9. Air and Greenhouse Gasses

9.1 Existing Environment

9.1.1 Meteorology

Temperatures vary significantly, with mean daily maximum temperatures ranging from 22°C (August) to 37°C (January), and mean daily minimum temperatures from 8°C (July) to 24°C (January). Average annual evaporation for Barrow Creek totals around 2,980 mm, with average monthly evaporation exceeding rainfall in all months (BOM 2015).

The climate of the region is arid to semi-arid with a mean annual rainfall of approximately 320 mm recorded at Barrow Creek, approximately 65 km east of the mining area. The climate is characterised by hot, wet summers and warm, dry winters.

Rain tends to fall during heavy rain events between November and March, with little follow on rain. The highest annual rainfall for Barrow Creek of 1,153 mm was recorded in 2010. Annual rainfall is highly variable.

Annual and seasonal wind roses for the Territory Grape Farm AWS, based on hourly observations, are shown for 2 July 2011 to 30 June 2012 in Figure 9-1. The wind roses show graphically the frequency of occurrence of winds by direction and strength, from varying compass points. The length of the bar represents the frequency of occurrence of winds from that direction and the colour corresponds to the wind speed categories, as defined in the legend. Figure 9-1 shows a dominant south easterly wind direction throughout the year.

9.1.2 Existing emissions

The Project is situated in a relatively isolated location, with sensitive receptors sparsely distributed across the region. Land use immediately adjacent to the Project is pastoral activities. There are no existing industrial air emission sources, nor has there been any air quality monitoring performed at or near the Project area. Fugitive air emissions occur within the region, with dust associated with wind erosion from exposed ground, station related vehicle traffic on unsealed roads and smoke emissions from seasonal bushfires.

9.1.3 Sensitive receptors

Sensitive receptor locations were identified based on aerial photographs and discussions with stakeholders. The nearest non-mining sensitive receptor to the Project is Anningie Station approximately 30 km to the south-west of the proposed mine site. The mine access road is located approximately 20 km to the south of the Wilora Aboriginal community. The Project will itself introduce an important sensitive receptor, the mine camp site. The sensitive receptors considered in the air quality assessment and their distance from the mine site are detailed in Table 9-1.

Whilst the majority of these receptors are unlikely to experience any impact during the construction or operation of the Project (due to the separation distance), they have been included in this assessment for completeness. Figure 9-2 shows the Project site and the relative location of these sensitive receptors.

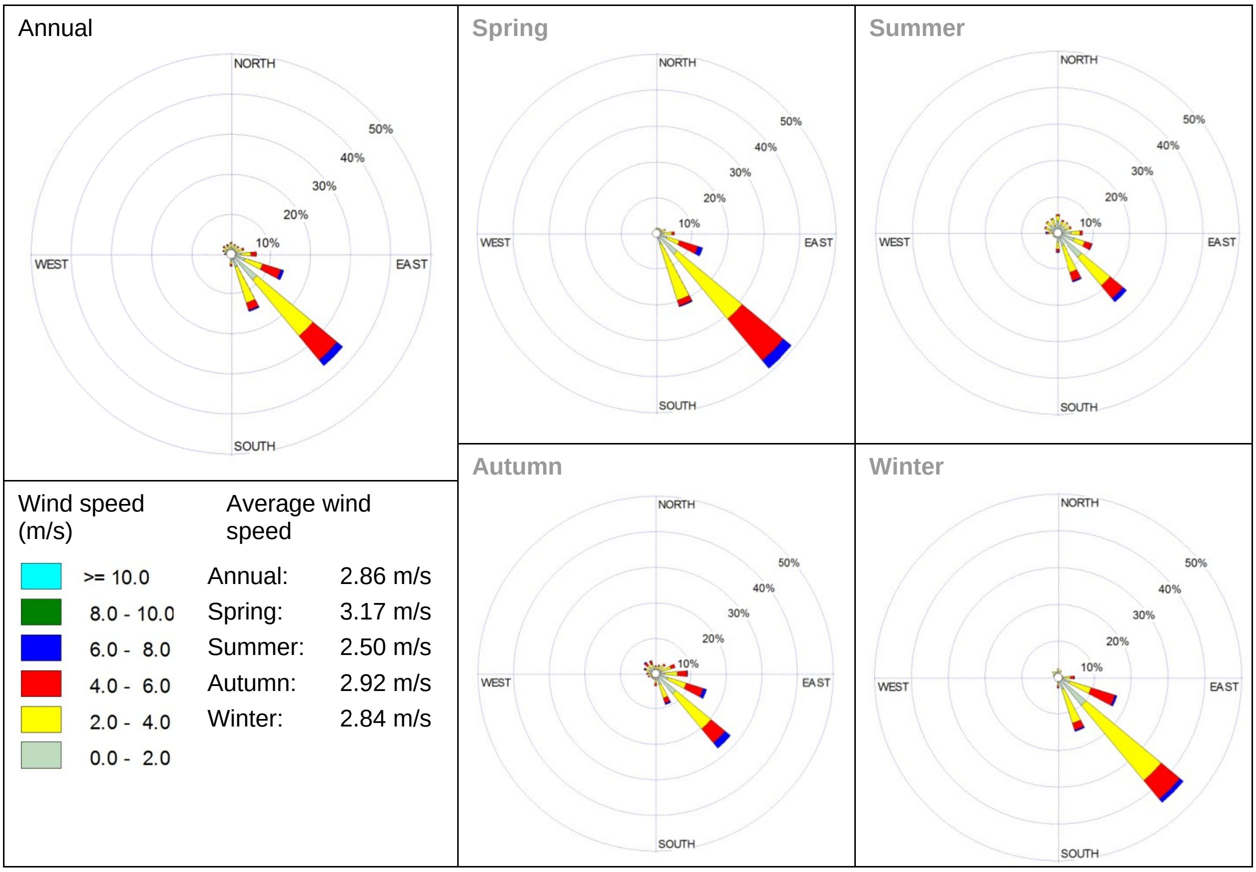

Figure 9-1 Annual and seasonal wind roses for observed meteorological data at the Territory Grape Farm AWS

Table 9-1 Sensitive receptors

Receptor name	Description	Distance from mine site (km)
Mine camp site	Mine accommodation village	5
Anningie Station	Pastoral lease homestead	30
Wilora	Aboriginal community	47
Stirling Station	Pastoral lease homestead	51
Ti Tree	Small town	52
Barrow Creek[1]	Small town	62
Willowra	Aboriginal community	80

[1] This location was included to represent the two semi-permanently occupied Indigenous outstations (Patsy's and Walkabout) on the western side of Stuart Highway between Wilora and Barrow Creek.

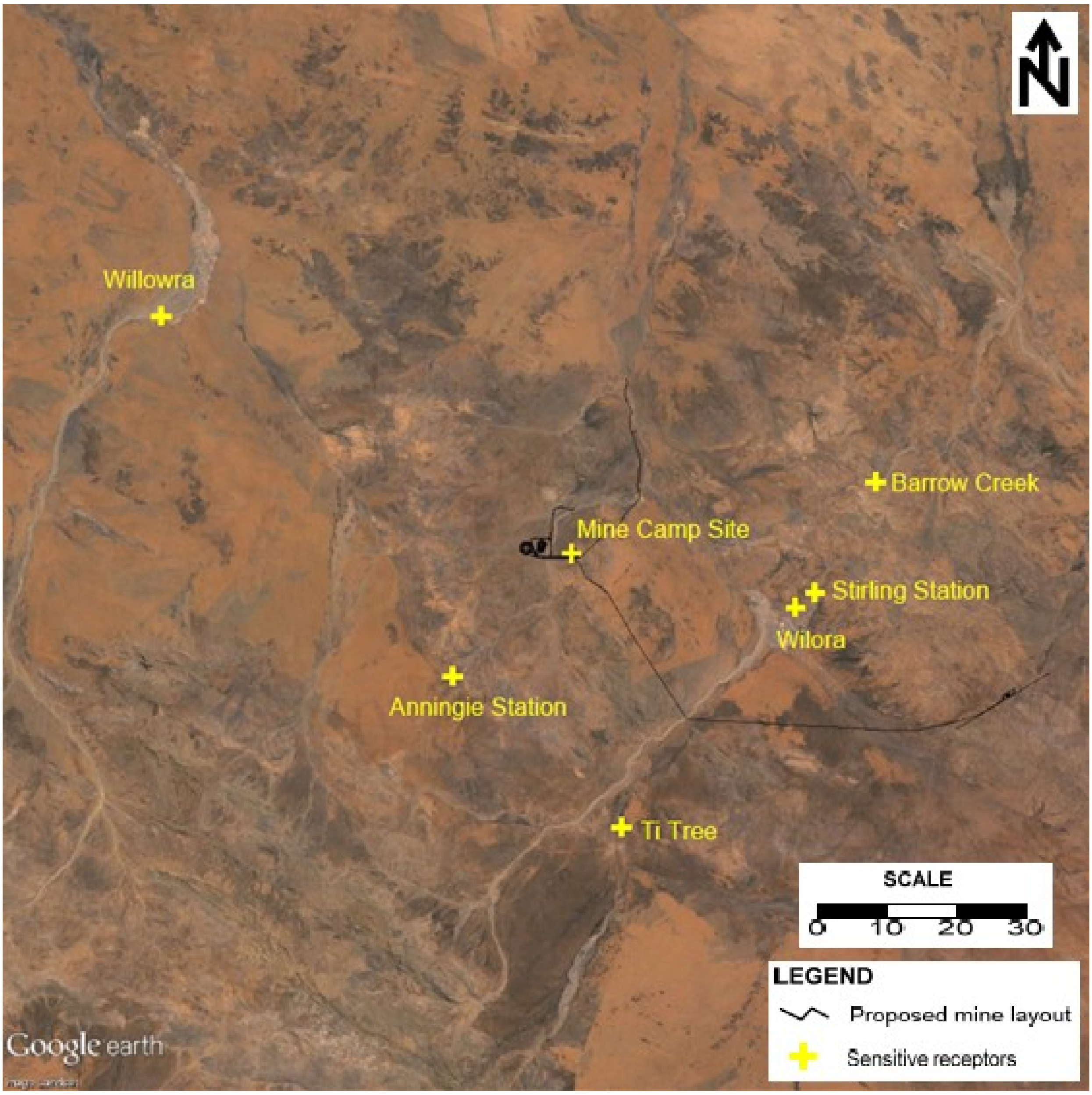

Figure 9-2 Project site and the closest sensitive receptors

9.2 Assessment Criteria

9.2.1 Air Emissions

Air quality impacts are assessed by comparing monitoring results or model predictions with appropriate pollutant criteria.

The impacts of emissions from mining activities in the NT are primarily assessed with reference to the *National Environment Protection (Ambient Air Quality) Measure* (Air NEPM) PM_{10} and $PM_{2.5}$ ambient standards. However, the Air NEPM criteria were selected to guide the management of emissions within air sheds with significant populations (and not specifically to individual emitters in more remote areas).

Alternative air criteria for assessment of individual facility emissions include the WA EPA criteria for total suspended particulates (TSP)[1], the Victoria Mining Protocol for Environmental Management (PEM) criteria for $PM_{2.5}$ and PM_{10} (EPA Victoria 2007), and the Victorian Environment Protection Authority (Vic EPA) Design Criteria for PM_{10}[2]. All of these criteria are presented in Table 9-2.

Table 9-2 Assessment levels for dust (in-air concentrations and deposition)

Pollutant	Averaging period	Max. / 99.9th %ile	Criterion	Source
TSP	24-hours	Maximum	90 µg/m^3	WA EPA
PM_{10}	1-hour	99.9th %ile	80 µg/m^3	SEPP-AQM
	24-hours	Maximum	50 µg/m^3	Air NEPM
	24-hours	Maximum	60 µg/m^3	Mining PEM
	Annual	Maximum	20 µg/m^3	Air NEPM[3]
Dust deposition	Annual	Maximum	2.0 g/m^2/month	NSW OEH

The Victorian Mining PEM criteria have been specifically developed for mining operations, where sources are primarily mobile / area-based, and are therefore the more appropriate criteria to apply for this Project.

There are no specific criteria for dust deposition in the NT and the NSW Office of Environment and Heritage (NSW OEH 2015) dust deposition standard provided in the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW has been applied. Assessment goals for an annual average dust deposition such that nuisance dust impacts could be avoided are provided in Table 9-2.

The impacts of particle emissions fall under two distinct categories, being health and amenity:

- potential health impacts are attributable to the concentration of respirable particles in ambient air. Respirable particles of dust (PM_{10}) would have maximum impact under light winds and stable atmospheric conditions. These conditions most frequently occur overnight and very early in the morning; and
- the presence of total suspended particles (TSP) greater than 35 microns, is likely to affect amenity by reducing visibility (whilst in the air column) and by soiling of materials via dust deposition. Amenity impacts are most marked in high wind conditions, when larger particles may be displaced and transported a significant distance before being deposited. Mitigation of amenity related dust impacts would in turn act to reduce health impacts associated with respirable particles emissions.

The proposed gas fired power station will generate the exhaust pollutants carbon monoxide (CO), oxides of nitrogen (NOx) as nitrogen dioxide (NO_2) and volatile organic compounds (VOCs). CO and NO_2 were assessed against the Air NEPM and Vic EPA design criteria. The pertinent emissions of VOCs were assessed against the Air Toxics NEPM and Vic EPA design criteria. Assessment criteria for emissions from the gas fired power station are outlined in Table 9-3.

1 The *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1999* (Kwinana EPP) specifies a standard of 90 µg/m^3 for least dust impacted areas (rural residential areas beyond the buffer area).

2 Established under the Victorian State Environment Protection Policy (Air Quality Management) (SEPP-AQM).

3 Proposed addition to the Air NEPM.

Table 9-3 Assessment criteria for stack emissions from the gas fired power station

Pollutant	Averaging period	Max. / 99.9^{th} %ile	Criterion	Source
Nitrogen dioxide	1-hour	Maximum	247 µg/m^3	Air NEPM
	1-hour	99.9th %ile	190 µg/m^3	SEPP-AQM
	Annual	Maximum	62 µg/m^3	Air NEPM
Carbon monoxide	1-hour	99.9th %ile	29,000 µg/m^3	SEPP-AQM
	8-hours	Maximum	11,254 µg/m^3	Air NEPM
Acetaldehyde	3-minutes	99.9th %ile	76 µg/m^3	SEPP-AQM
Benzene	3-minutes	99.9th %ile	53 µg/m^3	SEPP-AQM
	Annual	Maximum	10.5 µg/m^3	Air Toxics NEPM
Formaldehyde	3-minutes	99.9th %ile	40 µg/m^3	SEPP-AQM
	24-hours	Maximum	53.6 µg/m^3	Air Toxics NEPM
Toluene	3-minutes	99.9th %ile	650 µg/m^3	SEPP-AQM
	24-hours	Maximum	4114 µg/m^3	Air Toxics NEPM
	Annual	Maximum	411 µg/m^3	Air Toxics NEPM
Xylenes	3-minutes	99.9th %ile	350 µg/m^3	SEPP-AQM
	24-hours	Maximum	1183 µg/m^3	Air Toxics NEPM
	Annual	Maximum	946 µg/m^3	Air Toxics NEPM

9.2.2 Greenhouse Gas Emissions

Unlike emissions for air pollutants, there are no set criteria for greenhouse gas. However, there is legislation relevant to the greenhouse gas emissions from the Project. The key acts are:

- *National Greenhouse and Energy Reporting Act 2007*. The National Greenhouse and Energy Reporting Scheme applies to Scope 1 and 2 emissions at facilities that emit over 25,000 t CO_2-e per year or consume more than 100 TJ of energy, or corporations that emit over 50,000 t CO_2-e per year or consume more than 200 TJ of energy. The Project will trigger both the facility and corporation thresholds. Participation will need to be determined based on actual annual greenhouse gas emissions and energy consumption; and
- *Carbon Credits (Carbon Farming Initiative) Act 2011*. The Carbon Farming Initiative was developed to give farmers, forest growers and landholders the ability to generate accredited domestic offsets for access to domestic voluntary and international carbon markets.

9.3 Methodology

The main air emissions are expected to be from material transport, processing and wind erosion (particles as TSP, PM_{10} and $PM_{2.5}$), and the power station (CO, NOx as NO_2 and VOCs). Greenhouse gas emissions will also occur throughout the life of the mine.

9.3.1 Air Emissions

Construction

Air pollutant emissions during construction are not considered to represent a significant source of emissions. Potential air quality impacts during construction and site establishment for the Project will be emissions from heavy vehicle exhausts, particle generation from heavy equipment during earthworks and wind erosion from disturbed soil surfaces. Extensive inventories (NPI 2012, US EPA 2001) for PM_{10} and TSP emissions from earth moving machinery are commonly used to characterise the source dust emission rates from activities on-site during the construction phase.

At this stage, the reference design has not specified the schedule of construction or exact type and number of heavy machinery to be used, so it is not possible to accurately characterise these sources. For this reason, rather than attempt to estimate emissions that are not likely to be significant, the focus will be on developing a framework which includes a comprehensive range of mitigation measures for the management of dust emissions during the construction phase of the Project. Dust management and mitigation measures that will be consider and implemented where appropriate during the construction phase are discussed in Section 9.5.1.

Operation

The predominant mine operation dust sources include mechanical sources (trucking, conveying, dozing and grading) and wind erosion sources (cleared areas and stockpiles). Mine operations have the potential to generate particulate emissions from activities outlined in Table 9-4.

Wind erosion emissions will be affected by the size of the particles present. Shao *et al.* (1996) describes the process by which dust lift off occurs for different particle aerodynamic diameters:

- large particles (>1000 µm) remain stationary or move along the ground (creep) as they are too aerodynamically heavy;
- sand particles (typically between 60 and 1000 µm) are easily lifted from the surface into saltation motion as they have small threshold velocities. This leads to sand drift; and
- dust particles (typically <60 µm) are not lifted directly from the surface (under normal conditions) due to large inter-particle cohesive forces. However, when saltation bombardment occurs (by sand particles), dust particles are ejected from the surface due to sand grain impacts. In the atmosphere, turbulence and buoyancy keep the dust particles suspended for a period of time (determined by a number of factors) until deposition occurs, often many kilometres from the original source.

These movements are illustrated in Figure 9-3.

The method used by GHD to calculate wind erosion emissions was based on and adapted from work by SKM (2004) and Shao *et al.* (1996). A detailed description of the equations and coefficient factors used are detailed in the GHD (2015). This methodology has been adopted for a number of similar studies (GHD 2009, 2013, 2014).

Table 9-4 Potential dust sources from mine operations

Source type	Source location
Wind erosion	Mine pit, long-term ore stockpiles, crushed ore stockpile, waste rock dump and tailings storage facility
Drilling of ore and waste rock	Mine pit
Blasting of ore and waste rock	Mine pit
Loading ore and waste rock into haul trucks using excavators/shovels or front end loaders	Mine pit
Hauling ore and waste rock	Haul roads from mine pit to the crushing plant, long-term ore stockpiles and waste rock dump
Unloading ore and waste rock from haul trucks	Crushing plant, long-term ore stockpiles and waste rock dump
Dozing of waste rock and long-term ore stockpiles	Waste rock dump and long-term ore stockpiles
Ancillary vehicle movement	Mine roads
Grading haul roads	Haul roads
Primary crusher	Crushing plant
Ore handling and transfer	Crushing plant, crushed ore stockpile and crushed ore stockpile to processing plant

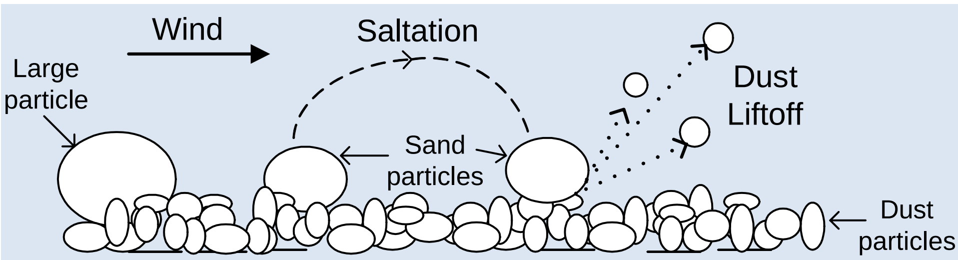

Figure 9-3 Dust lift off resulting from saltation of sand particles

Dust emissions from mechanical processes associated with the Project were calculated using a combination of process rates, ore properties and emission factors from the National Pollutant Inventory (NPI) estimation manual for mining (NPI 2012). Consideration was given to mitigation measure available to manage dust emissions. Emission factors were multiplied by various ratios, depending on controls employed to reduce dust emission from various dust sources. Control factors are from the NPI manual for mining (NPI 2012). The following control factors were used in this study for various activities:

- hauling – 75% for level 2 watering (>2 litres/m^2/h);
- wind erosion from stockpiles – 50% for water sprays; and
- unloading trucks – 70% for water sprays.

The power station is proposed to be natural gas fired. The primary pollutants from gas engines are NO_X formed by high temperatures generated in the combustor and CO and VOCs which are formed predominantly by the incomplete combustion of fuel. Emissions and its constituents were estimated using emission factors from the NPI emissions estimation manual for combustion engines (NPI 2008). Sulphur dioxide and particulate emissions were not modelled from the power station due to the negligible quantity of sulphur in the natural gas and negligible contribution of dust compared to other mine site activities.

The emissions assessment assumed the power station was operating at 100% of its maximum capacity rating and not the estimated load, to ensure a conservative approach that provides for increased loading if required. A risk assessment of air quality impacts due to upset conditions did not identify any significant risk from power station plant failure or malfunction. It was determined that gas supply failure or engine malfunction would result in the partial or full shut down of power generation systems and cessation of emissions to air. Therefore, power station upset conditions were not assessed as part of the modelling assessment. Emissions from gas engines would be mitigated by tuning for optimum performance, efficiency and lowest emissions. This involves using lean burn technology, involving combustion of a lean air-fuel mixture, which has more air than is required for the stoichiometric combustion of the fuel. This results in lower peak combustion temperatures, which in turn reduces NOx formation.

The emission characteristics for the various Project point and fugitive sources were incorporated into an air dispersion and deposition model to predict the fate and impact of these emissions. The US EPA approved CALPUFF dispersion model (version 5.8.4) was used to simulate the dispersion characteristics and concentrations of pollutants generated by the Project. CALPUFF is an advanced Lagrangian, non-steady state air dispersion model that utilises a three dimensional wind field to simulate the dispersion of air pollutants to predict ground level concentrations across a gridded domain. The model has been approved by the US EPA (2005), as the preferred model for assessing long range transport of pollutants. Surface meteorological observations from a nearby Bureau of Meteorology station were used to inform CALMET (the 3D meteorological model pre-processor to CALPUFF) in combination with upper air data synthesised using CSIRO’s The Air Pollution Model (TAPM). Model development was for the year 1 July 2011 to 30 June 2012. Mining Year 4 was chosen to represent the highest emissions year during operations. This year was chosen as it was identified to have one of the higher mining rates, and the pit depth is shallow such that wind erosion would be relatively high compared to subsequent years. More detailed information on the models used and their configuration is provided in the GHD Air Assessment report for the Project (GHD 2015). This report also details the identified emissions sources and characteristics as they relate to the fourth year of mine operation.

9.3.2 Greenhouse Gas Emissions

Fuel combustion for power generation and vehicle use (site and trains) will comprise the majority of greenhouse gas emissions from the Project. Other smaller emissions will include clearing of vegetation, use of explosives and wastewater treatment. Associated, but off site greenhouse gas emissions will include embodied emissions associated with the production of major construction materials, and transport of materials and employees to and from site.

Typically the smaller emissions identified above comprise approximately 20% of the total emissions from mine sites (GHD 2012). As this assessment has been undertaken at an early stage in the development of the Project and quantities of construction materials have not yet been estimated for some of the smaller emission sources, these emissions have not been estimated separately. Rather than attempt to separately estimate the emissions from these smaller sources, a 20% uplift has been added to the total emissions estimates for fuel combustion for vehicle use and power generation. This is considered to be an acceptable approach to ensure these ancillary emissions are accounted for in the assessment.

The greenhouse gases considered for the Project are listed in Table 9-5 together with their global warming potential. Global warming potential is a relative measure of how much heat a greenhouse gas traps in the atmosphere compared to a similar mass of carbon dioxide.

Table 9-5 Greenhouse gases and 100 year global warming potentials

Greenhouse gas	Global warming potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140-11,700
Perfluorocarbons (PFCs)	6,500-9,200
Sulphur hexafluoride (SF_6)	23,900

In accordance with the Greenhouse Gas Protocol, emissions are separated into three scopes:

- Scope 1 emissions are created directly by a person or business from sources that are owned or controlled by that person or business;
- Scope 2 emissions arise from the generation of electricity, heating, cooling or steam that is purchased and consumed by a person or business. These are indirect emissions as they arise from sources not owned or controlled by the person or business who consumes the electricity; and
- all other emissions associated with the Project are defined as Scope 3, since they are produced outside of the Project site, and TNG does not have operational control of the facilities from which they originate. For example, TNG will not own or operate vehicles used to transport raw materials to site and emissions resulting from the combustion of fuels for this transportation are classified as Scope 3.

Scope 1 emissions will be produced by the combustion of fuels such as natural gas and diesel at the mine site, and by vehicles, plant and equipment which TNG has operational control over. The site will also combust fuel for power generation. As the Project generates its own power, no Scope 2 emissions are included in this assessment. The main Scope 3 emission is diesel used in trains for the export of concentrate from site. All other Scope 3 emissions have been accounted for by adding 20% to the emissions calculated from fuel combustion. A detailed description of the equations and coefficient factors used to calculate emissions are detailed in the GHD Air Assessment report for the Project (GHD 2015).

9.4 Potential Impacts

9.4.1 Air Emissions

The Project is not anticipated to have adverse air impacts during the construction phase. TNG will develop a framework which includes mitigation measures for the management of dust emissions during the construction phase of the Project. More details are provided in Section 9.5.1.

The Project's air emissions during operation are modelled to have limited adverse impacts, with particle and other air pollutant concentrations well below the assessment criteria. Table 9-6 summarises the predicted PM_{10} and TSP concentrations at receptors during operation. A representation of the predicted 1-hour (99.9 %ile) PM_{10} emissions via a contour plot is provided in Figure 9-4.

Table 9-6 Predicted particle concentrations at sensitive receptors

Receptor	PM_{10}, µg/m^3			TSP, µg/m^3	
Averaging period	Annual	24-hour	1-hour	24-hour	1-hour
Rank	Max	Max	99.9 %ile	Max	99.9 %ile
Guideline	20	50	80	90	- -
Mine camp site	0.5	9.7	35	26.4	95.6
Anningie Station	0.04	1.2	4.3	3.3	11.7
Wilora	0.004	0.1	0.4	0.3	1.1
Stirling Station	0.004	0.01	0.3	0.3	0.8
Ti Tree	0.007	0.2	0.6	0.4	1.6
Barrow Creek	0.001	0.05	0.1	0.1	0.4
Willowra	0.05	0.2	8.8	0.6	2.4

Dust deposition is 2 g/m^2/mth in the direct vicinity of the mine site and quickly decreases to below detection beyond the mine site.

The highest predicted particle concentrations are located at the closest sensitive receptor (mine camp) where predicted concentrations range between 2.5% and 44% of the various assessment criteria. Predicted particle concentrations at non-mining receptors range between 0.005% and 5% of the assessment criteria. These low impacts were expected due to the large separation distances. From a cumulative perspective, the model shows the Project will not significantly impact non-mining sensitive receptors, with background regional and their own local neighbourhood sources expected to dominate.

It is noted that the second highest predicted concentrations occur at the furthest receptor (Willowra). This is a result of the predominant south easterly wind direction (Figure 9-1) directing emissions in a north westerly direction towards Willowra, and away from receptors south east of the mine site.

Table 9-7 presents the predicted concentrations for CO, NO_2 and VOCs at the sensitive receptor locations during operation. The predicted concentrations at all receptors are below the assessment criteria for all assessed pollutants. As there are limited anthropogenic sources of pollutants other than dust in the area, background levels are unlikely to be of any significance.

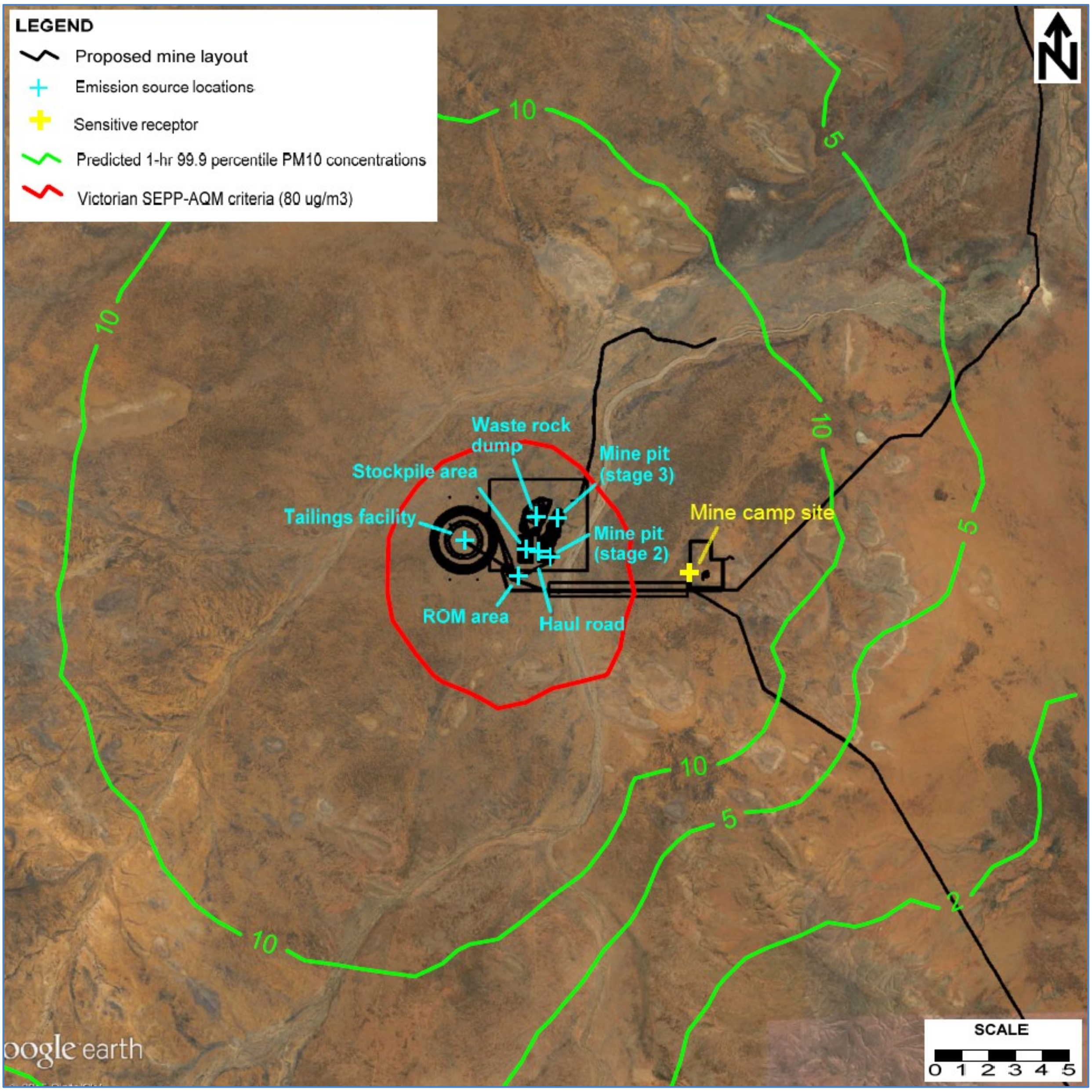

Figure 9-4 Predicted 99.9 percentile PM_{10} 1-hour concentration contour plot

Table 9-7 Predicted CO, NO_2 and VOCs concentrations at sensitive receptors

Receptor	CO	NO_2[4]		Acetaldehyde	Benzene	Formaldehyde	Toluene			Xylene
Averaging period	8-hour	1-hour	Annual	3-min	3-min	3-min	3-min	24-hour	annual	3-min
Rank	Max	Max	- -	99.9%ile	99.9%ile	99.9%ile	99.9%ile	max	- -	99.9%ile
Guideline	11,254 µg/m^3	247 µg/m^3	62 µg/m^3	76 µg/m^3	10.5 µg/m^3	40 µg/m^3	650 µg/m^3	4114 µg/m^3	411 µg/m^3	350 µg/m^3
Mine camp site	1.02	20	1.49	0.37	0.37	0.37	0.37	0.0007	0.000021	0.0084
Anningie Station	1.72	12.78	1.57	0.24	0.24	0.24	0.24	0.0008	0.000041	0.0054
Wilora	0.14	1.79	0.19	0.03	0.03	0.03	0.03	0.0001	0.000003	0.0008
Stirling Station	0.17	1.91	0.21	0.04	0.04	0.04	0.04	0.0001	0.000003	0.0008
Ti Tree	1.57	6.48	1.43	0.12	0.12	0.12	0.12	0.0007	0.000020	0.0027
Barrow Creek	0.14	1.47	0.17	0.03	0.03	0.03	0.03	0.0001	0.000002	0.0006
Willowra	0.45	2.20	0.46	0.04	0.04	0.04	0.04	0.0002	0.000026	0.0009

[4] Taken as 20% of NOx results

9.4.2 Greenhouse Gas Emissions

The Project's total greenhouse gas emissions for the life of mine were estimated based on two years of construction emissions and 15 years of operational emissions. The predicted source contribution, individual and total greenhouse gas emissions are presented in Table 9-8. Total emissions for the life of mine are estimated at 3,212,358 t CO_2-e.

Table 9-8 Summary of total emissions (life of mine)

Source	Total Emissions (tonnes CO_2-e)	Percentage of total
Fuel combustion - diesel (site vehicles)	500,235	16%
Fuel combustion – diesel (trains exporting concentrate)	701,516	22%
Fuel combustion – natural gas (power generation)	1,332,595	41%
Fuel combustion – diesel (power generation)	35,540	1%
Other emissions	642,472	20%
All emissions	3,212,358	100%

The Commonwealth Department of the Environment (DotE) estimates annual greenhouse gas emissions for Australia. The latest estimates are for 2013 (DotE 2013). Australia's total greenhouse gas emissions for 2013 were estimated at 548.6 Mt CO_2-e and the NT's emissions for the same period were estimated at 13.8 Mt CO_2-e. The major sources for NT emissions were agriculture (primarily the burning of savannah vegetation) and fuel combustion for stationary energy purposes. For comparison, global greenhouse gas emissions for 2012 from Annex 1 countries to the Kyoto protocol were 15.1 gigatonnes of CO_2-e (UNFCCC 2014).

Total greenhouse gas emissions for the Project are released over a 15+ year period, whereas the territory, national and global emissions listed above are for only one year. Average annual emissions from the Project are estimated at 178,000 tonnes CO_2-e. Assuming that NT emissions remain constant over the next 15 years, the Project's emissions will constitute approximately 1%, 0.03% and 0.001% of annual NT, national and global emissions respectively.

9.5 Emission Management and Mitigation Measures

9.5.1 Air Emissions

Dust emissions will be controlled by application of a dust management processes, defined as part of the site Environmental Management Plan. Using this approach, a staged management plan for dust mitigation and management measures would be influenced by the proximity of sensitive receptors. Due to the separation distance between the Project site and the nearest sensitive receptor, the dust management measures would detail actions for typical dust control, based on the principles found in the *Environmental Guidelines for Major Construction Sites* (EPA Victoria 1996). These management measures will be implemented during the construction phase and where relevant continue during operation.

From the identification of potential dust emission sources, appropriate dust management and mitigation measures would include:

- all construction and maintenance equipment/vehicles to be operated and maintained to manufacturer's specifications in order to minimise exhaust emissions;
- defined haul routes to be used wherever it is necessary for vehicles to traverse unsealed surfaces or unformed roads;
- vehicular speeds would be limited to 25 km/h on areas of unconsolidated or unsealed soil associated with the project; and
- prompt mitigation of excessive visible dust emissions, which may be a combination of:
  - stabilisation of surface silt content through application of localised water sprays, or the use of appropriate chemical dust suppressants (suitable for roads which are traversed less frequently);
  - control of mechanically induced dust emissions (from clearing, excavation, loading, dumping filling and levelling activities) by application of water sprays;
  - awareness of operational areas more frequently exposed to higher winds and the predominant wind directions in these areas at various times of the year. Temporary wind barriers may be employed where necessary;
  - review of daily weather updates from BoM or a private meteorology service provider, to give warning of likely strong winds to assist with daily management of wind-blown dust from unconsolidated soil surfaces and material stockpiles; and
  - all haulage vehicles are to have their loads covered while transporting material to or from the work area through off-site routes that may have sensitive receptors.

9.5.2 Greenhouse Gas Emissions

Impacts of the Project on greenhouse gas emissions have been avoided or minimised where possible through the planning and design process. The majority of emissions for the Project are from the combustion of natural gas to provide the Project with electricity. The greenhouse gas intensity of the power station was estimated to be 0.53 kg CO_2-e/kWh, whereas the grid electricity in the Northern Territory is 0.67 kg CO_2-e/kWh. Therefore, the onsite power station significantly reduces emissions associated with electricity supply. The consumption of diesel will be a necessary Project requirement. However, a reduction in the quantity of fuel consumed may be achievable through optimisation of operational activities and logistics and use of more efficient plant and vehicles. This will be investigated further during the detailed project design and planning stage.

The most significant greenhouse gas mitigation option for fuel related emissions is likely to be the potential use of biodiesel blends; however, this is dependent on a number of factors including the origin of the biodiesel feedstock. When sourced from appropriate feedstocks, the reduction in emissions is approximately equivalent to the percentage of biodiesel in the blend (for example diesel with 20% biodiesel will reduce greenhouse gas emissions by approximately 20%). There are other factors that require consideration prior to the use of biodiesel. There is debate over the suitability and / or the percentage of biodiesel that can be used in various engines. Biodiesel may not be suitable for some engines without major modifications. Plant operators are also concerned that warranties may be void if biodiesel or biodiesel blends are used. Opportunities for the use of biodiesel on the Project will be further examined.

A commitment to energy efficiency and management will be recognised via the site Environmental Management Plan. Appropriate management will be integrated into site activities and processes, and greenhouse gas emissions would be monitored. The company will undertake regular energy audits and reviews to identify energy efficiency improvement opportunities which may be implemented to progressively improve operations and subsequent energy efficiency. Through assessment and review, the Project will seek continuous improvement in compliance and emissions reduction.

TNG is also considering the potential use of solar power and storage battery systems which, if implemented, will also reduce greenhouse gas emissions.

The feasibility of generating carbon offsets at the Project site under the Carbon Farming Initiative is likely to be limited.

There are a number of legislative requirements for measuring, monitoring and reporting greenhouse gas emissions and energy consumption that are applicable to the Project. Scope 1 and 2 emissions will be measured or estimated as part of the National Greenhouse and Energy Reporting Scheme, in line with the technical guidelines for measuring and reporting these emissions. The legislative measuring and reporting requirements will be used to assist in the identification of greenhouse gas reduction opportunities and track performance throughout the Project life.

9.6 Summary of Impacts and Conclusions

9.6.1 Air Emissions

Due to the relatively large separation distances between the non-mining sensitive receptors and the Project, no adverse air quality impacts are predicted to occur during construction or operation. The modelled emissions are well below the relevant assessment criteria at the sensitive receptors. Given the lack of other major anthropogenic sources in the region, cumulative impacts were limited, with non-anthropogenic background regional sources and local neighbourhood sources expected to dominate sensitive receptor exposure.

Dust emissions will be controlled through the application of a dust management processes, defined as part of the site Environmental Management Plan. It is proposed that these management measures will be implemented during the construction and, where relevant, will continue during operation.

9.6.2 Greenhouse Gas Emissions

The total greenhouse gas emissions (for the life of mine) are estimated to be 3,212,358 t CO_2-e. This equates to an annualised average emission of 178,000 t CO_2-e. The Project’s emissions are estimated to contribute a small percentage to NT (1%), national (0.03%) and global (0.001 %) annual emissions. The following management measures will be implemented to avoid, mitigate and offset greenhouse gas emissions arising from the Project:

- commitment to energy efficiency within the site Environmental Management Plan;
- monitoring of greenhouse gas emissions and reporting of Scope 1 and Scope 2 emissions as part of National Greenhouse and Energy Reporting Scheme; and
- continuous improvement in compliance and emissions reduction throughout the Project life through assessment and review processes including legislative reporting requirements.