Appendix G - Talison Greenbushes Dust Impact Assessment (GHD)

TALISON LITHIUM

Talison Lithium Australia Pty Ltd

Greenbushes Lithium Mine Expansion

Dust Impact Assessment

July 2018

GHD

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

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Abbreviations and glossary

Abbreviation	Term
AAQ NEPM	*National Environment Protection (Ambient Air Quality) Measure*
BoM	Bureau of Meteorology
BWIP	Building Wake Input Program
CGP	Chemical Grade Plant
DWER	Department of Water and Environmental Regulation
g/m^2/month	Grams per square metre per month
GHD	GHD Pty Ltd
Mtpa	Million tonnes per annum
NEPC	National Environment Protection Council
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 micrometres
SEPP-AQM	*State Environment Protection Policy (Air Quality Management)*
SWWA	South-West Western Australia
TEOM	Tapered element oscillating microbalance
Talison	Talison Lithium Australia Pty Ltd
TGP	Technical Grade Plant
TSF	Tailings storage facility
TSP	Total suspended particulates
µg/m^3	Micrograms per cubic metre
WRL	Waste Rock Landform

1. Introduction

1.1 Project description

Talison Lithium Australia Pty Ltd (Talison) own and operate the Talison Greenbushes Lithium Mine (the Project), in Greenbushes, Western Australia. The mine is located within the Shire of Bridgetown – Greenbushes immediately south of the Greenbushes town site, approximately 250 km south of Perth and 80 km south-east of Bunbury in Western Australia (Figure 1-1).

Talison is proposing to expand the existing Project to increase the production of spodumene ore and lithium mineral concentrate from the operation. The expansion will increase throughput at the Mine from the current approved production rate of 4.7 Mtpa to 9.5 Mtpa of spodumene ore to produce up to 2.3 Mtpa of lithium mineral concentrate. The approved boundary for the mining operation (Mine Development Envelope) will expand from the current 1591 ha area to 1989 ha.

This Dust Impact Assessment has been undertaken to support environmental approval applications for the proposed expansion under Parts IV and V of the WA *Environmental Protection Act 1986* (EP Act) and the *Mining Act 1978*.

Figure 1-1 Location of Talison Greenbushes Lithium Mine, Western Australia

1.2 Scope of works

GHD Pty Ltd (GHD) was commissioned by Talison to quantify current dust impacts and develop an air dispersion model. The scope of works for the dust impact assessment included:

- A desktop review of nearby sensitive receptors, meteorological data and air quality monitoring data.
- Generation of an emissions inventory to determine onsite emission modelling rates for TSP and PM_{10} for the expansion project only. Emissions from the existing mine and processing facilities will be characterised using dust monitoring undertaken at the site.

- Development of site representative meteorological data for air dispersion modelling purposes.
- Air dispersion modelling for the expansion project for the operating year with the highest estimated dust emissions.
- Assessment of predicted ground level concentrations (GLCs) from air dispersion modelling against relevant air quality criteria to determine impacts as a result of the expansion project incrementally and cumulatively with the existing mine and processing facilities.
- Provide a dust management framework with abatement measures for the expansion project to reduce dust impacts at nearby sensitive receptors.

1.3 Limitations

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

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

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

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

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

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

2. Project overview

2.1 Project background

The Mine is located within the Shire of Bridgetown – Greenbushes immediately south of the Greenbushes town site, approximately 250 km south of Perth and 80 km south-east of Bunbury in Western Australia (Figure 1-1).

The Greenbushes region is recognised as the longest continuously operated mining area in WA, with mining of tin having commenced in 1888. Tin, tantalum and lithium mining have all occurred throughout the history of mining activity in the area. The current Mine has been operated as a modern open cut, hard rock operation on a continuous basis since 1983, with both tantalum and spodumene (lithium) ores being extracted and processed.

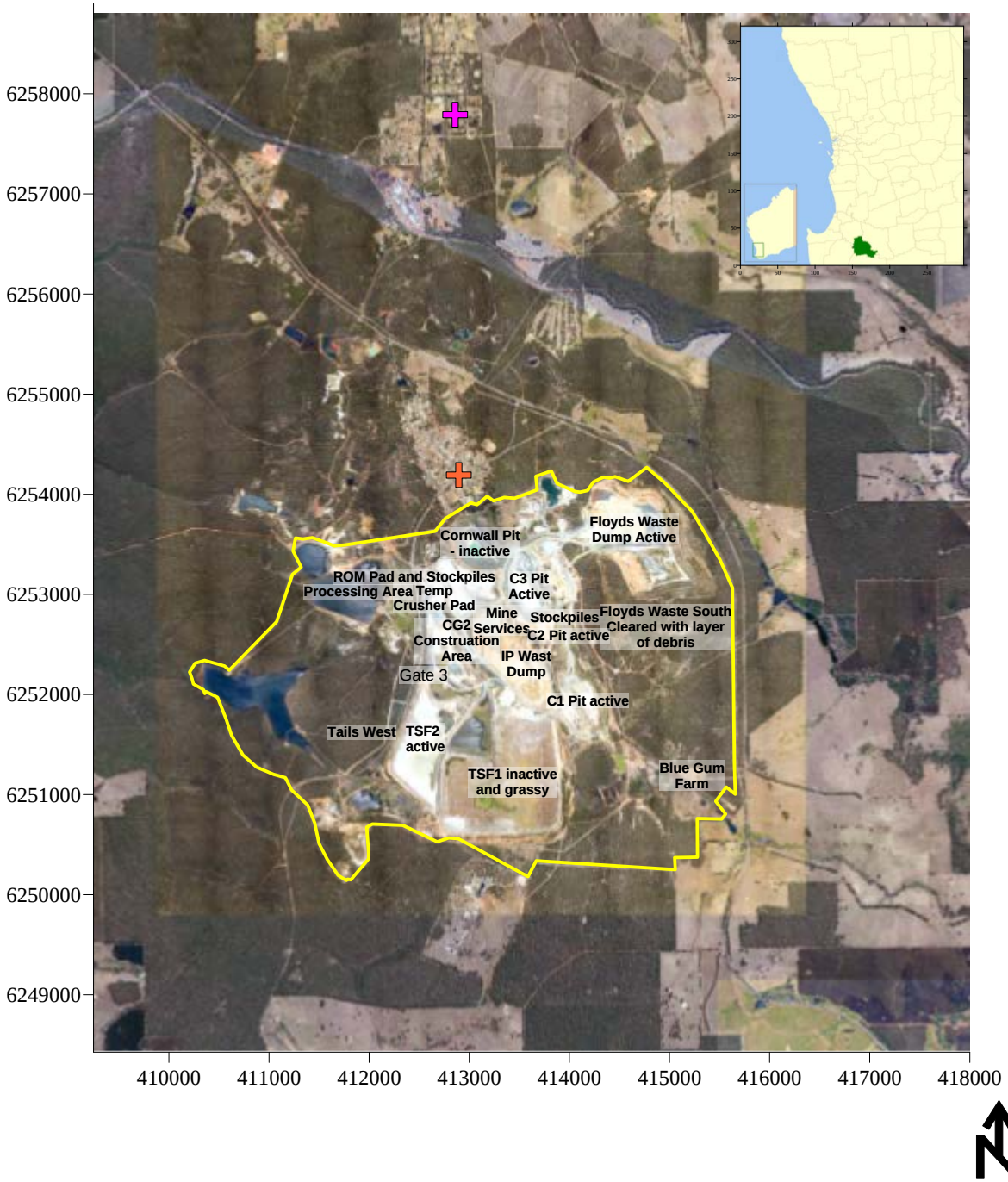
Currently there are two processing plants at the Mine, with an approved production rate of 4.7 Mtpa of spodumene ore.

Spodumene ore is mined from three existing pits. Mining consists of traditional drill and blast method within an open cut mine, and includes the stockpiling of ore. Waste rock is trucked to a designated area, Floyds Waste Rock Landform (WRL).

Progressive rehabilitation of the WRL is undertaken as part of the site annual rehabilitation program. Spodumene ore is trucked to one of two existing processing plants for treatment, the Technical Grade Plant (TGP) or the Chemical Grade Plant (CGP1), to produce lithium mineral concentrate. A second chemical grade plant, CGP2, is currently under construction at the Project and is expected to commence operation in 2019.

Currently, tailings resulting from processing of spodumene ore are transferred to the Tailings Storage Facility (TSF2) located south of the processing plants. The TSF is operated as a subaerial deposition storage. There is also an additional tailings facility, TSF1, which is currently inactive but use of the TSF will recommence as part of the mine expansion.

The current site layout is shown in Figure 2-1.



Legend

- Existing mine boundary
- Greenbushes Township
- Greenbushes North

0 1000 2000 3000 4000

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REVISION	DRAWING NO
Rev B	6136950-FIG-2-1

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Existing site layout

FIGURE 2-1

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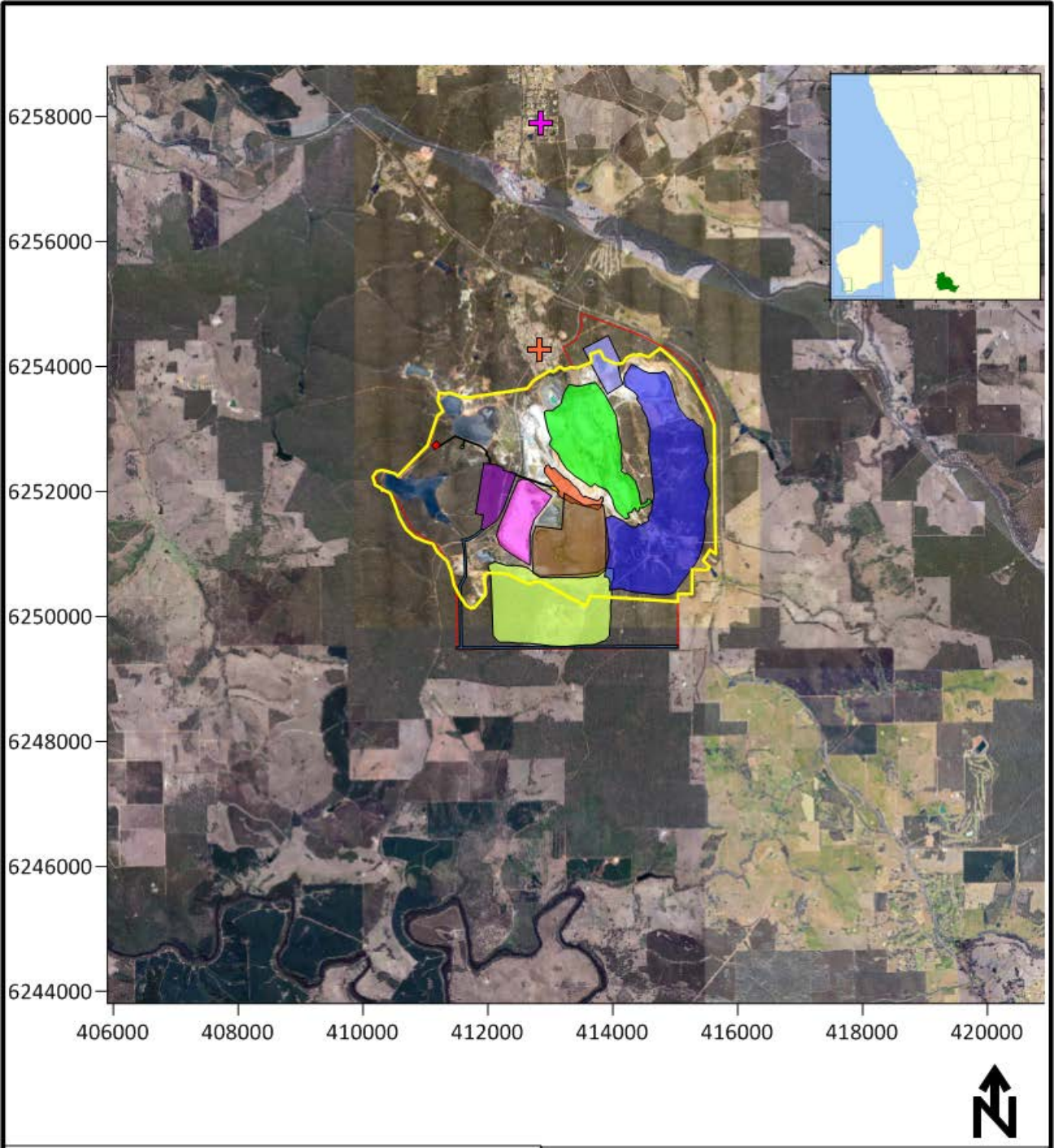
2.2 Project expansion

The expansion will increase throughput at the Mine from the current approved production rate of 4.7 Mtpa to 9.5 Mtpa of spodumene ore to produce up to 2.3 Mtpa of lithium mineral concentrate. Lithium mineral concentrate from the Mine is currently, and will continue to be, transported to the Ports of Bunbury and Fremantle for export. The expansion will result in increased supply of lithium mineral concentration which will be transported to the Tianqi Lithium Process Plant under construction in Kwinana, and the Albemarle Lithium Process Plant proposed for construction in the Kemerton Strategic Industrial Area north of Bunbury.

The approved boundary for the mining operation (Mine Development Envelope) will expand from the current 1591 ha area to 1889 ha. The expansion will involve the merging and expansion of three existing open pits, extension of the Floyds WRL, development of additional water catchment dams within the Floyd's WRL catchment, establishment of a new TSF4 to accommodate increased tailings production, and construction and operation of new infrastructure including a new Mine Services Area, explosive storage facilities, a new crushing circuit and two new CGPs (CGP3 and CGP4).

A general layout of the proposed expansion to the Project is shown in Figure 2-2.



Legend

- TSF2
- Explosives Batch Facility
- Magazine
- Pit LOM 3 Plants
- CPG3 & 4
- Proposed mine boundary
- Existing mine boundary
- Greenbushes Township
- Greenbushes North
- Linear Infrastructure Corridor
- TSF1
- Mine Services Area
- Magazine
- Floyds Waste Dump
- Conveyor
- Run of Mine
- TSF4

0 2000 4000 6000

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Proposed mine expansion site layout

FIGURE 2-2

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3. Emission sources

This section summarises the predominant sources, typical release types and major dust emissions from the proposed expansion. The emissions have been divided into construction and operational impacts.

3.1 Types of dust emissions

The majority of airborne particulates from the site are likely to be visible dust (TSP), with a low proportion of fine particulates. This is confirmed by site dust monitoring activities.

Emissions from the site operations are generated primarily from mining and process activities. The main pollutant of concern is dust and to a lesser extent emissions associated with the combustion of diesel fuel in mobile equipment. Emissions from site related activities comprises of the following dust particulate sizes:

- Total suspended particulates - particulates with an aerodynamic diameter less than 90 µm
- PM_{10} - particulates with an aerodynamic diameter less than 10 µm
- Deposited dust

3.2 Construction emissions

Emissions during construction include fugitive dust emissions from wind erosion, vehicle generated dust and minor emissions from fuel combustion from construction equipment and vehicles. Emissions occurring as a result of construction work include:

- Topsoil removal and vegetation clearing to expand the pits
- Construction of TSF4 and WRL

Installation and building of new TSF4, Mine Services Area, explosive storage facilities, a new crushing circuit and two new CGPs Generally, construction emissions associated with the expansion of the mine are variable and have a short-term nature, and it would be anticipated that the impact from construction to dust emissions would not be significant.

3.3 Operational emissions

The vast majority of dust from mining activities consists of course particles (around 40%) and particles larger than PM_{10}, generated from natural activities such as mechanical disturbance of rock and soil materials by blasting and drilling, dozing, excavation, loading and dumping, and trucks on haul roads. A small amount of dust emissions can be associated with crushing and processing. Dust is also generated when wind blows over bare ground and different types of stockpiles. The potentially significant sources of airborne particulates from the site have been assessed as being:

- Dust from drilling and blasting of the expanded pit
- Dust from excavation and dozing in the expanded pit and expansion of Floyds waste rock landform
- Dust from loading and dumping of spodumene ore product at the new pit and the additional run of mine (ROM). To a lesser extent, loading and dumping of spodumene ore at the new processing plants would also cause dust emissions.
- Dust from additional crushing and conveying activities
- Wind erosion dust from both the new TSF4 and the existing TSF1 and TSF2.

- Wind erosion dust from the expanded WRL
- Wind erosion dust from the exposed expanded mining pit
- Wind erosion dust from additional stockpiles (ROM, crushed ore and finished goods)
- Wind erosion dust lift off from new haul roads and internal roads resulting from light vehicle and heavy vehicle traffic

4. Air quality criteria

The impact of airborne particles as a result of mining operations are assessed by comparing air quality monitoring data or model estimates to appropriate criteria. The criteria referred to in this report include:

- *National Environment Protection (Ambient Air Quality) Measure* (AAQ NEPM), National Environment Protection Council (NEPC)
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (Kwinana), WA EPA
- *State Environment Protection Policy (Air Quality Management)* (SEPP-AQM), EPA Victoria (2002)
- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods), NSW EPA (2005)
- Licence conditions set out in Licence Number L4247/1991/13

4.1 Assessment criteria

The AAQ NEPM was developed to provide benchmark standards for ambient air quality to ensure all Australians have protection from the potential health effects of air pollution. AAQ NEPM standards have been developed for carbon monoxide, nitrogen dioxide, photochemical oxidants (ozone), sulphur dioxide, lead and particulate matter (NEPC, 1998), however as the main pollutants of concern for this assessment are particulates, AAQ NEPM standards for particulate matter only will be shown (Table 4-1).

The AAQ NEPM does not outline any 1-hour PM_{10} criteria, TSP or monthly deposition criteria. Accordingly, the *State Environment Protection Policy (Air Quality Management)* (EPA Victoria, 2002) *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (EPA WA) and *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2005) have been used for this assessment. These three additional guidelines set limits for criteria as indicated in Table 4-1.

Table 4-1 Criteria for ambient air quality

Pollutant	Averaging period	Maximum allowable concentration	Guideline
TSP	24-hour	90 µg/m^3	Kwinana
	Annual	90 µg/m^3	Approved Methods
PM_{10}	1-hour (99.9th percentile)	80 µg/m^3	SEPP-AQM
	24-hour	50 µg/m^3	AAQ NEPM
	Annual	25 µg/m^3	AAQ NEPM
Deposited dust	Maximum increase	2 g/m^2/month	Approved Methods
	Maximum total	4 g/m^2/month	Approved Methods

4.2 Ambient Air Quality Monitoring Conditions

Condition 3.4.1 of Talison's current operational licence issued under Part V of the EP Act (L4247/1991/13) requires that ambient air quality monitoring is carried out at a specified monitoring location. The condition requirements are provided in Table 4-2, and the location of the dust monitor is shown in Figure 5-5.

Table 4-2 Required monitoring of ambient air quality for Licence Number L4247/1991/13

Parameter	Averaging period	Maximum allowable concentration	Method
PM_{10}	24 hours	90 µg/m^3	Talison Lithium Environmental Procedure ENV 2010: Air quality monitoring – High volume sampler

5. Existing environment

5.1 Topography and land use

The Mine is located predominantly within the Greenbushes State Forest with a small area located on private property (rural). The surrounding area includes areas of native vegetation interspersed with historical and current mining operations, townsites, farmland, water storages, plantations, power infrastructure and roads. The current primary land uses within the Mining Development Envelope are for mining, agriculture, conservation and forestry (State Forest) and water catchment.

The Mine is located at a high point of the Darling Plateau. The Plateau is characterised as an expansive undulating landscape with green forest vegetation and occasional rocky outcrops and peaks. The open pits are located along a ridgeline at approximately 300 m AHD which runs from the Greenbushes town site to the south east. Development of the pits will continue along the ridge line for the expansion of the Mine.

Floyds WRL is located on an east facing hill slope between the open pits and the South Western Highway. The WRL acts as a buffer to receptors to the east of the Mine.

5.2 Climate and meteorology

The Mine is located within the South West of Western Australia (SWWA) which experiences a climate which is typically Mediterranean, characterised by hot, dry summers and mild, wet winters. Climate data from the Bridgetown weather station (located approximately 13 km south-east of the Project) is available from the Bureau of Meteorology (BoM) for the years 1998 to 2018 (BoM, 2018).

On average, the maximum temperature at Bridgetown ranges from 16ºC to 30ºC, with the maximum recording reaching 41ºC. The average minimum temperature ranges from 5ºC to 14ºC. Figure 5-1 shows annual temperatures recorded at Bridgetown.

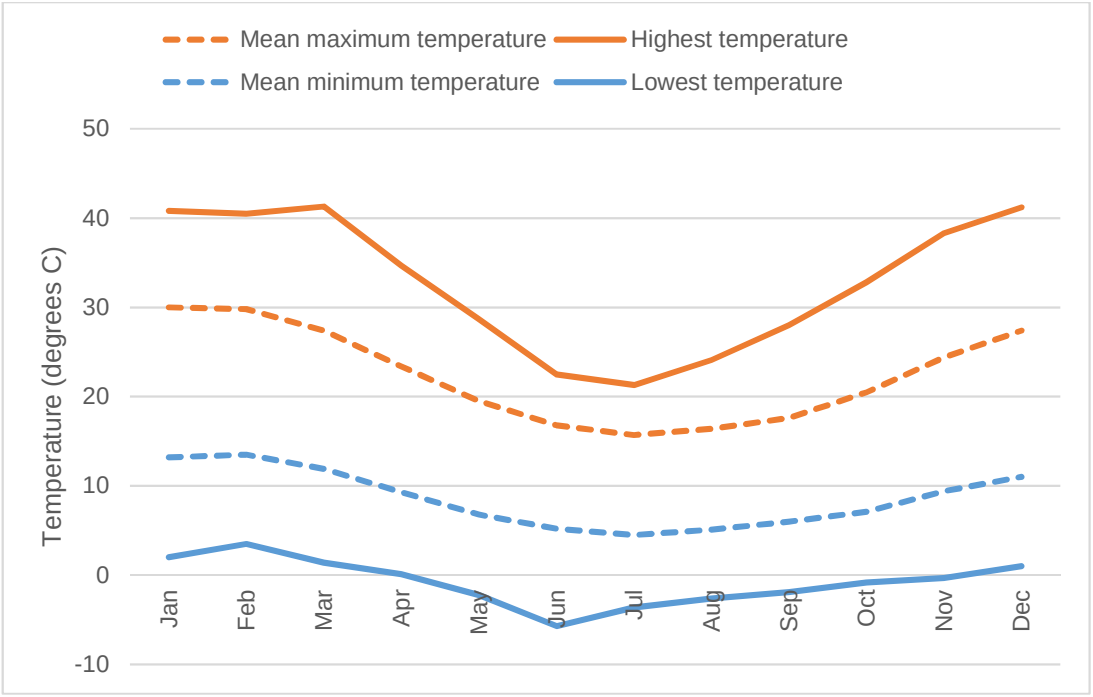


Figure 5-1 Temperature observations for Bridgetown, for years 1998 to 2018

Annual mean rainfall at the station is 721 mm, peaking in winter, with a maximum monthly mean of 128 mm during July. The lowest monthly mean rainfall is recorded in February with 12 mm. On average, the number of rain days per year is 156. Monthly rainfall observations for Bridgetown are shown in Figure 5-2.

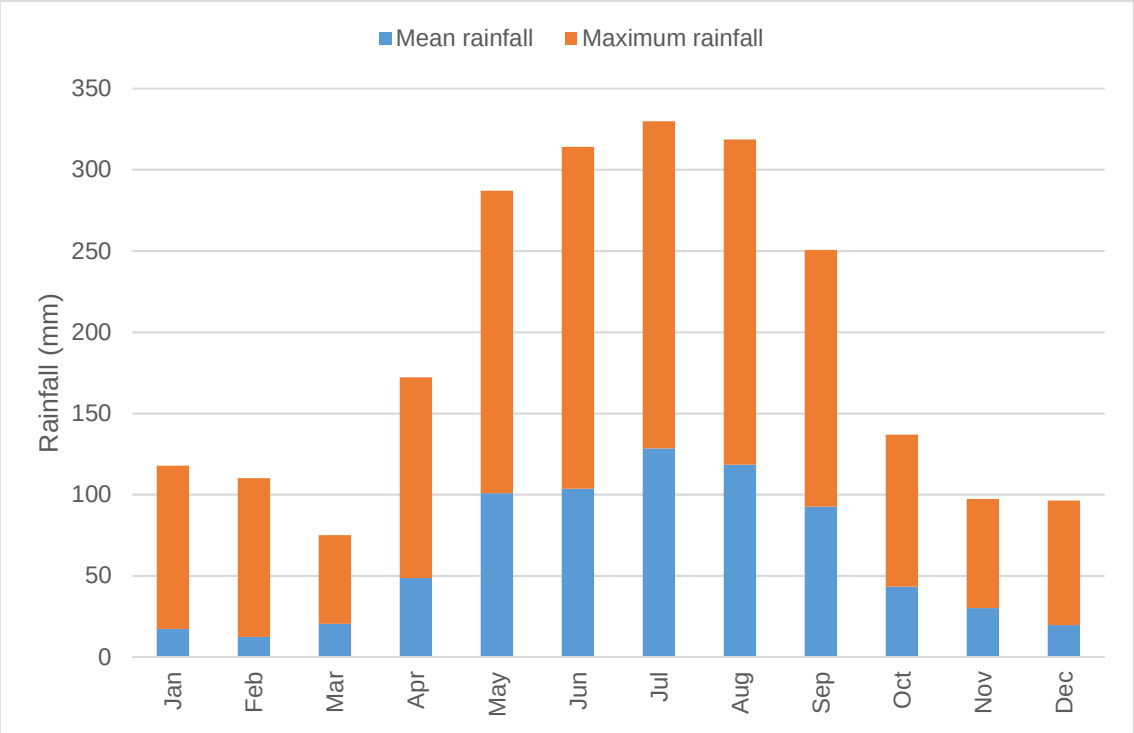


Figure 5-2 Rainfall observations for Bridgetown, for years 1998 to 2018

In Bridgetown, relative humidity peaks in winter during July and declines in summer, reflecting the dry climate of the SSWA region in the summer months. Minimum relative humidity occurs during December to February. 9:00 am and 3:00 pm relative humidity are shown in Figure 5-3.

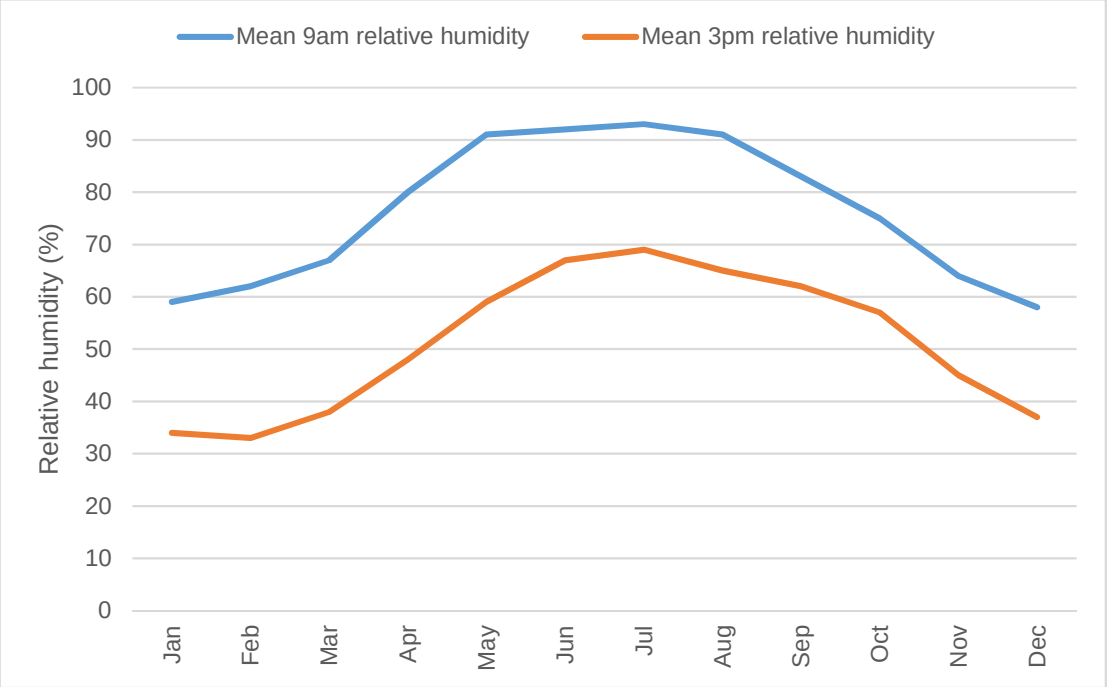


Figure 5-3 Mean relative humidity for Bridgetown, for years 1998 to 2010

Bridgetown is subject to mild variable winds with south-east winds dominating in the morning, and either south or north-westerly winds dominating in the afternoon.

5.3 Air quality

5.3.1 Existing emissions

It is essential to examine existing air quality to provide a general description and understanding of the current local air quality as a result of current mine operations and other contributing sources.

Regional dust sources in the local airshed of the site are:

- Mechanical land disturbance from surrounding pastoral properties;
- Vehicle movement along unsealed roads;
- Burning and incineration (e.g.. backyard burning, residential wood fired heaters, prescribed burns and wildfires); and
- Emissions from the existing Mine, including wind erosion from the TSF1, TSF2, Floyds WRL, existing pits, stockpiles and haul roads. Other dust sources to a smaller extent include blasting, crushing, conveyors and loading/unloading activities.

5.3.2 Project dust monitoring

PM_{10} is monitored by a permanent high volume dust monitor (HiVol), located at the north end of the site, shown on Figure 5-5.

Figure 5-4 shows the daily concentrations of PM_{10} recorded using the HiVol between 2013 and 2018. Occasional exceedances of 50 µg/m^3 at this location have been recorded at the monitoring location but these have been associated with smoke resulting from fires in the region, or unrelated construction/earthworks activities occurring in proximity to the dust monitor. No exceedances of the operating licence limit of 90 µg/m^3 PM_{10} (refer to Section 4.2) have occurred.

Table 5-1 shows the circumstances surrounding concentrations above 50 µg/m^3.

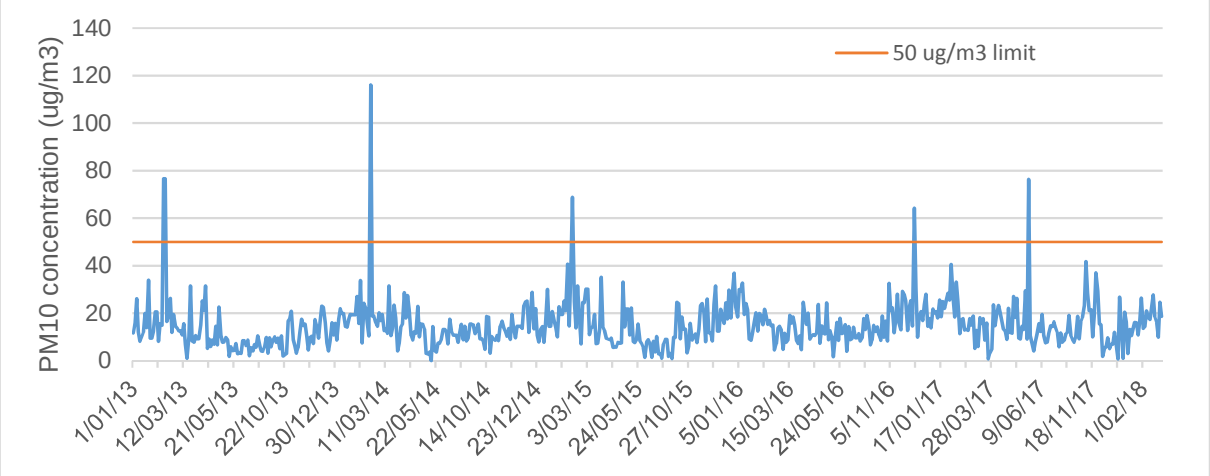


Figure 5-4 Daily PM_{10} concentrations recorded by the HiVol for years 2013 to 2018

Table 5-1 Explanations for concentrations over 50 µg/m^3

Date	Concentration (µg/m^3)	Explanation
12 February 2013	77	Southampton bushfire
14 February 2013	77	Southampton bushfire
18 February 2014	117	Water Corporation dozer clearing alongside dust monitor
10 February 2015	69	Northcliffe and Boddington bushfire
8 December 2016	64	Smoke
18 May 2017	76	Prescribed burning at Maranup Ford Road

When conducting air dispersion modelling, it is important to consider the existing background concentrations. The average, minimum, maximum and percentile concentrations for the modelled year 1 July 2015 to 31 June 2016. The annual average and 70th percentile 24-hour average concentration will be used for modelling. Table 5-2Table 5-2 shows the air quality statistics used for air dispersion modelling (also refer to Section 8.4).

Table 5-2 Air quality statistics for PM_{10}

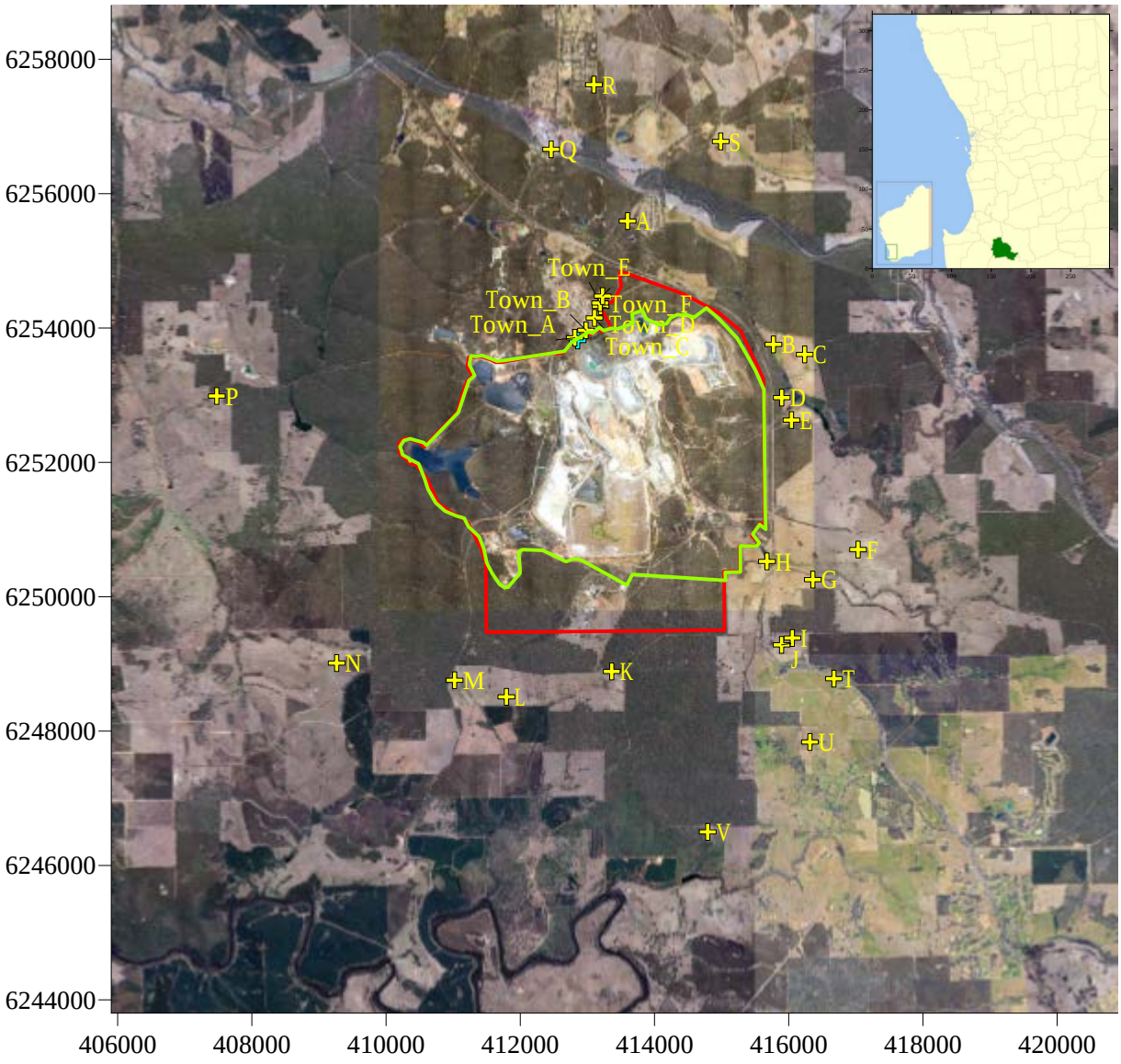
Parameter	Concentration (µg/m^3)
Minimum	0.8
30th percentile	9
50th percentile	13
Average	14
70th percentile	18
90th percentile	24
Maximum	37

5.4 Sensitive receptors

Sensitive receptors are classified as places where people are likely to work or reside. This may include dwellings, schools, hospitals, offices or public recreational areas (NSW DEC, 2005). There are 26 sensitive receptor within a 10 km radius of the Talison Greenbushes Lithium Operations.

Figure 5-5 shows the location of the sensitive receptors, including the HiVol dust monitor location.

Table 5-3 displays the sensitive receptors and their distance to the site.



Legend

- Sensitive receptor
- HiVol
- Existing mine boundary
- Proposed expansion mine boundary

0 2000 4000 6000

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Sensitive receptor locations

FIGURE 5-5

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Table 5-3 Sensitive receptors locations

Sensitive receptor	Land classification	Easting (m E UTM)	Northing (m S UTM)	Elevation (m AHD)	Distance from mine boundary (km)
Town A	Residential (Greenbushes Township)	412813	6253855	330	<1
Town B	Residential (Greenbushes Township)	412980	6253966	326	<1
Town C	Residential (Greenbushes Township)	413106	6254150	322	<1
Town D	Residential (Greenbushes Township)	413196	6254323	332	<1
Town E	Residential (Greenbushes Township)	413190.2	6254373	341	<1
Town F	Residential (Greenbushes Township)	413227	6254476	292	<1
A	Residential	413599	6255592	289	2.2
B	Residential	415772	6253756	287	2.9
C	Residential	416238	6253607	283	2.3
D	Residential	415896	6252964	227	<1
E	Residential	416041	6252630	264	<1
F	Residential	417034	6250703	234	<1
G	Residential	416360	6250255	224	<1
H	Residential	415676	6250526	251	1.4
I	Residential	416054	6249386	225	<1
J	Residential	415894	6249284	223	1.1
K	Residential	413363	6248888	267	<1
L	Residential	411793	6248510	268	1.1
M	Residential	411021	6248757	193	1.7
N	Residential	409264	6249013	241	2
O	Residential	405054	6249792	247	6.2
P	Residential	407477	6252988	257	<1
Q	Residential	412460	6256660	267	<1
R	Residential	413097	6257623	255	<1
S	Residential	414987	6256777	246	2.3
T	Residential	416674	6248781	222	2.8
U	Residential	414793	6246500	118	2.9
V	Residential	414793	6246500	331	< 1
HiVol	Dust monitor	412855.2	6253814	326	<1

6. Meteorological modelling

6.1 Surface and profile meteorological file

Onsite meteorological data was used to prepare meteorological data in required formats for the AERMOD dispersion model. Two meteorological data files were required: surface met file and upper air file. The following onsite meteorological observation were used for input to the surface file into AERMOD

- Wind speed
- Wind direction
- Temperature
- Relative humidity
- Convective mixing height
- Mechanical mixing height
- Monin-Obukhov length
- Surface roughness height
- Bowen ration
- Albedo
- Cloud cover

The upper air file for AERMOD provides information on the vertical structure of the atmosphere and requires minimum two soundings per day: around sunrise and sunset. These data were also extracted onsite meteorological data and formatted into a profile file. In applying the meteorological processor to prepare the meteorological data for the AERMOD model appropriate values for five surface characteristics needed to be determined:

- Wind speed
- Wind direction
- Temperature
- Sigma-theta
- Sigma-W

The surface roughness length is related to the height of obstacles to the wind flow and is important in determining mechanical turbulence and the stability of the boundary layer.

The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

Average land use characteristics were derived from satellite imagery. From this visual data, land use parameters were input into AERMOD across all sectors and are shown in Table 6-1 to Table 6-3.

Table 6-1 Land use characteristics input into AERMOD - Albedo

Season	Albedo
Summer	0.181
Autumn	0.181
Winter	0.199
Spring	0.181

Table 6-2 Land use characteristics input into AERMOD - Bowen ratio

Months	Bowen ratio
December to February	0.87
March to August	1.05
September to November	0.52

Table 6-3 Land use characteristics input into AERMOD - Surface roughness

Wind direction	Surface roughness
360/0º - 20º	0.27 m
20º - 340º	0.1 m
340º – 360/0º	0.27 m

6.2 Meteorological confirmation

A plot of the wind roses generated based on surface output meteorological data is presented in Figure 6-1Surface file wind rose (left) and onsite wind rose (right) for period 1 June 2015 to 30 June 2016

, together with the corresponding wind rose from the 1 June 2015 to 30 June 2016 modelling period. From these wind roses, it is evident that the surface wind direction and wind speed used in AERMOD input resembles the raw onsite data, although the frequency varies slightly. East south-easterly winds dominate the site with the majority of winds speeds between 3.6 and 8.8 metres per second. Wind speeds increase slightly in the west north-westerly to up to 11.1 metres per second.

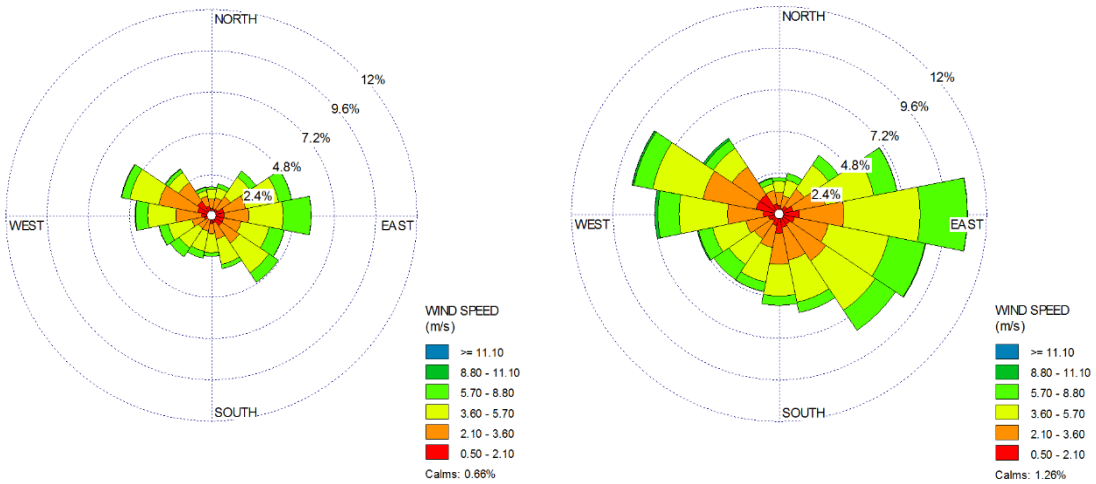


Figure 6-1 Surface file wind rose (left) and onsite wind rose (right) for period 1 June 2015 to 30 June 2016

7. Emission estimation

This section outlines the emission estimation process used to develop the emission inventory for operation of the expansion project.

7.1 Emission estimation process

Emissions were estimated for key dust sources during the operational phase of the expansion project.

While emissions from the operational phase of the expansion project will be referenced in the dispersion modelling, construction emissions associated with the expansion of the site will not be considered due to the variable spatial distribution of these activities and the challenges associated with modelling such emissions.

Dust impacts associated with construction activities at the site have been discussed in Section 3.2.

7.1.1 Sources of emissions - Operational phase

The emission sources for the operation phase of the expansion project are discussed in detail in Section 3.3. To summarise, dust for TSP and PM_{10} sources included:

- Drilling
- Blasting
- Excavation at the pits
- Material loading and unloading by loaders
- Bulldozers on ore and waste
- Wheel generated dust from haul roads
- Wind erosion from stockpiles, pits, TSF's and Floyds WRL

The year considered for predicted dust impact was 2028. This year represents the maximum amount of activity at the site. This includes mining from the pits for a maximum rate of 9.5 Mtpa. Of this, 0.4 Mtpa will be processed at the TGP plant, and the remaining 9.1 Mtpa will be processed via the CPGs. During the year 2028, an estimated 4.6 Mtpa of waste will be dumped at Floyds WRL.

Further details including drilling, blasting and waste volume are shown in Table 7-1. The dust control factors applied in the emissions estimation process are defined in Table 7-2. The resulting annual PM_{10} emissions from operations at the expansion project are presented in Table 7-3.

Table 7-1 Site-specific data – Operational phase

Item	Amount
Area per blast	4000 m^2
Number of blasts	1 /day
Number of holes drilled	250 /day
Quantity of ore extracted	9.5 Mtpa
Quantity of waste to facility	4.6 Mtpa

Table 7-2 Dust control factors (source: NPI EET Manual for Mining v3.1, Table 4)

Item	Dust reduction (%)
Level 1 watering of haul roads	50
Water sprays	50
In pit retention (TSP)	50
In pit retention (PM_{10})	5
Water sprays with chemicals	90
Vegetation established	90
Wind break	30
Rock armour/topsoil applied	30
Hooding with fabric filters	83
Hooding with scrubbers	65
Telescopic chute with water sprays	75

Table 7-3 TSP and PM_{10} emissions – Operational phase expansion project (kg/yr)

Activity	TSP	PM_{10}	Control
Drilling	1,583	832	Water spray
Blasting	300,750	155,778	Water sprays
Excavators	613,200	294,336	Wind breaks
ROM loaders	613,200	294,336	Wind breaks
Rock breakers/Excavators	459,900	220,752	Wind breaks
Transfer stations	208	685	Hooding with fabric filters
3 stage crusher	54,750	5,475	Telescopic chute with water sprays, hooding with scrubbers, water sprays (50%)
2 stage crusher	54,750	5,475	Telescopic chute with water sprays, hooding with scrubbers, water sprays (50%)
Stockpiles (loading and unloading)	399,806	173,218	Enclosure and water sprays
Haul trucks (pits and site)	12,118	3,581	Water sprays with chemicals, Level 1 watering ($2L/m^2/h$), wind breaks
Haul trucks (waste dump)	47,462	14,025	Water sprays with chemicals, Level 1 watering ($2L/m^2/h$), wind breaks
Dozer (pit)	208,488	50,282	Wind breaks
Dozer (waste dump)	187,639	45,254	Rock armour/ topsoil applied, vegetation established

The emission rates used for modelling based on the assumptions discussed above are shown in Table 7-4. Further site specific information and NPI emission factors used for estimating emissions to be used in AERMOD are shown in Appendix B.

Table 7-4 Emission rates used for AERMOD

Activity	Unit	TSP	PM_{10}
Blasting	g/s	4.64	2.40
Drilling	g/s	0.02	0.01
Excavators	g/s	1.32	0.63
Rock breakers	g/s	1.32	0.63
Dozers at pits	g/s	3.31	0.80
Dozers at WRL	g/s	1.98	0.48
Haul trucks to WRL	g/s	0.06	0.02
Haul trucks for pits	g/s	0.25	0.07
Conveyor transfer points	g/s	0.004	0.01
3 stage crusher	g/s	0.46	0.05
2 stage crusher	g/s	1.43	0.14
Unloading ore stockpiles	g/s	2.19	0.95
Loading fine ore stockpile at TIL	g/s	0.01	0.00
Loading final product stockpile	g/s	0.14	0.06
ROM stockpile (for TIL, CPG1 & CPG2)	g/s/ha	0.01	0.00
ROM stockpile (for CPG 3 & CPG4)	g/s/ha	0.01	0.00
Fine ore stockpile	g/s/ha	0.00	0.00
Final Product Stockpile	g/s/ha	0.00	0.00
Pits-1	g/s/ha	1.4	0.7
Pits-2	g/s/ha	1.4	0.7
Pits-3	g/s/ha	1.4	0.7
TSF1-1	g/s/ha	0.30	0.15
TSF1-2	g/s/ha	0.12	0.06
TSF4-1	g/s/ha	0.5	0.2
TSF4-2	g/s/ha	0.5	0.2
WRL	g/s/ha	0.38	0.2

8. Dispersion modelling

This section describes the model used to predict ground level concentrations (GLC) resulting from the expansion project based on derived emission rates and meteorological data.

This section provides further information on the model parameters selected for the dispersion model AERMOD. It also summarises the dispersion modelling results.

AERMOD is a steady state model and assumes that over time, the average concentrations distribution within a plume is Gaussian. AERMOD was used to predict the dispersion of TSP, PM_{10} and dust deposition at 35 receptors within the region (Figure 5-5). A sample AERMOD output file typical of those used in this assessment is presented in Appendix A. The main model options and assumptions used are listed below.

The emission estimations for all modelled sources are presented in Appendix B. AERMOD was run individually for each particle size (TSP and PM_{10}) with their corresponding emission rates. The TSP model run was configured to output dust deposition at the receptors.

8.1 Deposition modelling

One emission file was generated for each particle size category for TSP and PM_{10} with their corresponding particle size distributions; pollutant concentrations were modelled accounting for dry depletion. The TSP model run was configured to output dry deposition. Character particle source emissions to calculate deposited dust from TSP are shown in Table 8-1

Table 8-1 Character particle source emissions

Particle diameter (µ)	Mass fraction	Particle density (g/cm^3)
1	0.31	1
4	0.26	1
7	0.23	1
9	0.2	1

8.2 Source characteristics

A total of 60 volume sources were used to represent emissions: 34 sources to represent operational emissions including wind erosion and 26 sources to represent emissions of wheel generated dust. Modelling source characteristics are shown in Appendix C.

8.3 Grid system

AERMOD has the capability to calculate concentrations on both a uniform grid (gridded receptors) and at specified individual locations (discrete receptors). The model was configured to predict the ground-level concentrations on a 15 km square grid,. The model domain south-west corner was located at 403805 m E, 6241702 m S (50S UTM) with a grid resolution of 200 m.

8.4 Background concentrations

PM_{10} monitoring data discussed in Section 5.3.2 was used in this assessment. The 70th - percentile for 24-hour average (18 µg/m^3) and annual average (14 µg/m^3) (refer Table 5-2) were included as a background PM_{10} concentrations. Background concentrations consist of dust from the existing mine and processing facilities as well as regional background dust.

There was no available monitoring data for TSP or deposited dust.

8.5 Model results

This section presents the results for the model outputs for TSP, PM_{10} and dust deposition. Results presented are for the predicted contribution from the expansion project only (incremental) and for the expansion project inclusive of the existing mine and processing facilities (cumulative) by including the background, as discussed in Section 5.3. The emissions used in the modelling are presented in Section 7 while the assessment criteria are discussed in Section 4.
Section 8.5.1 to 8.5.3 show the results from predictive air dispersion modelling for TSP, PM_{10} and deposited dust. A discussion of results is included at Section 8.6.

Although air dispersion modelling has been conducted with the sophisticated and advanced model AERMOD, this complex model does not necessarily lead to pollutant predictions that are 100% accurate. As the number of input variables goes into AERMOD, including meteorological, spatial and temporal parameters, how these variables evolve over time will affect the predictions in the modelling year (2028).

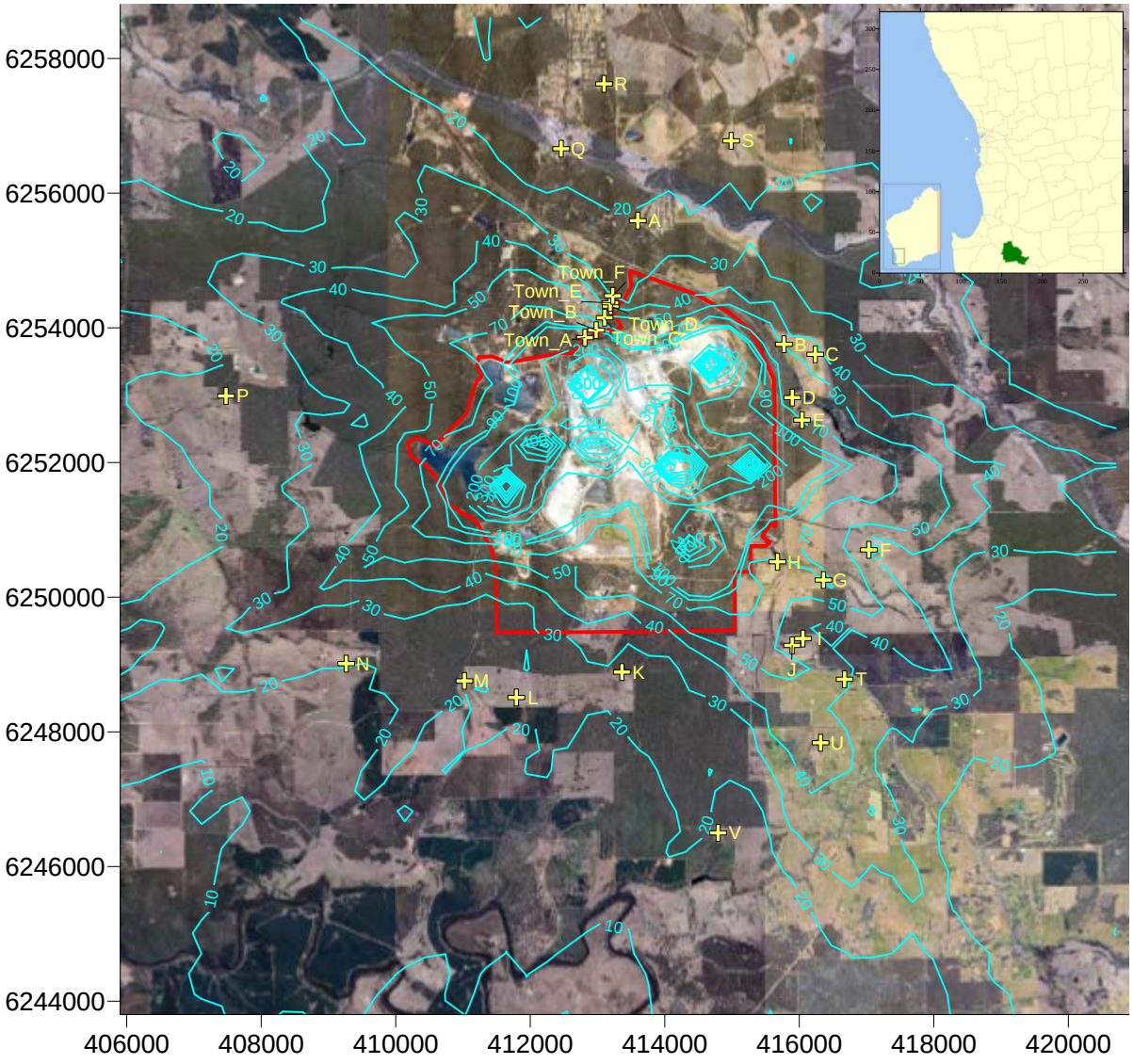
8.5.1 TSP

Table 8-2 shows the predicted maximum 24-hour average and annual average concentration of TSP. As there is no monitoring data from the existing mine and processing facilities for TSP, only incremental results are displayed.

Dispersion modelling results for predicted maximum 24-hour average and annual average concentrations are presented as contours in Figure 8-1 and Figure 8-2.

Table 8-2 Predicted maximum 24-hour and annual average concentrations for TSP (µg/m^3)

Receptor	24-hour average maximum	Annual average
	Incremental	Incremental
Criteria	90	90
Town A	61	13
Town B	75	13
Town C	51	10
Town D	31	7
Town E	25	5
Town F	23	4
A	18	3
B	12	2
C	18	2
D	43	10
E	43	8
F	51	14
G	72	17
H	31	11
I	69	19
J	74	15
K	42	9
L	41	9
M	39	7
N	42	6
O	15	2
P	30	6
Q	22	4
R	24	4
S	21	3
T	26	3
U	18	2
V	36	6
HiVol	45	12



TSP criteria = 90 µg/m³

Legend

- Maximum 24-hr average TSP concentration (µg/m³)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
HEIGHT DATUM: m AGL

DATE	FILE LOCATION:
25.6.2018	G:\61\36950\Tech\Dust Assessment\WP\Surfer\Contours
REVISION	DRAWING NO
Rev B	6136950-FIG-8-1

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Maximum incremental 24-hour TSP concentrations

FIGURE 8-1

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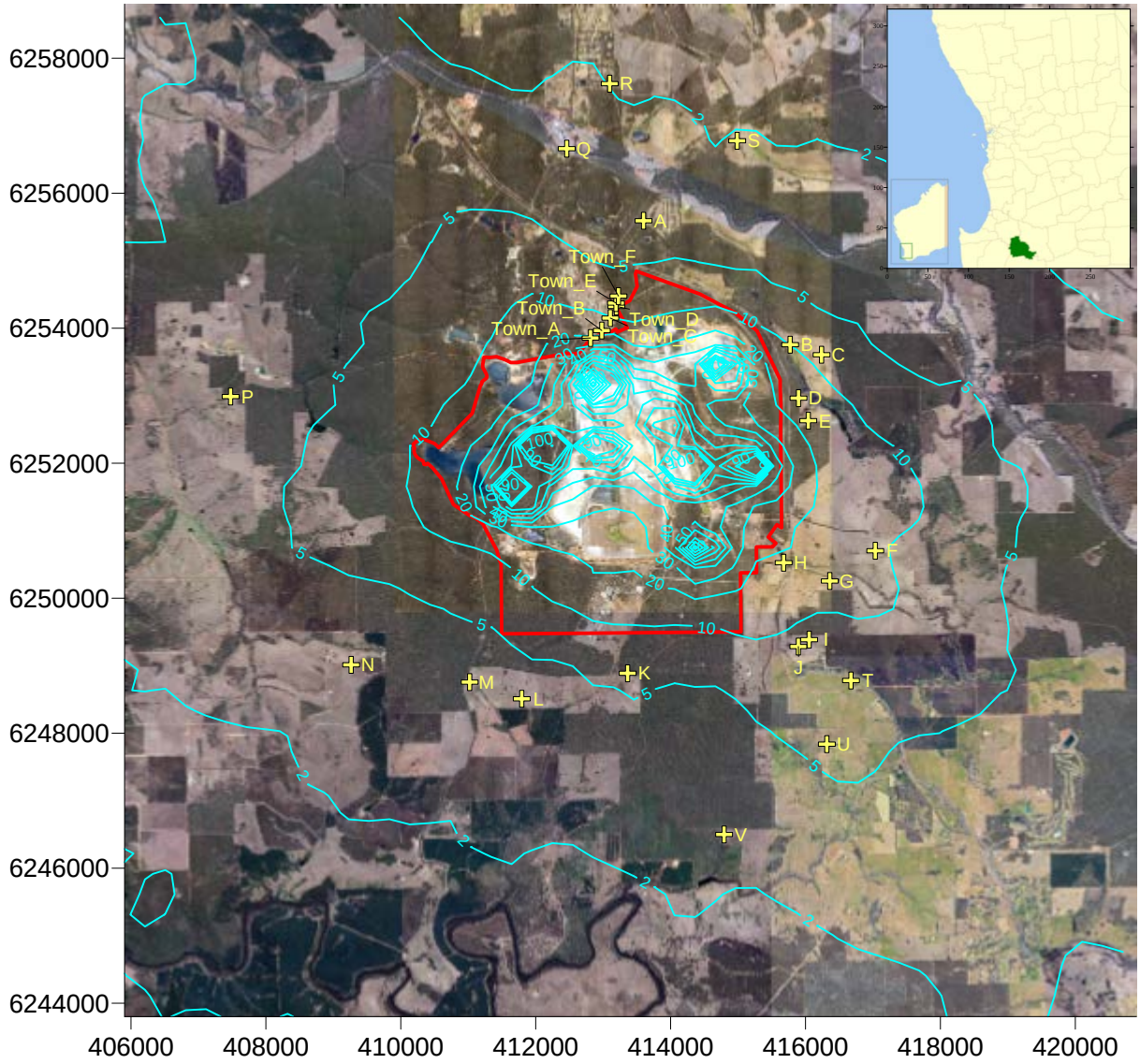

Legend

- Annual average TSP concentration (µg/m³)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
HEIGHT DATUM: m AGL

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Maximum incremental annual average TSP concentrations

FIGURE 8-2

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8.5.2 PM_{10}

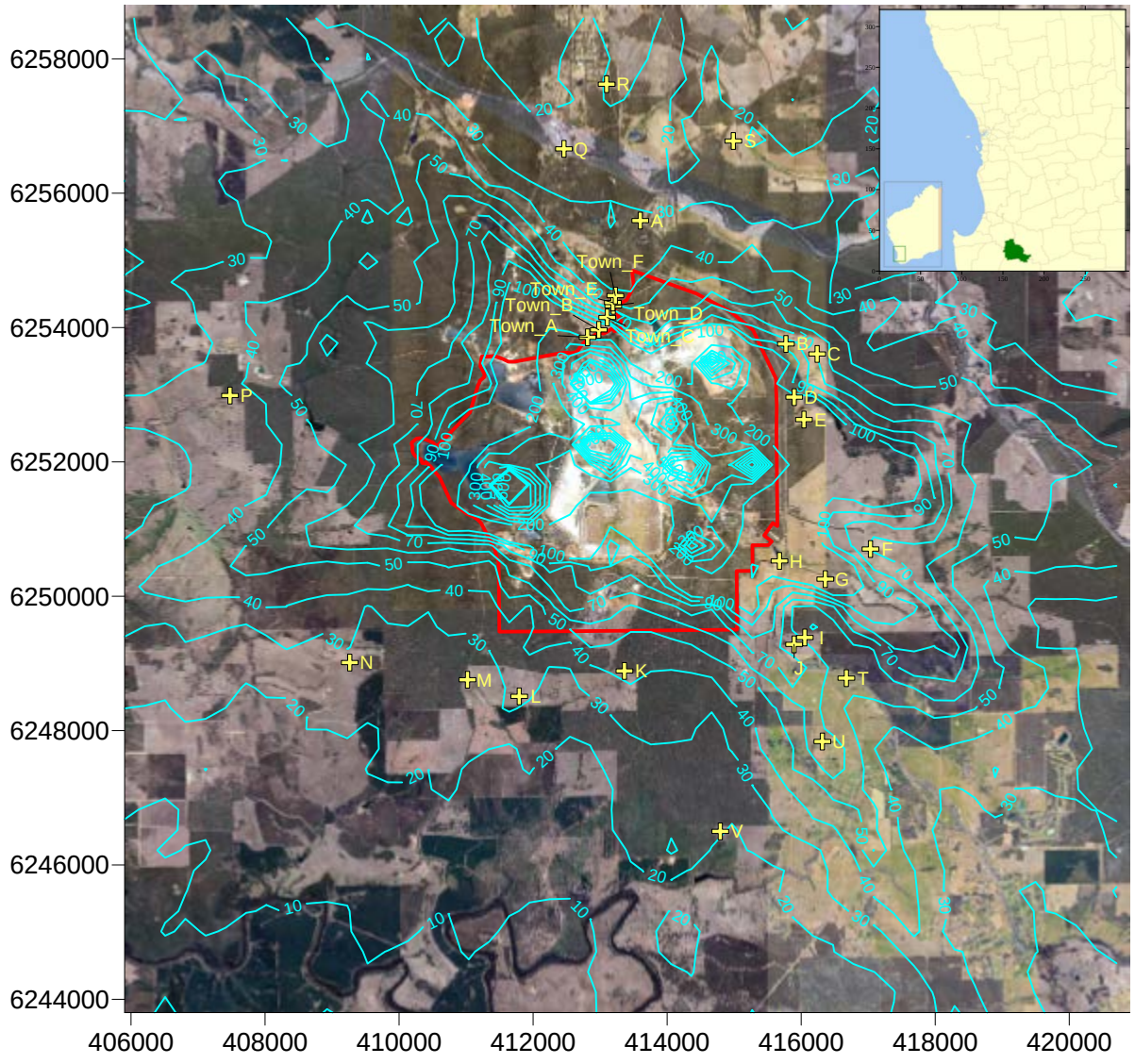
Table 8-3 shows the predicted 1-hour 99.9th percentile, maximum 24-hour and annual average concentration for PM_{10}. The 24-hour average and annual average results presented are incremental (i.e. operational emissions from the expansion project only) and cumulative (including existing mine and regional background concentrations). As there is no background monitoring data for 1-hour concentrations, incremental results are only displayed for 1-hour 99th percentile concentrations.

Predicted concentrations at the HiVol (Section 5.3.2) have been provided in order to determine licence compliance (Section 4.2) at the monitoring station.

Dispersion modelling results are also presented as contours in Figure 8-3, Figure 8-4 and Figure 8-5.

Table 8-3 Predicted 99.9th percentile, maximum 24-hour and annual average concentrations for PM_{10} (µg/m^3)

Receptor	1-hour 99.9th percentile	24-hour maximum		Annual average	
	Incremental	Incremental	Cumulative	Incremental	Cumulative
Criteria	80	50		25	
Town A	101	21	38	5	19
Town B	108	28	46	5	18
Town C	60	21	39	3	17
Town D	43	13	30	2	16
Town E	37	10	28	2	16
Town F	37	10	28	1	15
A	25	6	24	1	15
B	16	5	23	1	15
C	25	7	24	1	15
D	90	17	35	3	17
E	84	15	33	3	17
F	73	17	35	5	19
G	110	30	48	6	20
H	69	13	30	4	18
I	120	26	43	7	21
J	129	27	45	5	19
K	52	15	33	3	17
L	64	15	33	3	17
M	54	16	33	3	16
N	72	16	34	2	16
O	34	7	24	1	15
P	41	12	30	2	16
Q	39	9	27	1	15
R	31	10	27	1	15
S	25	8	26	1	15
T	39	11	28	1	15
U	21	7	24	1	15
V	40	15	32	2	16
HiVol	101	19	37	5	18



PM_{10} criteria = 80 µg/m³

Legend

- Incremental 99.9th percentile 1-hour PM_{10} concentration (µg/m³)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
HEIGHT DATUM: m AGL

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Incremental 99.9th percentile 1-hour PM_{10} concentrations

FIGURE 8-3

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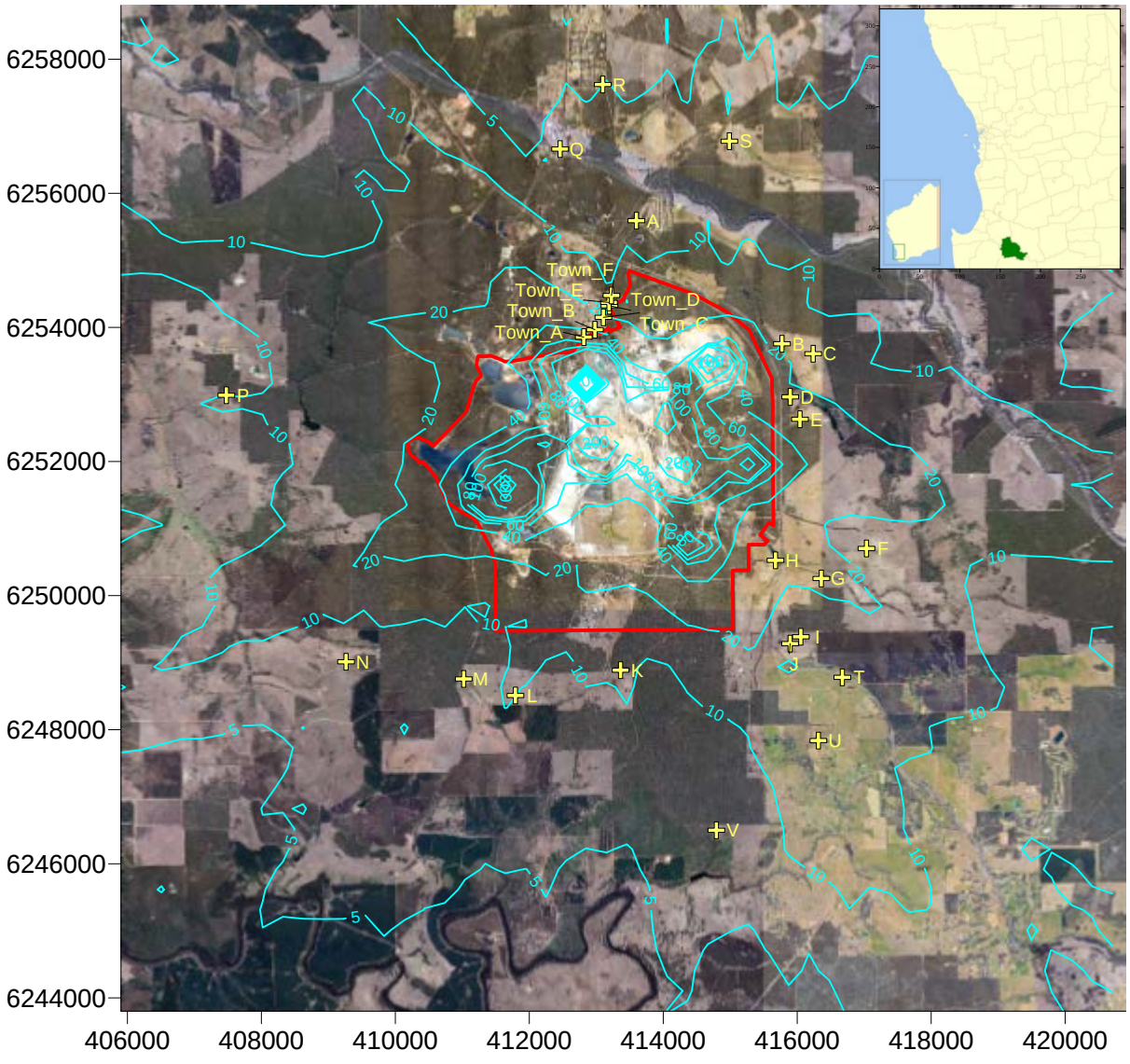

PM_{10} criteria = 50 µg/m³

Legend

- Maximum incremental 24-hr average PM_{10} concentration (µg/m³)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
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Maximum incremental 24-hour PM_{10} concentrations

FIGURE 8-4

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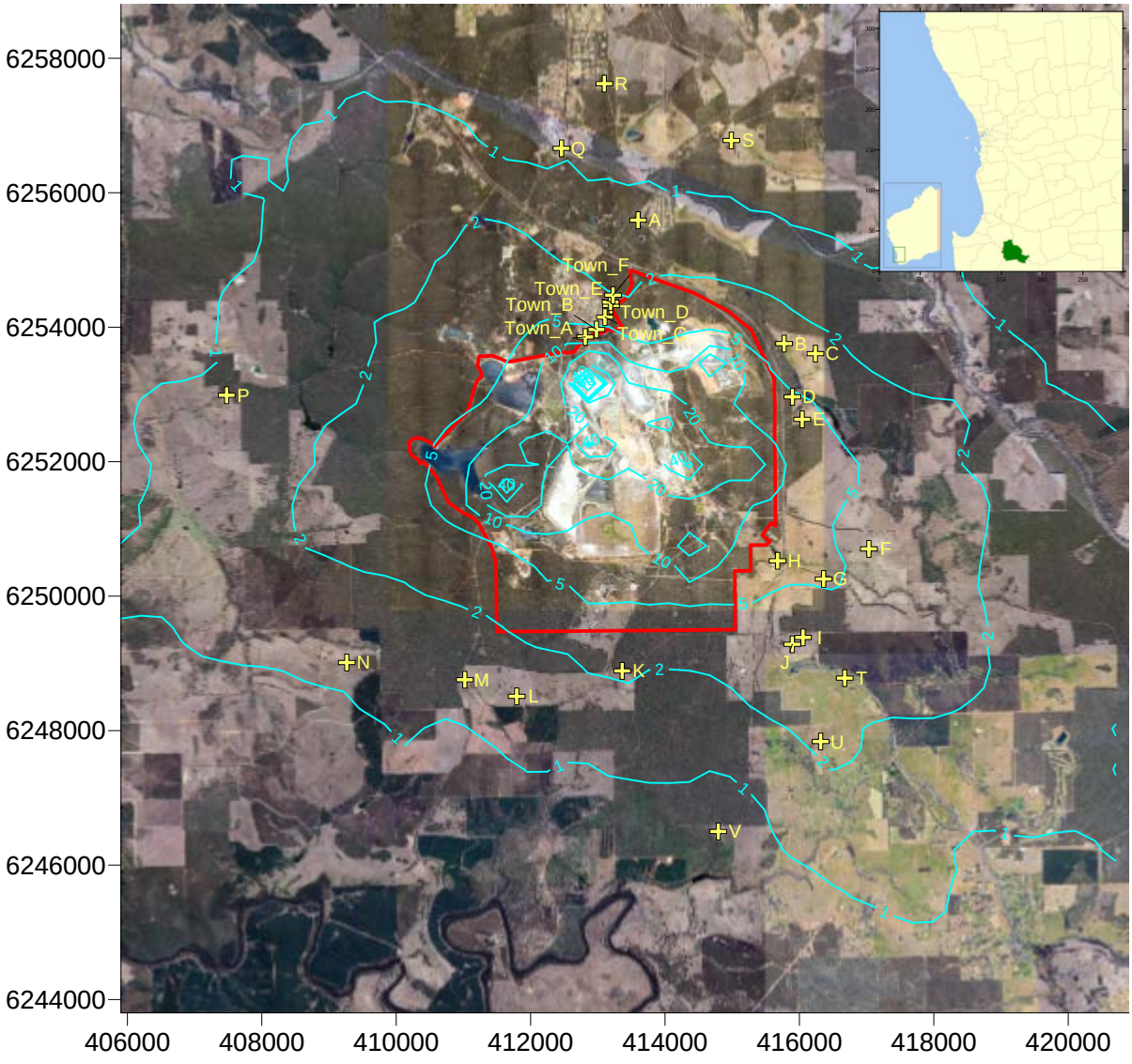

PM_{10} criteria = 25 µg/m^3

Legend

- Annual average PM_{10} concentration (µg/m^3)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
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Incremental annual average PM_{10} concentrations

FIGURE 8-5

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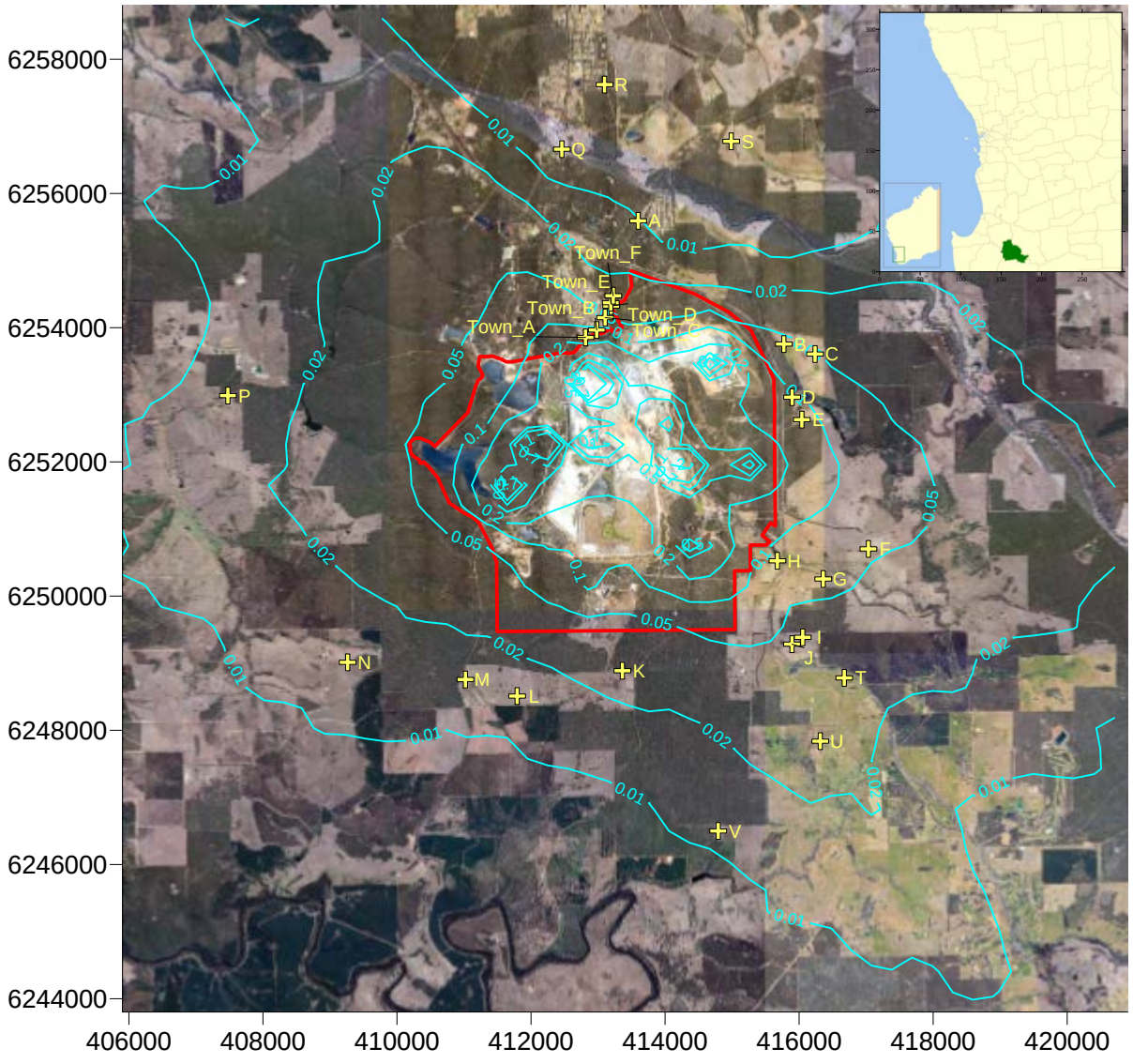
8.5.3 Dust deposition

Table 8-4 shows the predicted maximum total monthly incremental dust deposition rates. As there is no background monitoring data for TSP, incremental results only are included.

Dispersion modelling results are presented as contours in Figure 8-6.

Table 8-4 Maximum total deposited dust per month (g/m²/month)

Receptor	Maximum monthly total
	Incremental
Criteria	4
Town A	0.08
Town B	0.08
Town C	0.05
Town D	0.03
Town E	0.02
Town F	0.01
A	0.01
B	0.00
C	0.00
D	0.06
E	0.06
F	0.09
G	0.12
H	0.05
I	0.09
J	0.06
K	0.04
L	0.04
M	0.03
N	0.03
O	0.01
P	0.03
Q	0.01
R	0.01
S	0.01
T	0.01
U	0.01
V	0.01
HiVol	0.01



Maximum monthly dust deposition criteria = 4 g/m^2/month

Legend

- Maximum incremental monthly average dust deposition levels (g/m^2/mth)
- Proposed expansion mine boundary
- Sensitive receptor

0 2000 4000 6000

CREATED:	CHECKED:	APPROVED
GF	AST	JF

HORIZONTAL DATUM: WGS 84 PROJECTION: UTM Zone 50 H
HEIGHT DATUM: m AGL

DATE	FILE LOCATION:
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REVISION: Rev B	DRAWING NO: 6136950-FIG-8-5

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Maximum incremental monthly dust deposition levels

FIGURE 8-6

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8.6 Discussion of results

Model predicted TSP, PM_{10} and deposited dust concentrations indicate:

- All incremental maximum 24-hour average TSP concentrations are predicted to comply with the criteria at all identified sensitive receptors, as shown in Table 8-2. The highest concentration was 75 µg/m^3 at Town B, or 83% of the TSP 24-hour average criterion. This predicted dust concentration does not include contribution from the existing mine.
- Likewise, incremental annual average concentrations for TSP are predicted to not exceed the air quality criterion. The highest annual average concentration at I was 19 µg/m^3, which is 21% of the annual average TSP criterion. This predicted dust concentration does not include contribution from the existing mine.
- PM_{10} predicted concentrations are shown in Table 8-3. Incremental 1-hour 99.9th percentile concentrations for PM_{10} were predicted to reach a maximum of 129 µg/m^{3}at J, which is above the 1-hour criterion (of 80 µg/m^3). The criterion was exceed at a total of seven receptors (Town A, Town B, D, E, G, I, and J). Although there were seven exceedances in 1-hour 99.9th percentile concentrations, the 24-hour and annual average PM_{10} concentrations were all predicted to be below the respective criteria (refer to discussion point below).
- The predicted incremental maximum daily average for PM_{10} concentrations is predicted to be 30 µg/m^3 and the cumulative is predicted to be 48 µg/m^3 (G). The predicted cumulative concentration is 90 % of the air quality criteria. The maximum predicted cumulative annual average concentration for PM_{10} was 21 µg/m^3, which is 80% of the air quality criteria (I).
- The predicted maximum 24-hour average concentration for PM_{10} at the HiVol was 37 µg/m^3 (Table 8-3, includes background concentrations). This does not exceed the 24-hour average license condition of 90 µg/m^3.
- The highest deposited dust level was predicted to be 3% of the total monthly criteria of 4 g/m^2/mth (G) (Table 8-4).

During 2020 and 2024 there are plans to excavate and re-mine TSF1. The modelled scenario year, 2028 did not include work associated with this activity excavation of TSF1, and therefore dust impacts have not been considered in modelling. Current dust management strategies associated with mining and loading product at TSF1 (refer Section 9), including wet down ahead of excavation, and ceasing non-essential mining activities during excessively windy conditions and dust control of haul roads will be appropriately implemented during these activities

Results presented in this study show predicted concentrations which are indicative of worst-case scenarios. Predicted 1-hour 99.9th percentile PM_{10} concentrations exceed the relevant criteria, however this does not necessarily indicate that the site and surrounding local area will experience this level of impact.

Predicting air pollution is an extremely complex application and there are limitations with advanced dispersion models. Real air quality concentrations are likely to be highly variable depending on emission levels and the persistence of particular meteorological conditions. The concentrations predicted in this study do not explicitly dictate future air quality in 2028.

Furthermore, it is likely that results are conservative, as the model has not included the practical assumption of implementing additional ad-hoc dust management practises when PM_{10} alert concentrations are triggered by the air quality monitoring system (refer to Section 9.2). Therefore in this assessment the model has most likely over-predicted concentrations, in particular PM_{10} 1-hour concentrations, as this is the pollutant and timeframe so susceptible to variability in concentration levels. A recommended dust management framework for the Project is detailed in Section 9.

9. Dust management

A dust management plan provides the framework to ensure management strategies will protect human health and the environment, including amenity impacts resulting from dust emissions. This section gives a dust management framework in reference to the dust assessment above. Current dust management is also considered in this section.

9.1 Dust mitigation

Current dust management practices for the Project are summarised in Table 9-1.

Table 9-1 Current dust mitigation strategies onsite

Activity	Mitigation method
Blasting and drilling	Wet down ahead of blasting
Mining	Application of dust suppressant to haul roads Operate water carts on haul roads and open areas during summer Wet down ahead of blasts Cease non-essential mining activities during excessively windy conditions
TSF	Physical and chemical stability of TSF1 & TSF2 including: TSF1 & TSF2 operated to maintain maximum area of moisture Application of dust suppressant (e.g. Gluon) Application of soft rock to edges TSF1 & TSF2 seeded with ryegrass during winter for coverage over the summer period TSF1 & TSF2 rehabilitate batters as soon as practicable TSF1 & TSF2 has suitable capping and uses windbreaks
Stockpiles	Cover on the finished product stockpiles Sprinklers on the fine ore stockpiles Application of dust suppressant to non-active stockpiles
Crushing	Dust extraction system with wet scrubber Stockpile deposits from crusher are through a telescopic chute Sprinklers on crusher chutes and stockpiles
Conveying	Dust extraction on conveyor transfer stations
Processing plant	Dust extraction systems with bag houses on plant's driers Regular maintenance inspections and repairs on dust extraction ducting and bag houses
Haul/unsealed roads	Applications of dust suppressants to haul roads as required, Operate water carts during dry, windy conditions and summer months
Sealed roads	Onsite road sweeper to clean roads, either weekly or as required.
Trucks	Implement loading and unloading procedures to ensure dust emissions from material handling is minimised
Light vehicles	All site traffic is required to adhere to the site speed limit to minimise dust generated by vehicle movement
Education	All employees are educated regarding dust management onsite in reference to licence conditions, including reporting and best dust management practices
Meteorological conditions	Working in consideration with wind and weather forecasts and dust alerts from the Bureau of Meteorology
Complaints Register	Talison maintain a register of community complaints (which can potentially relate to dust). Complaints are investigated and mitigation undertaken where necessary.

In consideration of the outcomes of this assessment the following additional management and mitigations strategies are recommended:

- As discussed in Table 9-1, the existing TSF1 and TSF2 already have management practices in place for dust control. Current management measures for dust control at TSF1 & TSF2 should be incorporated into the design of TSF4 to ensure dust emissions are minimised from all TSFs
- Continue the program of progressive rehabilitation (vegetation re-establishment) of landforms, particularly the WRL as soon as practicable
- Configure an alarm on the meteorological monitoring station when a wind speed threshold value of 45 km/h or more is reached.

9.2 Dust monitoring plan

Current dust monitoring practises implemented at the Mine are discussed in Table 9-2.

Table 9-2 Current dust monitoring conducted at the Project

Monitoring	Description
Continuous real time meteorological monitoring	Observations captured at the onsite meteorological station. Observations captured include, rainfall, wind speed and direction, temperature, solar radiation, barometric pressure and relative humidity.
High volume sampling	Conducted at the northern end of the site at the boundary with the Greenbushes town site. This location has been agreed with DWER as a part of the regulatory licence L4247/1991/13. Monitoring is undertaken every second day from November to May and weekly from June to October.
Continuous particulate monitoring	Continuous particulate monitoring by the TEOM conducted at a location west of the TSF2 and Maranup Ford Road since January 2013. Between 1998 and 2013 the TEOM was located east of mine site at a location between TSF1 and the South West Highway.

Recommended additional dust monitoring practices which should be considered for implementation include:

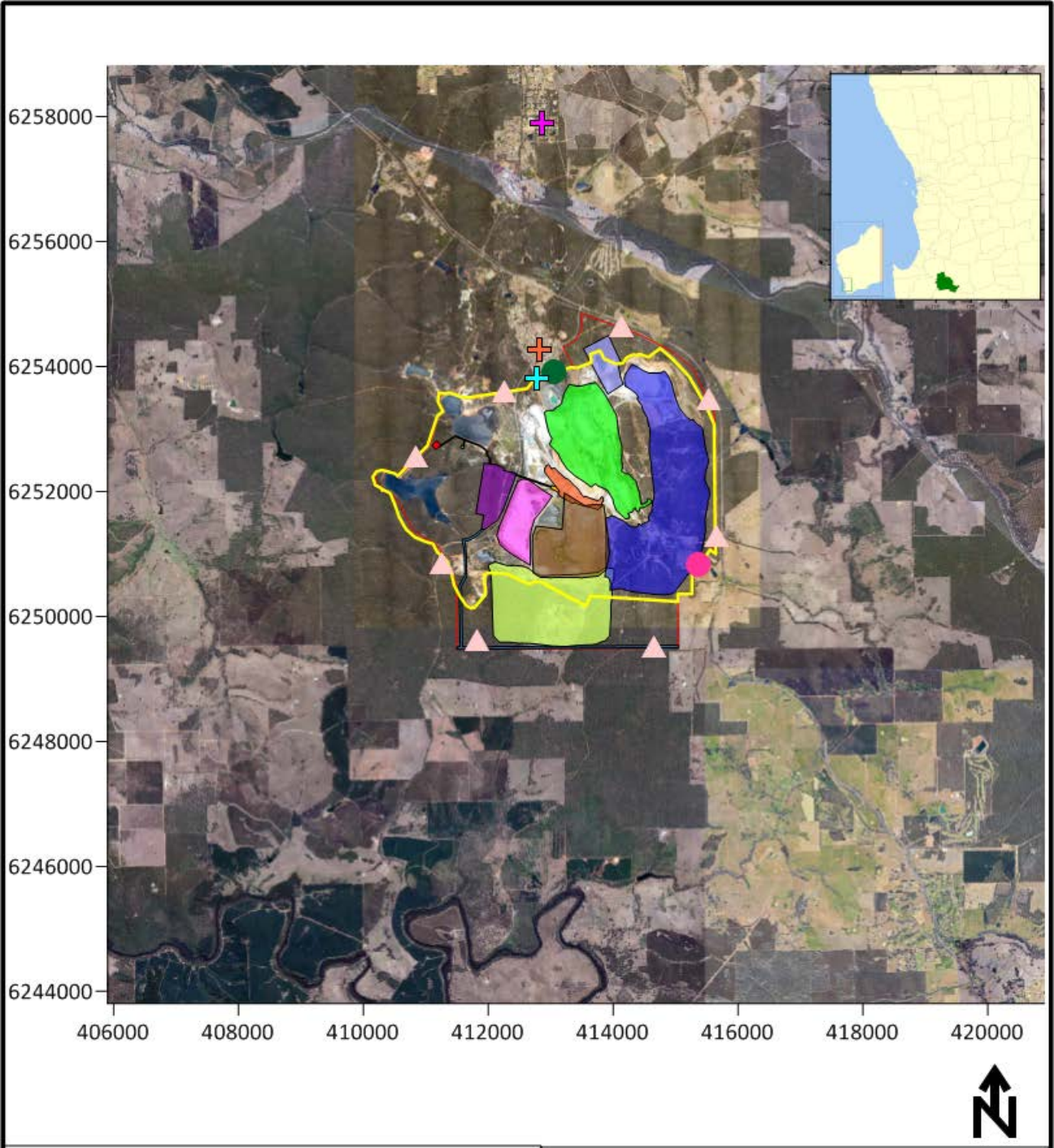
- Commission and install dust deposition gauges. Suggested evenly spaced locations for the gauges around the site are shown in Figure 9-1.
- Check of meteorological conditions prior to blasting events in consideration of a southerly wind to ensure minimal dust impacts to Greenbushes Township.
- Relocate the TEOM to the southeast corner of the WRL. A TEOM can be configured with an alarm system, which can be triggered when set levels (outlined in Table 9-3) are exceeded. Following this, dust control management will be actioned. It is recommended that a monitoring network be established between the pit operations and Greenbushes Township. Another TEOM is advised to be placed on the southeast boundary of the site. Recommended locations for the TEOMs are shown in Figure 9-1.
- Automated remote warning system that can send simultaneous emails and SMS alerts when PM_{10} concentrations exceed trigger values to nominated site personnel.
- Undertake training for nominated individuals to understand dust triggers and the response measures. Response measures for an alert are outlined in Table 9-4. It should be noted that if PM_{10} concentrations are above the screening alert levels it does not, necessarily indicate an exceedance, but does act as a trigger for additional dust mitigation and management.

Table 9-3 Recommended monitoring alert levels

Parameter	Normal	Alert Level
PM_{10} (1 hour average)	<30 µg/m^3	>80 µg/m^3
Meteorological conditions – alert triggered when both wind speed and direction alert levels occur		
Wind speed	4 m/s	Average wind speed >5 m/s
Wind direction	NA	TEOM-1: 70 - 160°
		TEOM-2: 315 - 45°

Table 9-4 Trigger Action – list of potential responses

	Normal	Response to Alert
Dust Monitor Alarm (PM_{10})	Continue work in accordance with dust management procedures	Ensure nominated site personnel notified. Review site conditions and monitoring results. Review operations and consider additional dust mitigation which can be implemented. Cease activities, if required. Consider aerial application of dust suppressant. Spray ore before loading and dumping into haul trucks. Engage any additional water carts. Continue or initiate sprinkler operation on stockpile area.



Legend

- TSF2
- Explosives Batch Facility
- Magazine
- Pit LOM 3 Plants
- CPG3 & 4
- Proposed mine boundary
- Existing mine boundary
- Greenbushes Township
- Greenbushes North
- Existing HiVol
- Recommended dust deposition gauge locations
- Linear Infrastructure Corridor
- TSF1
- Mine Services Area
- Magazine
- Floyds Waste Dump
- Conveyor
- Run of Mine
- TSF4
- TEOM 1
- TEOM 2

0 2000 4000 6000

CREATED: CP	CHECKED: ASI	APPROVED: JP
HORIZONTAL DATUM: WGS 84	PROJECTION: UTM Zone 50 H	
HEIGHT DATUM: m AGL		
DATE: 25.8.2015	FILE LOCATION: G:\61\39597\Tech\Dust Assessment\GIS\Scripts	
REVISION: Rev 0	DRAWING NO: 6139597-FIG-9-1	

TALISON LITHIUM LIMITED
TALISON GREENBUSHES DUST IMPACT ASSESSMENT
AIR QUALITY IMPACT ASSESSMENT

Recommended dust monitoring locations

FIGURE 9-1

GHD CLIENTS | PEOPLE | PERFORMANCE

10. Conclusion

The dust impact assessment has evaluated the potential dust impacts from the proposed expansions at the existing Greenbushes Lithium Mine, located approximately 250 km south of Perth. The expansion will increase production at the Mine from the current approved production rate of 4.7 Mtpa to 9.5 Mtpa of spodumene ore to produce up to 2.3 Mtpa of lithium mineral concentrate.

The year 2028 was considered for predictive air dispersion modelling, as this year represents the maximum amount of activity at the site and thus would have the potential to result in the highest dust emissions. Nearby sensitive receptors were identified and an air dispersion model was developed and used to predict incremental ground level concentrations of dust resulting from the mine expansion as well as cumulative ground level concentrations for the receptors identified.

The assessment used AERMOD to predict TSP, PM_{10} and deposited dust concentrations from the proposed expansion of the Mine.

Predictive air dispersion modelling indicated:

- The predicted incremental maximum daily average and annual average for TSP were below the relevant air quality criteria for all sensitive receptors.
- The 99.9th percentile 1-hour PM_{10} concentrations were predicted to exceed the air quality criteria at seven sensitive receptors. The 99.9th percentile did not include background concentrations. Predicted cumulative maximum daily average and annual average concentrations were below the relevant air quality criteria for all sensitive receptors.
- Concentrations are not predicted to exceed the 24-hour average license condition of 90 µg/m^3 at the HiVol located north of the site.
- Dust deposition rates are predicted to be below the monthly criteria.

Dust management and mitigation methods have been included in this assessment. Implementation of a program of real time dust monitoring and trigger levels to implement additional ad-hoc dust management measure, will reduce the likelihood of exceedances of air quality criteria.

11. References

BoM, 2018. Climate statistics for Australian locations. Monthly climate statistics- Bridgetown. Accessed: 30 May 2018. http://www.bom.gov.au/climate/averages/

DWER, 2018. Licence L4247/1991/13, issued December 2013. Accessed May 2018. https://www.der.wa.gov.au/

EPA WA, 1992. *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations 1992.* Updated August 2014.

EPA Victoria, 2002. *State Environment Protection Policy (Air Quality Management).*

NEPC, 1998. *National environment protection measure for ambient air quality*. Canberra, June 1998, as amended December 2015.

NPI, 2012. *Environment Australia (1999a) National Pollutant Inventory Emission Estimation Technique Manual for Mining*, Environment Australia, Canberra, Australia.

NSW DEC, 2005. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.* Sydney, Updated version December 2017.

Appendices

Appendix A – AERMOD output file

```
**
**********************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 9.2.0
** Lakes Environmental Software Inc.
** Date: 25/06/2018
** File: C:\Talison\TSP\TSP.ADI
**
**********************************
**
**
**********************************
** AERMOD Control Pathway
**********************************
**
**
CO STARTING
  TITLEONE C:\TalLith\TalLith.isc
  MODELOPT CONC VECTORWS
** 1-Hour Averaging Period used for the Percentile/Rolling Average Option
  AVERTIME 1 24 ANNUAL
  POLLUTID TSP
  RUNORNOT RUN
  ERRORFIL TSP.err
CO FINISHED
**
**********************************
** AERMOD Source Pathway
**********************************
**
```

```
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
  LOCATION 2         VOLUME    413702.000 6252672.000     25.000
** DESCRSRC Blasting
  LOCATION 61        VOLUME    413597.550 6252962.350     25.000
** DESCRSRC Drill 1
  LOCATION 62        VOLUME    413417.450 6253174.700     25.000
** DESCRSRC Drill 2
  LOCATION 63        VOLUME    413487.920 6253091.560     25.000
** DESCRSRC Drill 3
  LOCATION 64        VOLUME    413586.580 6253070.920     25.000
** DESCRSRC Drill 4
  LOCATION 65        VOLUME    413595.560 6253169.030     25.000
** DESCRSRC Drill 5
  LOCATION 66        VOLUME    413529.990 6253233.620     25.000
** DESCRSRC Drill 6
  LOCATION 67        VOLUME    413558.330 6253019.370     25.000
** DESCRSRC Drill 7
  LOCATION 3         VOLUME    413103.000 6253097.000    160.000
** DESCRSRC Excavators
  LOCATION 4         VOLUME    413897.000 6252834.000    172.212
** DESCRSRC Excavators
  LOCATION 5         VOLUME    413541.000 6252417.000    171.433
** DESCRSRC Excavators
  LOCATION 6         VOLUME    414209.000 6251837.000    170.000
** DESCRSRC Excavators
  LOCATION 7         VOLUME    413103.000 6253097.000    160.000
** DESCRSRC Loaders
  LOCATION 8         VOLUME    413897.000 6252834.000    172.212
```

** DESCRSRC Loaders

LOCATION 9 VOLUME 413541.000 6252417.000 171.433

** DESCRSRC Loaders

LOCATION 10 VOLUME 414209.000 6251837.000 170.000

** DESCRSRC Loaders

LOCATION 11 VOLUME 414250.000 6251978.000 192.973

** DESCRSRC Rockbreakers

LOCATION 12 VOLUME 413973.000 6252620.000 189.275

** DESCRSRC Rockbreakers

LOCATION 13 VOLUME 412987.000 6252210.000 275.226

** DESCRSRC Rockbreakers

LOCATION 14 VOLUME 413104.000 6252020.000 271.637

** DESCRSRC Conveyor transfer point 1

LOCATION 15 VOLUME 412404.000 6252262.000 257.064

** DESCRSRC Conveyor transfer point 2

LOCATION 16 VOLUME 412692.000 6252971.000 282.747

** DESCRSRC 3 stage crusher (for CPG 1 & CPG2)

LOCATION 17 VOLUME 412123.000 6252207.000 254.246

** DESCRSRC 2 stage crushing (for CPG3 & CPG 4)

LOCATION 18 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC ROM stockpile (for TIL, CPG1 & CPG2)

LOCATION 19 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC Fine ore stockpile - CPG3 & CPG 4

LOCATION 20 VOLUME 411964.000 6251901.000 253.847

** DESCRSRC Final Product Stockpile - CPG3 & CPG 4

LOCATION 21 VOLUME 411649.000 6251575.000 252.734

** DESCRSRC ROM stockpile (for CPG3 & CPG4)

LOCATION 22 VOLUME 413636.000 6253298.000 120.000

** DESCRSRC Dozer - pits

LOCATION 23 VOLUME 414185.000 6251979.000 163.551

** DESCRSRC Dozer - pits

LOCATION 24 VOLUME 414784.000 6253373.000 330.000

** DESCRSRC Dozer - waste

LOCATION 25 VOLUME 415171.000 6252015.000 290.000

** DESCRSRC Dozer - waste

LOCATION 26 VOLUME 414428.000 6250782.000 280.000

** DESCRSRC Dozer - waste

LOCATION 27 VOLUME 415031.000 6253549.000 283.425

** DESCRSRC Haultruck1 - north end to waste dump

LOCATION 28 VOLUME 414704.000 6253963.000 292.486

** DESCRSRC Haultruck2 - north end to waste dump

LOCATION 29 VOLUME 414100.000 6253671.000 301.342

** DESCRSRC Haultruck3 - north end to waste dump

LOCATION 30 VOLUME 413954.000 6253554.000 304.056

** DESCRSRC Haultruck4 - north end to waste dump

LOCATION 31 VOLUME 414271.000 6253468.000 307.482

** DESCRSRC Haultruck5 - north end to waste dump

LOCATION 32 VOLUME 414070.000 6253379.000 303.134

** DESCRSRC Haultruck6 - north end to waste dump

LOCATION 33 VOLUME 413517.000 6253705.000 320.000

** DESCRSRC Haultruck7 - north end to waste dump

LOCATION 34 VOLUME 412497.000 6253262.000 279.660

** DESCRSRC Haultruck8 - south end to processing facility

LOCATION 35 VOLUME 412480.000 6252874.000 263.016

** DESCRSRC Haultruck9 - south end to processing facility

LOCATION 36 VOLUME 412506.000 6252553.000 262.604

** DESCRSRC Haultruck10 - south end to processing facility

LOCATION 37 VOLUME 412883.000 6252727.000 312.025

** DESCRSRC Haultruck11 - south end to processing facility

LOCATION 38 VOLUME 412357.000 6251781.000 254.771

** DESCRSRC Haultruck12 - south end to processing facility

LOCATION 39 VOLUME 412106.000 6251292.000 239.249

** DESCRSRC Haultruck13 - south end to processing facility

LOCATION 40 VOLUME 412704.000 6250747.000 276.166

** DESCRSRC Haultruck14 - south end to processing facility

LOCATION 41 VOLUME 412696.000 6251466.000 258.900

** DESCRSRC Haultruck15 - south end to processing facility

LOCATION 42 VOLUME 413021.000 6251924.000 266.412

** DESCRSRC Haultruck16 - south end to processing facility

LOCATION 43 VOLUME 413139.000 6252398.000 310.848

** DESCRSRC Haultruck17 - south end to processing facility

LOCATION 44 VOLUME 413405.000 6252114.000 304.703

** DESCRSRC Haultruck18 - south end to processing facility

LOCATION 45 VOLUME 413676.000 6251863.000 297.813

** DESCRSRC Haultruck19 - south end to processing facility

LOCATION 46 VOLUME 413872.000 6251792.000 276.915

** DESCRSRC Haultruck20 - south end to processing facility

LOCATION 47 VOLUME 413916.000 6251316.000 288.061

** DESCRSRC Haultruck21 - south end to processing facility

LOCATION 48 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck22 - south end to processing facility

LOCATION 49 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck23 - south end to processing facility

LOCATION 50 VOLUME 414522.000 6251639.000 245.665

** DESCRSRC Haultruck24 - south end to processing facility

LOCATION 51 VOLUME 414502.000 6252041.000 267.758

** DESCRSRC Haultruck25 - south end to processing facility

LOCATION 52 VOLUME 414324.000 6252377.000 287.683

** DESCRSRC Haultruck26 - south end to processing facility

LOCATION 53 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC WE - ROM stockpile

LOCATION 54 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC WE - ROM stockpile

```
 LOCATION 55        VOLUME    411964.000  6251901.000     253.847
** DESCRSRCWE - Fine ore stockpile
 LOCATION 56        VOLUME    411649.000  6251575.000     252.734
** DESCRSRCWE - Final Product Stockpile
 LOCATION 57        VOLUME    414129.000  6252029.000     154.268
** DESCRSRCWE - Pits1
 LOCATION 58        VOLUME    413165.000  6252893.000     168.140
** DESCRSRCWE - Pits2
 LOCATION 71        VOLUME    413738.000  6252728.000     150.000
** DESCRSRCWE - Pits3
 LOCATION 60        VOLUME    415171.000  6252015.000     290.000
** DESCRSRCWE -Waste dump
 LOCATION 68        VOLUME    413229.000  6250880.000     280.000
** DESCRSRCWE - TSF1-1
 LOCATION 69        VOLUME    413519.000  6251490.000     280.000
** DESCRSRCWE - TSF1-2
 LOCATION 59        VOLUME    412668.000  6250295.000     263.054
** DESCRSRCWE - TSF4-2
 LOCATION 70        VOLUME    414058.000  6250269.000     280.000
** DESCRSRCWE - TSF4-1
** Source Parameters **
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 SRCPARAM 61    0.0245833333    1.000    1.163    0.465
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 SRCPARAM 63    0.0245833333    1.000    1.163    0.465
 SRCPARAM 64    0.0245833333    1.000    1.163    0.465
 SRCPARAM 65    0.0245833333    1.000    1.163    0.465
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 SRCPARAM 3     1.3179382293    1.000    1.163    0.465
 SRCPARAM 4     1.3179382293    1.000    1.163    0.465
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SRCPARAM 6	1.3179382293	1.000	0.698	0.465
SRCPARAM 7	1.3179382293	1.000	0.698	0.465
SRCPARAM 8	1.3179382293	1.000	0.698	0.465
SRCPARAM 9	1.3179382293	1.000	0.698	0.465
SRCPARAM 10	1.3179382293	1.000	1.304	0.465
SRCPARAM 11	1.7572509724	1.000	0.698	0.465
SRCPARAM 12	1.7572509724	1.000	1.304	0.465
SRCPARAM 13	1.7572509724	1.000	1.304	0.465
SRCPARAM 14	0.003584792	2.000	0.435	0.930
SRCPARAM 15	0.003584792	3.000	0.435	0.930
SRCPARAM 16	0.4558282598	2.500	4.348	1.163
SRCPARAM 17	1.4269406393	2.500	4.348	1.163
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SRCPARAM 19	0.0091324201	1.000	0.698	0.465
SRCPARAM 20	0.1369863014	1.000	0.698	0.465
SRCPARAM 21	3.4246575342	1.000	0.698	0.465
SRCPARAM 22	3.3055555556	1.000	0.698	0.465
SRCPARAM 23	3.3055555556	1.000	0.698	0.465
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SRCPARAM 26	1.9833333333	1.000	0.698	0.465
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SRCPARAM 28	0.0640419413	1.000	0.410	0.465
SRCPARAM 29	0.0640419413	1.000	0.410	0.465
SRCPARAM 30	0.0640419413	1.000	0.410	0.465
SRCPARAM 31	0.0640419413	1.000	0.410	0.465
SRCPARAM 32	0.0640419413	1.000	0.410	0.465
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  SRCPARAM 40        0.0792108117   1.000   0.410   0.465
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  SRCPARAM 42        0.0792108117   1.000   0.410   0.465
  SRCPARAM 43        0.0792108117   1.000   0.410   0.465
  SRCPARAM 44        0.0792108117   1.000   0.410   0.465
  SRCPARAM 45        0.0792108117   1.000   0.410   0.465
  SRCPARAM 46        0.0792108117   1.000   0.410   0.465
  SRCPARAM 47        0.0792108117   1.000   0.410   0.465
  SRCPARAM 48        0.0792108117   1.000   0.410   0.465
  SRCPARAM 49        0.0792108117   1.000   0.410   0.465
  SRCPARAM 50        0.0792108117   1.000   0.410   0.465
  SRCPARAM 51        0.0792108117   1.000   0.410   0.465
  SRCPARAM 52        0.0792108117   1.000   0.410   0.465
  SRCPARAM 53        0.0039269908   2.500   1.163   1.163
  SRCPARAM 54        0.0039269908   2.500   1.163   1.163
  SRCPARAM 55        0.0117809725   2.500   1.163   1.163
  SRCPARAM 56        0.0017671459   2.500   1.163   1.163
  SRCPARAM 57        1.3888888889   0.500   46.512   0.116
  SRCPARAM 58        1.3888888889   0.500   46.512   0.116
  SRCPARAM 71        1.3888888889   0.500   46.512   0.116
  SRCPARAM 60          0.378   0.500   209.302   0.500
  SRCPARAM 68        0.3033333333   0.500   93.023   0.116
  SRCPARAM 69        0.1213333333   0.500   93.023   0.116
  SRCPARAM 59        0.4666666667   0.500   93.023   0.116
  SRCPARAM 70        0.4666666667   0.500   93.023   0.116
  SRCGROUP ALL

SO FINISHED
```

```
**
**************************************
** AERMOD Receptor Pathway
**************************************
**
**
RE STARTING
** DESCRREC"" ""
  DISCCART   412813.00  6253855.00  330.47  335.00
  DISCCART   412980.00  6253966.00  325.53  336.00
  DISCCART   413106.00  6254150.00  322.20  335.00
  DISCCART   413196.00  6254323.00  332.25  341.00
  DISCCART   413190.20  6254372.57  331.37  343.00
  DISCCART   413227.00  6254476.00  341.11  341.11
  DISCCART   413599.00  6255592.00  292.17  292.17
  DISCCART   415772.00  6253756.00  227.10  282.00
  DISCCART   416238.00  6253607.00  264.07  284.00
  DISCCART   415896.00  6252964.00  234.45  247.00
  DISCCART   416041.00  6252630.00  224.13  261.00
  DISCCART   417034.00  6250703.00  250.77  250.77
  DISCCART   416360.00  6250255.00  223.33  274.00
  DISCCART   415676.00  6250526.00  225.00  280.00
  DISCCART   416054.00  6249386.00  267.21  267.21
  DISCCART   415894.00  6249284.00  267.86  284.00
  DISCCART   413363.00  6248888.00  257.10  282.00
  DISCCART   411793.00  6248510.00  267.13  267.13
  DISCCART   411021.00  6248757.00  254.80  288.00
  DISCCART   409264.00  6249013.00  246.28  264.00
  DISCCART   405054.00  6249792.00  117.96  333.00
  DISCCART   407477.00  6252988.00  222.07  278.00
  DISCCART   412460.00  6256660.00  288.78  288.78
```

```
  DISCCART   413097.00  6257623.00  287.32  287.32
  DISCCART   414987.00  6256777.00  283.14  293.00
  DISCCART   416674.00  6248781.00  192.77  287.00
  DISCCART   416316.00  6247838.00  241.17  241.17
  DISCCART   414793.00  6246500.00  246.70  294.00
RE FINISHED
**
**********************************
** AERMOD Meteorology Pathway
**********************************
**
**
ME STARTING
** Surface File Path: C:\Talison\TSP\
  SURFFILE Surf_1June18.sfc
** Profile File Path: C:\Talison\TSP\
  PROFFILE Prof_1June18.pfl
  SURFDATA 54321 2015
  UAIRDATA 54321 2015
  SITEDATA 99999 2015
  PROFBASE 10.0 METERS
ME FINISHED
**
**********************************
** AERMOD Output Pathway
**********************************
**
**
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 24 1ST
```

```
  DAYTABLE ALLAVE
** 1-Hour Binary POSTFILE for the Percentile/Rolling Average Option
  POSTFILE 1 ALL UNFORM C:\Talison\TSP\TSP.AD\1HGALLUN.POS 31
** Maximum Annual Average POST files for Each Met Year
  POSTFILE ANNUAL ALL PLOT C:\Talison\TSP\TSP.AD\ANNUAL_G001.PLT 32
** Auto-Generated Plotfiles
  PLOTFILE 24 ALL 1ST C:\Talison\TSP\TSP.AD\24H1GALL.PLT 33
  PLOTFILE ANNUAL ALL C:\Talison\TSP\TSP.AD\AN00GALL.PLT 34
OU FINISHED
**
**
**************************************
** Percentile/Rolling Average
**************************************
** PERCOPTN ON
** ROLLOPTN OFF
** SKIPCALM OFF
** ROLLPATH C:\Talison\TSP\TSP.AD\Percentile\
** PERVALUE = 99.90
**
**
**************************************
** Project Parameters
**************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    World Geodetic System 1984
** DTMRGN   Global Definition
** UNITS    m
** ZONE     -50
** ZONEINX  0
```

**

```
**
**************************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 9.2.0
** Lakes Environmental Software Inc.
** Date: 25/06/2018
** File: C:\Talison\PM10\TalLith_nogrid.ADI
**
**************************************
**
**
**************************************
** AERMOD Control Pathway
**************************************
**
**
CO STARTING
  TITLEONE C:\TalLith\TalLith.isc
  MODELOPT CONC VECTORWS
  AVERTIME 1 24 ANNUAL
  POLLUTID PM_10
  RUNORNOT RUN
  ERRORFIL TalLith_nogrid.err
CO FINISHED
**
**************************************
** AERMOD Source Pathway
**************************************
**
**
```

SO STARTING

** Source Location **

** Source ID - Type - X Coord. - Y Coord. **

LOCATION 2 VOLUME 413702.000 6252672.000 25.000

** DESCRSRC Blasting

LOCATION 61 VOLUME 413597.550 6252962.350 25.000

** DESCRSRC Drill 1

LOCATION 62 VOLUME 413417.450 6253174.700 25.000

** DESCRSRC Drill 2

LOCATION 63 VOLUME 413487.920 6253091.560 25.000

** DESCRSRC Drill 3

LOCATION 64 VOLUME 413586.580 6253070.920 25.000

** DESCRSRC Drill 4

LOCATION 65 VOLUME 413595.560 6253169.030 25.000

** DESCRSRC Drill 5

LOCATION 66 VOLUME 413529.990 6253233.620 25.000

** DESCRSRC Drill 6

LOCATION 67 VOLUME 413558.330 6253019.370 25.000

** DESCRSRC Drill 7

LOCATION 3 VOLUME 413103.000 6253097.000 160.000

** DESCRSRC Excavators

LOCATION 4 VOLUME 413897.000 6252834.000 172.212

** DESCRSRC Excavators

LOCATION 5 VOLUME 413541.000 6252417.000 171.433

** DESCRSRC Excavators

LOCATION 6 VOLUME 414209.000 6251837.000 170.000

** DESCRSRC Excavators

LOCATION 7 VOLUME 413103.000 6253097.000 160.000

** DESCRSRC Loaders

LOCATION 8 VOLUME 413897.000 6252834.000 172.212

** DESCRSRC Loaders

LOCATION 9 VOLUME 413541.000 6252417.000 171.433

** DESCRSRC Loaders

LOCATION 10 VOLUME 414209.000 6251837.000 170.000

** DESCRSRC Loaders

LOCATION 11 VOLUME 414250.000 6251978.000 192.973

** DESCRSRC Rockbreakers

LOCATION 12 VOLUME 413973.000 6252620.000 189.275

** DESCRSRC Rockbreakers

LOCATION 13 VOLUME 412987.000 6252210.000 275.226

** DESCRSRC Rockbreakers

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** DESCRSRC Conveyor transfer point 1

LOCATION 15 VOLUME 412404.000 6252262.000 257.064

** DESCRSRC Conveyor transfer point 2

LOCATION 16 VOLUME 412692.000 6252971.000 282.747

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LOCATION 17 VOLUME 412123.000 6252207.000 254.246

** DESCRSRC 2 stage crushing (for CPG3 & CPG 4)

LOCATION 18 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC ROM stockpile (for TIL, CPG1 & CPG2)

LOCATION 19 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC Fine ore stockpile - CPG3 & CPG 4

LOCATION 20 VOLUME 411964.000 6251901.000 253.847

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** DESCRSRC Dozer - pits

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** DESCRSRC Dozer - pits

LOCATION 24 VOLUME 414784.000 6253373.000 330.000

** DESCRSRC Dozer - waste

LOCATION 25 VOLUME 415171.000 6252015.000 290.000

** DESCRSRC Dozer - waste

LOCATION 26 VOLUME 414428.000 6250782.000 280.000

** DESCRSRC Dozer - waste

LOCATION 27 VOLUME 415031.000 6253549.000 283.425

** DESCRSRC Haultruck1 - north end to waste dump

LOCATION 28 VOLUME 414704.000 6253963.000 292.486

** DESCRSRC Haultruck2 - north end to waste dump

LOCATION 29 VOLUME 414100.000 6253671.000 301.342

** DESCRSRC Haultruck3 - north end to waste dump

LOCATION 30 VOLUME 413954.000 6253554.000 304.056

** DESCRSRC Haultruck4 - north end to waste dump

LOCATION 31 VOLUME 414271.000 6253468.000 307.482

** DESCRSRC Haultruck5 - north end to waste dump

LOCATION 32 VOLUME 414070.000 6253379.000 303.134

** DESCRSRC Haultruck6 - north end to waste dump

LOCATION 33 VOLUME 413517.000 6253705.000 320.000

** DESCRSRC Haultruck7 - north end to waste dump

LOCATION 34 VOLUME 412497.000 6253262.000 279.660

** DESCRSRC Haultruck8 - south end to processing facility

LOCATION 35 VOLUME 412480.000 6252874.000 263.016

** DESCRSRC Haultruck9 - south end to processing facility

LOCATION 36 VOLUME 412506.000 6252553.000 262.604

** DESCRSRC Haultruck10 - south end to processing facility

LOCATION 37 VOLUME 412883.000 6252727.000 312.025

** DESCRSRC Haultruck11 - south end to processing facility

LOCATION 38 VOLUME 412357.000 6251781.000 254.771

** DESCRSRC Haultruck12 - south end to processing facility

LOCATION 39 VOLUME 412106.000 6251292.000 239.249

** DESCRSRC Haultruck13 - south end to processing facility

LOCATION 40 VOLUME 412704.000 6250747.000 276.166

** DESCRSRC Haultruck14 - south end to processing facility

LOCATION 41 VOLUME 412696.000 6251466.000 258.900

** DESCRSRC Haultruck15 - south end to processing facility

LOCATION 42 VOLUME 413021.000 6251924.000 266.412

** DESCRSRC Haultruck16 - south end to processing facility

LOCATION 43 VOLUME 413139.000 6252398.000 310.848

** DESCRSRC Haultruck17 - south end to processing facility

LOCATION 44 VOLUME 413405.000 6252114.000 304.703

** DESCRSRC Haultruck18 - south end to processing facility

LOCATION 45 VOLUME 413676.000 6251863.000 297.813

** DESCRSRC Haultruck19 - south end to processing facility

LOCATION 46 VOLUME 413872.000 6251792.000 276.915

** DESCRSRC Haultruck20 - south end to processing facility

LOCATION 47 VOLUME 413916.000 6251316.000 288.061

** DESCRSRC Haultruck21 - south end to processing facility

LOCATION 48 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck22 - south end to processing facility

LOCATION 49 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck23 - south end to processing facility

LOCATION 50 VOLUME 414522.000 6251639.000 245.665

** DESCRSRC Haultruck24 - south end to processing facility

LOCATION 51 VOLUME 414502.000 6252041.000 267.758

** DESCRSRC Haultruck25 - south end to processing facility

LOCATION 52 VOLUME 414324.000 6252377.000 287.683

** DESCRSRC Haultruck26 - south end to processing facility

LOCATION 53 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC WE - ROM stockpile

LOCATION 54 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC WE - ROM stockpile

LOCATION 55 VOLUME 411964.000 6251901.000 253.847

```
** DESCRSRCWE - Fine ore stockpile
  LOCATION 56         VOLUME    411649.000  6251575.000     252.734
** DESCRSRCWE - Final Product Stockpile
  LOCATION 57         VOLUME    414129.000  6252029.000     154.268
** DESCRSRCWE - Pits1
  LOCATION 58         VOLUME    413165.000  6252893.000     168.140
** DESCRSRCWE - Pits2
  LOCATION 71         VOLUME    413738.000  6252728.000     150.000
** DESCRSRCWE - Pits3
  LOCATION 60         VOLUME    415171.000  6252015.000     290.000
** DESCRSRCWE -Waste dump
  LOCATION 68         VOLUME    413229.000  6250880.000     280.000
** DESCRSRCWE - TSF1-1
  LOCATION 69         VOLUME    413519.000  6251490.000     280.000
** DESCRSRCWE - TSF1-2
  LOCATION 59         VOLUME    412668.000  6250295.000     263.054
** DESCRSRCWE - TSF4-2
  LOCATION 70         VOLUME    414058.000  6250269.000     280.000
** DESCRSRCWE - TSF4-1
** Source Parameters **
  SRCPARAM 2            2.4    1.000    1.163    0.465
  SRCPARAM 61         0.013    1.000    1.163    0.465
  SRCPARAM 62         0.013    1.000    1.163    0.465
  SRCPARAM 63         0.013    1.000    1.163    0.465
  SRCPARAM 64         0.013    1.000    1.163    0.465
  SRCPARAM 65         0.013    1.000    1.163    0.465
  SRCPARAM 66         0.013    1.000    1.163    0.465
  SRCPARAM 67         0.013    1.000    1.163    0.465
  SRCPARAM 3     0.6326103501    1.000    1.163    0.465
  SRCPARAM 4     0.6326103501    1.000    1.163    0.465
  SRCPARAM 5     0.6326103501    1.000    0.698    0.465
```

SRCPARAM 6	0.6326103501	1.000	0.698	0.465
SRCPARAM 7	0.6326103501	1.000	0.698	0.465
SRCPARAM 8	0.6326103501	1.000	0.698	0.465
SRCPARAM 9	0.6326103501	1.000	0.698	0.465
SRCPARAM 10	0.6326103501	1.000	1.304	0.465
SRCPARAM 11	0.8434804668	1.000	0.698	0.465
SRCPARAM 12	0.8434804668	1.000	1.304	0.465
SRCPARAM 13	0.8434804668	1.000	1.304	0.465
SRCPARAM 14	0.0117786022	2.000	0.435	0.930
SRCPARAM 15	0.0117786022	3.000	0.435	0.930
SRCPARAM 16	0.045582826	2.500	4.348	1.163
SRCPARAM 17	0.1426940639	2.500	4.348	1.163
SRCPARAM 18	0.9481227803	1.000	0.698	0.465
SRCPARAM 19	0.0042808219	1.000	0.698	0.465
SRCPARAM 20	0.0582191781	1.000	0.698	0.465
SRCPARAM 21	1.4840182648	1.000	0.698	0.465
SRCPARAM 22	0.3416666667	1.000	0.698	0.465
SRCPARAM 23	0.3416666667	1.000	0.698	0.465
SRCPARAM 24	0.4783333333	1.000	0.698	0.465
SRCPARAM 25	0.4783333333	1.000	0.698	0.465
SRCPARAM 26	0.4783333333	1.000	0.698	0.465
SRCPARAM 27	0.0081106815	1.000	0.410	0.465
SRCPARAM 28	0.0081106815	1.000	0.410	0.465
SRCPARAM 29	0.0081106815	1.000	0.410	0.465
SRCPARAM 30	0.0081106815	1.000	0.410	0.465
SRCPARAM 31	0.0081106815	1.000	0.410	0.465
SRCPARAM 32	0.0081106815	1.000	0.410	0.465
SRCPARAM 33	0.0081106815	1.000	0.410	0.465
SRCPARAM 34	0.0081106815	1.000	0.410	0.465
SRCPARAM 35	0.0234074503	1.000	0.410	0.465
SRCPARAM 36	0.0234074503	1.000	0.410	0.465

```
  SRCPARAM 37        0.0234074503   1.000   0.410   0.465
  SRCPARAM 38        0.0234074503   1.000   0.410   0.465
  SRCPARAM 39        0.0234074503   1.000   0.410   0.465
  SRCPARAM 40        0.0234074503   1.000   0.410   0.465
  SRCPARAM 41        0.0234074503   1.000   0.410   0.465
  SRCPARAM 42        0.0234074503   1.000   0.410   0.465
  SRCPARAM 43        0.0234074503   1.000   0.410   0.465
  SRCPARAM 44        0.0234074503   1.000   0.410   0.465
  SRCPARAM 45        0.0234074503   1.000   0.410   0.465
  SRCPARAM 46        0.0234074503   1.000   0.410   0.465
  SRCPARAM 47        0.0234074503   1.000   0.410   0.465
  SRCPARAM 48        0.0234074503   1.000   0.410   0.465
  SRCPARAM 49        0.0234074503   1.000   0.410   0.465
  SRCPARAM 50        0.0234074503   1.000   0.410   0.465
  SRCPARAM 51        0.0234074503   1.000   0.410   0.465
  SRCPARAM 52        0.0234074503   1.000   0.410   0.465
  SRCPARAM 53        0.0039269908   2.500   1.163   1.163
  SRCPARAM 54        0.0039269908   2.500   1.163   1.163
  SRCPARAM 55        0.0117809725   2.500   1.163   1.163
  SRCPARAM 56        0.0017671459   2.500   1.163   1.163
  SRCPARAM 57             0.7   0.500  46.512   0.116
  SRCPARAM 58             0.5   0.500  46.512   0.116
  SRCPARAM 71             0.7   0.500  46.512   0.116
  SRCPARAM 60             0.2   0.500 209.302   0.500
  SRCPARAM 68       0.1516666667   0.500  93.023   0.116
  SRCPARAM 69       0.0606666667   0.500  93.023   0.116
  SRCPARAM 59             0.2   0.500  93.023   0.116
  SRCPARAM 70             0.2   0.500  93.023   0.116
  SRCGROUP ALL
SO FINISHED
**
```

```
**************************************
** AERMOD Receptor Pathway
**************************************
**
**
RE STARTING
** DESCRREC"" ""
  DISCCART   412813.00  6253855.00  330.47  335.00
  DISCCART   412980.00  6253966.00  325.53  336.00
  DISCCART   413106.00  6254150.00  322.20  335.00
  DISCCART   413196.00  6254323.00  332.25  341.00
  DISCCART   413227.00  6254476.00  341.11  341.11
  DISCCART   413599.00  6255592.00  292.17  292.17
  DISCCART   412460.00  6256660.00  288.78  288.78
  DISCCART   413097.00  6257623.00  287.32  287.32
  DISCCART   414987.00  6256777.00  283.14  293.00
  DISCCART   415772.00  6253756.00  227.10  282.00
  DISCCART   416238.00  6253607.00  264.07  284.00
  DISCCART   415896.00  6252964.00  234.45  247.00
  DISCCART   416041.00  6252630.00  224.13  261.00
  DISCCART   417034.00  6250703.00  250.77  250.77
  DISCCART   415676.00  6250526.00  225.00  280.00
  DISCCART   416360.00  6250255.00  223.33  274.00
  DISCCART   416054.00  6249386.00  267.21  267.21
  DISCCART   415894.00  6249284.00  267.86  284.00
  DISCCART   416674.00  6248781.00  192.77  287.00
  DISCCART   416316.00  6247838.00  241.17  241.17
  DISCCART   414793.00  6246500.00  246.70  294.00
  DISCCART   413363.00  6248888.00  257.10  282.00
  DISCCART   411793.00  6248510.00  267.13  267.13
  DISCCART   411021.00  6248757.00  254.80  288.00
```

```
  DISCCART    409264.00  6249013.00  246.28  264.00
  DISCCART    407477.00  6252988.00  222.07  278.00
  DISCCART    405054.00  6249792.00  117.96  333.00
  DISCCART    413190.20  6254372.57  331.37  343.00
RE FINISHED
**
**********************************
** AERMOD Meteorology Pathway
**********************************
**
**
ME STARTING
** Surface File Path: C:\Talison\PM10\
  SURFFILE Surf_1June18.sfc
** Profile File Path: C:\Talison\PM10\
  PROFFILE Prof_1June18.pfl
  SURFDATA 54321 2015
  UAIRDATA 54321 2015
  SITEDATA 99999 2015
  PROFBASE 10.0 METERS
ME FINISHED
**
**********************************
** AERMOD Output Pathway
**********************************
**
**
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 1 1ST
  RECTABLE 24 1ST
```

```
  DAYTABLE 24
  POSTFILE 24 ALL PLOT C:\Talison\PM10\TALLITH_NOGRID.AD\24_ALL.POS 31
** 1-Hour Binary POSTFILE for the Percentile/Rolling Average Option
  POSTFILE 1 ALL UNFORM C:\Talison\PM10\TalLith_nogrid.AD\1HGALLUN.POS 32
** Maximum Annual Average POST files for Each Met Year
  POSTFILE ANNUAL ALL PLOT C:\Talison\PM10\TALLITH_NOGRID.AD\ANNUAL_G001.PLT 33
** Auto-Generated Plotfiles
  PLOTFILE 1 ALL 1ST C:\Talison\PM10\TALLITH_NOGRID.AD\01H1GALL.PLT 34
  PLOTFILE 24 ALL 1ST C:\Talison\PM10\TALLITH_NOGRID.AD\24H1GALL.PLT 35
  PLOTFILE ANNUAL ALL C:\Talison\PM10\TALLITH_NOGRID.AD\AN00GALL.PLT 36
  SUMMFILE C:\Talison\PM10\TalLith_nogrid.sum
OU FINISHED
**
**
**************************************
** Percentile/Rolling Average
**************************************
** PERCOPTN ON
** ROLLOPTN OFF
** SKIPCALM OFF
** ROLLPATH C:\Talison\PM10\TalLith_nogrid.AD\Percentile\
** PERVALUE = 99.90
**
**
**************************************
** Project Parameters
**************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    World Geodetic System 1984
** DTMRGN   Global Definition
```

** UNITS m

** ZONE -50

** ZONEINX 0

**

```
**
**************************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 9.2.0
** Lakes Environmental Software Inc.
** Date: 25/06/2018
** File: C:\Talison\DD\DD.ADI
**
**************************************
**
**
**************************************
** AERMOD Control Pathway
**************************************
**
**
CO STARTING
  TITLEONE C:\TalLith\TalLith.isc
  MODELOPT CONC DDEP DRYDPLT VECTORWS
** 1-Hour Averaging Period used for the Percentile/Rolling Average Option
  AVERTIME 1 MONTH ANNUAL
  POLLUTID TSP
  RUNORNOT RUN
  ERRORFIL DD.err
CO FINISHED
**
**************************************
** AERMOD Source Pathway
**************************************
**
```

```
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
  LOCATION 2         VOLUME    413702.000 6252672.000     25.000
** DESCRSRC Blasting
  LOCATION 61        VOLUME    413597.550 6252962.350     25.000
** DESCRSRC Drill 1
  LOCATION 62        VOLUME    413417.450 6253174.700     25.000
** DESCRSRC Drill 2
  LOCATION 63        VOLUME    413487.920 6253091.560     25.000
** DESCRSRC Drill 3
  LOCATION 64        VOLUME    413586.580 6253070.920     25.000
** DESCRSRC Drill 4
  LOCATION 65        VOLUME    413595.560 6253169.030     25.000
** DESCRSRC Drill 5
  LOCATION 66        VOLUME    413529.990 6253233.620     25.000
** DESCRSRC Drill 6
  LOCATION 67        VOLUME    413558.330 6253019.370     25.000
** DESCRSRC Drill 7
  LOCATION 3         VOLUME    413103.000 6253097.000    160.000
** DESCRSRC Excavators
  LOCATION 4         VOLUME    413897.000 6252834.000    172.212
** DESCRSRC Excavators
  LOCATION 5         VOLUME    413541.000 6252417.000    171.433
** DESCRSRC Excavators
  LOCATION 6         VOLUME    414209.000 6251837.000    170.000
** DESCRSRC Excavators
  LOCATION 7         VOLUME    413103.000 6253097.000    160.000
** DESCRSRC Loaders
  LOCATION 8         VOLUME    413897.000 6252834.000    172.212
```

** DESCRSRC Loaders

LOCATION 9 VOLUME 413541.000 6252417.000 171.433

** DESCRSRC Loaders

LOCATION 10 VOLUME 414209.000 6251837.000 170.000

** DESCRSRC Loaders

LOCATION 11 VOLUME 414250.000 6251978.000 192.973

** DESCRSRC Rockbreakers

LOCATION 12 VOLUME 413973.000 6252620.000 189.275

** DESCRSRC Rockbreakers

LOCATION 13 VOLUME 412987.000 6252210.000 275.226

** DESCRSRC Rockbreakers

LOCATION 14 VOLUME 413104.000 6252020.000 271.637

** DESCRSRC Conveyor transfer point 1

LOCATION 15 VOLUME 412404.000 6252262.000 257.064

** DESCRSRC Conveyor transfer point 2

LOCATION 16 VOLUME 412692.000 6252971.000 282.747

** DESCRSRC 3 stage crusher (for CPG 1 & CPG2)

LOCATION 17 VOLUME 412123.000 6252207.000 254.246

** DESCRSRC 2 stage crushing (for CPG3 & CPG 4)

LOCATION 18 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC ROM stockpile (for TIL, CPG1 & CPG2)

LOCATION 19 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC Fine ore stockpile - CPG3 & CPG 4

LOCATION 20 VOLUME 411964.000 6251901.000 253.847

** DESCRSRC Final Product Stockpile - CPG3 & CPG 4

LOCATION 21 VOLUME 411649.000 6251575.000 252.734

** DESCRSRC ROM stockpile (for CPG3 & CPG4)

LOCATION 22 VOLUME 413636.000 6253298.000 120.000

** DESCRSRC Dozer - pits

LOCATION 23 VOLUME 414185.000 6251979.000 163.551

** DESCRSRC Dozer - pits

LOCATION 24 VOLUME 414784.000 6253373.000 330.000

** DESCRSRC Dozer - waste

LOCATION 25 VOLUME 415171.000 6252015.000 290.000

** DESCRSRC Dozer - waste

LOCATION 26 VOLUME 414428.000 6250782.000 280.000

** DESCRSRC Dozer - waste

LOCATION 27 VOLUME 415031.000 6253549.000 283.425

** DESCRSRC Haultruck1 - north end to waste dump

LOCATION 28 VOLUME 414704.000 6253963.000 292.486

** DESCRSRC Haultruck2 - north end to waste dump

LOCATION 29 VOLUME 414100.000 6253671.000 301.342

** DESCRSRC Haultruck3 - north end to waste dump

LOCATION 30 VOLUME 413954.000 6253554.000 304.056

** DESCRSRC Haultruck4 - north end to waste dump

LOCATION 31 VOLUME 414271.000 6253468.000 307.482

** DESCRSRC Haultruck5 - north end to waste dump

LOCATION 32 VOLUME 414070.000 6253379.000 303.134

** DESCRSRC Haultruck6 - north end to waste dump

LOCATION 33 VOLUME 413517.000 6253705.000 320.000

** DESCRSRC Haultruck7 - north end to waste dump

LOCATION 34 VOLUME 412497.000 6253262.000 279.660

** DESCRSRC Haultruck8 - south end to processing facility

LOCATION 35 VOLUME 412480.000 6252874.000 263.016

** DESCRSRC Haultruck9 - south end to processing facility

LOCATION 36 VOLUME 412506.000 6252553.000 262.604

** DESCRSRC Haultruck10 - south end to processing facility

LOCATION 37 VOLUME 412883.000 6252727.000 312.025

** DESCRSRC Haultruck11 - south end to processing facility

LOCATION 38 VOLUME 412357.000 6251781.000 254.771

** DESCRSRC Haultruck12 - south end to processing facility

LOCATION 39 VOLUME 412106.000 6251292.000 239.249

** DESCRSRC Haultruck13 - south end to processing facility

LOCATION 40 VOLUME 412704.000 6250747.000 276.166

** DESCRSRC Haultruck14 - south end to processing facility

LOCATION 41 VOLUME 412696.000 6251466.000 258.900

** DESCRSRC Haultruck15 - south end to processing facility

LOCATION 42 VOLUME 413021.000 6251924.000 266.412

** DESCRSRC Haultruck16 - south end to processing facility

LOCATION 43 VOLUME 413139.000 6252398.000 310.848

** DESCRSRC Haultruck17 - south end to processing facility

LOCATION 44 VOLUME 413405.000 6252114.000 304.703

** DESCRSRC Haultruck18 - south end to processing facility

LOCATION 45 VOLUME 413676.000 6251863.000 297.813

** DESCRSRC Haultruck19 - south end to processing facility

LOCATION 46 VOLUME 413872.000 6251792.000 276.915

** DESCRSRC Haultruck20 - south end to processing facility

LOCATION 47 VOLUME 413916.000 6251316.000 288.061

** DESCRSRC Haultruck21 - south end to processing facility

LOCATION 48 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck22 - south end to processing facility

LOCATION 49 VOLUME 413901.000 6250863.000 284.969

** DESCRSRC Haultruck23 - south end to processing facility

LOCATION 50 VOLUME 414522.000 6251639.000 245.665

** DESCRSRC Haultruck24 - south end to processing facility

LOCATION 51 VOLUME 414502.000 6252041.000 267.758

** DESCRSRC Haultruck25 - south end to processing facility

LOCATION 52 VOLUME 414324.000 6252377.000 287.683

** DESCRSRC Haultruck26 - south end to processing facility

LOCATION 53 VOLUME 412928.000 6253174.000 320.518

** DESCRSRC WE - ROM stockpile

LOCATION 54 VOLUME 413048.000 6252252.000 282.627

** DESCRSRC WE - ROM stockpile

```
 LOCATION 55        VOLUME   411964.000 6251901.000    253.847
** DESCRSRCWE - Fine ore stockpile
 LOCATION 56        VOLUME   411649.000 6251575.000    252.734
** DESCRSRCWE - Final Product Stockpile
 LOCATION 57        VOLUME   414129.000 6252029.000    154.268
** DESCRSRCWE - Pits1
 LOCATION 58        VOLUME   413165.000 6252893.000    168.140
** DESCRSRCWE - Pits2
 LOCATION 71        VOLUME   413738.000 6252728.000    150.000
** DESCRSRCWE - Pits3
 LOCATION 60        VOLUME   415171.000 6252015.000    290.000
** DESCRSRCWE -Waste dump
 LOCATION 68        VOLUME   413229.000 6250880.000    280.000
** DESCRSRCWE - TSF1-1
 LOCATION 69        VOLUME   413519.000 6251490.000    280.000
** DESCRSRCWE - TSF1-2
 LOCATION 59        VOLUME   412668.000 6250295.000    263.054
** DESCRSRCWE - TSF4-2
 LOCATION 70        VOLUME   414058.000 6250269.000    280.000
** DESCRSRCWE - TSF4-1
** Source Parameters **
 SRCPARAM 2            4.3   1.000   1.163   0.465
 SRCPARAM 61    0.0245833333   1.000   1.163   0.465
 SRCPARAM 62    0.0245833333   1.000   1.163   0.465
 SRCPARAM 63    0.0245833333   1.000   1.163   0.465
 SRCPARAM 64    0.0245833333   1.000   1.163   0.465
 SRCPARAM 65    0.0245833333   1.000   1.163   0.465
 SRCPARAM 66    0.0245833333   1.000   1.163   0.465
 SRCPARAM 67    0.0245833333   1.000   1.163   0.465
 SRCPARAM 3     1.3179382293   1.000   1.163   0.465
 SRCPARAM 4     1.3179382293   1.000   1.163   0.465
```

SRCPARAM 5	1.3179382293	1.000	0.698	0.465
SRCPARAM 6	1.3179382293	1.000	0.698	0.465
SRCPARAM 7	1.3179382293	1.000	0.698	0.465
SRCPARAM 8	1.3179382293	1.000	0.698	0.465
SRCPARAM 9	1.3179382293	1.000	0.698	0.465
SRCPARAM 10	1.3179382293	1.000	1.304	0.465
SRCPARAM 11	1.7572509724	1.000	0.698	0.465
SRCPARAM 12	1.7572509724	1.000	1.304	0.465
SRCPARAM 13	1.7572509724	1.000	1.304	0.465
SRCPARAM 14	0.003584792	2.000	0.435	0.930
SRCPARAM 15	0.003584792	3.000	0.435	0.930
SRCPARAM 16	0.4558282598	2.500	4.348	1.163
SRCPARAM 17	1.4269406393	2.500	4.348	1.163
SRCPARAM 18	2.1879756469	1.000	0.698	0.465
SRCPARAM 19	0.0091324201	1.000	0.698	0.465
SRCPARAM 20	0.1369863014	1.000	0.698	0.465
SRCPARAM 21	3.4246575342	1.000	0.698	0.465
SRCPARAM 22	3.3055555556	1.000	0.698	0.465
SRCPARAM 23	3.3055555556	1.000	0.698	0.465
SRCPARAM 24	1.9833333333	1.000	0.698	0.465
SRCPARAM 25	1.9833333333	1.000	0.698	0.465
SRCPARAM 26	1.9833333333	1.000	0.698	0.465
SRCPARAM 27	0.0640419413	1.000	0.410	0.465
SRCPARAM 28	0.0640419413	1.000	0.410	0.465
SRCPARAM 29	0.0640419413	1.000	0.410	0.465
SRCPARAM 30	0.0640419413	1.000	0.410	0.465
SRCPARAM 31	0.0640419413	1.000	0.410	0.465
SRCPARAM 32	0.0640419413	1.000	0.410	0.465
SRCPARAM 33	0.0640419413	1.000	0.410	0.465
SRCPARAM 34	0.0640419413	1.000	0.410	0.465
SRCPARAM 35	0.0792108117	1.000	0.410	0.465

SRCPARAM 36 0.0792108117 1.000 0.410 0.465

SRCPARAM 37 0.0792108117 1.000 0.410 0.465

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SRCPARAM 54 0.0039269908 2.500 1.163 1.163

SRCPARAM 55 0.0117809725 2.500 1.163 1.163

SRCPARAM 56 0.0017671459 2.500 1.163 1.163

SRCPARAM 57 1.3888888889 0.500 46.512 0.116

SRCPARAM 58 1.3888888889 0.500 46.512 0.116

SRCPARAM 71 1.3888888889 0.500 46.512 0.116

SRCPARAM 60 0.378 0.500 209.302 0.500

SRCPARAM 68 0.3033333333 0.500 93.023 0.116

SRCPARAM 69 0.1213333333 0.500 93.023 0.116

SRCPARAM 59 0.4666666667 0.500 93.023 0.116

SRCPARAM 70 0.4666666667 0.500 93.023 0.116

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PARTDENS 69 2 2 2 2 2 2 2

PARTDENS 70 2 2 2 2 2 2 2

PARTDENS 71 2 2 2 2 2 2 2

SRCGROUP ALL

SO FINISHED

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** AERMOD Receptor Pathway

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RE STARTING

** DESCRREC"" ""

DISCCART	412813.00	6253855.00	330.47	335.00
DISCCART	412980.00	6253966.00	325.53	336.00
DISCCART	413106.00	6254150.00	322.20	335.00
DISCCART	413196.00	6254323.00	332.25	341.00
DISCCART	413190.20	6254372.57	331.37	343.00
DISCCART	413227.00	6254476.00	341.11	341.11
DISCCART	413599.00	6255592.00	292.17	292.17
DISCCART	415772.00	6253756.00	227.10	282.00
DISCCART	416238.00	6253607.00	264.07	284.00
DISCCART	415896.00	6252964.00	234.45	247.00
DISCCART	416041.00	6252630.00	224.13	261.00
DISCCART	417034.00	6250703.00	250.77	250.77
DISCCART	416360.00	6250255.00	223.33	274.00
DISCCART	415676.00	6250526.00	225.00	280.00
DISCCART	416054.00	6249386.00	267.21	267.21
DISCCART	415894.00	6249284.00	267.86	284.00
DISCCART	413363.00	6248888.00	257.10	282.00
DISCCART	411793.00	6248510.00	267.13	267.13
DISCCART	411021.00	6248757.00	254.80	288.00
DISCCART	409264.00	6249013.00	246.28	264.00
DISCCART	405054.00	6249792.00	117.96	333.00
DISCCART	407477.00	6252988.00	222.07	278.00
DISCCART	412460.00	6256660.00	288.78	288.78
DISCCART	413097.00	6257623.00	287.32	287.32
DISCCART	414987.00	6256777.00	283.14	293.00
DISCCART	416674.00	6248781.00	192.77	287.00
DISCCART	416316.00	6247838.00	241.17	241.17
DISCCART	414793.00	6246500.00	246.70	294.00

RE FINISHED

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** AERMOD Meteorology Pathway
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  SURFFILE Surf_1June18.sfc
  PROFFILE Prof_1June18.pfl
  SURFDATA 54321 2015
  UAIRDATA 54321 2015
  SITEDATA 99999 2015
  PROFBASE 10.0 METERS
ME FINISHED
**
**************************************
** AERMOD Output Pathway
**************************************
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**
OU STARTING
  RECTABLE ALLAVE 1ST
  RECTABLE 1 1ST
  RECTABLE MONTH 1ST
** 1-Hour Binary POSTFILE for the Percentile/Rolling Average Option
  POSTFILE 1 ALL UNFORM DD.AD\1HGALLUN.POS 31
** Maximum Annual Average POST files for Each Met Year
  POSTFILE ANNUAL ALL PLOT DD.AD\ANNUAL_G001.PLT 32
** Auto-Generated Plotfiles
  PLOTFILE MONTH ALL 1ST DD.AD\MOH1GALL.PLT 33
  PLOTFILE ANNUAL ALL DD.AD\AN00GALL.PLT 34
OU FINISHED
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** Percentile/Rolling Average

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** PERCOPTN ON

** ROLLOPTN OFF

** SKIPCALM OFF

** ROLLPATH C:\Talison\DD\DD.AD\Percentile\

** PERVALUE = 99.90

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** Project Parameters

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** PROJCTN CoordinateSystemUTM

** DESCPTN UTM: Universal Transverse Mercator

** DATUM   World Geodetic System 1984

** DTMRGN Global Definition

** UNITS   m

** ZONE   -50

** ZONEINX 0

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Appendix B – Emission estimation

Emissions – operational phase

Site specific data used in emission estimation is shown in Table 1.

Table 1 Site specific information

Activity	Amount	Unit	Comments
Number of haul truck trips per year (ore)	112,203	Trips/year	Calculated; accounted for return trip
Number of haul truck trips per year (waste)	54,566	Trips/year	Calculated; accounted for return trip
Dozers	43,800	Hours	Based on 5 dozers operating at the pit and WRL 24/7
Drilling	91,250	Drills/year	Based on 250 drill-downs per day, every day of the year

References to the Emission calculations for the sources shown in Table 2 were estimated using the NPI equations detailed below.

Table 2 Emission factors used for AERMOD

Activity	References
Blasting	NPI EET Manual for Mining v3.1, Table 2, p15
Drilling	NPI EET Manual for Mining v3.1, Table 2, p15
Excavators	NPI EET Manual for Mining v3.1, Appendix A 1.1.2
Rockbreakers	NPI EET Manual for Mining v3.1, Appendix A 1.1.2
Dozers at pits and WRL	NPI EET Manual for Mining v3.1, Section 1.1.5
Haul trucks to pit and WRL	NPI EET Manual for Mining v3.1, Table 2, p15
Crushing	NPI EET Manual for Mining v3.1, Appendix A 1.1.16
Unloading/loading ore stockpiles	NPI EET Manual for Mining v3.1, Appendix A 1.1.2
Wind erosion	NPI EET Manual for Mining v3.1, Appendix A 1.1.18

Appendix C - Source characteristics

Source ID	Description	Easting	Northing	Sigma Y	Sigma Z	Release height
1	Blasting	413702	6252672	1.2	0.5	1
2	Drill 1	413702	6252672	1.2	0.5	1
3	Drill 2	413598	6252962	1.2	0.5	1
4	Drill 3	413417	6253175	1.2	0.5	1
5	Drill 4	413488	6253092	1.2	0.5	1
6	Drill 5	413587	6253071	1.2	0.5	1
7	Drill 6	413596	6253169	1.2	0.5	1
8	Drill 7	413530	6253234	1.2	0.5	1
9	Excavators	413103	6253097	0.7	0.5	1
10	Excavators	413897	6252834	0.7	0.5	1
11	Excavators	413541	6252417	0.7	0.5	1
12	Excavators	414209	6251837	0.7	0.5	1
13	Loaders	413103	6253097	0.7	0.5	1
14	Loaders	413897	6252834	0.7	0.5	1
15	Loaders	413541	6252417	0.7	0.5	1
16	Loaders	414209	6251837	1.3	0.5	1
17	Rockbreakers	414250	6251978	0.7	0.5	1
18	Rockbreakers	413973	6252620	1.3	0.5	1
19	Rockbreakers	412987	6252210	1.3	0.5	1
20	Conveyor transfer point 1	413104	6252020	0.4	0.9	2
21	Conveyor transfer point 2	412404	6252262	0.4	0.9	3
22	3 stage crusher (for CPG 1 & CPG2)	412692	6252971	4.3	1.2	2.5
23	2 stage crushing (for CPG3 & CPG 4)	412123	6252207	4.3	1.2	2.5

Source ID	Description	Easting	Northing	Sigma Y	Sigma Z	Release height
24	ROM stockpile (for TIL, CPG1 & CPG2)	412928	6253174	0.7	0.5	1
25	Fine ore stockpile - CPG3 & CPG 4	413048	6252252	0.7	0.5	1
26	Final Product Stockpile - CPG3 & CPG 4	411964	6251901	0.7	0.5	1
27	ROM stockpile (for CPG3 & CPG4)	411649	6251575	0.7	0.5	1
28	Dozer - pits	413636	6253298	0.7	0.5	1
29	Dozer - pits	414185	6251979	0.7	0.5	1
30	Dozer - waste	414784	6253373	0.7	0.5	1
31	Dozer - waste	415171	6252015	0.7	0.5	1
32	Dozer - waste	414428	6250782	0.7	0.5	1
33	Haultruck1 - north end to waste dump	415031	6253549	0.4	0.5	1
34	Haultruck2 - north end to waste dump	414704	6253963	0.4	0.5	1
35	Haultruck3 - north end to waste dump	414100	6253671	0.4	0.5	1
36	Haultruck4 - north end to waste dump	413954	6253554	0.4	0.5	1
37	Haultruck5 - north end to waste dump	414271	6253468	0.4	0.5	1
38	Haultruck6 - north end to waste dump	414070	6253379	0.4	0.5	1
39	Haultruck7 - north end to waste dump	413517	6253705	0.4	0.5	1
40	Haultruck8 - south end to processing facility	412497	6253262	0.4	0.5	1
41	Haultruck9 - south end to processing facility	412480	6252874	0.4	0.5	1

Source ID	Description	Easting	Northing	Sigma Y	Sigma Z	Release height
42	Haultruck10 - south end to processing facility	412506	6252553	0.4	0.5	1
43	Haultruck11 - south end to processing facility	412883	6252727	0.4	0.5	1
44	Haultruck12 - south end to processing facility	412357	6251781	0.4	0.5	1
45	Haultruck13 - south end to processing facility	412106	6251292	0.4	0.5	1
46	Haultruck14 - south end to processing facility	412704	6250747	0.4	0.5	1
47	Haultruck15 - south end to processing facility	412696	6251466	0.4	0.5	1
48	Haultruck16 - south end to processing facility	413021	6251924	0.4	0.5	1
49	Haultruck17 - south end to processing facility	413139	6252398	0.4	0.5	1
50	Haultruck18 - south end to processing facility	413405	6252114	0.4	0.5	1
51	Haultruck19 - south end to processing facility	413676	6251863	0.4	0.5	1
52	Haultruck20 - south end to processing facility	413872	6251792	0.4	0.5	1
53	Haultruck21 - south end to processing facility	413916	6251316	0.4	0.5	1
54	Haultruck22 - south end to processing facility	413901	6250863	0.4	0.5	1

Source ID	Description	Easting	Northing	Sigma Y	Sigma Z	Release height
55	Haultruck23 - south end to processing facility	413901	6250863	0.4	0.5	1
56	Haultruck24 - south end to processing facility	414522	6251639	0.4	0.5	1
57	Haultruck25 - south end to processing facility	414502	6252041	0.4	0.5	1
58	Haultruck26 - south end to processing facility	414324	6252377	0.4	0.5	1
59	WE - ROM stockpile	412928	6253174	1.2	1.2	2.5
60	WE - ROM stockpile	413048	6252252	1.2	1.2	2.5
61	WE - Fine ore stockpile	411964	6251901	1.2	1.2	2.5
62	WE - Final Product Stockpile	411649	6251575	1.2	1.2	2.5
63	WE - Pits1	414129	6252029	46.5	0.1	0.5
64	WE - Pits2	413165	6252893	46.5	0.1	0.5
65	WE - Pits3	413738	6252728	46.5	0.1	0.5
66	WE -Waste dump	415171	6252015	209.3	0.5	0.5
67	WE - TSF1-1	413229	6250880	93.0	0.1	0.5
68	WE - TSF1-2	413519	6251490	93.0	0.1	0.5
69	WE - TSF4-2	412668	6250295	93.0	0.1	0.5
70	WE - TSF4-1	414058	6250269	93.0	0.1	0.5

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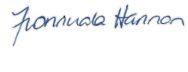
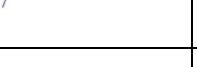
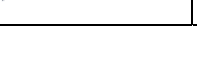
Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
Draft A	A Sala Tenna G Formentin	J Forrest A Callegari		F Hannon		12/6/2018
Draft B	A Sala Tenna G Formentin	J Forrest A Callegari		F Hannon		25/6/2018
Rev 0	A Sala Tenna G Formentin	J Forrest A Callegari		F Hannon		26/6/2018
R1	A Sala Tenna G Formentin	A Callegari		F Hannon		16/07/2018

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