from the US Agency for Toxic Substances and Disease Research (ATSDR) and is a Minimal Risk Level (MRL), defined as "*an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure*." MRLs are intended to serve as a screening tool to help public health professionals decide where to look more closely and are not intended to define action levels (EPA Victoria, 2022).

Table 15 Project Site Background Annual Average RCS and Metals Concentrations

Indicator	Annual Average Concentration (µg/m^3)		Annual Average APAC (µg/m^3)
	2019	2020	
RCS	0.046	0.12	3
Arsenic	<0.002	<0.002	0.007
Cadmium	<0.002	<0.004	0.005
Chromium	**0.025**	**0.025**	0.005
Copper	0.007	0.015	-
Lead	0.003	0.028	0.5
Manganese	0.053	0.044	0.15
Mercury	0.003	<0.001	1
Nickel	0.004	0.028	0.09
Vanadium	0.006	0.008	-
Zinc	0.017	0.058	2

The corresponding fractions of the individual metals expressed as a percentage of the PM_{10} concentration, based on the monitored annual average PM_{10} concentration of 19 µg/m^3 (refer **Section 8.5.1**), are provided in **Table 16**. The maximum concentrations, and corresponding fractions, from soil sampling undertaken in the Project area are provided for comparison (VHM assay results from 2019 drilling program) and, with the exception of arsenic and vanadium, are in general orders of magnitude less than the fractions in PM_{10}.

Table 16 Project Site Background Annual Average RCS and Metals Concentrations

Indicator	Air		Soil	
	Maximum Annual Average Concentration (µg/m^3)	Fraction of PM_{10}	Maximum Concentration (µg/m^3)	Fraction
Arsenic	0.002 [a]	0.011%	242	0.024%
Cadmium	0.004 [a]	0.021%	0.1	0.00001%
Chromium	0.025	0.13%	34	0.0034%
Copper	0.015	0.079%	8	0.00078%
Lead	0.028	0.15%	10	0.0010%
Manganese	0.053	0.28%	249	0.025%

Indicator	Air		Soil	
	Maximum Annual Average Concentration (µg/m³)	Fraction of PM_{10}	Maximum Concentration (µg/m³)	Fraction
Mercury	0.003	0.016%	0.2	0.000020%
Nickel	0.028	0.15%	16	0.0016%
Vanadium	0.008	0.042%	197	0.020%
Zinc	0.058	0.31%	98	0.010%

a Conservatively assumed equal to the limit of reporting.

To enable predictions of cumulative impacts, the greater of the two monitored annual average concentrations were selected to conservatively represent the background RCS and metals concentration in the Project area.

8.5.3 Dust Deposition

Insoluble solids dust deposition rates and ash content monitoring results reported in 640.11763.00300-R1-v5.0 for 2019 and 2020 are presented in **Figure 20** and **Figure 21**, respectively. The insoluble solids results indicate several instances, at various times of the year, where the deposition rate was greater than 4 g/m²/month across the Project area. The ash content deposition results (ash residue is the mineral component of the sample, with the organic component being destroyed at 800°C).

Excluding the May 2019 results which were unrealistically high, the average insoluble solids dust deposition rate across all locations was 2.8 g/m²/month. The corresponding ash content deposition rate was 1.5 g/m²/month.

The average insoluble solids dust deposition was used to represent background dust deposition rates in the Project area.

Figure 20 Project Site Background Annual Average Dust Deposition Rates: Insoluble Solids

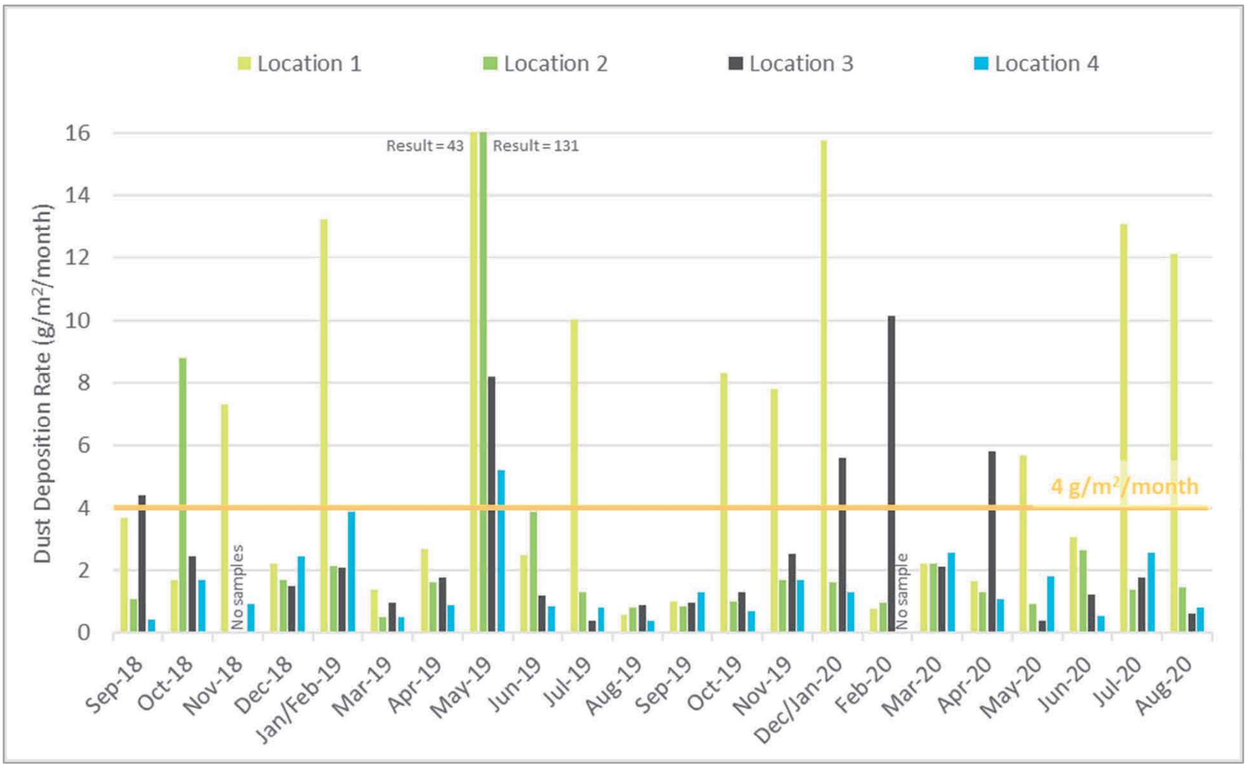
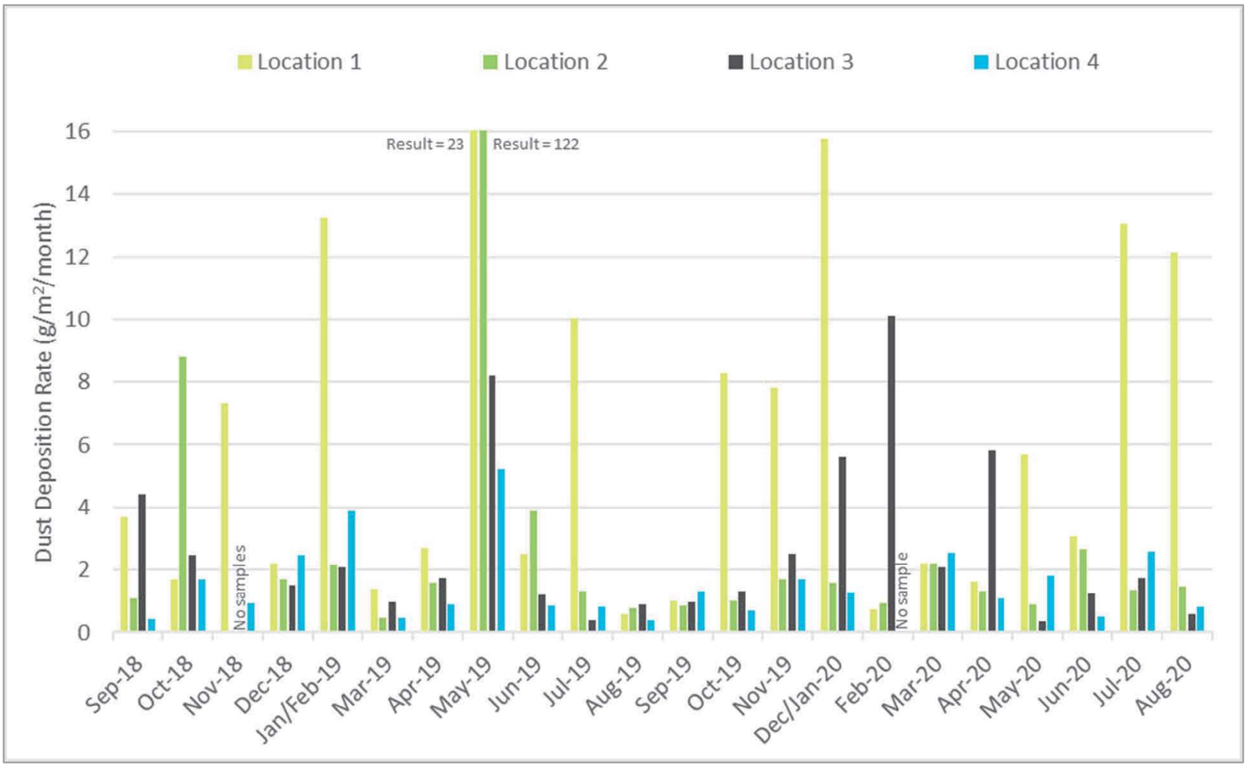


Figure 21 Project Site Background Annual Average Dust Deposition Rates: Ash Content

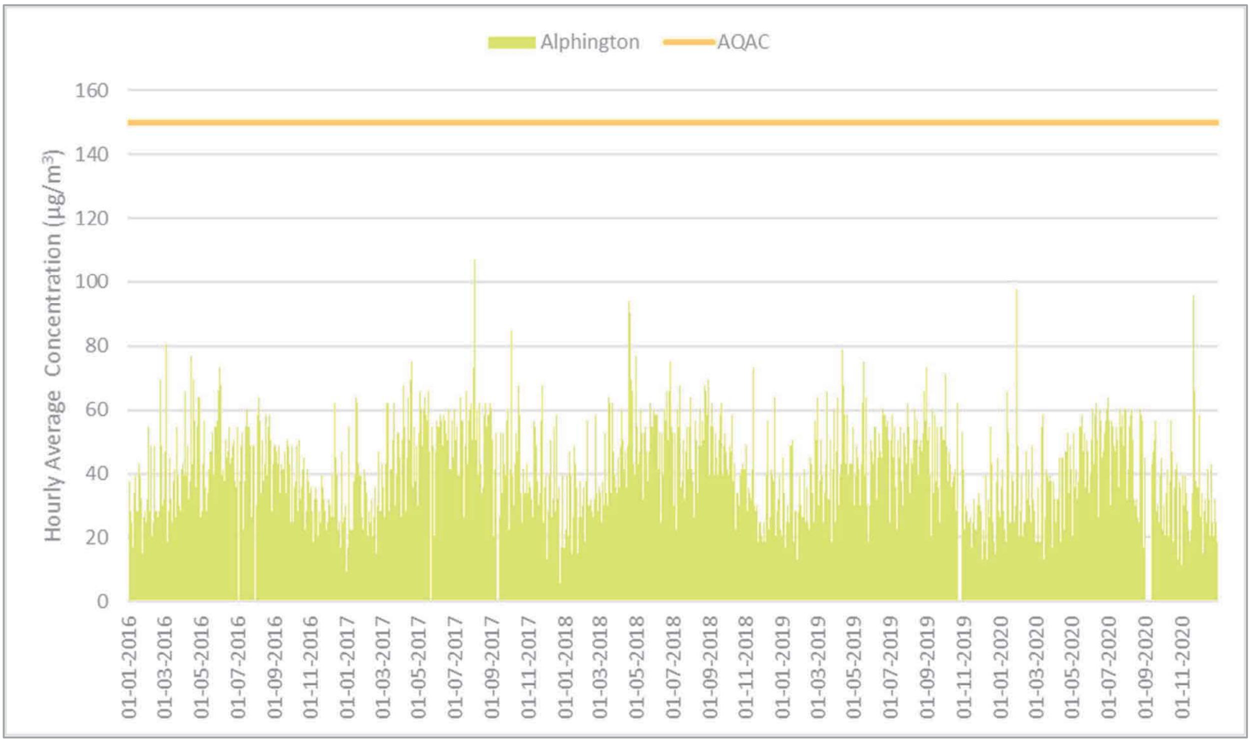


8.5.4 NO_2 (for Power Station and Pumping Station Assessments)

Monitoring of NO_2 was not conducted as part of the Project AAQMP. In the absence of a site-specific NO_2 concentrations dataset with which to predict cumulative impacts arising from the operation of the proposed power station and pumping station, the assessment used data from EPA's AAQMS at Alphington, which is classified as being located in an 'residential/light industrial' area and therefore can be considered very conservative for this Project. In reality, background NO_2 concentrations in a rural area such as the location of the Project, with limited vehicular traffic and other sources of diesel combustion, are likely to be much lower than these values.

Figure 22 presents the hourly average concentrations for the period 2016 to 2021.

Figure 22 EPA Alphington AAQMS Hourly Average NO_2 Concentrations



For the purposes of modelling the hourly average background concentration was added to the predicted incremental power station and pumping station impacts to provide an estimated hourly average cumulative concentration. Where a background concentration was not reported for one or more hours, these hours are prescribed a concentration equal to the 70th percentile of the dataset. The corresponding annual average NO_2 concentrations recorded at Alphington, provided in **Table 17**, were added to the annual average predicted incremental concentrations to provide an estimate of the cumulative annual concentration.

Table 17 Alphington NO_2 Concentrations to Represent Project Background

Year	Annual Average NO_2 Concentration (µg/m^3)
2016	17
2017	18
2018	18
2019	17
2020	15

9 Risk Assessment

The identified risks and associated residual risk ratings are listed in **Table 18**. The likelihood and consequence ratings determined during the risk assessment process and the mitigation measures to be achieved are presented in **Appendix A**.

Table 18 Air Quality Risks

Risk ID	Potential Threat and Effects on the Environment	Residual Risk Rating
Construction (and Closure/Rehabilitation)		
C1	Particulate emissions to air from scrapers, dozers, excavators and loading trucks.	Low
C2	Particulate emissions to air from exposed surface and stockpiles	Low
C3	Diesel vehicle and plant emissions to air	Low
C4	Particulate emissions to air from haul roads	Low
C5	Particulate emissions from construction of Processing Plant	Low
C6	Dust from some or all activities depositing at sensitive receptors.	Low
C7	Dust from some or all activities depositing and impacting surrounding vegetation and crops.	Low
Operation		
O1	Particulate emissions to air from excavators in pit loading trucks	Low
O2	Particulate emissions to air from trucks dumping	Low
O3	Particulate emissions to air from dozers	Low
O4	Particulate emissions to air from haul roads	Low
O5	Particulate emissions to air from exposed surface and stockpiles	Low
O6	Particulate emissions to air from preliminary processing stages	Low
O7	Particulate emissions to air from final processing stages	Low
O8	Dust from some or all activities depositing at sensitive receptors.	Low
C9	Dust from some or all activities depositing and impacting surrounding vegetation and crops.	Low
O10	Diesel vehicle and plant emissions to air	Low
O11	Diesel/LPG power station emissions to air impacting at sensitive receptors	Low
O12	Diesel/LPG power station emissions to air impacting locations at or beyond site boundary (occasional human receptor, continuous vegetation)	Medium
O13	Diesel road truck emissions to air	Low
O14	Road truck load dust emissions to air	Low
O15	Diesel/LPG pumping station emissions to air impacting sensitive receptor locations	Low
O16	Diesel/LPG pumping station emissions to air impacting locations at or beyond site boundary (occasional human receptor, continuous vegetation)	Low

10 Construction Impact Assessment

This section discusses the potential impacts of the Project as a result of construction activities and the associated mitigation measures that aim to reduce impacts to as low a level as possible. A qualitative risk assessment based on the methodology outlined in the Institute of Air Quality Management (UK) (IAQM) document, "*Assessment of dust from demolition and construction*" (IAQM, 2014) is presented.

Project Site Construction

Early Works

Early works will consist of some vegetation and topsoil stripping. While there will be establishment of contractor facilities, a construction accommodation camp will not be required as construction personnel will be housed within the local services centres. Scrapers, dozers, excavators and trucks used for topsoil stripping and stockpiling have the potential to generate dust and exposed areas resulting from the works will be susceptible to wind erosion. The emission of dust and products of combustion associated with diesel engines during early works also has the potential to adversely affect nearby sensitive receptors.

Processing Plant and Power Station Construction

Process plant construction will occur in a staged approach, starting at the WCP and progressing to the MSP (Dry Plant). Construction equipment will be as per typical industry usage, and may include cranes and mobile lifting plant, service vehicles, welding plant, lighting towers, assembly workshops, etc.

The construction contractor will provide all temporary construction power, administration and services buildings, ablutions, waste management and site security.

Pipeline and Pumping Station Construction

Pipeline construction will progress linearly with the corresponding potential for emissions to air moving along the pipeline route as the work progresses. Therefore any sensitive receptors along the route will only be exposed to these emissions for a relatively short period of time. The active footprint of the pipeline construction site is assumed to be 200 m long at any one time for the purpose of this assessment. Being geographically separate from the Project site for the most part, the pipeline construction and the pumping station are assessed separately.

10.1 Screening Based on Separation Distance

The screening criteria for detailed assessment are:

- a '*human receptor*[2]' within:
  - 350 m of the boundary of the site; or

[2] IAQM (2014) states that a 'human receptor', refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period. In terms of annoyance effects, this will most commonly relate to dwellings, but may also refer to other premises such as buildings housing cultural heritage collections (e.g. museums and galleries), vehicle showrooms, food manufacturers, electronics manufacturers, amenity areas and horticultural operations (e.g. salad or soft-fruit production).

    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).
- an '*ecological receptor*[3]' within:
    - 50 m of the boundary of the site; or
    - 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

10.1.1 Project Site

As noted in **Section 8.2**, the nearest sensitive receptor (R14) is located approximately 200 m from the nearest Site boundary, however Project construction activities, or the construction site, will be located approximately 900 m from the nearest sensitive receptor.

The nearest sensitive receptor has been identified to be 900 m of the construction site boundary, and therefore a detailed assessment for a human receptor is not required. Surrounding farmland is considered an ecological receptor and may potentially be within 50 m of one or more of the construction site boundary. The Project site construction assessment is therefore limited to ecological receptors.

10.1.2 Pipeline

The closest sensitive receptors to the pipeline route were identified to be within 50 m of the pipeline at the intersection of Mystic Park East Road and Wilson Street, Mystic Park, approximately 3 km west of the pumping station. Surrounding farmland is also within 50 m of the route and therefore the pipeline construction assessment includes consideration of both human and ecological receptors.

10.1.3 Pumping Station

The pumping station is to be located adjacent to farmland with the closest sensitive receptor, R18 (refer **Table 10**), approximately 300 m to the north. Therefore the pumping station construction assessment considers of both human and ecological receptors.

10.2 Assessment of Scale and Nature of the Works

Based on the IAQM definitions presented in **Appendix B**, dust emission magnitudes for the anticipated works have been categorised as presented in **Table 19, Table 20** and **Table 21** for the Project site, Pipeline, and Pumping Station respectively.

For the purposes of this assessment demolition activities are considered as part of the decommissioning phase, anticipated to occur at the end of the Project.

3 IAQM (2014) states that an 'ecological receptor' refers to any sensitive habitat affected by dust soiling. This includes the direct impacts on vegetation or aquatic ecosystems of dust deposition, and the indirect impacts on fauna (e.g. on foraging habitats).

Table 19 Project Site Construction Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Earthworks	Large	Total site area greater than 10,000 m2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t. *Footprint of Project areas within Area 1 is estimated to be greater than 250,000 m^2.*
Construction	Medium	Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (e.g., concrete), piling, on site concrete batching. *The total building volume may be greater than 25,000 m^3; piling and site concrete batching may occur.*
Trackout	Large	More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length. *The unpaved road length is estimated to be greater than 100 m.*
Demolition	Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level *The total building area is estimated to be greater than 3,000 m^2. Therefore, the total volume is likely to be greater than 25,000 m^3.*

Table 20 Pipeline Construction Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Earthworks	Medium	Total site area 2,500 m2 – 10,000 m2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes. *Footprint of active pipeline construction assumed to be approximately 200 m by 15 m = 3,000 m^2 at any time.*
Construction	Small	Total building volume less than 25,000 m3, construction material with low potential for dust release (e.g. metal cladding or timber). *Construction assumed to consist of placement of prefabricated steel or concrete pipeline with little potential for dust emissions.*
Trackout	Medium	Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length. *The unpaved road length is estimated to be approximately 100 m or greater, however, it is estimated that there will be less than 50 heavy vehicle movements per day*
Demolition	Not applicable	No demolition associated with pipeline proposed.

Table 21 Pumping Station Construction Categorisation of Dust Emission Magnitude

Activity	Dust Emission Magnitude	Basis
Earthworks	Small	Total site area less than 2,500 m^2, soil type with large grain size (e.g. sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months. *Footprint of pumping station construction assumed to be less than 2,500 m2 (e.g. less than 50 m by 50 m).*
Construction	Small	Total building volume less than 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber). *Construction assumed to consist of placement of concrete slab and prefabricated steel with little potential for dust emissions.*
Trackout	Small	Between less than 10 heavy vehicle movements per day, surface materials with low potential for dust generation, unpaved road length less than 50 m. *Relatively small footprint such that the unpaved road length is unlikely to be greater than 50 m.*
Demolition	Not applicable	No demolition associated with pipeline proposed.

10.2.1 Project Site

Based on the criteria listed in **Table B1** in **Appendix B**, the sensitivity of the identified ecological receptor in this study is classified as *low* for dust soiling and *low* for health effects.

Based on the classifications provided in **Table B2** and **Table B3** in **Appendix B**, the sensitivity of the area to dust soiling may be classified as *low* (1-10 receptors greater than 350 m from the construction site) while the sensitivity of the area to dust health effects may also be classified as *low* (receptor greater than 350 m from the construction site).

Table 22 presents the preliminary risk of air quality impacts from uncontrolled construction activities determined using the risk matrix provided in **Table B4** and **Table B5** in **Appendix B**, based on the identified receptor sensitivity and sensitivity of the area.

Table 22 Preliminary Risk of Air Quality Impacts from Project Site Construction Activities (Uncontrolled)

	Dust Soiling	Health Effects
Sensitivity of Area	Low	Low
Dust Emission Magnitude		
Earthworks	Large	Large
Construction	Medium	Medium
Trackout	Large	Large
Demolition	Medium	Medium
Preliminary Risk		
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk
Demolition	Low Risk	Low Risk

The results indicate that there is a low risk of adverse off-site dust soiling and health effects occurring for all works if no mitigation measures were to be applied to control emissions during the works.

10.2.2 Pipeline

Based on the criteria listed in **Table B1** in **Appendix B**, the sensitivity of the identified human receptors in this study (residences) are classified as *high* for dust soiling and *high* for health effects. Corresponding ecological receptors (farmland) would be classified as *low* for dust soiling, and *low* for health effects.

Based on the classifications shown in **Table B2** and **Table B3** in **Appendix B**, the sensitivity of the area to dust soiling may be classified as *low* (1-10 receptors less than 50 m from the construction site) while the sensitivity of the area to dust health effects may be classified as *medium* (annual average PM_{10} concentration of between 17 and 21 with 1-10 receptors less than 50 m from the construction site).

Table 23 presents the preliminary risk of air quality impacts from uncontrolled construction activities determined using the risk matrix provided in **Table B4** and **Table B5** in **Appendix B**, based on the identified receptor sensitivity and sensitivity of the area.

Table 23 Preliminary Risk of Air Quality Impacts from Pipeline Construction Activities (Uncontrolled)

	Dust Soiling	Health Effects
Sensitivity of Area	Low	Medium
Dust Emission Magnitude		
Earthworks	Medium	Medium
Construction	Small	Small
Trackout	Medium	Medium
Demolition	Not applicable	Not applicable
Preliminary Risk		
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk
Demolition	Not applicable	Not applicable

The results indicate that there is a low risk of adverse off-site dust soiling and health effects occurring for all works if no mitigation measures were to be applied to control emissions during the works.

10.2.3 Pumping Station

Based on the criteria listed in **Table B1** in **Appendix B**, the sensitivity of the identified human receptors in this study (residences) are classified as *high* for dust soiling and *high* for health effects. Corresponding ecological receptors (farmland) would be classified as *low* for dust soiling, and *low* for health effects.

Based on the classifications shown in **Table B2** and **Table B3** in **Appendix B**, the sensitivity of the area to dust soiling may be classified as *low* (1-10 receptors than 350 m from the construction site) while the sensitivity of the area to dust health effects may also be classified as *low* (annual average PM_{10} concentration of between 17 and 21 with 1-10 receptors less than 350 m from the construction site).

Table 24 presents the preliminary risk of air quality impacts from uncontrolled construction activities determined using the risk matrix provided in **Table B4** and **Table B5** in **Appendix B**, based on the identified receptor sensitivity and sensitivity of the area.

Table 24 Preliminary Risk of Air Quality Impacts from Pipeline Construction Activities (Uncontrolled)

	Dust Soiling	Health Effects
Sensitivity of Area	Low	Low
Dust Emission Magnitude		
Earthworks	Small	Small
Construction	Small	Small
Trackout	Small	Small
Demolition	Not applicable	Not applicable
Preliminary Risk		
Earthworks	Negligible Risk	Negligible Risk
Construction	Negligible Risk	Negligible Risk
Trackout	Negligible Risk	Negligible Risk
Demolition	Not applicable	Not applicable

The results indicate that there is a low risk of adverse off-site dust soiling and health effects occurring for all works if no mitigation measures were to be applied to control emissions during the works.

10.3 Summary

A reappraisal of the predicted unmitigated air quality impacts on sensitive receptors has been performed to demonstrate the opportunity for minimising risks associated with the use of mitigation strategies. Management and mitigation measures to be implemented during construction are summarised in **Section 13.1** and have the potential to result in the same or lower residual risk of impacts due to construction and decommissioning. Mitigation strategies for the pipeline construction will be concentrated on those areas passing close to sensitive receptors such that overall residual risks will be *low* or *negligible* for all activities.

11 Operational Impact Assessment

This section discusses the potential impacts of the Project as a result of operation of the Project and the associated mitigation measures that aim to reduce impacts to as low a level as possible. Mitigation measures referred to are defined in **Section 13.1.**

11.1 Modelled Scenarios

The mining schedule for the Project indicates that the focus of activities will progress across the site extracting and backfilling the mining blocks systematically. A plume dispersion model can only represent one period in time in the mining schedule. A review of the material movement schedule and mining block layouts established that two mining scenarios for each area would represent potential worst-case emission profiles based on:

- the amount of material (topsoil, clay, overburden and ore) extracted

- the amount of material taken to stockpiles (versus amount used to backfill nearby mining block)
- the distance between mining blocks and stockpiles
- the separation distance between the mining activities and nearby sensitive receptors

The transport of product by road truck to Ultima was identified as a low-risk activity due to the relatively low frequency of trips (1 or 2 per hour) along public roads (refer **Section 9** and **Appendix A**) and is therefore not specifically included in the operational impact assessment.

11.1.1 Scenario 1 – Area1 Y1Q1

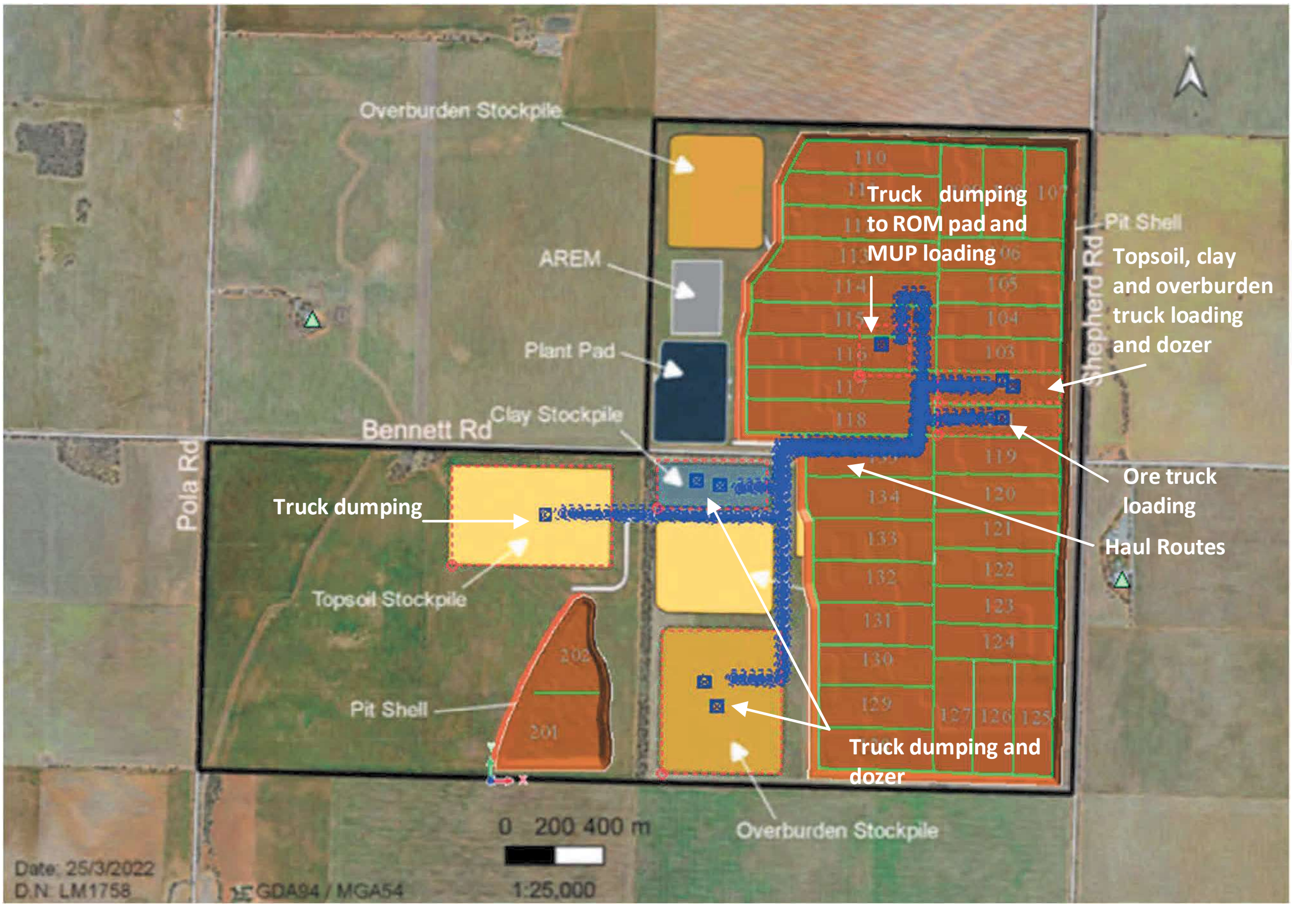
Although the amount of material to be mined during the initial stages of the mining schedule in Area 1 (year 1, quarter 1 (Y1Q1)) is relatively moderate, all of the material is required to be transported by truck to the topsoil, clay and overburden stockpiles or to the MUP. The distance between the mining blocks (101 and 102) and the stockpiles is relatively far, which together with the intensity of haulage required has the potential to generate the most dust emissions due to wheel generated dust.

The basis for Scenario 1 is summarised in **Table 25** and illustrated in **Figure 23.**

Table 25 Activity Data used in Fugitive Dust Emission Estimation: Scenario 1 – Area 1 Y1Q1

Parameter	Operational Data	Comment
Site haul truck gross weight	240 t	Client data
Site haul truck empty weight	110 t	Client data
Site haul truck payload	130 t	Client data
Silt content – haul roads	4.8 %	Conservatively assumed (AP42 13.2.2.1 sand and gravel plant road)
Areas and Stockpiles		
Block areas (each)	62,500 m^2	Client mining block plan
Topsoil stockpile active area	260,000 m^2	Client mine layout plan
Clay stockpile active area	90,000 m^2	Client mine layout plan
Overburden stockpile active area	278,400 m^2	Client mine layout plan
ROM pad area	40,000 m^2	Client mine layout plan
Extraction Rates		
Topsoil extraction, haulage and stockpiling	3,000 t/day	Client material movement schedule
Clay extraction, haulage and stockpiling	23,000 t/day	Client material movement schedule
Overburden extraction, haulage and stockpiling	18,000 t/day	Client material movement schedule
Ore extraction, haulage and MUP loading	10,000 t/day	Client material movement schedule
Haulage		
Block 102 to topsoil stockpile haul route	2.3 km one way	Client mine layout plan
Block 102 to clay stockpile haul route	1.4 km one way	Client mine layout plan
Block 102 to overburden stockpile haul route	2.2 km one way	Client mine layout plan
Block 101 to Area 1 MUP haul route	1.1 km one way	Client mine layout plan
Block 102 to topsoil stockpile daily trips	23.1 return trips per day	Calculated
Block 102 to clay stockpile daily trips	176.9 return trips per day	Calculated
Block 102 to overburden stockpile daily trips	138.5 return trips per day	Calculated
Block 101 to MUP daily trips	76.9 return trips per day	Calculated

Figure 23 Scenario 1 – Area1 Y1Q1 Model Layout



Active stockpiles, mining blocks and ROM pad subject to wind erosion outlined in dashed red.

11.1.2 Scenario 2 – Area1 Y6Q2

The mining schedule indicates that the maximum amount of material to be mined in Area 1 will occur during year 6. During year 6, quarter 2 (Y6Q2) the distance between the mining blocks (127 and 126) and the stockpiles is relatively far, increasing the potential for the generation of wheel generated dust, however the percentage of material sent to stockpile is reduced as a significant amount is used to backfill block 125.

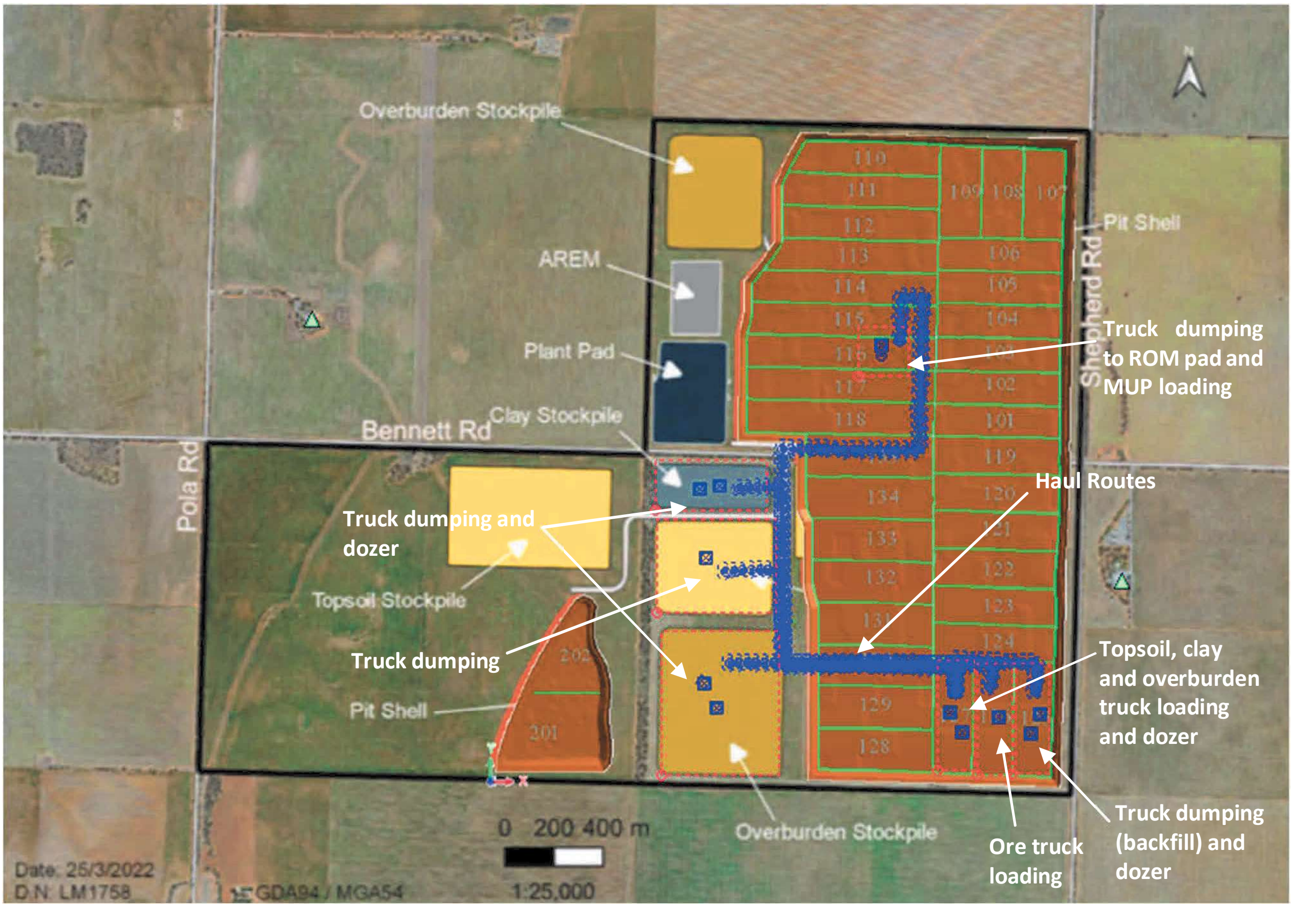
Being near the southern boundary of Area 1, the distance to the nearest sensitive receptors is reduced and the activities in this area will therefore be limited to daytime hours only to manage noise impacts. This will require increased intensity of mining activities during daytime hours to achieve the necessary material movement rates.

The basis for Scenario 2 is summarised in **Table 26** and illustrated in **Figure 24.**

Table 26 Activity Data used in Fugitive Dust Emission Estimation: Scenario 2 – Area 1 Y6Q2

Parameter	Operational Data	Comment
Site haul truck gross weight	240 t	Client data
Site haul truck empty weight	110 t	Client data
Site haul truck payload	130 t	Client data
Silt content – haul roads	4.8 %	Conservatively assumed (AP42 13.2.2.1 sand and gravel plant road)
Areas and Stockpiles		
Block areas (each)	62,500 m^2	Client mining block plan
Topsoil stockpile active area	260,000 m^2	Client mine layout plan
Clay stockpile active area	90,000 m^2	Client mine layout plan
Overburden stockpile active area	278,400 m^2	Client mine layout plan
ROM pad area	40,000 m^2	Client mine layout plan
Extraction Rates		
Topsoil extraction, haulage and stockpiling/backfilling	4,000 t/day (29% to stockpile; 71% to backfill)	Client material movement schedule
Clay extraction, haulage and stockpiling/backfilling	24,000 t/day (0% to stockpile; 100% to backfill)	Client material movement schedule
Overburden extraction, haulage and stockpiling/backfilling	32,000 t/day (48% to stockpile; 52% to backfill)	Client material movement schedule
Ore extraction, haulage and MUP loading	15,000 t/day	Client material movement schedule
Haulage		
Block 127 to topsoil stockpile haul route	1.4 km one way	Client mine layout plan
Block 127 to clay stockpile haul route	1.7 km one way	Client mine layout plan
Block 127 to overburden stockpile haul route	1.0 km one way	Client mine layout plan
Block 126 to Area 1 MUP haul route	3.3 km one way	Client mine layout plan
Block 127 to Block 125 (backfill)	0.6 km one way	Client mine layout plan
Block 127 to topsoil stockpile daily trips	8.9 return trips per day	Calculated. 11 hr day shift only.
Block 127 to clay stockpile daily trips	0.0 return trips per day	Calculated. 11 hr day shift only.
Block 127 to overburden stockpile daily trips	118.2 return trips per day	Calculated. 11 hr day shift only.
Block 126 to MUP daily trips	115.4 return trips per day	Calculated. 11 hr day shift only.
Block 127 to Block 125 (backfill)	334.5 return trips per day	Calculated. 11 hr day shift only.

Figure 24 Scenario 2 – Area1 Y6Q2 Model Layout



Active stockpiles, mining blocks and ROM pad subject to wind erosion outlined in dashed red.

11.1.3 Scenario 3 – Area3 Y11Q3

The amount of material to be mined during the initial stages of the mining schedule in Area 3 (year 11, quarter 3 (Y11Q3)) is relatively moderate, however the distance between the mining blocks (112 and 111) and the stockpiles and MUP is relatively far, increasing the potential for the generation of wheel generated dust. The percentage of material used to backfill block 110 is relatively low (approximately 20%).

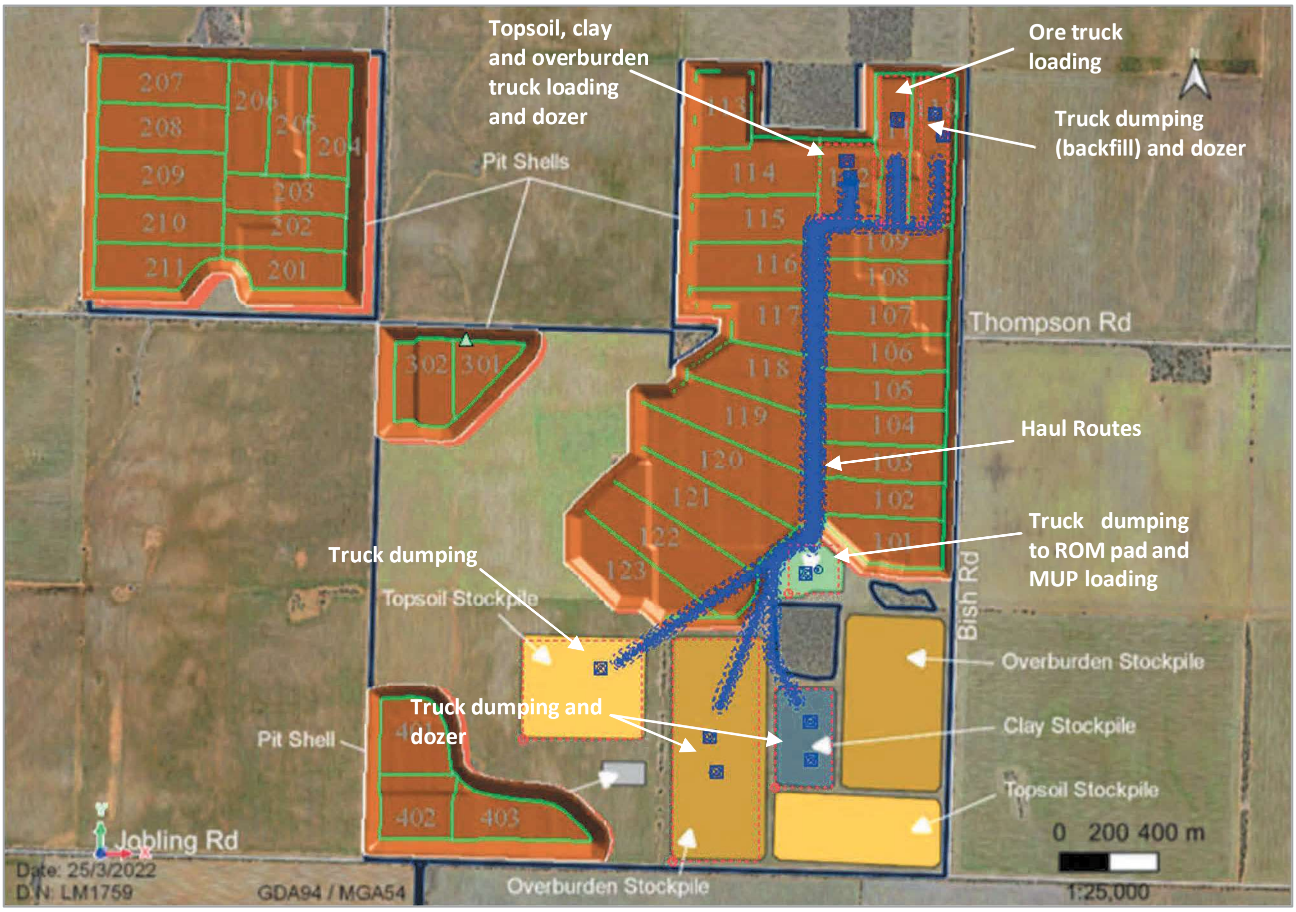
Being near the northern boundary of Area 3, the distance to the nearest sensitive receptors is reduced and activities in this area will therefore be limited to daytime hours only to manage noise impacts. This will require increased intensity of mining activities during daytime hours to achieve the necessary material movement rates.

The basis for Scenario 3, which accounts for this increased activity, is summarised in **Table 27** and illustrated in **Figure 25.**

Table 27 Activity Data used in Fugitive Dust Emission Estimation: Scenario 3 – Area 3 Y11Q3

Parameter	Operational Data	Comment
Site haul truck gross weight	240 t	Client data
Site haul truck empty weight	110 t	Client data
Site haul truck payload	130 t	Client data
Silt content – haul roads	4.8 %	Conservatively assumed (AP42 13.2.2.1 sand and gravel plant road)
Areas and Stockpiles		
Block areas (each)	66,000 m^2	Client mining block plan
Topsoil stockpile active area	192,500 m^2	Client mine layout plan
Clay stockpile active area	92,000 m^2	Client mine layout plan
Overburden stockpile active area	315,000 m^2	Client mine layout plan
ROM pad area	40,000 m^2	Client mine layout plan
Extraction Rates		
Topsoil extraction, haulage and stockpiling/backfilling	2000 t/day (100% to stockpile; 0% to backfill)	Client material movement schedule
Clay extraction, haulage and stockpiling/backfilling	11,000 t/day (0% to stockpile; 100% to backfill)	Client material movement schedule
Overburden extraction, haulage and stockpiling/backfilling	33,000 t/day (100% to stockpile; 0% to backfill)	Client material movement schedule
Ore extraction, haulage and MUP loading	14,000 t/day	Client material movement schedule
Haulage		
Block 112 to topsoil stockpile haul route	2.5 km one way	Client mine layout plan
Block 112 to clay stockpile haul route	2.4 km one way	Client mine layout plan
Block 112 to overburden stockpile haul route	2.4 km one way	Client mine layout plan
Block 111 to Area 1 MUP haul route	1.9 km one way	Client mine layout plan
Block 112 to Block 110 (backfill)	0.7 km one way	Client mine layout plan
Block 112 to topsoil stockpile daily trips	0 return trips per day	Calculated. 11 hr day shift only.
Block 112 to clay stockpile daily trips	176.9 return trips per day	Calculated. 11 hr day shift only.
Block 112 to overburden stockpile daily trips	230.8 return trips per day	Calculated. 11 hr day shift only.
Block 111 to MUP daily trips	107.7 return trips per day	Calculated. 11 hr day shift only.
Block 112 to Block 110 (backfill)	184.6 return trips per day	Calculated. 11 hr day shift only.

Figure 25 Scenario 3 – Area3 Y11Q3 Model Layout



Active stockpiles, mining blocks and ROM pad subject to wind erosion outlined in dashed red.

11.1.4 Scenario 4 – Area3 Y15Q2

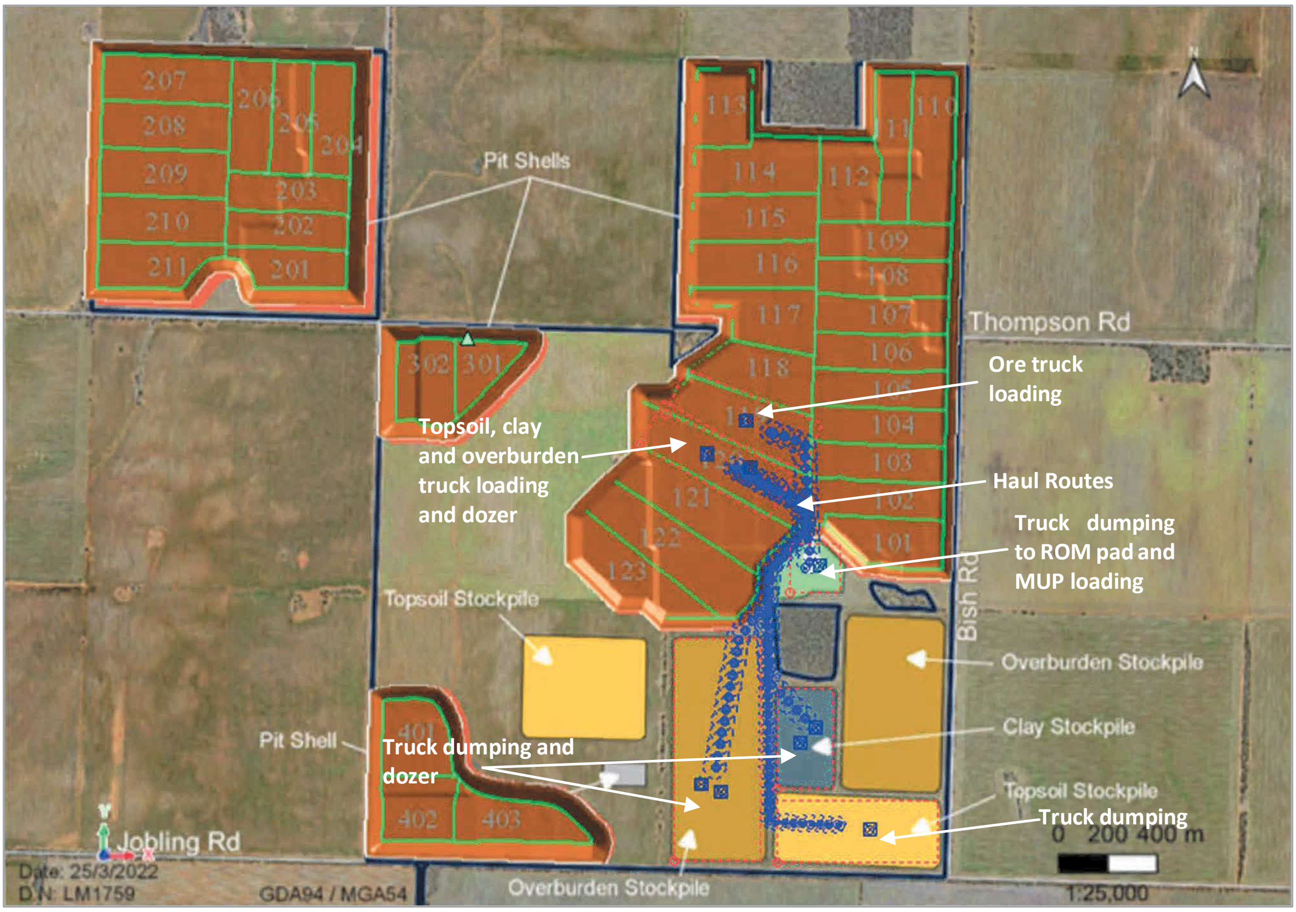
The amount of material to be mined during the year 15, quarter 2 (Y15Q2) is relatively high and all of it is to be transported by truck to the topsoil, clay and overburden stockpiles or to the MUP. The distance between the mining blocks (101 and 102) and the stockpiles is relatively far, which together with the intensity of haulage required, has the potential to generate the most dust emissions due to wheel generated dust.

The basis for Scenario 4 is summarised in **Table 28** and illustrated in **Figure 26.**

Table 28 Activity Data used in Fugitive Dust Emission Estimation: Scenario 4 – Area 3 Y15Q2

Parameter	Operational Data	Comment
Site haul truck gross weight	240 t	Client data
Site haul truck empty weight	110 t	Client data
Site haul truck payload	130 t	Client data
Silt content – haul roads	4.8 %	Conservatively assumed (AP42 13.2.2.1 sand and gravel plant road)
Areas and Stockpiles		
Block areas (each)	120,000 m^2	Client mining block plan
Topsoil stockpile active area	162,500 m^2	Client mine layout plan
Clay stockpile active area	90,000 m^2	Client mine layout plan
Overburden stockpile active area	318,000 m^2	Client mine layout plan
Block areas (each)	120,000 m^2	Client mining block plan
Extraction Rates		
Topsoil extraction, haulage and stockpiling	0 t/day	Client material movement schedule
Clay extraction, haulage and stockpiling	23,000 t/day	Client material movement schedule
Overburden extraction, haulage and stockpiling	30,000 t/day	Client material movement schedule
Ore extraction, haulage and MUP loading	14,000 t/day	Client material movement schedule
Haulage		
Block 120 to topsoil stockpile haul route	1.9 km one way	Client mine layout plan
Block 120 to clay stockpile haul route	1.3 km one way	Client mine layout plan
Block 120 to overburden stockpile haul route	1.5 km one way	Client mine layout plan
Block 119 to Area 1 MUP haul route	0.6 km one way	Client mine layout plan
Block 120 to topsoil stockpile daily trips	0 return trips per day	Calculated
Block 120 to clay stockpile daily trips	176.9 return trips per day	Calculated
Block 120 to overburden stockpile daily trips	230.8 return trips per day	Calculated
Block 119 to MUP daily trips	107.7 return trips per day	Calculated

Figure 26 Scenario 4 – Area3 Y15Q2 Model Layout



Active stockpiles, mining blocks and ROM pad subject to wind erosion outlined in dashed red.

11.1.5 Power Station

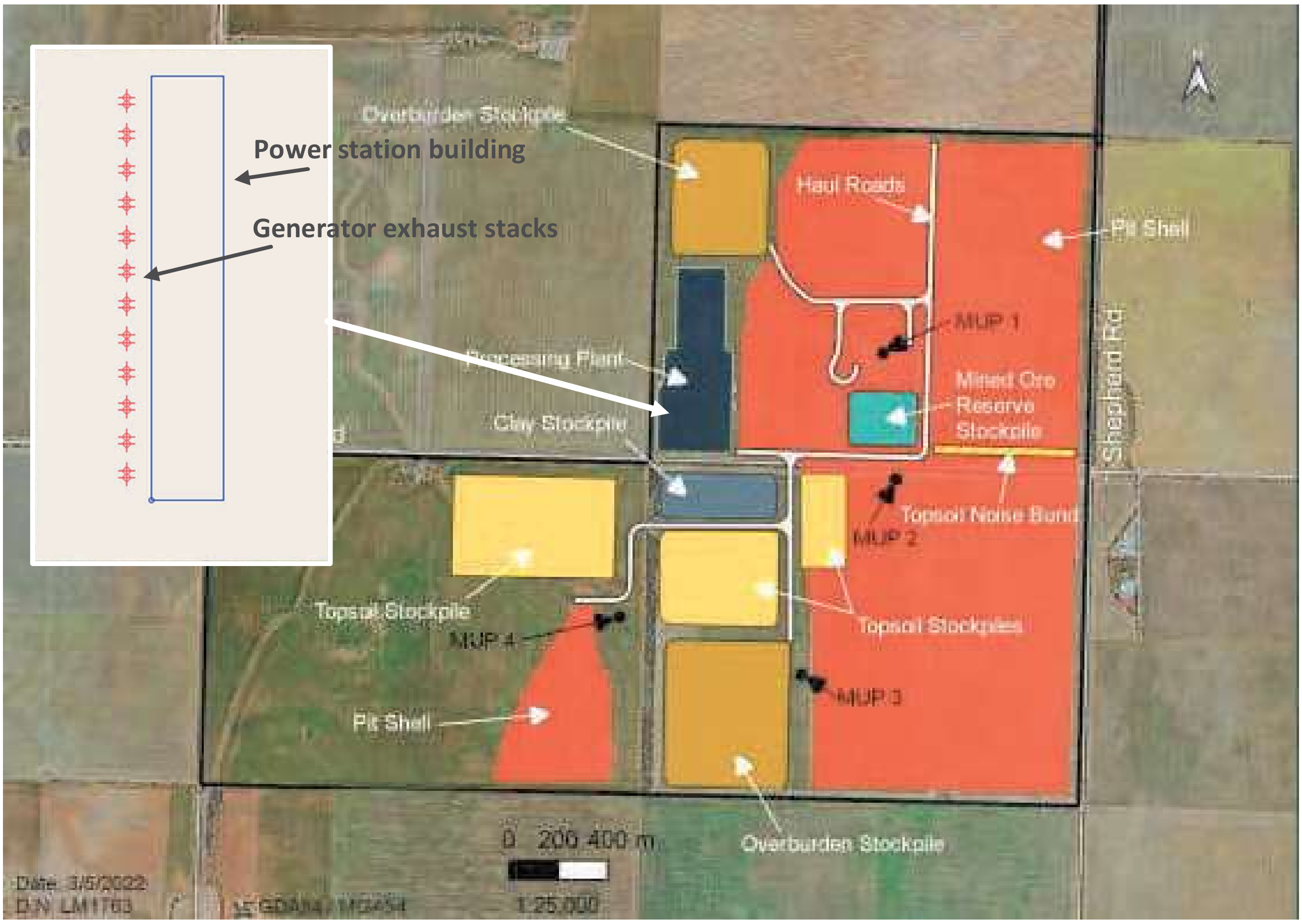
The basis for the power station assessment, including exhaust stack parameters and emission rates for NO_x and $PM_{2.5}$ (refer Section **3.2.6**) is summarised in **Table 29** and illustrated in **Figure 27**.

Table 29 Power Station Dual-Fuel Generator Parameters (Diesel)

Parameter	Units	Value
Model	-	Cummins KTA50-G3 [a]
Number	-	12 with 2 standby (14 in total)
Mechanical generation capacity: individual continuous power	kW_m	1,000
Mechanical generation capacity: combined continuous power	kW_m	12,000
NO_x emission at rate continuous power	g/kWh	7.2
	g/s	2.0 per generator
PM emission at rate continuous power	g/kWh	0.045
	g/s	0.012 per generator
Fuel rate at continuous power	L/h	299 per generator 3,588 combined
Exhausts per generator	-	2
Exhaust temperature	C	470
Exhaust stack exit height	M	8.4
Exhaust stack inside diameter	m	0.762 (at exhaust)
Gas flow rate per generator	m^3/s	4.53
Gas exit velocity (vertical) per stack	m/s	5.0
Generator building dimensions (downwash)	m	62.5 x 10.5 x 6 (L x W x H)

a Generator specifications provided in Appendix F

Figure 27 Power Station Model Layout



11.1.6 Pumping Station

The basis for the pumping station assessment, including exhaust stack parameters and emission rates for NO_x and $PM_{2.5}$ (refer Section **3.2.6**) is summarised in **Table 30** and illustrated in **Figure 28**.

Table 30 Pumping Station Dual-Fuel Generator Parameters (Diesel)

Parameter	Units	Value
Model	-	Based on Cummins KTA50-G3 [a]
Number	-	2
Mechanical generation capacity: individual continuous power	kW_m	1,000
Mechanical generation capacity: combined continuous power	kW_m	2,000
NO_x emission at rate continuous power	g/kWh	7.2
	g/s	2.0 per generator
PM emission at rate continuous power	g/kWh	0.045
	g/s	0.012 per generator
Fuel rate at continuous power	L/h	299 per generator 598 combined
Exhausts per generator	-	2
Exhaust temperature	C	470
Exhaust stack exit height	M	8.4
Exhaust stack inside diameter	m	0.762 (at exhaust)
Gas flow rate per generator	m^3/s	4.53
Gas exit velocity (vertical) per stack	m/s	5.0
Generator building dimensions (downwash)	m	10 x 10 x 6 (L x W x H)

a Generator specifications provided in Appendix F

Figure 28 Pumping Station Model Layout

11.2 Estimated Emissions

The emission inventories for each of the four scenarios described in **Section 11.1** are provided in **Table 31** to **Table 34**, with the relative emission distributions between the modelled sources presented in **Figure 29** to **Figure 32**.

A summary of the total average daily emissions for each scenario is provided in **Table 35**. Note that while average modelled emissions from wheel generated dust may be comparable to those from wind erosion of stockpiles and exposed areas, emissions due to wind erosion are subject to a cubic relation with wind speed (refer **Appendix D**). Therefore, the hourly wind erosion emissions increase greatly with wind speed, under which conditions dispersion is much improved. That is, worst case emission conditions correspond with best case dispersion conditions. This tends to result in relatively low predicted GLCs due to wind erosion compared to those of wheel generated dust, which are predicted to be emitted at a rate independent of wind (and therefore dispersion) conditions.

Table 31 Estimated Particulate Emissions: Scenario 1 – Area 1 Y1Q1

Activity	Emission Factor					Emission Rate (kg/hr)			Mitigation Measures Assumed in Emission Rate Estimate
	TSP	PM_{10}	$PM_{2.5}$	Unit	Source	TSP	PM_{10}	$PM_{2.5}$	
Block 102 excavator loading topsoils, clay and overburden to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	4.3E-01	2.0E-01	4.5E-02	Water sprays (50% control) [a]
Block 101 excavator loading ore to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	9.8E-02	4.6E-02	1.0E-02	Water sprays (50% control) [a]
Truck hauling to and from topsoil stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	1.0E+00	2.7E-01	2.7E-02	Water truck (95% control refer Section **7.6.2.3.2**)
Truck hauling to and from clay stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	4.9E+00	1.2E+00	1.2E-01	
Truck hauling to and from overburden stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	6.0E+00	1.5E+00	1.5E-01	
Truck hauling to and from ROM pad at MUP	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	1.7E+00	4.3E-01	4.3E-02	
Truck unloading to topsoil stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	4.5E-01	1.6E-01	4.7E-02	Water sprays (70% control) [a]
Truck unloading to clay stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	3.5E+00	1.2E+00	3.6E-01	
Truck unloading to overburden stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	2.7E+00	9.7E-01	2.8E-01	
Truck unloading to ROM pad at MUP	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	1.5E+00	5.4E-01	1.6E-01	
Loader loading ore to MUP	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	9.8E-02	4.6E-02	1.0E-02	
Block 102 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Clay stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Overburden stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Wind erosion – Block 102	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.4E-02	High moisture content – assume 50% control
Wind erosion – Block 101	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.4E-02	
Wind erosion – Topsoil stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	3.6E+00	1.8E+00	2.7E-01	Primary earthworks (30% control) [a] Water sprays (50% control) [a]
Wind erosion – Clay stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.5E-02	
Wind erosion – Overburden stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	3.9E+00	1.9E+00	2.9E-01	
Wind erosion – ROM pad	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	8.0E-01	4.0E-01	6.0E-02	High moisture content – assume 50% control
Total (every hour, 24 hours per day)						**40**	**14**	**2.7**	
Total per day						**951**	**328**	**65**	

a As per NPI (DSEWPC, 2012).

Table 32 Estimated Particulate Emissions: Scenario 2 – Area 1 Y6Q2

Activity	Emission Factor					Emission Rate (kg/hr)			Mitigation Measures Assumed in Emission Rate Estimate
	TSP	PM_{10}	$PM_{2.5}$	Unit	Source	TSP	PM_{10}	$PM_{2.5}$	
Block 127 excavator loading topsoils, clay and overburden to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	1.3E+00	6.1E-01	1.3E-01	Water sprays (50% control) [a]
Block 126 excavator loading ore to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	3.2E-01	1.5E-01	3.4E-02	Water sprays (50% control) [a]
Truck hauling to and from topsoil stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	5.4E-01	1.4E-01	1.4E-02	Water truck (95% control refer Section **7.6.2.3.2**)
Truck hauling to and from clay stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	0.0E+00	0.0E+00	0.0E+00	
Truck hauling to and from overburden stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	5.1E+00	1.3E+00	1.3E-01	
Truck hauling to and from ROM pad at MUP	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	1.6E+01	4.2E+00	4.2E-01	
Truck hauling from Block 127 to Block 125	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	8.5E+00	2.2E+00	2.2E-01	
Truck unloading to topsoil stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	3.8E-01	1.4E-01	4.0E-02	Water sprays (70% control) [a]
Truck unloading to clay stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	0.0E+00	0.0E+00	0.0E+00	
Truck unloading to overburden stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	5.0E+00	1.8E+00	5.3E-01	
Truck unloading to Block 125	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	4.9E+00	1.8E+00	5.2E-01	
Truck unloading to ROM pad at MUP	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	1.4E+01	5.1E+00	1.5E+00	
Loader loading ore to MUP	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	3.2E-01	1.5E-01	3.4E-02	
Block 127 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Clay stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Overburden stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Block 125 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Wind erosion – Block 127	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.4E-02	High moisture content – assume 50% control
Wind erosion – Block 126	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.4E-02	
Wind erosion – Topsoil stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	3.6E+00	1.8E+00	2.7E-01	Primary earthworks (30% control) [a] Water sprays (50% control) [a]
Wind erosion – Clay stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.5E-02	
Wind erosion – Overburden stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	3.9E+00	1.9E+00	2.9E-01	
Wind erosion – ROM pad	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	8.0E-01	4.0E-01	6.0E-02	High moisture content – assume 50% control
Wind erosion – Block 125	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.8E+00	8.8E-01	1.3E-01	Primary earthworks (30% control) [a]
Total (every hour, 11 daytime hours per day)						**76**	**25**	**5.1**	
Total per day						**831**	**276**	**56**	

a As per NPI (DSEWPC, 2012).

Table 33 Estimated Particulate Emissions: Scenario 3 – Area 3 Y11Q3

Activity	Emission Factor					Emission Rate (kg/hr)			Mitigation Measures Assumed in Emission Rate Estimate
	TSP	PM_{10}	$PM_{2.5}$	Unit	Source	TSP	PM_{10}	$PM_{2.5}$	
Block 112 excavator loading topsoils, clay and overburden to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	9.8E-01	4.6E-01	1.0E-01	Water sprays (50% control) [a]
Block 111 excavator loading ore to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	3.0E-01	1.4E-01	3.1E-02	Water sprays (50% control) [a]
Truck hauling to and from topsoil stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	1.7E+00	4.2E-01	4.2E-02	Water truck (95% control refer Section **7.6.2.3.2**)
Truck hauling to and from clay stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	0.0E+00	0.0E+00	0.0E+00	
Truck hauling to and from overburden stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	2.6E+01	6.7E+00	6.7E-01	
Truck hauling to and from ROM pad at MUP	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	8.8E+00	2.2E+00	2.2E-01	
Truck hauling from Block 112 to Block 110	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	2.5E+00	6.5E-01	6.5E-02	
Truck unloading to topsoil stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	6.5E-01	2.3E-01	6.9E-02	Water sprays (70% control) [a]
Truck unloading to clay stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	0.0E+00	0.0E+00	0.0E+00	
Truck unloading to overburden stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	1.1E+01	3.9E+00	1.1E+00	
Truck unloading to Block 110	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	4.6E+00	1.6E+00	4.8E-01	
Truck unloading to ROM pad at MUP	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	3.6E+00	1.3E+00	3.8E-01	
Loader loading ore to MUP	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	6.5E-01	2.3E-01	6.9E-02	
Block 112 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Clay stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	0.0E+00	0.0E-01	0.0E-01	None
Overburden stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Block 110 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Wind erosion – Block 112	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.6E-01	9.9E-02	High moisture content – assume 50% control
Wind erosion – Block 111	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.6E-01	9.9E-02	
Wind erosion – Topsoil stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	2.7E+00	1.3E+00	2.0E-01	Primary earthworks (30% control) [a] Water sprays (50% control) [a]
Wind erosion – Clay stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.4E-01	9.7E-02	
Wind erosion – Overburden stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	4.4E+00	2.2E+00	3.3E-01	
Wind erosion – ROM pad	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	8.0E-01	4.0E-01	6.0E-02	High moisture content – assume 50% control
Wind erosion – Block 110	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.8E+00	9.2E-01	1.4E-01	Primary earthworks (30% control) [a]
Total (every hour, 11 daytime hours per day)						**79**	**25**	**4.8**	
Total per day						**868**	**279**	**52**	

a As per NPI (DSEWPC, 2012).

Table 34 Estimated Particulate Emissions: Scenario 4 – Area 3 Y15Q2

Activity	Emission Factor					Emission Rate (kg/hr)			Mitigation Measures Assumed in Emission Rate Estimate
	TSP	PM_{10}	$PM_{2.5}$	Unit	Source	TSP	PM_{10}	$PM_{2.5}$	
Block 120 excavator loading topsoils, clay and overburden to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	5.2E-01	2.5E-01	5.4E-02	Water sprays (50% control) [a]
Block 119 excavator loading ore to truck	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	1.4E-01	6.5E-02	1.4E-02	Water sprays (50% control) [a]
Truck hauling to and from topsoil stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	0.0E+00	0.0E+00	0.0E+00	Water truck (95% control refer Section **7.6.2.3.2**)
Truck hauling to and from clay stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	4.5E+00	1.2E+00	1.2E-01	
Truck hauling to and from overburden stockpile	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	6.8E+00	1.7E+00	1.7E-01	
Truck hauling to and from ROM pad at MUP	4.7E-00	1.2E-00	1.2E-01	kg/VKT	AP42	1.4E+00	3.5E-01	3.5E-02	
Truck unloading to topsoil stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	0.0E+00	0.0E+00	0.0E+00	Water sprays (70% control) [a]
Truck unloading to clay stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	3.5E+00	1.2E+00	3.6E-01	
Truck unloading to overburden stockpile	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	4.5E+00	1.6E+00	4.7E-01	
Truck unloading to ROM pad at MUP	1.2E-02	4.3E-03	1.3E-03	kg/t	AP42	2.1E+00	7.5E-01	2.2E-01	
Loader loading ore to MUP	4.4E-04	2.1E-04	4.6E-05	kg/t	AP42	1.4E-01	6.5E-02	1.4E-02	
Block 120 bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Clay stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Overburden stockpile bulldozer	1.8E-00	3.4E-01	1.9E-01	kg/hr	AP42	1.8E+00	3.4E-01	1.9E-01	None
Wind erosion – Block 120	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	2.4E+00	1.2E+00	1.8E-01	High moisture content – assume 50% control
Wind erosion – Block 119	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	2.4E+00	1.2E+00	1.8E-01	
Wind erosion – Topsoil stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	2.3E+00	1.1E+00	1.7E-01	Primary earthworks (30% control) [a] Water sprays (50% control) [a]
Wind erosion – Clay stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	1.3E+00	6.3E-01	9.5E-02	
Wind erosion – Overburden stockpile	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	4.4E+00	2.2E+00	3.3E-01	
Wind erosion – ROM pad	4.0E-01	2.0E-01	1.9E-02	kg/ha/hr	NPI	8.0E-01	4.0E-01	6.0E-02	High moisture content – assume 50% control
Total (every hour, 24 hours per day)						**42**	**15**	**3.0**	
Total per day						**1014**	**357**	**72**	

a As per NPI (DSEWPC, 2012).

Figure 29 Estimated Particulate Emission Source Distribution: Scenario 1 – Area 1 Y1Q1

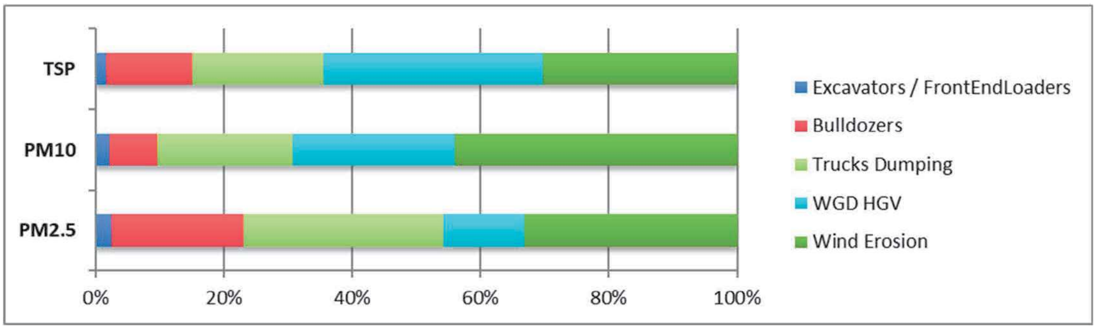


Figure 30 Estimated Particulate Emission Source Distribution: Scenario 2 – Area 1 Y6Q2

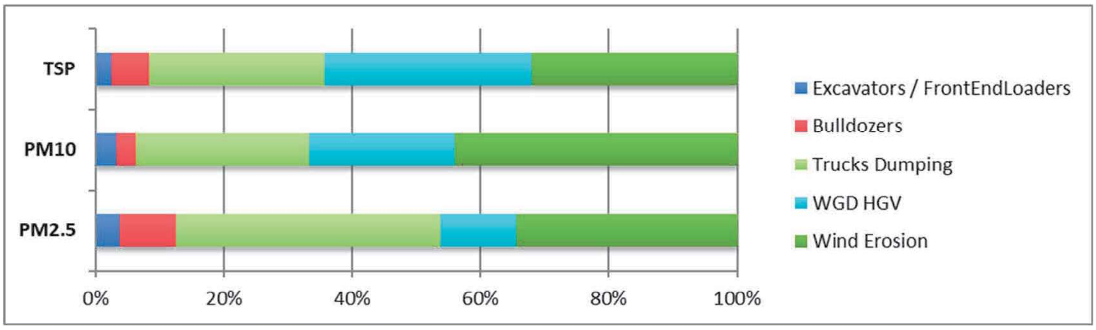


Figure 31 Estimated Particulate Emission Source Distribution: Scenario 3 – Area 3 Y11Q3

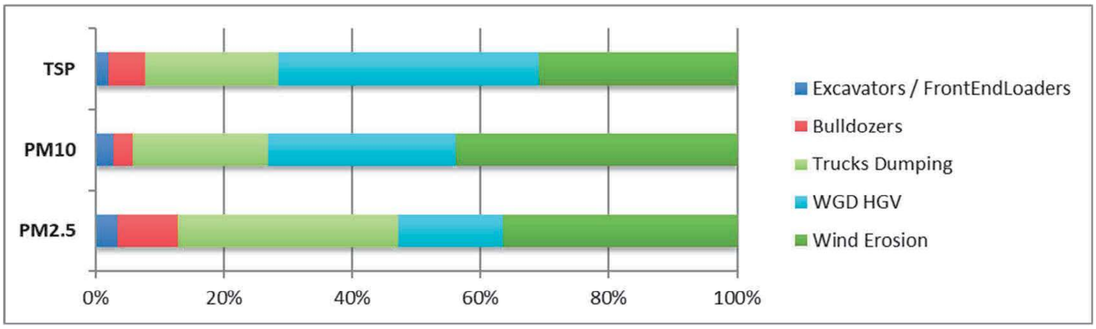


Figure 32 Estimated Particulate Emission Source Distribution: Scenario 4 – Area 3 Y15Q2

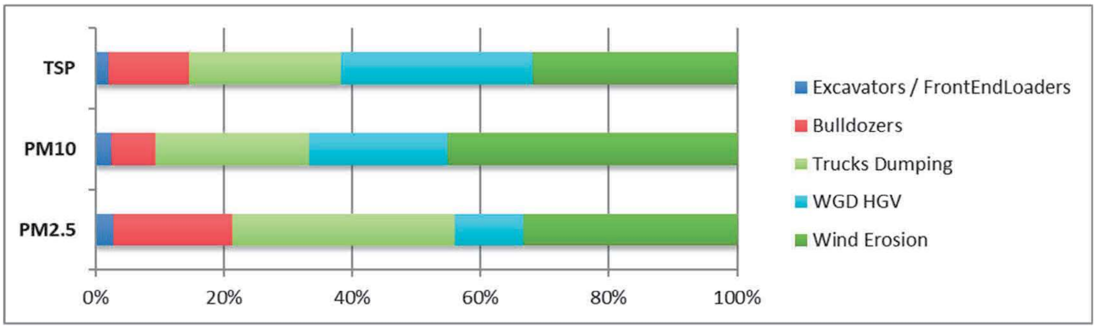


Table 35 Total Emissions Summary

Scenario	Extraction Rate (t/day)	Emissions Rate (kg/day)		
		TSP	PM_{10}	$PM_{2.5}$
Scenario 1 – Area 1_Y1Q1	54,000	951	328	65
Scenario 2 – Area 2 Y6Q2	75,000	831	276	56
Scenario 3 – Area 3 Y11Q3	60,000	868	279	52
Scenario 4 – Area 3 Y15Q2	67,000	1014	357	72

11.3 Modelling Results and Impact Assessment

11.3.1 Scenario 1 – Area 1 Y1Q1

11.3.1.1 Maximum Predicted 24-Hour Average GLCs

The maximum predicted 24-hour average cumulative (Project plus background) PM_{10} GLCs at each receptor are provided in **Table 36** for Scenario 1 for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project, are also provided.

The maximum predicted 24-hour average Project-only PM_{10} GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 37.** Cumulative concentrations that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

The corresponding predicted $PM_{2.5}$ results are provided in **Table 38** and **Table 39** and isopleth plots of the maximum predicted 24-hour average PM_{10} and $PM_{2.5}$ Project GLCs are presented in **Figure 33** and **Figure 34**.

Table 36 Scenario 1 Maximum Predicted Cumulative 24-Hour Average PM_{10} GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**210**	0.16	210	1	**210**	0.22	210	0
R2	**210**	0.23	210	0	**212**	2.3	210	0
R3	**211**	1.2	210	0	**211**	0.76	210	0
R4	**210**	0.048	210	0	**210**	0.21	210	0
R5	**210**	0.040	210	0	**210**	0.22	210	0
R6	**210**	0.13	210	0	**210**	0.30	210	0
R7	**210**	0.12	210	0	**210**	0.29	210	0
R8	**210**	0.19	210	0	**210**	0.42	210	0
R9	**210**	0.13	210	0	**211**	1.3	210	0
R10	**210**	0.20	210	0	**210**	0.49	210	0
R11	**210**	0.09	210	0	**211**	0.51	210	0
R12	**213**	2.7	210	1	**212**	1.7	210	0
R13	**210**	0.26	210	0	**211**	1.1	210	0
R14 [a]	***213***	*3.1*	*210*	*3*	***214***	*4.0*	*210*	*1*
R15	**210**	0.29	210	1	**212**	1.7	210	0
R16	**210**	0.11	210	0	**210**	0.40	210	0
R17	**210**	0.13	210	0	**210**	0.37	210	0
Criteria	**50**				**50**			

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 37 Scenario 1 Maximum Predicted Project 24-Hour Average PM_{10} GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	4.0	7.1	11	65	**69**	8%
R2	4.8	1.8	6.6	2.9	7.7	10%
R3	15	22	37	8	22	30%
R4	2.8	4.3	7.1	9.0	12	6%
R5	1.6	56	**58**	43	**45**	3%
R6	2.6	3.5	6.1	5.6	8.2	5%
R7	7.5	3.5	11	5.6	13	15%
R8	4.6	12	17	5	10	9%
R9	6.5	4.3	11	9.0	16	13%
R10	6.0	5.9	12	6.0	12	12%
R11	9.2	2.9	12	8.9	18	18%
R12	25	22	**47**	8	32	50%
R13	16	2.9	19	8.9	25	33%
R14 [a]	*54*	*2.5*	***57***	*0.3*	***55***	*109%*
R15	15	4.4	20	4.3	20	31%
R16	9.1	2.9	12	8.9	18	18%
R17	11	2.5	14	0.3	12	23%
Criteria			**50**		**50**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is within 20% of the APAC.

Red font indicates cumulative concentration exceeds the APAC.

Table 38 Scenario 1 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**45**	0.030	45	0	**81**	0.0014	81	0
R2	**45**	0.039	45	0	**81**	0.0023	81	0
R3	**45**	0.20	45	0	**81**	0.016	81	0
R4	**45**	0.0086	45	0	**81**	0.027	81	0
R5	**45**	0.0072	45	0	**81**	0.029	81	0
R6	**45**	0.019	45	0	**81**	0.013	81	0
R7	**45**	0.019	45	0	**81**	0.047	81	0
R8	**45**	0.030	45	0	**81**	0.025	81	0
R9	**45**	0.021	45	0	**81**	0.051	81	0
R10	**45**	0.028	45	0	**81**	0.054	81	0
R11	**45**	0.012	45	0	**81**	0.028	81	0
R12	**45**	0.42	45	0	**81**	0.068	81	0
R13	**45**	0.037	45	0	**81**	0.023	81	0
R14 [a]	***46***	*0.52*	*45*	*0*	***81***	*0.017*	*81*	*0*
R15	**45**	0.051	45	0	**81**	0.026	81	0
R16	**45**	0.019	45	0	**81**	0.058	81	0
R17	**45**	0.029	45	0	**81**	0.0021	81	0
Criteria	**25**				**25**			

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 39 Scenario 1 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.68	0.88	1.6	7.9	8.6	3%
R2	1.0	0.97	2.0	0.0	1.0	4%
R3	2.8	1.2	4.0	0.50	3.3	11%
R4	0.46	0.47	0.93	2.1	2.6	2%
R5	0.33	0.47	0.80	2.1	2.4	1%
R6	0.51	0.00	0.51	0.90	1.4	2%
R7	1.3	0.00	1.3	0.90	2.2	5%
R8	1.1	0.66	1.7	2.4	3.5	4%
R9	1.4	0.47	1.8	2.1	3.5	6%
R10	1.2	1.60	2.8	3.1	4.3	5%
R11	1.8	0.99	2.8	3.2	5.0	7%
R12	5.4	0.00	5.4	0.80	6.2	22%
R13	3.6	0.99	4.6	3.2	6.8	14%
R14 [a]	*10*	*1.1*	*11*	*0.50*	*11*	*40%*
R15	2.8	0.69	3.5	2.4	5.2	11%
R16	1.7	0.99	2.7	3.2	4.9	7%
R17	2.2	1.1	3.3	0.50	2.7	9%
Criteria			**25**		**25**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Figure 33 Scenario 1 Maximum Predicted 24-Hour Average Project PM_{10} GLCs

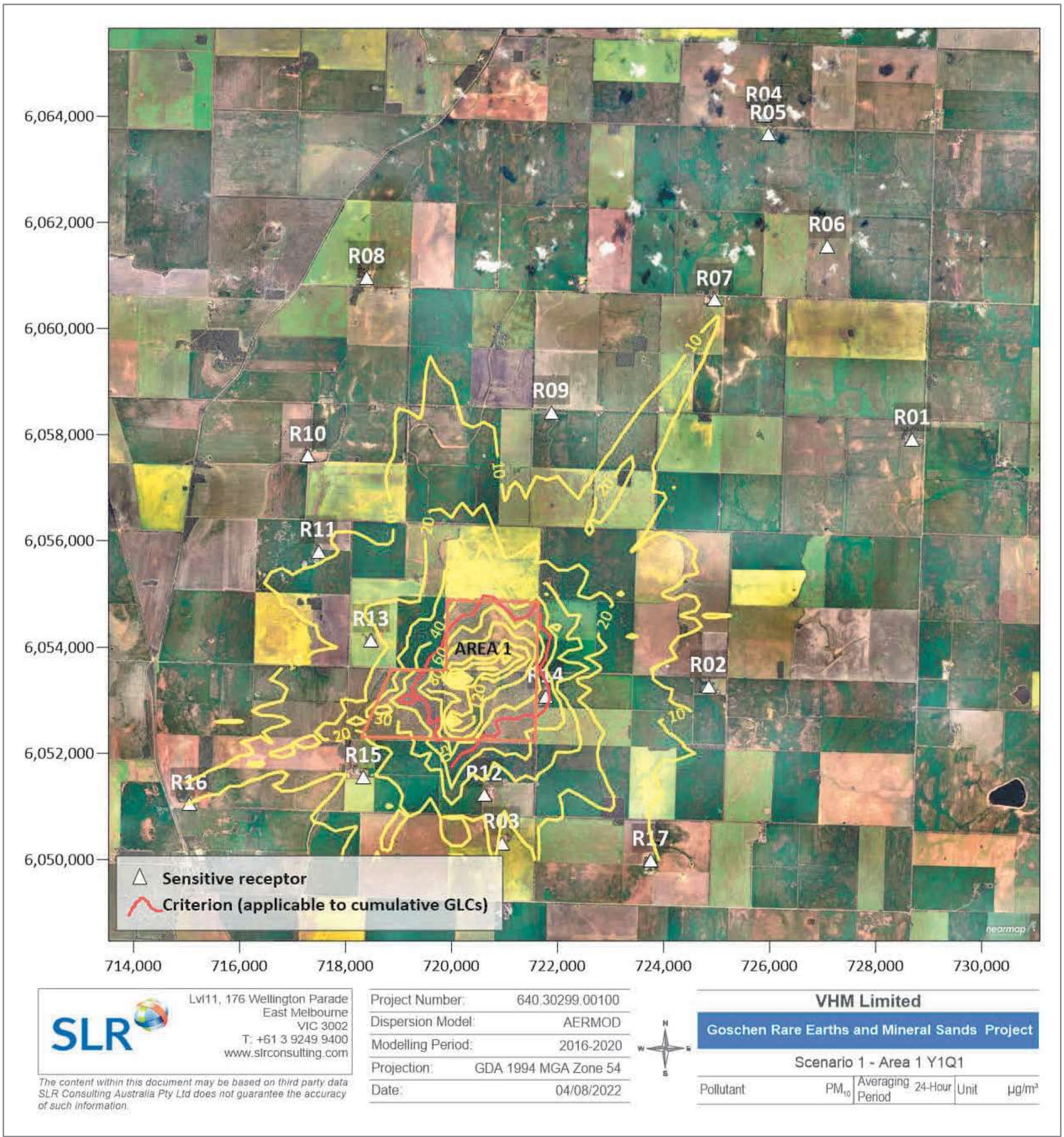
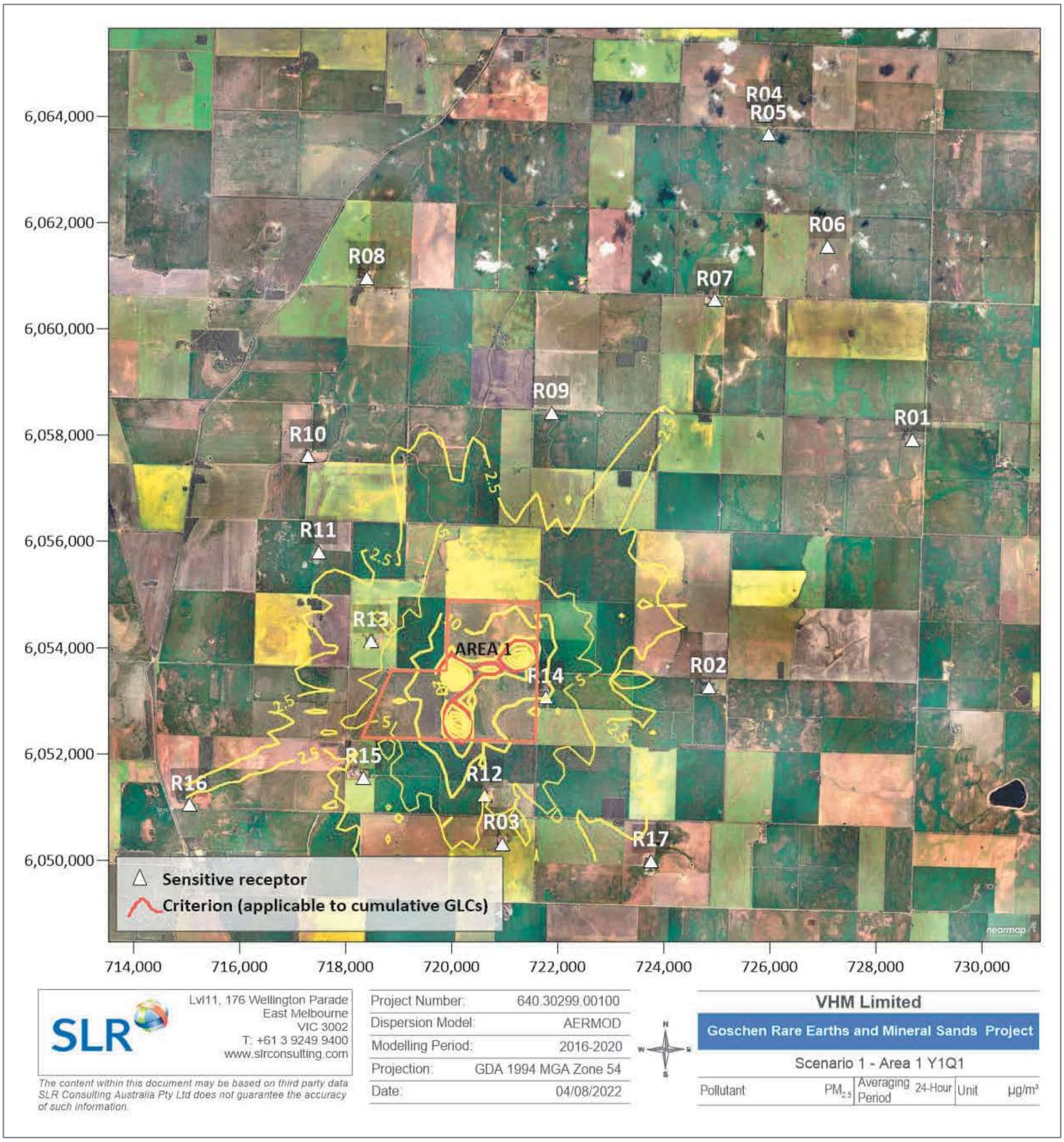


Figure 34 Scenario 1 Maximum Predicted 24-Hour Average Project $PM_{2.5}$ GLCs



11.3.1.2 Maximum Predicted Annual Average GLCs

The maximum predicted annual average (of five years) cumulative PM_{10} GLCs at each receptor are provided in **Table 40** for Scenario 1 for both normal and bushfire background concentrations years. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided. The corresponding $PM_{2.5}$ GLCs are provided in **Table 41.**

thee predicted RCS GLCs at each receptor are provided in **Table 42** and the predicted metals GLCs at the most impacted receptor are provided in **Table 43.** Isopleth plots of the predicted Project annual average PM_{10} and $PM_{2.5}$ GLCs are presented in **Figure 35** and **Figure 36**.

Table 40 Scenario 1 Maximum Predicted Cumulative Annual Average PM_{10} GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.10	19	19	21	**22**	0.4%
R2	0.30	19	19	21	**22**	1.2%
R3	0.53	19	19	21	**22**	2.1%
R4	0.084	19	19	21	**22**	0.3%
R5	0.082	19	19	21	**22**	0.3%
R6	0.094	19	19	21	**22**	0.4%
R7	0.15	19	19	21	**22**	0.6%
R8	0.12	19	19	21	**22**	0.5%
R9	0.30	19	19	21	**22**	1.2%
R10	0.20	19	19	21	**22**	0.8%
R11	0.31	19	19	21	**22**	1.2%
R12	1.1	19	**20**	21	**22**	4.3%
R13	0.83	19	**20**	21	**22**	3.3%
R14 [a]	*2.1*	*19*	***21***	*21*	***24***	*8.6%*
R15	0.61	19	19	21	**22**	2.4%
R16	0.15	19	19	21	**22**	0.6%
R17	0.23	19	19	21	**22**	0.9%
Criteria			**25**		25	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Table 41 Scenario 1 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.019	2.7	2.8	3.5	3.6	0.2%
R2	0.058	2.7	2.8	3.5	3.6	0.7%
R3	0.11	2.7	2.8	3.5	3.6	1.3%
R4	0.017	2.7	2.8	3.5	3.6	0.2%
R5	0.017	2.7	2.8	3.5	3.6	0.2%
R6	0.019	2.7	2.8	3.5	3.6	0.2%
R7	0.029	2.7	2.8	3.5	3.6	0.4%
R8	0.024	2.7	2.8	3.5	3.6	0.3%
R9	0.061	2.7	2.8	3.5	3.6	0.8%
R10	0.041	2.7	2.8	3.5	3.6	0.5%
R11	0.062	2.7	2.8	3.5	3.6	0.8%
R12	0.21	2.7	2.9	3.5	3.8	2.7%
R13	0.16	2.7	2.9	3.5	3.7	2.0%
R14 [a]	*0.41*	*2.7*	*3.1*	*3.5*	*3.9*	*5.1%*
R15	0.12	2.7	2.9	3.5	3.7	1.5%
R16	0.029	2.7	2.8	3.5	3.6	0.4%
R17	0.046	2.7	2.8	3.5	3.6	0.6%
Criteria			**8**		**8**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 42 Scenario 1 Maximum Predicted Cumulative Annual Average RCS GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)			Project Contribution Relative to APAC
	Project	Background	Cumulative	
R1	0.019	0.046	0.065	1%
R2	0.058	0.046	0.10	2%
R3	0.11	0.046	0.15	4%
R4	0.017	0.046	0.063	1%
R5	0.017	0.046	0.063	1%
R6	0.019	0.046	0.065	1%
R7	0.029	0.046	0.075	1%
R8	0.024	0.046	0.070	1%
R9	0.061	0.046	0.11	2%
R10	0.041	0.046	0.087	1%
R11	0.062	0.046	0.11	2%
R12	0.21	0.046	0.26	7%
R13	0.16	0.046	0.21	5%
R14 [a]	*0.41*	*0.046*	*0.45*	*14%*
R15	0.12	0.046	0.17	4%
R16	0.029	0.046	0.075	1%
R17	0.046	0.046	0.092	2%
Criteria			**3**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 43 Scenario 1 Maximum Predicted Cumulative Annual Average Metals GLCs

Most Impacted Receptor: R12							
Maximum Annual Average PM_{10} Concentration (µg/m³): 1.1							
Metal	Fraction of PM_{10} [a]	Annual Average Concentration (µg/m³)			APAC (µg/m³)	Project Contribution	
		Project	Background	Cumulative		Relative to APAC	Relative to Background
As	0.011%	0.00011	0.0020	0.0021	0.007	1.6%	5.6%
Cd	0.021%	0.00022	0.0040	**0.0042**	0.005	4.5%	5.6%
Cr	0.13%	0.0014	0.025	**0.026**	0.005	28%	5.6%
Cu	0.079%	0.00084	0.015	0.016	-	-	5.6%
Pb	0.15%	0.0016	0.028	0.030	0.5	0.3%	5.6%
Mn	0.28%	0.0030	0.053	0.056	0.15	2.0%	5.6%
Hg	0.016%	0.00017	0.0030	0.0032	1	0.02%	5.6%
Ni	0.15%	0.0016	0.028	0.030	0.09	1.7%	5.6%
V	0.042%	0.00045	0.0080	0.0084	-	-	5.6%
Zn	0.31%	0.00326	0.058	0.061	2	0.2%	5.6%

a Estimated metals fraction (refer **Section 7.6.2.3.4**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC. Red font indicates exceedance of the APAC.

Figure 35 Scenario 1 Predicted Annual Average Project PM_{10} GLCs (2016-2020)

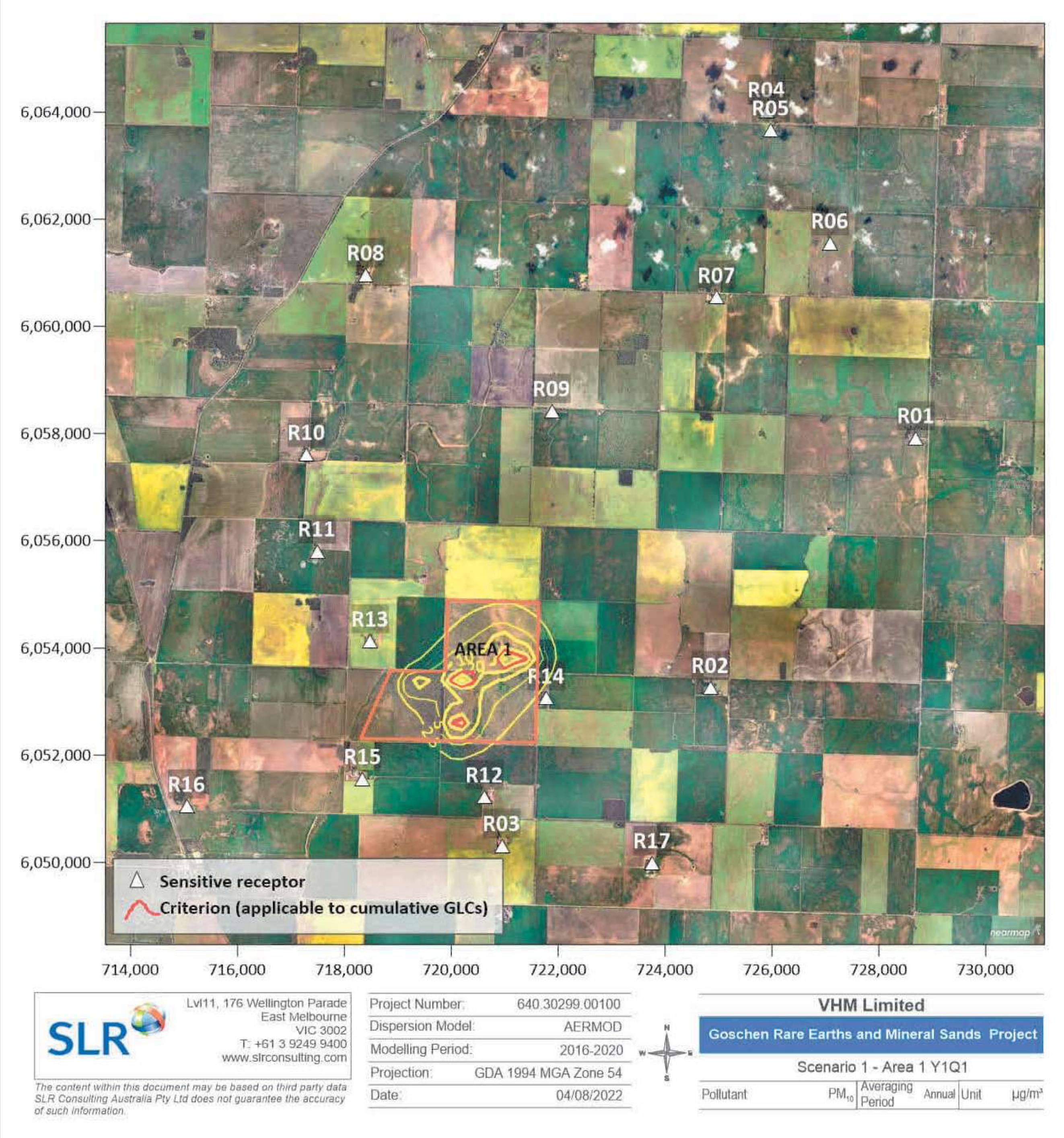
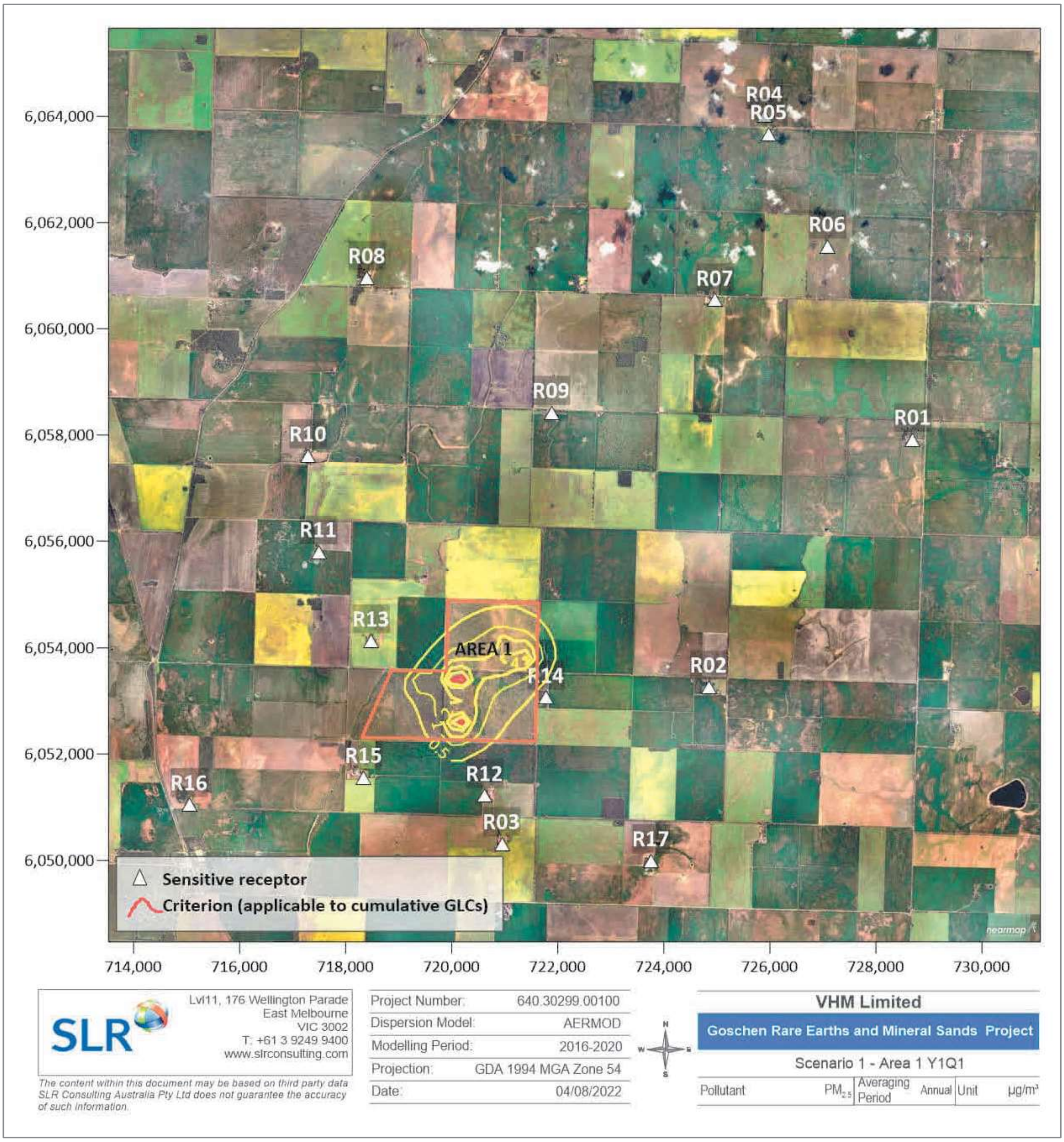


Figure 36 Scenario 1 Predicted Annual Average Project $PM_{2.5}$ GLCs (2016-2020)



11.3.2 Scenario 2 – Area 1 Y6Q2

11.3.2.1 Maximum Predicted 24-Hour Average GLCs

The maximum predicted 24-hour average cumulative PM_{10} GLCs at each receptor are provided in **Table 44** for Scenario 2 for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project, are also provided.

The maximum predicted 24-hour average Project-only PM_{10} GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 45**. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

The corresponding predicted $PM_{2.5}$ results are provided in **Table 46** and **Table 47** and **i**sopleth plots of the maximum predicted 24-hour average PM_{10} and $PM_{2.5}$ Project GLCs are presented in **Figure 37** and **Figure 38**.

Table 44 Scenario 2 Maximum Predicted Cumulative 24-Hour Average PM_{10} GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**210**	0.15	210	1	**210**	0.15	210	0
R2	**210**	0.29	210	0	**210**	0.41	210	0
R3	**211**	1.0	210	0	**211**	0.97	210	0
R4	**210**	0.037	210	0	**210**	0.15	210	0
R5	**210**	0.034	210	0	**210**	0.14	210	0
R6	**210**	0.057	210	0	**210**	0.11	210	0
R7	**210**	0.046	210	0	**210**	0.18	210	0
R8	**210**	0.18	210	0	**210**	0.18	210	0
R9	**210**	0.068	210	0	**210**	0.36	210	0
R10	**210**	0.11	210	0	**210**	0.29	210	0
R11	**210**	0.035	210	0	**210**	0.21	210	0
R12	**212**	1.9	210	1	**212**	1.7	210	0
R13	**210**	0.11	210	0	**210**	0.38	210	0
R14 [a]	***217***	*7.0*	*210*	*2*	***218***	*7.5*	*210*	*1*
R15	**211**	0.54	210	0	**210**	0.50	210	0
R16	**210**	0.11	210	0	**210**	0.24	210	0
R17	**210**	0.17	210	0	**210**	0.38	210	0
Criteria	**50**				**50**			

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 45 Scenario 2 Maximum Predicted Project 24-Hour Average PM_{10} GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	2.2	48	**50**	10	12	4%
R2	6.9	2.6	9.5	4.3	11	14%
R3	12	5.6	17	1.3	13	23%
R4	1.5	7.8	9.3	3.6	5.1	3%
R5	1.7	7.8	9.5	3.6	5.3	3%
R6	2.1	3.5	5.6	0.50	2.6	4%
R7	1.6	3.5	5.1	5.6	7.2	3%
R8	2.4	7.8	10	3.6	6.0	5%
R9	5.0	2.2	7.2	9.3	14	10%
R10	6.7	11	18	5.3	12	13%
R11	4.2	2.2	6.4	13	17	8%
R12	19	5.3	24	7.0	26	38%
R13	14	5.5	19	6.8	21	28%
R14 [a]	*36*	*8.5*	***45***	*9.7*	***46***	*73%*
R15	16	2.6	19	4.3	21	33%
R16	4.5	2.9	7.4	8.9	13	9%
R17	5.7	3.3	9.0	0.90	6.6	11%
Criteria [a]			**50**		**50**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Red font indicates cumulative concentration exceeds the APAC.

Table 46 Scenario 2 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**45**	0.019	45	0	**81**	0.0030	81	0
R2	**45**	0.051	45	0	**81**	0.0016	81	0
R3	**45**	0.12	45	0	**81**	0.16	81	0
R4	**45**	0.0055	45	0	**81**	0.0030	81	0
R5	**45**	0.0051	45	0	**81**	0.0038	81	0
R6	**45**	0.0081	45	0	**81**	0.0068	81	0
R7	**45**	0.0055	45	0	**81**	0.0076	81	0
R8	**45**	0.027	45	0	**81**	0.020	81	0
R9	**45**	0.0052	45	0	**81**	0.027	81	0
R10	**45**	0.012	45	0	**81**	0.029	81	0
R11	**45**	0.0050	45	0	**81**	0.011	81	0
R12	**45**	0.28	45	0	**81**	0.13	81	0
R13	**45**	0.010	45	0	**81**	0.0086	81	0
R14 [a]	***46***	*1.2*	*45*	*0*	***81***	*0.38*	*81*	*0*
R15	**45**	0.10	45	0	**81**	0.0027	81	0
R16	**45**	0.018	45	0	**81**	0.0010	81	0
R17	**45**	0.036	45	0	**81**	0.0016	81	0
Criteria	**25**				**25**			

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 47 Scenario 2 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.41	0.60	1.0	0.20	0.61	2%
R2	2.6	0.60	3.2	0.20	2.8	10%
R3	3.3	2.5	5.8	0.70	4.0	13%
R4	0.25	2.8	3.1	1.8	2.1	1%
R5	0.32	2.8	3.1	1.8	2.1	1%
R6	0.38	0.60	0.98	1.6	2.0	2%
R7	0.42	2.8	3.2	1.8	2.2	2%
R8	0.53	2.8	3.3	1.8	2.3	2%
R9	1.1	0.60	1.7	1.0	2.1	4%
R10	1.3	5.5	6.8	0.9	2.2	5%
R11	0.94	0.60	1.5	3.9	4.8	4%
R12	4.8	1.6	6.4	0.10	4.9	19%
R13	2.9	1.5	4.4	3.8	6.7	11%
R14 [a]	*8.4*	*0.60*	*9.0*	*1.6*	*10*	*34%*
R15	2.4	0.60	3.0	0.20	2.6	10%
R16	0.76	1.0	1.8	3.2	4.0	3%
R17	1.1	0.60	1.7	0.10	1.2	4%
Criteria			**25**		**25**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Figure 37 Scenario 2 Maximum Predicted 24-Hour Average Project PM_{10} GLCs

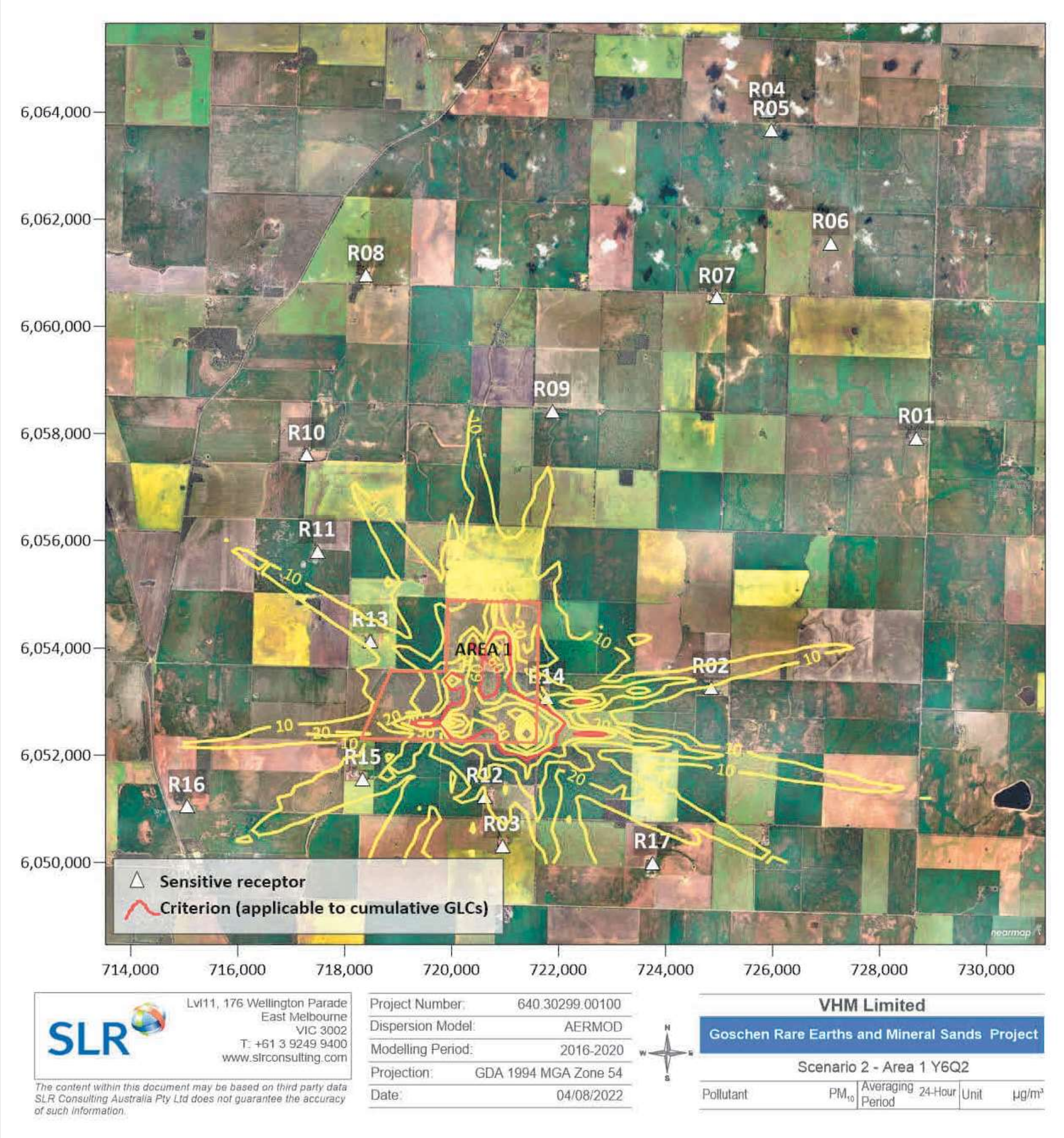
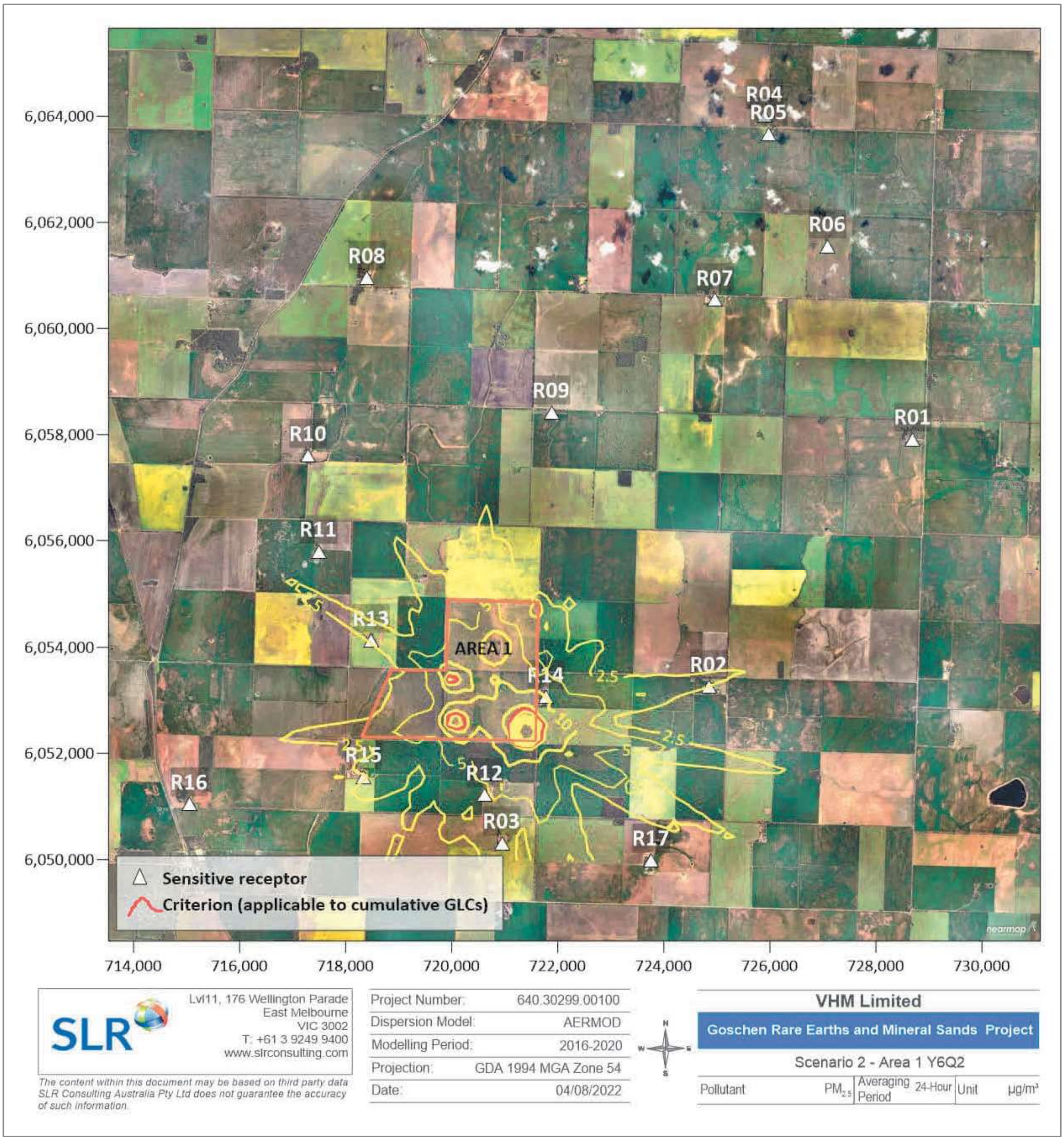


Figure 38 Scenario 2 Maximum Predicted 24-Hour Average Project $PM_{2.5}$ GLCs



11.3.2.2 Maximum Predicted Annual Average GLCs

The maximum predicted annual average (of five years) cumulative PM_{10} GLCs at each receptor are provided in **Table 48** for Scenario 2 for both normal and bushfire background concentrations years. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided. The corresponding $PM_{2.5}$ GLCs are provided in **Table 49.**

The predicted RCS GLCs at each receptor are provided in **Table 50** and the predicted metals GLCs at the most impacted receptor are provided in **Table 51.** Isopleth plots of the predicted Project annual average PM_{10} and $PM_{2.5}$ GLCs are presented in **Figure 39** and **Figure 40.**

Table 48 Scenario 2 Maximum Predicted Cumulative Annual Average PM_{10} GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.048	19	19	21	**21**	0.2%
R2	0.18	19	19	21	**22**	0.7%
R3	0.39	19	19	21	**22**	1.6%
R4	0.032	19	19	21	**21**	0.1%
R5	0.034	19	19	21	**21**	0.1%
R6	0.045	19	19	21	**21**	0.2%
R7	0.056	19	19	21	**21**	0.2%
R8	0.051	19	19	21	**21**	0.2%
R9	0.082	19	19	21	**22**	0.3%
R10	0.060	19	19	21	**22**	0.2%
R11	0.10	19	19	21	**22**	0.4%
R12	0.79	19	**20**	21	**22**	3.1%
R13	0.25	19	19	21	**22**	1.0%
R14 [a]	*2.8*	*19*	*22*	*21*	***24***	*11%*
R15	0.26	19	19	21	**22**	1.0%
R16	0.068	19	19	21	**21**	0.3%
R17	0.15	19	19	21	**22**	0.6%
Criteria			**25**		25	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Table 49 Scenario 2 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.0086	2.7	2.7	3.5	3.5	0.1%
R2	0.032	2.7	2.8	3.5	3.6	0.4%
R3	0.069	2.7	2.8	3.5	3.6	0.9%
R4	0.0053	2.7	2.7	3.5	3.5	0.1%
R5	0.0062	2.7	2.7	3.5	3.5	0.1%
R6	0.0083	2.7	2.7	3.5	3.5	0.1%
R7	0.010	2.7	2.7	3.5	3.5	0.1%
R8	0.010	2.7	2.7	3.5	3.5	0.1%
R9	0.021	2.7	2.8	3.5	3.6	0.3%
R10	0.016	2.7	2.8	3.5	3.6	0.2%
R11	0.016	2.7	2.7	3.5	3.6	0.2%
R12	0.13	2.7	2.9	3.5	3.7	1.6%
R13	0.036	2.7	2.8	3.5	3.6	0.4%
R14 [a]	*0.53*	*2.7*	*3.3*	*3.5*	*4.1*	*6.6%*
R15	0.040	2.7	2.8	3.5	3.6	0.5%
R16	0.011	2.7	2.7	3.5	3.5	0.1%
R17	0.026	2.7	2.8	3.5	3.6	0.3%
Criteria			**8**		**8**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 50 Scenario 2 Maximum Predicted Cumulative Annual Average RCS GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)			Project Contribution Relative to APAC
	Project	Background	Cumulative	
R1	0.0086	0.046	0.055	0.3%
R2	0.032	0.046	0.078	1.1%
R3	0.069	0.046	0.11	2.3%
R4	0.0053	0.046	0.051	0.2%
R5	0.0062	0.046	0.052	0.2%
R6	0.0083	0.046	0.054	0.3%
R7	0.010	0.046	0.056	0.3%
R8	0.010	0.046	0.056	0.3%
R9	0.021	0.046	0.067	0.7%
R10	0.016	0.046	0.062	0.5%
R11	0.016	0.046	0.062	0.5%
R12	0.13	0.046	0.18	4.3%
R13	0.036	0.046	0.082	1.2%
R14 [a]	*0.53*	*0.046*	*0.58*	*18%*
R15	0.040	0.046	0.086	1.3%
R16	0.011	0.046	0.057	0.4%
R17	0.026	0.046	0.072	0.9%
Criteria			**3**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 51 Scenario 2 Maximum Predicted Cumulative Annual Average Metals GLCs

Most Impacted Receptor: R12							
Maximum Annual Average PM_{10} Concentration (µg/m³): 0.79							
Metal	Fraction of PM_{10} [a]	Annual Average Concentration (µg/m³)			APAC (µg/m³)	Project Contribution	
		Project	Background	Cumulative		Relative to APAC	Relative to Background
As	0.011%	0.000083	0.0020	0.0021	0.007	1.2%	4.1%
Cd	0.021%	0.00017	0.0040	**0.0042**	0.005	3.3%	4.1%
Cr	0.13%	0.0010	0.025	**0.026**	0.005	21%	4.1%
Cu	0.079%	0.00062	0.015	0.016	-	-	4.1%
Pb	0.15%	0.0012	0.028	0.029	0.5	0.2%	4.1%
Mn	0.28%	0.0022	0.053	0.055	0.15	1.5%	4.1%
Hg	0.016%	0.00012	0.0030	0.0031	1	0.01%	4.1%
Ni	0.15%	0.0012	0.028	0.029	0.09	1.3%	4.1%
V	0.042%	0.00033	0.0080	0.0083	-	-	4.1%
Zn	0.31%	0.0024	0.058	0.060	2	0.1%	4.1%

a Estimated metals fraction (refer **Section 7.6.2.3.4**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC. Red font indicates exceedance of the APAC.

Figure 39 Scenario 2 Predicted Annual Average Project PM_{10} GLCs (2016-2020)

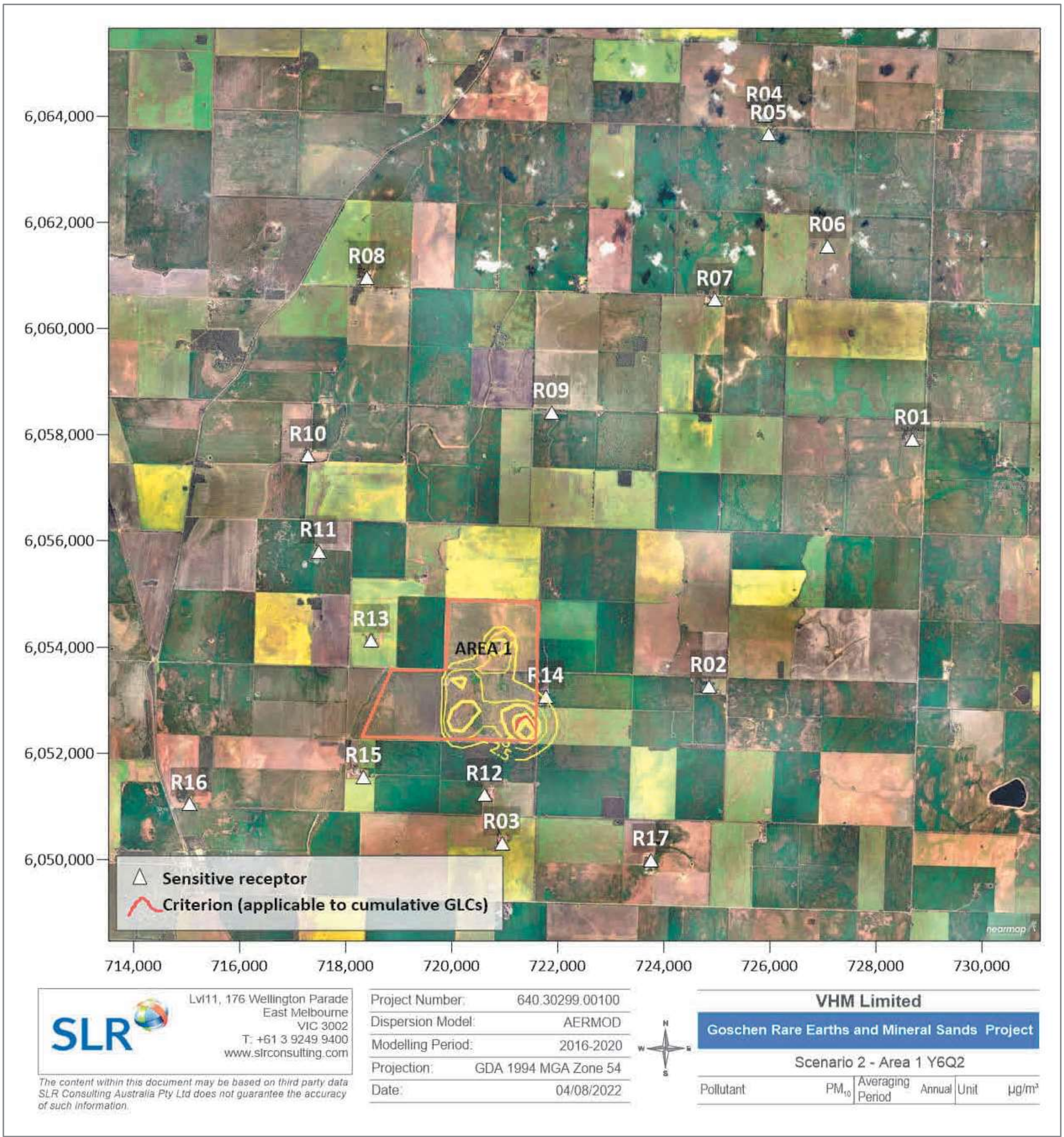
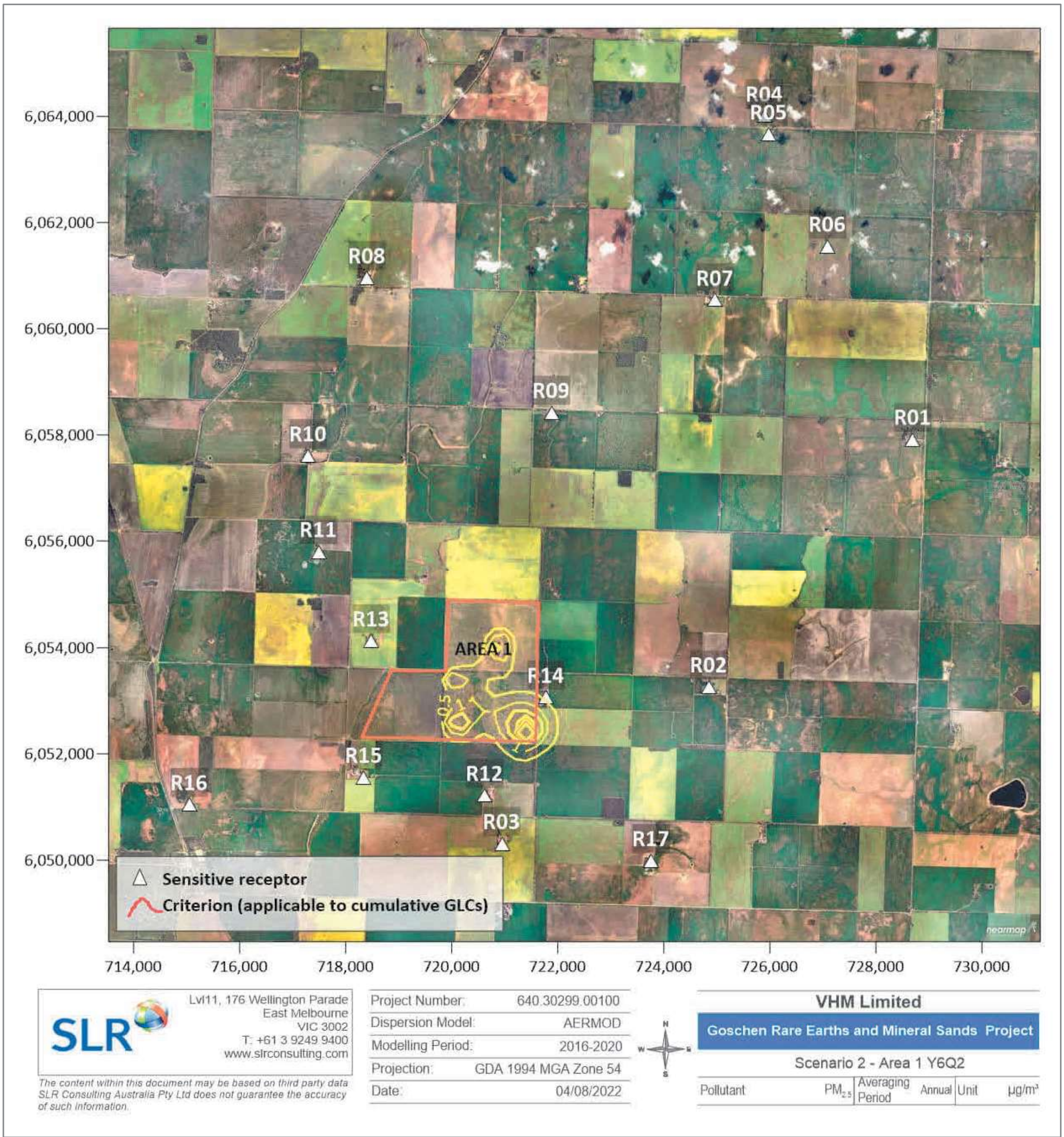


Figure 40 Scenario 2 Predicted Annual Average Project $PM_{2.5}$ GLCs (2016-2020)



11.3.3 Scenario 3 – Area 3 Y11Q3

11.3.3.1 Maximum Predicted 24-Hour Average GLCs

The maximum predicted 24-hour average cumulative PM_{10} GLCs at each receptor are provided in **Table 52** for Scenario 3 for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project, are also provided.

The maximum predicted 24-hour average Project-only PM_{10} GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 53**. Cumulative concentrations that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

The corresponding predicted $PM_{2.5}$ results are provided in **Table 54** and **Table 55** and isopleth plots of the maximum predicted 24-hour average PM_{10} and $PM_{2.5}$ Project GLCs are presented in **Figure 41** and **Figure 42**.

Table 52 Scenario 3 Maximum Predicted Cumulative 24-Hour Average PM_{10} GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**210**	0.12	210	0	**210**	0.13	210	0
R2	**210**	0.38	210	0	**211**	0.59	210	0
R3	**210**	0.040	210	0	**210**	0.29	210	0
R4	**210**	0.13	210	0	**210**	0.47	210	0
R5	**210**	0.12	210	0	**210**	0.42	210	0
R6	**210**	0.39	210	0	**210**	0.32	210	0
R7	**211**	0.98	210	0	**211**	1.0	210	0
R8	**210**	0.017	210	0	**210**	0.093	210	0
R9 [a]	***211***	*0.81*	*210*	*0*	***212***	*1.6*	*210*	*0*
R10	**210**	0.031	210	0	**210**	0.16	210	0
R11	**210**	0.070	210	0	**210**	0.23	210	0
R12	**210**	0.012	210	0	**210**	0.20	210	0
R13	**210**	0.090	210	0	**210**	0.13	210	0
R14 [b]	***210***	*0.13*	*210*	*0*	***211***	*0.61*	*210*	*0*
R15	**210**	0.015	210	0	**210**	0.12	210	0
R16	**210**	0.023	210	0	**210**	0.10	210	0
R17	**210**	0.17	210	0	**210**	0.084	210	0
Criteria	**50**				**50**			

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 53 Scenario 3 Maximum Predicted Project 24-Hour Average PM_{10} GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	7.5	3.6	11	3.2	11	15%
R2	8.2	2.5	11	0.30	8.5	16%
R3	7.8	5.3	13	7.0	15	16%
R4	6.4	7.8	14	3.6	10	13%
R5	3.7	8	12	3.6	7.3	7%
R6	3.7	2.3	6.0	4.1	7.8	7%
R7	14	2.3	16	4.1	18	27%
R8	3.8	5.5	9.3	6.8	11	8%
R9 [a]	*17*	*2.6*	*20*	*4.3*	*21*	*34%*
R10	2.9	3.8	6.7	18	21	6%
R11	5.0	2.6	7.6	4.3	9.3	10%
R12	5.0	2.6	7.6	1.5	6.5	10%
R13	3.6	3.8	7.4	6.9	11	7%
R14 [b]	*16*	*5.3*	*21*	*7.0*	*23*	*32%*
R15	2.2	7.7	10	4.8	7.0	4%
R16	2.3	3.8	6.1	2.9	5.2	5%
R17	5.7	2.5	8.2	0.3	6.0	11%
Criteria			**50**		**50**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 54 Scenario 3 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**45**	0.016	45	0	**81**	0.0010	81	0
R2	**45**	0.067	45	0	**81**	0.0011	81	0
R3	**45**	0.007	45	0	**81**	0.017	81	0
R4	**45**	0.019	45	0	**81**	0.0052	81	0
R5	**45**	0.019	45	0	**81**	0.0082	81	0
R6	**45**	0.043	45	0	**81**	0.0076	81	0
R7	**45**	0.13	45	0	**81**	0.037	81	0
R8	**45**	0.0019	45	0	**81**	0.0019	81	0
R9 [a]	***45***	*0.078*	*45*	*0*	***81***	*0.047*	*81*	*0*
R10	**45**	0.0039	45	0	**81**	0.00088	81	0
R11	**45**	0.010	45	0	**81**	0.00086	81	0
R12	**45**	0.0019	45	0	**81**	0.010	81	0
R13	**45**	0.017	45	0	**81**	0.00088	81	0
R14 [b]	***45***	*0.023*	*45*	*0*	***81***	*0.044*	*81*	*0*
R15	**45**	0.0024	45	0	**81**	0.00066	81	0
R16	**45**	0.0042	45	0	**81**	0.00049	81	0
R17	**45**	0.0073	45	0	**81**	0.0023	81	0
Criteria	**25**				**25**			

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 55 Scenario 3 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.98	1.0	2.0	0.0	1.0	4%
R2	1.1	1.1	2.2	0.50	1.6	5%
R3	1.2	0.70	1.9	3.7	4.9	5%
R4	1.0	2.8	3.8	1.8	2.8	4%
R5	0.65	2.8	3.4	1.8	2.4	3%
R6	0.60	0.0	0.60	2.0	2.6	2%
R7	2.6	0.0	2.6	2.0	4.6	10%
R8	0.40	1.5	1.9	3.8	4.2	2%
R9 [a]	*4.0*	*0.60*	*4.6*	*0.20*	*4.2*	*16%*
R10	0.40	1.0	1.4	0.0	0.4	2%
R11	0.55	1.0	1.5	3.2	3.7	2%
R12	0.72	0.90	1.6	0.50	1.2	3%
R13	0.55	0.0	0.55	1.9	2.4	2%
R14 [b]	*2.4*	*0.70*	*3.1*	*3.7*	*6.1*	*10%*
R15	0.43	1.6	2.0	0.10	0.5	2%
R16	0.29	0.20	0.49	0.30	0.6	1%
R17	0.70	1.1	1.8	0.50	1.2	3%
Criteria			**25**		**25**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Figure 41 Scenario 3 Maximum Predicted 24-Hour Average Project PM_{10} GLCs

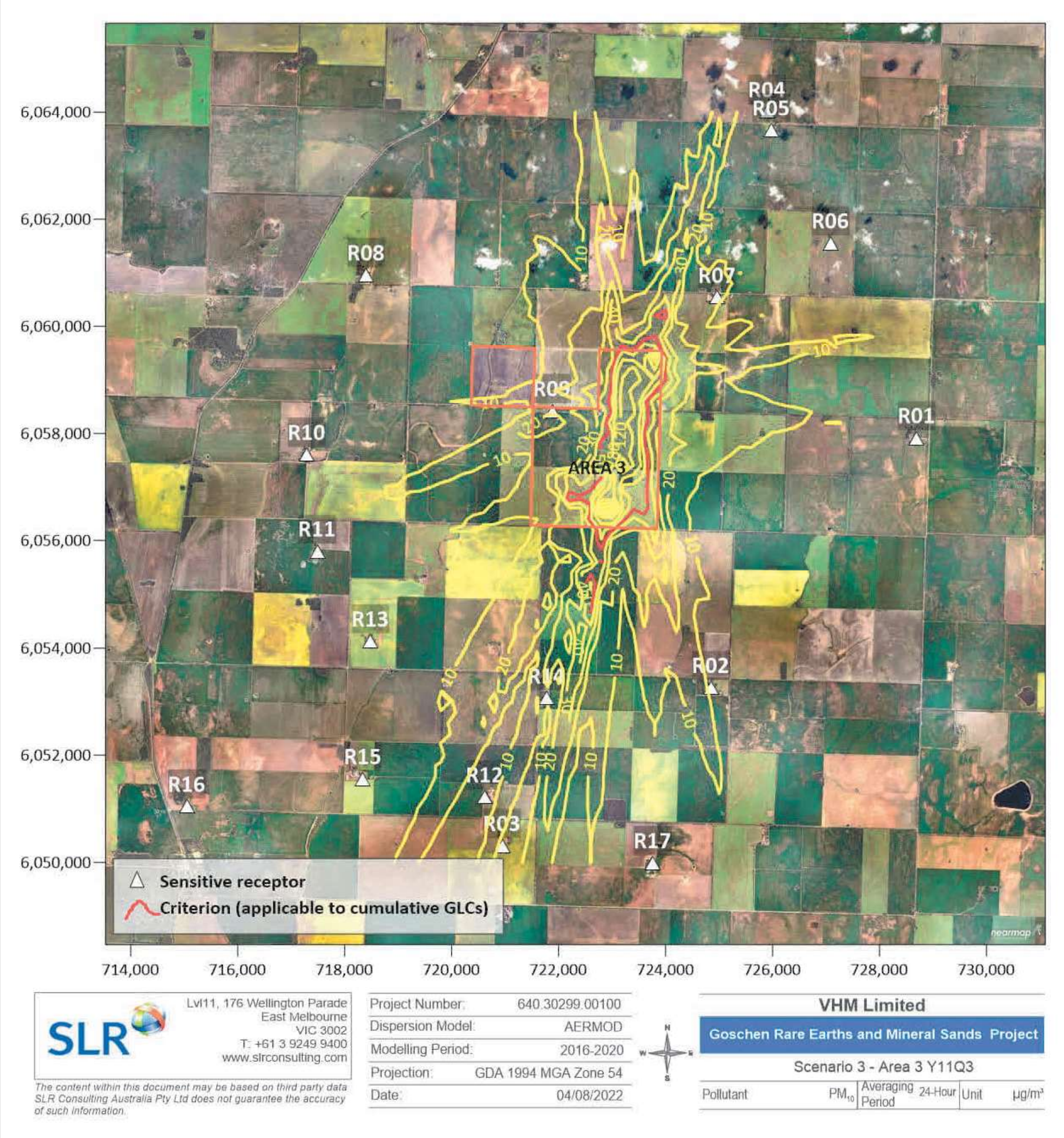
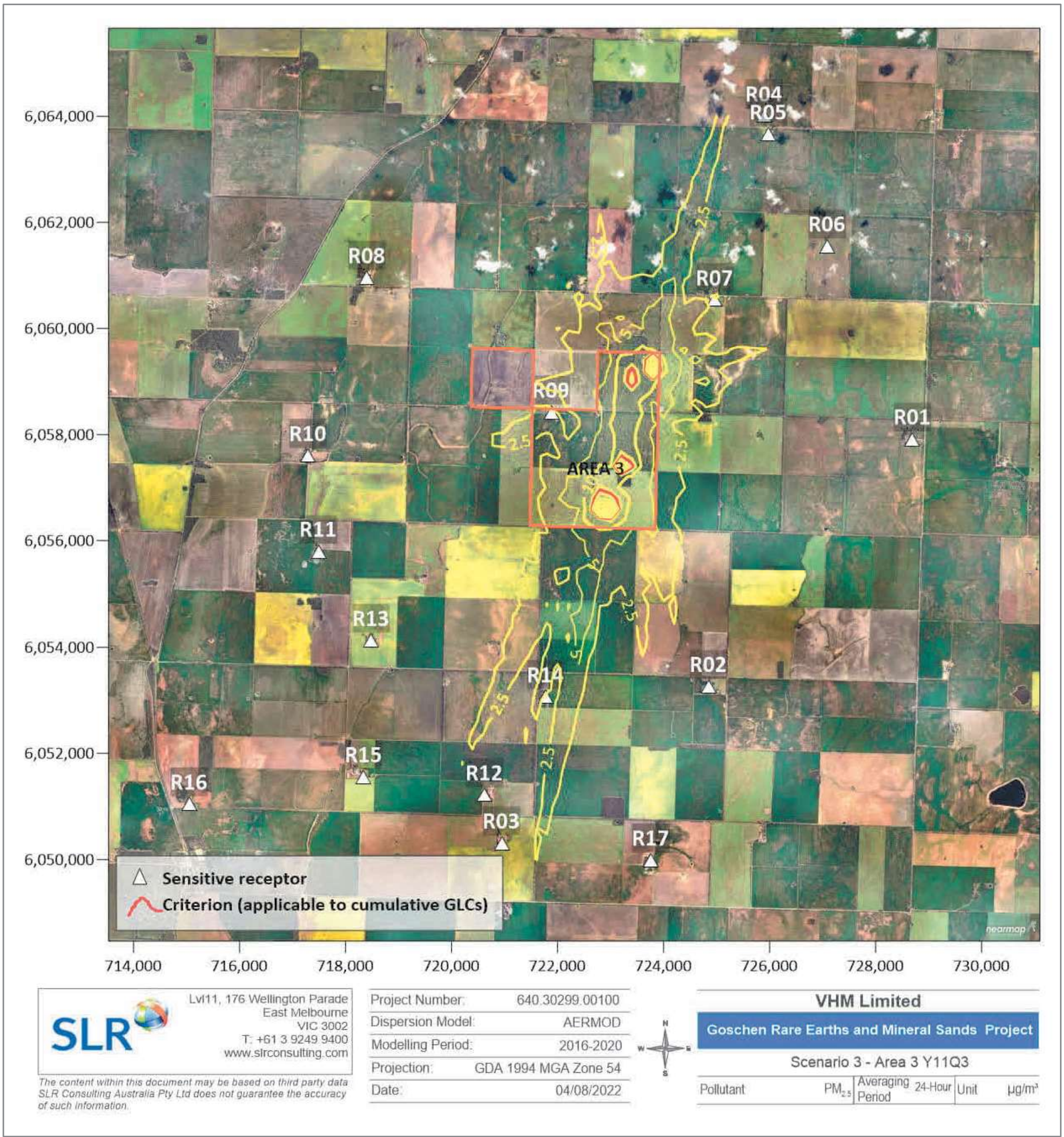


Figure 42 Scenario 3 Maximum Predicted 24-Hour Average Project $PM_{2.5}$ GLCs



11.3.3.2 Maximum Predicted Annual Average GLCs

The maximum predicted annual average (of five years) cumulative PM_{10} GLCs at each receptor are provided in **Table 56** for Scenario 3 for both normal and bushfire background concentrations years. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided. The corresponding $PM_{2.5}$ GLCs are provided in **Table 57.**

The predicted RCS GLCs at each receptor are provided in **Table 58** and the predicted metals GLCs at the most impacted receptor are provided in **Table 59.** Isopleth plots of the predicted Project annual average PM_{10} and $PM_{2.5}$ GLCs are presented in **Figure 43** and **Figure 44.**

Table 56 Scenario 3 Maximum Predicted Cumulative Annual Average PM_{10} GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.11	19	19	21	**22**	0.4%
R2	0.12	19	19	21	**22**	0.5%
R3	0.084	19	19	21	**22**	0.3%
R4	0.095	19	19	21	**22**	0.4%
R5	0.094	19	19	21	**22**	0.4%
R6	0.12	19	19	21	**22**	0.5%
R7	0.38	19	19	21	**22**	1.5%
R8	0.070	19	19	21	**21**	0.3%
R9 [a]	*0.57*	*19*	*19*	*21*	***22***	*2.3%*
R10	0.070	19	19	21	**21**	0.3%
R11	0.069	19	19	21	**21**	0.3%
R12	0.08	19	19	21	**22**	0.3%
R13	0.085	19	19	21	**22**	0.3%
R14 [b]	*0.18*	*19*	*19*	*21*	***22***	*0.7%*
R15	0.070	19	19	21	**21**	0.3%
R16	0.037	19	19	21	**21**	0.1%
R17	0.066	19	19	21	**21**	0.3%
Criteria			**25**		25	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Table 57 Scenario 3 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.016	2.7	2.7	3.5	3.6	0.2%
R2	0.018	2.7	2.8	3.5	3.6	0.2%
R3	0.012	2.7	2.7	3.5	3.5	0.2%
R4	0.014	2.7	2.7	3.5	3.6	0.2%
R5	0.014	2.7	2.7	3.5	3.6	0.2%
R6	0.017	2.7	2.8	3.5	3.6	0.2%
R7	0.057	2.7	2.8	3.5	3.6	0.7%
R8	0.0088	2.7	2.7	3.5	3.5	0.1%
R9 [a]	*0.072*	*2.7*	*2.8*	*3.5*	*3.6*	*0.9%*
R10	0.010	2.7	2.7	3.5	3.5	0.1%
R11	0.0092	2.7	2.7	3.5	3.5	0.1%
R12	0.011	2.7	2.7	3.5	3.5	0.1%
R13	0.011	2.7	2.7	3.5	3.5	0.1%
R14 [b]	*0.026*	*2.7*	*2.8*	*3.5*	*3.6*	*0.3%*
R15	0.0091	2.7	2.7	3.5	3.5	0.1%
R16	0.0052	2.7	2.7	3.5	3.5	0.1%
R17	0.0089	2.7	2.7	3.5	3.5	0.1%
Criteria			**8**		**8**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 58 Scenario 3 Maximum Predicted Cumulative Annual Average RCS GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)			Project Contribution Relative to APAC
	Project	Background	Cumulative	
R1	0.016	0.046	0.062	0.5%
R2	0.018	0.046	0.064	0.6%
R3	0.012	0.046	0.058	0.4%
R4	0.014	0.046	0.060	0.5%
R5	0.014	0.046	0.060	0.5%
R6	0.017	0.046	0.063	0.6%
R7	0.057	0.046	0.10	1.9%
R8	0.0088	0.046	0.055	0.3%
R9 [a]	*0.072*	*0.046*	*0.12*	*2.4%*
R10	0.010	0.046	0.056	0.3%
R11	0.0092	0.046	0.055	0.3%
R12	0.011	0.046	0.057	0.4%
R13	0.011	0.046	0.057	0.4%
R14 [b]	*0.026*	*0.046*	*0.072*	*0.9%*
R15	0.0091	0.046	0.055	0.3%
R16	0.0052	0.046	0.051	0.2%
R17	0.0089	0.046	0.055	0.3%
Criteria			**3**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 59 Scenario 3 Maximum Predicted Cumulative Annual Average Metals GLCs

Most Impacted Receptor: R7							
Maximum Annual Average PM_{10} Concentration (µg/m³): 0.38							
Metal	Fraction of PM_{10} [a]	Annual Average Concentration (µg/m³)			APAC (µg/m³)	Project Contribution	
		Project	Background	Cumulative		Relative to APAC	Relative to Background
As	0.011%	0.000040	0.0020	0.0020	0.007	0.6%	2.0%
Cd	0.021%	0.000080	0.0040	**0.0041**	0.005	1.6%	2.0%
Cr	0.13%	0.00050	0.025	**0.026**	0.005	10%	2.0%
Cu	0.079%	0.00030	0.015	0.015	-	-	2.0%
Pb	0.15%	0.00056	0.028	0.029	0.5	0.1%	2.0%
Mn	0.28%	0.0011	0.053	0.054	0.15	0.7%	2.0%
Hg	0.016%	0.000060	0.0030	0.0031	1	0.01%	2.0%
Ni	0.15%	0.00056	0.028	0.029	0.09	0.6%	2.0%
V	0.042%	0.00016	0.0080	0.0082	-	-	2.0%
Zn	0.31%	0.0012	0.058	0.059	2	0.1%	2.0%

a Estimated metals fraction (refer **Section 7.6.2.3.4**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Red font indicates cumulative concentration exceeds the APAC.

Figure 43 Scenario 3 Predicted Annual Average Project PM_{10} GLCs (2016-2020)

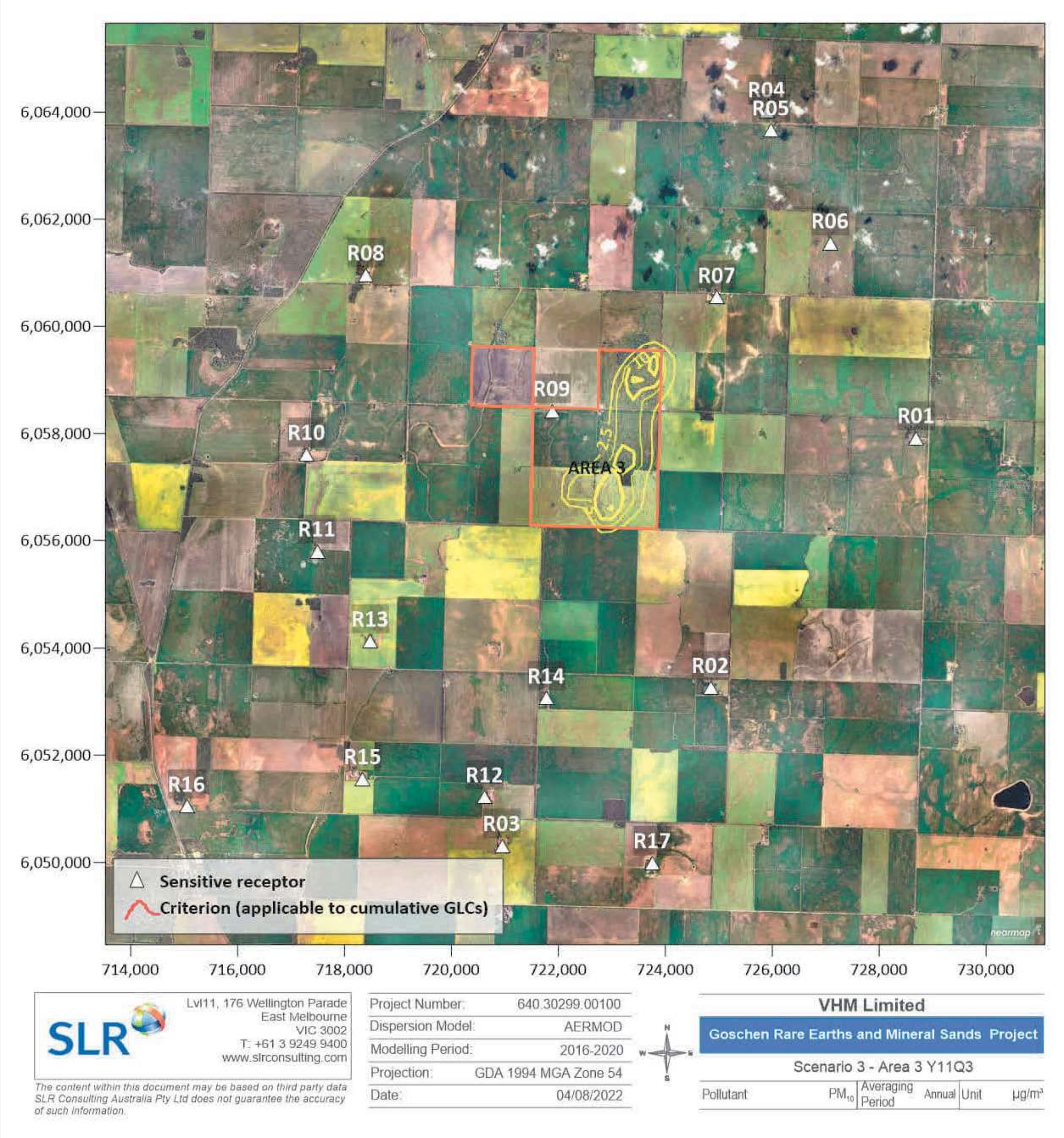
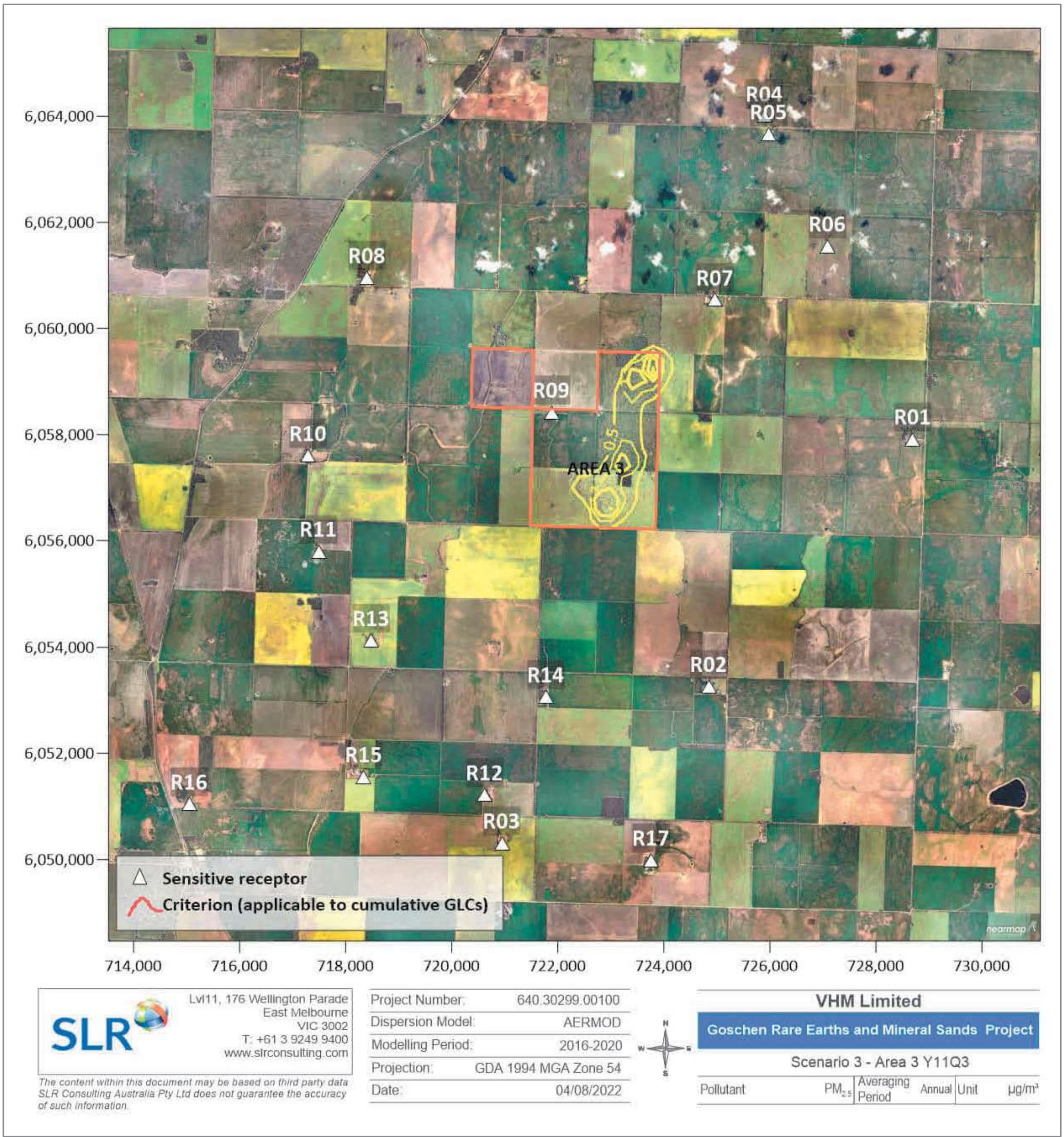


Figure 44 Scenario 3 Predicted Annual Average Project $PM_{2.5}$ GLCs (2016-2020)



11.3.4 Scenario 4 – Area 4 Y15Q2

11.3.4.1 Maximum Predicted 24-Hour Average GLCs

The maximum predicted 24-hour average cumulative PM_{10} GLCs at each receptor are provided in **Table 60** for Scenario 4 for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project, are also provided.

The maximum predicted 24-hour average Project-only PM_{10} GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 61**. Cumulative concentrations that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

The corresponding predicted $PM_{2.5}$ results are provided in **Table 62** and **Table 63** and isopleth plots of the maximum predicted 24-hour average PM_{10} and $PM_{2.5}$ Project GLCs are presented in **Figure 45** and **Figure 46**.

Table 60 Scenario 4 Maximum Predicted Cumulative 24-Hour Average PM_{10} GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**210**	0.11	210	0	**211**	1.1	210	0
R2	**210**	0.40	210	0	**211**	0.93	210	0
R3	**210**	0.030	210	0	**210**	0.49	210	0
R4	**210**	0.14	210	0	**211**	0.61	210	1
R5	**210**	0.15	210	0	**211**	0.59	210	0
R6	**210**	0.31	210	0	**210**	0.47	210	0
R7	**210**	0.43	210	1	**211**	1.2	210	1
R8	**210**	0.041	210	0	**210**	0.17	210	0
R9 [a]	***211***	*0.74*	*210*	*1*	***212***	*1.9*	*210*	*2*
R10	**210**	0.027	210	0	**210**	0.40	210	0
R11	**210**	0.077	210	0	**211**	0.54	210	0
R12	**210**	0.012	210	0	**210**	0.25	210	0
R13	**210**	0.087	210	0	**210**	0.43	210	0
R14 [b]	***210***	*0.10*	*210*	*0*	***211***	*1.0*	*210*	*0*
R15	**210**	0.011	210	0	**211**	0.94	210	0
R16	**210**	0.021	210	0	**210**	0.34	210	0
R17	**210**	0.45	210	0	**210**	0.081	210	0
Criteria	**50**				**50**			

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 61 Scenario 4 Maximum Predicted Project 24-Hour Average PM_{10} GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	3.3	3.7	7.0	3.6	6.9	7%
R2	17	5.3	22	5.9	23	33%
R3	7.5	14	21	14	21	15%
R4	4.3	9.7	14	7.7	12	9%
R5	5.1	4.3	9.4	9.0	14	10%
R6	5.5	0.9	6.4	3.3	8.8	11%
R7	16	3.5	19	5.6	21	32%
R8	7.6	2.9	10	8.9	16	15%
R9 [a]	*41*	*2.8*	***44***	*13*	***54***	*82%*
R10	6.3	2.2	8.5	9.3	16	13%
R11	5.2	2.6	7.8	4.3	9.5	10%
R12	8.6	2.6	11	4.3	13	17%
R13	5.1	33	38	5.7	11	10%
R14 [b]	*14*	*14*	*28*	*14*	*28*	*27%*
R15	5.0	2.2	7.2	9.3	14	10%
R16	1.9	5.4	7.3	5.7	7.6	4%
R17	8.5	16	24	16	24	17%
Criteria			**50**		**50**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 62 Scenario 4 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year	Maximum 24-Hour Average Concentration (µg/m³)			Maximum Additional Exceedances Each Year
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	45	0.014	45	0	81	0.0017	81	0
R2	45	0.074	45	0	81	0.0027	81	0
R3	45	0.0051	45	0	81	0.067	81	0
R4	45	0.026	45	0	81	0.046	81	0
R5	45	0.028	45	0	81	0.058	81	0
R6	45	0.048	45	0	81	0.029	81	0
R7	45	0.049	45	0	81	0.173	81	0
R8	45	0.0056	45	0	81	0.0056	81	0
R9 [a]	*45*	*0.13*	*45*	*0*	*81*	*0.22*	*81*	*0*
R10	45	0.0037	45	0	81	0.0017	81	0
R11	45	0.013	45	0	81	0.048	81	0
R12	45	0.0028	45	0	81	0.031	81	0
R13	45	0.016	45	0	81	0.0074	81	0
R14 [b]	*45*	*0.016*	*45*	*0*	*81*	*0.14*	*81*	*0*
R15	45	0.0023	45	0	81	0.0012	81	0
R16	45	0.0039	45	0	81	0.0035	81	0
R17	45	0.066	45	0	81	0.0021	81	0
Criteria	**25**				**25**			

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 63 Scenario 4 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	1.0	0.60	1.6	0.20	1.2	4%
R2	3.9	0.0	3.9	0.80	4.7	16%
R3	1.3	2.3	3.6	2.30	3.6	5%
R4	0.83	2.9	3.7	0.50	1.3	3%
R5	0.88	0.50	1.4	2.1	3.0	4%
R6	1.0	0.30	1.3	1.1	2.1	4%
R7	2.5	0.0	2.5	0.90	3.4	10%
R8	1.4	1.0	2.4	3.2	4.6	5%
R9 [a]	*9.2*	*0.60*	*9.8*	*3.9*	*13*	*37%*
R10	1.3	0.60	1.9	1.0	2.3	5%
R11	1.1	0.60	1.7	0.20	1.3	5%
R12	1.6	0.60	2.2	0.20	1.8	6%
R13	1.3	5.8	7.1	0.20	1.5	5%
R14 [b]	*2.6*	*0.40*	*3.0*	*5.1*	*7.7*	*10%*
R15	0.79	0.60	1.4	1.0	1.8	3%
R16	0.33	1.0	1.3	1.9	2.2	1%
R17	1.8	1.1	2.9	2.5	4.3	7%
Criteria			**25**		**25**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Figure 45 Scenario 4 Maximum Predicted 24-Hour Average Project PM_{10} GLCs

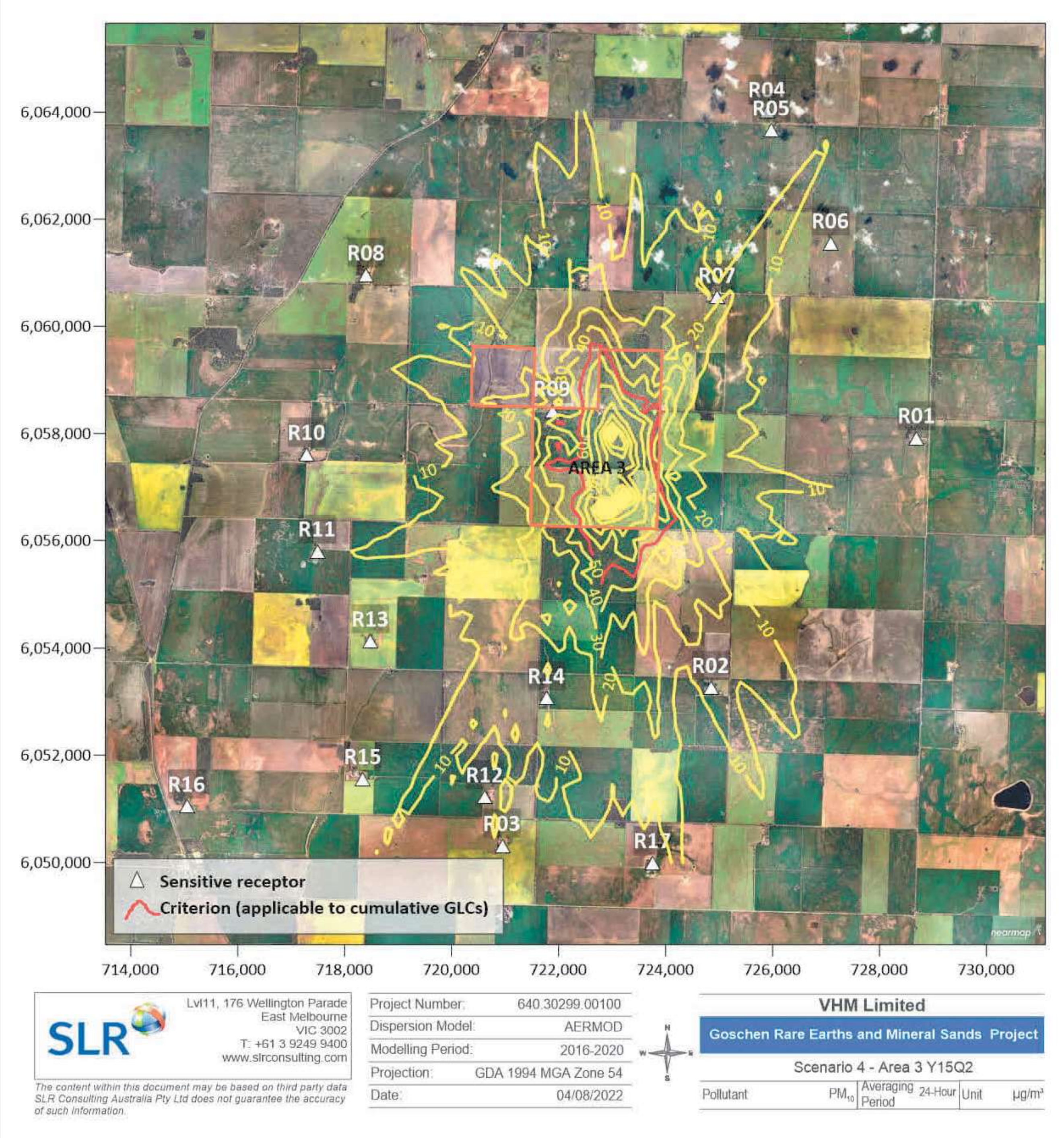
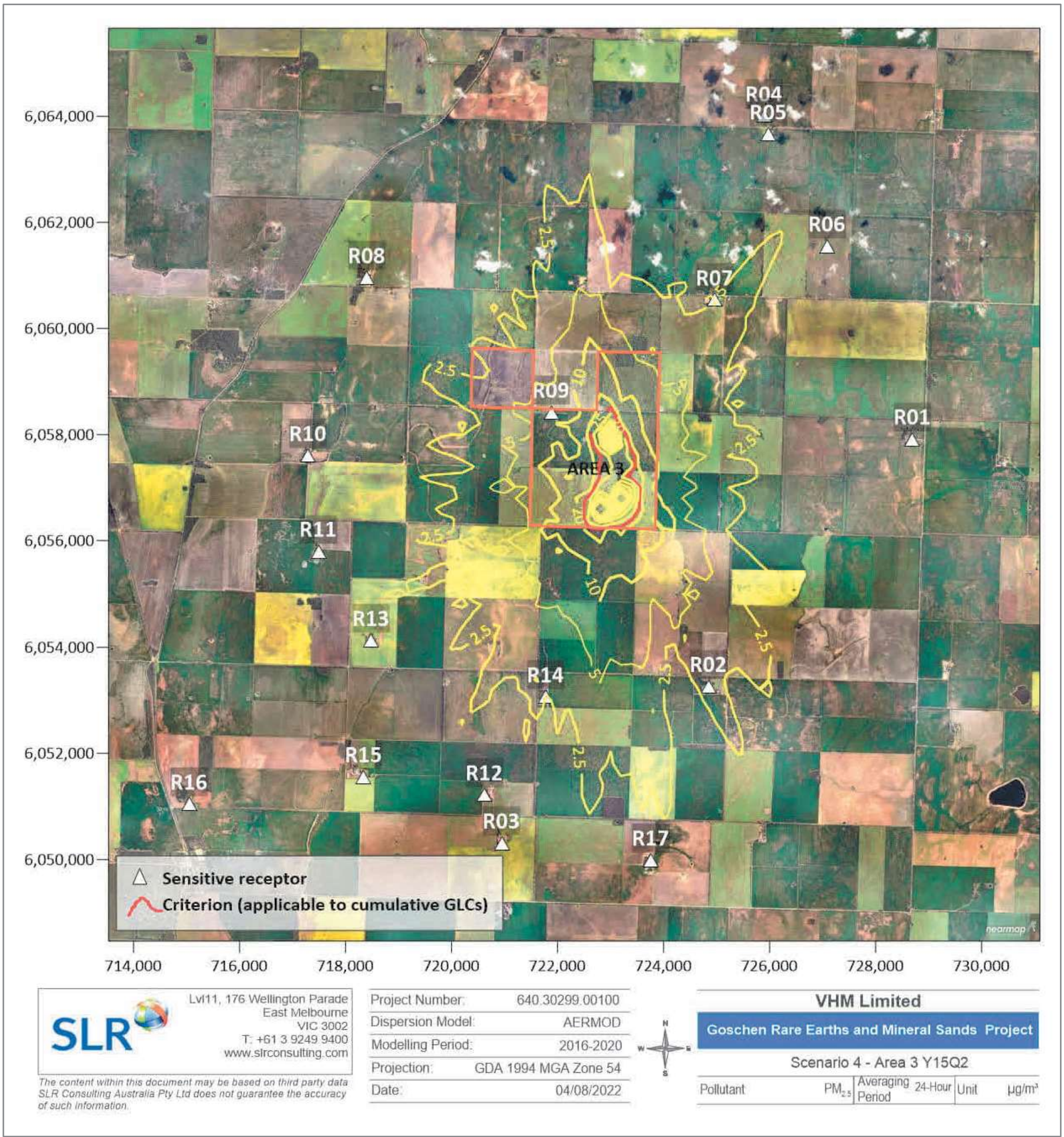


Figure 46 Scenario 4 Maximum Predicted 24-Hour Average Project $PM_{2.5}$ GLCs



11.3.4.2 Maximum Predicted Annual Average GLCs

The maximum predicted annual average (of five years) cumulative PM_{10} GLCs at each receptor are provided in **Table 64** for Scenario 3 for both normal and bushfire background concentrations years. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided. The corresponding $PM_{2.5}$ GLCs are provided in **Table 65.**

The predicted RCS GLCs at each receptor are provided in **Table 66** and the predicted metals GLCs at the most impacted receptor are provided in **Table 67.** Isopleth plots of the predicted Project annual average PM_{10} and $PM_{2.5}$ GLCs are presented in **Figure 47** and **Figure 48.**

Table 64 Scenario 4 Maximum Predicted Cumulative Annual Average PM_{10} GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.18	19	19	21	22	0.7%
R2	0.29	19	19	21	22	1.2%
R3	0.16	19	19	21	22	0.6%
R4	0.17	19	19	21	22	0.7%
R5	0.19	19	19	21	22	0.7%
R6	0.21	19	19	21	22	0.9%
R7	0.55	19	19	21	22	2.2%
R8	0.16	19	19	21	22	0.6%
R9 [a]	*1.5*	*19*	***20***	*21*	***23***	*6.0%*
R10	0.14	19	19	21	22	0.6%
R11	0.15	19	19	21	22	0.6%
R12	0.18	19	19	21	22	0.7%
R13	0.18	19	19	21	22	0.7%
R14 [b]	*0.37*	*19*	*19*	*21*	***22***	*1.5%*
R15	0.14	19	19	21	22	0.6%
R16	0.063	19	19	21	21	0.3%
R17	0.16	19	19	21	22	0.7%
Criteria			**25**		25	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Table 65 Scenario 4 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.036	2.7	2.8	3.5	3.6	0.5%
R2	0.062	2.7	2.8	3.5	3.6	0.8%
R3	0.034	2.7	2.8	3.5	3.6	0.4%
R4	0.035	2.7	2.8	3.5	3.6	0.4%
R5	0.038	2.7	2.8	3.5	3.6	0.5%
R6	0.045	2.7	2.8	3.5	3.6	0.6%
R7	0.11	2.7	2.8	3.5	3.6	1.4%
R8	0.032	2.7	2.8	3.5	3.6	0.4%
R9 [a]	*0.29*	*2.7*	*3.0*	*3.5*	*3.8*	*3.6%*
R10	0.031	2.7	2.8	3.5	3.6	0.4%
R11	0.031	2.7	2.8	3.5	3.6	0.4%
R12	0.040	2.7	2.8	3.5	3.6	0.5%
R13	0.038	2.7	2.8	3.5	3.6	0.5%
R14 [b]	*0.078*	*2.7*	*2.8*	*3.5*	*3.6*	*1.0%*
R15	0.028	2.7	2.8	3.5	3.6	0.3%
R16	0.013	2.7	2.7	3.5	3.5	0.2%
R17	0.034	2.7	2.8	3.5	3.6	0.4%
Criteria [a]			**8**		**8**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 66 Scenario 4 Maximum Predicted Cumulative Annual Average RCS GLCs

Receptor ID	Maximum Annual Average Concentration (µg/m³)			Project Contribution Relative to APAC
	Project	Background	Cumulative	
R1	0.036	0.046	0.082	1.2%
R2	0.062	0.046	0.11	2.1%
R3	0.034	0.046	0.080	1.1%
R4	0.035	0.046	0.081	1.2%
R5	0.038	0.046	0.084	1.3%
R6	0.045	0.046	0.091	1.5%
R7	0.11	0.046	0.16	3.7%
R8	0.032	0.046	0.078	1.1%
R9 [a]	*0.29*	*0.046*	*0.34*	*9.7%*
R10	0.031	0.046	0.077	1.0%
R11	0.031	0.046	0.077	1.0%
R12	0.040	0.046	0.086	1.3%
R13	0.038	0.046	0.084	1.3%
R14 [b]	*0.078*	*0.046*	*0.12*	*2.6%*
R15	0.028	0.046	0.074	0.9%
R16	0.013	0.046	0.059	0.4%
R17	0.034	0.046	0.080	1.1%
Criteria [a]			**3**	

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 67 Scenario 4 Maximum Predicted Cumulative Annual Average Metals GLCs

Most Impacted Receptor: R7							
Maximum Annual Average PM_{10} Concentration (µg/m³): 0.55							
Metal	Fraction of PM_{10} [a]	Maximum Annual Average Concentration (µg/m³)			APAC (µg/m³)	Project Contribution	
		Project	Background	Cumulative		Relative to APAC	Relative to Background
As	0.011%	0.000057	0.0020	0.0021	0.007	0.8%	2.9%
Cd	0.021%	0.00011	0.0040	**0.0041**	0.005	2.3%	2.9%
Cr	0.13%	0.00072	0.025	**0.026**	0.005	14%	2.9%
Cu	0.079%	0.00043	0.015	0.015	-	-	2.9%
Pb	0.15%	0.00080	0.028	0.029	0.5	0.2%	2.9%
Mn	0.28%	0.0015	0.053	0.055	0.15	1.0%	2.9%
Hg	0.016%	0.000086	0.0030	0.0031	1	0.01%	2.9%
Ni	0.15%	0.00080	0.028	0.029	0.09	0.9%	2.9%
V	0.042%	0.00023	0.0080	0.0082	-	-	2.9%
Zn	0.31%	0.0017	0.058	0.060	2	0.1%	2.9%

a Estimated metals fraction (refer **Section 7.6.2.3.4**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Red font indicates cumulative concentration exceeds the APAC.

Figure 47 Scenario 4 Predicted Annual Average Project PM_{10} GLCs (2016-2020)

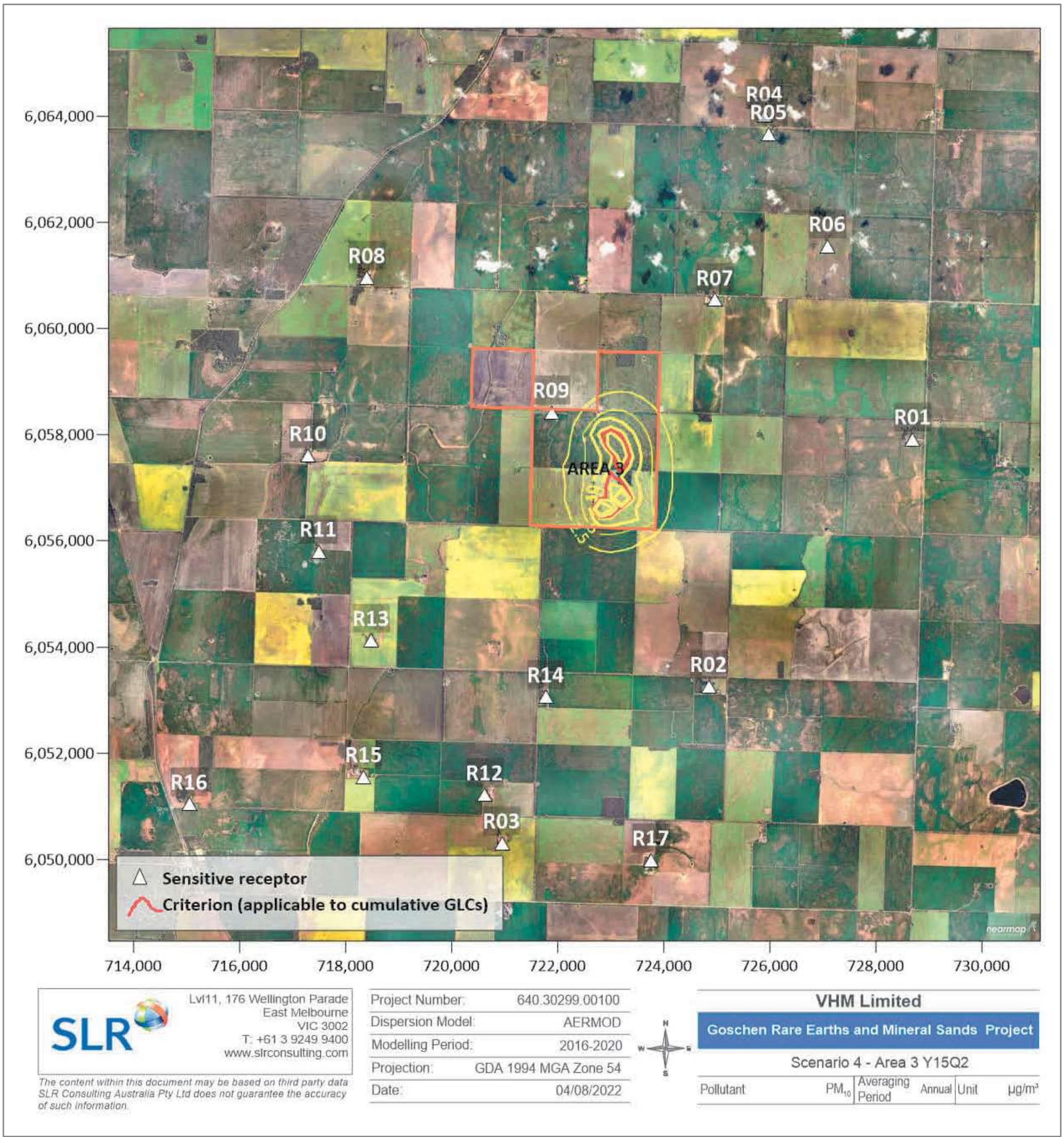
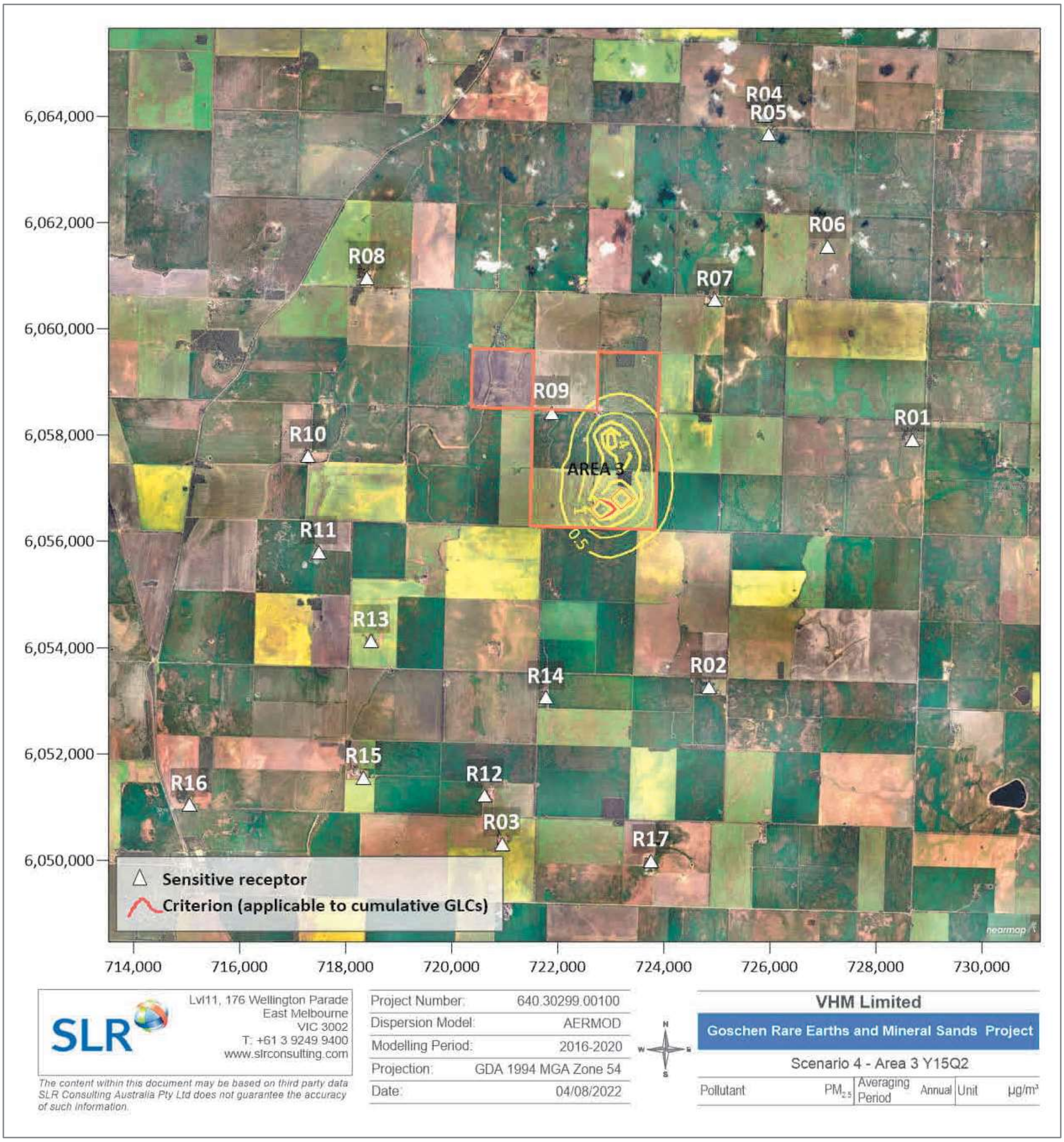


Figure 48 Scenario 4 Predicted Annual Average Project $PM_{2.5}$ GLCs (2016-2020)



11.3.5 Predicted Indicative Dust Deposition Rates

The maximum predicted annual average (of five years) Project and cumulative dust deposition rates at each receptor for each Scenario are provided in **Table 68**.

Isopleth plots of the predicted Project annual average Project dust deposition rates are presented in **Figure 49** to **Figure 52**.

Table 68 Maximum Annual Average Dust Deposition Rates

Receptor ID	Dust Deposition Rate (g/m²/month)								
	Project				Background	Cumulative			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4		Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1	0.0094	0.010	0.019	0.021	2.8	2.8	2.8	2.8	2.8
R2	0.028	0.037	0.027	0.033	2.8	2.8	2.8	2.8	2.8
R3	0.053	0.071	0.010	0.012	2.8	2.9	2.9	2.8	2.8
R4	0.006	0.0066	0.018	0.013	2.8	2.8	2.8	2.8	2.8
R5	0.006	0.0069	0.020	0.015	2.8	2.8	2.8	2.8	2.8
R6	0.0066	0.008	0.026	0.020	2.8	2.8	2.8	2.8	2.8
R7	0.010	0.011	0.079	0.045	2.8	2.8	2.8	2.9	2.8
R8	0.010	0.008	0.011	0.013	2.8	2.8	2.8	2.8	2.8
R9	0.020	0.019	*0.092* [a]	*0.15* [a]	2.8	2.8	2.8	*2.9* [a]	*2.9* [a]
R10	0.017	0.012	0.0094	0.010	2.8	2.8	2.8	2.8	2.8
R11	0.029	0.018	0.010	0.011	2.8	2.8	2.8	2.8	2.8
R12	0.12	0.14	0.012	0.013	2.8	2.9	2.9	2.8	2.8
R13	0.093	0.046	0.012	0.013	2.8	2.9	2.8	2.8	2.8
R14 [b]	*0.26*	*0.65*	*0.023*	*0.030*	*2.8*	*3.1*	*3.4*	*2.8*	*2.8*
R15	0.055	0.040	0.0093	0.010	2.8	2.9	2.8	2.8	2.8
R16	0.012	0.010	0.0046	0.0042	2.8	2.8	2.8	2.8	2.8
R17	0.019	0.027	0.0095	0.010	2.8	2.8	2.8	2.8	2.8
Guideline	**2**					**4**			

a Location will not be considered a sensitive receptor during Project phase in Area 3 (refer **Section 8.2**).

b Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Figure 49 Scenario 1 Predicted Annual Average Project Dust Deposition Rates (2016-2020)

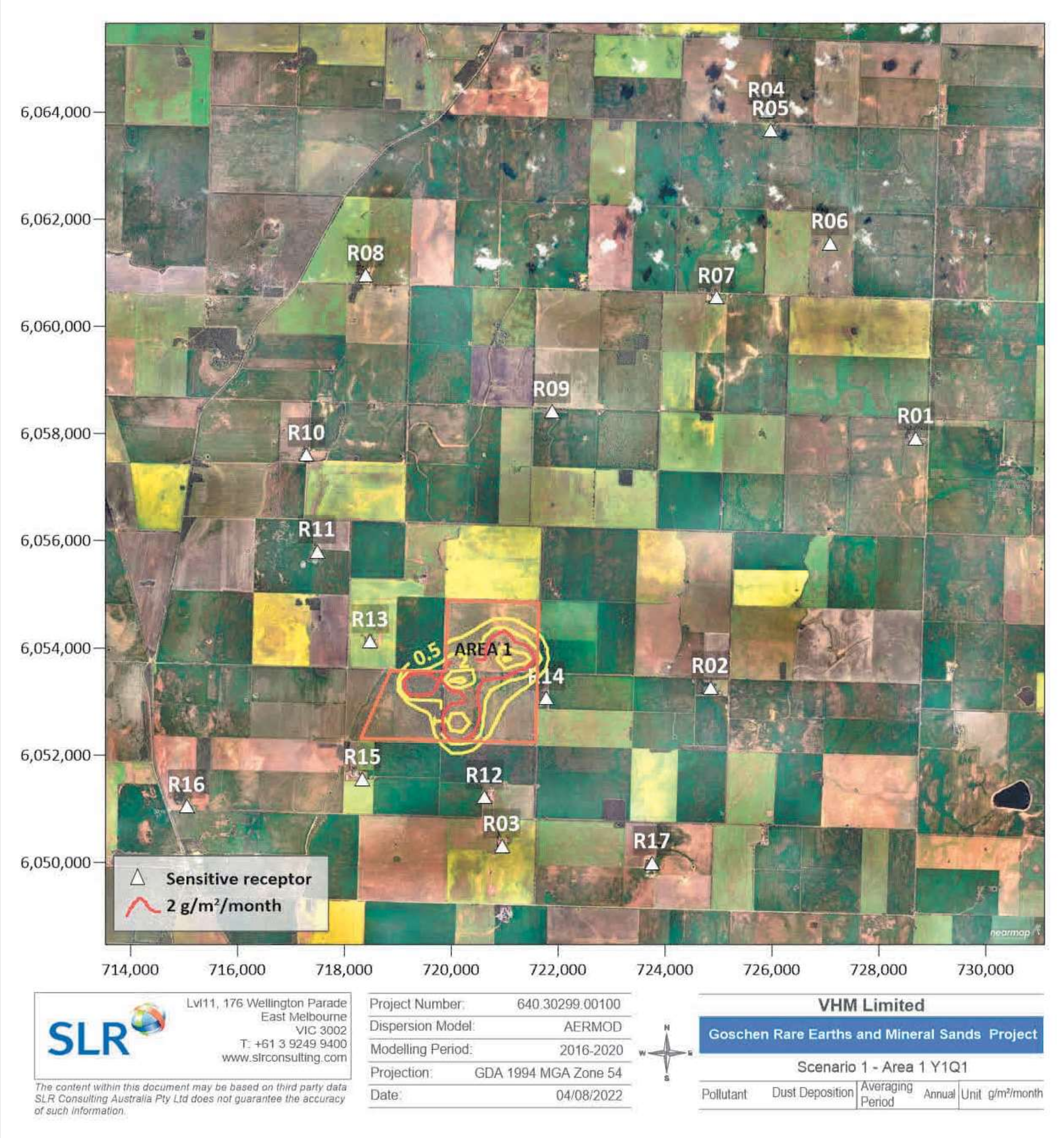


Figure 50 Scenario 2 Predicted Annual Average Project Dust Deposition Rates (2016-2020)

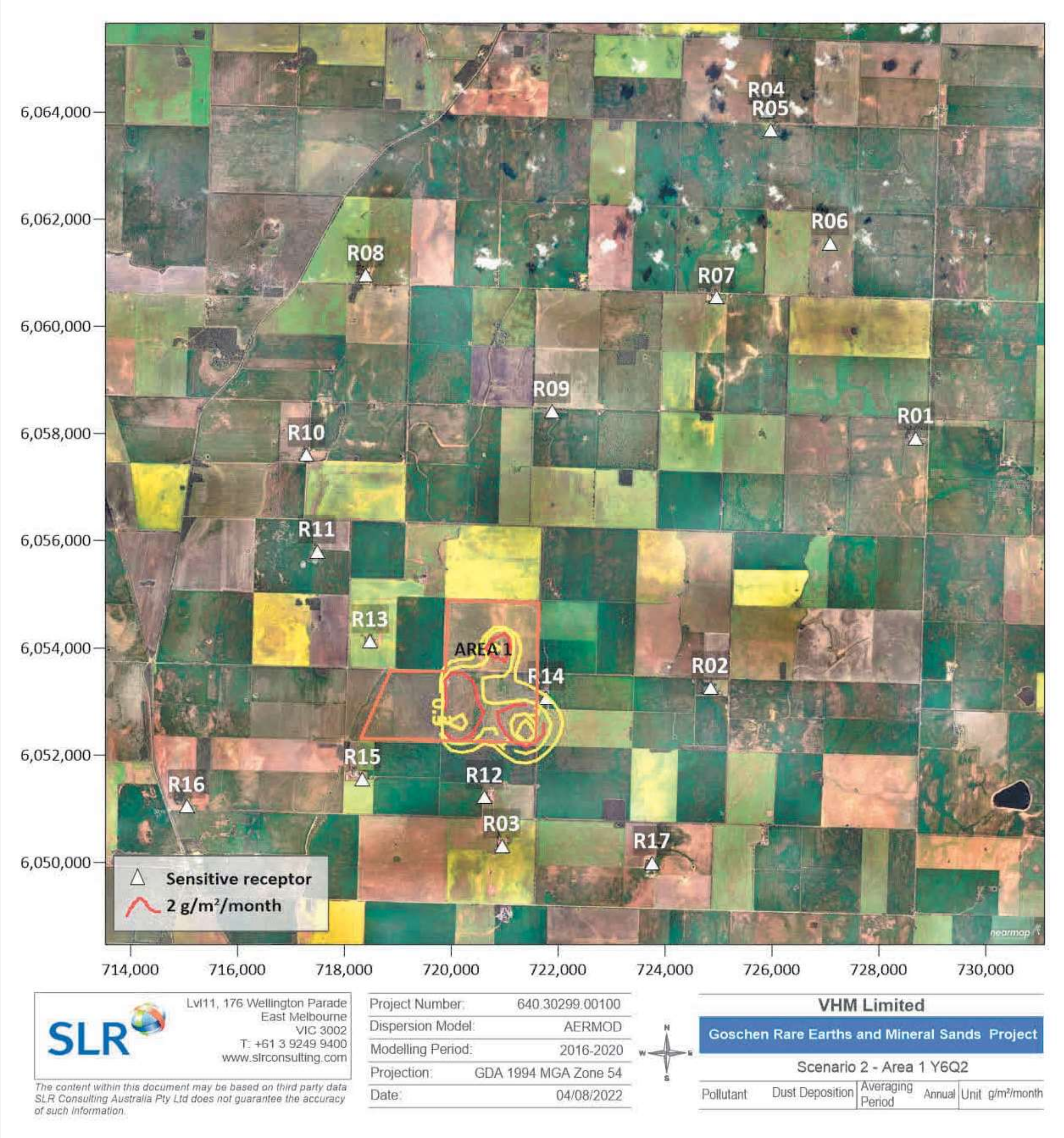


Figure 51 Scenario 3 Predicted Annual Average Project Dust Deposition Rates (2016-2020)

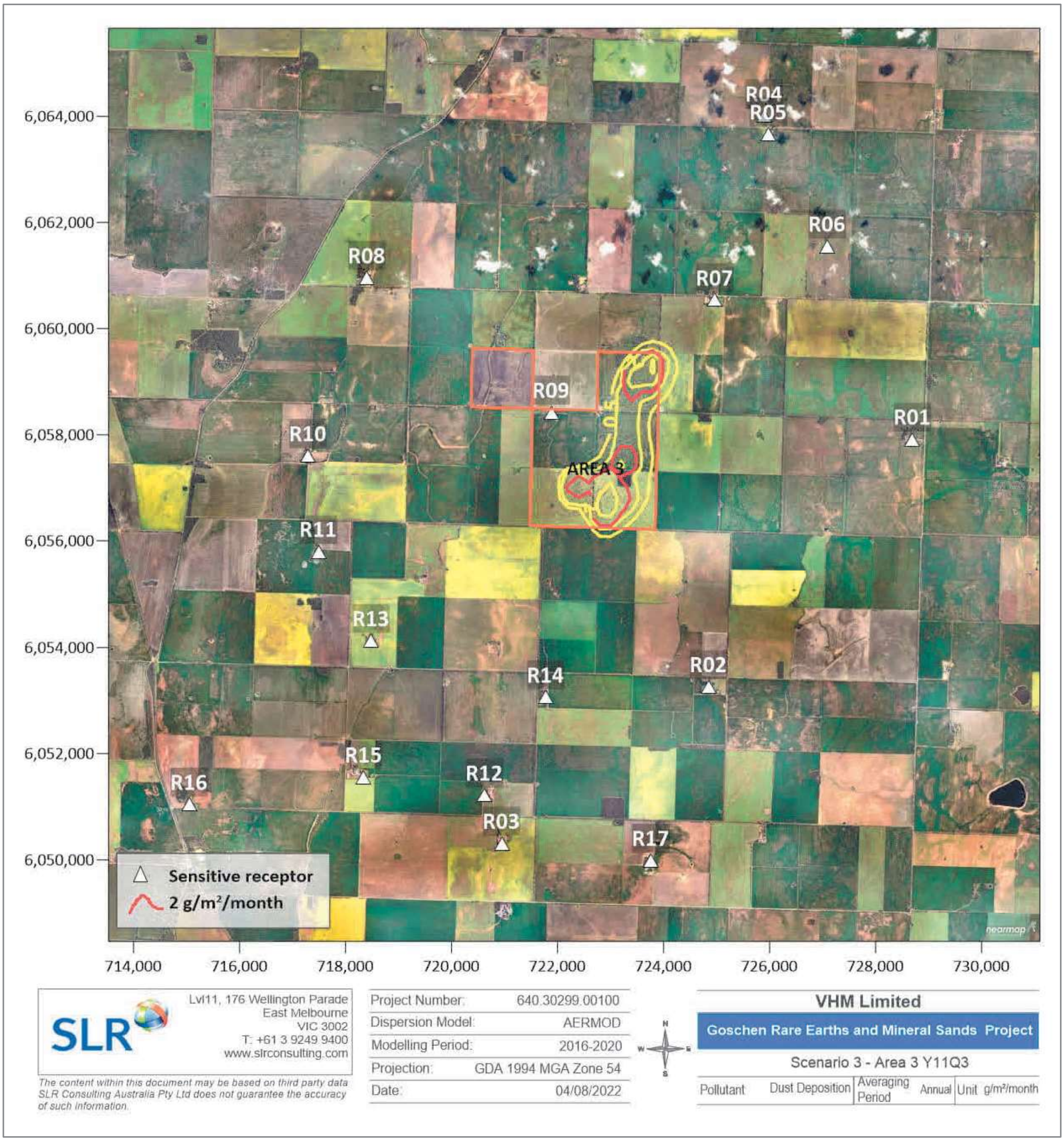
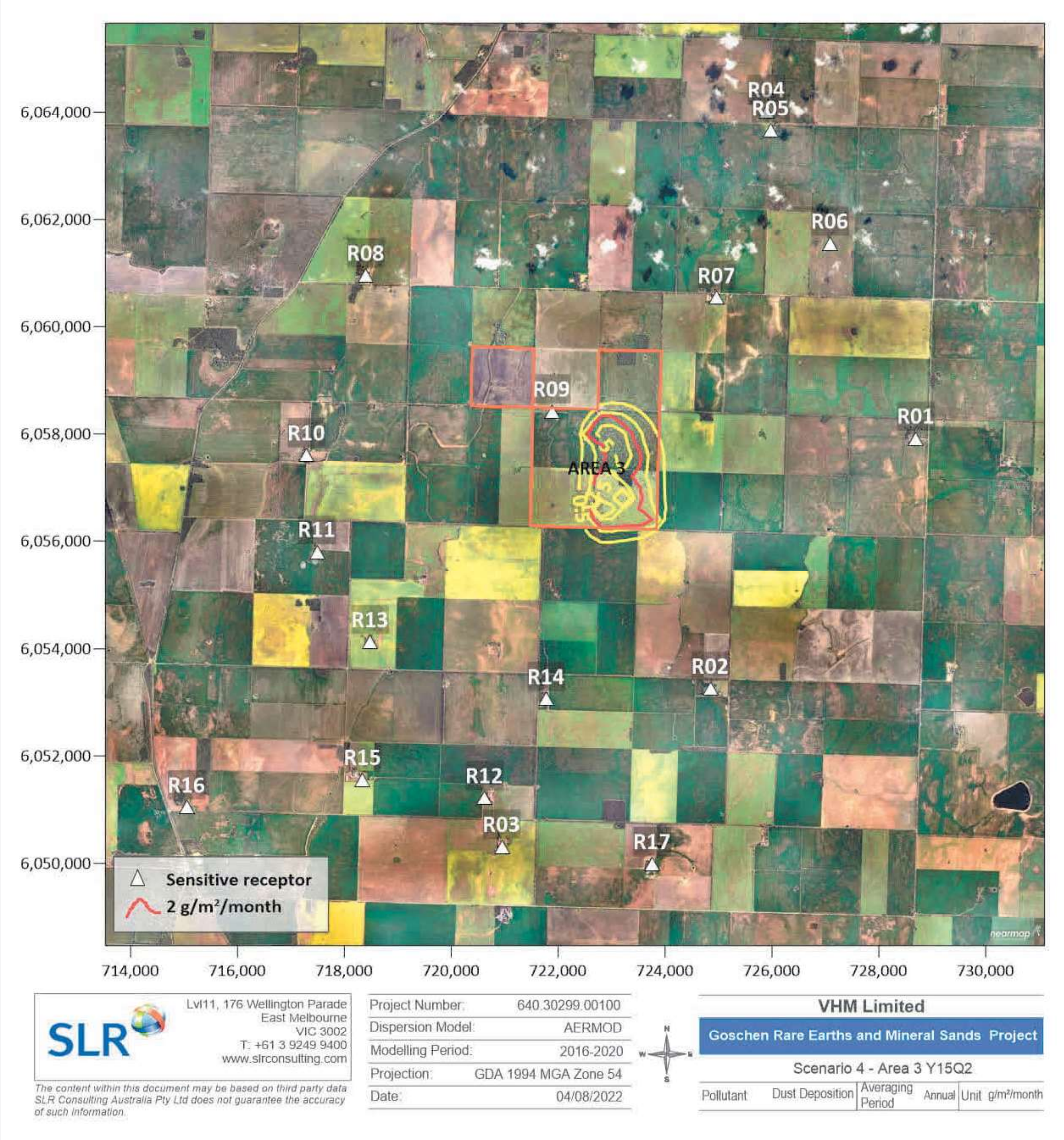


Figure 52 Scenario 4 Predicted Annual Average Project Dust Deposition Rates (2016-2020)



11.3.5.1 Metals Deposition

An estimation of the potential deposition of metals into rainwater tanks at sensitive receptors due to the Project is presented below. This assumes that the receptors have rainwater tanks and use these as their primary source of drinking water.

The average annual rainfall measured in nearby Swan Hill (refer **Section 8.4.2**) of 301 mm. A typical rural dwelling that uses the roof to collect rain water into a tank might therefore collect approximately 300 litres/m^2/year (L/m^2/year) into which metals in dust deposited on the roof might mix.

Table 68 (**Section 11.3.5**) indicates that R12 is predicted to be the most impacted receptor with a maximum predicted annual average dust deposition rate of 0.14 g/m^2/month, or 1.7 g/m^2/year, under Scenario 2. The resulting indicative maximum annual average deposition rate of metals resulting from the Project for receptor R12, conservatively assuming that all deposited dust contains metals fractions based on those of the PM_{10} background monitoring data (refer **Section 7.6.2.3.4**), is provided in **Table 69.** The resulting maximum predicted Project contribution to the metals concentrations in rainwater collected over one year is also presented, and compared with the current Australian drinking water guideline values with which they comply. This indicative assessment does not account for potential existing background deposition rates of metals at sensitive receptors for which there is no monitoring data at this time.
It is proposed to offer rainwater tank water quality testing to sensitive receptors nearest to the Project areas prior to the Project, and during the Project at regular intervals (refer **Section 13.2**).

Table 69 Maximum Predicted Annual Average Metals Deposition to Rainwater Tanks

Most Impacted Receptor: R12					
Maximum Annual Average Deposition Rate: 1.7 g/m^2/year					
Metal	Fraction of Dust [a]	Maximum Annual Average Deposition Rate (mg/m^2/year)	Average Rainfall (L/m^2/year)	Maximum Project Contribution to Rainwater Tank Concentration (mg/L)	Drinking Water Guideline (mg/L)
As	0.011%	0.18	300	0.00060	0.010
Cd	0.021%	0.36	300	0.0012	0.002
Cr	0.13%	2.3	300	0.0075	0.05
Cu	0.079%	1.4	300	0.0045	2
Pb	0.15%	2.5	300	0.0084	0.01
Mn	0.28%	4.8	300	0.016	0.5
Hg	0.016%	0.27	300	0.00090	0.001
Ni	0.15%	2.5	300	0.0084	0.02
V	0.042%	0.72	300	0.0024	-
Zn	0.31%	5.3	300	0.017	3.0

a Based on estimated metals fraction in PM_{10} (refer **Section 7.6.2.3.4**)
Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

11.3.6 Power Station

11.3.6.1 NO_2

The maximum (99.9th percentile) predicted 1-hour average cumulative NO_2 GLCs at and beyond the Project site boundary and at the sensitive receptors are provided in **Table 70**. Maximum predicted annual average (of five years) Project GLCS are also provided. Cumulative GLCs, including conservative background NO_2 concentrations, comply with the NO_2 1-hour average and annual average criteria at all sensitive receptors. Exceedances of the 1-hour and annual average criteria are predicted at or beyond the Project boundary.

Isopleths of the maximum 1-hour average and annual average GLCs are presented in **Figure 53** and **Figure 54**

Table 70 Maximum Predicted NO_2 GLCs at Sensitive Receptors (Power Station)

ID	Maximum (99.9th Percentile) 1 Hour Average NO_2 Concentration (µg/m³)			Project Contribution Relative to APAC	Annual Average NO_2 Concentration (µg/m³)			Project Contribution Relative to APAC
	Cumulative	Project [a]	Background [b]		Project [a]	Background [b]	Cumulative	
Project Boundary [c]	**957**	940	17	627%	44	19	**63**	157%
R1	77	0.015	77	51%	0.11	19	19	0.4%
R2	77	0.0033	77	51%	0.30	19	19	1.1%
R3	86	39	47	57%	0.31	19	19	1.1%
R4	77	39	38	51%	0.15	19	19	0.5%
R5	75	0.033	75	50%	0.15	19	19	0.5%
R6	76	4.5	71	51%	0.13	19	19	0.5%
R7	84	31.3	53	56%	0.23	19	19	0.8%
R8	77	0.008	77	51%	0.16	19	19	0.6%
R9	89	38	51	59%	0.43	19	19	1.5%
R10	80	29	51	53%	0.33	19	19	1.2%
R11	85	0.044	85	56%	0.51	19	19	1.8%
R12	97	74	23	64%	0.45	19	19	1.6%
R13	**126**	70	56	84%	1.3	19	20	4.7%
R14 [d]	*106*	*74*	*32*	*71%*	*0.89*	*19*	*19*	*3.2%*
R15	100	38	62	67%	0.76	19	19	2.7%
R16	81	22	58	54%	0.25	19	19	0.9%
R17	79	45	34	53%	0.24	19	19	0.9%
Criteria	**150**					**Health** **Vegetation**	**28** **30**	

a Assumed NO_2 to NO_x ratio of 30% (**Section 7.6.2.2.3**).

b Refer **Section 8.5**

c At or beyond the Project site boundary.

d Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Orange font indicates cumulative concentration is equal to or greater than 80% of the APAC.

Red font indicates cumulative concentration exceeds the APAC.

Figure 53 Maximum (100th Percentile) Predicted 1-Hour Average NO_2 GLCs (Power Station)

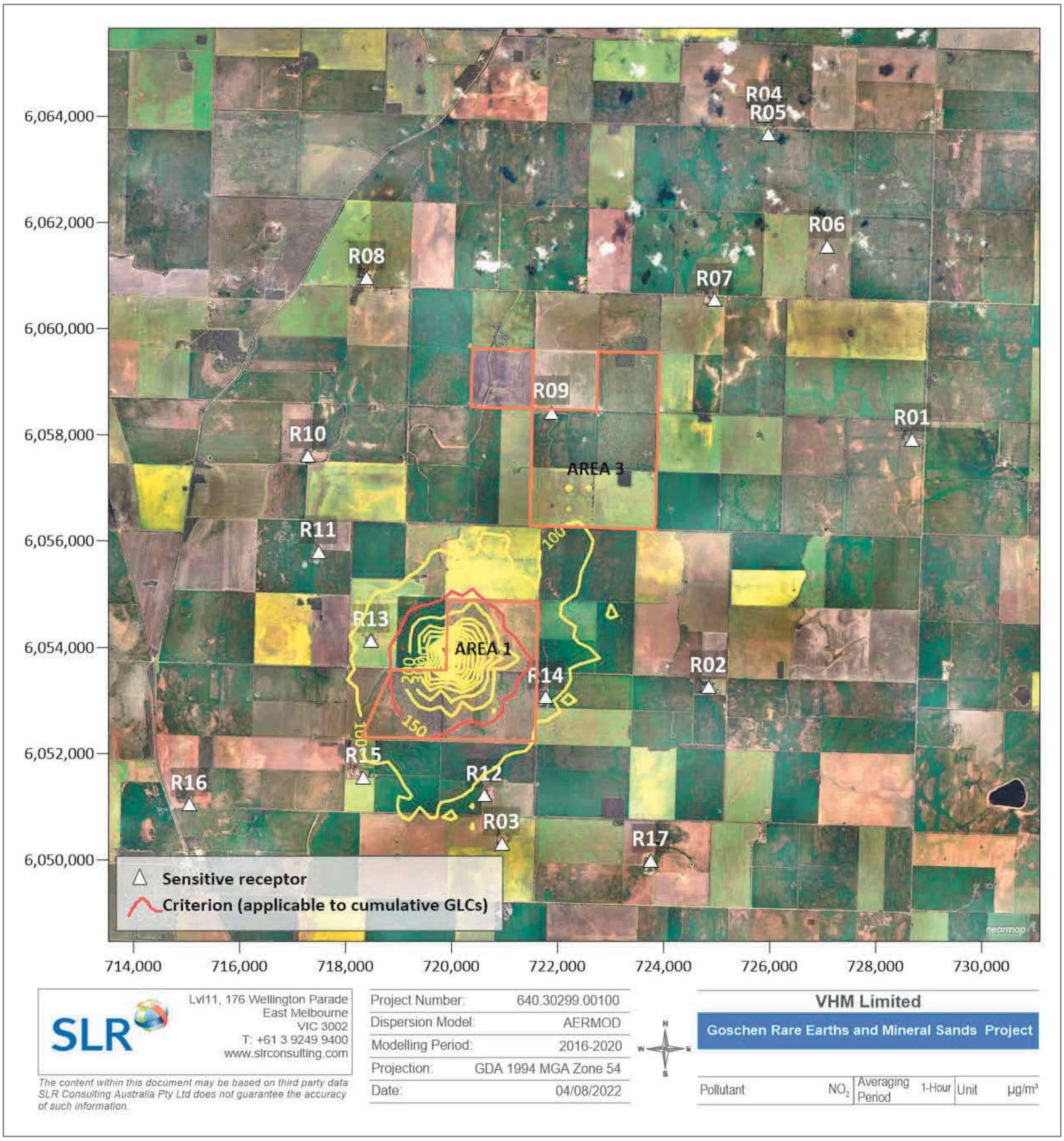
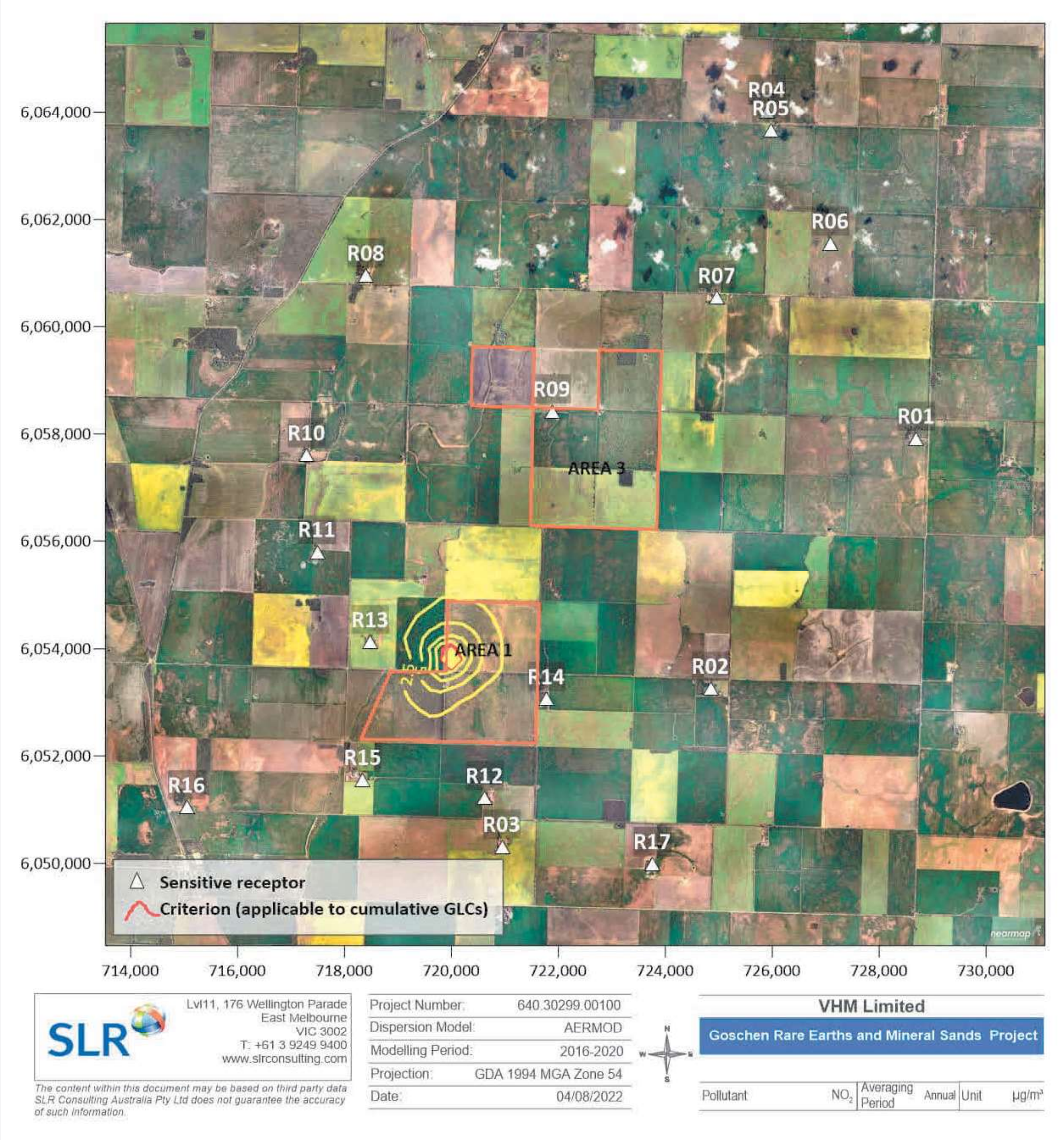


Figure 54 Predicted Annual Average NO_2 GLCs (Power Station)



11.3.6.2 $PM_{2.5}$

The maximum predicted 24-hour average cumulative $PM_{2.5}$ GLCs resulting from power station emissions to air at each receptor are provided in **Table 71** for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The maximum number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project every year, are also provided.

The maximum predicted 24-hour average Project-only $PM_{2.5}$ GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 72.** Cumulative concentrations that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

Corresponding annual average predictions are provided in **Table 73**.

Table 71 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs (Power Station)

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Additional Exceedances	Maximum 24-Hour Average Concentration (µg/m³)			Additional Exceedances
	Cumulative	Project	Background		Cumulative	Project	Background	
R1	**45**	0.0090	45	0	**81**	0.00035	81	0
R2	**45**	0.0088	45	0	**81**	0.00036	81	0
R3	**45**	0.0089	45	0	**81**	0.00048	81	0
R4	**45**	0.0023	45	0	**81**	0.011	81	0
R5	**45**	0.0030	45	0	**81**	0.011	81	0
R6	**45**	0.0041	45	0	**81**	0.0034	81	0
R7	**45**	0.0073	45	0	**81**	0.011	81	0
R8	**45**	0.011	45	0	**81**	0.0056	81	0
R9	**45**	0.0063	45	0	**81**	0.031	81	0
R10	**45**	0.0075	45	0	**81**	0.024	81	0
R11	**45**	0.0047	45	0	**81**	0.0048	81	0
R12	**45**	0.020	45	0	**81**	0.0012	81	0
R13	**45**	0.022	45	0	**81**	0.0029	81	0
R14 [a]	**45**	*0.066*	*45*	*0*	**81**	*0.0013*	*81*	*0*
R15	**45**	0.0019	45	0	**81**	0.0081	81	0
R16	**45**	0.00088	45	0	**81**	0.0040	81	0
R17	**45**	0.0060	45	0	**81**	0.00033	81	0
Criteria	**25**				**25**			

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Red font indicates cumulative concentration exceeds the APAC.

Table 72 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs (Power Station)

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.097	0.60	0.70	0.20	0.30	0.4%
R2	0.17	0.10	0.27	0.80	0.97	0.7%
R3	0.46	0.70	1.2	2.4	2.9	1.8%
R4	0.094	1.2	1.3	1.9	2.0	0.4%
R5	0.094	1.2	1.3	1.9	2.0	0.4%
R6	0.061	0.2	0.26	0.0	0.061	0.2%
R7	0.12	0.4	0.52	1.1	1.2	0.5%
R8	0.12	1.2	1.3	0.4	0.5	0.5%
R9	0.26	3.5	3.8	0.50	0.76	1.0%
R10	0.18	0.0	0.18	0.0	0.18	0.7%
R11	0.22	4.6	4.8	2.5	2.7	0.9%
R12	0.61	0.70	1.3	2.4	3.0	2.4%
R13	0.65	0.0	0.65	2.4	3.1	2.6%
R14 [a]	*0.38*	*1.8*	*2.2*	*1.1*	*1.5*	*1.5%*
R15	0.38	2.6	3.0	0.50	0.88	1.5%
R16	0.22	0.0	0.22	0.80	1.0	0.9%
R17	0.20	1.1	1.3	1.9	2.1	0.8%
Criteria			**25**		**25**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

Table 73 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs (Power Station)

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R1	0.0027	2.7	2.7	3.5	3.5	<0.1%
R2	0.0061	2.7	2.7	3.5	3.5	0.1%
R3	0.0088	2.7	2.7	3.5	3.5	0.1%
R4	0.0038	2.7	2.7	3.5	3.5	<0.1%
R5	0.0038	2.7	2.7	3.5	3.5	<0.1%
R6	0.0027	2.7	2.7	3.5	3.5	<0.1%
R7	0.0055	2.7	2.7	3.5	3.5	0.1%
R8	0.0056	2.7	2.7	3.5	3.5	0.1%
R9	0.011	2.7	2.7	3.5	3.5	0.1%
R10	0.0066	2.7	2.7	3.5	3.5	0.1%
R11	0.011	2.7	2.7	3.5	3.5	0.1%
R12	0.012	2.7	2.7	3.5	3.5	0.2%
R13	0.026	2.7	2.8	3.5	3.6	0.3%
R14 [a]	*0.020*	*2.7*	*2.8*	*3.5*	*3.6*	*0.3%*
R15	0.017	2.7	2.8	3.5	3.6	0.2%
R16	0.0046	2.7	2.7	3.5	3.5	0.1%
R17	0.0044	2.7	2.7	3.5	3.5	0.1%
Criteria			**8**		**8**	

a Location will not be considered a sensitive receptor during Project (refer **Section 8.2**).

11.3.7 Pumping Station

11.3.7.1 NO_2

The maximum (99.9th percentile) predicted 1-hour average cumulative NO_2 GLCs at and beyond the pumping station site boundary and at the sensitive receptors are provided in **Table 74**. Maximum predicted annual average (of five years) Project GLCs are also provided. Cumulative GLCs, including conservative background NO_2 concentrations, comply with the NO_2 1-hour average and annual average criteria at all sensitive receptors. Exceedances of the 1-hour and annual average criteria are predicted at or beyond the pumping station site boundary.

Isopleths of the maximum 1-hour average and annual average Project GLCs (no background) are presented in **Figure 55**and **Figure 56**. Note where the isopleth equal to the APAC is depicted in red, this is strictly applicable to the cumulative GLCs, not the Project only GLCs provided.

Table 74 Maximum Predicted NO_2 GLCs at Sensitive Receptors (Pumping Station)

ID	Maximum (99.9th Percentile) 1 Hour Average NO_2 Concentration (µg/m³)			Project Contribution Relative to APAC	Annual Average NO_2 Concentration (µg/m³)			Project Contribution Relative to APAC
	Cumulative	Project [a]	Background [b]		Project [a]	Background [b]	Cumulative	
Site Boundary [c]	**448**	392	56	261%	8.0	20	**28**	29%
R18	94	33	60	62%	2.7	17	20	9.6%
R19	80	31	49	53%	1.5	17	19	5.4%
R20	73	8.7	64	48%	0.68	17	18	2.4%
Criteria	**150**						**Health**	**28**	
						Vegetation	**30**	

a Assumed NO_2 to NO_x ratio of 30% (**Section 7.6.2.2.3**).

b Refer **Section 8.5**

c At or beyond the Project site boundary.

Red font indicates cumulative concentration exceeds the APAC.

Figure 55 Maximum (100th Percentile) Predicted 1-Hour Average NO_2 GLCs (Pumping Station)

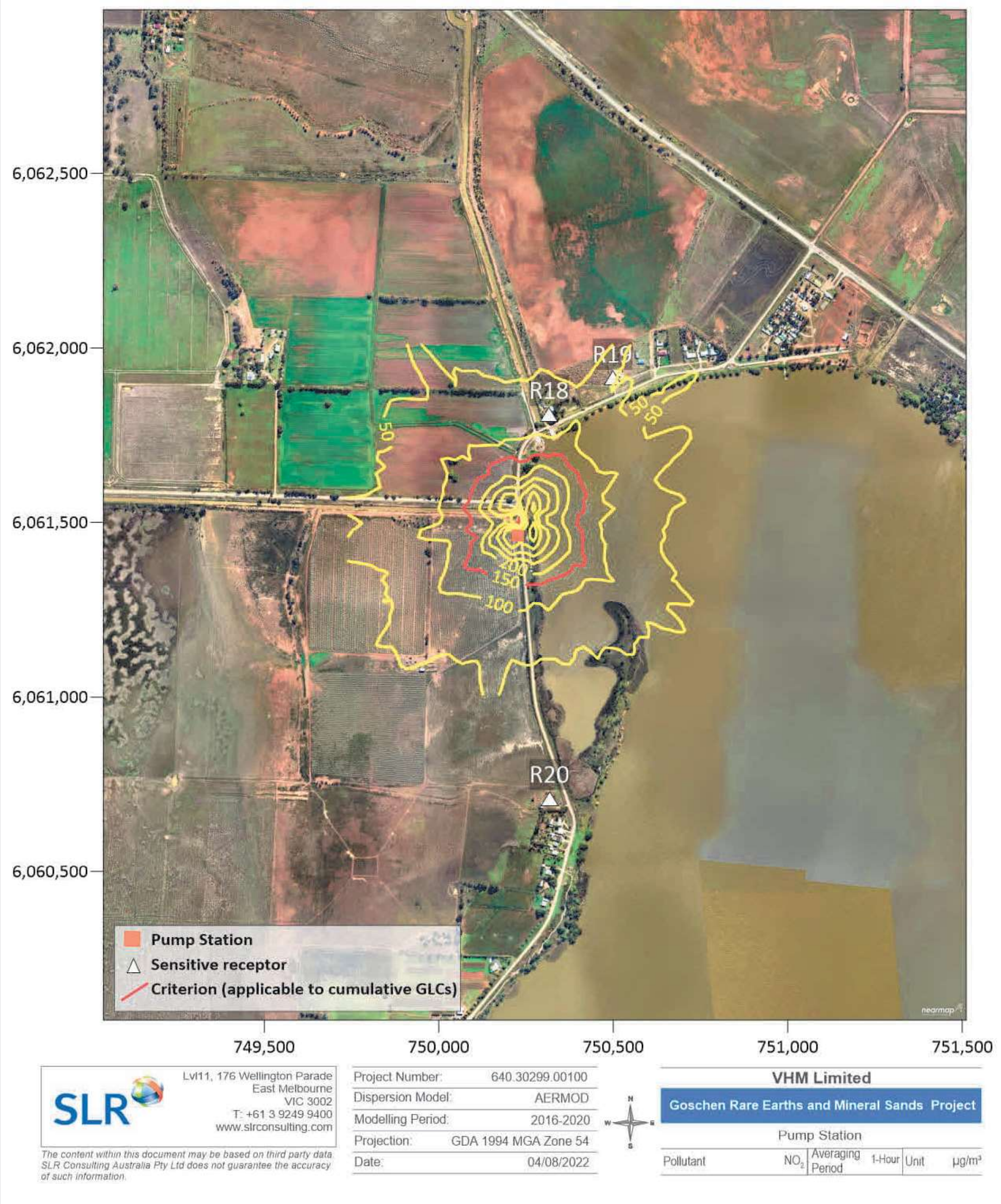
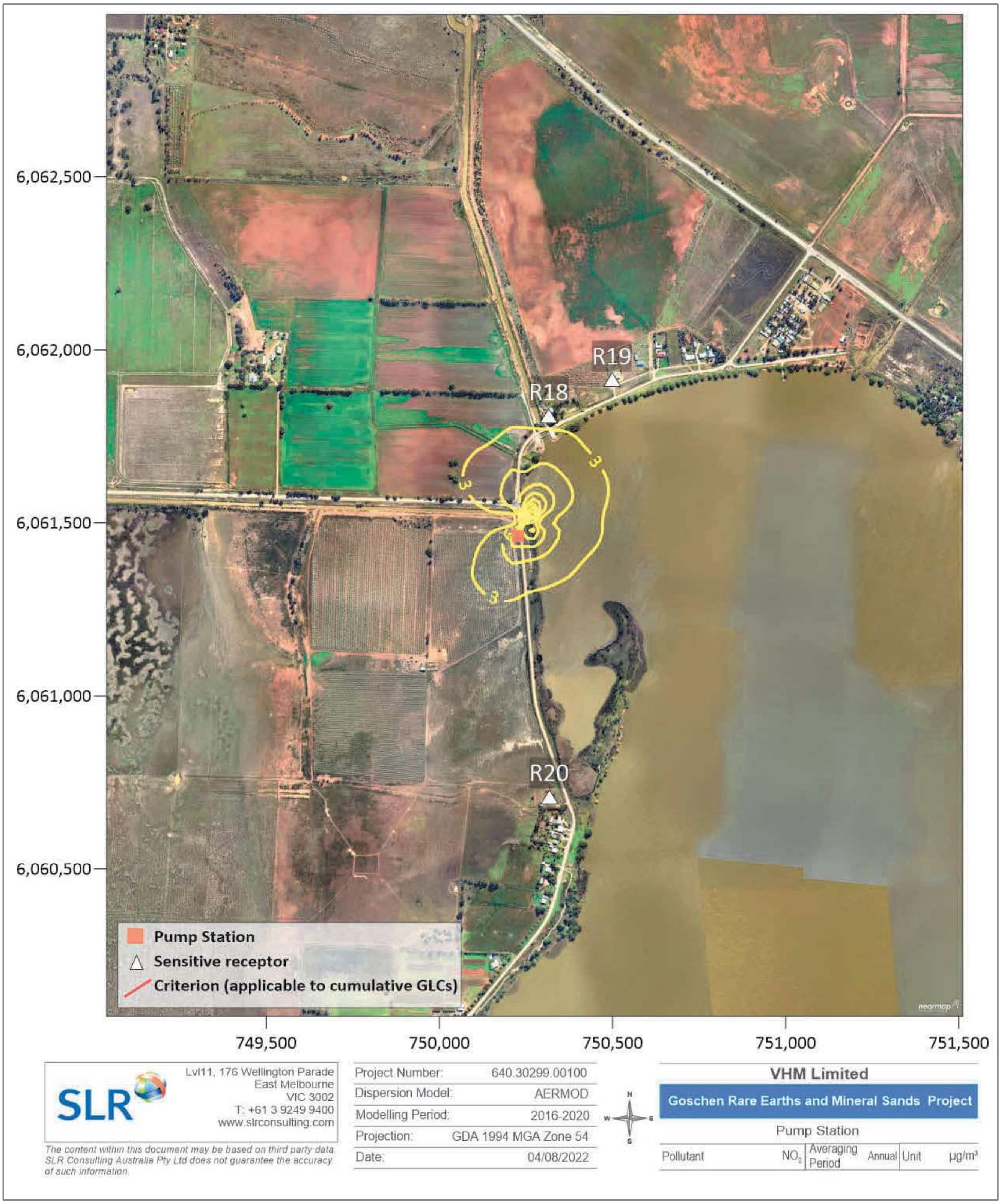


Figure 56 Predicted Annual Average NO_2 GLCs (Pumping Station)



11.3.7.2 $PM_{2.5}$

The maximum predicted 24-hour average cumulative $PM_{2.5}$ GLCs resulting from pumping station emissions to air at each receptor are provided in **Table 75** for both normal and bushfire background concentrations years. Exceedances of the APAC are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. Cumulative GLCs that approach or exceed the APAC are highlighted in orange or red, respectively. The maximum number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project every year, are also provided.

The maximum predicted 24-hour average Project-only $PM_{2.5}$ GLCs at each receptor, along with the corresponding background and resulting cumulative concentrations, are provided in **Table 76.** Cumulative concentrations that approach or exceed the APAC are highlighted in orange or red, respectively. The predicted Project contributions relative to the APAC, expressed as percentages, are also provided.

Corresponding annual average predictions are provided in **Table 77**.

Table 75 Maximum Predicted Cumulative 24-Hour Average $PM_{2.5}$ GLCs (Pumping Station)

Receptor ID	Normal Background Year				Bushfire Impacted Background Year			
	Maximum 24-Hour Average Concentration (µg/m³)			Additional Exceedances	Maximum 24-Hour Average Concentration (µg/m³)			Additional Exceedances
	Cumulative	Project	Background		Cumulative	Project	Background	
R18	**45**	0.11	45	0	**81**	0.17	81	0
R19	**45**	0.12	45	0	**81**	0.11	81	0
R20	**45**	0.066	45	0	**81**	0.019	81	0
Criteria	**25**				**25**			

Red font indicates cumulative concentration exceeds the APAC.

Table 76 Maximum Predicted Project 24-Hour Average $PM_{2.5}$ GLCs (Pumping Station)

Receptor ID	Maximum 24-Hour Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R18	0.62	0.00	0.62	1.0	1.6	2.5%
R19	0.32	0.00	0.32	0.80	1.1	1.3%
R20	0.19	0.10	0.29	0.0	0.19	0.8%
Criteria			**25**		**25**	

Table 77 Maximum Predicted Cumulative Annual Average $PM_{2.5}$ GLCs (Pumping Station)

Receptor ID	Maximum Annual Average Concentration (µg/m³)					Project Contribution Relative to APAC
	Project	Normal Background Year		Bushfire Impacted Background Year		
		Background	Cumulative	Background	Cumulative	
R18	0.054	2.7	2.8	3.5	3.6	0.7%
R19	0.030	2.7	2.8	3.5	3.6	0.4%
R20	0.014	2.7	2.7	3.5	3.5	0.2%
Criteria			**8**		**8**	

11.4 Summary of Residual Impacts

Residual impacts are those that remain once mitigation and management measures have been implemented. This section describes potential residual impacts during the operation phase of the Project, once mitigation and management measures have been considered and applied.

Mining Activities

Elevated background concentrations of PM_{10} and $PM_{2.5}$ (representative of normal and bushfire years) result in exceedances of the 24-hour criteria at all receptors before the Project contribution is considered. Depending on the modelled scenario, there is one additional exceedance predicted at one or more of R1, R4, R7, R9, R12 and R15 under normal and bushfire background conditions.

Table 78 summarises the highest predicted Project PM_{10} GLCs at valid sensitive receptors for each Scenario. The second and third highest predicted Project GLCs in any year are also provided and demonstrate that these are significantly lower than the 5-year maximum. Analysis of the model data indicates that the primary contributor to the predicted elevated impacts at these receptors is the wheel-generated dust associated with haulage of topsoil, overburden and ore. Watering of the haul routes has been assumed to provide a control of 95% on wheel generated dust emissions. The maintenance of haul road surfaces and use of chemical stabilisers could provide additional mitigation benefits reducing the emissions and potential impacts further.

Table 78 Maximum Predicted Project 24-Hour Average PM_{10} GLCs by Scenario

Modelled Scenario	Receptor ID	Maximum Concentration (µg/m³)	Project Contribution Relative to APAC	Second Highest Predicted Concentration (µg/m³)	Third Highest Predicted Concentration (µg/m³)
1	R12	25	50%	21	13
2	R12	19	38%	14	13
3	R2	8.2	16%	3.7	1.9
4	R2	17	34%	6.9	5.5

The annual average PM_{10} APAC, 24-hour and annual average $PM_{2.5}$ criteria, and annual average RCS APAC are met at all sensitive receptors under all modelled scenarios with the Project contributions generally being a relatively low percentage of the relevant APAC (maximum contribution of 50% for 24-hour average PM_{10} under Scenario 1).

The annual average metals (as PM_{10}) GLCs at the most impacted sensitive receptor meets the APACS for all metals, with the exception of chromium due to an assumed background concentration that exceeds the APAC before the Project contribution is added. The maximum predicted Project contribution of chromium is approximately 28% of the APAC, and 5.6% of the background concentration. It would be prudent to offer rainwater tank water quality testing at the nearest sensitive receptors before the Project and during the Project at regular intervals.

With regard to the potential for the Project to impact dust deposition rates, indicative modelling indicates that a maximum monthly deposition rate at a sensitive receptor of 0.14 g/m^2/month, at receptor R12. When compared to the deposition rate guideline of 2 g/m^2/month and baseline depositional dust monitoring results, no significant depositional impacts at sensitive receptors are indicated, such that nuisance impacts are deemed unlikely. Furthermore, the isopleths indicate that deposition rates of greater than 2 g/m^2/month are generally limited to within the Project area boundaries, and therefore suggest that there is little risk of deposition rates approaching the 30 g/m^2/month necessary to impact surrounding vegetated areas and crops (refer **Section 5.2.1**). The relatively low deposition rates predicted at sensitive receptors would result in corresponding low impacts to rainwater tanks, with deposition of metals unlikely to lead to exceedances of Australian drinking water guidelines.

It is anticipated that a combination of best practice haul route construction, maintenance and watering, including reactive dust management (e.g. reactive to visual inspection and real-time dust monitoring, refer **Section 13.2**) could reduce fugitive dust emissions such that impacts to air quality at these receptors could be further reduced in accordance with the GED.

As noted in **Section 8.2**, sensitive receptors located in the vicinity of, but further away than those included in the assessment will be impacted by Project emissions to a lesser degree due to their increased separation from the Project**.**

Power Station and Pumping Station

Maximum predicted NO_2 GLCs at or beyond the site boundary resulting from the power station emissions exceed the 1-hour human health APAC and the annual average vegetation APAC. Isopleths (**Figure 53**) indicate that exceedances of the health APAC extend to between 500 and 800 m of the site boundary into the surrounding field. Similarly, isopleths (**Figure 54**) indicate that exceedances of the vegetation APAC extend to approximately 50 m from the site boundary.

$PM_{2.5}$ GLCs resulting from power station emissions to air are negligible at the receptors such that cumulative concentrations are unlikely to be increased by an measurable amount. Sensitive receptors located further away than those included in the assessment will be impacted to a lesser degree due to their increased separation from the power station**.**

Likewise, the maximum predicted NO_2 GLCs at or beyond the site boundary resulting from the pumping station emissions exceed the 1-hour human health APAC and the annual average vegetation APAC. The isopleths (**Figure 55)** indicate that exceedances of the health APAC extend to approximately 200 m of the pumping station. The isopleths (**Figure 56)** indicate that there are unlikely to be exceedances of the vegetation APAC extending beyond approximately 10-15 m of the pumping station.

$PM_{2.5}$ GLCs resulting from pumping station emissions to air are negligible at the receptors such that cumulative concentrations are unlikely to be increased by an measurable amount. Sensitive receptors located further away than those included in the assessment will be impacted to a lesser degree due to their increased separation from the pumping station**.**

The geographical extent that both the power station and pumping station GLCs are predicted to exceed the NO_2 1-hour APAC is limited to areas which would seldomly be occupied by members of the public, including farmers. In the case of the power station, the potentially impacted land is a neighbouring field with no public access. The potentially impacted area surrounding the pumping station includes fields, roadways and the lake. While third party access is possible to all of these areas, it is likely to be infrequent and for no more than a few minutes at a time.

While the geographical extent to which the emissions from the power station are predicted to exceed the annual average APAC relating to vegetation is not large, it does suggest that there may be some detrimental effects to those areas, especially in the case of the power station where the impacted may be to an area of cropland. The annual average APAC relating to human health is not applicable in this area due to the absence of human receptors over this length of time. A reduction of NO_x emissions, and therefore NO_2 impacts, could potentially be achieved by using emission reduction technology (refer **Section 13.1**).

12 Closure/Rehabilitation Impact Assessment

It is assumed that impacts to air quality associated with decommissioning will be approximately equal to or less than those associated with construction (refer **Section 10**). Mitigation measures that aim to reduce impacts to as low a level as is reasonably practicable are summarised in **Section 13.1**.

13 Summary of Mitigation, Monitoring and Contingency Measures

13.1 Mitigation Measures

The Air Guideline states that:

> *Under the GED, persons who engage in activities that involve air emissions are required to eliminate risks of harm to human health and the environment from those emissions so far as reasonably practicable. Where it is not reasonably practicable to eliminate such risks, they are required to reduce them so far as reasonably practicable. Options for controlling such risks should be prioritised from the highest level of effectiveness to the lowest.*

This AQIA has identified potential hazards related to air quality associated with aspects of the Project and assessed the risk of those hazards assuming the implementation of overarching controls, for example, the watering of haul roads. However, it is intended that the process of identification of hazards, assessment of risks, implementation of controls and checking controls will be an ongoing process throughout the lifetime of the Project. This is especially true when presented with a change in conditions. A change in conditions may be associated with the environment (e.g. meteorological, regional air quality, neighbouring land use etc) or the Project (e.g. equipment/plant, process etc).

In accordance with the GED, it is proposed that the Project will implement additional mitigation measures to avoid, mitigate and/or manage air quality impacts associated with the Project. It is envisaged that an environmental management plan (EMP) will be prepared for the Project including dust management and mitigation measures incorporating those provided in **Table 79**.

Table 79 Management and Mitigation Measures Relevant to Air Quality

Measure ID	Management or Mitigation Measure	Phase
General		
1	All staff to receive a site induction including details of the various ways dust can be generated, methods to minimise dust generation, requirement for speed restrictions across the site and on public unsealed roads particularly for road truck (below the posted speed limit) and their responsibility to minimise and report observed dust generation.	Construction, Operation, Closure/Rehabilitation
2	Utilising water spray and misting systems to supress dust emissions in live active working areas at the mining face.	Operation
3	Excavator and loader operators will minimise the height from which material is dropped into trucks.	Construction, Operation
4	Water spray systems will be utilised where dust from mobile plant material movements and stockpiles cannot otherwise be practically contained	Construction, Operation, Closure/Rehabilitation
5	All trafficable areas within the process plant footprint will be sealed	Operation
6	Trucks carrying uncovered loads on internal roads, if cannot be avoided, to be loaded below 300 mm of the freeboard.	Construction, Operation
7	Regardless of posted speed limits, road trucks travelling to and from the Project on unsealed public roads will be advised to travel at reduced speed to reduce wheel generated dust. Speed reductions on site may be necessary during hot and dry conditions where excessive wheel generated dust is observed.	Construction, Operation, Closure/Rehabilitation
Wheel Generated Dust		
8	Preparing and maintaining level and well finished haul road surfaces to minimising dust emission from rolling wheeled vehicles.	Construction, Operation
9	Regular grading and gravelling of heavy traffic areas such as intersections as required with regular resurfacing of high traffic areas such as intersections to reduce silt build up.	Construction, Operation
10	Attentive monitoring and application of suppressants as surface dries out to avoid and minimise emissions as far as practicable	Construction, Operation
11	Maintaining a spray water regime to the surface of high traffic routes using a water and environmentally friendly organic based resins	Construction, Operation, Closure/Rehabilitation
Stockpiles		
12	Progressive consolidation of and re-vegetation of exposed areas	Operation, Closure/Rehabilitation
13	Topsoil stockpile height will be restricted to 2 m	Construction, Operation
14	Compaction of stockpile batters (where viability of topsoils for rehabilitation is not impacted) will reduce the amount of loose material that can be eroded by wind.	Construction, Operation
15	Environmentally friendly emulsions and polymers applied to stockpile surface on a periodic (nominally yearly) basis to reduce wind erosion.	Construction, Operation
16	Sand tailings stockpiles to be located within roofed and three-sided shelters to minimise wind erosion.	Operation, Closure/Rehabilitation

Measure ID	Management or Mitigation Measure	Phase
Equipment and Plant Exhaust Emissions		
17	All equipment/vehicles to be operated and maintained to manufacturer's specifications in order to minimise exhaust emissions.	Construction, Operation, Closure/Rehabilitation
18	All equipment/vehicles to be operated and maintained to manufacturer's specifications in order to minimise exhaust emissions.	Construction, Operation, Closure/Rehabilitation
19	To reduce NO_x emissions from power station and pumping station, select diesel generators employing emission reduction technology such as catalytic reduction (SCR; e.g. *AdBlue*) or use LNG.	Operation

13.2 Monitoring and Contingency Measures

The monitoring and contingency measures that are proposed to assess air quality impacts associated with the Project are summarised in **Table 80**.

Table 80 Monitoring and Contingency Measures Relevant to Air Quality

Measure ID	Monitoring or Contingency Measure	Phase
1	A Project specific air quality monitoring plan will be developed to: • Set out monitoring responsibilities of staff and contractors • Identify air quality indicators to be monitored • Establish monitoring criteria for the air quality indicators • Identify nearby sensitive receptors with the greatest potential to be impacted by emissions from the Project • Set out appropriate air quality monitoring methods, schedules and reporting requirements. (*see below*)	Construction, Operation, Closure/Rehabilitation
2	*Compliance* continuous PM_{10} and $PM_{2.5}$ monitoring will be conducted in accordance with relevant Australian Standards at a location representative a sensitive receptor(s) likely to experience the highest particulate concentrations during the operational stage of the Project to demonstrate that dust emissions are being controlled adequately to meet relevant APACs. Monitors will be used that are compliant with the relevant Australian Standards. Monitoring will be conducted by a suitably qualified person holding NATA accreditation for the monitoring methods and reported on a quarterly frequency (or less).	Construction, Operation, Closure/Rehabilitation

Measure ID	Monitoring or Contingency Measure	Phase
3	*Compliance* monitoring of RCS (as $PM_{2.5}$) and heavy metals (as PM_{10}) will be conducted monthly in accordance with relevant Australian Standards at a location representative a sensitive receptor(s) likely to experience the highest particulate concentrations during the operational stage of the Project to demonstrate that dust emissions are being controlled adequately to meet relevant APACs. Monitors will be used that are compliant with the relevant Australian Standards. Monitoring will be conducted by a suitably qualified person holding NATA accreditation for the monitoring methods and reported on a quarterly frequency (or less).	Operation
4	Indicative continuous PM_{10} monitoring will be conducted using light scattering instruments providing near real-time feedback to site management with regard to potential dust emission across the site boundaries. Short-term average concentration trigger levels will be used so that site management are alerted (e.g. via SMS) to elevated concentrations such that additional management controls can be actioned to reduce dust levels to below the trigger level. The Air Guideline suggests PM_{10} monitoring is used as an indicator of nuisance dust, with trigger levels set at 80 $\mu g/m^3$ (1-hour average), 120 $\mu g/m^3$ (30-minute average), 150 $\mu g/m^3$ (15-minute average) or 165 $\mu g/m^3$ (10-minute average).	Construction, Operation, Closure/Rehabilitation
5	Visual assessment of both fugitive dust generation, especially that leaving the site boundary, and dust deposition on the vegetation surrounding the site. All site personnel will have the responsibility to report observations of any excessive dust generation resulting from their own, or others work. The site manager will implement appropriate mitigation measures (e.g. increased haul road watering and/or further reduced speed limits for road trucks on unsealed site and public roads). Use of remote close circuit television (CCTV) will be considered in areas where site activities are of regular concern with regard to dust emissions and impacts.	Construction, Operation, Closure/Rehabilitation
6	Offer rainwater tank water quality testing to the sensitive receptors nearest to the Project areas prior to the Project, and during the Project at regular intervals (e.g. annually).	Construction, Operation, Closure/Rehabilitation

14 Summary of Implications Under Relevant Legislation

This study has assessed the impacts of construction and operation of the Project on air quality assets and values to be protected.

The significance of the impacts has been assessed in accordance with the evaluation framework, based on applicable legislation, policy and standards and the evaluation objectives and environmental significance guidelines arising from the government terms of reference established to guide the assessments.

The following sections summarise these identified impacts under the relevant Commonwealth and Victorian legislation.

14.1 Commonwealth

Potential impacts to air quality resulting from the Project have been assessed against Victorian criteria adopted from the Air NEPM. Air NEPM standards apply at performance monitoring locations, with each station located in such a manner that it obtains a representative measure of air quality likely to be experienced by the general population in a region or sub-region of 25,000 people or more. Given the rural location of the Project, with a nearby population or less than 100 people, in demonstrating general compliance with these criteria, the assessment may be considered relatively conservative.

14.2 Victorian

In relation to the evaluation objectives set out in the EES Scoping Requirements, the Project would not have significant impacts on air quality for the following reasons:

- Predictions of PM_{10}, $PM_{2.5}$ and RCS GLCs at sensitive receptors surrounding the Project during operation are demonstrated to be in general compliance with the intent of the relevant APACs in that these are not criteria that one may pollute up to and are not concentrations below which no action, management and/or mitigation of emissions to air is required. Up to three additional exceedances of the PM_{10} 24-hour APAC over those due to background conditions are predicted at the nearest sensitive receptor, however, additional mitigation including a combination of best practice haul route construction, maintenance and watering including reactive dust management (e.g. reactive to visual inspection and real-time dust monitoring) would likely reduce fugitive dust emissions further such that impacts to air quality at these receptors could be further reduced.
- Predictions of NO_2 GLCs at and beyond the Project boundary (including the pumping station) during operation are demonstrated to be in general compliance with the intent of the relevant APACs. Areas in which exceedances of the 1-hour average APAC are exceeded are limited and due to their relatively remote location, are likely to be occupied infrequently and for no more than a few minutes at a time.
- Emissions of PM_{10}, $PM_{2.5}$, RCS, and NO_2 during construction and decommissioning are deemed to be less than those during operation and are therefore also considered to be in compliance with the relevant APACs.
- Mitigation measures coupled with proactive air quality monitoring will be used to avoid, mitigate or manage emissions such any residual risk to public health and safety or diminished social wellbeing would be low.

15 Conclusion

The purpose of this report is to assess the potential air quality impacts associated with the Project to inform the preparation of the EES required for the Project. A summary of the key assets, values or uses potentially affected by the Project, and an associated assessment of air quality impacts and recommended mitigation measures, are summarised below.

With the implementation of the mitigation measures recommended and included in this assessment, potential adverse impacts to air quality resulting from the Project are demonstrated to be minimised, protecting the health and wellbeing of nearby residents and workers.

Existing Environment

The Project is located within flat farmland, with several rural residences surrounding the Project area. Wind roses for nearby Swan Hill indicate that overall, winds from the south and southwest are predominant, with very few winds from the east.

Ambient air quality monitoring undertaken between January 2019 and September 2020 indicates that like any Victorian rural area with little anthropogenic activity, the area may be subject to periods of elevated PM_{10} and $PM_{2.5}$ concentrations due to regional bushfire and backburning impacts, and dust storms. Bushfires across Victoria in January 2020 were clearly evident in the data with elevated $PM_{2.5}$, and to a lesser extent PM_{10}, concentrations. However, the non-bushfire impacted year 2019 demonstrates elevated concentrations in the summer months such that the distinction between the years representing normal and bushfire conditions is not significant. Both years include periods of elevated background PM_{10} and $PM_{2.5}$ concentrations which exceed the relevant 24-hour average criteria. Monitored concentrations of RCS were well below the annual average APAC. In the absence of NO_x monitoring in the Project area, with little anthropogenic activity, the background concentrations of NO_x are likely to be low, approaching zero. However for assessment purposes, alternative data is sourced to conservatively represent potential background concentrations.

Impact Assessment Findings

The risk of impacts to health and the environment due to dust soiling from construction and decommissioning works of the Project site and the pipeline corridor were assessed to be low, or in some cases negligible, with the application of the proposed dust management and mitigation strategies.

During operation, exceedances of the PM_{10} and $PM_{2.5}$ criteria are predicted at all receptors due to the maximum background concentration exceeding the APAC before the Project contribution is added. The number of additional exceedances (over and above those of the background concentrations) predicted to be generated by the Project are few (0 or 1 depending on receptor and stage of mining).

While elevated background concentrations of PM_{10} and $PM_{2.5}$ result in exceedances of the 24-hour criteria at all receptors before the Project contribution is considered, there are no exceedances of the PM_{10} 24-hour APAC due to Project impacts alone with the greatest Project contribution equivalent to 50% of the criterion at nearby receptor R12 under Scenario 1, and 38% under Scenario 2. Over the 5 years of meteorological conditions assessed, the second and third highest predicted corresponding concentrations are significantly lower than these maximums, indicating that out of over 1800 meteorological condition scenarios, significantly elevated concentrations at nearby sensitive receptors are few. Annual average PM_{10}, $PM_{2.5}$ and RCS criteria are met at all receptors. Likewise, dust deposition rates are not predicted to result in significant impacts to the rainwater tanks of nearby sensitive receptors, nor to surrounding vegetation.

The power station and pumping station diesel generator emissions are predicted to result in exceedances of the 1-hour average NO_2 concentration beyond the Project boundaries. Due to the rural and relatively remote nature of these Project locations, however, the likelihood of a third party occupying these impacted areas for more than a few minutes at a time is low. While the geographical extent to which the emissions from the power station are predicted to exceed the annual average APAC relating to vegetation is not large, it does suggest that there may be some detrimental effects to those areas, especially in the case of the power station where the impacts may be to an area of cropland. The annual average APAC relating to human health is not applicable in this area due to the absence of human receptors over this length of time. $PM_{2.5}$ GLCs resulting from pumping station emissions to air are negligible at the receptors such that cumulative concentrations are unlikely to be increased by an measurable amount. These findings indicate that the risk of impacts from other products of diesel combustion (e.g. SO_2, VOCs, PAHs etc) will also be low.

Mitigation and Contingency Measures

The mining schedule, which will generally include only six active blocks at any one time will limit exposed areas subject to wind erosion, with surface consolidation and revegetation occurring throughout the mine life, rather than at the end.

Best practice dust emission mitigation measures will be employed for all aspects of the Project operations including use of water sprays and misting systems and water trucks. Wheel generated dust from haul roads has been identified as the primary potential source of dust emissions, therefore preparing and maintaining level and well finished haul road surfaces with low silt content material will be considered a priority. Contingency measures may include reducing the site speed limit for haul trucks during periods of hot and dry weather coupled with increased water truck application.

Closing

The risk of impacts to health and the environment from the construction, operation and decommissioning of the Project were assessed to be low, or in some cases negligible. With the application of the proposed management and mitigation strategies, potential impacts on air quality due to the Project would be avoided, minimised or managed to required standards such that the health and wellbeing of residents and the local community would be protected.

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APPENDIX A

Risk Register

Table A1 Risk Register

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction (and decommissioning)									
C1	Particulate emissions to air from scrapers, dozers, excavators and loading trucks impacting sensitive receptors.	Emissions associated with excavation and agitation of ground surface material.	Likely	Moderate	High	Moisture content to be controlled using water sprays. Drop height to be minimised when loading trucks.	Unlikely	Minor	Low
C2	Particulate emissions to air from exposed surface and stockpiles impacting sensitive receptors.	Loose mined material including topsoil, overburden, clay and ore may be subject to wind erosion.	Likely	Moderate	High	Moisture content to be controlled using water sprays and promotion of crusting (not disturbing stockpile surfaces). Earthworks are to including profiling and compacting to consolidate loose material.	Unlikely	Minor	Low
C3	Diesel vehicle and plant emissions to air impacting sensitive receptors.	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from all diesel site vehicles and plant including trucks, excavators etc.	Unlikely	Minor	Low	Use pre-start checks to ensure excessive emission from plant and equipment is not adversely impacting air quality. Vehicles and mechanical plant, including exhaust systems, to be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Ensure smoke from internal combustion engines is not visible for more than 10 seconds. Turn off vehicles plant and equipment when not in use. Include awareness in prestart meetings.	Rare	Minor	Low

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
C4	Particulate emissions to air from haul roads impacting sensitive receptors.	Vehicular traffic on unsealed roads generates dust emissions (*wheel generated dust*) as function of traffic intensity (VKT), vehicle weight, number of wheels, vehicle speed, and silt and moisture content of the road surface.	Almost certain	Major	Very high	Dust suppression measures (water cart and water sprays) applied as necessary. Polymer and road sealing agents may be applied to minimise dust generation as needed. Vehicle speeds will be limited onsite to reduce dust generation.	Unlikely	Minor	Low
C5	Particulate emissions from construction of Processing Plant impacting sensitive receptors.	General emissions associated with excavation and agitation of ground surface material for foundations etc. Emission of dust collected on sealed surfaces and hardstand.	Likely	Moderate	High	Sweeping and wetting of sealed surfaces to minimise dust generation as required.	Unlikely	Insignificant	Low
C6	Dust from some or all activities depositing at sensitive receptors.	Larger particulate from all dust generating activities is transported to and deposited at sensitive receptors, potentially soiling water tanks.	Possible	Moderate	Medi-um	Separation distance to sensitive receptors and use of dust mitigation measures listed above. Indicative plume dispersion modelling suggests that impacts at sensitive receptors are negligible.	Unlikely	Minor	Low
C7	Dust from some or all activities depositing and impacting surrounding vegetation and crops.	Larger particulate from all dust generating activities is transported beyond Project site boundaries and deposited on neighbouring crops.	Possible	Moderate	Medi-um	Indicative plume dispersion modelling suggests that impacts beyond the Project site areas are negligible compared to the deposition rates required to impact vegetation.	Unlikely	Insignificant	Low
Operation									

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
O1	Particulate emissions to air from excavators in pit loading trucks	Emissions associated with excavation and agitation of ground surface material.	Likely	Moderate	High	Moisture content to be controlled using water sprays. Drop height to be minimised when loading trucks.	Unlikely	Minor	Low
O2	Particulate emissions to air from trucks dumping	Emissions associated with agitation trucked material.	Likely	Moderate	High	Moisture content to be controlled using water sprays.	Unlikely	Minor	Low
O3	Particulate emissions to air from dozers	Emissions associated with scraping and agitation of ground surface material.	Likely	Moderate	High	Moisture content to be controlled using water sprays.	Unlikely	Minor	Low
O4	Particulate emissions to air from haul roads	Vehicular traffic on unsealed roads generates dust emissions (*wheel generated dust*) as function of traffic intensity (VKT), vehicle weight, number of wheels, vehicle speed, and silt and moisture content of the road surface. Dispersion modelling indicates that if not uncontrolled, this is the most significant source of dust emission from the Project.	Almost certain	Major	Very high	The vehicle movements are to be on a combination of sealed and unsealed roads with dust suppression measures (water cart and water sprays) applied as necessary. Polymer and road sealing agents may be applied to minimise dust generation as needed. Vehicle speeds will be limited onsite to reduce dust generation.	Unlikely	Minor	Low
O5	Particulate emissions to air from exposed surface and stockpiles	Loose mined material including topsoil, overburden, clay and ore may be subject to wind erosion.	Likely	Moderate	High	Moisture content to be controlled using water sprays and promotion of crusting (not disturbing stockpile surfaces). Earthworks are to including profiling and compacting to consolidate loose material.	Unlikely	Minor	Low

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
O6	Particulate emissions to air from preliminary processing stages	Agitation of mined material during transfer, sorting, crushing etc promotes the emission of dust.	Likely	Moderate	High	The mining transitioning material into the first processing stage at the mining unit plant (MUP) is into the trommel which is a wet stage where fluidising water is used as part of the trommel screening process. Hereafter the processing remains a wet process with no opportunity for dust emission.	Unlikely	Insignificant	Low
O7	Particulate emissions to air from final processing stages	The final drying stage via gas fired appliances for the various product streams reduces the moisture content of the product material increasing the potential for dust emissions.	Likely	Moderate	High	The final drying stages are subject to dust extraction baghouses prior to sealed storage into the onsite silo. Dust emission at this point is also mitigated by a sealed bottom silo loadout into covered trailers as part of export from site to port. No final product stockpiles will be used.	Rare	Minor	Low
O8	Dust from some or all activities depositing at sensitive receptors.	Larger particulate from all dust generating activities is transported to and deposited at sensitive receptors, potentially soiling water tanks.	Possible	Moderate	Medi-um	Separation distance to sensitive receptors and use of dust mitigation measures listed above. Indicative plume dispersion modelling suggests that impacts due to Project at sensitive receptors are unlikely to lead to an exceedance of the drinking water guidelines.	Unlikely	Minor	Low
O9	Dust from some or all activities depositing and impacting surrounding vegetation and crops.	Larger particulate from all dust generating activities is transported beyond Project site boundaries and deposited on neighbouring crops.	Possible	Minor	Medi-um	Indicative plume dispersion modelling suggests that impacts beyond the Project site areas are negligible compared to the deposition rates required to impact vegetation.	Unlikely	Insignificant	Low

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
O10	Diesel vehicle and plant emissions to air	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from all diesel site vehicles and plant including trucks, excavators etc. Total diesel fuel consumption rate for the site is 32,000 L/day. Emissions of which will be dispersed across the Project (e.g. trucks on haul roads) promoting dispersion in the air environment, reducing GLCs.	Unlikely	Minor	Low	Use pre-start checks to ensure excessive emission from plant and equipment is not adversely impacting air quality. Vehicles and mechanical plant, including exhaust systems, to be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Ensure smoke from internal combustion engines is not visible for more than 10 seconds. Turn off vehicles plant and equipment when not in use. Include awareness in prestart meetings.	Rare	Minor	Low
O11	Diesel/LPG power station emissions to air impacting sensitive receptor locations	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from the diesel fired power station. Emissions of NO_x and to a lesser degree $PM_{2.5}$ have the greatest potential to impact air quality. Total diesel fuel consumption rate for the site is 86,000 L/day.	Rare	Insignificant	Low	Generators will be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Plume dispersion modelling indicates that impacts at sensitive receptors are negligible.	Rare	Insignificant	Low

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
O12	Diesel/LPG power station emissions to air impacting locations at or beyond site boundary (occasional human receptor, continuous vegetation)	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from the diesel fired power station. Emissions of NO_x and to a lesser degree $PM_{2.5}$ have the greatest potential to impact air quality. Total diesel fuel consumption rate for the site is 86,000 L/day.	Likely	Minor	Medi-um	Generators will be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Plume dispersion modelling indicates that 1-hour average health APAC and annual average vegetation APAC are exceeded at and beyond site boundary. Unlikely to impact human receptor due to frequency of occupation, however, potential to impact vegetation.	Likely	Minor	Med-ium
O13	Diesel road truck emissions to air	Pollutants associated with the combustion of diesel fuel and wheel generated dust from road trucks transporting product travelling along public roads in vicinity of the Project passing residences.	Possible	Minor	Medi-um	Trucks to be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Frequency of road truck transport is expected to be less than 1 or 2 per hour.	Possible	Insignificant	Low
O14	Road truck load dust emissions to air.	Dust from product road trucks travelling along public roads in vicinity of the Project passing residences.	Possible	Minor	Medi-um	Product will be transported from site in sealed freight containers. Frequency of road truck transport is expected to be less than 1 or 2 per hour.	Rare	Insignificant	Low

Risk ID	Risk Pathway	Causes / Background	Initial Risk Level			Final Mitigation	Residual Risk Level		
			Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
O15	Diesel/LPG pumping station emissions to air impacting sensitive receptor locations	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from the diesel fired generator powering the pumping. Emissions of NO_x and to a lesser degree $PM_{2.5}$ have the greatest potential to impact air quality. Total diesel fuel consumption rate for the site is 14,400 L/day.	Rare	Insignificant	Low	Generators will be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Plume dispersion modelling indicates that impacts at sensitive receptors are negligible.	Rare	Insignificant	Low
O16	Diesel/LPG pumping station emissions to air impacting locations at or beyond site boundary (occasional human receptor, continuous vegetation)	Pollutants associated with the combustion of diesel fuel including $PM_{2.5}$, NO_x, SO_2, CO and VOCs will be emitted from the diesel fired generator powering the pumping station. Emissions of NO_x and to a lesser degree $PM_{2.5}$ have the greatest potential to impact air quality. Total diesel fuel consumption rate for the site is 14,400 L/day.	Likely	Minor	Medi-um	Generators will be operated and maintained to the manufacturer's specifications to minimise exhaust emissions. Plume dispersion modelling indicates that 1-hour average health APAC and annual average vegetation APAC are exceeded at and beyond site boundary. Unlikely to impact human receptor due to frequency of occupation. Potential to impact very small area of vegetation.	Unlikely	Minor	Low

APPENDIX B

IAQM Construction Assessment Methodology

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the Site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the Site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects.

Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides "dust emissions magnitudes" for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of soils and dusty materials onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Project, are as follows:

Demolition *(Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time)*:

- ***Large***: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- ***Medium***: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***Small***: Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks *(Covers the processes of soil-stripping, ground-levelling, excavation and landscaping)*:

- ***Large***: Total site area greater than 10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- ***Medium***: Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (e.g. silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- ***Small***: Total site area less than 2,500 m^2, soil type with large grain size (e.g. sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction *(Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc)*:

- ***Large***: Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.
- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Track-out *(The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network)*:

- ***Large***: More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.
- ***Medium***: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- ***Small***: Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

- Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:
- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts
- The proximity and number of those receptors
- In the case of PM_{10}, the local background concentration
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in **Table A-1**. It is noted that user expectations of amenity levels (dust soiling) are dependent on existing deposition levels.

Table A-1 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: Dwellings, museums, medium- and long-term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to* PM_{10}.	*Examples: Public footpaths, playing fields, parks and shopping street.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activity on nearby sites

- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place
- Any conclusions drawn from local topography
- The duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts)
- Any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table A-2**. The sensitivity of the area should be derived for each of activity relevant to the project (i.e. construction and earthworks).

Table A-2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table A-3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (i.e. an annual average of 25 µg/m^3 for PM_{10}) the IAQM method has been modified slightly.

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
- Any history of dust generating activities in the area
- The likelihood of concurrent dust generating activity on nearby sites
- Any pre-existing screening between the source and the receptors
- Any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place
- Any conclusions drawn from local topography
- Duration of the potential impact
- Any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A-3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc.	Number of receptors [a,b]	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Notes: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m); noting that only the highest level of area sensitivity from the table needs to be considered.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A-4** (demolition), **Table A-5** (earthworks and construction) and **Table A-6** (track-out) to determine the risk category with no mitigation applied.

Table A-4 Risk Category from Demolition Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible Risk

Table A-5 Risk Category from Earthworks and Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible Risk

Table A-6 Risk Category from Trackout Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible Risk
Low	Low Risk	Low Risk	Negligible Risk

Step 3 - Site-Specific Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the Site is a low, medium or high-risk site.

Step 4 – Residual Impacts

Following Step 3, the residual impact is then determined after management measures have been considered.

APPENDIX C

Meteorological Modelling

WRF

The Weather Research and Forecast (WRF) model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. The model serves a wide range of meteorological applications across scales from tens of meters to thousands of kilometres.

For this assessment, the WRF modelling system was used to produce the meteorological field from which the AERMET input files could be extracted at the Project location. Parameters used in the WRF model for this assessment are presented **Table B1**. Data was also extracted at the location of the nearest BoM station at Swan Hill to enable model validation to be undertaken (below).

Table C1 Meteorological Parameters – WRF

Parameter	Domain 1	Domain 2	Domain 3	Domain 4 (Project)	Domain 5 (validation: Swan Hill)
Modelling domain (km)	1,890 x 1,890	225 x 252	66 x 93	31 x 31	22 x 22
Grid resolution (km)	27	9	3	1	1
Number of vertical levels	30	30	30	30	30
Parent Domain	-	1	2	3	3
Microphysics	WSM6	WSM6	WSM6	WSM6	WSM6
Cumulus parametrization	Kain-Fritsch	Kain-Fritsch	Kain-Fritsch	Kain-Fritsch	Kain-Fritsch
Shortwave radiation physics	Dudhia	Dudhia	Dudhia	Dudhia	Dudhia
Longwave radiation physics	RRTM	RRTM	RRTM	RRTM	RRTM
Planetary boundary layer	YSU	YSU	YSU	YSU	YSU

Model Data Validation

To provide confidence in the site representative meteorological dataset generated using WRF, meteorological data representative of the Swan Hill AWS location was generated then compared with the observational data recorded at Swan Hill AWS for validation purposes.

Modelled and observed wind data at Swan Hill AWS site are presented as annual and seasonal wind roses in **Figure C4** and **Figure C5**, respectively. The predicted wind data are in reasonably good agreement with the observational data. Both model predictions and observational data indicate a southeasterly bias on an annual basis, with the following observed for both datasets by season:

- summer winds are from the south and southeastern quadrants
- the distribution of winds in autumn is relatively evenly spread with the exception of the east from which there are few winds
- the distribution of winds in autumn is relatively evenly spread between the south west and north east, with few winds from the east, southeast and south.
- spring winds are predominantly from the southwestern quadrant.

The comparison of the WRF meteorological modelling and observational data at the BoM station location suggests that the modelling output at the Project site may also likely be generally representative of local conditions.

Figure C4 Modelled Wind Data – Swan Hill

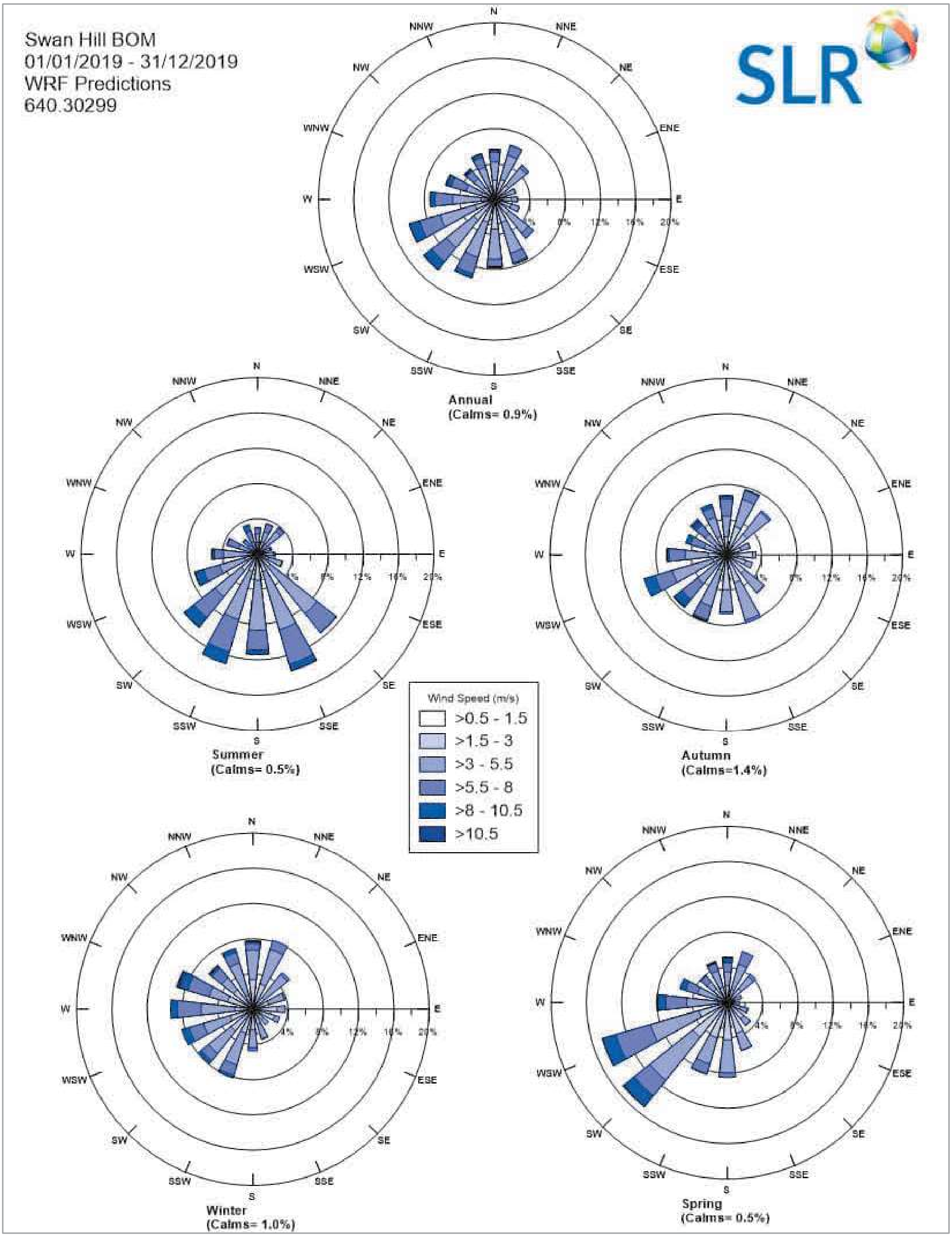


Figure C5 Observed Wind Data – Swan Hill AWS

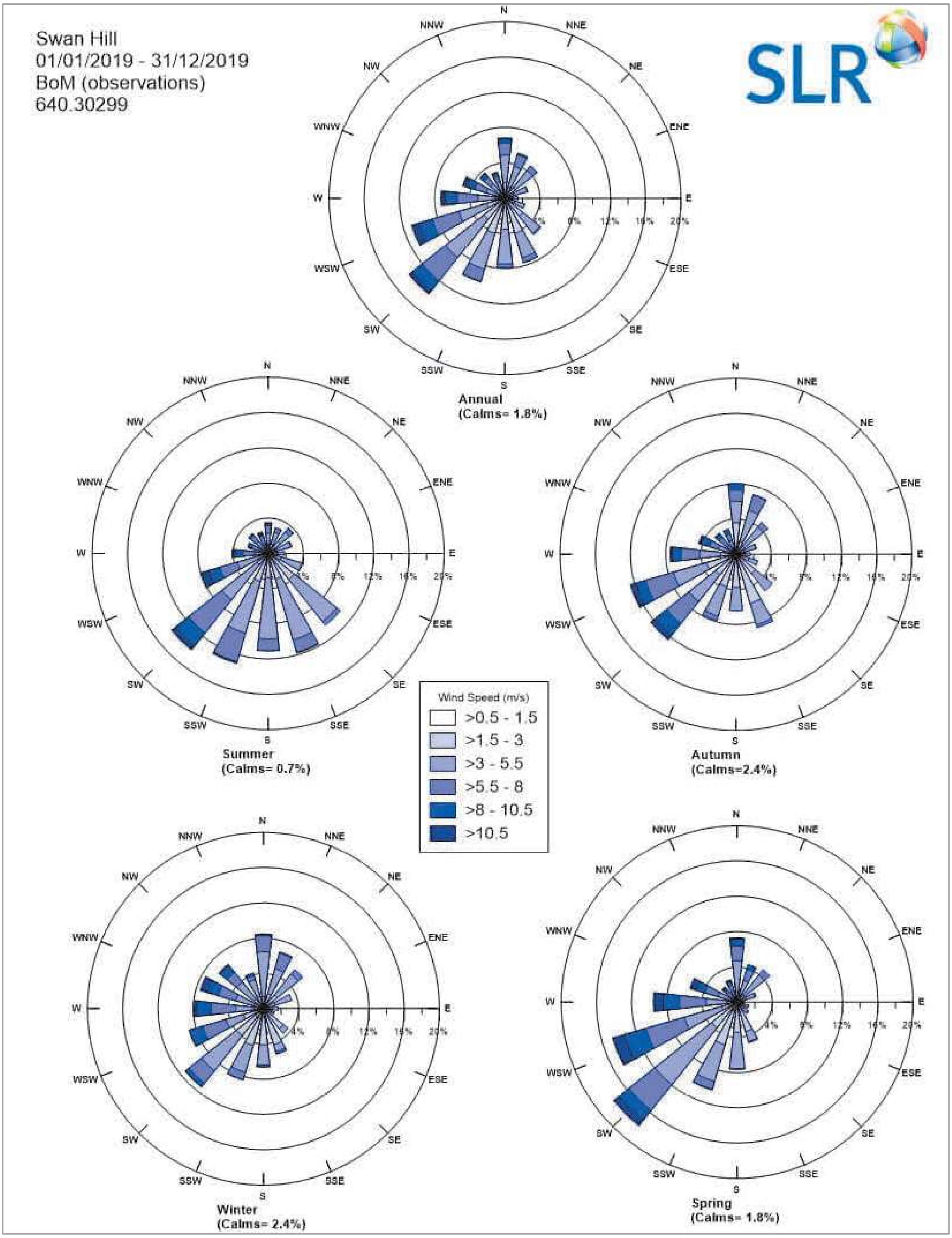


Table C2 provides a summary of the model performance statistics, while **Figure B6** and **Figure B7** present the observed and predicted wind speed and wind direction frequencies, respectively. The WRF predictions generally under-predict the wind speeds and could therefore be considered conservative for modelling purposes.

Table C2 Model Performance Statistics

Parameter	Statistic	Observed	Predicted
Wind Speed	Mean	4.4	4.1
	Standard deviation	2.5	2.2
	Index of agreement[1]	0.89	
Wind Direction	Mean[2]	191	192
	Standard deviation	94.2	97.2
	Index of agreement[1]	0.79	

1. The index of agreement (IOA) is a measure of the overall agreement between modelled and observed time series. It ranges between zero for no agreement and 1 if the two time series are identical. The IOA shows no agreement if the time series are different by orders of magnitude, even if they happen to be correlated, and hence is a more stringent measure of performance than the correlation coefficient. IOAs of 0.7 - 0.8 are considered to indicate good dispersion model performance.

2 Scalar mean.

Figure C6 Wind Speed Frequency Comparison

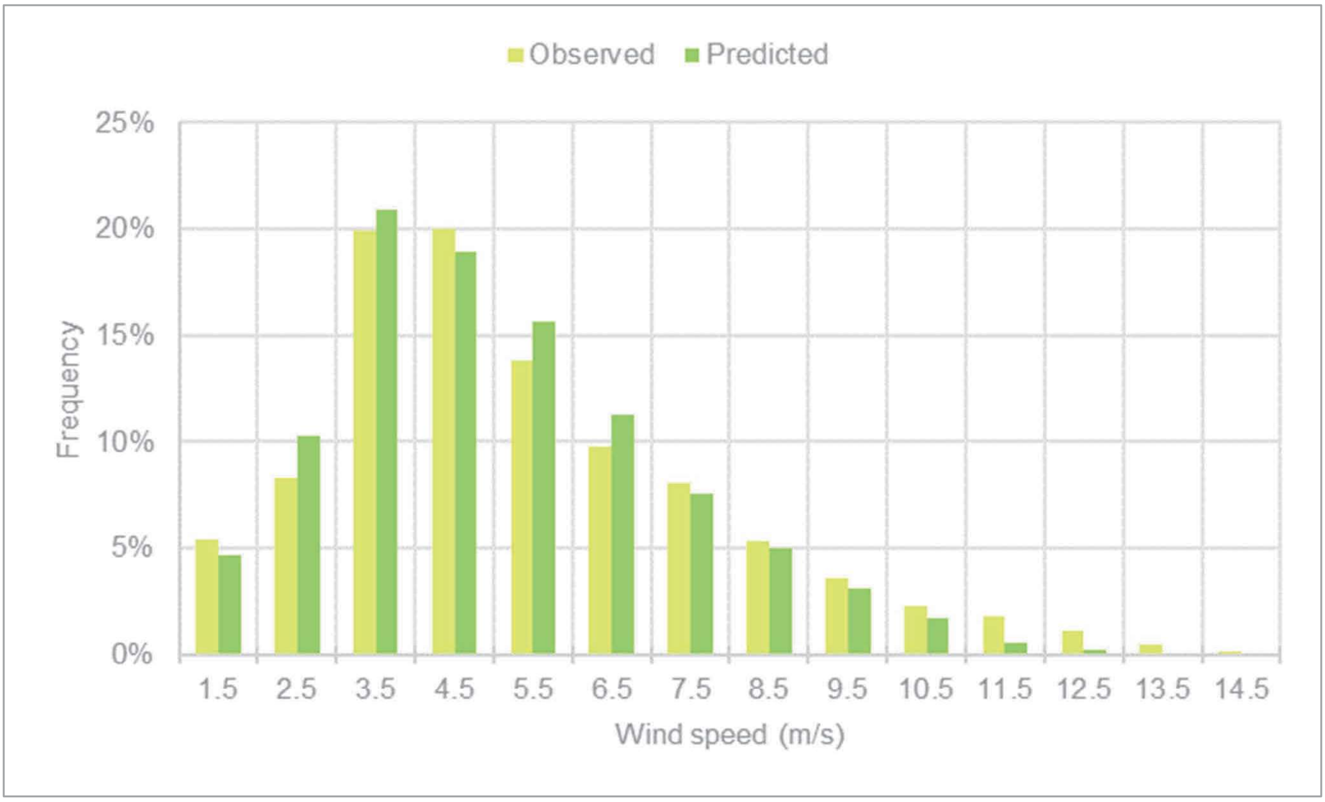
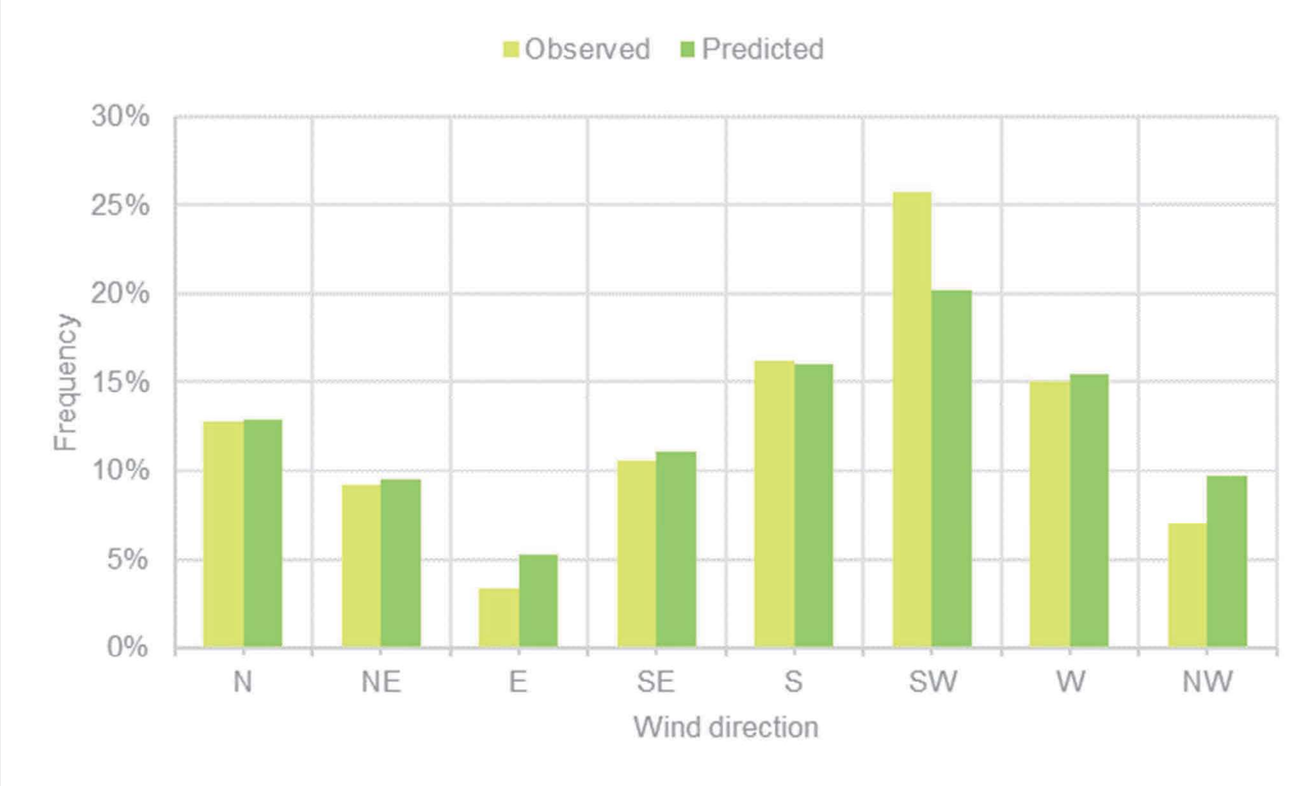


Figure C7 Wind Direction Frequency Comparison



Summary

Overall, WRF predictions are concluded to adequately represent the observed wind speeds and wind directions recorded by the Swan Hill AWS BoM station. It is expected that WRF solutions extracted at the Project is likely to be a good representation of the conditions experienced at that location.

Project Site Representative Meteorological Data

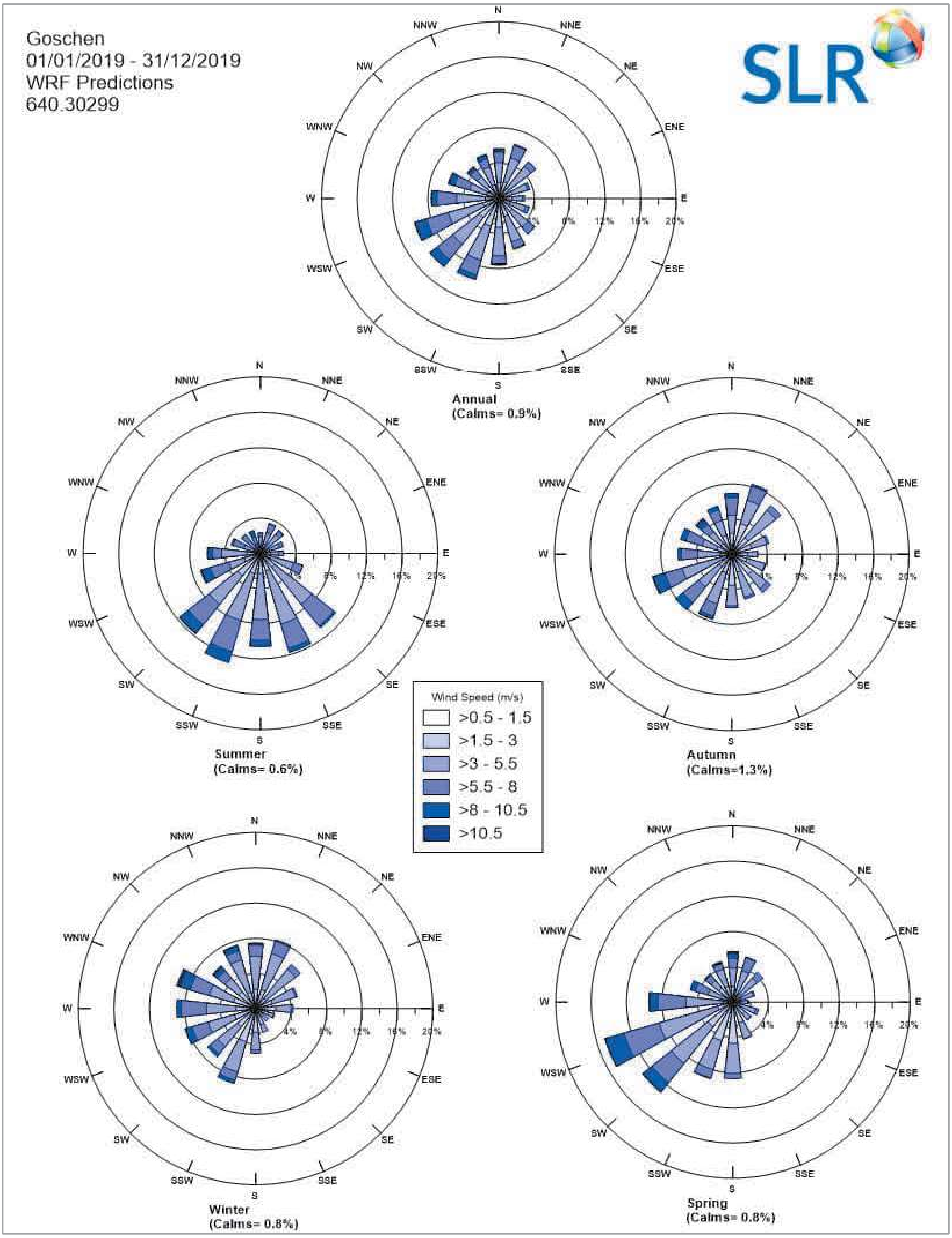
This section presents a summary of the key meteorological conditions predicted by WRF and AERMET at the Project site.

Wind Speed and Direction

A summary of the annual wind behaviour predicted by WRF for the Project site is presented in **Figure C8.** Based on the model predictions, the site experiences light to strong winds (between 1.5 m/s and 13.6 m/s), from all directions but with some bias from the southwestern quadrant. There are few calm wind conditions (wind speeds less than 0.5 m/s), predicted to occur approximately 0.9% of the time.

The seasonal wind roses indicate that in summer, when dust emissions are potentially greatest due to warm and dry conditions, winds from the southern quadrant predominate.

Figure C8 Wind Roses for the Project Site, as Predicted by WRF



The diurnal variations in maximum and average wind speed predicted by WRF at the Project in 2019 are illustrated in **Figure C9**. Wind speeds during the day are greater due to convective forcing. The frequency of wind speeds predicted by WRF at the Project during 2019 are illustrated in **Figure C10**. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. In general, higher wind speeds promote dispersion and result in lower pollutant ground level concentrations.

Figure C9 WRF Predicted Diurnal Variation in Wind Speed for the Project (2019)

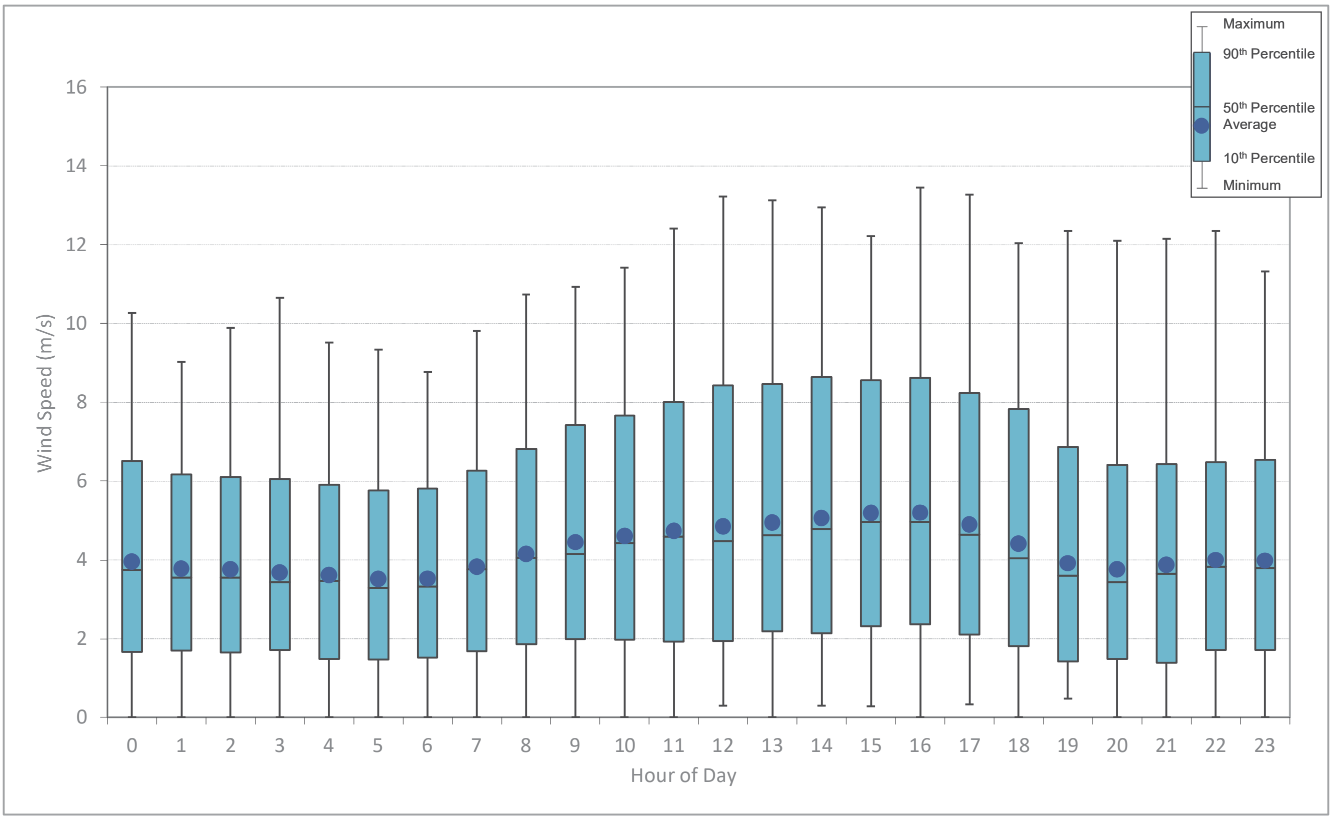
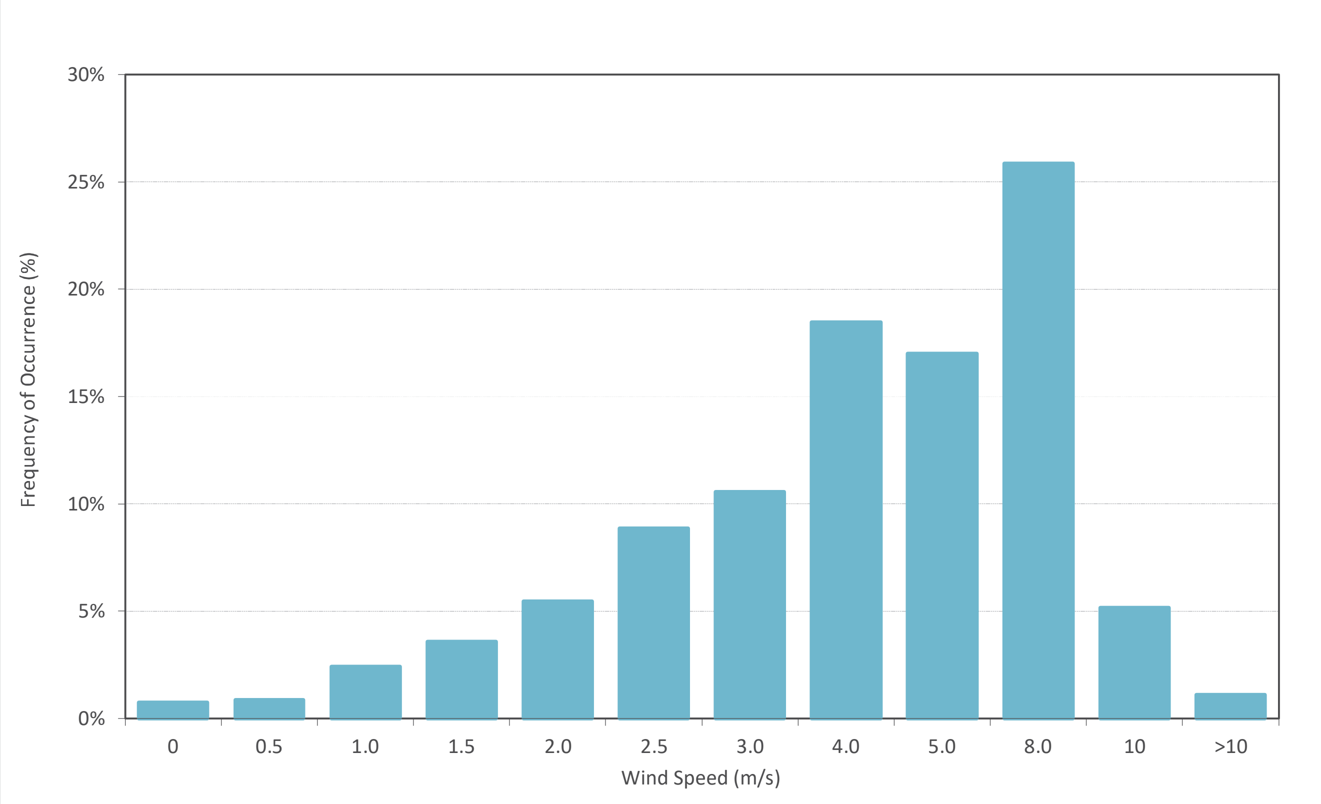


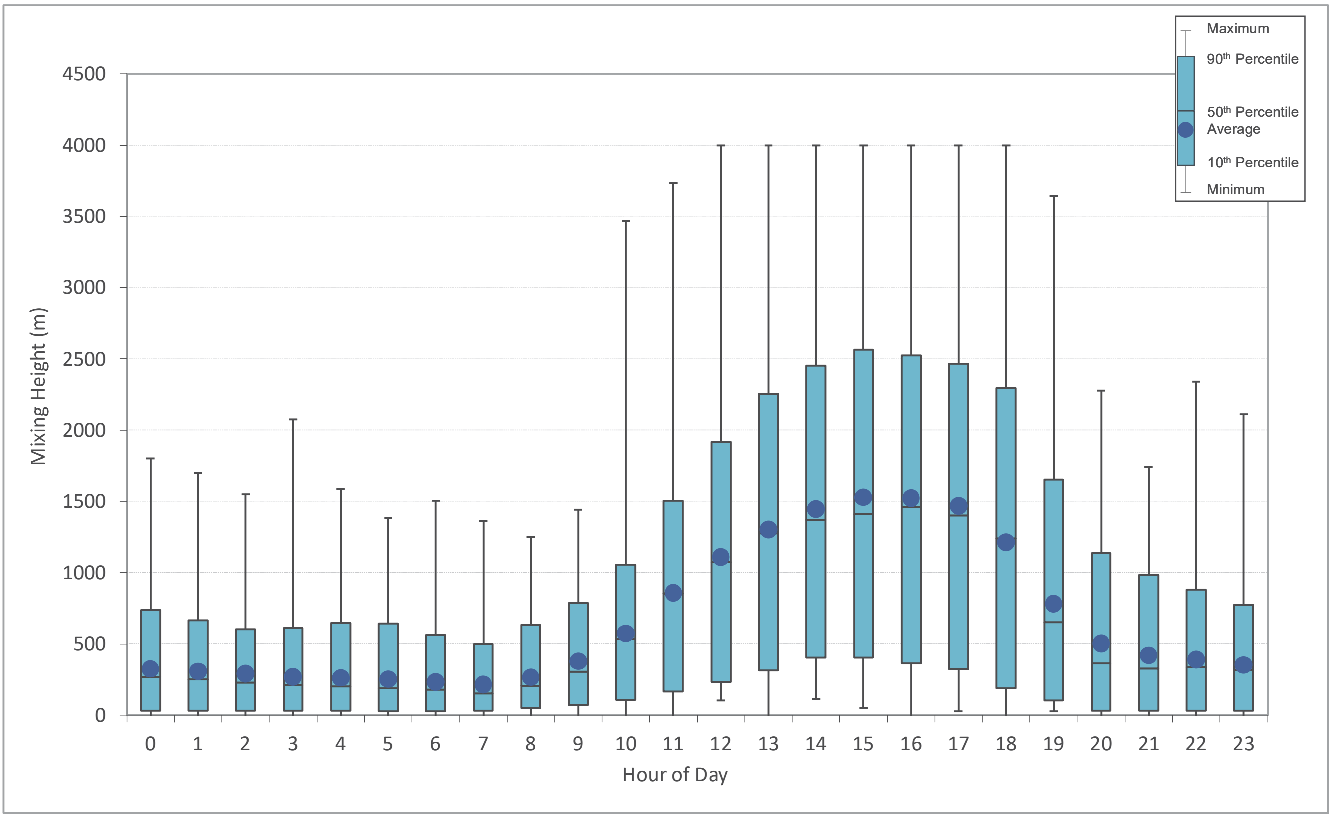
Figure C10 WRF Predicted Wind Speed Frequency for the Project (2019)



Mixing Height

The diurnal variations in maximum and average mixing depths predicted by AERMET at the Project during 2019 are illustrated in **Figure C11**. An increase in the mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. The maximum average mixing heights occur in the early to mid-afternoon, then begin to decrease due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure C11 AERMET Predicted Diurnal Variation in Mixing Height for the Project (2019)



APPENDIX D

Variable Emission File Configuration

Variable Emission File – Calculation Steps

A brief summary of the steps used in calculating the hourly varying emission rates for each source are presented below.

Step 1: Calculate daily/weekly/annual average emission rate (kg/year) for FP, CM and RE

$FP = PM_{2.5}$	(FP) Fine Particulate – particulate of size less than 2.5 µm
$CM = PM_{10} – PM_{2.5}$	(CM) Coarse Particulate – particulate of size between 10 µm and 2.5 µm
$RE = TSP - PM_{10}$	(RE) Rest Particulate – particulate of size greater than 10 µm

Step 2: Identify the operating hours for each activity

Step 3: Classify the sensitivity of each type of activity to wind speed

- Wind insensitive: activities with emission factor that is independent of wind speed (e.g. wheel generated dust)
- Wind sensitive: activities with emission factor that is a function of $(\text{wind speed}/2.2)^{1.3}$ (e.g. loading)
- Wind erosion: emission from exposed areas/stockpiles

Step 4: Identify the number of sources associated with each activity

Step 5: Calculate the hourly average emission rate for each activity per source

$$FP_{AC,i,h} = \frac{FP_i \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

$$CM_{AC,i,h} = \frac{CM_i \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

$$RE_{AC,i,h} = \frac{RE_i \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

For wind insensitive activities

$$WSFactor_{i,h} = 1$$

For wind sensitive activities

$$WSFactor_{i,h} = \frac{\left(\frac{WS_h}{2.2}\right)^{1.3}}{\frac{\sum_{j=1}^{n}\left(\frac{WS_j}{2.2}\right)^{1.3}}{n}}$$

For wind erosion activities

$$WSFactor_{i,h} = \frac{(WS_h)^3}{\frac{\sum_{j=1}^{n}(WS_j)^3}{n}}$$

Where:

$FP_{AC,i,h}$- Fine particulates emission rate for Activity i (g/s) at hour h
$CM_{AC,i,h}$- Fine particulates emission rate for Activity i (g/s) at hour h
$CM_{AC,i,h}$- Fine particulates emission rate for Activity i (g/s) at hour h
OH_i-daily Operating hours (1- 24) for Activity i
N_{days} -Number of days in the meteorological data file
$N_{s,i}$ -Number of sources associated with Activity i
WS_h-Wind speed at the hour
n -number of hours in the meteorological data file

Note: If the activity was modelled as area source, the equation on the left column of the table needs to be divided by the area of that activity.

Step 6: Calculate hourly average emission rate for each source

To calculate the emission rate for a particular source for a particular hour, add up the calculated emission rate for each activity associated with source. For example, if Source 1 is associated with Activity 1, Activity 2 and Activity 3, then:

- $ER_{S1,h,FP} = FP_{AC,1,h} + FP_{AC,2,h} + FP_{AC,3,h}$
- $ER_{S1,h,CM} = CM_{AC,1,h} + CM_{AC,2,h} + CM_{AC,3,h}$

$ER_{S1,h,RE} = RE_{AC,1,h} + RE_{AC,2,h} + RE_{AC,3,h}$

APPENDIX E

Emission Formulae

Inventory Activity	Units	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Source
Overburden Activities					
Loading/unloading overburden to/from trucks/front end loader, excavator, or shovel	kg/t	$0.74 \times 0.0016 \times \left(\left(\frac{U}{2.2}\right)^{1.3} / \left(\frac{M}{2}\right)^{1.4}\right)$	$0.35 \times 0.0016 \times \left(\left(\frac{U}{2.2}\right)^{1.3} / \left(\frac{M}{2}\right)^{1.4}\right)$	$0.053 \times 0.0016 \times \left(\left(\frac{U}{2.2}\right)^{1.3} / \left(\frac{M}{2}\right)^{1.4}\right)$	NPI EETM/ AP42 13.2.4
Bulldozers/front end loaders on overburden i.e. dozers FEL pushing material around	kg/hr	$2.6 \times \frac{s^{1.2}}{M^{1.3}}$	$0.3375 \times \frac{s^{1.5}}{M^{1.4}}$	0.105 * TSP	NPI EETM/ AP42 11.9 Table 11.9-2
Graders	kg/t	$0.0034 \times S^{2.5}$	$0.0034 \times S^{2.0}$		NPI EETM/ AP42 11.9 Table 11.9-4
Hauling					
Hauling on unsealed roads	kg/VKT	$\left(\frac{0.4536}{1.6093}\right) \times 4.9 * \left(\frac{s}{12}\right)^{0.7} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$	$\left(\frac{0.4536}{1.6093}\right) \times 1.5 * \left(\frac{s}{12}\right)^{0.9} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$	$\left(\frac{0.4536}{1.6093}\right) \times 0.15 * \left(\frac{s}{12}\right)^{0.9} \times \left(\frac{W \times 1.1023}{3}\right)^{0.45}$	AP42 13.2.2
Hauling on sealed roads	kg/VKT	$(k(sL)^{0.91} \times (W * 1.1023)^{1.02})/1000$			AP42 13.2.1
		k = 3.23	k = 0.62	k = 0.15	
Wind Erosion					
Wind erosion	kg/ha/h	0.4	0.2	0.03 * TSP (AP42-13-2-5 Industrial wind erosion states an emission factor multiplier for $PM_{2.5}$ of 0.075*TSP)	NPI EETM
Drilling and Blasting					
Drilling	kg/hole	0.59	0.52 * TSP (PM_{10} ratio assumed same as blasting AP42 11.9.7 Table 11.9-2)	0.03 * TSP ($PM_{2.5}$ ratio assumed same as blasting AP42 11.9.7 Table 11.9-2)	NPI EETM/ AP42 11.9 Table 11.9-4
Blasting	kg/blast	$0.00022 \times A^{1.5}$	0.52 * TSP	0.03 * TSP	NPI EETM/ AP42 11.9 Table 11.9-2

A = horizontal area (m2)
M = material moisture content (%)
s = material silt content (or surface silt content in unpaved roads) (%)
u = wind speed (m/s)
d = drop height (m)
W = mean vehicle weight (tonnes)
S = mean vehicle speed (km/h)
sL = silt loading (%)

APPENDIX F

Power Station Generator Specifications

Cummins Inc. Columbus, Indiana 47202-3005 EXHAUST EMISSIONS DATA SHEET	Basic Engine Model: KTA50-G3	Curve Number: FR6250	G-DRIVE K50 1
	Engine Critical Parts List: CPL : 2227	Date: 30 JUN 12	

Displacement : 50.3 litre (3067 in^3)	**Bore** : 159 mm (6.25 in.) **Stroke** : 159 mm (6.25 in.)
No. of Cylinders : 16	**Aspiration** : Turbocharged and Aftercooled
Emission Certification : N/A	

Engine Speed	Standby Power		Prime Power				Continuous Power	
			Limited Time		Unlimited Time			
RPM	kWm	hp	kWm	hp	kWm	hp	kWm	hp
1500	1227	1645	1150	1541	1097	1470	900	1206
1800	1380	1850	1300	1742	1220	1635	1000	1340

Exhaust Emissions Data @ 1500 RPM

		Standby Power			Prime Power			Continuous Power		
Component		g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM
HC	(Total Unburned Hydrocarbons)	0.13	55	110	0.12	50	100	0.1	42	90
NOx	(Oxides of Nitrogen as NO_2)	12	6100	2880	11	5500	2590	9	4500	2140
CO	(Carbon Monoxide)	2.8	1400	1060	2.7	1400	1020	2.6	1300	930
PM	(Particulate Matter)	0.08	40	-	0.09	35	-	0.11	55	-
SO_2	(Sulfer Dioxide)	0.12	56	28	0.12	58	26	0.13	56	28

Exhaust Emissions Data @ 1800 RPM

		Standby Power			Prime Power			Continuous Power		
Component		g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM	g/BHP-h	mg/m^3	PPM
HC	(Total Unburned Hydrocarbons)	0.12	45	90	0.12	45	100	0.13	50	100
NOx	(Oxides of Nitrogen as NO_2)	12.70	6300	3040	11.3	5700	2760	9.7	4800	2290
CO	(Carbon Monoxide)	1.00	480	400	0.08	360	290	0.5	250	190
PM	(Particulate Matter)	0.06	30	-	0.07	35	-	0.06	30	-
SO_2	(Sulfer Dioxide)	0.12	59	29	0.12	58	28	0.13	56	28

Note: mg/m^3 and PPM numbers are measured dry and corrected to 5% O_2 content.

Test Methods and Conditions:
Steady-State emissions recorded per ISO8178-1 during operation at rated engine speed (+/- 2%) and stated constant load (+/-2%) with engine temperatures, pressures, and emission rates stabilized.

Fuel Specifications:
46.5 Cetane Number, 0.035 Wt. % Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Reference:
25°C (77°F) Air Inlet Temperature, 40°C (104°F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H_2O/lb) of dry air Humidity (required for NOx correction); Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back Pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification, and reference conditions stated above and is subject to engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel, or reference conditions can yield different results.

Data subject to change without notice.

Cummins Inc. Columbus, Indiana 47201 ENGINE PERFORMANCE CURVE	Basic Engine Model: **KTA50-G9**	Curve Number: **FR-6244 (1P / 2L)** **FR-6295 (2P / 2L)**	Page No.
	Engine Critical Parts List: **CPL: 2527 (1 Pump / 2 Loop)** **CPL: 2533 (2 Pump / 2 Loop)**	Date: **26Nov01**	

Displacement : **50.3** litre (**3067** in^3)	Bore : **159** mm (**6.25** in.) Stroke : **159** mm (**6.25** in.)
No. of Cylinders : **16**	Aspiration : **Turbocharged and Low Temperature Aftercooled**

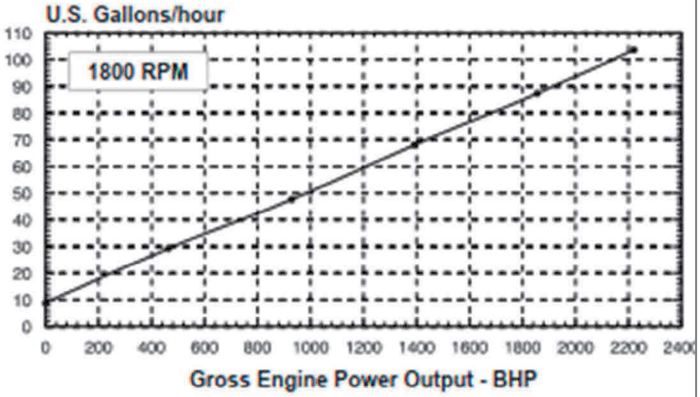
Engine Speed	Standby Power		Prime Power		Continuous Power	
RPM	kWm	BHP	kWm	BHP	kWm	BHP
1800	1656	2220	1384	1855	1224	1640

Emissions Certification

This engine complies with certain emissions requirements established by US EPA/CARB.
See Exhaust Emissions Data Sheet for conformance specifics.

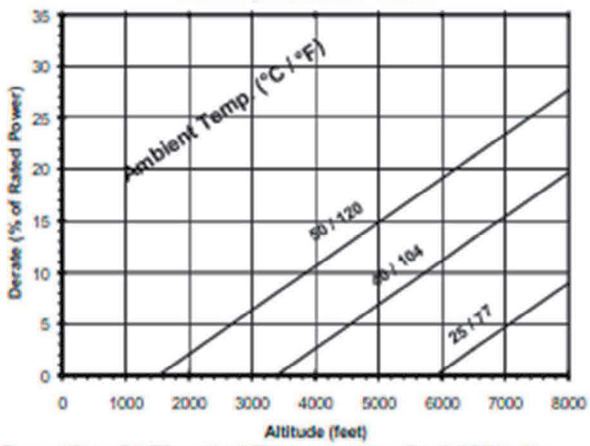
Engine Performance Data @ 1800 RPM

OUTPUT POWER			FUEL CONSUMPTION			
%	kWm	BHP	kg/ kWm·h	lb/ BHP·h	liter/ hour	U.S. Gal/ hour
STANDBY POWER						
100	1656	2220	0.201	0.331	392	103.6
PRIME POWER						
100	1384	1855	0.203	0.334	330	87.3
75	1038	1391	0.211	0.347	257	68.0
50	692	928	0.221	0.364	180	47.6
25	346	463	0.273	0.449	111	29.2
CONTINUOUS POWER						
100	1224	1640	0.208	0.342	299	79.0

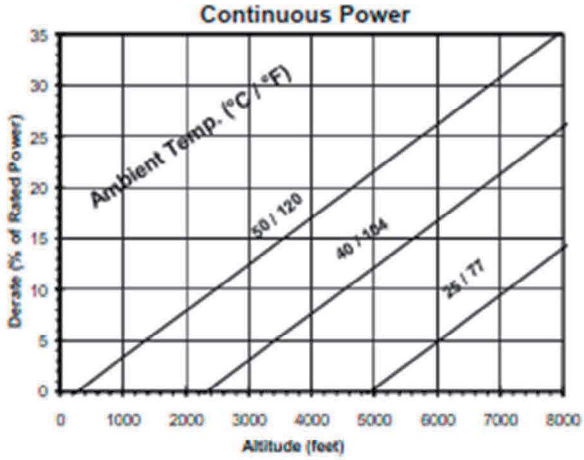


Power Derate Curves:

Standby / Prime Power



Continuous Power



Operation At Elevated Temperature And Altitude:

For sustained operation above these conditions, derate by an additional 4.5% per 300 m (1000 ft), and 10% per 10° C (18° F).

CONVERSIONS:(Liters = U.S. Gal x 3.785) (U.S.Gal = Liters x 0.2642)

Data Subject to Change Without Notice

These guidelines have been formulated to ensure proper application of generator drive engines in A.C. generator set installations. **STANDBY POWER RATING:** Applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A Standby rated engine should be sized for a maximum of an 80% average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby ratings should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency. **PRIME POWER RATING:** Applicable for supplying electric power in lieu of commercially purchased power. Prime Power applications must be in the form of one of the following two categories: **UNLIMITED TIME RUNNING PRIME POWER:** Prime Power is available for an unlimited number of hours per year in a variable load application. Variable load should not exceed a 70% average of the Prime Power rating during any operating period of 250 hours. The total operating time at 100% Prime Power shall not exceed 500 hours per year. A 10% overload capability is available for a period of 1 hour within a 12-hour period of operation. Total operating time at the 10% overload power shall not exceed 25 hours per year. **LIMITED TIME RUNNING PRIME POWER:** Limited Time Prime Power is available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating. The customer should be aware, however, that the life of any engine will be reduced by this constant high load operation. Any operation exceeding 750 hours per year at the Prime Power rating should use the Continuous Power rating. **CONTINUOUS POWER RATING:** Applicable for supplying utility power at a constant 100% load for an unlimited number of hours per year. No overload capability is available for this rating.

Reference AEB 10.47 for determining Electrical Output.

Data shown above represent gross engine performance capabilities obtained and corrected in accordance with ISO-3046 conditions of 100 kPa (29.53 in Hg) barometric pressure [110 m (361 ft) altitude], 25 °C (77 °F) air inlet temperature, and relative humidity of 30% with No. 2 diesel or a fuel corresponding to ASTM D2.
Derates shown are based on 15 in H_2O air intake restriction and 2 in Hg exhaust back pressure.

The fuel consumption data is based on No. 2 diesel fuel weight at 0.85 kg/liter (7.1 lbs/U.S. gal). Power output curves are based on the engine operating with fuel system, water pump and lubricating oil pump; not included are battery charging alternator, fan, optional equipment and driven components.

Data Status: Limited Production

Data Tolerance: ± 5%

Chief Engineer:

D K. Trueblood

Cummins Engine Company, Inc.
Engine Data Sheet

ENGINE MODEL :	**KTA50-G9**	**DATA SHEET :**	DS-6244
CONFIGURATION NUMBER :	D283022DX02	**DATE :**	26Nov01
PERFORMANCE CURVE :		**PERFORMANCE CURVE :**	FR-6244 (1P / 2L)
			FR-6295 (2P / 2L)

INSTALLATION DIAGRAM
- Fan to Flywheel (1P / 2L): 3170289
- Fan to Flywheel (2P / 2L): 3626419

CPL NUMBER
- Engine Critical Parts List : 2527 (1 Pump / 2 Loop)
- Engine Critical Parts List : 2533 (2 Pump / 2 Loop)

GENERAL ENGINE DATA

Type		4-Cycle; 60° Vee; 16-Cylinder Diesel	
Aspiration		Turbocharged & Low Temp. Aftercooled	
Bore x Stroke	— in x in (mm x mm)	6.25 x 6.25 (159 x 159)	
Displacement	— in^3 (liter)	3067 (50.3)	
Compression Ratio		13.9 : 1	
Dry Weight			
Fan to Flywheel Engine	— lb (kg)	11820	(5360)
Wet Weight			
Fan to Flywheel Engine	— lb (kg)	12485	(5662)
Moment of Inertia of Rotating Components			
• with FW 6009 Flywheel	— $lb_m \cdot ft^2$ ($kg \cdot m^2$)	301	(12.7)
• with FW 6017 Flywheel	— $lb_m \cdot ft^2$ ($kg \cdot m^2$)	515	(21.7)
Center of Gravity from Rear Face of Flywheel Housing (FH 6024)	— in (mm)	47.5	(1206)
Center of Gravity above Crankshaft Centerline	— in (mm)	11.0	(279)
Maximum Static Loading at Rear Main Bearing	— lb (kg)	2000	(908)

ENGINE MOUNTING

Maximum Bending Moment at Rear Face of Block	— lb • ft (N • m)	4500	(6100)

EXHAUST SYSTEM

Maximum Back Pressure @ Standby Power Rating	— in Hg (mm Hg)	2	(51)

AIR INDUCTION SYSTEM

Maximum Intake Air Restriction			
• with Dirty Filter Element @ Standby Power Rating	— in H_2O (mm H_2O)	25	(635)
• with Clean Filter Element @ Standby Power Rating	— in H_2O (mm H_2O)	15	(381)

COOLING SYSTEM (Low Temperature Aftercooling Required; 1 Pump / 2 Loop or 2 Pump / 2 Loop)

Coolant Capacity — Engine Only	— US gal (liter)	37	(140)
— Aftercoolers	— US gal (liter)	9	(34)
Maximum Static Head of Coolant Above Engine Crank Centerline	— ft (m)	60	(18.3)
Thermostat Modulating Range — High Flow (Jacket)	— °F (°C)	180 - 200	(82 - 93)
Maximum Top Tank Temperature for Standby Power / Prime Power	— °F (°C)	220 / 212	(104 / 100)
Target Coolant Inlet Temperature to Aftercoolers @ 77 °F (25 °C) Ambient—	°F (°C)	130	(55)
Maximum Coolant Temperature to Aftercoolers; Standby Power / Prime Power	— °F (°C)	160 / 150	(71 / 66)
Additional 2 Pump / 2 Loop Requirements			
Maximum Coolant Friction Head External to Engine— High Flow (Jacket)	— psi (kPa)	10	(67)
— Low Flow (Aftercooler)	— psi (kPa)	7	(48)
Thermostat Modulating Range — Low Flow (Aftercooler) (2P / 2L) w/ HX ____ .	— °F (°C)	N.A.	(N.A.)
Minimum Pressure Cap (for Cooling Systems with less than 2 m [6 ft.] Static Head)...	— psi (kPa)	14	(96)
Additional 1 Pump / 2 Loop Requirements			
Maximum Coolant Friction Head External to Engine— High Flow (Jacket)	— psi (kPa)	15	(103)
— Low Flow (Aftercooler)	— psi (kPa)	5	(35)
Thermostat Modulating Range — Low Flow (Aftercooler)	— °F (°C)	150 - 175	(66 - 79)
Minimum Pressure Cap (for Cooling Systems with less than 2 m [6 ft.] Static Head)...	— psi (kPa)	14	(96)

LUBRICATION SYSTEM

Oil Pressure @ Idle Speed	— psi (kPa)	20	(138)
@ Governed Speed	— psi (kPa)	50 - 70	(345 - 483)
Maximum Oil Temperature	— °F (°C)	250	(121)
Oil Capacity with OP 6027 Oil Pan : High - Low	— US gal (liter)	47 - 39	(178 - 148)
Total System Capacity (Including Bypass Filter)	— US gal (liter)	54	(204)

FUEL SYSTEM

Type Injection System		Direct Injection Cummins PT	
Maximum Restriction at PT Fuel Injection Pump — with Clean Fuel Filter	— in Hg (mm Hg)	4.0	(102)
— with Dirty Fuel Filter	— in Hg (mm Hg)	8.0	(203)
Maximum Allowable Head on Injector Return Line (Consisting of Friction Head and Static Head)	— in Hg (mm Hg)	6.5	(165)
Maximum Fuel Flow to Injection Pump	— US gph (liter / hr)	183	(693)

ELECTRICAL SYSTEM

Cranking Motor (Heavy Duty, Positive Engagement)	— volt	24	
Battery Charging System, Negative Ground	— ampere	35	
Maximum Allowable Resistance of Cranking Circuit	— ohm	0.002	
Minimum Recommended Battery Capacity			
• Cold Soak @ 50 °F (10 °C) and Above	— 0°F CCA	1280	
• Cold Soak @ 32 °F to 50 °F (0 °C to 10 °C)	— 0°F CCA	1800	
• Cold Soak @ 0 °F to 32 °F (-18 °C to 0 °C)	— 0°F CCA	1800	

COLD START CAPABILITY

Minimum Ambient Temperature for Aided (with Coolant Heater) Cold Start within 10 seconds	— °F (°C)	50	(10)
Minimum Ambient Temperature for Unaided Cold Start	— °F (°C)	45	(7)

PERFORMANCE DATA

All data is based on:
- Engine operating with fuel system, water pump, lubricating oil pump, air cleaner and exhaust silencer; not included are battery charging alternator, fan, and optional driven components.
- Engine operating with fuel corresponding to grade No. 2-D per ASTM D975.
- ISO 3046, Part 1, Standard Reference Conditions of:

Barometric Pressure	: 100 kPa (29.53 in Hg)	Air Temperature	: 25 °C (77 °F)
Altitude	: 110 m (361 ft)	Relative Humidity	: 30%

Steady State Stability Band at any Constant Load	— %	+/- 0.25
Estimated Free Field Sound Pressure Level of a Typical Generator Set; Excludes Exhaust Noise; at Rated Load and 7.5 m (24.6 ft); 1800 rpm	— dBA	94.6
Exhaust Noise at 1 m Horizontally from Centerline of Exhaust Pipe Outlet Upwards at 45°	— dBA	130

		STANDBY POWER 60 hz	STANDBY POWER 50 hz	PRIME POWER UNLIMITED TIME 60 hz	PRIME POWER UNLIMITED TIME 50 hz
Governed Engine Speed	— rpm	1800	Not Applicable for 1500 RPM Operation	1800	Not Applicable for 1500 RPM Operation
Engine Idle Speed	— rpm	725 - 775		725 - 775	
Gross Engine Power Output	— BHP (kW_m)	2220 (1656)		1855 (1384)	
Brake Mean Effective Pressure	— psi (kPa)	318 (2221)		266 (1835)	
Piston Speed	— ft / min (m / s)	1875 (9.5)		1875 (9.5)	
Friction Horsepower	— HP (kW_m)	225 (168)		225 (168)	
Engine Data with Dry Type Exhaust Manifold					
Intake Air Flow	— cfm (liter / s)	4400 (2075)		4100 (1930)	
Exhaust Gas Temperature	— °F (°C)	960 (515)		880 (470)	
Exhaust Gas Flow	— cfm (liter / s)	10650 (5025)		9600 (4530)	
Air to Fuel Ratio	— air : fuel	25.2 : 1		27.6 : 1	
Radiated Heat to Ambient	— BTU / min (kW_m)	11220 (200)		9610 (170)	
Heat Rejection to Exhaust	— BTU / min (kW_m)	58925 (1040)		51690 (910)	
Additional Engine Aftercooler Data (2 Pump / 2 Loop)					
Engine Jacket Coolant Flow at Stated Friction Head External to Engine:					
• 4 psi Friction Head	— US gpm (liter / s)	430 (27.1)		430 (27.1)	
• Maximum Friction Head	— US gpm (liter / s)	376 (23.7)		376 (23.7)	
Heat Rejection to Coolant (Aftercooler)	— BTU / min (kW_m)	19500 (345)		15200 (270)	
Heat Rejection to Coolant (Engine)	— BTU / min (kW_m)	40600 (715)		35100 (620)	
Aftercooler Coolant Flow at Stated Friction Head External to Engine: .					
• 2 psi Friction Head	— US gpm (liter / s)	112 (7.1)		112 (7.1)	
• Maximum Friction Head	— US gpm (liter / s)	100 (6.3)		100 (6.3)	
Additional Engine Aftercooler Data (1 Pump / 2 Loop)					
Engine Jacket Coolant Flow at Stated Friction Head External to Engine:					
• 4 psi Friction Head	— US gpm (liter / s)	430 (27.1)		430 (27.1)	
• Maximum Friction Head	— US gpm (liter / s)	376 (23.7)		376 (23.7)	
Heat to be Rejected by Low Temperature Radiator*	— BTU / min (kW_m)	35720 (630)		36620 (645)	
Heat to be Rejected by Jacket Coolant Radiator*	— BTU / min (kW_m)	26110 (460)		15600 (275)	
Aftercooler Coolant Flow at Stated Friction Head External to Engine: .					
• 2 psi Friction Head	— US gpm (liter / s)	97 (6.1)		97 (6.1)	
• Maximum Friction Head	— US gpm (liter / s)	94 (5.9)		94 (5.9)	

* See AEB 90.39 1 Pump / 2 Loop KTA50-G8/9 system.

N.A. - Data is Not Available
N/A - Not Applicable to this Engine
TBD - To Be Determined

ENGINE MODEL : **KTA50-G9**
DATA SHEET : DS-6244
DATE : 26Nov01
CURVE NO. : FR-6244 (1P / 2L)
FR-6295 (2P / 2L)

CUMMINS ENGINE COMPANY, INC. Columbus, Indiana 47202-3005

APPENDIX G

Model Outputs for Radionuclide Assessment

Table G1 Annual Average Project Rn-222 and Rn-220 Concentrations

Receptor ID	Area 1		Area 3	
	Rn-222 (Bq/m^3)	Rn-220 (Bq/m^3)	Rn-222 (Bq/m^3)	Rn-220 (Bq/m^3)
R1	0.0046	1	0.0078	1.2
R2	0.014	2.1	0.010	1.5
R3	0.020	2.9	0.0056	0.84
R4	0.0035	0.52	0.0079	1.2
R5	0.0035	0.52	0.0082	1.2
R6	0.0041	0.62	0.010	1.5
R7	0.0062	0.93	0.025	3.8
R8	0.0061	0.91	0.0083	1.2
R9	0.018	2.7	0.12	18
R10	0.010	1.5	0.0078	1.2
R11	0.014	2.2	0.0073	1.1
R12	0.034	5.2	0.0075	1.1
R13	0.030	4.5	0.0075	1.1
R14	0.10	15	0.012	1.8
R15	0.021	3.2	0.0051	0.76
R16	0.0065	1.0	0.0030	0.46
R17	0.010	1.5	0.0054	0.81

Assumed emission rates: Rn-220 = 13.5 MBq/s; Rn-222 = 0.090 MBq/s

Table G2 Annual Average TSP Concentrations and Dust Deposition Rates

Receptor ID	TSP Concentration (µg/m³)				Dust Deposition Rate (g/m²/year)			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1	0.071	0.054	0.12	0.17	0.084	0.10	0.21	0.20
R2	0.26	0.22	0.14	0.24	0.31	0.39	0.24	0.27
R3	0.44	0.47	0.074	0.12	0.48	0.73	0.11	0.13
R4	0.052	0.036	0.10	0.13	0.056	0.065	0.18	0.13
R5	0.053	0.037	0.10	0.14	0.058	0.067	0.19	0.14
R6	0.061	0.042	0.14	0.18	0.066	0.072	0.25	0.20
R7	0.090	0.058	0.42	0.42	0.10	0.10	0.76	0.45
R8	0.092	0.047	0.072	0.13	0.10	0.080	0.11	0.14
R9	0.22	0.11	0.61	1.4	0.22	0.20	0.97	1.5
R10	0.17	0.080	0.061	0.11	0.19	0.14	0.090	0.092
R11	0.29	0.12	0.065	0.11	0.32	0.19	0.093	0.10
R12	0.94	0.97	0.081	0.14	1.08	1.5	0.12	0.14
R13	0.82	0.28	0.083	0.15	0.96	0.44	0.12	0.14
R14	2.1	3.4	0.17	0.31	2.6	6.4	0.26	0.34
R15	0.59	0.27	0.062	0.10	0.59	0.38	0.092	0.10
R16	0.12	0.065	0.032	0.051	0.11	0.086	0.044	0.046
R17	0.18	0.18	0.060	0.10	0.19	0.28	0.10	0.10

Figure G1 Annual Average Project Rn-222 – Area 1

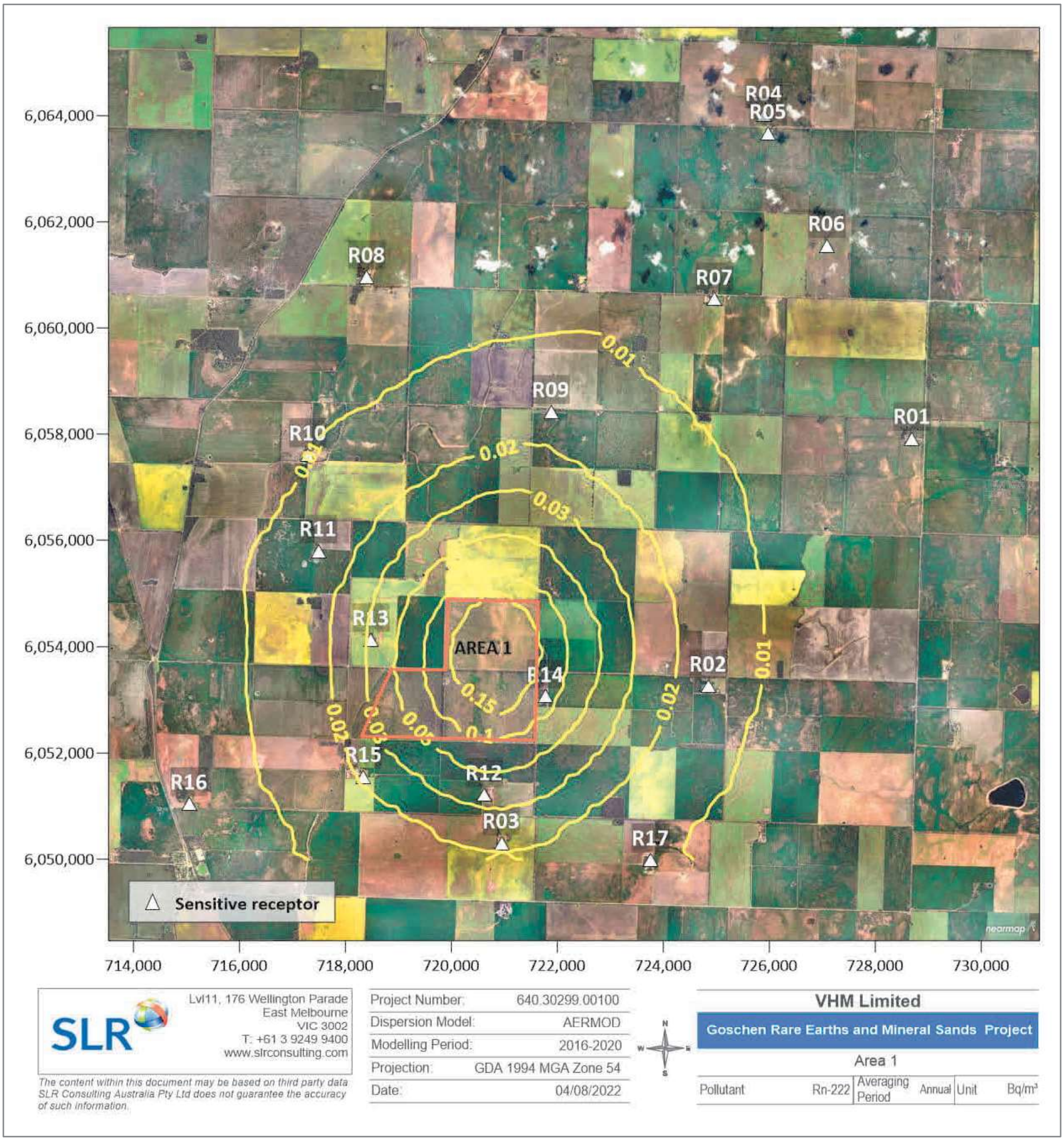


Figure G2 Annual Average Project Rn-220 – Area 1

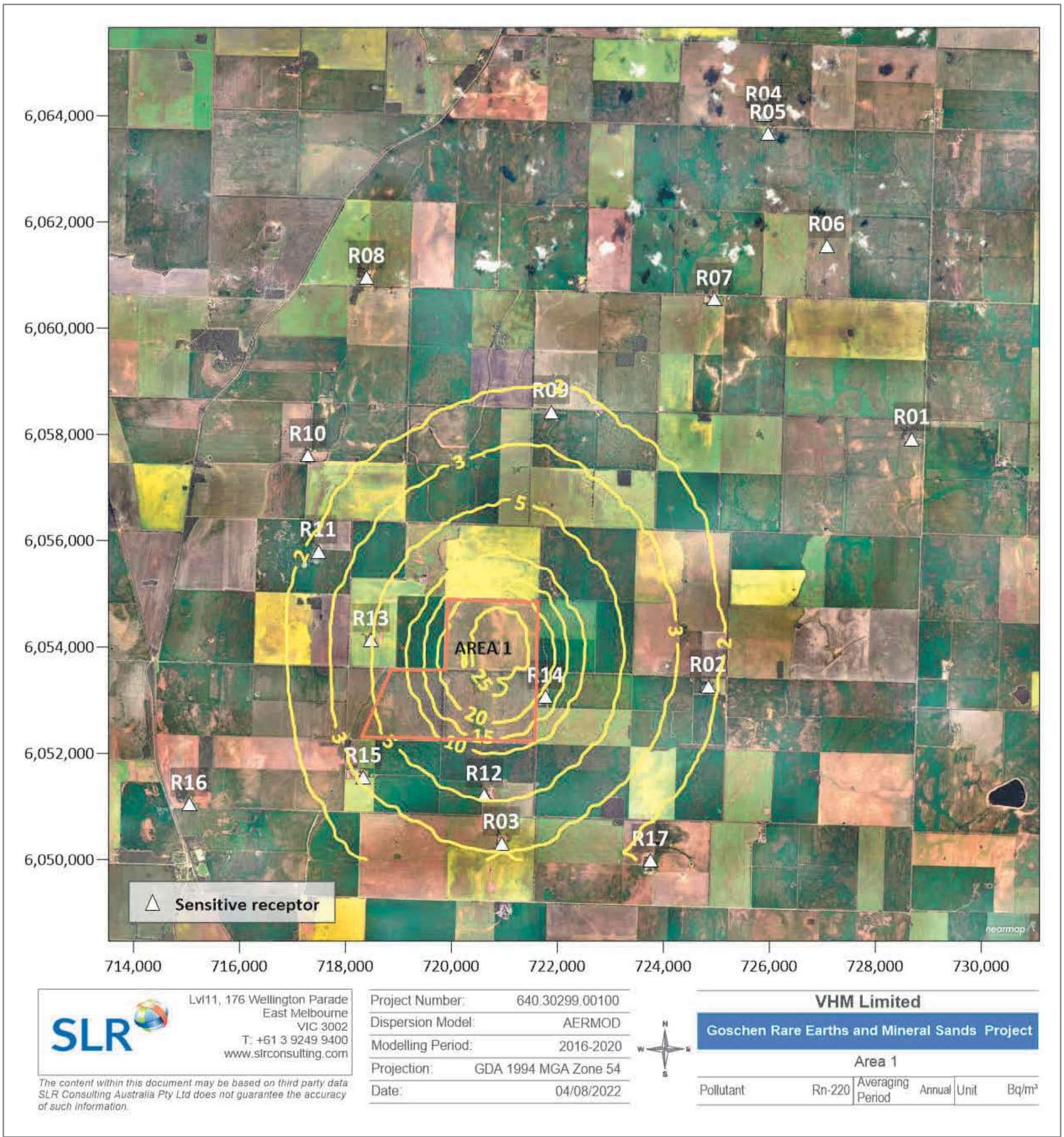


Figure G3 Annual Average Project Rn-222 – Area 3

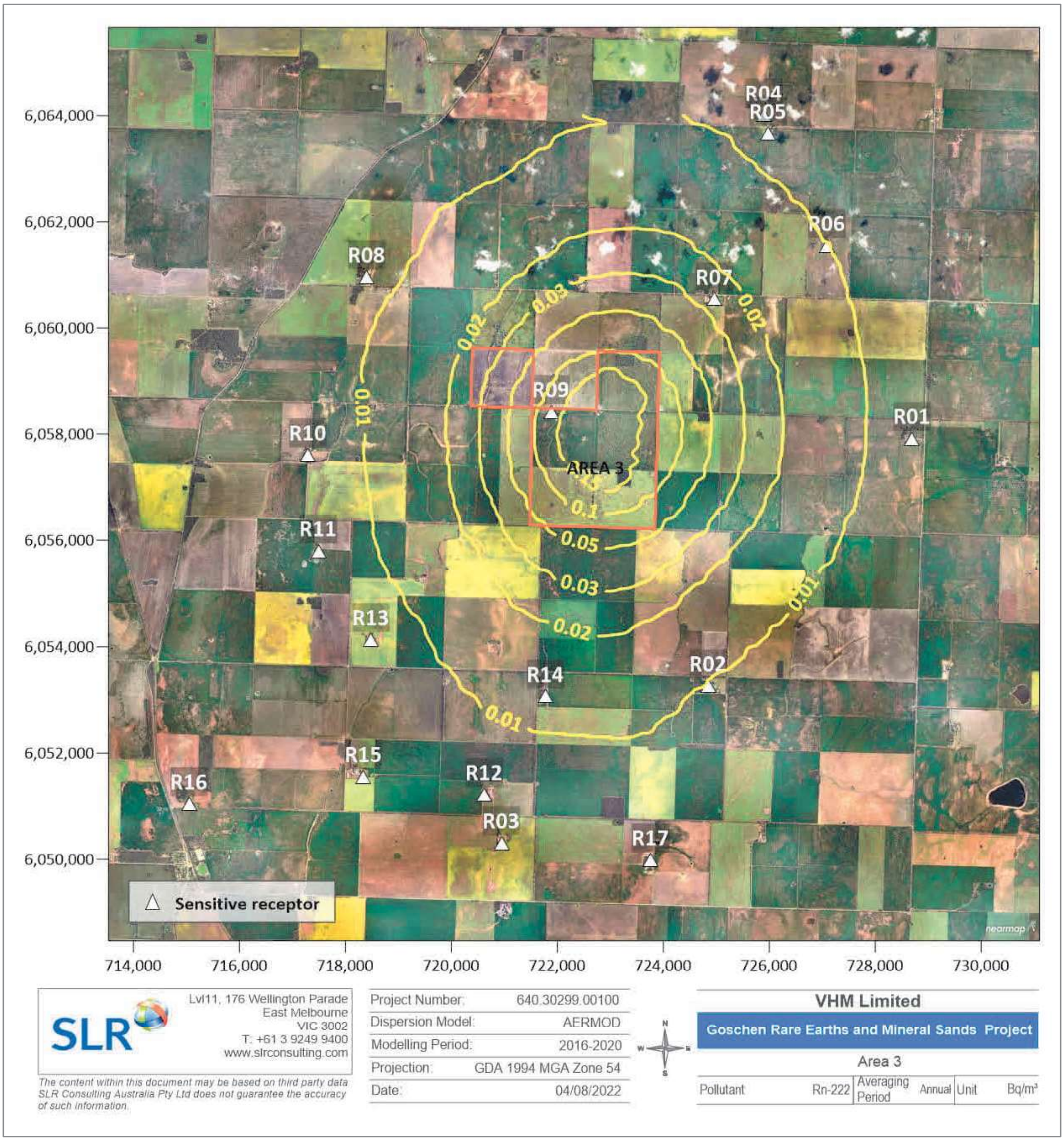


Figure G4 Annual Average Project Rn-220 – Area 3

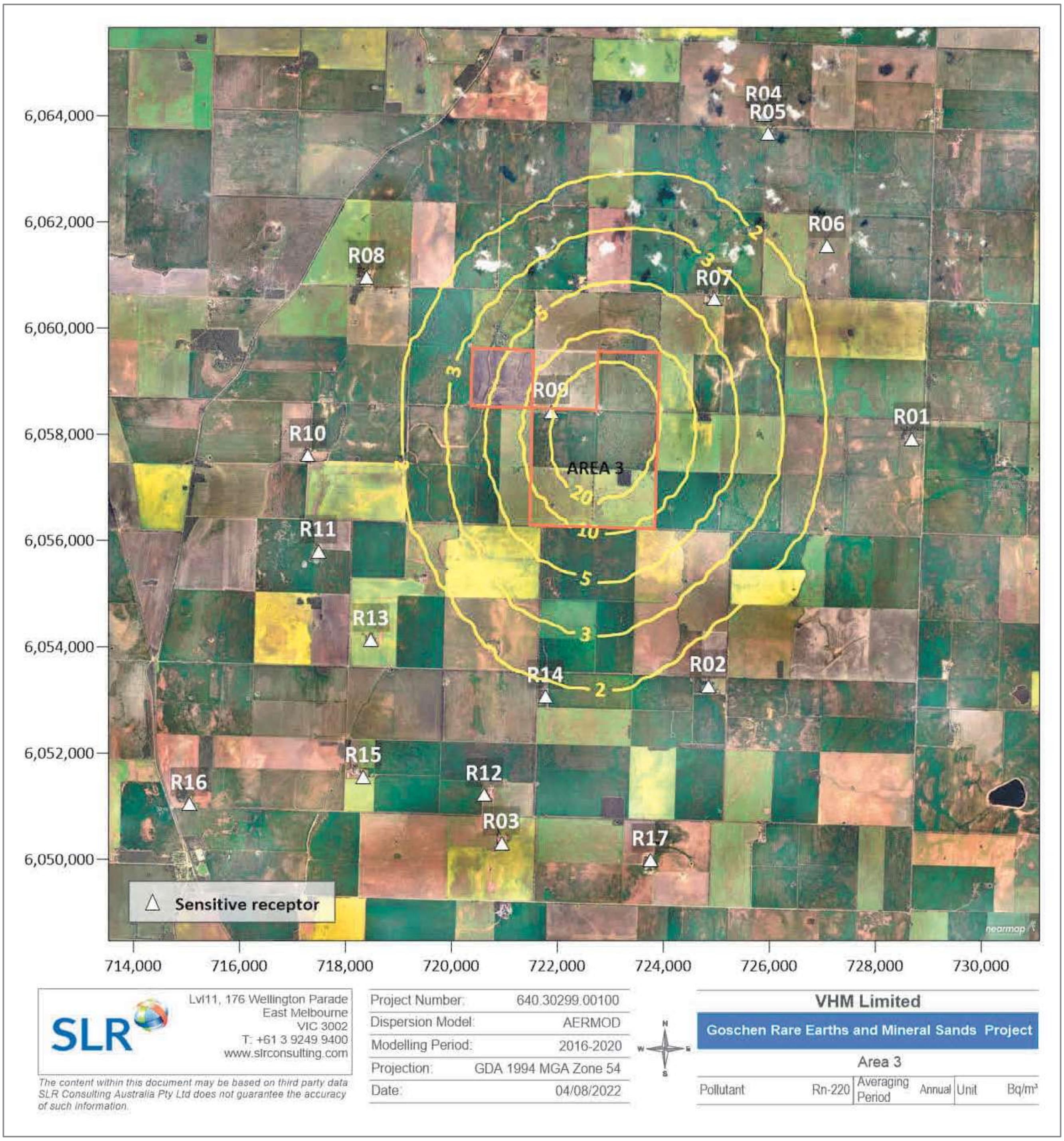


Figure G5 Scenario 1 Predicted Annual Average Project TSP Concentration

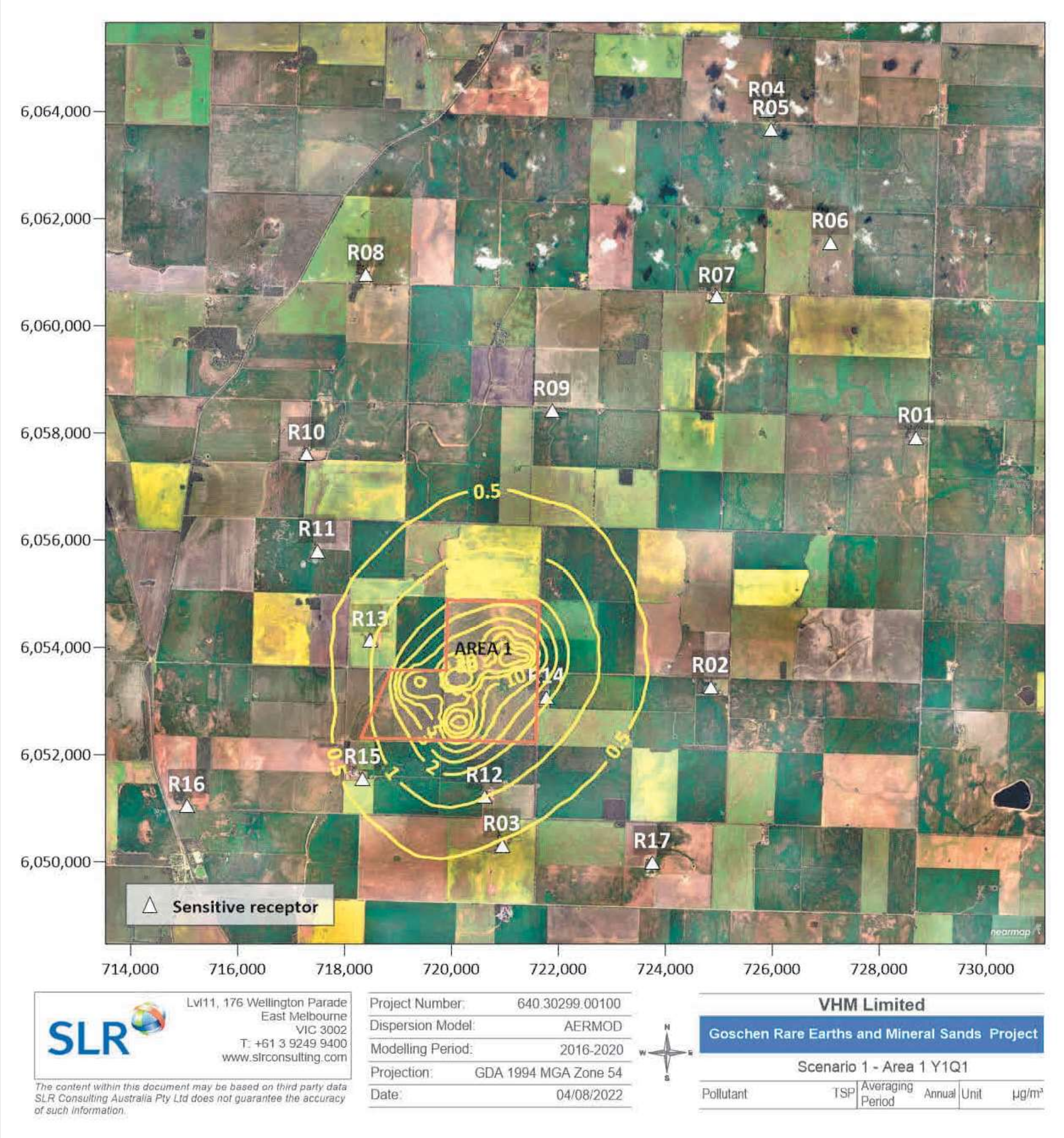


Figure G6 Scenario 2 Predicted Annual Average Project TSP Concentration

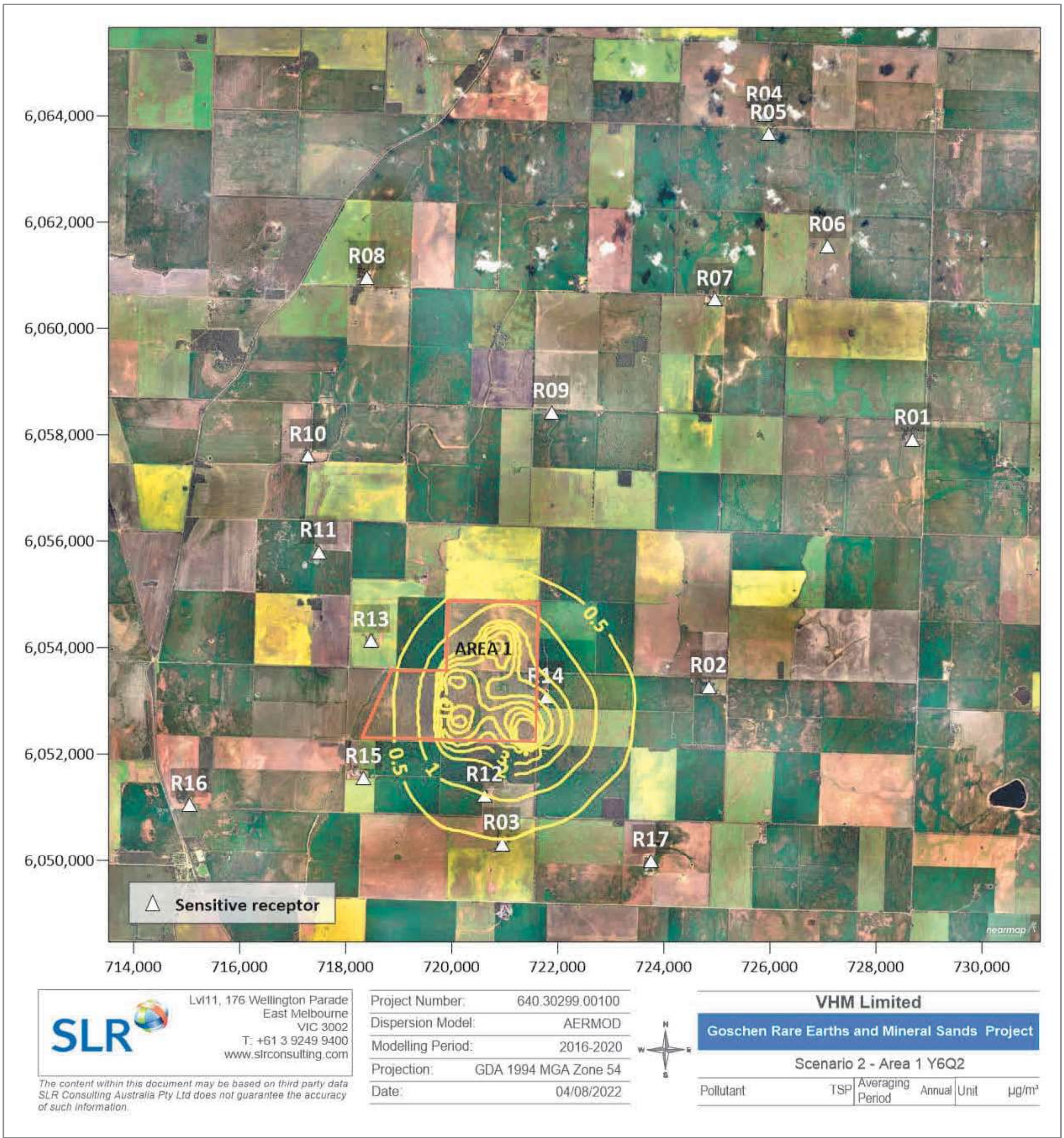


Figure G7 Scenario 3 Predicted Annual Average Project Dust TSP Concentration

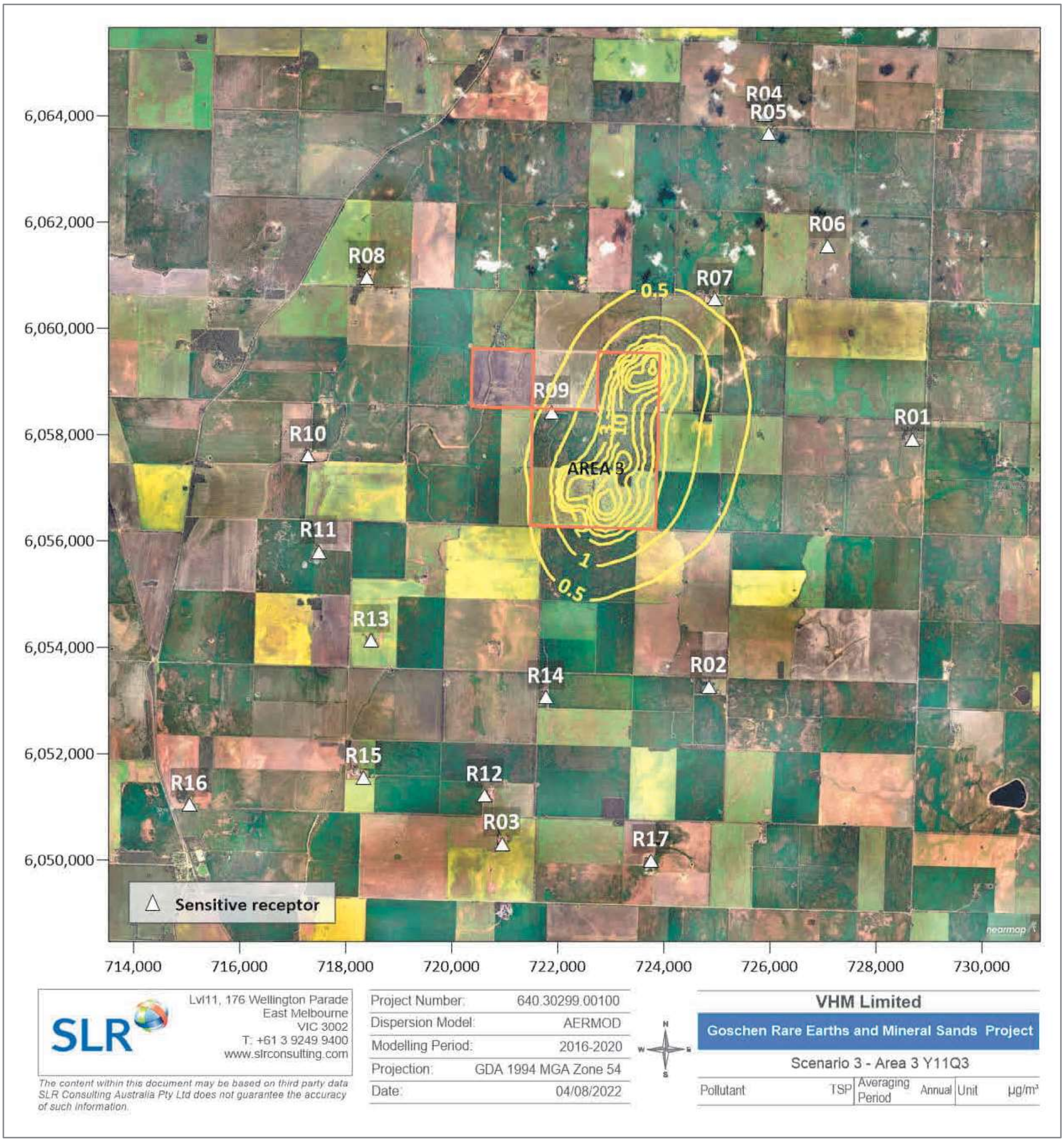


Figure G8   Scenario 4 Predicted Annual Average Project Dust TSP Concentration

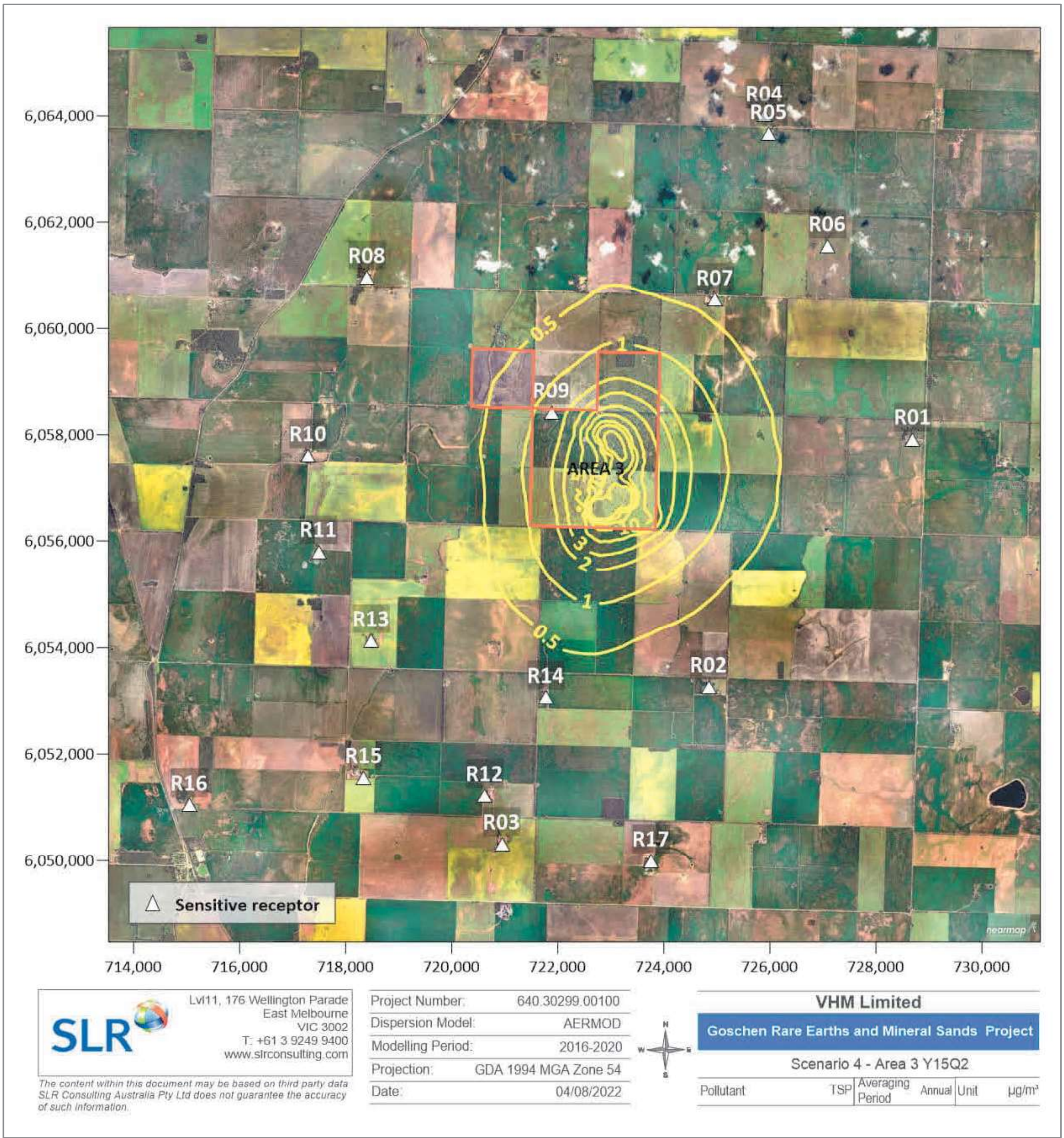


Figure G9 Scenario 1 Predicted Annual Average Project Dust Deposition Rate

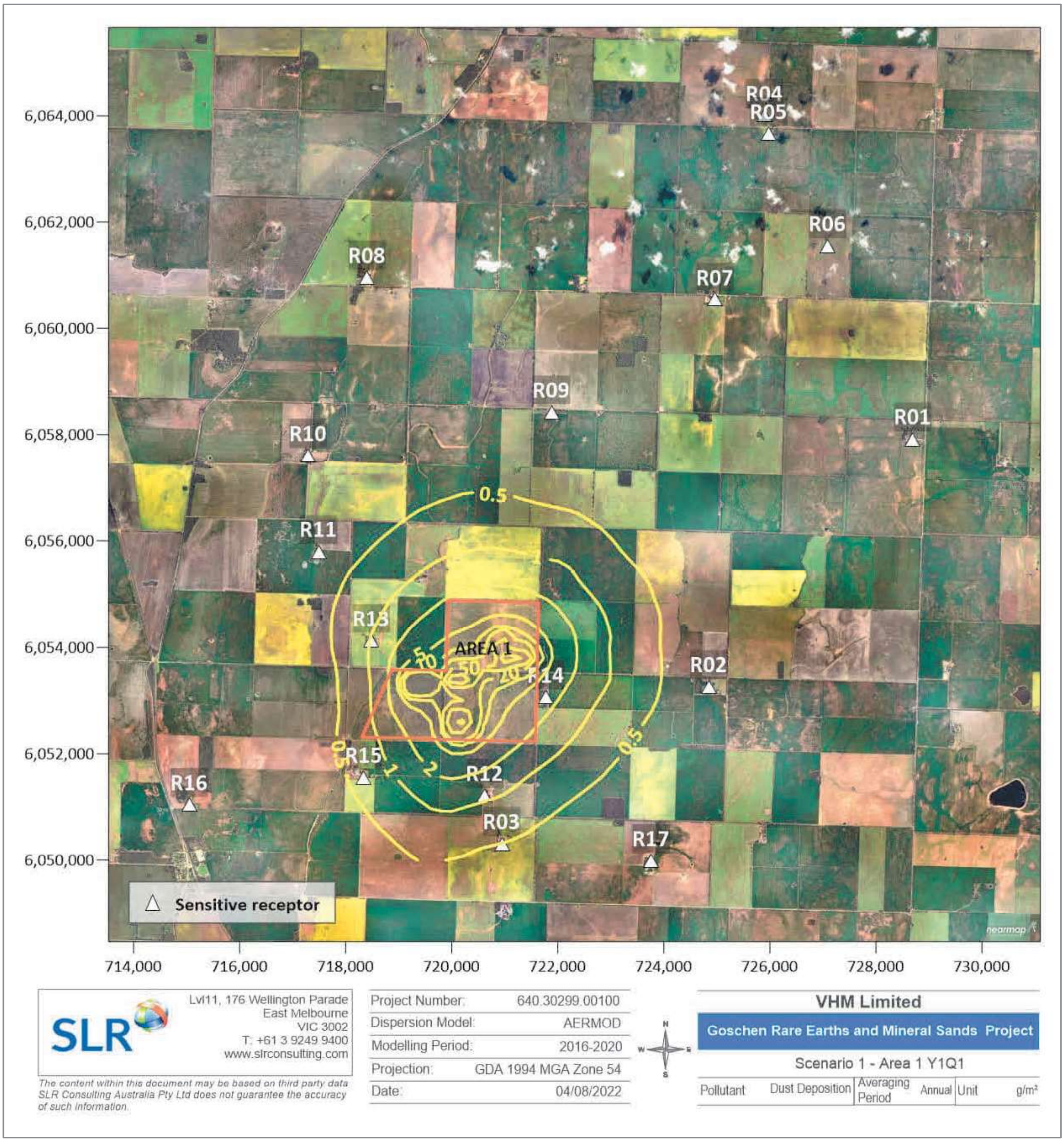


Figure G10 Scenario 2 Predicted Annual Average Project Dust Deposition Rate

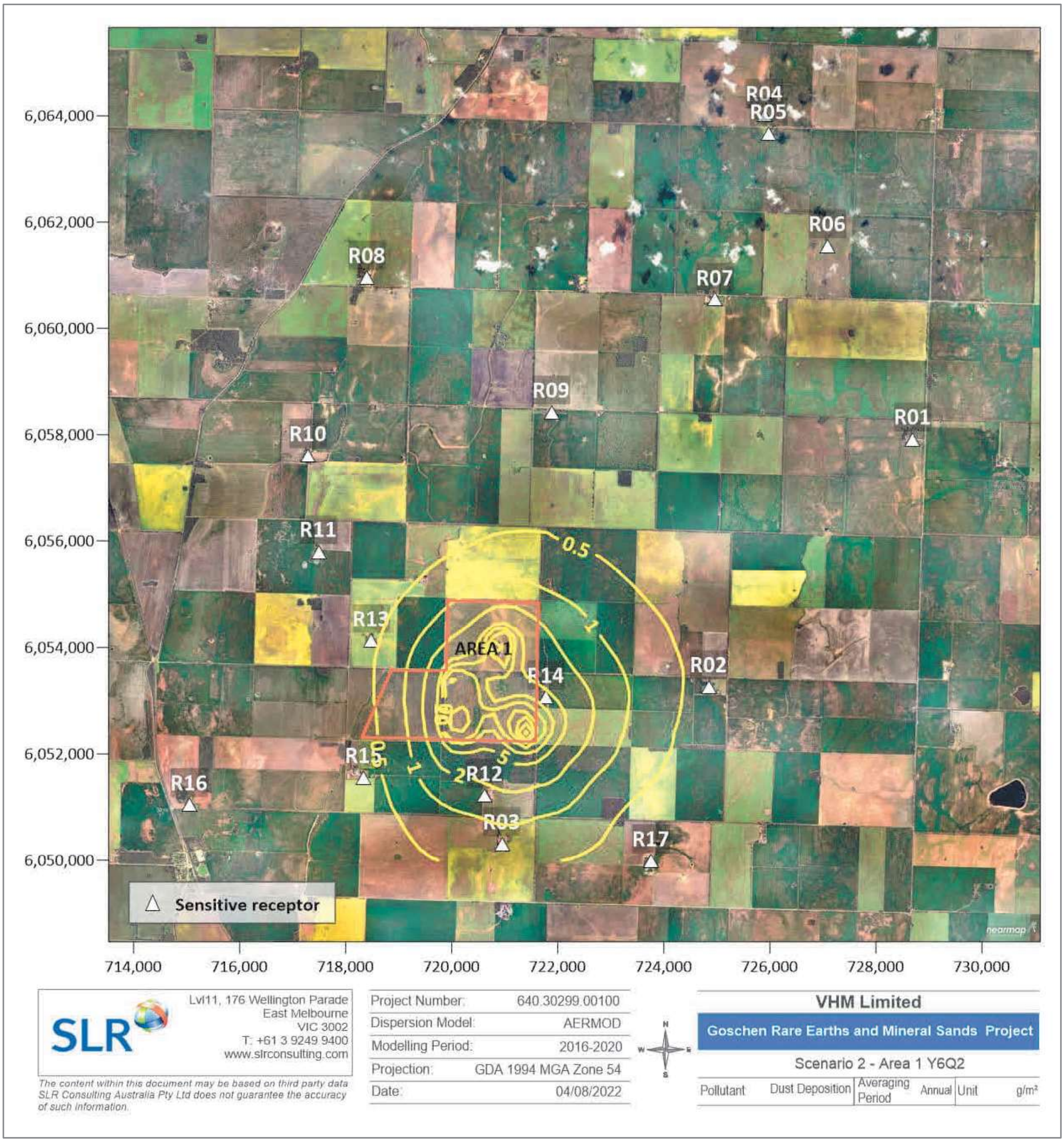
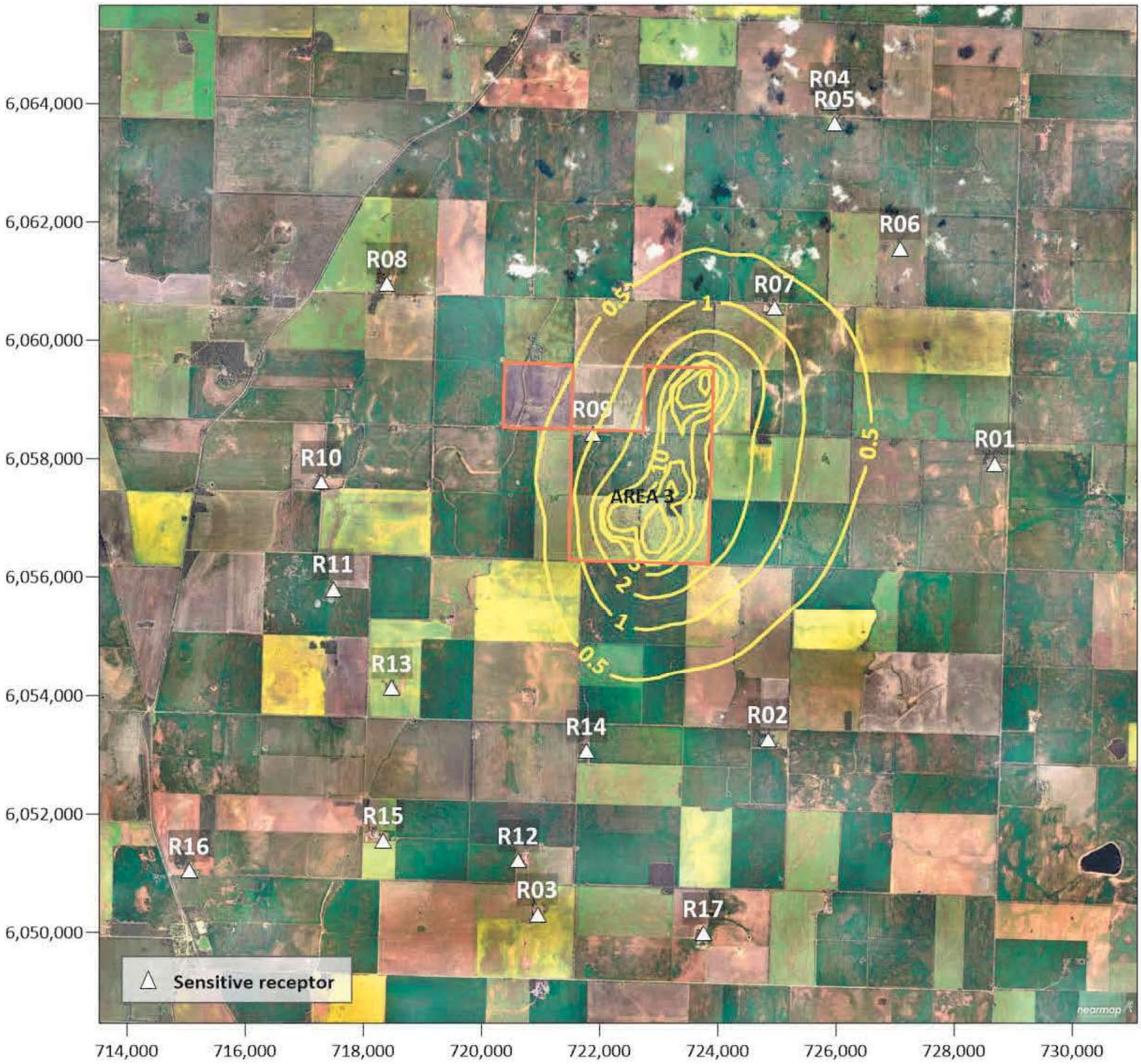


Figure G11 Scenario 3 Predicted Annual Average Project Dust Deposition Rate



Project Number:	640.30299.00100
Dispersion Model:	AERMOD
Modelling Period:	2016-2020
Projection:	GDA 1994 MGA Zone 54
Date:	04/08/2022

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East Melbourne
VIC 3002
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VHM Limited

Goschen Rare Earths and Mineral Sands Project

Scenario 3 - Area 3 Y11Q3

Pollutant	Dust Deposition	Averaging Period	Annual	Unit	g/m²

Figure G12 Scenario 4 Predicted Annual Average Project Dust Deposition Rate

Lvl11, 176 Wellington Parade East Melbourne VIC 3002 T: +61 3 9249 9400 www.slrconsulting.com	
Project Number:	640.30299.00100
Dispersion Model:	AERMOD
Modelling Period:	2016-2020
Projection:	GDA 1994 MGA Zone 54
Date:	04/08/2022

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VHM Limited

Goschen Rare Earths and Mineral Sands Project

Scenario 4 - Area 3 Y15Q2

Pollutant	Dust Deposition	Averaging Period	Annual	Unit	g/m²

APPENDIX H

Baseline Air Quality Monitoring Reports

ASIA PACIFIC OFFICES

ADELAIDE
60 Halifax Street
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APPENDIX H

Baseline Air Quality Monitoring Reports

GOSCHEN MINERAL SANDS AND RARE EARTHS PROJECT

BASELINE AIR QUALITY MONITORING REPORT

Prepared for:

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Level 2 389 Oxford Street
Mt Hawthorn WA 6016

SLR

SLR Ref: 640.11763-R01
Version No: -v5.0
October 2020

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with VHM Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.11763-R01-v5.0	26 October 2020	Jason Shepherd	Graeme Starke	Jason Shepherd
640.11763-R01-v4.0	9 October 2020	Jason Shepherd	Graeme Starke	Jason Shepherd
640.11763-R01-v3.0	8 July 2020	Jason Shepherd	Graeme Starke	DRAFT
640.11763-R01-v2.0	29 April 2020	Jason Shepherd	Graeme Starke	DRAFT
640.11763-R01-v1.0	18 March 2020	Jason Shepherd	Graeme Starke	DRAFT

EXECUTIVE SUMMARY

VHM Limited (VHM) engaged SLR Consulting Australia Pty Ltd (SLR) to prepare an air quality impact assessment (AQIA) to support an Environmental Effects Statement (EES) for the Goschen Mineral Sands Project (Project). VHM engaged SLR to undertake a 12-months baseline ambient air quality monitoring programme (AAQMP) at the Project site to inform the AQIA as required by Environmental Protection Authority Victoria (EPAV) Publication 1191 'Protocol for Environmental Management: Mining and Extractive Industries' (EPAV, 2007) (Mining PEM), an incorporated document of the State Environment Protection Policy (Ambient Air Quality) SEPP(AQM). This report presents the results of the AAQMP from commencement on 1 September 2018 to 14 September 2020.

The primary component of the AAQMP is the continuous monitoring (as opposed to batch monitoring; e.g. 1-in-6 days) of 24-hour average concentrations of particulate with an aerodynamic diameter of less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$), at the Project site.

In consultation with VHM, SLR commissioned two Met One E-BAM beta-attenuation monitors (BAM) to monitor PM_{10} and $PM_{2.5}$ at the Project site on 31 August 2018, prior to being able to secure a meeting with the Environment Protection Authority Victoria (EPAV) to confirm the appropriateness of the instrumentation.

SLR and VHM were advised at a subsequent meeting with EPAV that the equipment did not hold United States Environmental Protection Agency (USEPA) Federal Equivalent Method (FEM) designation or equivalency and therefore did not comply with the relevant AS and was not appropriate for the AAQMP.

In consultation with VHM, SLR commissioned two USEPA FEM compliant BAM instruments (Met One E-BAM Plus and Met One BAM-1022) on 18 December 2018 with monitoring commencing on 1 January 2019. SLR continued to operate original E-BAM instruments in parrallel with the replacement instruments until the end of 2019 upon which they were decommissioned and removed from site.

A summary of 24-hour concentrations for particulate monitoring (PM_{10}, $PM_{2.5}$ and deposited dust) is presented in **Table ES 1**, **Table ES 2** and **Table ES 3**, respectively. These tables also identify recorded exceedances including exceedances of the 24-hour average PM_{10}, 24-hour average $PM_{2.5}$ and monthly insoluble solids Mining PEM criteria. The number of exceedances of the relevant criterion indicates that the environment surrounding Project is already considerably dusty and subject to the impacts of meteorological influences (dry periods) and regional scale dust events (eg bushfires). It can be seen in **Table ES 1** and **Table ES 2** indicate that these impacts are seasonal with most exceedances occurring in Quarter 1 (Q1) or Quarter 4 (Q4).

A comparison of the PM_{10} and $PM_{2.5}$ USEPA FEM and non-USEPA FEM instruments is discussed and relationships between the two instrument type datasets is presented.

Respirable Crystalline Silica (RCS) and arsenic concentrations throughout the monitoring period were all below the Mining PEM annual average criteria. The annual average RCS concentrations for 2019 and 2020 (0.083 µg/m³ and 0.090 µg/m³, respectively) were below the Mining PEM criterion of 3 µg/m³. The annual average arsenic concentrations for 2019 and 2020 (both 0.002 µg/m³) were below the Mining PEM criterion of 0.003 µg/m³.

EXECUTIVE SUMMARY

Table ES 1 Summary of 24-Hour Average PM_{10} Monitoring January 2019 to September 2020: E-BAM Plus

Monitoring Period		Concentration (µg/m³) [a]			Exceedances of Criterion [b]
		Max.	Ave.	70th %ile	
1Q19	01-01-19 – 31-01-19	150	32	30	4
	01-02-19 – 28-02-19	52	24	31	0
	01-03-19 – 31-03-19	190	30	29	2
2Q19	01-04-19 – 30-04-19	64	28	30	1
	01-05-19 – 31-05-19	26	8.5	10	0
	01-06-19 – 30-06-19	12	5.1	5.7	0
3Q19	01-07-19 – 31-07-19	13	4.8	5.2	0
	01-08-19 – 31-08-19	25	5.3	5.5	0
	01-09-19 – 30-09-19	16	6.4	7.1	0
4Q19	01-10-19 – 31-10-19	82	16	16	1
	01-11-19 – 30-11-19	47	18	22	0
	01-12-19 – 31-12-19	42	16	16	0
1Q20	01-01-20 – 31-01-20	83 [c]	17	13	1
	01-02-20 – 29-02-20	69 [c]	17	15	1
	01-03-20 – 31-03-20	51	15	15	0
2Q20	01-04-20 – 30-04-20	62	12	16	1
	01-05-20 – 31-05-20	65	9.4	8.0	1
	01-06-20 – 30-06-20	13	5.3	6.2	0
3Q20	01-07-20 – 31-07-20	18	4.7	5.9	0
	01-08-20 – 31-08-20	11	4.2	5.1	0
	01-09-20 – 13-09-20	17	8.6	9.1	0

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 60 µg/m³.

c Victoria experienced widespread bushfire impacts to air quality during these months.

EXECUTIVE SUMMARY

Table ES 2 Summary of 24-Hour Average $PM_{2.5}$ Monitoring January 2019 to September 2020: BAM-1022

Monitoring Period		Concentration (µg/m3) [a]			Exceedances of Criterion [b]
		Max.	Ave.	70th %ile	
1Q19	01-01-19 – 31-01-19	19	4.9	5.9	0
	01-02-19 – 28-02-19	7.2	6.7	6.9	0
	01-03-19 – 31-03-19	10	3.7	4.5	0
2Q19	01-04-19 – 30-04-19	9.1	3.4	4.3	0
	01-05-19 – 31-05-19	3.1	1.0	1.3	0
	01-06-19 – 30-06-19	5.5	1.2	1.3	0
3Q19	01-07-19 – 31-07-19	3.5	1.1	1.2	0
	01-08-19 – 31-08-19	7.3	1.0	1.0	0
	01-09-19 – 30-09-19	4.8	1.0	1.4	0
4Q19	01-10-19 – 31-10-19	5.3	2.4	3.7	0
	01-11-19 – 30-11-19	17	3.3	3.4	0
	01-12-19 – 31-12-19	45 [c]	6.7	6.4	1
1Q20	01-01-20 – 31-01-20	81 [c]	15	17	3
	01-02-20 – 29-02-20	17	4.0	3.7	0
	01-03-20 – 31-03-20	4.3	1.6	2.1	0
2Q20	01-04-20 – 30-04-20	5.2	2.6	3.2	0
	01-05-20 – 31-05-20	4.7	1.5	2.0	0
	01-06-20 – 30-06-20	4.1	1.5	2.2	0
3Q20	01-07-20 – 31-07-20	5.8	1.4	1.7	0
	01-08-20 – 31-08-20	2.6	0.7	1.2	0
	01-09-20 – 13-09-20	2.7	1.6	2.1	0

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 36 µg/m³.

c Victoria experienced widespread bushfire impacts to air quality during these months.

EXECUTIVE SUMMARY

Table ES 3 Monthly RCS Monitoring 1 January 2019 to 25 August 2020: Partisol $PM_{2.5}$

Monitoring Period	Concentration (µg/m³)
01-01-2019 - 07-01-2019	0.32
27-02-2019 - 06-03-2019	0.15
30-04-2019 - 10-05-2019	0.053
25-06-2019 - 05-07-2019	<0.03
01-08-2019 - 11-08-2019	0.049
31-08-2019 - 10-09-2019	<0.02
30-09-2019 - 10-10-2019	<0.02
09-11-2019 - 19-11-2019	<0.02
19-12-2019 - 29-12-2019	0.12
08-01-2020 - 18-01-2020	0.37
27-02-2020 - 08-03-2020	0.35
08-03-2020 - 18-03-2020	0.025
18-03-2020 - 28-03-2020	<0.02
28-03-2020 - 07-04-2020	<0.03
27-04-2020 - 07-05-2020	<0.02
06-06-2020 - 16-06-2020	<0.02
06-07-2020 - 16-07-2020	<0.02
Annual Average Concentration (µg/m³) [a]	**2019: 0.046** **2020: 0.12**
Criterion (µg/m³)	**3**

EXECUTIVE SUMMARY

Table ES 4 Monthly Arsenic Monitoring 1 January 2019 to 25 August 2020: Partisol PM_{10}

Monitoring Period	Concentration (µg/m³)
01-01-2019 - 08-01-2019	<0.012
27-02-2019 - 06-03-2019	<0.003
27-03-2019 - 05-04-2019	<0.002
30-04-2019 - 10-05-2019	<0.002
27-05-2019 - 06-06-2019	<0.002
25-06-2019 - 05-07-2019	<0.002
01-08-2019 - 11-08-2019	0.002
31-08-2019 - 10-09-2019	<0.002
30-09-2019 - 10-10-2019	<0.002
30-10-2019 - 09-11-2019	<0.002
19-12-2019 - 29-12-2019	<0.002
0.8-01-2020 - 18-01-2020	<0.002
27-02-2020 - 08-03-2020	<0.002
08-03-2020 - 18-03-2020	<0.002
28-03-2020 - 07-04-2020	<0.002
07-05-2020 – 17-05-2020	<0.002
06-06-2020 – 16-06-2020	<0.002
06-07-2020 – 16-07-2020	<0.002
15-08-2020 – 25-08-2020	<0.002
Annual Average Concentration (µg/m³) [a]	**2019: 0.002**
	2020: <0.002
Criterion (µg/m³)	**0.003**

EXECUTIVE SUMMARY

Table ES 5 Monthly Dust Deposition Monitoring September 2018 to September 2020: Insoluble Solids

Monitoring Period		Deposition Rate ($g/m^2/month$) by Location [a]			
Start	**Finish**	**Loc 1**	**Loc 2**	**Loc 3**	**Loc 4**
27-08-18 10:00	02-10-18 10:45	3.7	1.1	4.4	0.43
02-10-18 10:00	02-11-18 10:45	1.7	8.8	2.5	1.7
02-11-18 10:00	05-12-18 11:15	7.3	-	-	0.93
02-11-18 10:15	16-01-19 19:10	2.2	1.7	1.5	2.4
16-01-19 15:45	26-02-19 16:10	13	2.2	2.1	3.9
26-02-19 15:10	26-03-19 13:25	1.4	0.49	1.0	0.49
26-03-19 12:45	29-04-19 14:00	2.7	1.6	1.7	0.90
29-04-19 13:20	27-05-19 14:15	43	131	8.2	5.2
27-05-19 13:10	26-06-19 09:40	2.5	3.9	1.2	0.85
26-06-19 08:45	31-07-19 11:15	10	1.3	0.39	0.82
31-07-19 10:15	03-09-19 14:30	0.60	0.80	0.90	0.40
03-09-19 13:20	03-10-19 14:05	1.0	0.85	1.0	1.3
03-10-19 13:20	30-10-19 15:00	8.3	1.0	1.3	0.69
30-10-19 14:00	02-12-19 15:00	7.8	1.7	2.5	1.7
02-12-19 14:15	21-01-20 14:50	16	1.6	5.6	1.3
21-01-20 14:25	26-02-20 08:40	0.76	0.95	10	-
26-02-20 08:40	27-03-20 09:27	2.2	2.2	2.1	2.5
27-03-20 08:45	27-04-20 14:04	1.6	1.3	5.8	1.1
27-04-20 13:19	29-05-20 07:54	5.7	0.91	0.37	1.8
29-05-20 07:19	30-06-20 07:27	3.1	2.7	1.2	0.53
30-06-20 06:53	31-07-20 08:22	13	1.4	1.8	2.6
31-07-20 07:43	14-09-20 14:16	12	1.5	0.6	0.8
Criterion [b]		4			
Exceedances of criterion		**10**	**2**	**5**	**1**

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 4 $g/m^2/month$.

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GLOSSARY OF TERMS

Abbreviation	Definition
AC	Ash content
As	Arsenic
AS	Australian Standard
BAM	Beta-attenuation monitor
BAM-1022	Proprietary name for Met One's USEPA FEM (for $PM_{2.5}$) BAM
CM	Combustible Matter
DDG	Dust deposition gauge
E-BAM	Proprietary name for Met One's BAM (non-USEPA FEM)
E-BAM Plus	Proprietary name for Met One's USEPA FEM (for PM_{10}) BAM
EPAV	Environment Protection Authority Victoria
FEM	Federal Equivalent Method
HVAS	High Volume Air Sampler
LVAS	Low Volume Air Sampler
g/m^2/month	Grams per square metre per month
mm	Millimetres
NIOSH	National Institute for Occupational Safety and Health
Partisol	Thermo Scientific Partisol 2025i sequential air sampler
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micron
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micron
RCS	Respirable crystalline silica
$\mu g/m^3$	Micrograms per cubic metre
USEPA	United States Environment Protection Agency

1 Introduction

VHM Limited (VHM) engaged SLR Consulting Australia Pty Ltd (SLR) to prepare an air quality impact assessment (AQIA) to support an Environmental Effects Statement (EES) for the Goschen Mineral Sands Project (Project). VHM engaged SLR to undertake a 12-months baseline ambient air quality monitoring programme (AAQMP) at the Project site to inform the AQIA as required by Environmental Protection Authority Victoria (EPAV) Publication 1191 'Protocol for Environmental Management: Mining and Extractive Industries' (EPAV, 2007) (Mining PEM), an incorporated document of the *State Environment Protection Policy (Air Quality Management)* SEPP(AQM).

In consultation with VHM, the AAQMP has been extended in duration. This report presents the results of the AAQMP from commencement on 1 September 2018 to conclusion on 14 September 2020 (the AAQMP monitoring period).

1.1 AQIA Methodology

In accordance with the Mining PEM and SEPP(AQM) Schedule C 'Modelling Emissions to Air', the AQIA is to model the dispersal of pollutant emissions to air from the Project using the Victorian regulatory model AERMOD and must include background (existing) concentrations. In the absence of nearby background ambient air quality monitoring data representative of the project area, 12-months of real-time continuous 24-hour monitoring of particulate with an aerodynamic diameter of less than 10 microns (PM_{10}) and of less than 2.5 microns ($PM_{2.5}$) must be conducted. This should also include analysis of respirable crystalline silica (as $PM_{2.5}$) and heavy metal content (of PM_{10}) as appropriate.

1.2 Scope

1.2.1 Background

On 31 August 2018 SLR commissioned two Met One E-BAM beta-attenuation monitors (BAM) with solar power capability (due to the remoteness of the site) to monitor PM_{10} and $PM_{2.5}$ at the Project site. Two Airmetrics MiniVol low volume air samplers (LVAS) were also deployed to sample PM_{10} and $PM_{2.5}$ for subsequent heavy metals and RCS analysis. SLR understood these instruments were compliant with the relevant Australian Standards (AS). In consultation with VHM, the equipment the was deployed prior to being able to secure a meeting with the Environment Protection Authority Victoria (EPAV) to confirm the appropriateness of the instrumentation.

SLR and VHM were advised at a subsequent meeting with EPAV that the equipment did not hold United States Environmental Protection Agency (USEPA) Federal Equivalent Method (FEM) designation or equivalency and therefore did not comply with the relevant AS and was not appropriate for the AAQMP.

USEPA FEM compliant BAM instrument (Met One E-BAM Plus and Met One BAM-1022) were commissioned on 19 December 2018. The monitoring site was moved to a location near to a residence such that mains power could be accessed due to the increased power demands of this equipment. The original E-BAM equipment was moved to the new location with the intention of continuing to monitor for a three-month period to enable a comparison of the data from the USEPA FEM compliant and non-compliant instruments during this period. SLR continued to operate the E-BAM instruments at this location until the end of 2019 upon which they were decommissioned and removed from site. In addition a Thermo Scientific Partisol 2025i sequentual air sampler was comissioned to enable 7-10 day sampling of PM_{10} and $PM_{2.5}$ for subsquent aresnic and RCS analysis, respectively.

The scope of monitoring included monthly site visits by SLR staff to maintain and calibrate the equipment as required.

2 Monitoring Locations

Four monitoring locations were commissioned on 31 August 2018, with a fifth location commissioned between 5 December 2018 and 19 December 2018 as presented in **Table 1**.

Table 1 Scope of Works at each Monitoring Location

Monitoring Location	UTM Zone 54H		Monitoring Period	Parameters Monitored
	Northing (m)	Easting (m)		
Location 1 Thompson Road Farm	6058547 m S 35°35’32.11”S	720482 m E 143°26’0.13”E	31 August 2018 – 14 September 2020	Dust deposition
Location 2 Crn Bennette and Shepherd Road	6053640 m S 35°38’9.72”S	721622 m E 143°26’51.21”E	31 August 2018 – 14 September 2020	Dust deposition
Location 3 Jobling Road Farm	6057480 m S 35°36’9.72”S	717156 m E 143°23’49.27”E	31 August 2018 – 14 September 2020	Dust deposition
Location 4 Bish Road Farm	6058065 m S 35°35’44.19”S	722723 m E 143°27’30.21”E	31 August 2018 – 14 September 2020	Dust deposition
			31 August 2018 – 5 December 2018	Continuous PM_{10} and $PM_{2.5}$, respirable crystalline silica, heavy metals
Location 5 Thompson Road Residence	6058297 m S 35°35’39.16”S	721960 m E 143°27’0.53”E	1 January 2019 – 13 September 2020	Continuous PM_{10} and $PM_{2.5}$, respirable crystalline silica, heavy metals

Each of the five monitoring locations were in compliance with AS/NZS 3580.1.1: 2016 “*Methods for sampling and analysis of ambient air: Guide to siting air monitoring equipment*“ with the exception of Location 2 which did not meet the minimum distance to the dripline of a nearby tree (≥10 metres) for a background monitoring location. SLR considered this to be the most suitable location available to achieve the project objectives while considering suitable discrete security measures, accessibility, impacts from farming machinery and meeting as many of the siting criteria detailed in the standards. Non-compliance with these criteria does not invalidate the results, but may impose certain considerations when deriving conclusions from those results.

Table 2 provides the siting details compared with the AS/NZS 3580.1.1 2016 recommended criteria.

Table 2 Siting Criteria Compliance

Site No.	Location Type	AS3580.1.1 Compliance [a]					
		Inlet above ground (m): DDG 1.8 – 2.2 $PM_{10}/PM_{2.5}$ 1.5 – 15	>10 m from nearest object/tree dripline	>5 m from source	Clear Sky Angle >120°	Unrestricted airflow of 360° around sample inlet	No extraneous sources
Location 1 Thompson Road Farm	Neighbourhood / Background	Yes	Yes	Yes	Yes	Yes	Yes
Location 2 Crn Bennette and Shepherd Road	Neighbourhood / Background	Yes	No	Yes	Yes	Yes	Yes
Location 3 Jobling Road Farm	Neighbourhood / Background	Yes	Yes	Yes	Yes	Yes	Yes
Location 4 Bish Road Farm	Neighbourhood / Background	Yes	Yes	Yes	Yes	Yes	Yes
Location 5 Thompson Road Residence	Neighbourhood / Background	Yes	Yes	Yes	Yes	Yes	Yes

a Non-compliance with these criteria does not invalidate the results but may impose certain considerations when deriving conclusions from the results.

Refer to **Appendix A** for an overview of monitoring site location and photographs of the instruments installed on site.

3 Monitoring Conditions

Annual and seasonal wind roses for the AAQMP monitoring period for Swan Hill Bureau of Meteorology station (No. 077094), approximately 25 km northeast of Location 5, are provided in **Figure 1** and **Figure 2** for 2019 and 2020, respectively.

Figure 1 Regional Area Wind Roses 2019

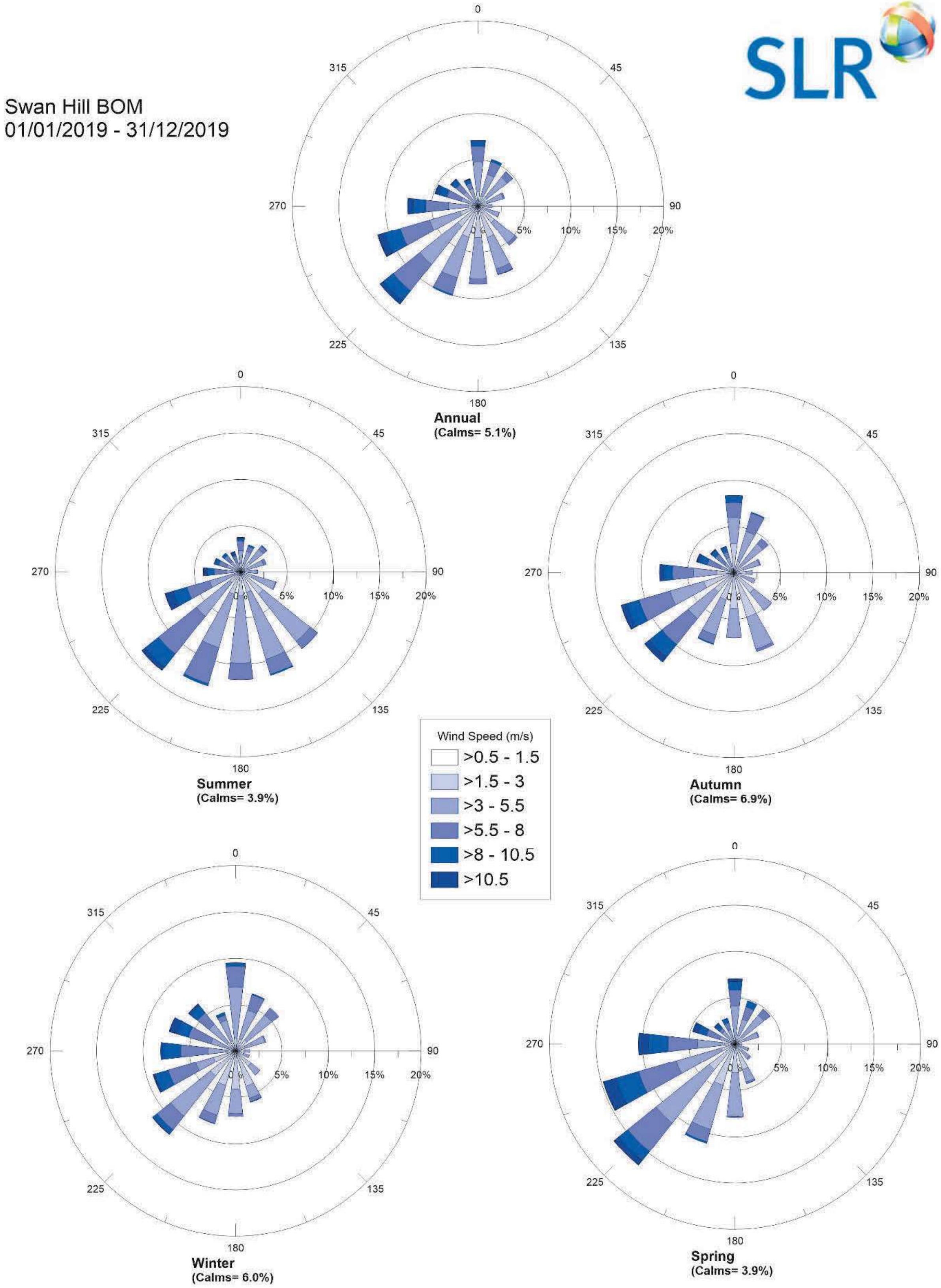
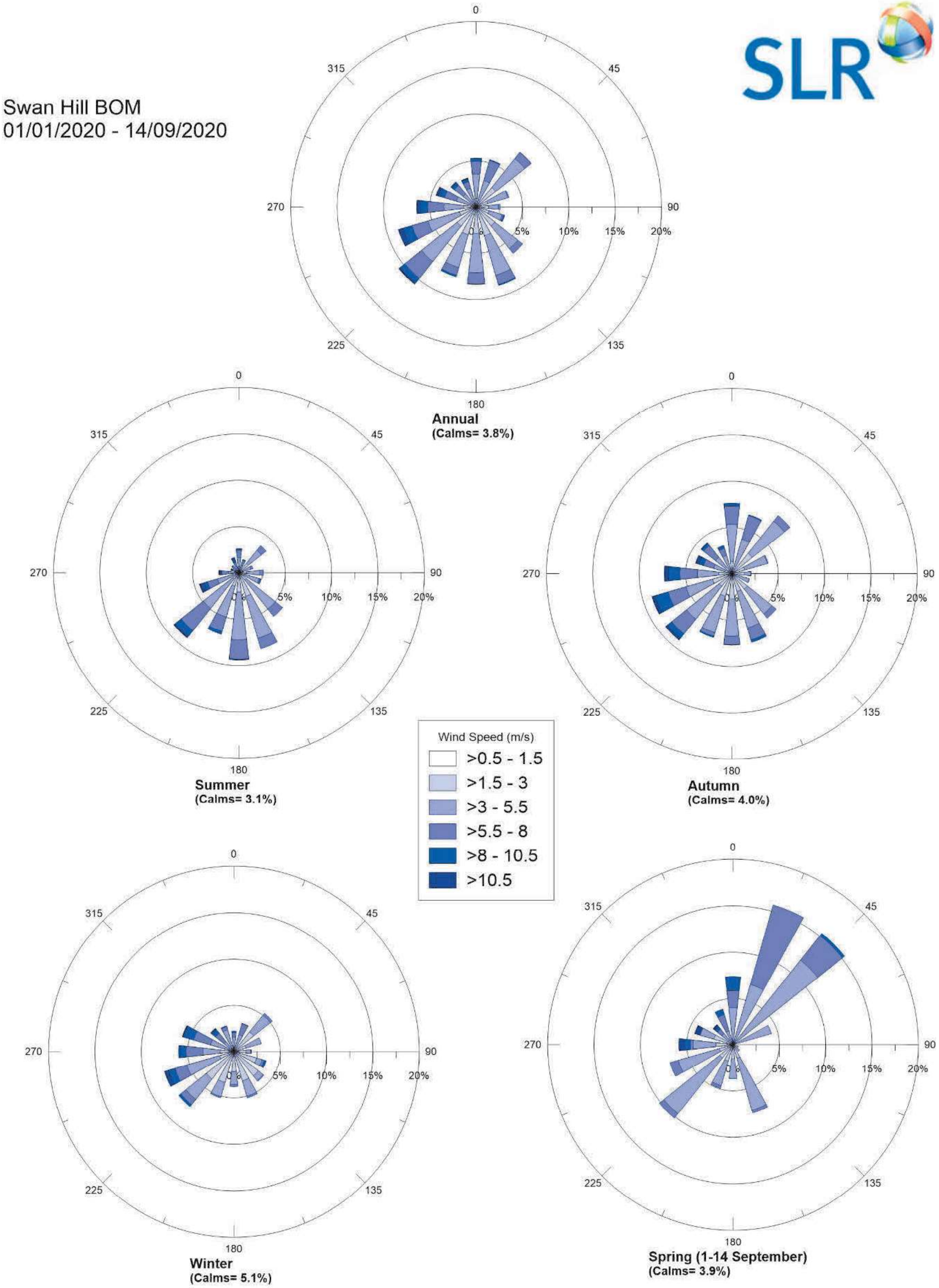


Figure 2 Regional Area Wind Roses 2020



4 Assessment Criteria

Assessment criteria for the AQIA are adopted from the Mining PEM as provided in **Table 3** and inform the AAQMP with regard to relevant averaging periods and limits of reporting (LOR). Note that the Air NEPM criteria are specifically for State and Territory performance monitoring stations located in regions representative of population greater than 25,000 and are not applicable to mining assessments except in exceptional circumstances, however these have been included for comparison.

Table 3 Assessment Criteria

Indicator	Criteria	Units	Averaging period	Source
PM_{10}	60	µg/m³	24 hour	Mining PEM
	50	µg/m³	24 hour	Air NEPM
$PM_{2.5}$	36	µg/m³	24 hour	Mining PEM
	25 (20 in 2025)	µg/m³	24 hour	Air NEPM
	8 (7 in 2025)	µg/m³	Annual	Air NEPM
RCS (as $PM_{2.5}$)	3	µg/m³	Annual	Mining PEM
Arsenic	0.003	µg/m³	Annual	Mining PEM
Dust deposition Rate	4	g/m²/month	Monthly	Mining PEM

5 Methodology

5.1 PM_{10}

Continuous PM_{10} monitoring was performed using E-BAM SLR ID 2110 / SN P20746 in accordance with AS/NZS 3580.9.11:2008 (Amdt1 2009) "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – PM_{10} beta attenuation monitors*" and in general accordance with AS/NZS 3580.9.11: 2016. Commissioning was performed from 26 August 2018 to 30 August 2018. Monitoring commenced from 1 September 2018.

Continuous PM_{10} monitoring was performed using USEPA FEM compliant E-BAM Plus SLR ID 2739 / SN X19174 in accordance with AS 3580.9.11:2016 (USEPA – EQPM-1215-226). Commissioning were performed from 5 December 2018 to 19 December 2018. Monitoring commenced from 1 January 2019.

AS 3580.9.11:2016 states that BAMs may record short-term (<24h) negative PM_{10} concentrations due to loss of moisture or semi-volatile compounds in the collected particulate matter from the filter media. Short term negative values resulting from such loss should be considered to be real data and should not be invalidated from the dataset.

5.2 $PM_{2.5}$

Continuous $PM_{2.5}$ monitoring was performed using E-BAM SLR ID 2108 / SN P20741 in accordance with AS 3580.9.12:2013 "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – $PM_{2.5}$ beta attenuation monitors*". Commissioning was performed from 26 August 2018 to 30 August 2018. Monitoring commenced on 1 September 2018.

Continuous $PM_{2.5}$ monitoring was performed using USEPA FEM compliant BAM-1022 SLR ID 2740 / SN X24567 in accordance with AS 3580.9.12:2013 (USEPA – EQPM-1013-209). Commissioning was performed from 5 December 2018 to 19 December 2018. Monitoring commenced on 1 January 2019.

AS 3580.9.12:2013 states that BAMs may record short-term (<24h) negative $PM_{2.5}$ concentrations due to loss of moisture or semi-volatile compounds in the collected particulate matter from the filter media. Short term negative values resulting from such loss should be considered to be real data and should not be invalidated from the dataset.

5.3 RCS

Batch $PM_{2.5}$ monitoring for RCS was performed using a LVAS and 47mm PVC filters in accordance with AS/NZS 3580.9.10:2017 "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – $PM_{2.5}$ low volume sampler – Gravimetric method*" and AS 2985: 2009 / NIOSH 7500. Commissioning was performed from 26 August 2018 to 30 August 2018. Monitoring commenced on 1 September 2018.

Batch $PM_{2.5}$ monitoring for RCS was performed using a Partisol and 47mm PVC filters in accordance with AS 3580.9.7:2009 "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – Dichotomous sampler (PM_{10}, coarse PM and $PM_{2.5}$) – Gravimetric method*" and AS 2985: 2009 "*Workplace atmospheres – Method for sampling and gravimetric determination of respirable dust*" / NIOSH 7500 "*Elements by ICP*". Commissioning was performed from 5 December 2018 to 19 December 2018. Monitoring commenced on 1 January 2019.

Gravimetric and crystalline silica (quartz) analysis was conducted by Simtars , NATA accreditation No. 2681.

5.4 Heavy Metals

Batch PM_{10} monitoring for heavy metals was performed using a LVAS and PTFE or quartz coated glass fibre filters in accordance with AS/NZS 3580.9.9: 2017 "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – PM_{10} low volume sampler – Gravimetric method*" and AS/NZS 3580.9.15: 2014 "*Methods for sampling and analysis of ambient air: Determination of suspended particulate matter – Particulate metals high or low volume sampler gravimetric collection – Inductively coupled plasma (ICP) spectrometric method*". Commissioning was performed from 26 August 2018 to 30 August 2018. Monitoring commenced from 1 September 2018.

Batch PM_{10} monitoring for heavy metals was performed using a Partisol and PTFE or quartz coated glass fibre filters in accordance with AS/NZS 3580.9.7: 2009 and NIOSH 7300. Commissioning was performed from 5 December 2018 to 19 December 2018. Monitoring commenced on 1 January 2019.

Gravimetric and heavy metals analysis was conducted by National Measurement Institute, NATA accreditation No. 198.

5.5 Dust Deposition

Monthly dust deposition rate monitoring was conducted using dust deposition gauges in accordance with AS/NZS 3580.10.1: 2016 "*Methods for sampling and analysis of ambient air: Determination of particulate matter – Deposited matter – Gravimetric method*". Commissioning was performed from 26 August 2018 to 30 August 2018. Monitoring commenced from 1 September 2018.

Gravimetric analysis for total insoluble solids and ash content was conducted by ALS Environmental (NSW), NATA accreditation No. 825.

5.6 Instrument Flow Rates

Instrument flow rates were calibrated using a BGI TetraCal air flow calibrator and inlet flow adaptor. The TetraCal was calibrated by Vipac Engineers and Scientists Ltd, NATA accreditation No 676.

5.7 Temperature

Ambient temperature was monitored using a BGI TetraCal. The TetraCal was calibrated by Vipac Engineers and Scientists Ltd, NATA accreditation No 676.

5.8 Pressure

Barometric pressure was monitored using a BGI TetraCal. The TetraCal was calibrated by Vipac Engineers and Scientists Ltd, NATA accreditation No 676.

5.9 Data Averaging

Note that averaging of data has been calculated in accordance with National Environmental Protection (Ambient Air Quality) Measure (Air NEPM) "Technical Paper No. 5 – Data Collection and Handling" (Air NEPM TP No.5) (NEPC, 2001) which states:

> *An average concentration can be valid only if it is based on at least 75% of the expected samples in the averaging period. This rule applies to all averaging periods, from the hourly concentrations that make up basic air quality data to annual averages.*

6 Measurement Uncertainty

6.1 PM_{10}

The MetOne E-BAM Plus meets USEPA requirements accuracy and precision and for PM_{10} measurement. SLR estimates that the measurement uncertainty associated with PM_{10} (24-hour average) by E-BAM Plus is ±2 $\mu g/m^3$.[1]

6.2 $PM_{2.5}$

The MetOne BAM-1022 meets USEPA requirements for Class III $PM_{2.5}$ FEM. SLR estimates that the measurement uncertainty associated with $PM_{2.5}$ (24-hour average) by BAM-1022 is ±2 $\mu g/m^3$.[1]

[1] Equivalent Thermo-fisher 5014i USEPA FEM instrument specifications state ±2.0 $\mu g/m^3$ <80 $\mu g/m^3$; 4-5$\mu g/m^3$ > 80 $\mu g/m^3$ (24-hour average).

6.3 RCS

The measurement uncertainty associated with low volume sampling by dichotomous sampler (24-hour average) is published in AS/NZS 3580.9.7 as ±5 $\mu g/m^3$. Simtars estimate the uncertainty for analysis of quartz collected on filters to be ±30% over the range 0.005 to 0.60 mg.

6.4 Metals

The measurement uncertainty associated with low volume sampling by dichotomous sampler (24-hour average) is published in AS/NZS 3580.9.7 as ±5 $\mu g/m^3$. AS/NZS 3580.9.15 indicates that field validation testing suggests that the measurement uncertainty associated with the ICP spectrometric method is typically 10-20% depending on the metal.

6.5 Dust Deposition

The measurement uncertainty, based on the laboratory sampling and weighing procedures, for deposited dust (insoluble solids) is dependent on the laboratory result as follows, where the limit of reporting (LOR) = 0.1 g/m^2/month:

- Result < 10 times LOR: no limit
- Result >10 times LOR; <20 times LOR: 0-50%
- Result >20 times LOR: 0-20%.

7 Data Capture Objective

For State compliance monitoring in accordance with the Air NEPM (NEPC, 2016), to demonstrate compliance with criteria the Air NEPM TP No.5 states that:

> *It is essential that data loss is kept to an absolute minimum. For representative monitoring data and for credible compliance assessment it is desirable to have data capture rates higher than 95%. 75% data availability is specified as an absolute minimum requirement for data completeness.*
>
> *To make a valid assessment of compliance for annual reporting, annual compliance statistics must be based on hourly (daily for PM_{10} and lead) data that are at least 75% complete in each calendar quarter (in addition to an annual data availability of at least 75% based on valid hourly (daily for PM_{10} and lead) data).*

While this baseline AAQMP is not subject to the requirements of the Air NEPM, in the absence of guidance in the Mining PEM these data capture criteria inform the baseline AAQMP data capture objectives for 24-hour average PM_{10} and $PM_{2.5}$:

- Annual (including each calendar quarter): >75%

8 Results

Summary results for each of the parameters monitored are provided in the following sections. Full results for PM_{10} and $PM_{2.5}$ are provided in **Appendix B.** Note that Victoria was subject to widespread bushfire events between late December 2019 and mid-February 2020. Intermittent periods of elevated $PM_{2.5}$ concentrations (and PM_{10} concentrations of which $PM_{2.5}$ makes up a portion) are expected, and observed, during these periods due to the bushfire smoke.

8.1 PM_{10}

The E-BAM non-USEPA compliant monitoring data is summarised in **Table 4**. The USEPA compliant monitoring data is summarised in **Table 5**. The 24-hour averaged datasets of each instrument are presented in **Figure 3.**

Table 4 Summary of 24-Hour Average PM_{10} Monitoring 1 September 2018 to 31 December 2019: E-BAM

Monitoring Period		Concentration (µg/m³) [a]			Exceedances of Criterion [c]	Data Capture (%) [c]		Comment
		Max.	Ave.	70th %ile		Month	Quarter	
3Q18	01-09-18 – 30-09-18	-	-	-	-	0	0	A
4Q18	01-10-18 – 31-10-18	25	7	7	0	61	78	A
	01-11-18 – 30-11-18	53	16	15	0	97		
	01-12-18 – 31-12-18	79	22	26	1	77		B
1Q19	01-01-19 – 31-01-19	130	27	27	2	100	100	
	01-02-19 – 28-02-19	80	24	25	2	100		
	01-03-19 – 31-03-19	110	23	25	1	100		
2Q19	01-04-19 – 30-04-19	35	17	19	0	100	86	
	01-05-19 – 31-05-19	15	6.4	7.1	0	97		
	01-06-19 – 30-06-19	11	4.7	6.0	0	60		C
3Q19	01-07-19 – 31-07-19	-	-	-	-	**0**	**67**	C
	01-08-19 – 31-08-19	20	4.7	4.7	0	100		
	01-09-19 – 30-09-19	12	5.6	6.3	0	100		
4Q19	01-10-19 – 31-10-19	63	13	11	1	100	**43**	
	01-11-19 – 30-11-19	49	49	49	0	**3**		C
	01-12-19 – 31-12-19	17	14	16	0	**26**		C
2018						**59**		
2019						**74**		
All						75		

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 60 µg/m³.

c Bold font indicates data capture does not meet AAQMP objective.

A Instrument failure on 30/08/18, fixed on next site visit 01/10/18

B Instrument blown over in strong winds on 13/12/18. Corrected on 19/12/18.

C Flow failure due to unresolved intermittent instrument issues.

Table 5 Summary of 24-Hour Average PM_{10} Monitoring 1 September 2018 to 13 September 2020: E-BAM Plus

Monitoring Period		Concentration (µg/m³) [a]			Exceedances of Criterion [b]	Data Capture (%) [c]		Comment
		Max.	Ave.	70th %ile		Month	Quarter	
1Q19	01-01-19 – 31-01-19	150	32	28	4	100	100	
	01-02-19 – 28-02-19	52	24	31	0	100		
	01-03-19 – 31-03-19	190	30	29	2	100		
2Q19	01-04-19 – 30-04-19	64	28	30	1	100	99	
	01-05-19 – 31-05-19	26	8.5	10	0	97		
	01-06-19 – 30-06-19	12	5.1	5.7	0	100		
3Q19	01-07-19 – 31-07-19	13	4.8	5.2	0	100	100	
	01-08-19 – 31-08-19	25	5.3	5.5	0	100		
	01-09-19 – 30-09-19	16	6.4	7.1	0	100		
4Q19	01-10-19 – 31-10-19	**82**	16	16	1	100	**73**	
	01-11-19 – 30-11-19	47	18	22	0	**67**		A
	01-12-19 – 31-12-19	42	16	16	0	**52**		B
1Q20	01-01-20 – 31-01-20	**83** [d]	17	13	1	**32**	**64**	B
	01-02-20 – 29-02-20	**69** [d]	17	15	1	**59**		B
	01-03-20 – 31-03-20	51	15	15	0	100		
2Q20	01-04-20 – 30-04-20	**62**	12	16	1	100	99	
	01-05-20 – 31-05-20	**65**	9.4	8.0	1	97		
	01-06-20 – 30-06-20	13	5.3	6.2	0	100		
3Q20	01-07-20 – 31-07-20	18	4.7	5.9	0	100	100	
	01-08-20 – 31-08-20	11	4.2	5.1	0	100		
	01-09-20 – 13-09-20	17	8.6	9.1	0	100		
2019						93		
2020						88		
All						91		

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 60 µg/m³.

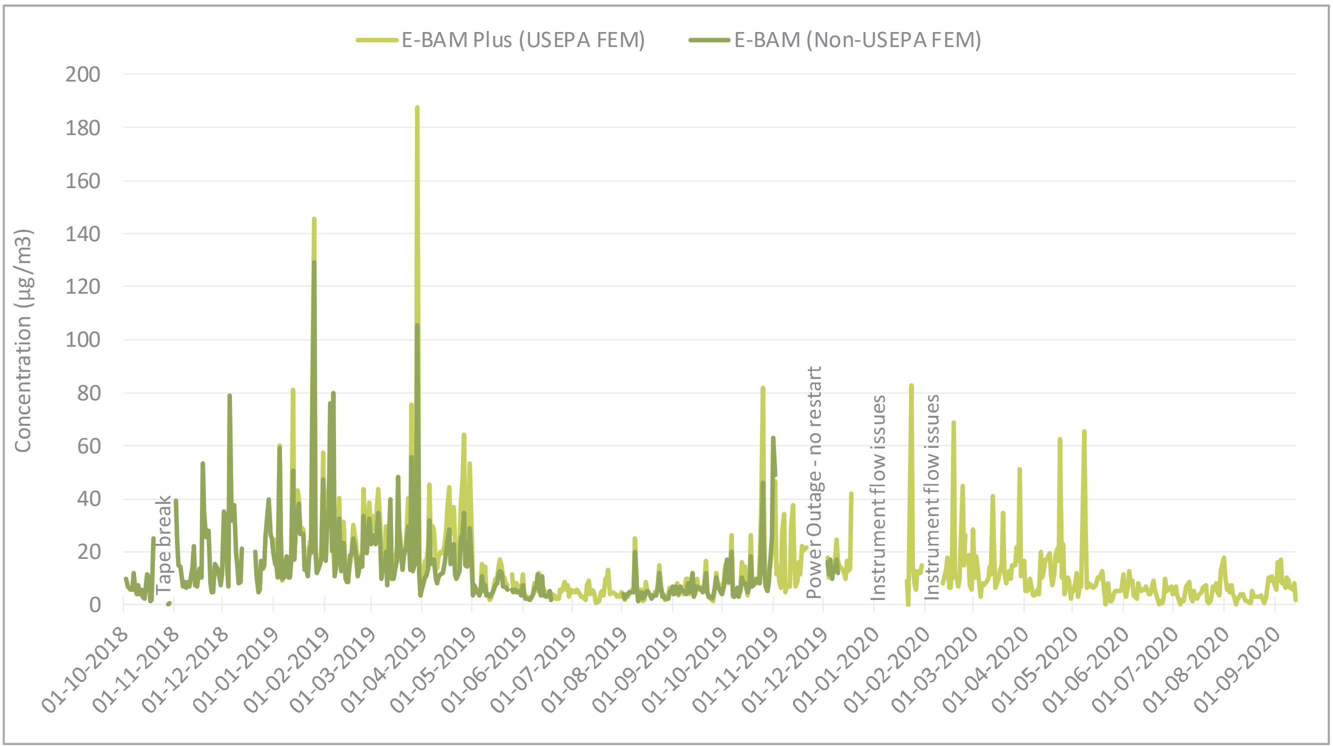
c Bold font indicates data capture does not meet AAQMP objective.

d Victoria experienced widespread bushfire impacts to air quality during these months

A Temperature sensor plug broken leading to flow alarm – fixed during site visit 2 December 2019.

B Instrument alarmed and hanged (stopped recording data) due to intermittent instrument issues pump and/or flow controller module. Instrument supplier unable to resolve. During 27 February 2020 site visit, timer added to cycle power off/on at midnight each night to overcome this issue. Modem installed to monitor instrument operation remotely.

Figure 3 24-Hour Average PM_{10} Datasets: E-BAM Plus and EBAM



8.2 $PM_{2.5}$

The E-BAM non-USEPA compliant monitoring data is summarised in **Table 6**. The USEPA compliant monitoring data is summarised in **Table 7**. The 24-hour averaged datasets of each instrument are presented in **Figure 4.**

Table 6 Summary of 24-Hour Average $PM_{2.5}$ Monitoring 1 September 2018 to 31 December 2019: E-BAM

Monitoring Period		Concentration ($\mu g/m^3$)			Exceedances of Criterion [a]	Data Capture (%) [b]		Comment
		Max.	Ave.	70th %ile		Month	Quarter	
3Q18	01-09-18 – 30-09-18	9.3	3.6	3.9	0	100	100	
4Q18	01-10-18 – 31-10-18	6.7	4.1	4.6	0	100	92	
	01-11-18 – 30-11-18	9.0	4.8	5.9	0	100		
	01-12-18 – 31-12-18	10	5.5	6.7	0	77		
1Q19	01-01-19 – 31-01-19	15	6.8	7.5	0	100	98	
	01-02-19 – 28-02-19	15	7.0	8.5	0	93		
	01-03-19 – 31-03-19	15	5.8	6.3	0	100		
2Q19	01-04-19 – 30-04-19	15	6.1	7.0	0	100	99	
	01-05-19 – 31-05-19	10	3.8	3.8	0	97		
	01-06-19 – 30-06-19	6.5	3.2	3.3	0	100		
3Q19	01-07-19 – 31-07-19	4.8	2.7	2.9	0	100	100	
	01-08-19 – 31-08-19	8.5	3.0	2.9	0	100		
	01-09-19 – 30-09-19	9.8	3.6	4.0	0	100		
4Q19	01-10-19 – 31-10-19	12	5.5	5.4	0	**35**	**47**	A
	01-11-19 – 30-11-19	6.8	3.4	4.0	0	**50**		A
	01-12-19 – 31-12-19	21	5.2	5.1	0	**55**		A
2018						94		
2019						86		
All						86		

a Mining PEM criterion of 36 $\mu g/m^3$.

b Bold font indicates data capture does not meet AAQMP objective/

A Flow failure due to unresolved flow issues

Table 7 Summary of 24-Hour Average $PM_{2.5}$ Monitoring 1 January 2019 to 13 September 2020: BAM-1022

Monitoring Period		Concentration (µg/m³) [a]			Exceedances of Criterion [b]	Data Capture (%) [c]		Comment
		Max.	Ave.	70th %ile		Month	Quarter	
	01-01-19 – 31-01-19	19	4.9	5.9	0	81		
1Q19	01-02-19 – 28-02-19	7.2	6.7	6.9	0	**7**	**63**	A
	01-03-19 – 31-03-19	10	3.7	4.5	0	100		
	01-04-19 – 30-04-19	9.1	3.4	4.3	0	100		
2Q19	01-05-19 – 31-05-19	3.1	1.0	1.3	0	**55**	85	A
	01-06-19 – 30-06-19	5.5	1.2	1.3	0	100		
	01-07-19 – 31-07-19	3.5	1.1	1.2	0	100		
3Q19	01-08-19 – 31-08-19	7.3	1.0	1.0	0	100	100	
	01-09-19 – 30-09-19	4.8	1.0	1.4	0	100		
	01-10-19 – 31-10-19	5.3	2.4	3.7	0	**39**		C
4Q19	01-11-19 – 30-11-19	17	3.3	3.4	0	100	80	
	01-12-19 – 31-12-19	45 [d]	6.7	6.4	1	100		
	01-01-20 – 31-01-20	81 [d]	15	17	3	94		
1Q20	01-02-20 – 29-02-20	17	4.0	3.7	0	100	97	D
	01-03-20 – 31-03-20	4.3	1.6	2.1	0	100		
	01-04-20 – 30-04-20	5.2	2.6	3.2	0	100		
2Q20	01-05-20 – 31-05-20	4.7	1.5	2.0	0	90	95	
	01-06-20 – 30-06-20	4.1	1.5	2.2	0	97		
	01-07-20 – 31-07-20	5.8	1.4	1.7	0	100		
3Q20	01-08-20 – 31-08-20	2.6	0.7	1.2	0	100	100	
	01-09-20 – 13-09-20	2.7	1.6	2.1	0	100		
2019						82		
2020						98		
All						88		

a Red font indicates measured concentration above adopted criterion.

b Mining PEM criterion of 36 µg/m³.

c Bold font indicates data capture does not meet AAQMP objective.

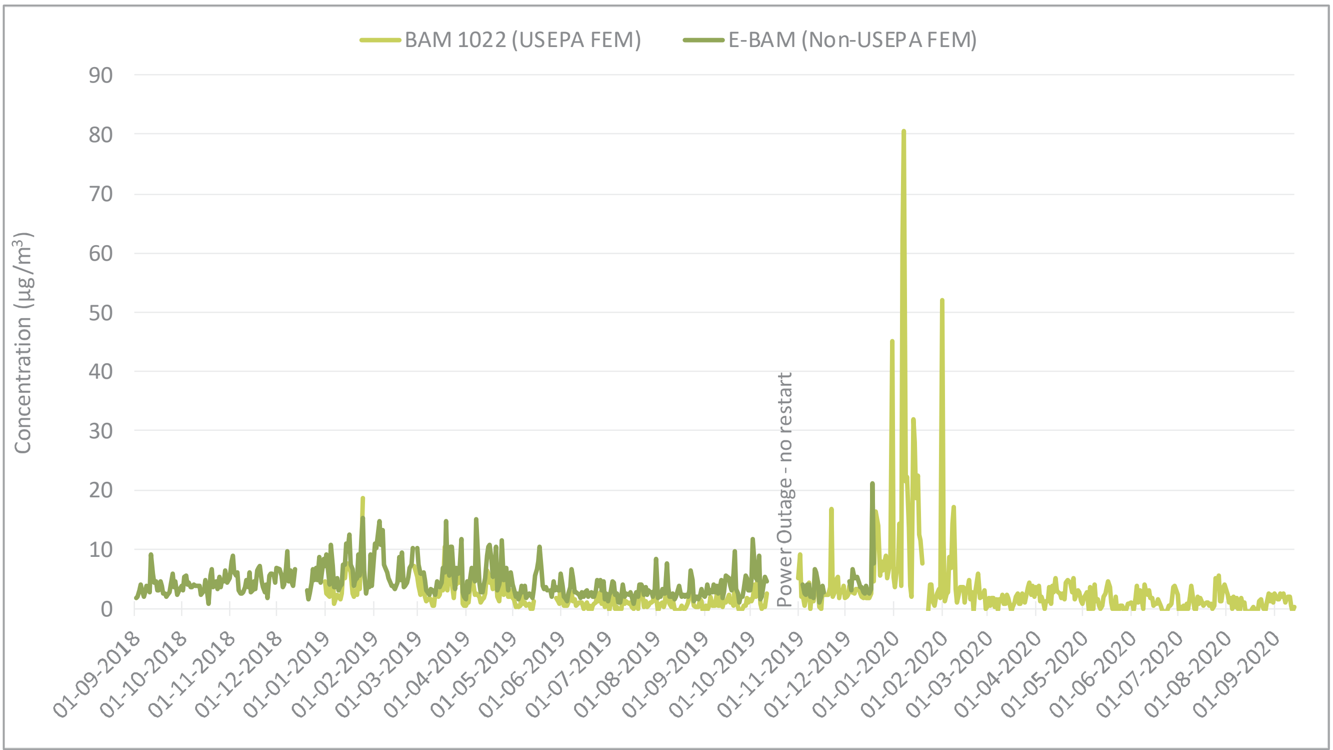
d Victoria experienced widespread bushfire impacts to air quality during these months.

A Tape break shortly after site visit, replaced on next site visit

B Short power interruption, instrument restart.

D During 27 February 2020 site visit, timer added to cycle power off/on at midnight each night to avoid any alarm issues. Modem installed to monitor instrument operation remotely.

Figure 4 24-Hour Average $PM_{2.5}$ Datasets: BAM-1022 and E-BAM



8.3 RCS

The Partisol RCS monitoring results are provided in **Table 8**. Laboratory test certificates are provided in **Appendix C.**

Table 8 RCS Monitoring 1 January 2019 to 25 August 2020: Partisol

Sample Number	Monitoring Period		Concentration (µg/m³)	Laboratory Analysis Report
	Start - Finish	Hours		
8101/181016-90 - 181024-1 [a]	01-01-2019 - 07-01-2019	168	0.32	OL693765N1
8047/181101-11 - 181101-17 [a]	27-02-2019 - 06-03-2019	192	0.15	OL693771N1
8848-1/181024-63	30-04-2019 - 10-05-2019	224	0.053	OL693804N1
8815/181024-71	25-06-2019 - 05-07-2019	224	<0.03	OL693856N1
8963-1/181024-72	01-08-2019 - 11-08-2019	239	0.049	OL693878N1
9050-1/181024-75	31-08-2019 - 10-09-2019	239	<0.02	OL693896N1
9139-1/181024-80	30-09-2019 - 10-10-2019	239	<0.02	OL693920N1
9230/181024-82	09-11-2019 - 19-11-2019	239	<0.02	OL693939N1
9373-5/181024-86	19-12-2019 - 29-12-2019	239	0.12	OL693962N1
9373-7/181024-88	08-01-2020 - 18-01-2020	239	0.37	OL693962N1
9494/K9338	27-02-2020 - 08-03-2020	239	0.35	OL693988N1
9544/K9340	18-03-2020 - 28-03-2020	240	<0.02	OL694006N1
9734/K9343	28-03-2020 - 07-04-2020	240	<0.03	OL694053N1
9736/K9346	27-04-2020 - 07-05-2020	240	<0.02	OL694053N1
9873/SLRV56	06-06-2020 - 16-06-2020	240	<0.02	OL694053N1
10012-2/SLRV65	06-07-2020 - 16-07-2020	240	<0.02	OL694069N1
Annual Average Concentration (µg/m³)			**2019: 0.046** **2020: 0.12**	
Criterion (µg/m³)			**3**	

a Composite Sample: Results presented were obtained from a composite sample of seven consecutive 24-hour Partisol samples and were not included in annual average

8.4 Metals

The LVAS and Partisol metals monitoring results are provided in **Table 9**. Laboratory test certificates are provided in **Appendix C.**

Table 9 Heavy Metals Monitoring 1 January 2019 to 29 December 2019: Partisol

Sample Number	Monitoring Period		Concentration (µg/m³)										Laboratory Analysis Report
	Start - Finish	Hours	As	Cd	Cr	Cu	Pb	Mn	Hg	Ni	V	Zn	
8100 [a]	01-01-2019 - 08-01-2019	168	<0.02	<0.02	0.23	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	NMI RN1269278
8099 [a]	27-02-2019 - 06-03-2019	168	<0.02	<0.02	0.22	<0.02	<0.02	0.15	<0.02	<0.02	<0.05	<0.02	NMI RN1269281
8303	27-03-2019 - 05-04-2019	240	<0.002	<0.001	0.0080	0.0010	0.0010	0.010	<0.001	<0.001	<0.002	0.014	NMI RN1231849
8450-1	30-04-2019 - 10-05-2019	224	<0.002	<0.002	0.016	0.0038	<0.002	0.043	<0.002	0.0027	0.0056	0.011	NMI RN1269289
8614-1	27-05-2019 - 06-06-2019	224	<0.002	<0.002	0.012	<0.002	<0.002	0.0083	<0.002	<0.002	<0.005	0.020	NMI RN1269290
8816-1	25-06-2019 - 05-07-2019	224	<0.002	<0.0005	0.021	0.0032	0.0014	0.017	<0.0005	0.0014	<0.005	0.0092	NMI RN1269297
8966-1	01-08-2019 - 11-08-2019	240	0.002	<0.002	0.082	0.028	0.0073	0.15	<0.002	0.0091	0.007	0.052	NMI RN1269332
9049-1	31-08-2019 - 10-09-2019	240	<0.002	<0.002	0.0048	<0.002	<0.002	0.0087	<0.002	0.0070	<0.004	0.0074	NMI RN1269333
9138-1	30-09-2019 - 10-10-2019	240	<0.002	<0.002	0.023	0.0022	<0.002	0.032	<0.002	<0.002	<0.004	0.010	NMI RN1269334
9229-10	30-10-2019 - 09-11-2019	240	<0.002	<0.002	0.015	0.0058	0.0023	0.063	<0.002	0.0039	0.0063	0.0076	NMI RN1269335
9370-5	19-12-2019 - 29-12-2019	240	<0.002	<0.002	0.026	0.0070	0.0032	0.11	0.012	0.0051	0.0093	0.018	NMI RN1269336
9370-7	08-01-2020 - 18-01-2020	240	<0.002	<0.002	0.026	0.0064	0.0041	0.20	<0.002	0.0055	0.013	0.017	NMI RN1269336
9541	27-02-2020 - 08-03-2020	240	<0.002	<0.002	0.014	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	NMI RN1271624
9543	08-03-2020 - 18-03-2020	240	<0.002	<0.002	0.019	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	NMI RN1271624
9726	28-03-2020 - 07-04-2020	240	<0.002	<0.004	<0.02	<0.02	<0.04	0.036	<0.0002	<0.04	<0.009	<0.089	MPL 247115
9729	07-05-2020 – 17-05-2020	240	<0.002	<0.004	<0.02	<0.02	<0.04	0.052	<0.0002	<0.04	<0.009	<0.09	MPL 247115
9872	06-06-2020 – 16-06-2020	240	<0.002	<0.004	0.030	<0.021	<0.04	<0.02	<0.0002	<0.04	<0.009	<0.09	MPL 247115
10011-2	06-07-2020 – 16-07-2020	240	<0.002	<0.004	0.039	0.026	<0.04	<0.02	<0.0002	<0.04	<0.009	<0.09	MPL 248394
10115	15-08-2020 – 25-08-2020	240	<0.002	<0.004	<0.02	<0.02	<0.04	<0.02	<0.0002	<0.04	<0.009	<0.09	MPL 251062
Annual Average (µg/m³)		**2019**	**<0.002**	**<0.002**	**0.025**	**0.007**	**0.003**	**0.053**	**0.003**	**0.004**	**0.006**	**0.017**	
		2020	**<0.002**	**<0.004**	**0.025**	**0.015**	**0.028**	**0.044**	**<0.001**	**0.028**	**0.008**	**0.058**	
Criteria			**0.003**	-	-	-	-	-	-	-	-	-	

a Results obtained from a composite sample of seven consecutive 24-hour Partisol samples. Not included in annual average calculation. b Minivol sample not included in annual average calculation.

8.5 Dust Deposition

The dust deposition insoluble solids and ash content monitoring results are provided in **Table 10** and **Table 11**, respectively. Corresponding plots of the results are provided in **Figure 5** and **Figure 6**. Laboratory test certificates are provided in **Appendix C.**

Table 10 Monthly Dust Deposition Monitoring 1 September 2018 to 14 September 2020: Insoluble Solids

Sample Numbers	Monitoring Period		Deposition Rate ($g/m^2/month$) by Location [a]				Laboratory Analysis Report
	Start	Finish	Loc 1	Loc 2	Loc 3	Loc 4	
7837-7840	27-08-18 10:00	02-10-18 10:45	3.7	1.1	4.4	0.43	EN1806687
7330-7333	02-10-18 10:00	02-11-18 10:45	1.7	8.8	2.5	1.7	EN1807945
7512-7513	02-11-18 10:00	05-12-18 11:15	7.3	-[b]	-[b]	0.93	EN1808475
7699-7702	02-11-18 10:15	16-01-19 19:10	2.2	1.7	1.5	2.4	EN1900474
7967-7970	16-01-19 15:45	26-02-19 16:10	13	2.2	2.1	3.9	EN1901498
8043-8046	26-02-19 15:10	26-03-19 13:25	1.4	0.49	1.0	0.49	EN1902211
8298-8301	26-03-19 12:45	29-04-19 14:00	2.7	1.6	1.7	0.90	EN1903081
8441-8444[c]	29-04-19 13:20	27-05-19 14:15	43	131	8.2	5.2	EN1903848
8608-8611	27-05-19 13:10	26-06-19 09:40	2.5	3.9	1.2	0.85	EN1904546
8811-8814	26-06-19 08:45	31-07-19 11:15	10	1.3	0.39	0.82	EN1905495
8959-8962	31-07-19 10:15	03-09-19 14:30	0.60	0.80	0.90	0.40	EN1906344
9038-9041	03-09-19 13:20	03-10-19 14:05	1.0	0.85	1.0	1.3	EN1907045
9132-9135	03-10-19 13:20	30-10-19 15:00	8.3	1.0	1.3	0.69	EN1907834
9214-9217	30-10-19 14:00	02-12-19 15:00	7.8	1.7	2.5	1.7	EN1908650
9366-9369	02-12-19 14:15	21-01-20 14:50	16	1.6	5.6	1.3	EN2000705
9490-9492	21-01-20 14:25	26-02-20 08:40	0.76	0.95	10	-[d]	EB2006150
9523-9526	26-02-20 08:40	27-03-20 09:27	2.2	2.2	2.1	2.5[d]	EM2005286
9589-9592	27-03-20 08:45	27-04-20 14:04	1.6	1.3	5.8	1.1	EM2007040
9720-9723	27-04-20 13:19	29-05-20 07:54	5.7	0.91	0.37	1.8	EM2009211
9831-9834	29-05-20 07:19	30-06-20 07:27	3.1	2.7	1.2	0.53	EM2011290
9976-9979	30-06-20 06:53	31-07-20 08:22	13	1.4	1.8	2.6	EM2013388
10111-10114	31-07-20 07:43	14-09-20 14:16[e]	12	1.5	0.6	0.8	EM2016080
Criterion			4				Mining PEM
Exceedances of criterion			10	2	5	1	

a Red text indicates measured concentration above adopted criterion.
b No access to location 2 and 3 due to poor road conditions.
c Foreign material (e.g. insects, grass, soil) noted.
d Location 4 not collected in February.
e Collection delayed due to COVID-19 travel restrictions.

Table 11 Monthly Dust Deposition Monitoring 1 September 2018 to 14 September 2020: Ash Content

Sample Numbers	Monitoring Period		Deposition Rate ($g/m^2/month$) by Location [a]				Laboratory Analysis Report
	Start	Finish	Loc 1	Loc 2	Loc 3	Loc 4	
7837-7840	27-08-18 10:00	02-10-18 10:45	1.3	1.0	2.3	0.33	EN1806687
7330-7333	02-10-18 10:00	02-11-18 10:45	1.2	6.2	1.6	1.3	EN1807945
7512-7513	02-11-18 10:00	05-12-18 11:15	3.1	-	-	0.82	EN1808475
7699-7702	02-11-18 10:15	16-01-19 19:10	1.4	1.2	1.3	2.1	EN1900474
7967-7970	16-01-19 15:45	26-02-19 16:10	2.9	1.7	1.8	2.8	EN1901498
8043-8046	26-02-19 15:10	26-03-19 13:25	0.55	0.49	0.91	0.49	EN1902211
8298-8301	26-03-19 12:45	29-04-19 14:00	1.2	1.4	1.6	0.85	EN1903081
8441-8444[c]	29-04-19 13:20	27-05-19 14:15	23	122	6.9	4.1	EN1903848
8608-8611	27-05-19 13:10	26-06-19 09:40	1.3	3.5	0.85	0.68	EN1904546
8811-8814	26-06-19 08:45	31-07-19 11:15	3.5	1.3	0.29	0.58	EN1905495
8959-8962	31-07-19 10:15	03-09-19 14:30	0.30	0.65	0.70	0.25	EN1906344
9038-9041	03-09-19 13:20	03-10-19 14:05	0.85	0.68	0.79	0.91	EN1907045
9132-9135	03-10-19 13:20	30-10-19 15:00	2.0	0.94	1.3	0.57	EN1907834
9214-9217	30-10-19 14:00	02-12-19 15:00	4.9	1.4	2.0	1.3	EN1908650
9366-9369	02-12-19 14:15	21-01-20 14:50	3.4	1.3	5.0	1.0	EN2000705
9490-9492	21-01-20 14:25	26-02-20 08:40	0.47	0.62	8.6	-[d]	EB2006150
9523-9526	26-02-20 08:40	27-03-20 09:27	0.79	1.2	1.2	1.8[d]	EM2005286
9589-9592	27-03-20 08:45	27-04-20 14:04	0.65	0.38	1.4	0.38	EM2007040
9720-9723	27-04-20 13:19	29-05-20 07:54	2.2	0.91	0.16	0.43	EM2009211
9831-9834	29-05-20 07:19	30-06-20 07:27	0.74	1.4	0.32	0.16	EM2011290
9976-9979	30-06-20 06:53	31-07-20 08:22	4.5	0.33	0.60	0.33	EM2013388
10111-10114	31-07-20 07:43	14-09-20 14:16[e]	4.2	0.71	0.19	0.23	EM2016080

a Red text indicates measured concentration above adopted criterion.
b No access to location 2 and 3 due to poor road conditions.
c Foreign material (e.g. insects, grass, soil) noted.
d Location 4 not collected in February.
e Collection delayed due to COVID-19 travel restrictions.

Figure 5 Dust Depositions Rate 1 September 2018 to 14 September 2020: Insoluble Solids

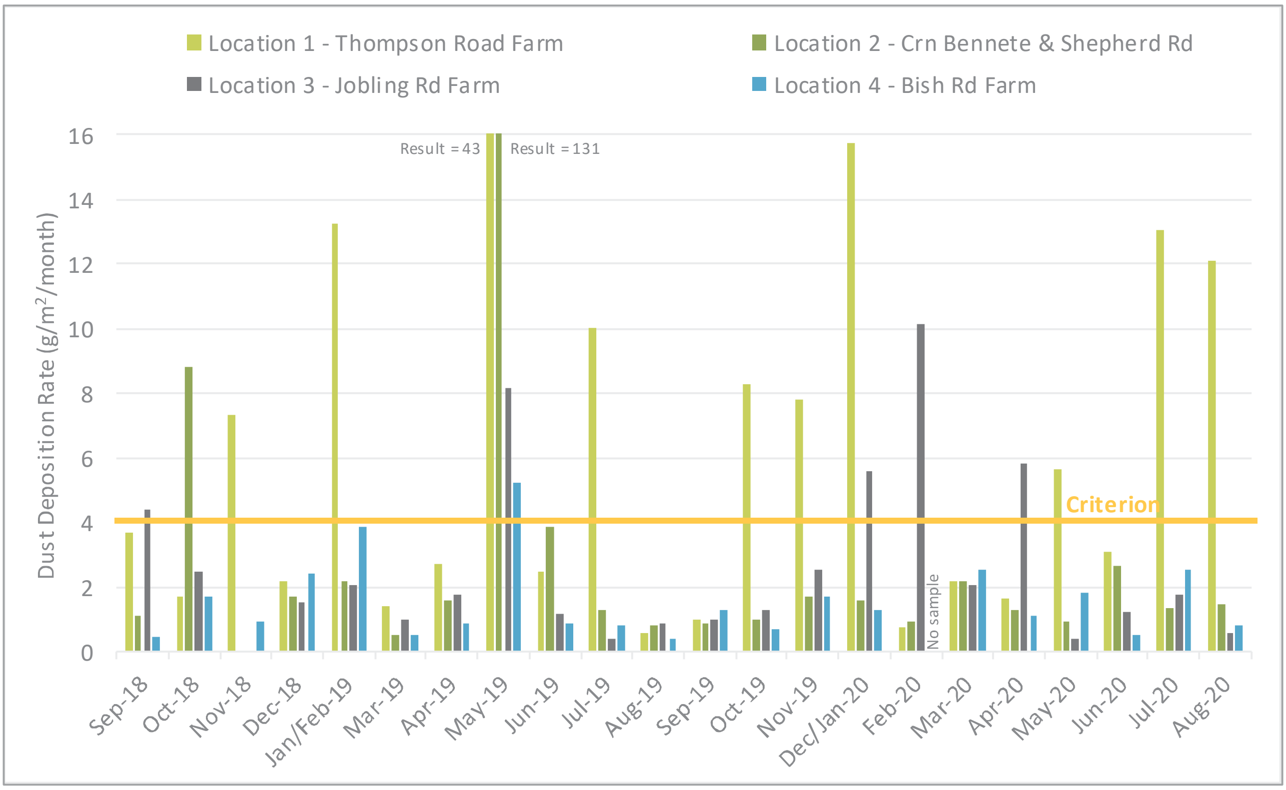
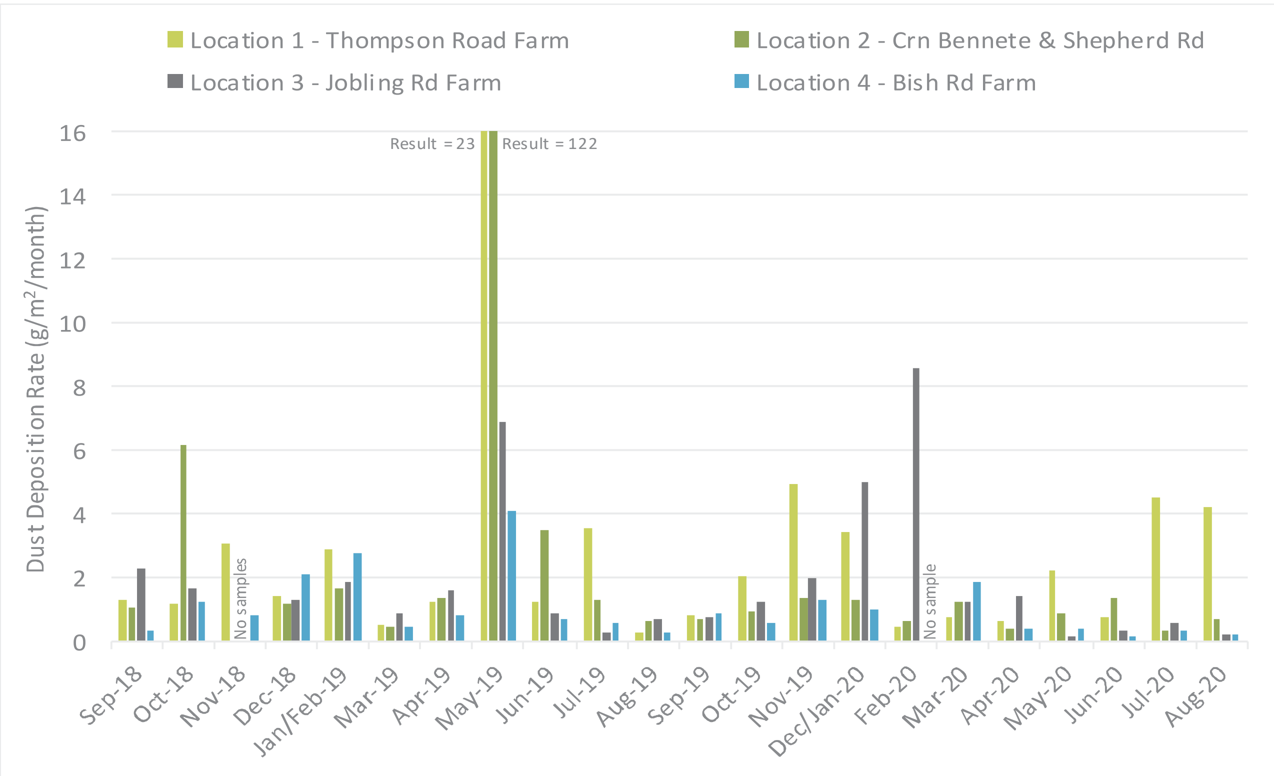


Figure 6 Dust Depositions Rate 1 September 2018 to 14 September 2020: Ash Content



9 Discussion

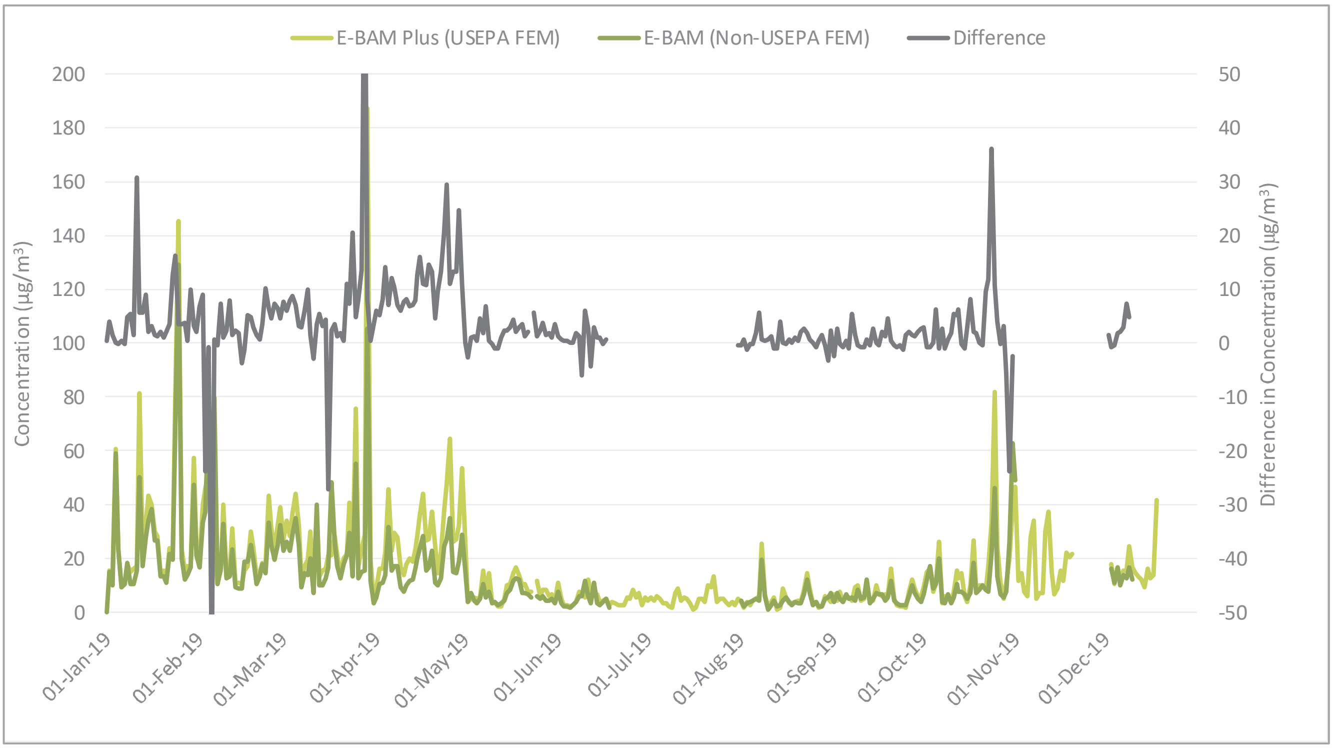
9.1 PM_{10}

9.1.1 E-BAM Plus (USEPA FEM) and E-BAM (Non-USEPA FEM) Data Comparison

The data presented in **Figure 3** indicates a relatively good correlation between the concentrations reported by the two instruments. The difference in the PM_{10} concentrations reported by the instruments is presented in **Figure 7**, overlaid on the individual datasets. In general, the E-BAM Plus instrument reports greater concentrations, with an average difference between the two of 3.5 µg/m^3 and an average absolute difference of 4.9 µg/m^3. The correlation coefficient value between the two PM_{10} datasets is 0.90, where the correlation coefficient indicates a strong positive correlation as the value approaches 1 and a strong negative correlation as it approaches -1. A correlation coefficient greater than 0.7 is considered a strong correlation.

Both datasets are provided in **Appendix B.**

Figure 7 Comparison of E-BAM Plus and E-BAM PM_{10} Datasets



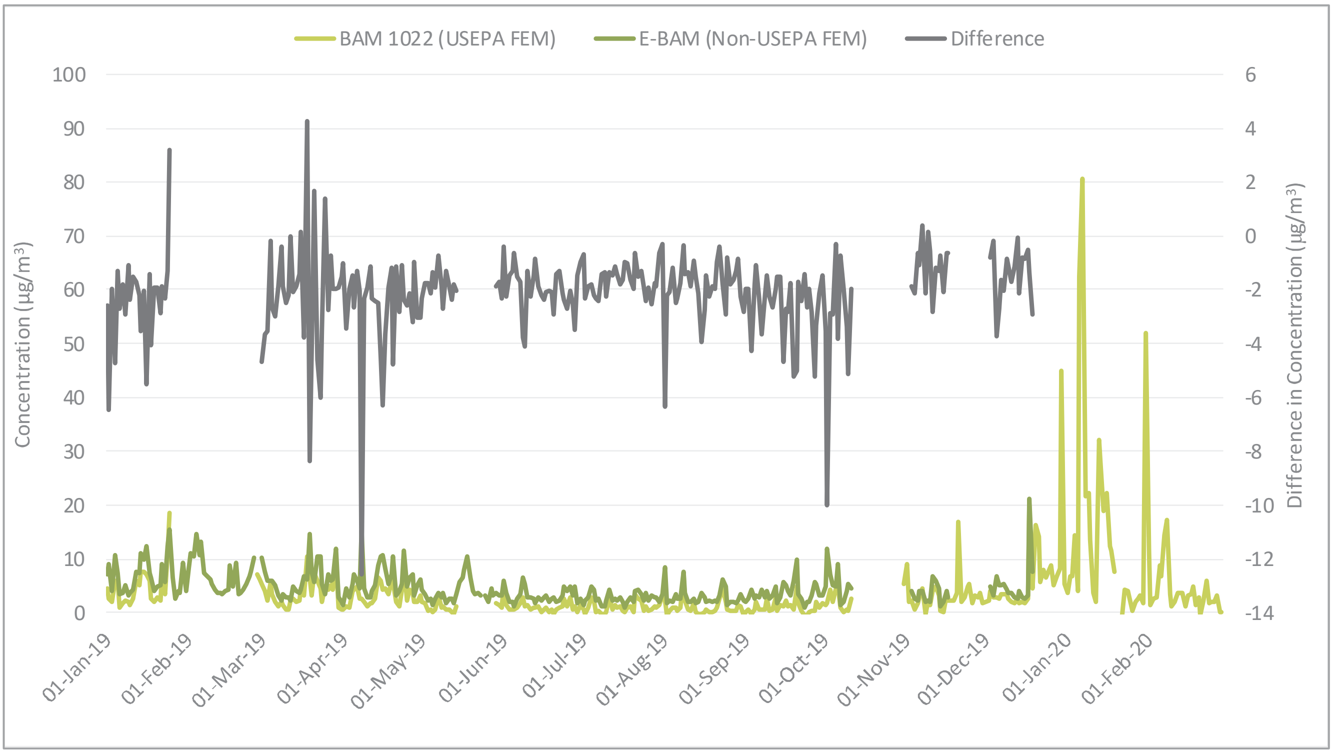
9.2 $PM_{2.5}$

9.2.1 BAM-1022 (USEPA FEM) and E-BAM (Non-USEPA FEM) Data Comparison

The data presented in **Figure 4** indicates a relatively good correlation between the concentrations reported by the two instruments. The difference in the $PM_{2.5}$ concentrations reported by the instruments is presented in **Figure 8**, overlaid on the individual datasets. In general, the BAM-1022 instrument reports lower concentrations, with an average difference between the two of -2.1 µg/m³ and an average absolute difference of 2.2 µg/m³. The correlation coefficient value between the two $PM_{2.5}$ datasets is 0.83.

Both datasets are provided in **Appendix B.**

Figure 8 Comparison of BAM-1022 and E-BAM $PM_{2.5}$ Datasets



9.3 RCS

RCS concentrations throughout the monitoring period has all been below the Mining PEM criterion. The annual average RCS concentrations for 2019 and 2020 were 0.046 µg/m³ and <0.12 µg/m³, respectively, both below the Mining PEM criterion of 3 µg/m³.

9.4 Metals (Arsenic)

With the exception of two results, all arsenic concentrations were below the Mining PEM criterion. The annual average arsenic concentrations for 2019 and 2020 were <0.002 µg/m³, both below the Mining PEM criterion of 0.003 µg/m³.

9.5 Dust Deposition

Though the Mining PEM does not specify what fraction of deposited dust the criterion relates to, it is convention for the criterion to apply to insoluble solids. Further assessment of the ash content dust deposition rate is made against the criterion where the dust impacts from the identified source(s) are likely to be non-combustible, mineral material, as is most associated with mining. A comparison of the insoluble solids and ash content deposition rates indicates that the majority of the exceedances of the criterion are due primarily to combustible material in the sample, e.g. small windblown parts of insects, vegetation etc.

The sample period beginning 29 April 2019 returned exceptional results for Location 1 and Location 2. The result for Location 2 in particular cannot be considered representative of normal conditions given it is some 500% greater than the next highest result of any location.

9.6 Data Capture

The data capture of the USEPA FEM compliant instrument datasets are summarised in **Table 12** against the AAQMP objective.

Table 12 USEPA FEM Instrumentation PM_{10} and $PM_{2.5}$ Data Capture

Monitoring Period	Data Capture %		
	PM_{10} [a]	$PM_{2.5}$ [a]	Objective
1Q19	100	**63**	>75
2Q19	99	85	>75
3Q19	100	100	>75
4Q19	**73**	80	>75
1Q20	**64**	97	>75
2Q20	99	95	>75
3Q20	100	100	>75
2019	93	82	>75
2020	88	98	>75
All	91	89	>75

a Bold font indicates data capture does not meet AAQMP objective

Data capture is less than the AAQMP objective for the following periods:

- PM_{10}: 4Q19 and 1Q20
- $PM_{2.5}$: 1Q19

9.7 Data Validation

Data contained in this report has been validated against performance and calibration requirements for each monitoring method. Data has been removed from the validated dataset for periods where the instrument has not performed within specified performance limits (e.g. sample flow rate tolerance) and during periods where maintenance and calibration has been conducted. Data exceptions are provided in **Appendix D**.

10 Closing

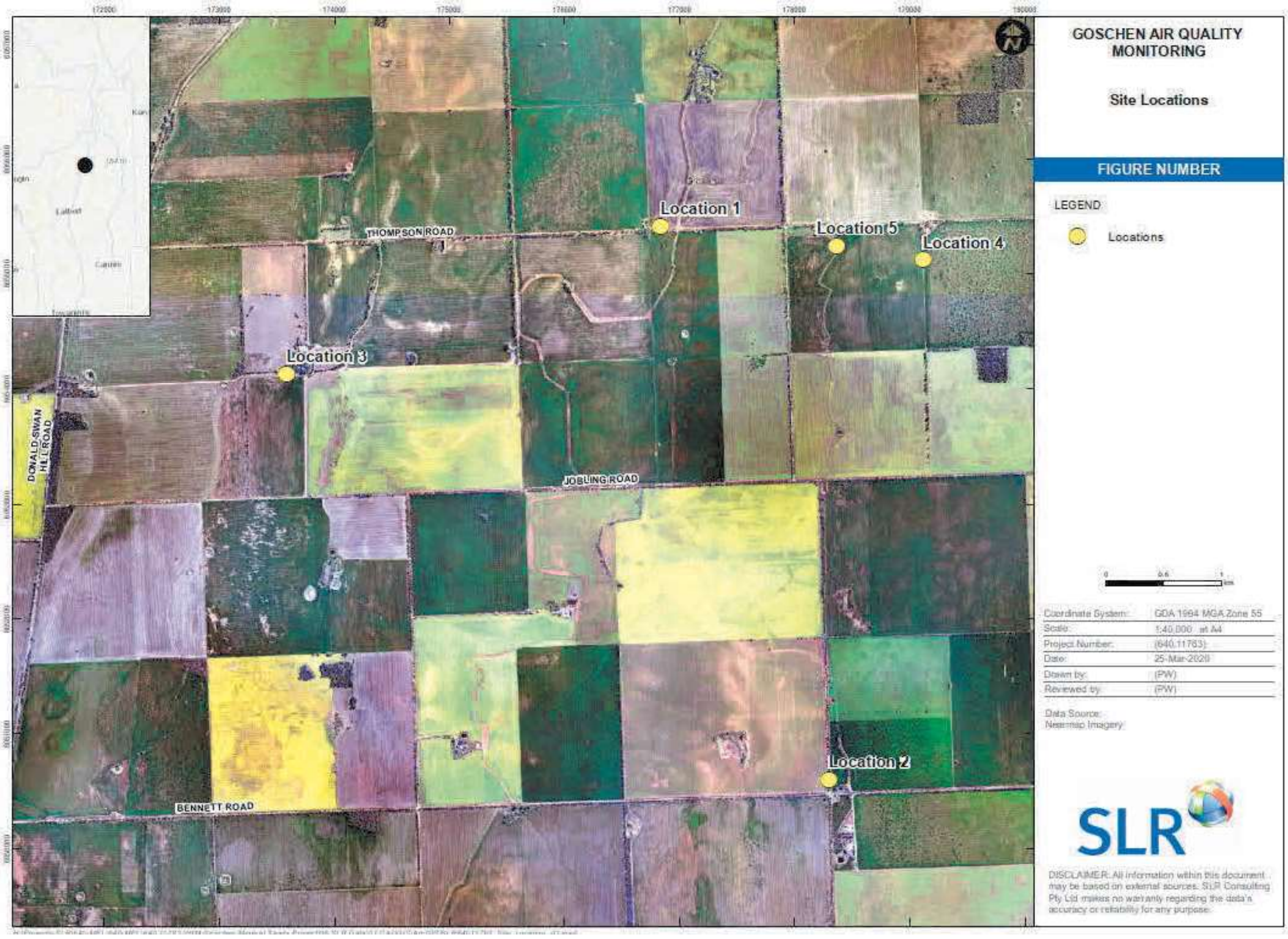
Monitoring at the Project site commenced on 1 September 2018, with the introduction of USEPA FEM compliant instrumentation on 1 January 2019. The AAQMP concluded on 14 September 2020.

The monitoring was conducted in accordance with the requirements of a Level 1 Mining PEM assessment, which stipulates monitoring of real time continuous 24-hour PM_{10} and $PM_{2.5}$ data for a 12-month period, analysis of crystalline silica ($PM_{2.5}$) and heavy metal content (PM_{10}).

APPENDIX A

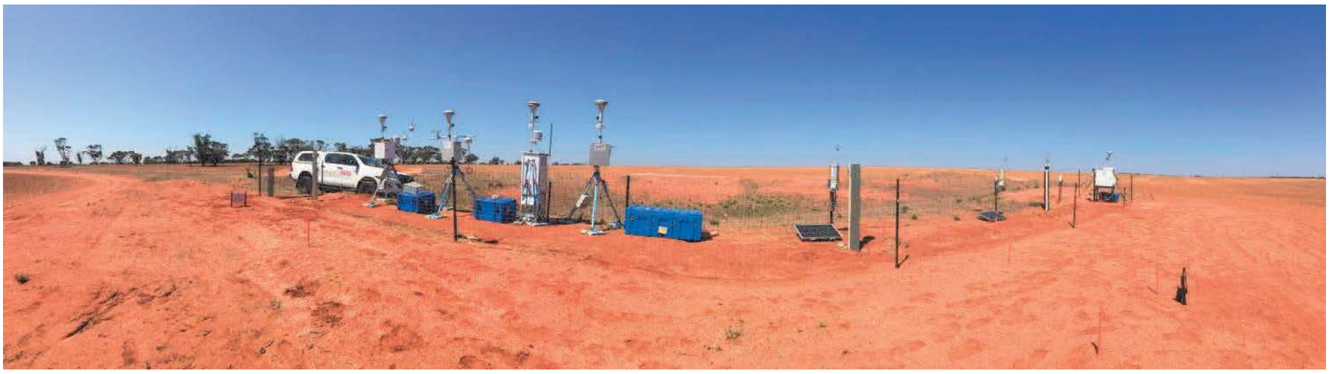
Monitoring Site Location

Figure A9 Overview of Air Quality Baseline Monitoring Locations



Site 1 – Monitoring Equipment Installed September 2018 to December 2018 – Location 1

Site 5 – Monitoring Equipment Installed January 2019 to Present – Location 5



APPENDIX B

Monitoring Results Tables

Table 13 Continuous 24-Hour Average Datasets

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
01-09-2018	-	-	-	1.7
02-09-2018	-	-	-	2.2
03-09-2018	-	-	-	3.0
04-09-2018	-	-	-	4.0
05-09-2018	-	-	-	3.2
06-09-2018	-	-	-	2.1
07-09-2018	-	-	-	2.9
08-09-2018	-	-	-	3.8
09-09-2018	-	-	-	3.7
10-09-2018	-	-	-	2.8
11-09-2018	-	-	-	9.3
12-09-2018	-	-	-	5.9
13-09-2018	-	-	-	4.4
14-09-2018	-	-	-	4.7
15-09-2018	-	-	-	3.2
16-09-2018	-	-	-	3.2
17-09-2018	-	-	-	4.6
18-09-2018	-	-	-	3.8
19-09-2018	-	-	-	2.6
20-09-2018	-	-	-	2.5
21-09-2018	-	-	-	2.0
22-09-2018	-	-	-	2.3
23-09-2018	-	-	-	2.8
24-09-2018	-	-	-	4.1
25-09-2018	-	-	-	5.9
26-09-2018	-	-	-	3.7
27-09-2018	-	-	-	4.7
28-09-2018	-	-	-	2.5
29-09-2018	-	-	-	3.3
30-09-2018	-	-	-	3.9
01-10-2018	-	-	-	3.2
02-10-2018	-	-	-	5.5
03-10-2018	-	9.7	-	5.7
04-10-2018	-	6.9	-	4.0
05-10-2018	-	5.8	-	4.4
06-10-2018	-	5.9	-	3.5
07-10-2018	-	12.0	-	3.7
08-10-2018	-	6.6	-	4.2
09-10-2018	-	4.1	-	4.0
10-10-2018	-	7.5	-	3.9
11-10-2018	-	3.8	-	3.9
12-10-2018	-	5.5	-	3.9

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
13-10-2018	-	2.9	-	2.3
14-10-2018	-	2.5	-	2.9
15-10-2018	-	11.0	-	3.1
16-10-2018	-	10.0	-	4.9
17-10-2018	-	1.1	-	2.5
18-10-2018	-	1.9	-	0.7
19-10-2018	-	25.0	-	5.5
20-10-2018	-	-	-	6.7
21-10-2018	-	-	-	3.6
22-10-2018	-	-	-	4.3
23-10-2018	-	-	-	4.6
24-10-2018	-	-	-	3.4
25-10-2018	-	-	-	5.3
26-10-2018	-	-	-	3.7
27-10-2018	-	-	-	4.8
28-10-2018	-	0.2	-	4.5
29-10-2018	-	0.7	-	6.3
30-10-2018	-	-	-	4.5
31-10-2018	-	-	-	5.1
01-11-2018	-	-	-	7.9
02-11-2018	-	39.0	-	9.0
03-11-2018	-	23.0	-	6.0
04-11-2018	-	15.0	-	5.6
05-11-2018	-	14.0	-	6.3
06-11-2018	-	6.9	-	3.2
07-11-2018	-	8.7	-	2.7
08-11-2018	-	6.3	-	2.7
09-11-2018	-	8.5	-	2.9
10-11-2018	-	7.0	-	3.6
11-11-2018	-	9.7	-	5.0
12-11-2018	-	15.0	-	3.5
13-11-2018	-	22.0	-	6.0
14-11-2018	-	7.7	-	2.8
15-11-2018	-	6.6	-	3.2
16-11-2018	-	13.0	-	4.8
17-11-2018	-	11.0	-	3.4
18-11-2018	-	53.0	-	6.5
19-11-2018	-	35.0	-	6.8
20-11-2018	-	26.0	-	7.1
21-11-2018	-	28.0	-	4.5
22-11-2018	-	28.0	-	3.5
23-11-2018	-	7.8	-	2.9
24-11-2018	-	4.5	-	4.1

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
25-11-2018	-	4.5	-	1.8
26-11-2018	-	15.0	-	5.7
27-11-2018	-	14.0	-	5.9
28-11-2018	-	10.0	-	5.9
29-11-2018	-	7.3	-	5.6
30-11-2018	-	11.0	-	4.3
01-12-2018	-	35.0	-	7.0
02-12-2018	-	34.0	-	6.5
03-12-2018	-	14.0	-	5.6
04-12-2018	-	7.1	-	3.5
05-12-2018	-	79.0	-	4.0
06-12-2018	-	32.0	-	7.0
07-12-2018	-	37.0	-	9.7
08-12-2018	-	20.0	-	4.5
09-12-2018	-	14.0	-	6.3
10-12-2018	-	8.2	-	4.5
11-12-2018	-	8.5	-	3.8
12-12-2018	-	21.0	-	6.7
13-12-2018	-	-	-	-
14-12-2018	-	-	-	-
15-12-2018	-	-	-	-
16-12-2018	-	-	-	-
17-12-2018	-	-	-	-
18-12-2018	-	-	-	-
19-12-2018	-	-	-	-
20-12-2018	-	20.0	-	3.2
21-12-2018	-	11.0	-	1.6
22-12-2018	-	4.3	-	2.6
23-12-2018	-	5.7	-	4.4
24-12-2018	-	17.0	-	6.7
25-12-2018	-	14.0	-	5.0
26-12-2018	-	15.0	-	7.0
27-12-2018	-	26.0	-	4.9
28-12-2018	-	40.0	-	8.8
29-12-2018	-	26.0	-	4.4
30-12-2018	-	25.0	-	6.0
31-12-2018	-	20.0	-	8.5
01-01-2019	25.0	15.0	4.6	7.2
02-01-2019	15.0	15.0	2.7	9.1
03-01-2019	14.0	10.0	2.1	4.1
04-01-2019	60.0	59.0	5.9	11.0
05-01-2019	23.0	23.0	5.9	7.3
06-01-2019	9.4	9.5	0.8	3.5

Date	PM10 (µg/m³)		PM2.5 (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
07-01-2019	11.0	10.0	1.9	3.7
08-01-2019	18.0	18.0	2.3	5.2
09-01-2019	15.0	10.0	2.0	3.0
10-01-2019	16.0	10.0	1.4	3.8
11-01-2019	17.0	16.0	2.7	4.2
12-01-2019	81.0	50.0	5.9	7.5
13-01-2019	23.0	17.0	5.2	7.4
14-01-2019	33.0	28.0	7.5	11.0
15-01-2019	43.0	34.0	7.8	9.8
16-01-2019	40.0	38.0	7.0	13.0
17-01-2019	30.0	27.0	6.1	7.5
18-01-2019	28.0	27.0	2.6	6.6
19-01-2019	14.0	13.0	2.0	3.9
20-01-2019	15.0	13.0	3.0	4.9
21-01-2019	12.0	11.0	2.3	5.2
22-01-2019	24.0	22.0	7.3	9.1
23-01-2019	23.0	19.0	3.5	5.8
24-01-2019	81.0	68.0	11.0	12.0
25-01-2019	150.0	130.0	19.0	15.0
26-01-2019	23.0	20.0	-	6.4
27-01-2019	16.0	12.0	-	2.6
28-01-2019	17.0	14.0	-	4.0
29-01-2019	17.0	17.0	-	3.6
30-01-2019	57.0	47.0	-	9.3
31-01-2019	25.0	21.0	-	3.9
01-02-2019	19.0	17.0	-	8.3
02-02-2019	40.0	33.0	-	11.0
03-02-2019	46.0	37.0	-	10.0
04-02-2019	52.0	76.0	-	15.0
05-02-2019	20.0	21.0	-	11.0
06-02-2019	20.0	80.0	-	13.0
07-02-2019	11.0	11.0	-	7.5
08-02-2019	16.0	16.0	-	6.9
09-02-2019	40.0	33.0	-	6.2
10-02-2019	13.0	13.0	-	5.3
11-02-2019	16.0	13.0	-	4.3
12-02-2019	31.0	23.0	-	3.8
13-02-2019	11.0	9.7	-	3.8
14-02-2019	11.0	8.8	-	3.3
15-02-2019	10.0	8.8	-	4.0
16-02-2019	15.0	19.0	-	4.4
17-02-2019	17.0	19.0	-	8.6
18-02-2019	30.0	25.0	-	4.9

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
19-02-2019	24.0	19.0	-	9.4
20-02-2019	13.0	11.0	-	3.5
21-02-2019	15.0	13.0	-	3.8
22-02-2019	19.0	18.0	-	4.3
23-02-2019	18.0	14.0	-	5.4
24-02-2019	44.0	33.0	-	6.8
25-02-2019	31.0	25.0	-	7.5
26-02-2019	24.0	19.0	-	10.0
27-02-2019	32.0	25.0	7.2	-
28-02-2019	39.0	32.0	6.1	-
01-03-2019	27.0	23.0	5.5	10.0
02-03-2019	34.0	26.0	3.9	7.5
03-03-2019	28.0	23.0	2.4	5.9
04-03-2019	37.0	29.0	5.6	5.8
05-03-2019	44.0	35.0	3.4	6.1
06-03-2019	32.0	25.0	2.0	5.0
07-03-2019	13.0	9.5	1.2	3.1
08-03-2019	17.0	14.0	1.9	2.3
09-03-2019	20.0	14.0	1.6	3.4
10-03-2019	30.0	20.0	0.5	3.0
11-03-2019	8.8	7.2	0.6	2.8
12-03-2019	37.0	40.0	2.3	2.4
13-03-2019	13.0	9.8	2.7	4.8
14-03-2019	15.0	9.9	2.1	4.0
15-03-2019	16.0	13.0	2.2	3.6
16-03-2019	21.0	16.0	4.5	4.3
17-03-2019	21.0	48.0	3.1	6.9
18-03-2019	28.0	26.0	10.0	6.3
19-03-2019	21.0	17.0	6.4	15.0
20-03-2019	14.0	13.0	3.2	7.5
21-03-2019	20.0	18.0	7.4	5.8
22-03-2019	22.0	21.0	5.8	10.0
23-03-2019	40.0	29.0	4.5	11.0
24-03-2019	21.0	13.0	1.9	5.4
25-03-2019	76.0	55.0	4.7	3.3
26-03-2019	17.0	13.0	4.2	7.0
27-03-2019	24.0	15.0	5.2	5.9
28-03-2019	29.0	15.0	4.3	6.3
29-03-2019	190.0	110.0	9.8	12.0
30-03-2019	19.0	11.0	0.9	2.8
31-03-2019	3.7	3.4	0.6	2.1
01-04-2019	9.0	5.6	0.5	1.6
02-04-2019	16.0	10.0	1.1	4.5

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
03-04-2019	16.0	11.0	1.0	2.9
04-04-2019	22.0	14.0	4.0	5.5
05-04-2019	46.0	32.0	4.3	7.0
06-04-2019	23.0	16.0	4.7	6.0
07-04-2019	29.0	17.0	2.4	4.5
08-04-2019	28.0	17.0	2.6	15.0
09-04-2019	17.0	9.5	2.1	4.5
10-04-2019	14.0	7.8	1.1	3.0
11-04-2019	18.0	10.0	1.7	2.8
12-04-2019	20.0	12.0	1.8	4.1
13-04-2019	19.0	12.0	2.6	5.0
14-04-2019	23.0	16.0	6.4	8.9
15-04-2019	28.0	20.0	6.0	11.0
16-04-2019	36.0	24.0	4.4	11.0
17-04-2019	44.0	28.0	4.6	8.3
18-04-2019	27.0	15.0	3.4	5.4
19-04-2019	27.0	17.0	6.0	7.2
20-04-2019	37.0	23.0	5.6	10.0
21-04-2019	24.0	11.0	2.0	3.1
22-04-2019	14.0	9.8	1.3	4.1
23-04-2019	22.0	13.0	4.3	5.3
24-04-2019	38.0	24.0	9.1	12.0
25-04-2019	48.0	27.0	2.4	5.0
26-04-2019	64.0	35.0	4.2	6.4
27-04-2019	26.0	15.0	3.8	7.0
28-04-2019	27.0	14.0	2.1	3.0
29-04-2019	32.0	19.0	2.0	5.0
30-04-2019	54.0	29.0	3.1	6.2
01-05-2019	26.0	15.0	1.9	4.2
02-05-2019	3.9	3.7	1.6	3.4
03-05-2019	4.7	7.3	0.4	2.2
04-05-2019	5.5	4.5	0.5	2.6
05-05-2019	4.8	3.5	0.2	1.5
06-05-2019	5.3	4.9	0.7	2.6
07-05-2019	15.0	11.0	3.1	3.8
08-05-2019	7.1	5.4	0.9	2.8
09-05-2019	14.0	7.5	1.1	3.8
10-05-2019	3.5	3.2	0.5	1.8
11-05-2019	3.9	4.1	0.7	2.6
12-05-2019	2.0	3.0	0.1	2.5
13-05-2019	2.1	3.3	-0.1	1.7
14-05-2019	5.2	4.4	1.3	3.3
15-05-2019	9.7	7.4	-	5.7

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
16-05-2019	10.0	8.2	-	6.6
17-05-2019	15.0	12.0	-	8.0
18-05-2019	17.0	13.0	-	10.0
19-05-2019	14.0	12.0	-	6.5
20-05-2019	10.0	6.9	-	4.0
21-05-2019	10.0	7.0	-	3.5
22-05-2019	7.7	6.4	-	3.7
23-05-2019	7.6	5.7	-	3.0
24-05-2019	-	-	-	-
25-05-2019	12.0	5.8	-	3.0
26-05-2019	6.1	4.8	-	2.0
27-05-2019	8.3	5.9	-	4.6
28-05-2019	8.3	4.4	-	3.0
29-05-2019	6.0	4.5	1.8	3.7
30-05-2019	6.9	5.2	1.3	3.0
31-05-2019	4.5	3.5	0.9	3.2
01-06-2019	11.0	7.7	5.5	5.8
02-06-2019	4.8	3.5	1.6	3.8
03-06-2019	3.0	2.4	0.5	2.0
04-06-2019	2.8	2.4	0.6	1.9
05-06-2019	2.2	1.8	0.6	1.3
06-06-2019	2.9	2.9	1.0	2.5
07-06-2019	4.0	3.9	1.9	3.5
08-06-2019	7.8	6.1	2.8	6.5
09-06-2019	7.4	6.3	1.3	5.4
10-06-2019	5.4	11.0	1.6	2.9
11-06-2019	12.0	6.1	0.7	2.9
12-06-2019	5.9	3.4	1.0	2.5
13-06-2019	6.5	11.0	1.0	1.9
14-06-2019	6.3	3.5	1.1	2.9
15-06-2019	3.8	2.9	0.0	2.2
16-06-2019	4.6	3.7	0.5	2.9
17-06-2019	4.8	5.0	1.0	3.0
18-06-2019	2.5	1.7	0.1	2.1
19-06-2019	4.0	-	0.6	2.7
20-06-2019	3.5	-	-0.2	2.8
21-06-2019	2.6	-	0.6	2.0
22-06-2019	2.6	-	0.9	2.2
23-06-2019	2.5	-	1.1	3.2
24-06-2019	5.6	-	2.5	4.9
25-06-2019	5.1	-	1.2	4.0
26-06-2019	8.5	-	2.9	4.9
27-06-2019	5.5	-	0.7	3.2

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
28-06-2019	7.4	-	1.2	4.7
29-06-2019	2.9	-	0.2	1.7
30-06-2019	5.5	-	1.5	2.5
01-07-2019	4.4	-	0.7	1.4
02-07-2019	5.3	-	-0.1	2.2
03-07-2019	4.5	-	0.9	2.8
04-07-2019	5.8	-	2.9	4.8
05-07-2019	5.2	-	2.2	4.4
06-07-2019	3.1	-	0.0	2.3
07-07-2019	3.1	-	0.2	2.7
08-07-2019	2.3	-	-0.3	1.1
09-07-2019	1.6	-	-0.2	1.2
10-07-2019	7.3	-	0.1	2.3
11-07-2019	9.1	-	2.8	4.2
12-07-2019	4.3	-	0.7	2.2
13-07-2019	5.6	-	1.4	2.5
14-07-2019	5.2	-	0.9	2.3
15-07-2019	3.4	-	1.1	2.9
16-07-2019	0.9	-	0.3	2.0
17-07-2019	1.3	-	0.0	0.9
18-07-2019	4.7	-	1.0	2.0
19-07-2019	5.0	-	1.2	2.8
20-07-2019	3.7	-	0.1	2.1
21-07-2019	9.9	-	3.5	4.1
22-07-2019	9.5	-	2.6	4.2
23-07-2019	13.0	-	2.2	3.5
24-07-2019	4.1	-	0.3	2.2
25-07-2019	4.9	-	1.2	3.6
26-07-2019	4.8	-	0.4	2.3
27-07-2019	4.0	-	0.7	3.2
28-07-2019	2.9	-	1.1	2.9
29-07-2019	3.7	-	1.0	2.9
30-07-2019	3.0	-	1.4	2.0
31-07-2019	4.8	-	3.0	3.4
01-08-2019	3.8	4.3	2.2	8.5
02-08-2019	1.7	2.2	-0.5	1.8
03-08-2019	3.8	3.2	0.2	2.3
04-08-2019	2.7	4.1	0.9	2.1
05-08-2019	4.1	4.4	1.0	3.5
06-08-2019	4.7	4.8	0.4	2.7
07-08-2019	6.3	4.4	1.0	2.7
08-08-2019	25.0	20.0	7.3	7.6
09-08-2019	6.8	6.0	2.3	3.7

Date	PM10 (µg/m³)		PM2.5 (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
10-08-2019	1.7	1.2	0.7	2.1
11-08-2019	3.7	2.9	0.3	2.1
12-08-2019	5.7	4.5	1.6	2.5
13-08-2019	1.0	2.1	0.1	1.6
14-08-2019	1.8	2.7	-0.2	2.0
15-08-2019	8.6	4.6	-0.2	3.8
16-08-2019	5.5	5.4	0.1	2.9
17-08-2019	3.3	3.6	0.6	2.1
18-08-2019	3.4	2.6	0.0	2.3
19-08-2019	3.8	3.6	0.1	2.0
20-08-2019	4.3	3.3	0.4	2.4
21-08-2019	3.6	3.3	1.0	2.0
22-08-2019	8.5	6.4	2.6	3.0
23-08-2019	15.0	12.0	4.5	6.3
24-08-2019	8.8	6.9	1.9	4.8
25-08-2019	3.5	2.8	0.6	1.4
26-08-2019	3.8	3.7	0.2	2.0
27-08-2019	1.8	2.4	0.4	2.0
28-08-2019	2.4	2.1	0.4	1.6
29-08-2019	6.3	4.7	1.5	2.3
30-08-2019	5.2	5.7	1.2	3.5
31-08-2019	3.8	7.1	-0.4	2.4
01-09-2019	6.3	4.0	0.0	2.0
02-09-2019	4.5	7.0	0.7	2.6
03-09-2019	7.8	5.1	-0.1	4.2
04-09-2019	3.6	3.8	0.7	2.5
05-09-2019	5.9	6.7	2.1	3.2
06-09-2019	5.4	5.1	0.6	2.9
07-09-2019	4.3	5.3	0.5	4.2
08-09-2019	9.6	4.3	0.5	2.8
09-09-2019	9.8	8.3	2.5	3.9
10-09-2019	4.3	4.8	0.5	2.7
11-09-2019	4.9	5.7	0.6	3.3
12-09-2019	12.0	12.0	2.9	4.8
13-09-2019	3.8	3.0	0.2	1.8
14-09-2019	4.3	4.7	1.4	2.9
15-09-2019	9.7	7.0	1.0	5.7
16-09-2019	6.4	6.3	2.4	5.1
17-09-2019	5.8	6.3	1.1	3.9
18-09-2019	6.8	4.6	1.4	3.1
19-09-2019	6.6	5.5	0.6	5.8
20-09-2019	16.0	12.0	4.8	9.8
21-09-2019	4.9	4.5	1.6	3.3

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
22-09-2019	2.8	3.2	0.2	2.6
23-09-2019	2.1	2.7	-0.4	1.0
24-09-2019	2.1	2.5	-0.6	2.1
25-09-2019	1.4	2.7	0.0	2.0
26-09-2019	7.7	6.2	0.4	3.3
27-09-2019	12.0	10.0	0.5	5.7
28-09-2019	8.7	7.2	1.9	5.3
29-09-2019	6.1	4.9	1.0	3.2
30-09-2019	6.0	4.0	1.7	3.1
01-10-2019	9.3	6.7	1.4	4.9
02-10-2019	15.0	12.0	1.8	12.0
03-10-2019	16.0	17.0	4.2	7.1
04-10-2019	8.0	8.8	2.1	5.1
05-10-2019	11.0	11.0	4.6	4.9
06-10-2019	26.0	20.0	5.1	9.0
07-10-2019	3.1	4.0	0.9	1.6
08-10-2019	5.9	3.2	0.0	2.0
09-10-2019	5.6	6.5	0.6	4.0
10-10-2019	3.9	3.2	0.3	5.4
11-10-2019	7.5	5.7	2.6	4.6
12-10-2019	16.0	10.0	-	-
13-10-2019	13.0	7.8	-	-
14-10-2019	14.0	7.9	-	-
15-10-2019	6.1	6.3	-	-
16-10-2019	3.7	4.8	-	-
17-10-2019	10.0	7.0	-	-
18-10-2019	26.0	18.0	-	-
19-10-2019	8.9	6.9	-	-
20-10-2019	9.8	8.0	-	-
21-10-2019	10.0	9.8	-	-
22-10-2019	8.0	8.4	-	-
23-10-2019	17.0	7.8	-	-
24-10-2019	34.0	22.0	-	-
25-10-2019	82.0	46.0	-	-
26-10-2019	24.0	14.0	-	-
27-10-2019	11.0	6.8	-	-
28-10-2019	5.0	5.3	-	-
29-10-2019	11.0	7.8	-	-
30-10-2019	20.0	26.0	-	-
31-10-2019	39.0	63.0	5.3	-
01-11-2019	47.0	49.0	9.1	-
02-11-2019	12.0	-	2.0	-
03-11-2019	14.0	-	2.3	4.1

Date	PM10 (µg/m³)		PM2.5 (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
04-11-2019	8.0	-	0.5	2.6
05-11-2019	6.2	-	1.7	2.3
06-11-2019	28.0	-	3.0	4.0
07-11-2019	34.0	-	4.4	4.0
08-11-2019	4.8	-	-0.1	2.0
09-11-2019	7.0	-	2.4	2.3
10-11-2019	7.0	-	1.3	1.9
11-11-2019	30.0	-	4.0	6.8
12-11-2019	37.0	-	4.8	6.0
13-11-2019	15.0	-	3.1	4.4
14-11-2019	6.9	-	0.4	1.1
15-11-2019	8.9	-	0.0	2.1
16-11-2019	16.0	-	3.3	4.0
17-11-2019	12.0	-	2.2	2.9
18-11-2019	22.0	-	2.3	-
19-11-2019	20.0	-	2.3	-
20-11-2019	21.0	-	3.6	-
21-11-2019	-	-	17.0	-
22-11-2019	-	-	2.0	-
23-11-2019	-	-	2.8	-
24-11-2019	-	-	4.8	-
25-11-2019	-	-	5.3	-
26-11-2019	-	-	1.9	-
27-11-2019	-	-	3.2	-
28-11-2019	-	-	2.8	-
29-11-2019	-	-	3.8	-
30-11-2019	-	-	1.7	-
01-12-2019	-	-	2.0	-
02-12-2019	-	-	2.3	-
03-12-2019	18.0	16.0	3.9	4.7
04-12-2019	11.0	11.0	3.0	3.1
05-12-2019	16.0	17.0	2.9	6.7
06-12-2019	12.0	10.0	2.5	5.2
07-12-2019	16.0	14.0	3.5	5.1
08-12-2019	16.0	13.0	3.3	5.3
09-12-2019	24.0	17.0	3.5	4.3
10-12-2019	17.0	12.0	2.6	3.7
11-12-2019	15.0	-	2.0	3.7
12-12-2019	13.0	-	1.8	2.9
13-12-2019	12.0	-	2.5	2.6
14-12-2019	9.7	-	1.8	4.0
15-12-2019	16.0	-	1.9	2.8
16-12-2019	13.0	-	1.8	2.6

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
17-12-2019	14.0	-	2.7	3.3
18-12-2019	42.0	-	20.0	21.0
19-12-2019	-	-	4.7	7.6
20-12-2019	-	-	16.0	-
21-12-2019	-	-	14.0	-
22-12-2019	-	-	5.6	-
23-12-2019	-	-	7.9	-
24-12-2019	-	-	6.4	-
25-12-2019	-	-	7.9	-
26-12-2019	-	-	8.9	-
27-12-2019	-	-	5.2	-
28-12-2019	-	-	6.8	-
29-12-2019	-	-	8.1	-
30-12-2019	-	-	45.0	-
31-12-2019	-	-	5.5	-
01-01-2020	-	-	3.7	-
02-01-2020	-	-	6.7	-
03-01-2020	-	-	6.7	-
04-01-2020	-	-	14.0	-
05-01-2020	-	-	4.0	-
06-01-2020	-	-	62.0	-
07-01-2020	-	-	81.0	-
08-01-2020	-	-	22.0	-
09-01-2020	-	-	22.0	-
10-01-2020	-	-	14.0	-
11-01-2020	-	-	3.8	-
12-01-2020	-	-	2.0	-
13-01-2020	-	-	32.0	-
14-01-2020	-	-	28.0	-
15-01-2020	-	-	19.0	-
16-01-2020	-	-	22.0	-
17-01-2020	-	-	12.0	-
18-01-2020	-	-	11.0	-
19-01-2020	-	-	7.7	-
20-01-2020	-	-	-	-
21-01-2020	9.3	-	-	-
22-01-2020	-1.0	-	-0.4	-
23-01-2020	83.0	-	4.2	-
24-01-2020	14.0	-	4.1	-
25-01-2020	7.4	-	1.3	-
26-01-2020	5.9	-	0.5	-
27-01-2020	13.0	-	1.9	-
28-01-2020	12.0	-	2.6	-

Date	PM10 (µg/m³)		PM2.5 (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
29-01-2020	12.0	-	3.3	-
30-01-2020	15.0	-	1.8	-
31-01-2020	-	-	52.0	-
01-02-2020	-	-	12.0	-
02-02-2020	-	-	1.4	-
03-02-2020	-	-	2.6	-
04-02-2020	-	-	2.9	-
05-02-2020	-	-	8.8	-
06-02-2020	-	-	6.8	-
07-02-2020	-	-	14.0	-
08-02-2020	-	-	17.0	-
09-02-2020	-	-	3.3	-
10-02-2020	-	-	1.2	-
11-02-2020	-	-	2.1	-
12-02-2020	8.0	-	3.6	-
13-02-2020	13.0	-	3.7	-
14-02-2020	18.0	-	3.7	-
15-02-2020	6.5	-	1.1	-
16-02-2020	6.4	-	3.1	-
17-02-2020	12.0	-	3.5	-
18-02-2020	69.0	-	4.8	-
19-02-2020	10.0	-	1.5	-
20-02-2020	11.0	-	2.8	-
21-02-2020	7.1	-	-0.5	-
22-02-2020	9.5	-	2.4	-
23-02-2020	45.0	-	5.9	-
24-02-2020	15.0	-	1.7	-
25-02-2020	26.0	-	2.1	-
26-02-2020	-	-	2.1	-
27-02-2020	19.0	-	3.0	-
28-02-2020	7.6	-	0.1	-
29-02-2020	5.7	-	0.2	-
01-03-2020	28.5	-	1.7	-
02-03-2020	10.4	-	0.7	-
03-03-2020	18.2	-	1.9	-
04-03-2020	14.2	-	1.7	-
05-03-2020	2.9	-	0.3	-
06-03-2020	7.9	-	1.6	-
07-03-2020	7.4	-	-0.3	-
08-03-2020	7.9	-	1.6	-
09-03-2020	8.5	-	1.2	-
10-03-2020	9.6	-	2.3	-
11-03-2020	14.1	-	0.9	-

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
12-03-2020	11.7	-	0.8	-
13-03-2020	40.7	-	2.4	-
14-03-2020	19.8	-	1.8	-
15-03-2020	6.4	-	0.6	-
16-03-2020	9.7	-	-0.6	-
17-03-2020	12.8	-	0.3	-
18-03-2020	15.2	-	1.1	-
19-03-2020	34.6	-	2.1	-
20-03-2020	12.3	-	2.5	-
21-03-2020	7.7	-	0.8	-
22-03-2020	10.7	-	0.7	-
23-03-2020	12.8	-	2.5	-
24-03-2020	9.8	-	1.4	-
25-03-2020	14.9	-	1.1	-
26-03-2020	14.9	-	3.7	-
27-03-2020	21.6	-	4.3	-
28-03-2020	16.6	-	2.3	-
29-03-2020	50.8	-	3.8	-
30-03-2020	10.6	-	2.1	-
31-03-2020	12.3	-	3.7	-
01-04-2020	16.3	-	2.5	-
02-04-2020	5.2	-	3.8	-
03-04-2020	5.4	-	1.4	-
04-04-2020	7.6	-	2.0	-
05-04-2020	9.8	-	1.1	-
06-04-2020	3.5	-	0.0	-
07-04-2020	3.3	-	1.2	-
08-04-2020	4.1	-	1.4	-
09-04-2020	5.6	-	3.6	-
10-04-2020	3.8	-	0.8	-
11-04-2020	19.8	-	3.8	-
12-04-2020	10.3	-	2.9	-
13-04-2020	12.0	-	5.0	-
14-04-2020	17.3	-	3.0	-
15-04-2020	17.2	-	2.8	-
16-04-2020	19.3	-	2.5	-
17-04-2020	10.6	-	1.9	-
18-04-2020	7.3	-	2.5	-
19-04-2020	11.6	-	1.5	-
20-04-2020	18.8	-	4.5	-
21-04-2020	21.0	-	4.9	-
22-04-2020	16.5	-	4.7	-
23-04-2020	62.1	-	4.3	-

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
24-04-2020	10.5	-	2.8	-
25-04-2020	22.5	-	5.2	-
26-04-2020	4.0	-	1.5	-
27-04-2020	10.2	-	3.0	-
28-04-2020	9.3	-	2.8	-
29-04-2020	2.6	-	1.3	-
30-04-2020	5.0	-	0.7	-
01-05-2020	5.2	-	1.8	-
02-05-2020	8.7	-	2.4	-
03-05-2020	12.1	-	2.8	-
04-05-2020	3.0	-	-0.1	-
05-05-2020	7.0	-	3.7	-
06-05-2020	7.0	-		-
07-05-2020	65.1	-		-
08-05-2020	28.0	-	4.0	-
09-05-2020	6.3	-	1.3	-
10-05-2020	7.9	-	1.6	-
11-05-2020	6.7	-	0.6	-
12-05-2020	7.5	-	0.0	-
13-05-2020	6.4	-	0.5	-
14-05-2020	6.6	-	2.0	-
15-05-2020	7.7	-	2.5	-
16-05-2020	10.5	-	3.6	-
17-05-2020	9.8	-	4.7	-
18-05-2020	12.6	-	3.6	-
19-05-2020	7.2	-	1.1	-
20-05-2020		-		-
21-05-2020	4.8	-	-0.1	-
22-05-2020	8.1	-	2.0	-
23-05-2020	1.2	-	-0.2	-
24-05-2020	1.1	-	-0.1	-
25-05-2020	2.6	-	0.6	-
26-05-2020	4.5	-	0.6	-
27-05-2020	5.1	-	0.1	-
28-05-2020	5.3	-	-0.9	-
29-05-2020	5.5	-	0.9	-
30-05-2020	6.0	-	0.8	-
31-05-2020	11.3	-	1.0	-
01-06-2020	5.3	-	0.9	-
02-06-2020	2.8	-	-0.2	-
03-06-2020	7.1	-	1.8	-
04-06-2020	12.5	-	3.9	-
05-06-2020	9.3	-	1.0	-

Date	PM10 (µg/m³)		PM2.5 (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
06-06-2020	8.9	-	3.2	-
07-06-2020	3.6	-	1.8	-
08-06-2020	2.4	-		-
09-06-2020	8.0	-	4.1	-
10-06-2020	5.7	-	3.1	-
11-06-2020	5.3	-	2.4	-
12-06-2020	6.0	-	3.2	-
13-06-2020	5.5	-	1.9	-
14-06-2020	6.9	-	1.9	-
15-06-2020	5.5	-	0.5	-
16-06-2020	4.2	-	0.7	-
17-06-2020	3.9	-	0.7	-
18-06-2020	9.0	-	1.6	-
19-06-2020	5.6	-	0.9	-
20-06-2020	4.3	-	0.2	-
21-06-2020	1.5	-	-0.5	-
22-06-2020	0.3	-	-0.5	-
23-06-2020	1.3	-	-0.7	-
24-06-2020	0.7	-	-0.4	-
25-06-2020	3.1	-	0.5	-
26-06-2020	9.7	-	0.5	-
27-06-2020	5.4	-	0.7	-
28-06-2020	5.5	-	3.6	-
29-06-2020	6.8	-	3.8	-
30-06-2020	4.3	-	2.4	-
01-07-2020	5.9	-	-0.8	-
02-07-2020	6.6	-	0.3	-
03-07-2020	3.3	-	-0.3	-
04-07-2020	2.4	-	0.5	-
05-07-2020	0.3	-	-0.4	-
06-07-2020	1.7	-	0.8	-
07-07-2020	1.3	-	0.0	-
08-07-2020	4.1	-	2.0	-
09-07-2020	7.0	-	4.0	-
10-07-2020	8.4	-	1.7	-
11-07-2020	2.7	-	0.0	-
12-07-2020	1.5	-	-0.2	-
13-07-2020	5.0	-	2.1	-
14-07-2020	3.2	-	0.8	-
15-07-2020	2.6	-	1.9	-
16-07-2020	3.3	-	1.1	-
17-07-2020	3.9	-	0.6	-
18-07-2020	4.7	-	0.9	-

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
19-07-2020	6.0	-	1.0	-
20-07-2020	7.5	-	1.1	-
21-07-2020	1.4	-	0.4	-
22-07-2020	0.8	-	0.8	-
23-07-2020	1.3	-	0.1	-
24-07-2020	3.4	-	0.5	-
25-07-2020	6.6	-	5.1	-
26-07-2020	5.7	-	3.7	-
27-07-2020	7.9	-	5.8	-
28-07-2020	4.9	-	1.4	-
29-07-2020	3.6	-	1.3	-
30-07-2020	12.6	-	3.5	-
31-07-2020	17.7	-	4.2	-
01-08-2020	10.6	-	2.4	-
02-08-2020	5.8	-	1.0	-
03-08-2020	7.2	-	1.7	-
04-08-2020	4.7	-	0.0	-
05-08-2020	7.5	-	2.2	-
06-08-2020	3.9	-	0.3	-
07-08-2020	3.2	-	1.8	-
08-08-2020	0.0	-	0.0	-
09-08-2020	1.7	-	-0.5	-
10-08-2020	4.2	-	1.9	-
11-08-2020	3.7	-	0.7	-
12-08-2020	4.0	-	1.2	-
13-08-2020	1.6	-	-0.8	-
14-08-2020	1.0	-	-0.4	-
15-08-2020	1.1	-	-0.5	-
16-08-2020	0.4	-	-0.7	-
17-08-2020	0.9	-	0.1	-
18-08-2020	5.1	-	0.3	-
19-08-2020	3.1	-	-0.9	-
20-08-2020	3.2	-	0.0	-
21-08-2020	2.7	-	-0.2	-
22-08-2020	3.1	-	1.3	-
23-08-2020	3.6	-	1.6	-
24-08-2020	1.6	-	0.6	-
25-08-2020	0.5	-	0.0	-
26-08-2020	2.9	-	-0.3	-
27-08-2020	6.8	-	1.1	-
28-08-2020	10.5	-	2.6	-
29-08-2020	8.9	-	1.2	-
30-08-2020	11.0	-	2.4	-

Date	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
	USEPA FEM Compliant	Non-USEPA FEM Compliant	USEPA FEM Compliant	Non-USEPA FEM Compliant
31-08-2020	6.7	-	1.0	-
01-09-2020	6.0	-	2.7	-
02-09-2020	15.7	-	1.6	-
03-09-2020	9.3	-	1.6	-
04-09-2020	16.9	-	2.7	-
05-09-2020	8.2	-	2.1	-
06-09-2020	8.7	-	2.5	-
07-09-2020	6.1	-	1.1	-
08-09-2020	10.0	-	1.9	-
09-09-2020	9.0	-	2.1	-
10-09-2020	6.6	-	2.0	-
11-09-2020	6.0	-	0.6	-
12-09-2020	7.8	-	-0.5	-
13-09-2020	2.0	-	0.2	-

APPENDIX C

Laboratory Test Certificates

Queensland Government

Simtars

Occupational Hygiene, Environment and Chemistry Centre

Street Address 2 Robert Smith Street, Redbank Q 4301
Postal Address PO Box 467, Goodna Q 4300
Phone 07 3810 6333
Fax 07 3810 6338

Analysis Report

Report Number	OL693765N1
Report Issue Date	April 10, 2019
Report To	Attn. Michael Brecko SLR Consulting Australia Pty Ltd 2 Lincoln Street, LANE COVE NSW 2066
Client Reference	PO26041
Job Description	7 x Filters for Dust & Quartz Analysis
Date Received	April 04, 2019
Date Tested/Completed	April 09, 2009
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA WORLD RECOGNISED ACCREDITATION

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693765/01	181016-90	22.169	22.115	<0.01	--	
OL693765/02	181016-91	22.132	22.090	<0.01	--	
OL693765/03	181016-97	24.469	24.411	<0.01	--	
OL693765/04	181016-98	22.312	22.278	<0.01	--	
OL693765/05	181016-99	25.152	25.089	<0.01	--	
OL693765/06	181016-100	25.296	25.237	<0.01	--	
OL693765/07	1810240-1	21.607	21.556	<0.01	--	
Consolidated weight		--	--	<0.01	0.02	
Limit of Reporting (LOR)		**0.01**	**0.01**	**0.01**	**0.01**	

Filters were received preweighed from client. Preweights were all > than Reweights: dust weight results reported as <LOR
Result for dust weight is not covered under NATA scope of accreditation.
As advised by client following reweighing filters were combined and analysed as a single sample for quartz content

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Queensland Government

Simtars

Occupational Hygiene, Environment and Chemistry Centre

Street Address 2 Robert Smith Street, Redbank Q 4301
Postal Address PO Box 467, Goodna Q 4300
Phone 07 3810 6333
Fax 07 3810 6338

Analysis Report

Report Number	OL693771N1
Report Issue Date	April 18, 2019
Report To	Attn. Danny Echeverri SLR Consulting Australia Pty Ltd 2 Lincoln Street, Lany Cove, NSW, 2066
Client Reference	PO 26007
Job Description	9 x Filters for Dust & Quartz Analysis
Date Received	April 11, 2019
Date Tested/Completed	April 16, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Client Sample Identification	Client Filter Pre-weight (mg)	Client Filter Post-weight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693771/01	8047-1	25.903	23.507	<0.01	--	
OL693771/02	8047-2	22.847	22.941	0.09	--	
OL693771/03	8047-3	25.715	21.300	<0.01	--	
OL693771/04	8047-4	24.037	21.116	<0.01	--	
OL693771/05	8047-5	22.131	22.802	0.67	--	
OL693771/06	8047-6	26.041	21.762	<0.01	--	
OL693771/07	8047-7	22.145	21.709	<0.01	--	
OL693771/08	8047-8	26.003	22.293	<0.01	--	
Consolidated weight for 8047-1 to 8047-		--	--	0.77	0.02	
OL693771/09	8047-9	26.142	22.894	<0.01	0.01	
Limit of Reporting (LOR)		**--**	**--**	**0.01**	**0.01**	

Filters were received preweighed from client. Preweights that were > than Reweights are reported as < LOR
Result/s for dust weight/s are not covered under NATA scope of accreditation.
As advised by client following reweighing, filters 8047-1 to 8047-8 were combined and analysed as a single sample for quartz content

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693804N1
Report Issue Date	June 6, 2019
Report To	Attn. Danny Echeverri SLR Consulting Australia Pty Ltd 2 Lincoln Street LANE COVE NSW 2066
Client Reference	PO26351
Job Description	3 x Filters for Dust & Quartz Analysis
Date Received	June 03, 2019
Date Tested/Completed	June 05, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693804/01	8448-1	22.347	22.740	0.39	0.01	
OL693804/02	8448-2	23.463	23.703	0.24	0.01	
OL693804/03	8449	25.972	25.973	<0.01	<0.005	
Limit of Reporting (LOR)		**0.01**	**0.01**	**0.01**	**0.005**	

Filters were received preweighed from client.
Result for dust weight is not covered under NATA scope of accreditation.

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693856N1
Report Issue Date	August 20, 2019
Report To	Attn. Danny Echeverri SLR 2 Lincoln Street, LANE COVE NSW 2066
Client Reference	PO26715
Job Description	3 x Filters for Dust & Quartz Analysis
Date Received	August 07, 2019
Date Tested/Completed	August 16, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA
WORLD RECOGNISED ACCREDITATION

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693856/01	8815-1	23.380	23.796	0.42	<0.005	
OL693856/02	8815-2	21.706	21.647	<0.01	<0.005	
OL693856/03	8817	21.249	21.607	0.36	<0.005	filter torn on receipt
Limit of Reporting (LOR)			**0.01**	**0.01**	**0.005**	

Filters were received preweighed from client.
Result for dust weight is not covered under NATA scope of accreditation.

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693878N1
Report Issue Date	September 12, 2019
Report To	Attn. Danny Echeverri SLR 2 Lincoln Street, LANE COVE NSW 2066
Client Reference	PO26908
Job Description	2 x Filters for Dust & Quartz Analysis
Date Received	September 10, 2019
Date Tested/Completed	September 12, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA
WORLD RECOGNISED ACCREDITATION

Report Number: OL693878N1

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693878/01	8963-1	25.910	26.321	0.41	0.01	Clients own filters
OL693878/02	8965	22.868	23.136	0.27	0.01	Clients own filters
Limit of Reporting (LOR)		**0.01**	**0.01**	**0.01**	**0.005**	

Filters were received preweighed from client.
Result for dust weight is not covered under NATA scope of accreditation.

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693896N1
Report Issue Date	October 17, 2019
Report To	Attn. Danny Echeverri SLR Consulting Australia Pty Ltd 2 Lincoln Street, LANE COVE NSW 2066
Client Reference	PO27062
Job Description	2 x Filters for Dust & Quartz Analysis
Date Received	October 15, 2019
Date Tested/Completed	October 17, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL693896/01	9050-1	25.300	25.634	0.33	<0.005	Clients own filters
OL693896/02	9047	24.631	24.788	0.16	<0.005	Clients own filters
Limit of Reporting (LOR)		**0.01**	**0.01**	**0.01**	**0.005**	

Filters were received preweighed from client.
Result for dust weight is not covered under NATA scope of accreditation.

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693920N1
Report Issue Date	November 13, 2019
Report To	Attn: Danny Echeverri SLR Consulting Australia Pty Ltd 2 Lincoln Street, Lane Cove, NSW. 2066.
Client Reference	Project: 640.11763.00300, PO:27187.
Job Description	2 x Filters for Dust & Quartz Analysis
Date Received	November 07, 2019
Date Tested/Completed	November 12, 2019
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Respirable Dust Content (mg)	Quartz Content (mg)	Comments
OL693920/01	9139-1	0.50	<0.005	
OL693920/02	9137	0.17	<0.005	
Limit of Reporting (LOR)		**0.01**	**0.005**	

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693939N1
Report Issue Date	January 17, 2020
Report To	Attn. Michael Brecko SLR Consulting Pty Ltd Suite 2, 2 Domville Ave. Hawthorn, Vic. 3122
Client Reference	SLR Project# 640.11763.00300, Purchase Order: 27333
Job Description	4 x 47mm PVC Filters for Dust & Quartz Analysis 2 x 47mm PVC Filters for Dust (Gravimetric) Analysis
Date Received	December 06, 2019
Date Tested/Completed	December 11, 2019
Responsibility for Sampling	Client
Approved Signatory	Bryan Mead - Senior Chemist

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	*Filter Pre-weight** *(mg)*	Filter Re-weight (mg)	*Dust Weight** (mg)	Quartz Content (mg)	Comments
OL693939/01	181024-82	*23.364**	23.991	*0.63**	<0.005	Client supplied filter
OL693939/02	181024-83	*22.682**	23.641	*0.96**	0.011	Client supplied filter
OL693939/03	181016-83	*21.163**	21.794	*0.63**	<0.005	Client supplied filter
OL693939/04	181024-92	*22.654**	25.389	*2.74**	-	Client supplied filter
OL693939/05	181024-93	*24.854**	30.809	*5.96**	-	Client supplied filter
OL693939/06	K9322			0.36	<0.005	SIMTARS filter
Limit of Reporting (LOR)				**0.01**	**0.005**	

**Filters OL693939/01 through OL693939/05 were received pre-weighed from client. Results for dust weight calculated using pre-weights supplied by client are not covered by the laboratory's NATA Accreditation.*

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

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Analysis Report

Report Number	OL693962N1
Report Issue Date	February 19, 2020
Report To	Attn. Danny Echeverri SLR Consulting Australia Pty Ltd 2 Lincoln Street, LANE COVE NSW 2066
Client Reference	SLR Project# 640.11763.00300, Purchase Order: 27538
Job Description	4 x 47mm PVC Filters for Dust & Quartz Analysis
Date Received	February 04, 2020
Date Tested/Completed	February 13, 2020
Responsibility for Sampling	Client
Approved Signatory	Bryan Mead - Senior Chemist

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	*Filter Pre-weight** *(mg)*	Filter Re-weight (mg)	*Dust Weight** (mg)	Quartz Content (mg)	Comments
OL693962/01	9373-5	*24.642**	26.069	*1.43**	0.024	Client supplied filter
OL693962/02	9373-7	*24.802**	27.653	*2.85**	0.073	Client supplied filter
OL693962/03	9373-9	*22.944**	22.923	*<0.01**	<0.005	Client supplied filter
OL693962/04	K9326			0.35	0.011	SIMTARS filter
Limit of Reporting (LOR)				**0.01**	**0.005**	

**Filters OL693962/01 through OL693962/03 were received pre-weighed from client. Results for dust weight calculated using pre-weights supplied by client are not covered by the laboratory's NATA Accreditation.*

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Simtars
Safety in Mines Testing and Research Station

2 Robert Smith Street, Redbank Q 4301
www.simtars.com.au

Analysis Report

Report Number	OL693988N1
Report Issue Date	March 17, 2020
Report To	Attn. Michael Brecko SLR Level 2, 15 Astor Terrace, SPRING HILL QLD 4000
Client Reference	PO27678
Job Description	2 x Filters for Dust & Quartz Analysis
Date Received	March 05, 2020
Date Tested/Completed	March 09, 2020
Responsibility for Sampling	Client
Approved Signatory	Patrick Lynch - Principal Scientist

P. Lynch

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA
WORLD RECOGNISED ACCREDITATION

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	*Filter Pre-weight** *(mg)*	Filter Re-weight (mg)	*Dust Weight** (mg)	Quartz Content (mg)	Comments
OL693988/01	9494	*19.796*	21.066	*1.27*	0.07	
OL693988/02	9496	*23.522**	23.907	*0.39**	0.02	Client supplied filter
Limit of Reporting (LOR)				**0.01**	**0.005**	

**Filter OL693988/02 was received pre-weighed from client. Results for dust weight calculated using pre-weights supplied by client are not covered by the laboratory's NATA Accreditation.*

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Simtars
Safety in Mines Testing and Research Station

2 Robert Smith Street, Redbank Q 4301
www.simtars.com.au

Analysis Report

Report Number	OL694006N1
Report Issue Date	April 22, 2020
Report To	Attn. Danny Echeverri SLR Consulting Australia Pty Ltd PO Box 2003, NORTH SYDNEY, NSW, 2059
Client Reference	SLR PO: 27818
Job Description	4 x Filters for Dust & Quartz Analysis
Date Received	April 08, 2020
Date Tested/Completed	April 20, 2020
Responsibility for Sampling	Client
Approved Signatory	Jeremy Hollyer - Analytical Chemist

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Pre-weight (mg)	Filter Post-weight (mg)	Dust Weight (mg)	Quartz Content (mg)	Comments
OL694006/01	9540	22.434	22.721	0.29	<0.005	
OL694006/02	9542	19.849	20.391	0.54	0.005	
OL694006/03	9544	21.159	21.659	0.50	<0.005	
OL694006/04*	9546*	-	-	-	<0.005	Client supplied filter
Limit of Reporting (LOR)				**0.01**	**0.005**	

* No pre-weight supplied for sample 9546. Dust weight unable to be determined.

Reference:

Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Simtars
Safety in Mines Testing and Research Station

2 Robert Smith Street, Redbank Qld 4301
www.simtars.com.au

Analysis Report

Report Number	OL694053N1
Report Issue Date	July 29, 2020
Report To	Attn. Mark Skoroszewski Level 2, 15 Astor Terrace SPRING HILL QLD 4000
Client Reference	PO28189
Job Description	4 x 47mm PVC's Filters for Dust & Quartz Analysis
Date Received	July 08, 2020
Date Tested/Completed	July 28, 2020
Responsibility for Sampling	Client
Approved Signatory	Jeremy Hollyer - Analytical Chemist

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA
WORLD RECOGNISED ACCREDITATION

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Content (mg)	Quartz Content (mg)	Comments
OL694053/01	9735	---	---	0.70	<0.005	SIMTARS filter
OL694053/02	9736	---	---	0.47	<0.005	SIMTARS filter
OL694053/03	*9873**	*25.590*	*26.552*	*0.60**	*<0.005*	*Client supplied filter*
OL694053/04	*9374**	*25.370*	*25.401*	*0.03**	*<0.005*	*Client supplied filter*
Limit of Reporting (LOR)		**0.01**	**0.01**	**0.01**	**0.005**	

** Filters OL694053 / 03 and OL694053 / 04 were received preweighed from client. Result for dust weight calculated using pre-weights supplied by client are not covered by the laboratories NATA accreditation.*

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Simtars
Safety in Mines Testing and Research Station

2 Robert Smith Street, Redbank Qld 4301
www.simtars.com.au

Analysis Report

Report Number	OL694069N1
Report Issue Date	August 13, 2020
Report To	Attn. Jason Shepherd SLR Consulting Australia Pty Ltd Level 11, 176 Wellington Parade, EAST MELBOURNE VIC 3002
Client Reference	PO28299
Job Description	2 x Filters for Dust & Quartz Analysis
Date Received	August 11, 2020
Date Tested/Completed	August 13, 2020
Responsibility for Sampling	Client
Approved Signatory	Jeremy Hollyer - Analytical Chemist

Accredited for compliance with ISO/IEC 17025 Testing. Accreditation Number 2681.

NATA
WORLD RECOGNISED ACCREDITATION

Results for Gravimetric & Quartz Analysis:

Laboratory Number	Sample Identification	Filter Preweight (mg)	Filter Reweight (mg)	Dust Content (mg)	Quartz Content (mg)	Comments
OL694069/01	10012-2	*20.730**	21.414	*0.68**	<0.005	Client supplied filter
OL694069/02	10014			<0.01	<0.005	SIMTARS filter
Limit of Reporting (LOR)				**0.01**	**0.005**	

** Filter OL694069 / 01 was received preweighed from client. Result for dust weight calculated using pre-weights supplied by client are not covered by the laboratories NATA accreditation.*

References:
Quartz by FTIR using Simtars in-house procedure LP0016.
Weighing of fine particulate matter filters by Simtars in-house procedure LP0046.

Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

NATA

REPORT OF ANALYSIS

Report No. RN1269278

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/190404
		Quote No.	: QT-02018
		Order No.	: 26040
		Date Received	: 04-APR-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/009098	8100-1	FILTER- LOCATION 5 181016-77
N19/009099	8100-2	FILTER- LOCATION 5 181016-78
N19/009100	8100-3	FILTER- LOCATION 5 181016-79
N19/009101	8100-4	FILTER- LOCATION 5 181016-80

Lab Reg No.		**N19/009098**	**N19/009099**	**N19/009100**	**N19/009101**	
Date Sampled		**01-JAN-2019**	**02-JAN-2019**	**03-JAN-2019**	**04-JAN-2019**	
Sample Reference	**Units**	**8100-1**	**8100-2**	**8100-3**	**8100-4**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Chromium	ug/sample	0.49	0.51	0.39	0.55	NT2_52
Copper	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Lead	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Manganese	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Vanadium	ug/sample	0.11	<0.1	<0.1	<0.1	NT2_52
Zinc	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52

N19/009098
-N19/009105
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269278

Lab Reg No.	Units	N19/009098	N19/009099	N19/009100	N19/009101	Method
Date Sampled		01-JAN-2019	02-JAN-2019	03-JAN-2019	04-JAN-2019	
Sample Reference		8100-1	8100-2	8100-3	8100-4	
Miscellaneous						
Sample Weight	g	<0.00001	<0.00001	<0.00001	0.00002	NW_S4

N19/009098

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269278

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/190404 : QT-02018 : 26040 : 04-APR-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/009102	8100-5	FILTER- LOCATION 5 181016-81
N19/009103	8100-6	FILTER- LOCATION 5 181016-87
N19/009104	8100-6	FILTER- LOCATION 5 181016-88
N19/009105	8100-8	FILTER- LOCATION 5 181016-89

Lab Reg No.		**N19/009102**	**N19/009103**	**N19/009104**	**N19/009105**	
Date Sampled		**05-JAN-2019**	**06-JAN-2019**	**07-JAN-2019**	**08-JAN-2019**	
Sample Reference	**Units**	**8100-5**	**8100-6**	**8100-6**	**8100-8**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Chromium	ug/sample	0.4	0.69	0.46	0.4	NT2_52
Copper	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Lead	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Manganese	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Vanadium	ug/sample	0.11	<0.1	<0.1	<0.1	NT2_52
Zinc	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269278

Lab Reg No.		**N19/009102**	**N19/009103**	**N19/009104**	**N19/009105**	
Date Sampled		**05-JAN-2019**	**06-JAN-2019**	**07-JAN-2019**	**08-JAN-2019**	
Sample Reference	**Units**	**8100-5**	**8100-6**	**8100-6**	**8100-8**	**Method**
Miscellaneous						
Sample Weight	g	<0.00001	<0.00001	<0.00001	<0.00001	NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

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ACCREDITED FOR TECHNICAL COMPETENCE

This Report supersedes reports: *RN1228665* *RN1228732* *RN1228806*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

REPORT OF ANALYSIS

Report No. RN1269281

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/190409
		Quote No.	: QT-02018
		Order No.	: 26008
		Date Received	: 09-APR-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/009759	8048-1	FILTER LOCATION 5 D1 START 27-02-2019 END 28/02/2019 ID 181101-2
N19/009760	8048-2	FILTER LOCATION 5 D2 START 28-02-2019 END 01/03/2019 ID 181101-3
N19/009761	8048-3	FILTER LOCATION 5 D3 START 01-03-2019 END 02/03/2019 ID 181101-4
N19/009762	8048-4	FILTER LOCATION 5 D4 START 02-03-2019 END 03/03/2019 ID 181101-5

Lab Reg No.		**N19/009759**	**N19/009760**	**N19/009761**	**N19/009762**	
Date Sampled		**Not Provided**	**Not Provided**	**Not Provided**	**Not Provided**	
Sample Reference	**Units**	**8048-1**	**8048-2**	**8048-3**	**8048-4**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Chromium	ug/sample	0.53	0.3	0.41	0.5	NT2_52
Copper	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Lead	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Manganese	ug/sample	0.44	0.25	0.44	0.25	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	0.05	<0.05	<0.05	<0.05	NT2_52
Vanadium	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52
Zinc	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269281

Lab Reg No.	**Units**	**N19/009759**	**N19/009760**	**N19/009761**	**N19/009762**	**Method**
Date Sampled		**Not Provided**	**Not Provided**	**Not Provided**	**Not Provided**	
Sample Reference		**8048-1**	**8048-2**	**8048-3**	**8048-4**	
Miscellaneous						
Sample Weight	g	0.00446	0.00541	0.00141	0.00354	NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269281

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/190409
		Quote No.	: QT-02018
		Order No.	: 26008
		Date Received	: 09-APR-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/009763	8048-5	FILTER LOCATION 5 D5 START 03-03-2019 END 04/03/2019 ID 181101-6
N19/009764	8048-6	FILTER LOCATION 5 D6 START 04-03-2019 END 05/03/2019 ID 181101-7
N19/009765	8048-7	FILTER LOCATION 5 D7 START 05-03-2019 END 06/03/2019 ID 181101-8
N19/009766	8048-8	FILTER LOCATION 5 D8 START 06-03-2019 END 07/03/2019 ID 181101-9

Lab Reg No.		**N19/009763**	**N19/009764**	**N19/009765**	**N19/009766**	
Date Sampled		**Not Provided**	**Not Provided**	**Not Provided**	**Not Provided**	
Sample Reference	**Units**	**8048-5**	**8048-6**	**8048-7**	**8048-8**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Chromium	ug/sample	0.53	0.52	0.48	0.38	NT2_52
Copper	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Lead	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Manganese	ug/sample	0.34	0.38	0.14	0.06	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	<0.05	0.05	<0.05	<0.05	NT2_52
Vanadium	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52
Zinc	ug/sample	<0.1	0.36	<0.1	<0.1	NT2_52

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269281

Lab Reg No.	Units	N19/009763	N19/009764	N19/009765	N19/009766	Method
Date Sampled		Not Provided	Not Provided	Not Provided	Not Provided	
Sample Reference		8048-5	8048-6	8048-7	8048-8	
Miscellaneous						
Sample Weight	g	<0.00001	0.00286	0.00272	0.00094	NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269281

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/190409 : QT-02018 : 26008 : 09-APR-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/009767	8048-9	FILTER LOCATION 5 D9 START 07-03-2019 END 08/03/2019 ID 181101-21

Lab Reg No.		**N19/009767**				
Date Sampled		**Not Provided**				
Sample Reference	**Units**	**8048-9**				**Method**
Trace Elements						
Arsenic	ug/sample	<0.05				NT2_52
Cadmium	ug/sample	<0.05				NT2_52
Chromium	ug/sample	0.37				NT2_52
Copper	ug/sample	<0.05				NT2_52
Lead	ug/sample	<0.05				NT2_52
Manganese	ug/sample	<0.05				NT2_52
Mercury	ug/sample	<0.05				NT2_52
Nickel	ug/sample	<0.05				NT2_52
Vanadium	ug/sample	<0.1				NT2_52
Zinc	ug/sample	<0.1				NT2_52

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

Lab Reg No.		**N19/009767**				
Date Sampled		**Not Provided**				
Sample Reference	**Units**	**8048-9**				**Method**
Miscellaneous						
Sample Weight	g	<0.00001				NW_S4

REPORT OF ANALYSIS

Lab Reg No.	Units	N19/009767				Method
Date Sampled		Not Provided				
Sample Reference		8048-9				

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

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ACCREDITED FOR
TECHNICAL
COMPETENCE

This Report supersedes reports: *RN1229178* *RN1229180*
RN1229198

Measurement Uncertainty is available upon request.

Note: Where sampling dates are not provided NMI is unable to determine compliance to any applicable Holding Time requirements
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

REPORT OF ANALYSIS

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/190506 : QT-02018 : 26194 : 06-MAY-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/011731	8303	FILTER LOCATION 5 MV 27/03/2019 0:01 - 05/04/2019 23:59 FILTER 47-131P6623434

Lab Reg No.		**N19/011731**				
Date Sampled		**27-MAR-2019**				
Sample Reference	**Units**	**8303**				**Method**
Trace Elements						
Arsenic	ug/sample	<0.1				NT2_52
Cadmium	ug/sample	<0.05				NT2_52
Chromium	ug/sample	0.32				NT2_52
Copper	ug/sample	0.06				NT2_52
Lead	ug/sample	0.06				NT2_52
Manganese	ug/sample	0.41				NT2_52
Mercury	ug/sample	<0.05				NT2_52
Nickel	ug/sample	<0.05				NT2_52
Vanadium	ug/sample	<0.1				NT2_52
Zinc	ug/sample	0.58				NT2_52

N19/011731
All results are expressed on sample (whole filter) as received.

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

13-MAY-2019

REPORT OF ANALYSIS

Report No. RN1231849

Lab Reg No.	Units	N19/011731				Method
Date Sampled		27-MAR-2019				
Sample Reference		8303				
Miscellaneous						
Sample Weight	g	0.00378				NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

13-MAY-2019

Accredited for compliance with ISO/IEC 17025 - Testing.
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Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1231569* *RN1231845*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

NATA

REPORT OF ANALYSIS

Report No. RN1269289

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/190531/2
		Quote No.	: QT-02018
		Order No.	: 26349
		Date Received	: 31-MAY-2019
Attention	: MARK SKOROSZEWSKI	**Sampled By**	: CLIENT
Project Name	:		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/014179	8450-1	FILTER LOCATION 5 START 30/04/2019 END 10/05/2019 SAMPLE ID 47-148P6579729
N19/014180	8450-2	FILTER LOCATION 5 START 10/05/2019 END 20/05/2019 SAMPLE ID 47-131P6623431
N19/014181	8451	FILTER LOCATION 5 FB START 29/04/2019 END 29/04/2019 SAMPLE ID 47-148P6579736

Lab Reg No.		**N19/014179**	**N19/014180**	**N19/014181**		
Date Sampled		**30-APR-2019**	**10-MAY-2019**	**29-APR-2019**		
Sample Reference	**Units**	**8450-1**	**8450-2**	**8451**		**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05		NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05		NT2_52
Chromium	ug/sample	0.35	0.24	0.29		NT2_52
Copper	ug/sample	0.08	0.78	<0.05		NT2_52
Lead	ug/sample	<0.05	0.06	<0.05		NT2_52
Manganese	ug/sample	0.91	0.24	<0.05		NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05		NT2_52
Nickel	ug/sample	0.058	<0.05	<0.05		NT2_52
Vanadium	ug/sample	0.12	<0.1	<0.1		NT2_52
Zinc	ug/sample	0.23	0.79	<0.1		NT2_52

N19/014179
-N19/014181
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269289

Lab Reg No.		**N19/014179**	**N19/014180**	**N19/014181**		
Date Sampled		**30-APR-2019**	**10-MAY-2019**	**29-APR-2019**		
Sample Reference	**Units**	**8450-1**	**8450-2**	**8451**		**Method**
Miscellaneous						
Sample Weight	g	0.00185	0.00047	0.00011		NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

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This Report supersedes reports: *RN1235153* *RN1236834*
RN1236946

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Australian Government
Department of Industry, Science, Energy and Resources

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REPORT OF ANALYSIS

Report No. RN1269290

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/190702
		Quote No.	: QT-02018
		Order No.	: 26509
		Date Received	: 02-JUL-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/016543	8614-1	FILTER LOCATION 5 28-05-2019 0:00 - 07-06-2019 0:00
N19/016544	8614-2	FILTER LOCATION 5 07-06-2019 0:00 - 17-06-2019 0:00

Lab Reg No.		**N19/016543**	**N19/016544**			
Date Sampled		**28-MAY-2019**	**28-MAY-2019**			
Sample Reference	**Units**	**8614-1**	**8614-2**			**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05			NT2_52
Cadmium	ug/sample	<0.05	<0.05			NT2_52
Chromium	ug/sample	0.25	<0.1			NT2_52
Copper	ug/sample	<0.05	<0.05			NT2_52
Lead	ug/sample	<0.05	<0.05			NT2_52
Manganese	ug/sample	0.18	<0.05			NT2_52
Mercury	ug/sample	<0.05	<0.05			NT2_52
Nickel	ug/sample	<0.05	<0.05			NT2_52
Vanadium	ug/sample	<0.1	<0.1			NT2_52
Zinc	ug/sample	0.44	0.28			NT2_52

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269290

Lab Reg No.		N19/016543	N19/016544			
Date Sampled		28-MAY-2019	28-MAY-2019			
Sample Reference	Units	8614-1	8614-2			Method
Miscellaneous						
Sample Weight	g	0.00106	0.00931			NW_S4

N19/016543
-N19/016544.
All results are expressed on sample (whole filter) as received.

Wei Huang, Analyst
Inorganics - NSW
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This Report supersedes reports: *RN1238992* *RN1242509* *RN1242625*

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REPORT OF ANALYSIS

Report No. RN1269297

Client : SLR CONSULTING AUSTRALIA PTY LTD		**Job No.**	: SLRC01/190806
LEVEL 2 / 2 LINCOLN STREET		**Quote No.**	: QT-02018
LANE COVE WEST NSW 2066		**Order No.**	: 26714
		Date Received	: 06-AUG-2019
Attention : MICHAEL BRECKO		**Sampled By**	: CLIENT
Project Name : 640.11763.00300			
Your Client Services Manager : Tony Lattari		**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/019761	8816-1	LOCATION 5 26-06-2019
N19/019762	8816-2	LOCATION 5 FB 01-08-2019
N19/019763	8818	LOCATION 5 MV 26-06-2019

Lab Reg No.		N19/019761	N19/019762	N19/019763		
Date Sampled		26-JUN-2019	01-AUG-2019	26-JUN-2019		
Sample Reference	Units	8816-1	8816-2	8818		Method
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05		NT2_52
Cadmium	ug/sample	<0.01	<0.01	<0.01		NT2_52
Chromium	ug/sample	0.45	0.38	0.07		NT2_52
Copper	ug/sample	0.07	0.13	0.03		NT2_52
Lead	ug/sample	0.03	<0.01	0.02		NT2_52
Manganese	ug/sample	0.38	0.04	0.04		NT2_52
Mercury	ug/sample	<0.01	<0.01	<0.01		NT2_52
Nickel	ug/sample	0.03	0.05	0.02		NT2_52
Vanadium	ug/sample	<0.1	<0.1	<0.1		NT2_52
Zinc	ug/sample	0.2	<0.01	0.12		NT2_52

N19/019761
-N19/019763
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

06-APR-2020

REPORT OF ANALYSIS

Report No. RN1269297

Lab Reg No.		N19/019761	N19/019762	N19/019763		
Date Sampled		**26-JUN-2019**	**01-AUG-2019**	**26-JUN-2019**		
Sample Reference	**Units**	**8816-1**	**8816-2**	**8818**		**Method**
Miscellaneous						
Sample Weight	g	0.00537	<0.00001	0.00022		NW_S4

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This Report supersedes reports: *RN1242417* *RN1242849* *RN1242897*

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Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

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REPORT OF ANALYSIS

Report No. RN1269332

Client	: SLR CONSULTING AUSTRALIA PTY LTD	**Job No.**	: SLRC01/190910
	LEVEL 2 / 2 LINCOLN STREET	**Quote No.**	: QT-02018
	LANE COVE WEST NSW 2066	**Order No.**	: 26923
		Date Received	: 10-SEP-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/022909	8966-1	FILTER LOCATION 5 02-08-2019 0:00 - 12-08-2019 0:00
N19/022910	8967-1	FILTER LOCATION 5 12-08-2019 0:00 - 22-08-2019 0:00
N19/022911	8968-1	FILTER LOCATION 5 22-08-2019 0:00 - 01-09-2019 0:00
N19/022912	8967-2	FILTER LOCATION 5 12-08-2019 0:00 - 22-08-2019 0:00

Lab Reg No.		N19/022909	N19/022910	N19/022911	N19/022912	
Date Sampled		02-AUG-2019	12-AUG-2019	22-AUG-2019	12-AUG-2019	
Sample Reference	**Units**	8966-1	8967-1	8968-1	8967-2	**Method**
Trace Elements						
Arsenic	ug/sample	0.05	<0.05	<0.05	0.09	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	0.09	NT2_52
Chromium	ug/sample	1.9	2.5	2.7	3.2	NT2_52
Copper	ug/sample	0.65	0.36	0.39	0.3	NT2_52
Lead	ug/sample	0.17	0.08	0.45	0.4	NT2_52
Manganese	ug/sample	3.4	0.88	1.3	0.24	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	0.21	0.11	0.18	0.23	NT2_52
Vanadium	ug/sample	0.17	<0.1	<0.1	0.25	NT2_52
Zinc	ug/sample	1.2	1.6	3.4	2.2	NT2_52

N19/022909
-N19/022914
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

REPORT OF ANALYSIS

Report No. RN1269332

Lab Reg No.		N19/022909	N19/022910	N19/022911	N19/022912	
Date Sampled		**02-AUG-2019**	**12-AUG-2019**	**22-AUG-2019**	**12-AUG-2019**	
Sample Reference	**Units**	**8966-1**	**8967-1**	**8968-1**	**8967-2**	**Method**
Miscellaneous						
Sample Weight	g	0.00108	0.00071	0.00113	0.00022	NW_S4

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

REPORT OF ANALYSIS

Report No. RN1269332

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/190910 : QT-02018 : 26923 : 10-SEP-2019
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	**Sample Ref**	**Sample Description**
N19/022913	8968-2	FILTER LOCATION 5 22-08-2019 0:00 - 01-09-2019 0:00
N19/022914	8969	FILTER LOCATION 5 MV 02-08-2019 0:00 - 12-08-2019 0:00

Lab Reg No.		**N19/022913**	**N19/022914**			
Date Sampled		**22-AUG-2019**	**02-AUG-2019**			
Sample Reference	**Units**	**8968-2**	**8969**			**Method**
Trace Elements						
Arsenic	ug/sample	0.12	<0.05			NT2_52
Cadmium	ug/sample	0.25	<0.05			NT2_52
Chromium	ug/sample	3.5	3.3			NT2_52
Copper	ug/sample	0.19	0.3			NT2_52
Lead	ug/sample	2	0.11			NT2_52
Manganese	ug/sample	0.18	0.58			NT2_52
Mercury	ug/sample	<0.05	<0.05			NT2_52
Nickel	ug/sample	0.17	0.24			NT2_52
Vanadium	ug/sample	0.43	<0.1			NT2_52
Zinc	ug/sample	2.3	0.87			NT2_52

Richard Tea, Analyst
Inorganics - NSW
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Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

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REPORT OF ANALYSIS

Report No. RN1269332

Lab Reg No.	Units	N19/022913	N19/022914			Method
Date Sampled		22-AUG-2019	02-AUG-2019			
Sample Reference		8968-2	8969			
Miscellaneous						
Sample Weight	g	0.00038	0.00027			NW_S4

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This Report supersedes reports: *RN1247267* *RN1247342* *RN1247348*

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Department of Industry, Science, Energy and Resources

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REPORT OF ANALYSIS

Report No. RN1269333

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/191015 : QT-02018 : 27064 : 15-OCT-2019
Attention	: MARK SKOROSZEWSKI	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/025908	9049-1	FILTER LOCATION 5 01-09-2019 0:00 - 11-09-2019 0:00
N19/025909	9048	FILTER LOCATION 5 MV 04-09-2019 0:00 - 14-09-2019 0:00

Lab Reg No.		**N19/025908**	**N19/025909**			
Date Sampled		**01-SEP-2019**	**04-SEP-2019**			
Sample Reference	**Units**	**9049-1**	**9048**			**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05			NT2_52
Cadmium	ug/sample	<0.05	<0.05			NT2_52
Chromium	ug/sample	0.11	0.42			NT2_52
Copper	ug/sample	<0.05	<0.05			NT2_52
Lead	ug/sample	<0.05	<0.05			NT2_52
Manganese	ug/sample	0.2	<0.05			NT2_52
Mercury	ug/sample	<0.05	<0.05			NT2_52
Nickel	ug/sample	0.16	0.057			NT2_52
Vanadium	ug/sample	<0.1	<0.1			NT2_52
Zinc	ug/sample	0.17	0.13			NT2_52
Dates						
Date extracted		21-OCT-2019	21-OCT-2019			
Date analysed		22-OCT-2019	22-OCT-2019			

N19/025908
-N19/025909
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

REPORT OF ANALYSIS

Report No. RN1269333

Lab Reg No.		**N19/025908**	**N19/025909**			
Date Sampled		**01-SEP-2019**	**04-SEP-2019**			
Sample Reference	**Units**	**9049-1**	**9048**			**Method**
Miscellaneous						
Sample Weight	g	0.00107	0.00017			NW_S4
Dates						
Date extracted		16-OCT-2019	16-OCT-2019			
Date analysed		17-OCT-2019	17-OCT-2019			

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

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This Report supersedes reports: *RN1250196* *RN1250204* *RN1250232*

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REPORT OF ANALYSIS

Report No. RN1269334

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/191106
		Quote No.	: QT-02018
		Order No.	: 27182
		Date Received	: 06-NOV-2019
Attention	: MARK SKOROSZEWSKI	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/027959	9138-1	FILTER LOCATION 5 01-10-2019 0:00 - 11-10-2019 0:00
N19/027960	9136	FILTER LOCATION 5 MV 04-10-2019 0:00 - 14-10-2019 0:00

Lab Reg No.		**N19/027959**	**N19/027960**			
Date Sampled		**01-OCT-2019**	**01-OCT-2019**			
Sample Reference	**Units**	**9138-1**	**9136**			**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05			NT2_52
Cadmium	ug/sample	<0.05	<0.05			NT2_52
Chromium	ug/sample	0.51	1.2			NT2_52
Copper	ug/sample	0.05	0.16			NT2_52
Lead	ug/sample	<0.05	<0.05			NT2_52
Manganese	ug/sample	0.73	0.16			NT2_52
Mercury	ug/sample	<0.05	<0.05			NT2_52
Nickel	ug/sample	<0.05	0.53			NT2_52
Vanadium	ug/sample	<0.1	<0.1			NT2_52
Zinc	ug/sample	0.22	0.2			NT2_52
Dates						
Date extracted		20-NOV-2019	20-NOV-2019			
Date analysed		20-NOV-2019	20-NOV-2019			

N19/027959
-N19/027960
All results are expressed on sample (whole filter) as received.

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

REPORT OF ANALYSIS

Report No. RN1269334

Lab Reg No.	Units	N19/027959	N19/027960			Method
Date Sampled		01-OCT-2019	01-OCT-2019			
Sample Reference		9138-1	9136			
Miscellaneous						
Sample Weight	g	0.00147	0.00032			NW_S4
Dates						
Date extracted		7-NOV-2019	7-NOV-2019			
Date analysed		19-NOV-2019	19-NOV-2019			

Wei Huang, Analyst
Inorganics - NSW
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07-APR-2020

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This Report supersedes reports: *RN1253050* *RN1253331* *RN1253343*

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REPORT OF ANALYSIS

Report No. RN1269335

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/191205
		Quote No.	: QT-02018
		Order No.	: 27332
		Date Received	: 05-DEC-2019
Attention	: MARK SKOROSZEWSKI	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N19/031588	9229-10	FILTER LOCATION 5 30-10-2019 0:00 TO 09-11-2019 0:00
N19/031589	9227	FILTER LOCATION 5 MV 31-10-2019 0:00 TO 10-11-2019 0:00

Lab Reg No.		**N19/031588**	**N19/031589**			
Date Sampled		**30-OCT-2019**	**31-OCT-2019**			
Sample Reference	**Units**	**9229-10**	**9227**			**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05			NT2_52
Cadmium	ug/sample	<0.05	<0.05			NT2_52
Chromium	ug/sample	0.33	0.33			NT2_52
Copper	ug/sample	0.13	<0.05			NT2_52
Lead	ug/sample	0.052	<0.05			NT2_52
Manganese	ug/sample	1.4	0.12			NT2_52
Mercury	ug/sample	<0.05	<0.05			NT2_52
Nickel	ug/sample	0.087	<0.05			NT2_52
Vanadium	ug/sample	0.14	<0.1			NT2_52
Zinc	ug/sample	0.17	<0.1			NT2_52
Dates						
Date extracted		13-DEC-2019	13-DEC-2019			
Date analysed		16-DEC-2019	16-DEC-2019			

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

REPORT OF ANALYSIS

Report No. RN1269335

Lab Reg No.		**N19/031588**	**N19/031589**			
Date Sampled		**30-OCT-2019**	**31-OCT-2019**			
Sample Reference	**Units**	**9229-10**	**9227**			**Method**
Miscellaneous						
Sample Weight	g	0.00341	0.01999			NW_S4
Dates						
Date extracted		10-DEC-2019	10-DEC-2019			
Date analysed		11-DEC-2019	11-DEC-2019			

N19/031588
-N19/031589.
All results are expressed on sample (whole filter) as received.

N19/031589
Sample Weight is a total weight (filter pre - weight not received)

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

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This Report supersedes reports: *RN1256971* *RN1257916* *RN1257941*

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REPORT OF ANALYSIS

Report No. RN1269336

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.**	: SLRC01/200203
		Quote No.	: QT-02018
		Order No.	: 27537
		Date Received	: 03-FEB-2020
Attention	: MARK SKOROSZEWSKI	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/002118	9370-5	FILTER LOCATION 5 19-12-2019 0:00 - 29-12-2019 0:00
N20/002119	9370-7	FILTER LOCATION 5 08-01-2020 0:00 - 18-01-2020 0:00
N20/002120	9371	FILTER LOCATION 5 FB 21-01-2020 0:00 - 21-01-2020 0:00
N20/002121	9372	FILTER LOCATION 5 MV 03-12-2019 0:00 - 13-12-2019 0:00

Lab Reg No.		**N20/002118**	**N20/002119**	**N20/002120**	**N20/002121**	
Date Sampled		**19-DEC-2019**	**08-JAN-2020**	**21-JAN-2020**	**03-DEC-2019**	
Sample Reference	**Units**	**9370-5**	**9370-7**	**9371**	**9372**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	0.07	<0.05	NT2_52
Chromium	ug/sample	0.55	0.56	0.65	0.47	NT2_52
Copper	ug/sample	0.15	0.14	0.31	<0.05	NT2_52
Lead	ug/sample	0.07	0.09	<0.05	<0.05	NT2_52
Manganese	ug/sample	2.3	4.3	<0.05	0.08	NT2_52
Mercury	ug/sample	0.26	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	0.11	0.12	0.1	<0.05	NT2_52
Vanadium	ug/sample	0.2	0.28	<0.1	<0.1	NT2_52
Zinc	ug/sample	0.39	0.36	0.29	<0.1	NT2_52
Dates						
Date extracted		7-FEB-2020	7-FEB-2020	7-FEB-2020	7-FEB-2020	
Date analysed		7-FEB-2020	7-FEB-2020	7-FEB-2020	7-FEB-2020	

N20/002118
-N20/002121
All results are expressed on sample (whole filter) as received.

REPORT OF ANALYSIS

Report No. RN1269336

Lab Reg No.	Units	N20/002118	N20/002119	N20/002120	N20/002121	Method
Date Sampled		19-DEC-2019	08-JAN-2020	21-JAN-2020	03-DEC-2019	
Sample Reference		9370-5	9370-7	9371	9372	

Richard Tea, Analyst
Inorganics - NSW
Accreditation No. 198

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

Lab Reg No.	Units	N20/002118	N20/002119	N20/002120	N20/002121	Method
Date Sampled		19-DEC-2019	08-JAN-2020	21-JAN-2020	03-DEC-2019	
Sample Reference		9370-5	9370-7	9371	9372	
Miscellaneous						
Sample Weight	g	0.00396	0.00606	-0.00003	-0.00053	NW_S4
Dates						
Date extracted		5-FEB-2020	5-FEB-2020	5-FEB-2020	5-FEB-2020	
Date analysed		6-FEB-2020	6-FEB-2020	6-FEB-2020	6-FEB-2020	

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

07-APR-2020

This Report supersedes reports: *RN1262475* *RN1262489* *RN1262498*

Measurement Uncertainty is available upon request.

Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

REPORT OF ANALYSIS

Report No. RN1271624

Client	: SLR CONSULTING AUSTRALIA PTY LTD LEVEL 2 / 2 LINCOLN STREET LANE COVE WEST NSW 2066	**Job No.** **Quote No.** **Order No.** **Date Received**	: SLRC01/200407 : QT-02018 : 27817 : 07-APR-2020
Attention	: MICHAEL BRECKO	**Sampled By**	: CLIENT
Project Name	: 640.11763.00300		
Your Client Services Manager	: Tony Lattari	**Phone**	: 02 9449 0196

Lab Reg No.	Sample Ref	Sample Description
N20/007994	9539	FILTER LOCATION 5 28-02-2020 0:00 - 08-03-2020 23:59
N20/007995	9541	FILTER LOCATION 5 27-02-2020 17:58 - 08-03-2020 17:58
N20/007996	9543	FILTER LOCATION 5 08-03-2020 17:58 - 18-03-2020 17:58
N20/007997	9545	FILTER LOCATION 5

Lab Reg No.		**N20/007994**	**N20/007995**	**N20/007996**	**N20/007997**	
Date Sampled		**28-FEB-2020**	**27-FEB-2020**	**28-FEB-2020**	**28-FEB-2020**	
Sample Reference	**Units**	**9539**	**9541**	**9543**	**9545**	**Method**
Trace Elements						
Arsenic	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Cadmium	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Chromium	ug/sample	0.55	0.31	0.43	0.69	NT2_52
Copper	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Lead	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Manganese	ug/sample	0.13	<0.05	<0.05	<0.05	NT2_52
Mercury	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Nickel	ug/sample	<0.05	<0.05	<0.05	<0.05	NT2_52
Vanadium	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52
Zinc	ug/sample	<0.1	<0.1	<0.1	<0.1	NT2_52
Dates						
Date extracted		17-APR-2020	17-APR-2020	17-APR-2020	17-APR-2020	
Date analysed		20-APR-2020	20-APR-2020	20-APR-2020	20-APR-2020	

N20/007994
-N20/007997
All results are expressed on sample (whole filter) as received.

Fiona Zhang, Analyst
Inorganics - NSW
Accreditation No. 198

29-APR-2020

REPORT OF ANALYSIS

Report No. RN1271624

Lab Reg No.	Units	N20/007994	N20/007995	N20/007996	N20/007997	Method
Date Sampled		28-FEB-2020	27-FEB-2020	28-FEB-2020	28-FEB-2020	
Sample Reference		9539	9541	9543	9545	
Miscellaneous						
Sample Weight	g	0.00046	0.00131	0.00295	<0.00001	NW_S4
Dates						
Date extracted		14-APR-2020	14-APR-2020	14-APR-2020	14-APR-2020	
Date analysed		16-APR-2020	16-APR-2020	16-APR-2020	16-APR-2020	

N20/007994
to N20/007997
Sample Weight = Dust Weight

N20/007995

Wei Huang, Analyst
Inorganics - NSW
Accreditation No. 198

29-APR-2020

NATA
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Results relate only to the sample(s) as received and tested.

This Report supersedes reports: *RN1270488*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 247115

Client Details

Client	SLR Consulting Australia Pty Ltd
Attention	M Skoroszewski
Address	Ground Floor, 2 Lincoln Street, LANE COVE, NSW, 2066

Sample Details

Your Reference	**640.11763.00300**
Number of Samples	4 x filters
Date samples received	14/07/2020
Date completed instructions received	14/07/2020
Sampler Name	Not applicable for this job

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	21/07/2020
Date of Issue	21/07/2020

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Results Approved By
Tom Edwards, Occupational Hygiene and Microbiology Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Metals in Dust						
Our Reference			247115-1	247115-2	247115-3	247115-4
Your Reference	UNITS	PQL	K9334	K9344	SLRV53	SLRV57
Sample ID			9726	9729	9872	9731
Date Sampled			07/04/2020	07/05/2020	06/06/2020	
Filter No					SLRV53	SLRV57
Weight of Filter (initial)	mg	0.02	18.26	19.19	21.05	25.39
Weight of Filter (final)	mg	0.02	20.54	23.44	22.03	25.39
Dust	mg/filter	0.04	2.3	4.2	0.98	<0.04
Arsenic	µg/filter	0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	µg/filter	0.1	<0.1	<0.1	<0.1	<0.1
Chromium	µg/filter	0.5	<0.5	<0.5	0.7	0.9
Copper	µg/filter	0.5	<0.5	<0.5	<0.5	<0.5
Mercury (Particulate)	µg/filter	0.005	<0.005	<0.005	<0.005	<0.005
Manganese	µg/filter	0.5	0.8	1.2	<0.5	<0.5
Nickel	µg/filter	1	<1	<1	<1	<1
Lead	µg/filter	1	<1	<1	<1	<1
Vanadium	µg/filter	0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/filter	2	<2	<2	<2	<2

Method ID	Methodology Summary
DUST-004	Airborne samples analysed according to AS 2985 for Respirable Dust or AS 3640 for Inhalable Dust . Sample results based on volume data supplied by client. Samples tested as received, *accreditation does not cover sampling.
METALS-020/021/022	Determination of various metals on filters by ICP-AES/ICP-MS and Hg by CV-AAS using NIOSH 7300, 7301 & 7303 and in house METALS-006/025. Some PQL's reported may be higher than the laboratory PQL stated due to different or lower air volumes sampled by client.
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Metals in Dust					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Arsenic	µg/filter	0.05	METALS-022	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cadmium	µg/filter	0.1	METALS-020/021/022	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Chromium	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	98	[NT]
Copper	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Mercury (Particulate)	µg/filter	0.005	METALS-020/021/022	<0.005	[NT]	[NT]	[NT]	[NT]	99	[NT]
Manganese	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Nickel	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Lead	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Vanadium	µg/filter	0.2	METALS-020/021/022	<0.2	[NT]	[NT]	[NT]	[NT]	97	[NT]
Zinc	µg/filter	2	METALS-020/021/022	<2	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

DOL	Samples rejected due to particulate overload
RPF	Sample rejected due to pump failure
RFD	Sample rejected due to filter damage
RUD	Sample rejected due to uneven deposition
PQL	Practical quantitation limit

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Samples 1 and 2: Filter pre-weights provided by client.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 248394

Client Details

Client	SLR Consulting Australia Pty Ltd
Attention	J Sheperd
Address	Lvl 11, 176 Wellington Parade, East Melbourne, VIC, 3002

Sample Details

Your Reference	**640.11763.99399 QT-02018**
Number of Samples	2 x filters
Date samples received	10/08/2020
Date completed instructions received	10/08/2020
Sampler Name	Not applicable for this job

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	17/08/2020
Date of Issue	17/08/2020

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Results Approved By
Tom Edwards, Occupational Hygiene and Microbiology Supervisor

Authorised By

Michael Kubiak, Laboratory Manager

Metals in Dust				
Our Reference			248394-1	248394-2
Your Reference	UNITS	PQL	SLRV60	L5263
Sample ID			10011-2	11013
Date Sampled			06/07/2020	
Weight of Filter (initial)	mg	0.02	21.29	21.17
Weight of Filter (final)	mg	0.02	21.92	21.18
Dust	mg/filter	0.04	0.63	<0.04
Arsenic	µg/filter	0.05	<0.05	<0.05
Cadmium	µg/filter	0.1	<0.1	<0.1
Chromium	µg/filter	0.5	0.9	<0.5
Copper	µg/filter	0.5	0.6	<0.5
Mercury (Particulate)	µg/filter	0.005	<0.005	<0.005
Manganese	µg/filter	0.5	<0.5	<0.5
Nickel	µg/filter	1	<1	<1
Lead	µg/filter	1	<1	<1
Vanadium	µg/filter	0.2	<0.2	<0.2
Zinc	µg/filter	2	<2	<2

Method ID	Methodology Summary
DUST-004	Airborne samples analysed according to AS 2985 for Respirable Dust or AS 3640 for Inhalable Dust . Sample results based on volume data supplied by client. Samples tested as received, *accreditation does not cover sampling.
METALS-020/021/022	Determination of various metals on filters by ICP-AES/ICP-MS and Hg by CV-AAS using NIOSH 7300, 7301 & 7303 and in house METALS-006/025. Some PQL's reported may be higher than the laboratory PQL stated due to different or lower air volumes sampled by client.
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Metals in Dust					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Arsenic	µg/filter	0.05	METALS-022	<0.05	[NT]	[NT]	[NT]	[NT]	99	[NT]
Cadmium	µg/filter	0.1	METALS-020/021/022	<0.1	[NT]	[NT]	[NT]	[NT]	118	[NT]
Chromium	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	111	[NT]
Copper	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	112	[NT]
Mercury (Particulate)	µg/filter	0.005	METALS-020/021/022	<0.005	[NT]	[NT]	[NT]	[NT]	102	[NT]
Manganese	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	110	[NT]
Nickel	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Lead	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Vanadium	µg/filter	0.2	METALS-020/021/022	<0.2	[NT]	[NT]	[NT]	[NT]	121	[NT]
Zinc	µg/filter	2	METALS-020/021/022	<2	[NT]	[NT]	[NT]	[NT]	109	[NT]

Result Definitions

DOL	Samples rejected due to particulate overload
RPF	Sample rejected due to pump failure
RFD	Sample rejected due to filter damage
RUD	Sample rejected due to uneven deposition
PQL	Practical quantitation limit

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Sample 2: Initial weight provided by client.

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
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lab@mpl.com.au
www.mpl.com.au

CERTIFICATE OF ANALYSIS 251062

Client Details

Client	SLR Consulting Australia Pty Ltd
Attention	Jason Shepherd
Address	Tenancy 202, Submarine School,, Sub Base Platypus, 120 High Street, NORTH SYDNEY, NSW, 2060

Sample Details

Your Reference	**640.11763.00300**
Number of Samples	2 filters
Date samples received	02/10/2020
Date completed instructions received	02/10/2020
Sampler Name	Not applicable for this job

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Report Details

Date results requested by	09/10/2020
Date of Issue	09/10/2020

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Results Approved By
Heram Halim, Operations Manager

Authorised By

Michael Kubiak, Laboratory Manager

Metals in Dust				
Our Reference			251062-1	251062-2
Your Reference	UNITS	PQL	L5268	L5270
Sample ID			10115	10116
Date Sampled			05/08/2020	
Date prepared	-		07/10/2020	07/10/2020
Date analysed	-		07/10/2020	07/10/2020
Arsenic	µg/filter	0.05	<0.05	<0.05
Chromium	µg/filter	0.5	<0.5	<0.5
Copper	µg/filter	0.5	<0.5	<0.5
Cadmium	µg/filter	0.1	<0.1	<0.1
Lead	µg/filter	1	<1	<1
Manganese	µg/filter	0.5	<0.5	<0.5
Mercury (Particulate)	µg/filter	0.005	<0.005	<0.005
Nickel	µg/filter	1	<1	<1
Vanadium	µg/filter	0.2	<0.2	<0.2
Zinc	µg/filter	2	<2	<2

Method ID	Methodology Summary
METALS-020/021/022	Determination of various metals on filters by ICP-AES/ICP-MS and Hg by CV-AAS using NIOSH 7300, 7301 & 7303 and in house METALS-006/025. Some PQL's reported may be higher than the laboratory PQL stated due to different or lower air volumes sampled by client.
METALS-022	Determination of various metals by ICP-MS.

QUALITY CONTROL: Metals in Dust					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			07/10/2020	[NT]	[NT]	[NT]	[NT]	07/10/2020	[NT]
Date analysed	-			07/10/2020	[NT]	[NT]	[NT]	[NT]	07/10/2020	[NT]
Arsenic	µg/filter	0.05	METALS-022	<0.05	[NT]	[NT]	[NT]	[NT]	103	[NT]
Chromium	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Copper	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cadmium	µg/filter	0.1	METALS-020/021/022	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Lead	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Manganese	µg/filter	0.5	METALS-020/021/022	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Mercury (Particulate)	µg/filter	0.005	METALS-020/021/022	<0.005	[NT]	[NT]	[NT]	[NT]	84	[NT]
Nickel	µg/filter	1	METALS-020/021/022	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Vanadium	µg/filter	0.2	METALS-020/021/022	<0.2	[NT]	[NT]	[NT]	[NT]	102	[NT]
Zinc	µg/filter	2	METALS-020/021/022	<2	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

DOL	Samples rejected due to particulate overload
RPF	Sample rejected due to pump failure
RFD	Sample rejected due to filter damage
RUD	Sample rejected due to uneven deposition
PQL	Practical quantitation limit

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1806687**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	:
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 9428 8134	Telephone	: +61 2 4014 2500
Project	: 640.11763.00300	Date Samples Received	: 11-Oct-2018 09:30
Order number	: 25090	Date Analysis Commenced	: 15-Oct-2018
C-O-C number	: DDG	Issue Date	: 17-Oct-2018 17:50
Sampler	: ----		
Site	:		
Quote number	: EN/032/17		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 36 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 7008 27/08/18 - 2/10/18	Location 2 - 7009 27/08/18 - 2/10/18	Location 3 - 7010 27/08/18 - 2/10/18	Location 4 - 7011 27/08/18 - 2/10/18	----
			Client sampling date / time	02-Oct-2018 10:00	02-Oct-2018 14:15	02-Oct-2018 13:50	02-Oct-2018 13:00	----
Compound	*CAS Number*	*LOR*	*Unit*	EN1806687-001	EN1806687-002	EN1806687-003	EN1806687-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	1.3	1.0	2.3	0.3	----
Ash Content (mg)	----	1	mg	28	22	48	7	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	2.4	0.1	2.1	0.1	----
Combustible Matter (mg)	----	1	mg	50	1	45	2	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	3.7	1.1	4.4	0.4	----
Total Insoluble Matter (mg)	----	1	mg	78	23	93	9	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1807945**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 9428 8134	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300	Date Samples Received	: 28-Nov-2018 10:00
Order number	: 25355	Date Analysis Commenced	: 10-Dec-2018
C-O-C number	: ----	Issue Date	: 17-Dec-2018 17:01
Sampler	: MICHAEL BRECKO		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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ISO/IEC 17025 - Testing

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Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 7330 02/10/18 - 01/11/18	Location 2 - 7331 02/10/18 - 01/11/18	Location 3 - 7332 02/10/18 - 01/11/18	Location 4 - 7333 02/10/18 - 01/11/18	----
			Client sampling date / time	01-Nov-2018 11:20	01-Nov-2018 15:20	01-Nov-2018 14:24	01-Nov-2018 13:20	----
Compound	CAS Number	LOR	Unit	EN1807945-001	EN1807945-002	EN1807945-003	EN1807945-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	1.2	6.4	1.7	1.3	----
Ash Content (mg)	----	1	mg	22	113	30	23	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	0.6	2.7	0.8	0.5	----
Combustible Matter (mg)	----	1	mg	9	48	15	8	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	1.8	9.1	2.5	1.8	----
Total Insoluble Matter (mg)	----	1	mg	31	161	45	31	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1808475**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 9428 8134	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300	Date Samples Received	: 14-Dec-2018 16:30
Order number	: 25477	Date Analysis Commenced	: 18-Dec-2018
C-O-C number	: ----	Issue Date	: 21-Dec-2018 17:12
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 34 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 7512 01/11/18 - 05/12/18	Location 4 - 7513 01/11/18 - 05/12/18	----	----	----
			Client sampling date / time	05-Dec-2018 10:30	05-Dec-2018 11:15	----	----	----
Compound	CAS Number	LOR	Unit	EN1808475-001	EN1808475-002	--------	--------	--------
				Result	Result	----	----	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	3.0	0.8	----	----	----
Ash Content (mg)	----	1	mg	60	16	----	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	7.1	0.9	----	----	----
Total Insoluble Matter (mg)	----	1	mg	142	18	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1900474**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 9428 8134	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300	Date Samples Received	: 21-Jan-2019 17:00
Order number	: 25652	Date Analysis Commenced	: 22-Jan-2019
C-O-C number	: ----	Issue Date	: 29-Jan-2019 20:05
Sampler	: D Echeverri		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 42 days for #1 and #4, and 76 days for #2-#3 which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 DDG - 7699 05/12/18 - 16/01/19	Location 2 DDG - 7700 01/11/18 - 16/01/19	Location 3 DDG - 7701 01/11/18 - 16/01/19	Location 4 DDG - 7702 05/12/18 - 16/01/19	----
			Client sampling date / time	16-Jan-2019 00:00	16-Jan-2019 00:00	16-Jan-2019 00:00	16-Jan-2019 00:00	----
Compound	CAS Number	LOR	Unit	EN1900474-001	EN1900474-002	EN1900474-003	EN1900474-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	1.4	1.2	1.3	2.1	----
Ash Content (mg)	----	1	mg	35	52	59	52	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	2.2	1.7	1.5	2.5	----
Total Insoluble Matter (mg)	----	1	mg	55	75	67	61	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1901498**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: D Echeverri	Contact	: Tyler Cachia
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Goschen	Date Samples Received	: 04-Mar-2019 17:00
Order number	: 25863	Date Analysis Commenced	: 05-Mar-2019
C-O-C number	: ----	Issue Date	: 08-Mar-2019 13:54
Sampler	: D Echeverri		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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ISO/IEC 17025 - Testing

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Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 41 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 7967 16/01/19 - 26/02/19	Location 2 - 7968 16/01/19 - 26/02/19	Location 3 - 7969 16/01/19 - 26/02/19	Location 4 - 7970 16/01/19 - 26/02/19	----
			Client sampling date / time	26-Feb-2019 00:00	26-Feb-2019 00:00	26-Feb-2019 00:00	26-Feb-2019 00:00	----
Compound	CAS Number	LOR	Unit	EN1901498-001	EN1901498-002	EN1901498-003	EN1901498-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	2.9	1.7	1.8	2.8	----
Ash Content (mg)	----	1	mg	70	40	44	67	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	13.2	2.2	2.1	3.9	----
Total Insoluble Matter (mg)	----	1	mg	320	52	50	93	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1902211**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: Danny Echeverri	Contact	: Tyler Cachia
Address	:	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Goschen	Date Samples Received	: 01-Apr-2019 17:00
Order number	: 26005	Date Analysis Commenced	: 03-Apr-2019
C-O-C number	: ----	Issue Date	: 08-Apr-2019 19:26
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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General Comments

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 8043 26/02/19 - 26/03/19	Location 2 - 8044 26/02/19 - 26/03/19	Location 3 - 8045 26/02/19 - 26/03/19	Location 4 - 8046 26/02/19 - 26/03/19	----
			Client sampling date / time	26-Mar-2019 13:15	26-Mar-2019 12:45	26-Mar-2019 13:00	26-Mar-2019 13:25	----
Compound	CAS Number	LOR	Unit	EN1902211-001	EN1902211-002	EN1902211-003	EN1902211-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**0.5**	**0.5**	**0.9**	**0.5**	----
Ash Content (mg)	----	1	mg	**9**	**8**	**15**	**8**	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**0.9**	<0.1	**0.1**	<0.1	----
Combustible Matter (mg)	----	1	mg	**14**	<1	**1**	<1	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**1.4**	**0.5**	**1.0**	**0.5**	----
Total Insoluble Matter (mg)	----	1	mg	**23**	**8**	**16**	**8**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1903081**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300	Date Samples Received	: 06-May-2019 17:30
Order number	: 26190	Date Analysis Commenced	: 08-May-2019
C-O-C number	: QMS 9470 - FORM	Issue Date	: 15-May-2019 12:25
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
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- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 34 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - 8298 26/03/19 - 29/04/19	Location 2 - 8299 26/03/19 - 29/04/19	Location 3 - 8300 26/03/19 - 29/04/19	Location 4 - 8301 26/03/19 - 29/04/19	----
			Client sampling date / time	29-Apr-2019 13:45	29-Apr-2019 13:30	29-Apr-2019 13:20	29-Apr-2019 14:00	----
Compound	CAS Number	LOR	Unit	EN1903081-001	EN1903081-002	EN1903081-003	EN1903081-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**1.2**	**1.4**	**1.6**	**0.8**	----
Ash Content (mg)	----	1	mg	**25**	**28**	**32**	**17**	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**1.5**	**0.2**	**0.1**	**0.1**	----
Combustible Matter (mg)	----	1	mg	**29**	**4**	**3**	**1**	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**2.7**	**1.6**	**1.7**	**0.9**	----
Total Insoluble Matter (mg)	----	1	mg	**54**	**32**	**35**	**18**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1903848**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: Danny Echeverri	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300	Date Samples Received	: 03-Jun-2019 17:00
Order number	: 26352	Date Analysis Commenced	: 04-Jun-2019
C-O-C number	: ----	Issue Date	: 07-Jun-2019 16:32
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

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Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 01 DDG - 8441 29/04/19 - 27/05/19	Location 02 DDG - 8442 29/04/19 - 27/05/19	Location 03 DDG - 8443 29/04/19 - 27/05/19	Location 04 DDG - 8444 29/04/19 - 27/05/19	----
			Client sampling date / time	27-May-2019 13:50	27-May-2019 13:30	27-May-2019 13:10	27-May-2019 14:15	----
Compound	*CAS Number*	*LOR*	*Unit*	EN1903848-001	EN1903848-002	EN1903848-003	EN1903848-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	23.2	122	6.9	4.1	----
Ash Content (mg)	----	1	mg	383	2020	114	68	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	19.8	8.5	1.3	1.1	----
Combustible Matter (mg)	----	1	mg	326	139	21	18	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	43.0	131	8.2	5.2	----
Total Insoluble Matter (mg)	----	1	mg	709	2160	135	86	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1904546**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 02-Jul-2019 17:00
Order number	: 26494	Date Analysis Commenced	: 03-Jul-2019
C-O-C number	: ----	Issue Date	: 09-Jul-2019 18:31
Sampler	: Danny Echeverri		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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ISO/IEC 17025 - Testing

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Signatories

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 DDG - 8608 27/05/19 - 26/06/19	Location 2 DDG - 8609 27/05/19 - 26/06/19	Location 3 DDG - 8610 27/05/19 - 26/06/19	Location 4 DDG - 8611 27/05/19 - 26/06/19	----
			Client sampling date / time	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	26-Jun-2019 00:00	----
Compound	CAS Number	LOR	Unit	EN1904546-001	EN1904546-002	EN1904546-003	EN1904546-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	1.2	3.5	0.8	0.7	----
Ash Content (mg)	----	1	mg	22	61	15	12	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	1.3	0.3	0.4	0.1	----
Combustible Matter (mg)	----	1	mg	22	7	6	3	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	2.5	3.8	1.2	0.8	----
Total Insoluble Matter (mg)	----	1	mg	44	68	21	15	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1905495**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 07-Aug-2019 17:00
Order number	: 26722	Date Analysis Commenced	: 08-Aug-2019
C-O-C number	: ----	Issue Date	: 14-Aug-2019 17:53
Sampler	: Danny Echeverri		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 35 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 01 DDG - 8811 26/06/19 - 31/07/19	Location 02 DDG - 8812 26/06/19 - 31/07/19	Location 03 DDG - 8813 26/06/19 - 31/07/19	Location 04 DDG - 8814 26/06/19 - 31/07/19	----
			Client sampling date / time	31-Jul-2019 00:00	31-Jul-2019 00:00	31-Jul-2019 00:00	31-Jul-2019 00:00	----
Compound	CAS Number	LOR	Unit	EN1905495-001	EN1905495-002	EN1905495-003	EN1905495-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	3.5	1.3	0.3	0.6	----
Ash Content (mg)	----	1	mg	73	27	6	12	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	6.5	<0.1	0.1	0.2	----
Combustible Matter (mg)	----	1	mg	134	<1	2	5	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	10.0	1.3	0.4	0.8	----
Total Insoluble Matter (mg)	----	1	mg	207	27	8	17	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1906344**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 10-Sep-2019 17:00
Order number	: 26928	Date Analysis Commenced	: 12-Sep-2019
C-O-C number	: ----	Issue Date	: 17-Sep-2019 18:22
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 34 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: **DEPOSITIONAL DUST** (Matrix: **AIR**)			*Client sample ID*	**Location 01 DDG - 8959 31/07/19 - 03/09/19**	**Location 02 DDG - 8960 31/07/19 - 03/09/19**	**Location 03 DDG - 8961 31/07/19 - 03/09/19**	**Location 04 DDG - 8962 31/07/19 - 03/09/19**	----
			Client sampling date / time	03-Sep-2019 00:00	03-Sep-2019 00:00	03-Sep-2019 00:00	03-Sep-2019 00:00	----
Compound	*CAS Number*	*LOR*	*Unit*	**EN1906344-001**	**EN1906344-002**	**EN1906344-003**	**EN1906344-004**	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**0.3**	**0.6**	**0.7**	**0.2**	----
Ash Content (mg)	----	1	mg	**6**	**13**	**14**	**5**	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**0.3**	**0.2**	**0.2**	**0.2**	----
Combustible Matter (mg)	----	1	mg	**6**	**3**	**4**	**3**	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.6**	**0.8**	**0.9**	**0.4**	----
Total Insoluble Matter (mg)	----	1	mg	**12**	**16**	**18**	**8**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1907045**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 08-Oct-2019 17:00
Order number	: 27038	Date Analysis Commenced	: 10-Oct-2019
C-O-C number	: ----	Issue Date	: 16-Oct-2019 16:59
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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- Analytical Results

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Signatories

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Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

General Comments

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LOR = Limit of reporting
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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 1 - DDG - 9038 03/09/19 - 03/10/19	Location 2 - DDG - 9039 03/09/19 - 03/10/19	Location 3 - DDG - 9040 03/09/19 - 03/10/19	Location 4 - DDG - 9041 03/09/19 - 03/10/19	----
			Client sampling date / time	03-Oct-2019 00:00	03-Oct-2019 00:00	03-Oct-2019 00:00	03-Oct-2019 00:00	----
Compound	CAS Number	LOR	Unit	EN1907045-001	EN1907045-002	EN1907045-003	EN1907045-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	0.8	0.7	0.8	0.9	----
Ash Content (mg)	----	1	mg	15	12	14	16	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	0.2	0.1	0.2	0.4	----
Combustible Matter (mg)	----	1	mg	3	3	3	7	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	1.0	0.8	1.0	1.3	----
Total Insoluble Matter (mg)	----	1	mg	18	15	17	23	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1907834**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MS KIRSTEN LAWRENCE	Contact	: Tyler Cachia
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 07 38584800	Telephone	: +61 2 8784 8555
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 05-Nov-2019 17:00
Order number	: 27174	Date Analysis Commenced	: 06-Nov-2019
C-O-C number	: ----	Issue Date	: 13-Nov-2019 09:30
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- General Comments
- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 27 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 01 DDG - 9132 03/10/19 - 30/10/19	Location 02 DDG - 9133 03/10/19 - 30/10/19	Location 03 DDG - 9134 03/10/19 - 30/10/19	Location 04 DDG - 9135 03/10/19 - 30/10/19	----
			Client sampling date / time	30-Oct-2019 14:50	30-Oct-2019 14:25	30-Oct-2019 14:00	30-Oct-2019 15:00	----
Compound	CAS Number	LOR	Unit	EN1907834-001	EN1907834-002	EN1907834-003	EN1907834-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	2.0	0.9	1.3	0.6	----
Ash Content (mg)	----	1	mg	32	15	20	9	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	6.3	0.1	<0.1	0.1	----
Combustible Matter (mg)	----	1	mg	100	1	1	2	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	8.3	1.0	1.3	0.7	----
Total Insoluble Matter (mg)	----	1	mg	132	16	21	11	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN1908650**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: MR MICHAEL BRECKO	Contact	: Tyler Cachia
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 94278100	Telephone	: +61 2 8784 8555
Project	: Confidential 640.11763.00300	Date Samples Received	: 05-Dec-2019 17:00
Order number	: 27322	Date Analysis Commenced	: 09-Dec-2019
C-O-C number	: ----	Issue Date	: 13-Dec-2019 12:24
Sampler	: D Echeverri		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Alison Graham	Supervisor - Inorganic	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 33 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			*Client sample ID*	Location 01 DDG - 9214 30/10/19 - 02/12/19	Location 02 DDG - 9215 30/10/19 - 02/12/19	Location 03 DDG - 9216 30/10/19 - 02/12/19	Location 04 DDG - 9217 30/10/19 - 02/12/19	----
			Client sampling date / time	02-Dec-2019 14:50	02-Dec-2019 14:30	02-Dec-2019 14:15	02-Dec-2019 15:00	----
Compound	*CAS Number*	*LOR*	*Unit*	EN1908650-003	EN1908650-004	EN1908650-005	EN1908650-006	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	4.9	1.4	2.0	1.3	----
Ash Content (mg)	----	1	mg	96	27	38	25	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	2.9	0.3	0.5	0.4	----
Combustible Matter (mg)	----	1	mg	56	6	11	8	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	7.8	1.7	2.5	1.7	----
Total Insoluble Matter (mg)	----	1	mg	152	33	49	33	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EN2000705**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Newcastle
Contact	: Danny Echeverri	Contact	:
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: ----	Telephone	: +61 2 4014 2500
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 04-Feb-2020 17:00
Order number	: 27536	Date Analysis Commenced	: 06-Feb-2020
C-O-C number	: ----	Issue Date	: 12-Feb-2020 08:42
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Jennifer Targett	Laboratory Technician	Newcastle - Inorganics, Mayfield West, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.
- Sample exposure period is 50 days which is outside the typical exposure period of 30 +/- 2 days as per AS3580.10.1.

Analytical Results

Sub-Matrix: DEPOSITIONAL DUST (Matrix: AIR)			Client sample ID	Location 01 - 9366 02/12/19 - 21/01/20	Location 02 - 9367 02/12/19 - 21/01/20	Location 03 - 9368 02/12/19 - 21/01/20	Location 04 - 9369 02/12/19 - 21/01/20	----
			Client sampling date / time	21-Jan-2020 00:00	21-Jan-2020 00:00	21-Jan-2020 00:00	21-Jan-2020 00:00	----
Compound	CAS Number	LOR	Unit	EN2000705-001	EN2000705-002	EN2000705-003	EN2000705-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	3.4	1.3	5.0	1.0	----
Ash Content (mg)	----	1	mg	101	39	148	30	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	12.4	0.3	0.6	0.3	----
Combustible Matter (mg)	----	1	mg	363	8	17	8	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	15.8	1.6	5.6	1.3	----
Total Insoluble Matter (mg)	----	1	mg	464	47	165	38	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2006150**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR MICHAEL BRECKO	Contact	: Carsten Emrich
Address	: Level 2 15 ASTOR TERRACE SPRING HILL 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 02 94278100	Telephone	: +61 7 3552 8616
Project	: 640.11763.00300 - Confidential	Date Samples Received	: 04-Mar-2020 12:16
Order number	: 27174	Date Analysis Commenced	: 13-Mar-2020
C-O-C number	: ----	Issue Date	: 17-Mar-2020 08:50
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 3		
No. of samples analysed	: 3		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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LOR = Limit of reporting
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~ = Indicates an estimated value.

- Analysis as per AS 3580.10.1-2016. Samples passed through 1mm sieve prior to analysis. Period Sampled: 21/1/20 to 26/2/20.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation does not apply for results reported in g/m².mth as sampling data was provided by the client.

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	Location 01 DDG 9490	Location 02 DDG 9491	Location 03 DDG 9492	----	----
			Client sampling date / time	26-Feb-2020 08:40	26-Feb-2020 08:20	26-Feb-2020 08:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	EB2006150-001	EB2006150-002	EB2006150-003	--------	--------
				Result	Result	Result	----	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**0.4**	**0.6**	**8.5**	----	----
Ash Content (mg)	----	1	mg	**10**	**13**	**181**	----	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**0.3**	**0.3**	**1.5**	----	----
Combustible Matter (mg)	----	1	mg	**6**	**7**	**32**	----	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**0.8**	**0.9**	**10.0**	----	----
Total Insoluble Matter (mg)	----	1	mg	**16**	**20**	**213**	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2005286**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: D Echeverri	Contact	: Customer Services EM
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 30-Mar-2020 12:00
Order number	: 27174	Date Analysis Commenced	: 30-Mar-2020
C-O-C number	: ----	Issue Date	: 03-Apr-2020 22:18
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sampling Period: 26/02/2020 - 27/03/2020
- ....:) Manual Comment :)..........

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	9523 Location 01 DDG	9524 Location 02 DDG	9525 Location 03 DDG	9526 Location 04 DDG	----
			Client sampling date / time	27-Mar-2020 09:15	27-Mar-2020 08:45	27-Mar-2020 09:01	27-Mar-2020 09:27	----
Compound	CAS Number	LOR	Unit	EM2005286-001	EM2005286-002	EM2005286-003	EM2005286-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**0.8**	**1.2**	**1.2**	**4.1**	----
Ash Content (mg)	----	1	mg	**14**	**22**	**22**	**72**	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**1.4**	**1.0**	**0.9**	**1.5**	----
Combustible Matter (mg)	----	1	mg	**25**	**17**	**15**	**27**	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**2.2**	**2.2**	**2.1**	**5.6**	----
Total Insoluble Matter (mg)	----	1	mg	**39**	**39**	**37**	**99**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2007040**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: D Echeverri	Contact	: Customer Services EM
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 28-Apr-2020 12:50
Order number	: 27888	Date Analysis Commenced	: 30-Apr-2020
C-O-C number	: ----	Issue Date	: 04-May-2020 17:11
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sampling Period: 27/03/2020 - 27/04/2020.
- EM2007022 #1-11: Copper sulphate correction factor of 0.055 has been used in the calculation.

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	9589 Location 01 DDG	9590 Location 02 DDG	9591 Location 03 DDG	9592 Location 04 DDG	----
			Client sampling date / time	27-Apr-2020 13:19	27-Apr-2020 13:48	27-Apr-2020 13:33	27-Apr-2020 14:04	----
Compound	CAS Number	LOR	Unit	EM2007040-001	EM2007040-002	EM2007040-003	EM2007040-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	0.6	0.4	1.4	0.4	----
Ash Content (mg)	----	1	mg	12	7	26	7	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	1.0	0.9	4.5	0.7	----
Combustible Matter (mg)	----	1	mg	18	17	81	13	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	1.6	1.3	5.9	1.1	----
Total Insoluble Matter (mg)	----	1	mg	30	24	107	20	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2009211**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: Danny Echeverri	Contact	: Customer Services EM
Address	:	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 01-Jun-2020 10:45
Order number	: ----	Date Analysis Commenced	: 03-Jun-2020
C-O-C number	: ----	Issue Date	: 10-Jun-2020 10:57
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

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Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sampling period: 27/04/2020 - 29/05/2020
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sample exposure period is within the typical exposure period of 30+/-2 days as per AS3580.10.1

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	9720 Location 01 DDG	9721 Location 02 DDG	9722 Location 03 DDG	9723 Location 04 DDG	----
			Client sampling date / time	29-May-2020 07:45	29-May-2020 07:32	29-May-2020 07:19	29-May-2020 07:54	----
Compound	CAS Number	LOR	Unit	EM2009211-001	EM2009211-002	EM2009211-003	EM2009211-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	**2.2**	**0.9**	**0.2**	**0.4**	----
Ash Content (mg)	----	1	mg	**42**	**17**	**3**	**8**	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	**3.4**	<0.1	**0.2**	**1.4**	----
Combustible Matter (mg)	----	1	mg	**64**	<1	**4**	**26**	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	**5.6**	**0.9**	**0.4**	**1.8**	----
Total Insoluble Matter (mg)	----	1	mg	**106**	**17**	**7**	**34**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2011290**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
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Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 30-Jun-2020 15:10
Order number	: 28153	Date Analysis Commenced	: 06-Jul-2020
C-O-C number	: ----	Issue Date	: 07-Jul-2020 13:56
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sampling Period: 29/05/2020-30/06/2020.
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sample exposure period is within the typical exposure period of 30+/-2 days as per AS3580.10.1
- Dust samples have been dosed with Copper Sulphate prior to sample collection and a copper correction factor of 0.055 has been used for calculations.

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	9831 Location 01 DDG	9832 Location 02 DDG	9833 Location 03 DDG	9834 Location 04 DDG	----
			Client sampling date / time	30-Jun-2020 07:18	30-Jun-2020 07:04	30-Jun-2020 06:53	30-Jun-2020 07:27	----
Compound	CAS Number	LOR	Unit	EM2011290-001	EM2011290-002	EM2011290-003	EM2011290-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	0.7	1.4	0.3	0.2	----
Ash Content (mg)	----	1	mg	14	26	6	3	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	2.4	1.3	0.9	0.3	----
Combustible Matter (mg)	----	1	mg	44	24	17	7	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	3.1	2.7	1.2	0.5	----
Total Insoluble Matter (mg)	----	1	mg	58	50	23	10	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2013388**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: D Echeverri	Contact	: Customer Services EM
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Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 31-Jul-2020 14:25
Order number	: 28276	Date Analysis Commenced	: 04-Aug-2020
C-O-C number	: ----	Issue Date	: 06-Aug-2020 10:40
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
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Signatories

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Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
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~ = Indicates an estimated value.

- Sampling Period: 30/06/2020 - 31/07/2020
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sample exposure period is within the typical exposure period of 30+/-2 days as per AS3580.10.1
- Dust samples were not dosed with Copper Sulphate prior to sample collection and no Copper correction factor has been used during calculation.

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	9976 Location 01 DDG	9977 Location 02 DDG	9978 Location 03 DDG	9979 Location 04 DDG	----
			Client sampling date / time	31-Jul-2020 08:11	31-Jul-2020 07:55	31-Jul-2020 07:43	31-Jul-2020 08:22	----
Compound	CAS Number	LOR	Unit	EM2013388-001	EM2013388-002	EM2013388-003	EM2013388-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	4.6	0.3	0.6	0.3	----
Ash Content (mg)	----	1	mg	83	6	11	6	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	8.5	1.1	1.2	2.3	----
Combustible Matter (mg)	----	1	mg	156	19	21	41	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	13.1	1.4	1.8	2.6	----
Total Insoluble Matter (mg)	----	1	mg	239	25	32	47	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM2016080**	Page	: 1 of 2
Client	: **SLR Consulting Australia Pty Ltd**	Laboratory	: Environmental Division Melbourne
Contact	: MR MICHAEL BRECKO	Contact	: Customer Services EM
Address	: PO BOX 176 2/2 LINCOLN ST LANECOVE NSW, AUSTRALIA 1595	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 02 94278100	Telephone	: +61-3-8549 9600
Project	: 640.11763.00300	Date Samples Received	: 16-Sep-2020 15:00
Order number	: 29481	Date Analysis Commenced	: 21-Sep-2020
C-O-C number	: ----	Issue Date	: 24-Sep-2020 15:40
Sampler	: ----		
Site	: ----		
Quote number	: EN/032/18 Primary work only BQ		
No. of samples received	: 4		
No. of samples analysed	: 4		

NATA

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This Certificate of Analysis contains the following information:

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- Analytical Results

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Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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~ = Indicates an estimated value.

- Sampling period: 31/07/2020 - 14/09/2020
- Analysis as per AS3580.10.1-2016. Samples passed through a 1mm sieve prior to analysis. NATA accreditation is not held for results reported in g/m².mth.
- Sample exposure period is 45 days which is outside the typical exposure period of 30+/-2 days as per AS3580.10.1
- Dust samples have been dosed with Copper Sulphate prior to sample collection and a copper correction factor of 0.055g has been used for calculations.

Analytical Results

Sub-Matrix: DUST (Matrix: AIR)			Client sample ID	10111 Location 01 DDG	10112 Location 02 DDG	10113 Location 03 DDG	10114 Location 04 DDG	----
			Client sampling date / time	14-Sep-2020 08:11	14-Sep-2020 07:55	14-Sep-2020 07:43	14-Sep-2020 08:22	----
Compound	CAS Number	LOR	Unit	EM2016080-001	EM2016080-002	EM2016080-003	EM2016080-004	--------
				Result	Result	Result	Result	----
EA120: Ash Content								
Ash Content	----	0.1	g/m².month	4.3	0.7	0.2	0.2	----
Ash Content (mg)	----	1	mg	113	19	5	6	----
EA125: Combustible Matter								
Combustible Matter	----	0.1	g/m².month	7.9	0.8	0.4	0.6	----
Combustible Matter (mg)	----	1	mg	210	20	11	16	----
EA141: Total Insoluble Matter								
Total Insoluble Matter	----	0.1	g/m².month	12.2	1.5	0.6	0.8	----
Total Insoluble Matter (mg)	----	1	mg	323	39	16	22	----

APPENDIX D

PM$_{10}$ and PM$_{2.5}$ Data Exceptions

Table 14 PM_{10} and $PM_{2.5}$ Data Exceptions

Start	Finish	Parameter	Reason
08/09/2018	01/10/2018	PM_{10} (E-BAM)	Filter tape break
1/12/2018	1/12/2018	PM_{10} (E-BAM); $PM_{2.5}$ (E-BAM)	Maintenance/Calibration
13/12/2018	19/12/2018	PM_{10} (E-BAM); $PM_{2.5}$ (E-BAM)	Instrument relocation - offline
26/01/2019	26/02/2019	$PM_{2.5}$ (BAM-1022)	Filter tape break
27/02/2019	28/02/2019	$PM_{2.5}$ (E-BAM)	Maintenance/Calibration
15/05/2019	28/05/2019	$PM_{2.5}$ (BAM-1022)	Tape break
24/05/2019	24/05/2019	PM_{10} (E-BAM Plus; E-BAM); $PM_{2.5}$ (E-BAM)	Power interruption to site
19/06/2019	31/07/2019	PM_{10} (E-BAM)	Invalidated – flow out of range
12/10/2019	30/10/2019	$PM_{2.5}$ (BAM-1022)	Instrument didn't restart after power outage
12/10/2019	02/11/2019	$PM_{2.5}$ (E-BAM)	Invalidated – flow out of range
2/11/2019	11/12/2020	PM_{10} (E-BAM)	Invalidated – flow out of range
18/11/2019	02/12/2019	$PM_{2.5}$ (E-BAM-1022)	Invalidated – flow out of range
11/12/2019	20/01/2020	PM_{10} (E-BAM)	Instrument alarm - offline - decommissioned
20/12/2019	21/01/2020	$PM_{2.5}$ (E-BAM)	Invalidated – flow out of range - decommissioned
21/11/2019	02/12/2019	PM_{10} (E-BAM Plus)	Instrument didn't restart after power outage
19/12/2019	20/01/2020	PM_{10} (E-BAM Plus)	Instrument flow issues
31/01/2020	11/02/2020	PM_{10} (E-BAM Plus)	Instrument flow issues – resolved with daily power cycle
06/05/2020	07/05/2020	$PM_{2.5}$ (E-BAM-1022)	Instrument didn't restart after power outage
20/05/2020	20/05/2020	PM_{10} (E-BAM Plus) $PM_{2.5}$ (E-BAM-1022)	Power interruption to site
08/06/2020	08/06/2020	$PM_{2.5}$ (E-BAM-1022)	Instrument didn't restart after power outage

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